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Your Ref. Tlisitseng PV Plant
Our Ref. 4202-02

17/05/2016

SiVEST
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ATT: Mr Shaun Taylor

Proposed Construction Of The Tlisitseng Solar Photovoltaic (Pv) Energy Facility Near Lichtenburg, North West Province : Surface Water Impact Assessment Report

SiVEST have been appointed by Biotherm Energy (Pty) Ltd to undertake an Environmental Impact Assessment (EIA) for the proposed construction of the Tlisitseng Solar Photovoltaic (PV) energy facility, including the associated infrastructure near Lichtenburg, in the North West Province. Ultimately, Tlisitseng Solar will consist of two (2) x 75MW solar PV facilities, namely Tlisitseng Solar 1 and Tlisitseng Solar 2, as well as a substation and an associated 132kV power line which will connect each of the PV facilities to the proposed Tlisitseng substations.

It was noted that all the relevant conservation and development planning tools were applied for the purpose of the report. This included the National Freshwater Priority Areas database (2011), the Environmental Potential Atlas database (2000) and the National Biodiversity Assessment database (2012) Relevant legislation such as the *National Water Act, 1998 (Act No. 36 of 1998)* and the *National Environmental Management Act, 1998 (Act No. 107 of 1998)* was also considered. Spatial planning with regards to biodiversity and protected areas have been undertaken for some provinces such as Mpumalanga, Gauteng and Limpopo. Spatial planning for the Northern West Province is not available.

The acceptable methodologies as required by the Department of Water and Sanitation (A practical field procedure for the identification and delineation of wetlands and riparian areas, 2005). Was used to identify and delineate wetland areas and classification of wetland types was also undertaken using the latest available methodologies (Ollis *et al*., 2013). Based on the methodologies applied, desktop assessments and field verification no water resources were identified within the study area associated with the Tlisitseng Solar 1 facility and only one (1) small pan was identified in the study area associated with Tlisitseng Solar facility.

Several impacts were identified as part of the current study, but these impacts are easily mitigated and as a result of the limited distribution of water resources the impacts will mostly be of low significance.

The preferred alternatives as indicated in each report should also be accepted, as these alternatives have been selected based on a rigorous process and with considering the potential impacts

Dr Martin Ferreira

BIOTHERM ENERGY (PTY) LTD

Proposed Construction of the Tlisitseng 1 Substation and associated 132kV Power Line near Lichtenburg, North West Province

Surface Water Impact Assessment Report

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Date:	3rd May 2017
Document Title:	Proposed Construction of the Tlisitseng 1 Substation and associated 132kV Power Line near Lichtenburg, North West Province - Surface Water Impact Assessment Report
Author:	Shaun Taylor
Revision Number:	4
Checked by:	Veronique Evans
Approved:	Andrea Gibb
Signature:	
For:	SiVEST Environmental Division

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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File Reference Number:	12/12/20/
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Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Construction of the Tlisitseng 1 Substation and associated 132kV Power Line near Lichtenburg, North West Province.

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The specialist appointed in terms of the Regulations

I, **Shaun Taylor**, declare that --

General declaration:

- I act as the independent specialist in this application;
- 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 report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the 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 form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist

SiVEST Environmental

Name of company (if applicable)

3rd May 2017

Date

BIOTHERM ENERGY (PTY) LTD

PROPOSED CONSTRUCTION OF THE TLISITSENG 1 SUBSTATION AND ASSOCIATED 132KV POWER LINE NEAR LICHTENBURG, NORTH WEST PROVINCE

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SURFACE WATER IMPACT ASSESSMENT REPORT

1 INTRODUCTION

BioTherm Energy (Pty) Ltd (hereafter referred to as "BioTherm") are proposing to construct a Solar Photovoltaic (PV) development, including the associated substations and 132kV power lines, located near Lichtenburg, in the North West Province (hereafter referred to as the "proposed development"). Tlisitseng Solar will consist of two (2) 75MW solar PV facilities, namely Tlisitseng Solar 1 and Tlisitseng Solar 2, as well as a substation and an associated 132kV power line which will connect each of the PV facilities to the proposed Tlisitseng substations. There will therefore be two substations and two 132kV power lines in total for the project.

In terms of the Environmental Impact Assessment (EIA) Regulations (08 December 2014) promulgated under Sections 24 and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), various aspects of the proposed development are considered to fall within the ambit of listed activities which may have an impact on the environment, and therefore require environmental authorisation from the National Department of Environmental Affairs (DEA) prior to the commencement of such activities.

It has been identified that an EIA process is to be followed for the PV project components which will require scoping and impact phase assessments for the proposed Tlisitseng 1 and 2 PV developments. It must be noted that each respective PV facility will be treated separately for the purpose of the EIA processes. Additionally, the substation and 132kV power line for each PV facility will be undertaken as separate Basic Assessment (BA) processes. This report will focus on the BA of the Tlisitseng 1 substation and 132kV power line.

This report will provide information obtained at a desktop level as well as detailed information obtained as a result of on-site fieldwork undertaken to verify and groundtruth desktop findings in the desktop assessment. The fieldwork information will also include any additional findings that were not identified in the desktop assessment where relevant. This report will furthermore provide details on the project type (technology considered, output capacity, layout alternatives etc.), comparative assessment of the alternatives to be considered, the anticipated legislative requirements, the potential environmental impacts that could be associated with the proposed development and other surrounding developments respectively from a surface water perspective and finally specialist recommendations.

SiVEST Environmental Division has been appointed as the independent surface water specialist consultant to undertake the surface water assessment for the two Tlisitseng Solar PV facilities as well as two 132kV power lines and substations proposed for each PV facility, near Lichtenburg in the North West Province. Note again, however, that this report will only include findings on the Tlisitseng 1 substation and 132kV power line. Associated studies for the remaining project components have been compiled in separate reports for the relevant impact and basic assessments.

1.1 Legislative Context

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

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) was created in order to ensure the protection and sustainable use of water resources (including wetlands) in South Africa. The NWA recognises that the ultimate aim of water resource management is to achieve the sustainable use of water for the benefit of all users. Bearing these principles in mind, there are a number of stipulations within the NWA that are relevant to the potential impacts on rivers, streams and wetlands that may be associated with the proposed development. These stipulations are explored below and are discussed in the context of the proposed development.

Firstly, it is important to discuss the type of water resources protected under the NWA. Under the NWA, a 'water resource' includes a watercourse, surface water, estuary, or aquifer. Specifically, a watercourse is defined as (*inter alia*):

- A river or spring;
- A natural channel in which water flows regularly or intermittently; and
- A wetland, lake or dam into which, or from which, water flows.

In this context, it is important to note that reference to a watercourse includes, where relevant, its bed and banks. Furthermore, it is important to note that water resources, including wetlands, are protected under the NWA. 'Protection' of a water resource, as defined in the NWA entails the:

- Maintenance of the quality and the quantity of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource; and
- Rehabilitation of the water resource.

In the context of the proposed development and implications towards surface water resources potentially occurring on the study site, the definition of pollution and pollution prevention contained within the NWA is relevant. 'Pollution', as described by the NWA, is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (*inter alia*):

- Less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- Harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

The inclusion of physical properties of a water resource within the definition of pollution entails that any physical alterations to a water body (for example, the excavation of a wetland or changes to the morphology of a water body) can be considered to be pollution. Activities which cause alteration of the biological properties of a watercourse, i.e. the fauna and flora contained within that watercourse are also considered pollution.

In terms of **Section 19** of the NWA, owners / managers / people occupying land on which any activity or process undertaken which causes, 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. These measures may include measures to (*inter alia*):

- Cease, modify, or control any act or process causing the pollution;
- Comply with any prescribed waste standard or management practice;
- Contain or prevent the movement of pollutants;
- Remedy the effects of the pollution; and
- Remedy the effects of any disturbance to the bed and banks of a watercourse.

1.1.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management, 1998 (Act No. 107 of 1998) (NEMA) was created essentially to establish:

- 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 organs of the state to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment.

It is stipulated in NEMA *inter alia* that everyone has the right to an environment that is not harmful to his or her health or well-being. Moreover, everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Accordingly, several of the principles of NEMA contained in **Chapter 1 Section 2**, as applicable to wetlands, stipulate that:

- Development must be socially, environmentally and economically sustainable;
- Sustainable development requires the consideration of all relevant factors including the following:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied.
- That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied.
- That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

- The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

In line with the above, **Chapter 7** further elaborates on the application of appropriate environmental management tools in order to ensure the integrated environmental management of activities. In other words, this chapter of NEMA addresses the tools that must be utilised for effective environmental management and practice. Under these auspices, the Environmental Impact Regulations (2006, 2010 and 2014 as amended) were promulgated in order to give effect to the objectives set out in NEMA. Subsequently, activities were defined in a series of listing notices for various development activities. Should any of these activities be triggered, an application for Environmental Authorisation subject to a Basic Assessment (BA) or Environmental Impact Assessment (EIA) process is to be applied for. Fundamentally, applications are to be applied for so that any potential impacts on the environment in terms of the listed activities are considered, investigated, assessed and reported on to the competent authority charged with granting the relevant environmental authorisation.

The above stipulations of the NWA and NEMA have implications for the proposed development in the context of surface water resources. Accordingly, implications and potential impacts / issues of the proposed development on potentially affected surface water resources are addressed later in this report (**Section 8 & 9**).

1.2 Definition of Surface Water Resources as Assessed in this Study

Using the definition of a surface water resource under the NWA, this study will include a river, a spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which, or from which, water flows.

1.2.1 Wetlands

For wetlands specifically, the lawfully accepted definition of a wetland in South Africa is that within the NWA. Accordingly, the NWA defines a wetland as, “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”.

Moreover, wetlands are accepted as land on which the period of soil saturation is sufficient to allow for the development of hydric soils, which in normal circumstances would support hydrophytic vegetation (i.e. vegetation adapted to grow in saturated and anaerobic conditions).

Inland wetlands can be categorised into hydrogeomorphic units (HGM units). **Ollis *et al*. (2013)** have described a number of different wetland hydrogeomorphic forms which include the following:

- Channel (river, including the banks): a linear landform with clearly discernable bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit.
- Channelled valley-bottom wetland: a valley-bottom wetland with a river channel running through it. Channelled valley-bottom wetlands must be considered as wetland ecosystems that are distinct from, but sometimes associated with, the adjacent river channel itself, which must be classified as a “river”.
- Unchannelled valley-bottom wetland: a valley-bottom wetland without a river channel running through it.
- Floodplain wetland: a wetland area on the mostly flat or gently-sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank. Floodplain wetlands must be considered as wetland ecosystems that are distinct from but associated with the adjacent river channel itself, which must be classified as a “river”.
- Depression: a wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates.
- Flat: a Level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench, closed elevation contours are not evident around the edge of a wetland flat.
- Hillslope seep: a wetland are located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope.

1.2.2 Riparian Habitat

Riparian habitats may potentially occur in the study area. Riparian habitats (also known as riparian areas or zones) include plant communities usually adjacent to or along natural channels that are affected by surface and subsurface flows (**DWAF, 2005**). Riparian habitats can be found on the edges of lakes, or drainage lines but are more commonly associated with channelled flowing systems like streams and rivers. Riparian habitats can also be associated with wetlands that are similarly associated with streams and rivers. These are defined as riparian wetlands.

1.2.3 Watercourses

According to the NWA, a watercourse falls within the ambit of a 'water resource'. For watercourses however, the following is relevant:

- A river or spring; and
- A natural channel in which water flows regularly or intermittently.

Watercourses may be perennial or non-perennial in nature. Moreover, non-perennial watercourses can encompass seasonal or ephemeral watercourses (including drainage lines) depending on the climate and other environmental constraints.

Any of the above mentioned wetland forms, riparian habitats or watercourses may occur within the study area. The types of surface water resources identified are addressed later in the report (**Section 6**).

1.3 Assumptions and Limitations

This study has only focused on the identification and in-field delineation of surface water resources within the proposed development area. Delineation of surface water resources in the wider areas were not undertaken.

Aquatic studies of fish, invertebrates, amphibians etc. have not been included in this report. Nor has a hydrological or groundwater study been included.

Wetland or river health, ecosystem services and the ecological importance/sensitivity have also not been assessed for identified surface water resources.

As an avifaunal assessment is being carried out for this project, impacts as related to waterfowl are not included in this report. It is assumed that potential impacts to waterfowl as included in the avi-faunal assessment.

2 PROJECT NEED AND DESIRABILITY

The negative environmental impacts of using fossil fuels are well documented. In addition to depleting fossil fuels, the processes often result in large pollution risks. The Government of South Africa has committed to contributing to the global effort to mitigate greenhouse emissions.

According to the White Paper on the Promotion of Renewable Energy and Clean Energy Development (2002), the Government has committed to develop the framework within which the renewable energy industry can operate, grow, and contribute positively to the South African economy and to the global environment.

Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels.

In response to this goal, BioTherm are proposing to establish a Solar PV developments, including the associated substation and 132kV power line near Lichtenburg, in the North West Province.

The overall objective of the project is to generate electricity to feed into Eskom's national electricity grid by means of renewable energy technologies.

3 PROJECT TECHNICAL DESCRIPTION: TLISITSENG SOLAR PV DEVELOPMENTS

3.1 Project Location

The Tlisitseng Solar PV developments (PV facilities, Tlisitseng substations and associated 132kV power lines) will be located approximately 8km north-west of Lichtenburg, within the Ngaka Modiri Molema District Municipality of the North West Province. The Tlisitseng Solar development will consist of two (2) 75MW solar PV facilities, namely Tlisitseng Solar 1 and Tlisitseng Solar 2 on the following farm:

- Farm Houthaalboom 31, portion number 25.

Grid connections for the proposed Tlisitseng Solar PV Facilities will be to the proposed Tlisitseng substation. The Tlisitseng substation will be connected to the existing Watershed Main Transmission substation by the proposed 132kV power line. The Watershed Main Transmission substation is located approximately 2.4km to the south-east of the application site.

The project site has been identified through pre-feasibility studies conducted by BioTherm based on an estimation of the solar energy resource as well as weather, topography, dust, dirt, snow and surface albedo. Grid connection, land availability and site access were also important initial considerations. The North West Province in South Africa has the highest solar irradiation potential after the Northern Cape. The project site receives an annual global horizontal irradiation of approximately 2120 kWh/ m2/year.

The application site and proposed grid connections with regards to the Tlisitseng 1 substation and associated 132kV power line located near Lichtenburg are shown in the locality map (Figure 1).

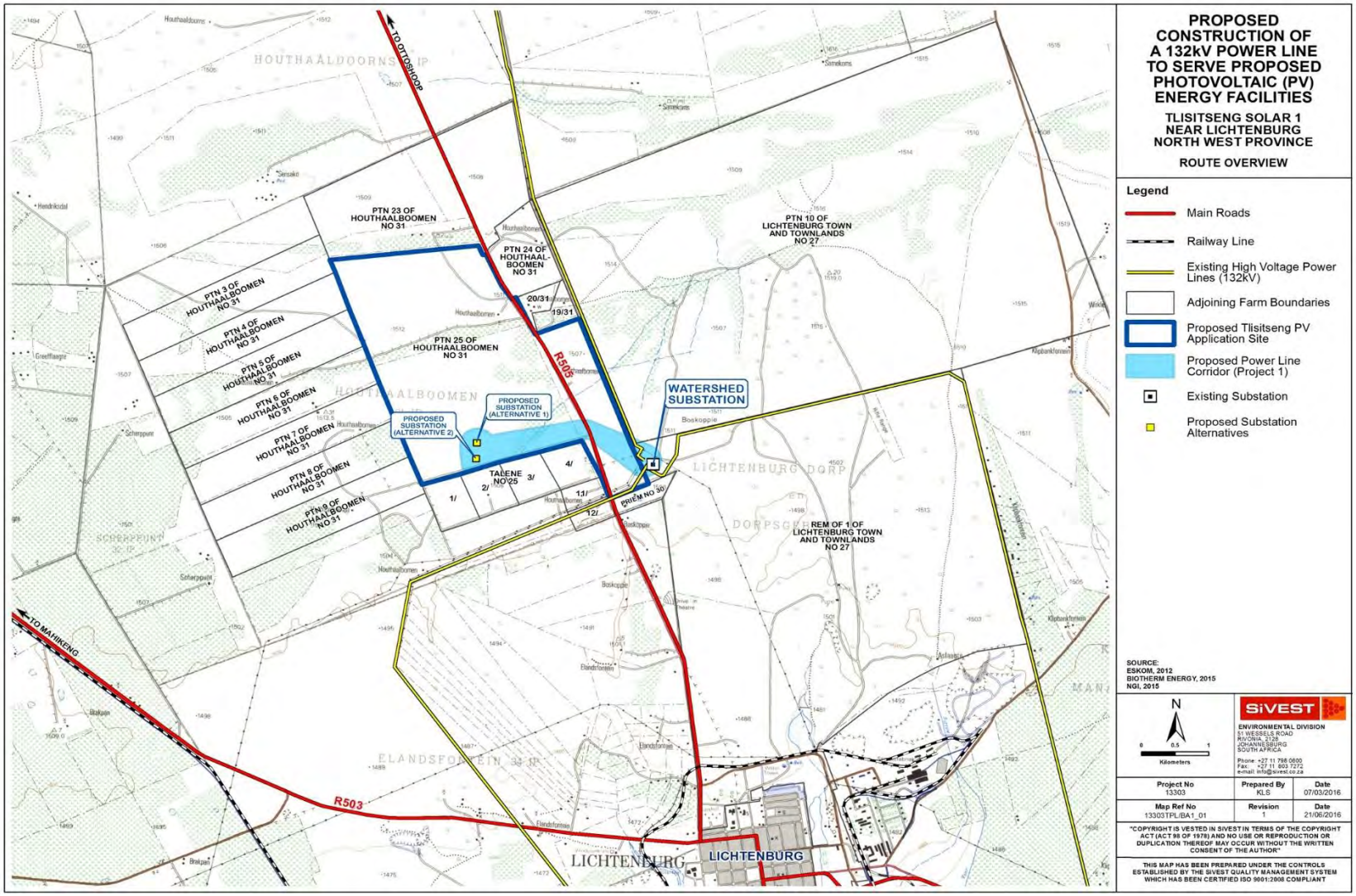

Figure 1. Proposed Tlisitseng 1 Substation and associated 132kV Power Line Study Area

3.2 Tlisitseng 1 Substation and 132kV Power Line Technical details

It is anticipated that the proposed Tlisitseng 1 PV solar development will include the construction/development of an on-site substation (namely Tlisitseng 1 substation), as well as a 132kV power line, which will aim at connecting the proposed Tlisitseng 2 PV facility to the national grid. The proposed development will include the following components/factors:

- Grid connection for the proposed Tlisitseng 1 Solar PV facility will be to the proposed Tlisitseng 1 substation;
- The proposed Tlisitseng 1 substation will occupy a footprint area of approximately 6.25ha;
- The capacity of the proposed on-site substation is anticipated to be up to 132kV;
- A power line(s) of up to 132kV is also proposed and will run from the proposed on-site substation (Tlisitseng 2 substation) to the existing Watershed Main Transmission substation;
- The proposed 132kV power line will have a servitude width of approximately 31m;
- The point of connection is approximately 2.5km from Eskom's existing Watershed Main Transmission Substation;
- An Onsite switching substation with grid transformer(s) for voltage step up to a high voltage of up to 132kV. The switching Station will be a common substation connecting multiple phases of the project to Eskom Watershed Main Transmission Substation;
- The Watershed Main Transmission substation is located approximately 2km to the south-east of the greater application site;
- The type of power line towers which are being considered at this stage include self-supported suspension (518H) or 0°-45° angle strain (518C) tower types. The height will vary based on the terrain, but will ensure minimum OHL line clearances with buildings and surrounding infrastructure;
- Power line towers are expected to be situated approximately 250m apart, depending on the terrain;
- Access roads; and
- Administration, control and warehouse buildings.

3.3 Alternatives

In terms of the NEMA and the EIA Regulations, feasible alternatives are required to be considered during the BA process. All identified, feasible alternatives are required to be evaluated in terms of social, biophysical, economic and technical factors. The following alternatives will be considered as part of this report:

- Site Location Alternatives for the proposed Tlisitseng 1 substation which will consider two (2) different location alternatives including:
    - Tlisitseng 1 Substation Option 1; and
    - Tlisitseng 1 Substation Option 2.
- The No-go Alternative.

4 METHODOLOGY

The first step in the surface water assessment was to identify and delineate the geographic boundaries of any potential surface water features at a desktop level using various information sources. This was undertaken using Geographic Information System (GIS) software. The software ArcView developed by ESRI was used. The collection of data source information encompassed (but is not limited to) the National Freshwater Ecosystem Priority Areas **(NFEPA, 2011)** database, the North West and National Environmental Potential Atlas **(ENPAT, 2000)** database as well as the National Biodiversity Assessment **(SANBI, 2012)** database. The use of Google Earth™ imagery supplemented these data sources.

Utilising these resources, wetlands and any other surface water resources identified were mapped and highlighted for the in-field phase of the assessment. The supplementary use of satellite imagery (**Google Earth™**) allowed for other potentially overlooked surface water resources, not contained within the above mentioned databases, to be identified and earmarked for ground-truthing for the field work component.

4.1 Field-based Surface Water Resources Delineation Techniques

4.1.1 Wetlands

Wetland delineations are based primarily on soil wetness indicators. For an area to be considered a wetland, redoximorphic features must be present within the top 50cm of the soil profile **(Collins, 2005)**. Redoximorphic features are the result of the reduction, translocation and oxidation (precipitation) of Fe (iron) and Mn (manganese) oxides that occur when soils alternate between aerobic (oxygenated) and anaerobic (oxygen depleted) conditions. Only once soils within 50cm of the surface display these redoximorphic features, can the soils be considered 'hydric soils'. Redoximorphic features typically occur in three types **(Collins, 2005)**:

- A reduced matrix - i.e. an in situ low chroma (soil colour), resulting from the absence of Fe3+ ions which are characterised by "grey" colours of the soil matrix;
- Redox depletions - the "grey" (low chroma) bodies within the soil where Fe-Mn oxides have been stripped out, or where both Fe-Mn oxides and clay have been stripped. Iron depletions and clay depletions can occur;
- Redox concentrations - Accumulation of iron and manganese oxides (also called mottles). These can occur as:
    - Concretions - harder, regular shaped bodies;
    - Mottles - soft bodies of varying size, mostly within the matrix, with variable shape appearing as blotches or spots of high chroma colours;
    - Pore linings - zones of accumulation that may be either coatings on a pore surface, or impregnations of the matrix adjacent to the pore. They are recognized as high chroma

colours that follow the route of plant roots, and are also referred to as oxidised rhizospheres.

The potential occurrence / non-occurrence of wetlands and wetland (hydric) soils on the study site were assessed according to the **DWAF (2005)** guidelines, "A practical field procedure for the identification and delineation of wetlands and riparian areas". According to the **DWAF (2005)** guidelines, soil wetness indicators (i.e. identification of redoximorphic features) are the most important indicator of wetland occurrence. This is mainly due to the fact that soil wetness indicators remain in wetland soils, even if they are degraded or desiccated. It is important to note that the presence or absence of redoximorphic features within the upper 50cm of the soil profile alone is sufficient to identify the soil as being hydric or non-hydric (non-wetland soil) **(Collins, 2005)**. Three other indicators (vegetation, soil form and terrain unit) are typically used in combination with soil wetness indicators to supplement findings. Where soil wetness and/or soil form could not be identified, information and personal professional judgment was exercised using the other indicators to determine what area would represent the outer edge of the wetland.

It must be recognised that there are normally three zones to every wetland including the permanent zone, seasonal zone and the temporary zone. Each zone is differentiated based on the degree and duration of soil saturation. The permanent zone usually reflects soils that indicate inundation cycles that last more or less throughout the year, whilst the seasonal zone may only reflect soils that indicate inundation cycles for a significant period during the rainy season. Lastly, the temporary zone reflects soils that indicate the shortest period(s) of inundation that are long enough, under normal circumstances, for the formation of hydromorphic soils and the growth of wetland vegetation **(DWAF, 2005)**.

Vegetation identification was based on identifying general plant species within the wetland boundaries focusing on the occurrence of hydrophytic (water loving) wetland vegetation. In identifying hydrophytic vegetation, it is important to distinguish between plant species that are **(DWAF, 2005)**:

- Obligate wetland species (ow): always grows in wetland - >99% chance of occurrence;
- Facultative wetland species (fw): usually grow in wetlands – 67-99% chance of occurrence;
- Facultative species (f): are equally likely to grow in wetlands and non-wetland areas – 34-66% chance of occurrence;
- Facultative dry-land species (fd): usually grow in non-wetland areas but sometimes grow in wetland = 1-34% chance of occurrence.

The actual delineation process essentially entailed drawing soil samples, at depths between 0-50 cm in the soil profile, using a soil augur. This is done in order to determine the location of the outer edge of the temporary zone for wetlands. The outer edge of the temporary zone will usually constitute the full extent of the wetland, thereby encompassing any other inner lying zones that are saturated for longer periods. Where the appropriate wetland soil form is of interest, soil samples are drawn up to a depth of 1.2 metres (where possible).

Where a wetland was identified, a conventional handheld Global Positioning System (GPS) was used to record the points taken in the field. The GPS points were then imported into a GIS system for mapping purposes. The GPS is expected to be accurate from 5 up to 15 metres depending on meteorological conditions. A GIS shapefile was created to represent the boundaries of the delineated wetlands or other surface water resources.

4.1.2 Riparian Habitat

In terms of watercourses and riparian habitats, the **DWAF (2005)**, the assessment for riparian habitats requires the following aspects to be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

The topography associated with a watercourse can (but not always limited to) comprise the macro channel bank. This is a rough indicator of the outer edge of the riparian habitat.

The riparian habitat relies primarily on vegetation indicators. The outer edge of the riparian habitat can be delineated where there is a distinctive change in the species composition to the adjacent terrestrial area or where there is a difference in the physical structure (robustness or growth forms – size, structure, health, compactness, crowding, number of individual plants) of the species from the adjacent terrestrial area (**DWAF, 2005**).

Riparian habitats are usually associated with alluvial soils (relatively recent deposits of sand, mud or any type of soil sediment) (**DWAF, 2005**). This indicator is not commonly viewed as the primary indicator but rather as a supplementary indicator to confirm either topographical or vegetation indicators, or both.

Where riparian habitats occur, the above mentioned indicators were used to identify the outer edge. A GPS was used to record the points taken in the field.

4.1.3 Drainage Pathways

In terms of drainage lines or pathways, there are no official methodologies or guidelines for delineating drainage lines in the country. As such, the environmental indicators used to identify riparian habitats (such as topography associated with a watercourse, alluvial soils and deposited materials, and vegetation), which also form integral biophysical components of drainage lines were used to identify these temporary conduits for surface water run-off.

4.2 Surface Water Buffer Zones

Depending on the type of land use or development proposed, an appropriate buffer zone to protect wetlands (and any other surface water resource) should also be delineated **(DWAF, 2005)**. Buffer zones are typically required to protect and minimise edge impacts to wetlands or any other surface water resource. As such, professional judgement and academic research was used to produce a scientifically informed buffer zone for surface water resources identified in the study area.

4.3 Impact Assessment Method

Current and potential impacts will be identified based on the proposed development and potential impacts that may result for the construction, operation and decommissioning of the proposed development. The identified potential impacts will be evaluated using an impact rating method **(Appendix A)**. This is addressed in **Section 9**.

5 GENERAL STUDY AREA

The proposed greater application site for the Tlisitseng Solar development will be located approximately 8km north of Lichtenburg, within the Ngaka Modiri Molema District Municipality of the North West Province. The project site has a relatively flat topography which is regarded suitable for the development of a solar PV facility. The solar PV facilities will be located on the following farm:

- Farm Houthaalboom 31, portion number 25.

Specifically, grid connections for the proposed Tlisitseng 2 Solar development will from the proposed Tlisitseng 1 substation. The Tlisitseng 1 substation will be connected to the existing Watershed Main Transmission substation by a proposed 132kV power line. The project therefore has access to the national grid via the existing Watershed Main Transmission substation which is located approximately 2.4km from the application site.

The Tlisitseng 1 substation and 132kV power line development site is easily accessible as the tarred R505 road transects the farm and connects to the N14 national road which leads to the R503 in Lichtenburg. Importantly, the R505 bisects Portion 25 of the Farm Houthaalboom 31 into two with an area west of the R505 and an area east of the R505. The area west of the R505 is where the proposed Tlisitseng 1 Substation alternative sites and the power line corridor are located. The surrounding land use within the direct proximity of the development site comprises predominantly of vacant land, existing cultivations (agriculture) and mining.

A map indicating the land use of the area surrounding the site proposed for the Tlisitseng 1 substation and associated 132kV power line has been provided in **Figure 2** below**.**

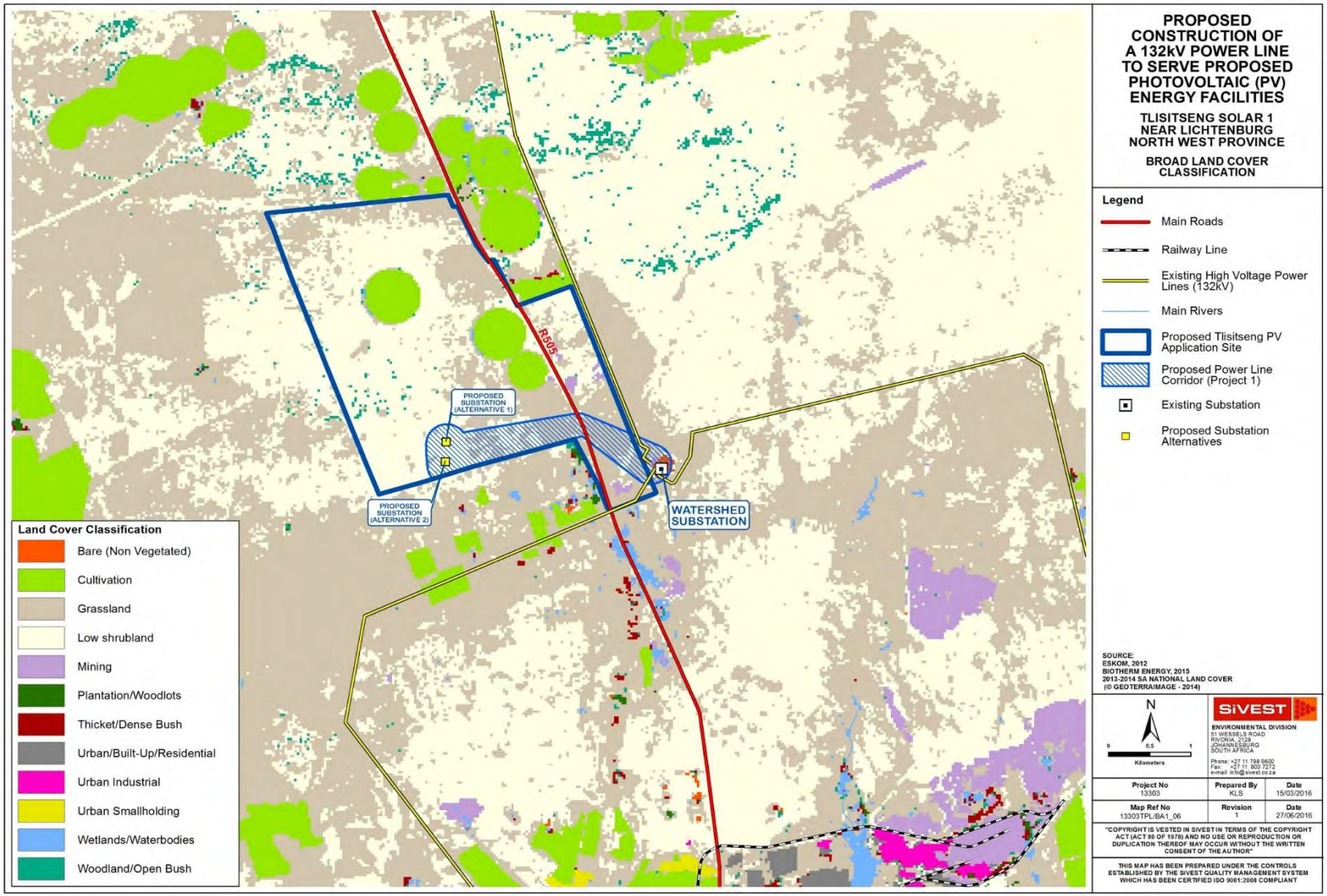

Figure 2. Land Use Map

According to **Mucina and Rutherford (2006)**, the proposed development site for the Tlisitseng 1 substation and associated 132kV power line falls within the Grassland Biome. Within a biome, smaller groupings referred to as bioregions can be found which provide more specific but general details as to the biophysical characteristics of smaller areas. The development site can be found within the Dry Highveld Grassland bioregion. Going into even finer detail, vegetation units are classified which contain a set of general but more local biophysical characteristics as opposed to the entire bioregion. The proposed Tlisitseng 1 substation and associated 132kV power line development site can therefore be found within the Carletonville Dolomite Grassland vegetation unit (**Figure 3**). The description of Vegetation and Landscape Features, Geology and Soils, Climate and Conservation as contained in **Mucina and Rutherford (2006)** are provided below for this vegetation unit.

5.1 Carleton Dolomite Grassland

The vegetation and landscape features of the Carletonville Dolomite Grassland vegetation unit are characterised by slightly undulating plains dissected by prominent rocky chert ridges as well as species-rich grasslands which form a complex mosaic pattern dominated by many species.

The geology and soils of this vegetation unit are characterised by Dolomite and chert of the Malmani Subgroup (Transvaal Supergroup) which support mostly shallow Mispah and Glenrosa soil forms typical of the Fa land type. It must be noted that the landscapes of this vegetation unit are dominated by the Fa land type. In addition, deeper red to yellow apedal soils (Hutton and Clovelly forms) also occur sporadically and represent the Ab land type.

The climate is characteristic of a warm-temperate, summer-rainfall region with overall Mean Annual Precipitation (MAP) of approximately 593mm. Temperatures in summer are high with severe, frequent frost occurring in winter.

The conservation status of the vegetation unit is described as vulnerable. A small extent is conserved, in statutory (Sterkfontein Caves-part of the Cradle of Humankind World Heritage Site, Oog Van Malmanie, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifansvlei and Groenkloof) and in at least six (6) private conservation areas. Almost a quarter of this vegetation unit has already been transformed by cultivation, urban sprawl, mining activity and the building of the Boskop and Klerkskraal Dams. In addition, erosion in this unit varies from very low (84%) to low (15%).

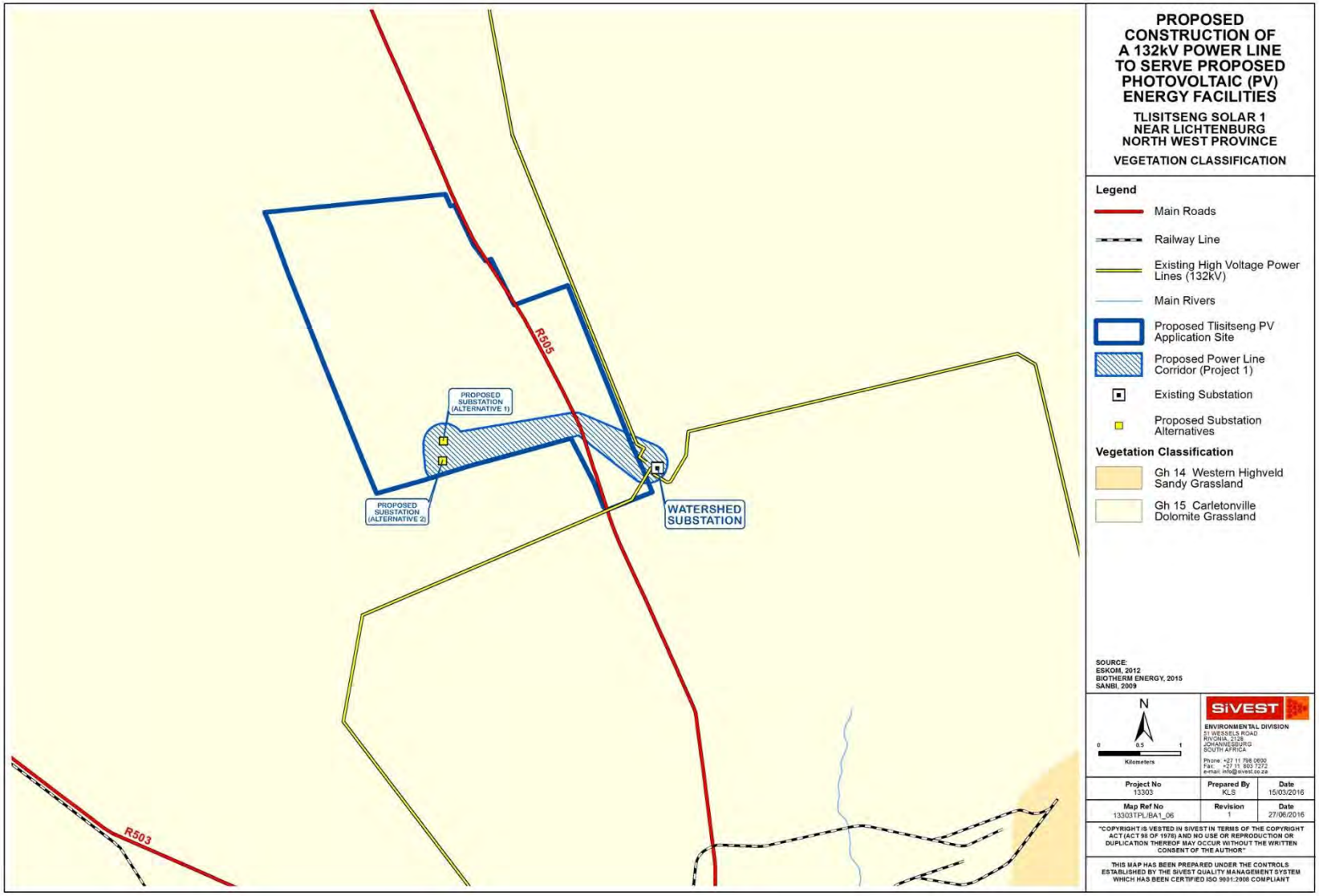

Figure 3. Vegetation Unit Map

6 FINDINGS OF ASSESSMENT

6.1 Desktop Findings

In terms of the **National and North West ENPAT (2000)** databases, both substation alternatives (Tlisitseng 1 Substation Alternative 1 and 2) as well as the 132kV power line corridor are found within the Lower Vaal Water Management Area. These respective substation alternatives and the power line corridor was further found to be situated within the Vaal Primary Catchment. More specifically, the substation and power line corridor alternatives are found within the C31A quaternary catchment.

In terms of surface water resources within the Tlisitseng 1 Substation and Powerline corridor, it was found that there are no wetlands within these areas (**Figure 4**).Only one watercourse was identified from the consulted databases which appeared to be flowing in a north easterly direction originating from the southern boundary of the site. This feature was investigated in the fieldwork component of the assessment below.

6.2 In-field Investigations and Delineations for the Application Site

The in-field wetland delineation assessment took place from the 1st to 2nd of December 2015. The fieldwork verification, ground-truthing and delineation assessment was undertaken to scrutinise the results of the desktop identified features as well as to identify any potentially overlooked wetlands or other surface water resources in the field for the greater application site. The results are displayed in **Figure 5**.

Following the fieldwork, no wetlands, watercourses nor any other surface water resources were identified in the proposed substation alternative sites and/or the power line corridor. Only one small wetland (depression) was identified within the greater Proposed Tlisitseng Solar Application site, approximately 35m to the east of the R505. As such, this wetland is sufficiently distanced so as not to be affected by the proposed power line development.

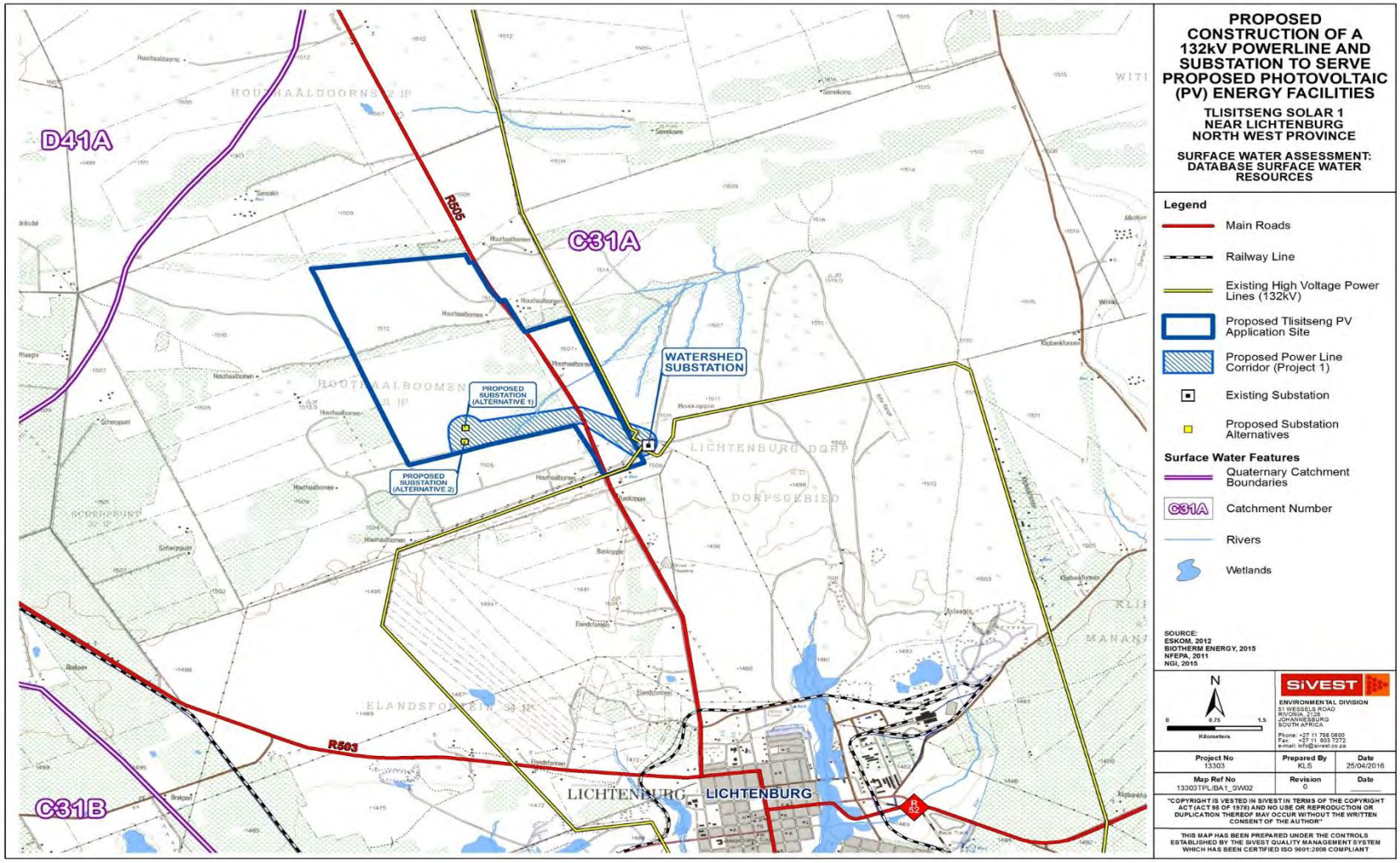

Figure 4. Tlisitseng 2 Substation and Power Line Corridor Database Surface Water Map

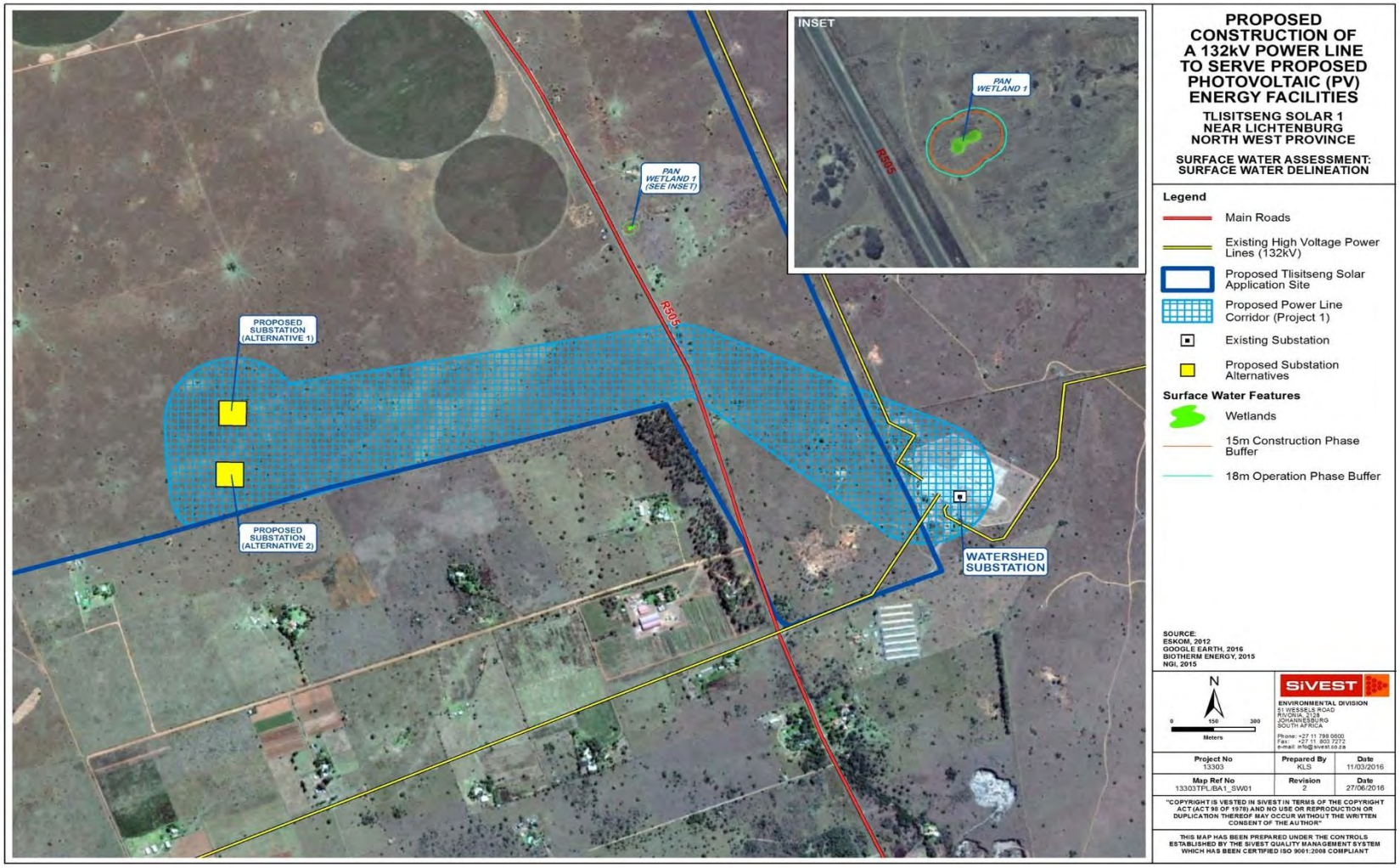

Figure 5. Tlisitseng 2 Substation and Power Line Corridor Surface Water Delineation Map

6.3 Surface Water Buffer Zones

As no wetlands or any other surface water resources were identified within the Proposed Power Line Corridor, no buffer zones are applicable.

7 ALTERNATIVES COMPARATIVE ASSESSMENT

Substation alternative sites have been investigated for the proposed solar PV development. These alternatives have been comparatively assessed in order to determine the preferred alternative from a surface water perspective.

The following factors were taken into account when comparatively evaluating the proposed alternatives:

- Size and number of potentially impacted surface water resource(s) in the proposed alternative;
- Proximity to the nearest surface water resource(s);
- The location of any surface water resources present and the ability of the proposed development to be constructed out of, around or away from any nearby surface water resources; and
- Existing impact factors (such as existing infrastructure, roads and impacted land).

In terms of the first criteria, the size and number of surface water resources within an alternative area was relevant. The more surface water resources that are present and the greater the area each occupies, it is likely that the impact of the proposed development will be greater.

The second criteria to consider is proximity of the proposed development positioning to any nearby surface water resources. The type of surface water resource and the distance of the proposed development to it will have a bearing on whether there may be direct or indirect impacts that could affect it.

The third criteria focuses on whether the proposed development may be able to be constructed with surface water resources present. It may be possible for the proposed development to be constructed if there are few surface water resources present and the facility component or infrastructure is repositioned to avoid the surface water feature. In this instance, maneuverability of the site layout may only also be possible should any surface water resources be located on the boundary of the proposed development area under consideration.

The final criteria of significance, when selecting the most suitable alternative, is existing infrastructure (power lines, roads, railway etc.) and impacted land (agricultural fields, urban areas etc.). Disturbance to an existing impacted area will be less than if undisturbed, or where less impacted land is affected.

The logic for each criteria was applied in the assessment below.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
SUBSTATION		
Tlisitseng 1 Substation Option 1	No preference	Both alternatives are suitable for the placement of the substation from a surface water perspective as there are no wetlands or watercourses within any of the two alternative sites nor within close proximity (500m) to any surface water resources in the nearby area. There is no preference between the two alternative sites and both are suitable for the location of the Substation.
Tlisitseng 1 Substation Option 2	No preference	Both alternatives are suitable for the placement of the substation from a surface water perspective as there are no wetlands or watercourses within any of the two alternative sites nor within close proximity (500m) to any surface water resources in the nearby area. There is no preference between the two alternative sites and both are suitable for the location of the Substation.

8 LEGISLATIVE IMPLICATIONS

8.1 National Environmental Management Act, 1998 (Act No. 108 of 1998) and Environmental Impact Assessment Regulations (2014)

In the context of NEMA (1998) and the EIA Regulations (2014), no activities will be triggered from a surface water perspective as these are no surface water resources within the proposed development area for the substation and power line corridor.

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

In the context of the NWA (1998) and the proposed development, a "water use" is required where construction activities will impact on a water resource. In this light, "water use" is defined *inter alia* as follows:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in stream flow reduction activity contemplated in Section 36 of the NWA;
e) Engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38(1) of the NWA;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing of waste in a manner of water which contains waste from, or which has been heated in any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

In this context, no water uses will be triggered from a surface water perspective as these are no surface water resources within the proposed development area for the substation and power line corridor.

9 NATURE OF THE POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED TLISITSENG 1 SUBSTATION AND ASSOCIATED 132KV POWER LINE

From a surface water resource perspective, as there are no wetlands or watercourses in the Proposed Power Line Corridor of the project, there are no potential impacts anticipated.

10 CUMULATIVE IMPACTS

Based on the DEA's comments on the Draft Basic Assessment Report (DBAR), the Department of Environmental Affairs (DEA) requested that a cumulative environmental impact assessment be conducted including a literature review of other specialist assessments / studies on the neighbouring adjacent properties for other renewable energy and power line developments in a 30km radius of the project site. This is to be undertaken in order to ascertain any additional cumulative impacts associated with power line developments in general as well as the power lines associated with the renewable energy developments that should be taken into consideration.

10.1 Steps Undertaken to Obtain Relevant Surface Water Information

In an effort to meet this requirement SiVEST under took every effort to obtain the information (including specialist studies, BA / EIA / Scoping and EMPr Reports) for the above mentioned developments. The steps taken to acquire the relevant documents for the above mentioned projects is detailed in **Table 1** below.

Table 1: Proposed Renewable Energy Projects in the Area and Steps taken to obtain the Relevant Information and Documents

Proposed Development	EAP	Steps taken to obtain relevant documents	Documents Obtained
Tlisitseng 2	SiVEST SA (Pty) Ltd	SiVEST is the EAP for the proposed development. The proposed development Final Scoping Report (FSR) has been accepted by the DEA. Additionally, the specialist impact assessments have been conducted to form part of the Draft Environmental Impact Assessment Report (DEIAR). All the relevant documents were therefore available for the cumulative assessment.	▪ Biodiversity Impact Assessment Report; ▪ Avifaunal Impact Assessment Report; ▪ Surface Water Impact Assessment Report; ▪ Soils and Agricultural potential Impact Assessment Report; ▪ Visual Impact Assessment Report; ▪ Heritage Impact Assessment Report; ▪ Socio-economic Impact Assessment Report; ▪ Geotechnical Impact Assessment Report; and ▪ Traffic Impact Assessment Report
Lichtenburg Solar Park	Africa Geo-Environmental Services (AGES)	▪ Google Search for PV facilities near Lichtenberg North West Province; ▪ Proposed Development was found on Leads 2 Business website (www.l2b.co.za/project-region/**North-West**). ▪ Google search of the proposed development project name was undertaken. ▪ Consulted the SAHRA Website for Heritage and PIA Report (http://sahra.org.za/sahris/cases/lichtenburg-solar-park). ▪ Attempted to download reports from the AGES Website (http://ages-group.com/)	▪ Archaeological Impact Assessment Report ▪ Heritage Impact Assessment Report

		○ Reports were not available for publically available to download ▪ Contacted AGES in an effort to obtain outstanding specialist reports that were not available for public download. ○ AGES responded to SiVEST request for the FBAR and specialist reports noting that the proposed development has not been awarded preferred Bidder Status in terms on the DoE's IPP programme. ○ AGES further stated that they are not in a position to send any of the reports through to SiVEST. However, they were able to provide SiVEST with the locality map for the proposed Lichtenburg Solar Park as well as layout plans. ▪ Additionally, SiVEST attempted to contact the developers of the proposed development, however contact details were not publically available.	
Watershed Solar Energy Facility Phase 1 Watershed Solar Energy Facility Phase 2	Savannah Environmental (Pty) Ltd Savannah Environmental (Pty) Ltd	▪ Google Search for PV facilities near Lichtenberg North West Province; ▪ The proposed Development was found on Leads 2 Business website (www.l2b.co.za/project-region/**North-West**). ▪ Google search of the proposed development project name was undertaken. FEIR (excluding appendices) was able to be downloaded as a PDF. ▪ Consulted the SAHRA Website for Heritage Report (http://sahra.org.za/sahris/heritage-reports/heritage-report-watershed-solar-facility).	▪ Watershed PV (phase I and II) FEIR ▪ Visual Scoping Report ▪ Social Scoping report ▪ Draft EMPr (Phase 1) ▪ Draft EMPr (Phase 2) ▪ Archaeological Impact Assessment Report ▪ Background Information Documents ▪ EAs

		▪ From the SAHRA website other documents were available to be downloaded. (http://sahra.org.za/sahris/cases/watershed-solar-energy-facilities-556-557).
		▪ Attempted to download reports from the Savannah Environmental Website
		  o Reports were not publically available to download.
		▪ Contacted Savannah Environmental in an effort to obtain outstanding specialist reports that we not available for public download.
		  o Savannah Environmental noted that the project has already been archived and handed over to the developers.
		  o Savannah Environmental noted that it is against their company policy to give out developers contact details. However, they were able to provide SiVEST with the EA's for the proposed development.	

Hibernia PV Solar Energy Facility	Savannah Environmental (Pty) Ltd	▪ Google Search for PV facilities near Lichtenberg North West Province; ▪ The proposed Development was found on Leads 2 Business website (www.l2b.co.za/project-region/**North-West**). ▪ Google search of the proposed development project name was undertaken. BID was able to be downloaded as a PDF. ▪ Consulted the SAHRA Website for Heritage Report (http://sahra.org.za/sahris/heritage-reports/aia-paleo-reports-hibernia).	▪ Heritage Assessment Report ▪ Final BAR ▪ BID

		▪ From the SAHRA website other documents were available to be downloaded. FEIR (excluding appendices)was able to be downloaded as a PDF. http://sahra.org.za/sahris/cases/hibernia-solar-facility-1062).
		▪ Attempted to download reports from the Savannah Environmental Website
		  ○ Reports were not publically available to download
		▪ Contacted Savannah Environmental in an effort to obtain outstanding specialist reports that we not available for public download.
		  ○ Savannah Environmental noted that the project has already been archived and handed over to the developers.
		  ○ Savannah Environmental noted that it is against their company policy to give out developers contact details. However, they were able to provide SiVEST with the EA's for the proposed development.
		▪ Additionally, SiVEST attempted to contact the developers of the proposed development, however contact details were not publically available.	

Proposed 88kv Powerline from Watershed Substation, Lichtenburg, to the Mmabatho	Arcus GiBB (Pty) Ltd	▪ Google Search for power lines developments near Lichtenberg North West Province.	▪ Heritage Assessment Report

Substation, North West Province			
Proposed Re-routing of 132kv Powerlines and associated infrastructure at the Watershed Substation near Lichtenburg, North West Province	Environmental Impact Management Services (EIMS)	▪ Google Search for power lines developments near Lichtenberg North West Province.	▪ Draft Basic Assessment Report

Some of the project sites are at a very advanced stage, and the initial studies were undertaken in 2012. As a result, many of the documents are not currently publically available to download. Nonetheless, SiVEST was able to source some of information that was available. The information (including specialist studies, EIA / Scoping and EMPr Reports) that could be obtained for the surrounding renewable energy sites planned that were taken into account as elaborated on below.

10.2 Surface Water Cumulative Impacts

The area has seen some interest from developers of various renewable energy projects, which could be associated with the wind and solar energy resource potential found in the region, proximity to the existing sub-station and its evacuation capacity, as well as other factors. Such developments, whether already approved or only proposed, need to be considered as they have the potential to create numerous cumulative impacts, whether positive or negative, if implemented. **Table 2** lists the projects that will need to be considered when examining the cumulative impacts; their location relative to the project under review is illustrated in **Figure 6**.

Table 2: Proposed Renewable Energy Projects in the Area

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Proposed Capacity	Farm Details
Tlisitseng 2 – 75MW PV Facility	14/12/16/3/3/2/890	EIA ongoing	BioTherm Energy	75MW	Portion 25 of the Farm Houthaalboomen No 31
Lichtenburg Solar Park	14/12/16/3/3/3/270	Scoping and EIA processes underway	Matrigenix (Pty) Ltd	70MW	A portion of portion 10 of the Farm Lichtenburg Town and Townlands 27
Watershed Solar Energy Facility Phase 1	14/12/16/3/3/2/556	Scoping and EIA processes underway.	FVR Energy South Africa (Pty) Ltd	75MW	Portions 1, 9, 10 and 18 of the Farm Houthaalboomen 31
Watershed Solar Energy Facility Phase 2	14/12/16/3/3/2/557	Scoping and EIA processes underway.	FVR Energy South Africa (Pty) Ltd	75MW	Portions 1, 9, 10 and 18 of the Farm Houthaalboomen 31
Hibernia PV Solar Energy Facility	14/12/16/3/3/2/1062	Project has received environmental authorisation	South Africa Mainstream Renewable Power Developments (Pty) Ltd	5MW	Portions 9 and 31 of the Farm Hibernia 52

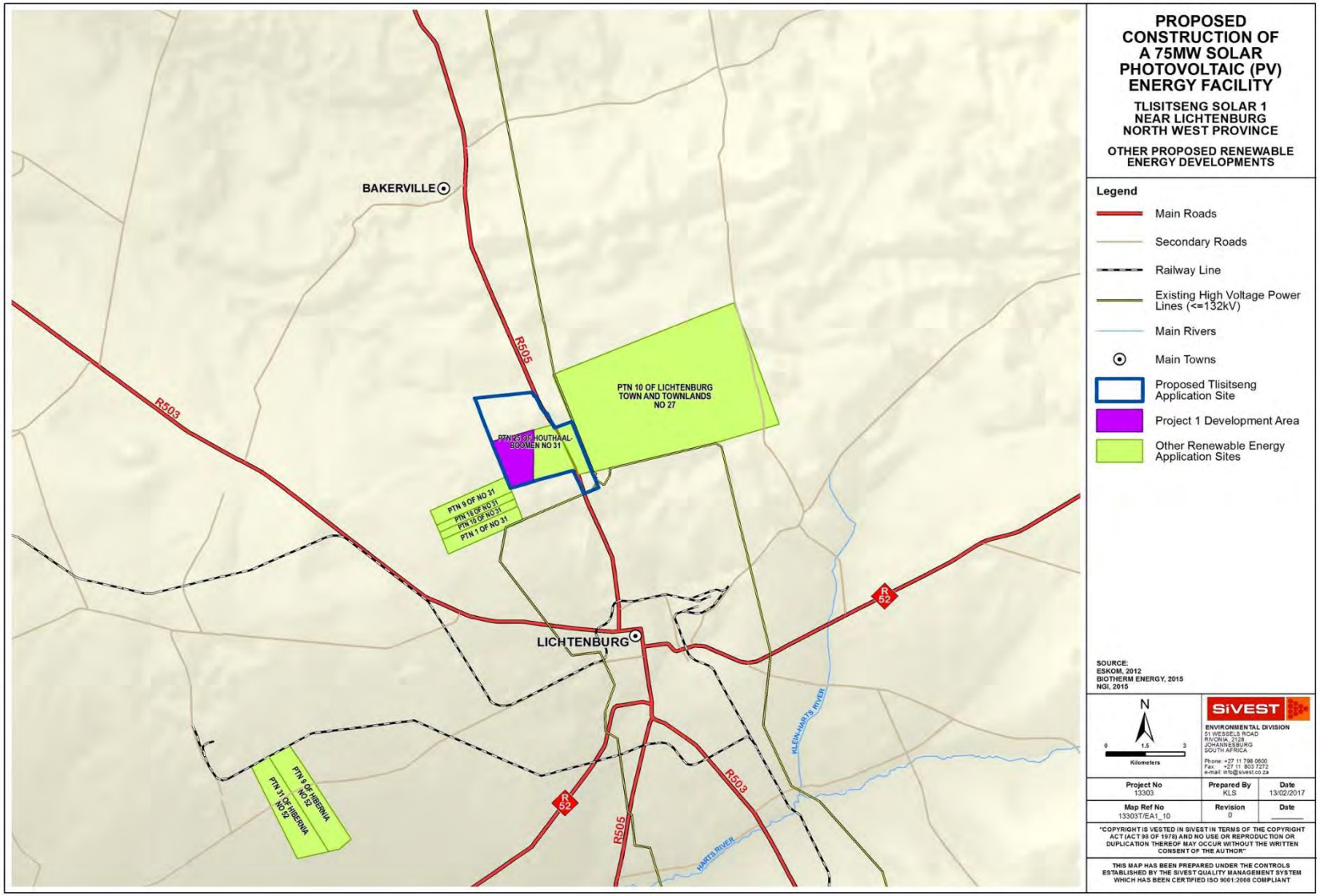

Figure 6. Surrounding Renewable Energy Projects

In terms of the review undertaken on the above reports, no surface water resources (including watercourses and wetlands) were identified on the proposed renewable energy sites including the Hibernia PV Solar Energy Facility, Watershed Solar Energy Facilities Phase 1 and 2 as well as the Lichtenburg Solar Park. The only exception is the one pan (depression) wetland identified on the Tlisitseng 2 – 75MW PV site. In terms of the power line developments, no surface water resources could be identified that will be directly affected by the proposed power lines. With this in mind, the main cumulative impacts from a catchment perspective for surface water resources in the regional area include potential indirect impacts. The typical potential indirect impacts relate mainly to increased run-off, sedimentation and erosion to the endorheic (inward draining wetland). These potential cumulative impacts are evaluated below.

10.2.1 Construction (including Decommissioning) Phase Potential Cumulative Impacts

From an indirect cumulative impact perspective, there is a potential that power line developments leading to Watershed Substation as well as nearby renewable energy developments (particularly, Tlisitseng 2 – 75MW PV) may impact on the pan wetland. The potential indirect impact from proposed power lines will be on the pan is extremely minimal however since the footprint is relatively small for each tower location and spaced several hundred metres apart. The risk of indirect impacts from the Tlisitseng 2 – 75MW PV facility however is greater. Drainage on the study site appears to be in a north easterly direction. Clearing activities as a result of the proposed power line and renewable developments in the construction phase is likely to generate some sediment. Following rainfall events, increased run-off is likely to be generated where exposed surface water present during construction. Additionally, the generated sediment may potentially be transported via run-off from the proposed development site to the adjacent Tlisitseng 2 – 75MW PV site where the pan wetland is located. However, the proposed development is separated by the R505 which serves as a physical barrier between the proposed development and the Tlisitseng 2 – 75MW PV site. Nonetheless, drainage is likely to enter the site via culverts beneath the R505. In addition, erosion potential exists with increased run-off and drainage to the adjacent Tlisitseng 2 – 75MW PV site. However, it must be noted that the pan wetland is located approximately 1km away from the proposed development. These factors were taken into consideration in the impact assessment in **Table 3** below.

Table 3. Impact rating for Construction Phase Increased Stormwater Run-off, Erosion and Sedimentation Potential Cumulative Impacts

IMPACT TABLE	
Environmental Parameter	Pan Wetland
Issue/Impact/Environmental Effect/Nature	Increased storm water run-off, erosion and increased sedimentation impacting on the nearby pan wetland
Extent	*Local*
Probability	*Possible*
Reversibility	*Completely reversible*
Irreplaceable loss of resources	*Marginal loss of resources*

Duration	*Medium term*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be further reduced to a negligible level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	- 22 (low negative)	- 6 (low negative)
Mitigation measures	**Preventing Increased Run-off, Sedimentation and Erosion Impacts** – Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future. An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas. In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian “sausage” nets can be used to prevent erosion in susceptible construction areas. All impacted areas are to be adequately sloped to prevent the onset of erosion.	

It is not anticipated that the proposed development will need to be decommissioned. However, should this need to take place, all relevant identified potential construction impacts will be applicable and the relevant mitigation measures must be implemented where applicable.

10.2.2 Operation Phase Potential Cumulative Impacts

Similarly, during the operation phase, increased run-off, sedimentation and erosion potential as a result of decreased surface roughness on the nearby pan wetland due to the proposed development may result. Assessment of the above potential negative cumulative impacts and mitigation measures thereto are provided in **Table 4** below.

Table 4. Impact rating for Operation Phase Increased Stormwater Run-off, Erosion and Sedimentation Potential Cumulative Impacts

IMPACT TABLE		
Environmental Parameter	Pan Wetland	
Issue/Impact/Environmental Effect/Nature	Increased storm water run-off, erosion and increased sedimentation impacting on the wetland	
Extent	*Local*	
Probability	*Possible*	
Reversibility	*Completely reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be further reduced to a negligible level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	- 22 (low negative)	- 6 (low negative)
Mitigation measures	**Preventing Increased Run-off, Sedimentation and Erosion Impacts** – A suitable operational storm water management plan must be compiled and implemented that accounts for the use of appropriate structures or devices that will prevent increased run-off and sediment entering the adjacent Tlisitseng 2 – 75MW PV site, thereby also preventing erosion. This	

	must be submitted to the relevant environmental and water authority for approval.

Based on the construction and operation phase ratings above, the potential impact after mitigation will be low. As such, the proposed development can proceed with the implementation of stipulated mitigation measures.

11 SPECIALIST RECOMMENDATIONS

Mitigation measures must be implemented as stipulated in the cumulative impact assessment above.

12 CONCLUSIONS

A surface water delineation and impact assessment is provided in this report for the proposed development. Investigations were based on a method for delineating wetlands and riparian habitat as per the **DWAF 2005** guidelines. Ultimately, it was found that there are no surface water resources in the Proposed Power Line Corridor. As such, the comparative assessment yielded no preference as to a preferred location between the proposed substation alternative sites. Both were viewed as suitable from a surface water perspective as there would be no potential impacts. Accordingly, in terms of potentially applicable environmental and water related legislature, no listed activities and/or water uses will be triggered for the proposed development. No potential impacts are therefore anticipated. However, cumulative impacts (construction, operation and decommissioning) were evaluated. The cumulative impacts were assessed to be low after mitigation. As such, the proposed development can proceed with the implementation of stipulated mitigation measures. From a surface water perspective, there are no major concerns with respect to the Proposed Power Line and Substation development.

13 REFERENCES

1. Collins, N.B., 2005: Wetlands: *The basics and some more*. Free State Department of Tourism, Environmental and Economic Affairs.
2. Department of Water Affairs and Forestry (DWAF), 2005: *A practical field procedure for identification and delineation of wetlands and riparian areas* (edition 1). DWAF, Pretoria.
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4. Ollis, D. J., Snaddon, C. D., Job, N. M & Mbona, M., 2013: *Classification System for Wetlands and other Aquatic Ecosystems in South Africa*, User Manual: Inland Systems.

Appendix A

Environmental Impact Assessment Methodology

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in table below.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		

1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	**Impact Significance Rating**	**Description**
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.

51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Appendix B

Specialist CV

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