Peddie Solar Project

ECOLOGICAL IMPACT ASSESSMENT

Prepared for:

InnoWind

Prepared by:

Coastal & Environmental Services
EAST LONDON
2 Marine Terrace, Hampton Court
5201
043 742 3302
Also in Grahamstown and Durban
www.cesnet.co.za

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THE PROJECT TEAM

Dr Alan Carter, Director of the East London Office, has extensive training and experience in both financial accounting and environmental science disciplines with international accounting firms in South Africa and the USA. He is a member of the American Institute of Certified Public Accountants and holds a PhD in Plant Sciences. He is also a certified ISO14001 EMS auditor with the American National Standards Institute and the British Standards Institute.

Dr Greer Hawley, Senior Environmental Consultant, has a BSc degree in Botany and Zoology and a BSc Honours in Botany from the University of Cape Town. She completed her PhD thesis (Microbiology) at Rhodes University. Greer has been involved in a number of diverse activities. The core academic focus has been directed in the field of taxonomy both in the plant and fungal kingdom. Greer's research ranges from studying fresh and marine algae, estuarine diatoms, Restio species classification in the fynbos and forest vegetation and fungal species identification and ecology. Greer's study of fungi have also contributed towards an understanding of soil ecology and "below ground" ecology. She is currently working on numerous impact assessments at the East London branch.

Mr Roy de Kock, holds a BSc in Botany and Geology and a BSc Honours in Geology from the Nelson Mandela Metropolitan University in Port Elizabeth. He is currently completing his MSc thesis in Rehabilitation Ecology with the focus on Mine Rehabilitation. His Masters thesis titled; Bushclump Rehabilitation Within Couga Bontveld After Strip Mining focused on rehabilitation of mined Bontveld vegetation on limestones of the Nanaga Formation where he attempts to recognise the evolutionary path of the present landscape, as well as focusing on primary ecological processes such as hydrology, energy capture and nutrient cycling and the impact of mining on change in diversity and ecosystem health. Currently he is working on numerous impact assessments at the East London branch.

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1 INTRODUCTION

1.1 Project description

InnoWind South Africa (hereafter referred to as InnoWind) proposes to construct a 10 mega Watt (MW) Photovoltaic (PV) solar energy facility on land located near Peddie in the Eastern Cape Province of South Africa. The proposed project will entail the construction and operation of a PV solar energy facility on land currently zoned for agriculture and used for grazing cattle.

It is anticipated that the footprint of the PV facility within this landholding will be approximately 18-19 Ha (10 x 1.0 MW arrays at 1.5 Ha per array). Associated infrastructure such as a storage facility and access roads may contribute towards another 3-4 Ha footprint. Therefore the **total transformed area is calculated to be at most 22-23 Ha in total**.

The proposed development will connect to the local Ngqushwa Local Municipality (NLM) electricity grid via a NLM Substation, adjacent to the site.

An ecological impact assessment was commissioned in order to predict and assess the significance of identified ecological impacts associated with the proposed activity.

1.2 Project locality

The proposed development site is located alongside the R345 to the north-west of Peddie, between East London and Grahamstown (Figure 1.1 below).

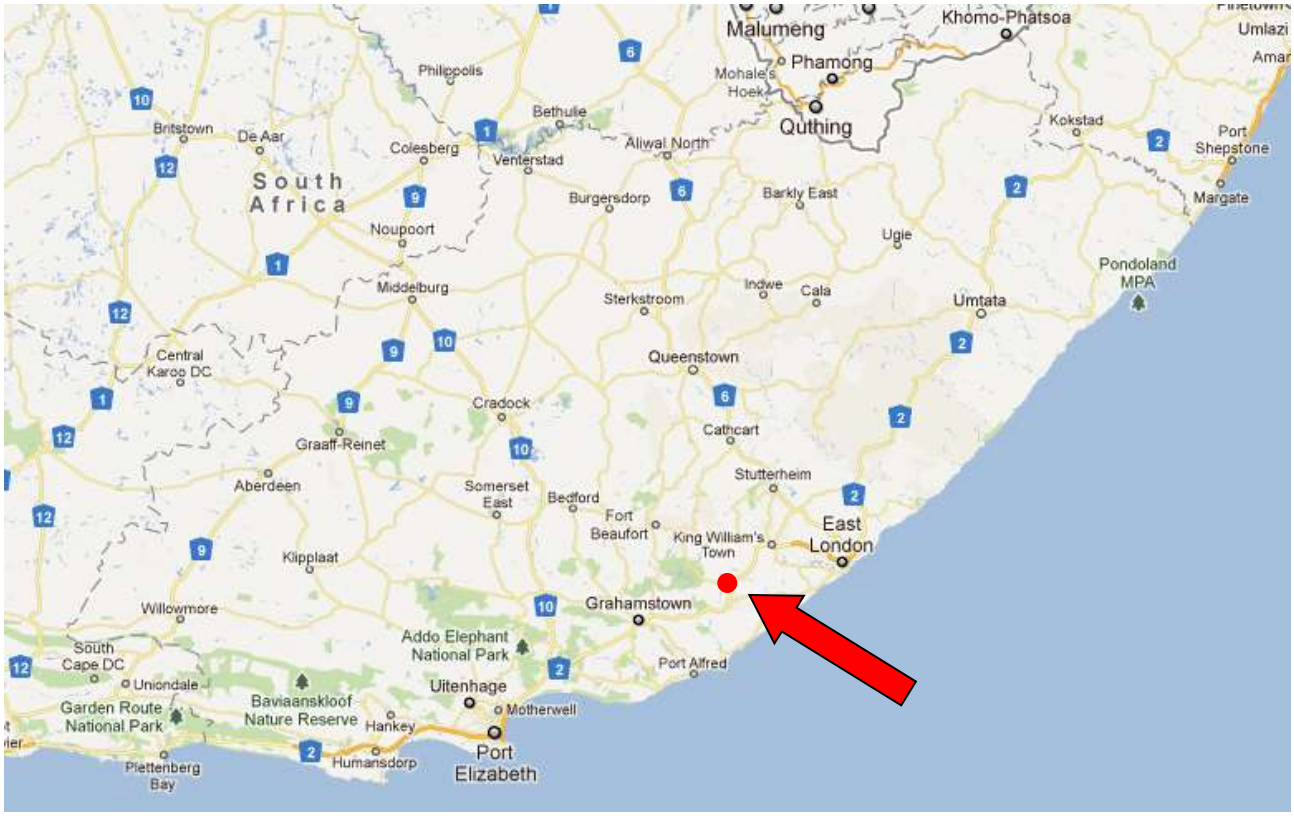
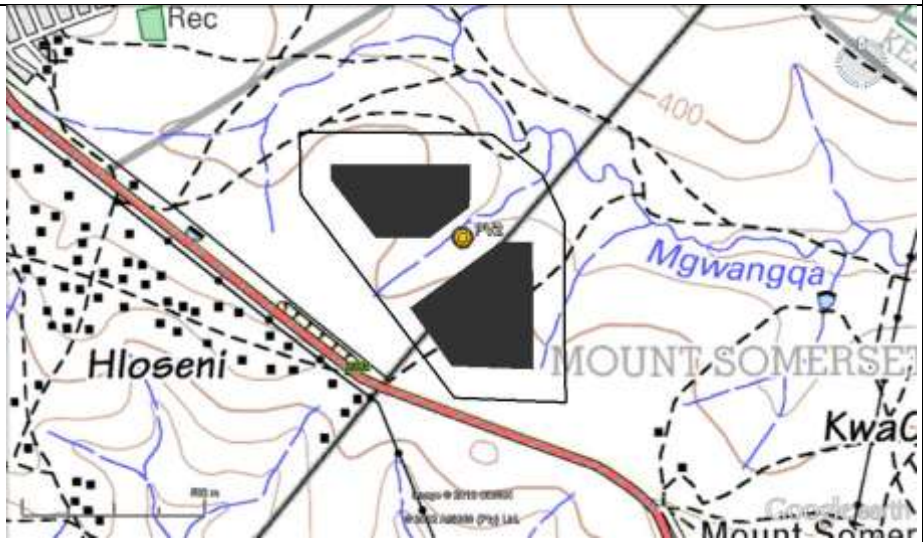
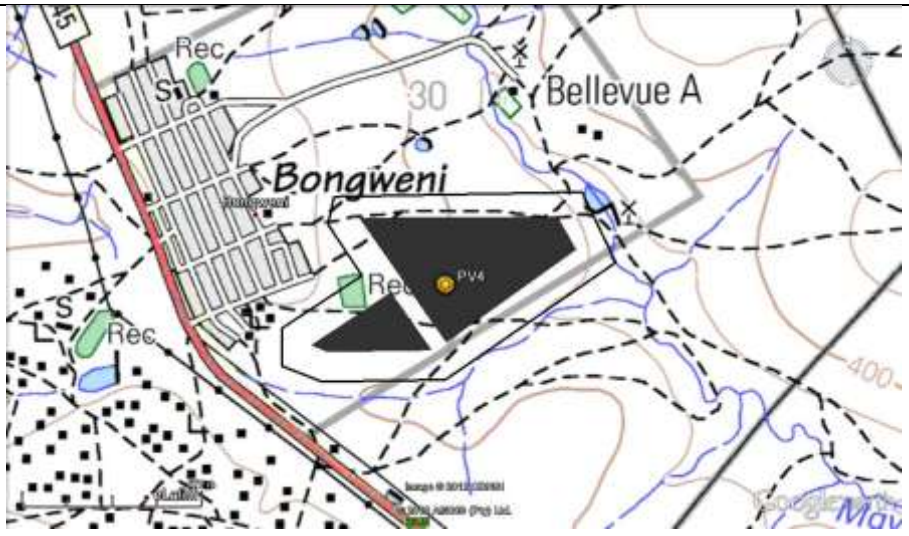


Figure 1.1 Locality map indicating the location of proposed Peddie solar energy project in the Eastern Cape.

1.3 Site alternatives

Three alternative PV sites are proposed namely PV1, PV2 and PV4. Alternative PV3 was eliminated as a possible site and will not be discussed in this report:

Alternative	Location	Description
PV1		GPS: 33° 8.350'S 27° 7.669'E The site is situated next to the village of KwaCrossman between the R345 and the N2.
PV2		GPS: 33° 8.071'S 27° 6.694'E The site is located next to the R345. A drainage line divides the area into 2 sections
PV4		GPS: 33° 7.707'S 27° 6.258'E The site is located next to the village of Bongweni and the R345.

1.4 Objectives and Terms of Reference

The following terms of reference was used as a guideline for the objectives of this study:

- A detailed description of the ecological (fauna and flora) environment within and immediately surrounding the footprint of the proposed PV facility and will consider terrestrial fauna and flora. Fauna include mammals, reptiles, amphibians, and insects but not avifauna. This aspect of the report will specifically include the identification of –
  - Areas of high sensitivity;
  - The presence of species of special concern, including sensitive, endemic and protected species;
  - Habitat associations of the identified fauna and flora;
  - The presence of areas sensitive to invasion by alien species; and
  - The presence of conservation areas, sensitive habitats and high biodiversity areas where disturbance should be avoided or minimised.
- Review relevant legislation, policies, guidelines and standards.
- Provide an assessment of the potential direct, indirect and cumulative impacts resulting from the proposed PV project (including the PV panels and associated infrastructure e.g. access road), both on the footprint and the immediate surrounding area during construction and operation;
- A detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts for each phase of the project, where required; and
- Checklists of floral and faunal groups identified in the region to date, highlighting sensitive species and their possible areas of distribution.

1.5 Approach

The study site and surrounding areas were described using a two-phased approach. Firstly, a desktop assessment of the site was conducted in terms of current vegetation classifications and biodiversity programmes and plans. This included the consideration of:

- The South African Vegetation Map (Mucina and Rutherford, 2006)
- Subtropical Thicket Ecosystem Programme (STEP)
- Eastern Cape Biodiversity Conservation Plan (ECBCP)

Further to the above, a site visits were conducted on the 10th November 2011 in order to assess the actual ecological state, current land-use, identify potential sensitive ecosystems and identify plant species associated with the proposed project activities. The site visits also served to inform potential impacts of the proposed project and how significantly it would impact on the surrounding ecological environment.

1.6 Limitations and assumptions

This report is based on currently available information and, as a result, the following limitations and assumptions are implicit:–

- The report is based on a project description taken from design specifications for the proposed solar facility that have not yet been finalised, and which are likely to undergo a number of iterations and refinements before they can be regarded as definitive;
- Descriptions of the natural and social environments are based on limited fieldwork and available literature.

2 RELEVANT LEGISLATION

The following legislation is relevant when considering ecological impacts identified during the Planning and Design, Construction and Operation Phase of the proposed Peddie Energy Photovoltaic Facility.

2.1 National Environmental Management Act (107 of 1998)

The objective of NEMA is: "*To provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state; and to provide for matters connected therewith*."

A key aspect of NEMA is that it provides a set of environmental management principles that apply throughout the Republic to the actions of all organs of state that may significantly affect the environment. The proposed development has been assessed in terms of possible conflicts or compliance with these principles. Section 2 of NEMA contains principles (see Box 1) relevant to the proposed project, and likely to be utilised in the process of decision making by DEA.

BOX 1: NEMA ENVIRONMENTAL MANAGEMENT PRINCIPLES

(2)	Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.
(3)	Development must be socially, environmentally and economically sustainable.
(4)(a)	Sustainable development requires the consideration of all relevant factors including the following: i. That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; ii. That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied; iii. That waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner.
(4)(e)	Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.
(4)(i)	The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.
(4)(j)	The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.
(4)(p)	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.
(4)(r)	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.

As these principles are utilised as a guideline by the competent authority in ensuring the protection of the environment, the proposed development should, where possible, be in accordance with

these principles. Where this is not possible, deviation from these principles would have to be very strongly motivated.

NEMA introduces the duty of care concept, which is based on the policy of strict liability. This duty of care extends to the prevention, control and rehabilitation of significant pollution and environmental degradation. It also dictates a duty of care to address emergency incidents of pollution. A failure to perform this duty of care may lead to criminal prosecution, and may lead to the prosecution of managers or directors of companies for the conduct of the legal persons.

Employees who refuse to perform environmentally hazardous work, or whistle blowers, are protected in terms of NEMA.

In addition NEMA introduces a new framework for environmental impact assessments, the EIA Regulations (2010) discussed previously.

Relevance to the proposed Peddie PV Project:

- The developer must be mindful of the principles, broad liability and implications associated with NEMA and must eliminate or mitigate any potential impacts.
- The developer must be mindful of the principles, broad liability and implications of causing damage to the environment.

2.2 National Environmental Management: Biodiversity Act (10 of 2004)

This Act provides for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act 107 of 1998 (see Box 2). In terms of the Biodiversity Act, the developer has a responsibility for:

1. The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).
2. Application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all developments within the area are in line with ecological sustainable development and protection of biodiversity.
3. Limit further loss of biodiversity and conserve endangered ecosystems.

The objectives of this Act are –

- To provide, within the framework of the National Environmental Management Act, for –
    - The management and conservation of biological diversity within the Republic;
    - The use of indigenous biological resources in a sustainable manner.

The Act's permit system is further regulated in the Act's Threatened or Protected Species Regulations, which were promulgated in February 2007.

Relevance to the proposed Peddie PV Project:

- The proposed reticulation pipeline must conserve endangered ecosystems and protect and promote biodiversity;
- Must assess the impacts of the proposed development on endangered ecosystems;
- No protected species may be removed or damaged without a permit;
- The proposed site must be cleared of alien vegetation using appropriate means

2.3 National Water Act (No. 36 of 1998)

In terms of Section 21 of the Water Act, certain activities trigger the need for water-use licenses. It is likely that the proposed bridges, culverts or major drainage structures will trigger the need for water use license applications in terms of the following:

- Sec 21 (c) - impeding or diverting the flow of water in a watercourse, and
- Sec 21 (i) - altering the bed, banks, course or characteristics of a watercourse

Relevance to the proposed Peddie PV Project:

- If any development will take place in or wihin 32 meters of a water course, the developer will require a water use licence from the DWA to perform any of the above-listed activities.

3 BACKGROUND TO VEGETATION ASSESSMENT

3.1 Biological elements

The "natural environment" and the state thereof are defined by the quality of the environment and can be described by measures of the following parameters:

- Vegetation type
- Plant biodiversity
- Rare, endangered and protected plant species
- Endemism of plant species
- Diversity of plant biomes
- Animal and insect biodiversity
- Overall species richness and abundance within population
- Quality of the environment (degree of impact degradation or level of transformation, if present), determined by soil exposure and plant species present (pioneer vs. late stage).

The Sensitivity of a particular ecological system can be further described as the value of a particular environment in terms of rarity of a set of populations or the fragility (easily destroyed) of a particular environment. There are a number of programmes that can be used to guide a desktop assessment of the value and sensitivity of a particular vegetation type, based on previous studies e.g. South African National Biodiversity Institute: Vegetation Map (Mucina and Rutherford (eds), 2006), the Subtropical Thicket Ecosystem Plan (Pearce S.M., 2003), and Eastern Cape Biodiversity Conservation Plan (Berliner and Desmet, 2007). However, ground-truthing of these studies is required for higher resolution accuracy.

3.2 Physical elements and ecological systems

Sensitive ecological systems can also be identified by physical landscape features. Three main factors contribute towards characterising ecological sensitivity and include:

- Slope
- Soil type and geology
- Water sources
    - Presence of diverse land or water features

3.3 Methodology

3.3.1 Desktop Analysis: Literature review

The following desktop procedures were employed:

1. Assessment of biodiversity reference material and conservation planning frameworks (SANBI Vegetation, ECBCP, STEP, NPAEP) in context of proposed development.
2. Quality of vegetation determined from aerial images.
3. Analysis of contour maps to determine slope gradient
4. Investigate published data available on the geology, soil structure and hydrology of the area

3.3.2 Site observations

A site visit was undertaken on the 13-17 February 2012. The route was investigated in terms of plant species, vegetation structure and degree of disturbance. The state of the localised environment was also described.

4 DESCRIPTION OF THE ECOLOGICAL ENVIRONMENT

4.1 Literature review and Desktop information

Published literature on the ecology of the area was referenced in order to describe the study site in the context of the region and the Eastern Cape Province. The following documents/plans are referenced:

- SANBI (South African National Biodiversity Institute) vegetation
- STEP (Subtropical Thicket Ecosystem Programme)
- ECBCP (Eastern Cape Biodiversity Conservation Plan)

4.1.1 SANBI Vegetation (Mucina and Rutherford, 2006)

The PV layouts are situated predominantly in a vegetation type named "Great Fish Thicket" (Figure 4.1 below). A small corner section of Alternative PV2 has been described as "Bhisho Thornveld", but the difference in vegetation was not visually apparent.

Figure 4.1 SANBI Vegetation map of the region.

Great Fish Thicket (Hoare *et al*., 2006)
This Thicket type are found on steep slopes of deeply dissected rivers and supports short, medium and long thicket types where both the woody trees and shrubs and the succulent components are well developed. Spinicent shrubs are common. Dominant species are *Euphorbia bothae*, *E. tetragona* and *E. triangulates*. These conditions were not present at the site in question. Slopes associated with the PV sites were relatively gentle and covered by grasses.

Bhisho Thornveld (Rutherford *et al*., 2006)
This open savanna is characterised by small trees of *Acacia natalitia* with a short to medium, dense and sour grassy understorey which is usually dominated by *Thermeda triandra* and are mostly found on undulating steep slopes and sometimes in drainage valleys. The conservation status of Bhisho Thornveld is "Least Threatened". This vegetation description is better suited to environmental conditions observed at the PV sites.

4.1.2 Subtropical Thicket Ecosystem Programme (STEP)

The STEP Conservation Priority Map classifies areas into a number of categories, based on plant and animal biodiversity of the planning domain, with emphasis on Thicket biomes (Pierce, 2003). The Conservation Priority map for the study area is presented in Figure 4.2. Most of the study area is classified as a STEP "Class IV" area. The land-use management guidelines for (Table taken from STEP) classified as a Class IV (currently not vulnerable) area requires that these areas can withstand a loss off or disturbance of natural areas through human activity or development. Most of the area shown in Alternative site PV4 are also considered as degraded.

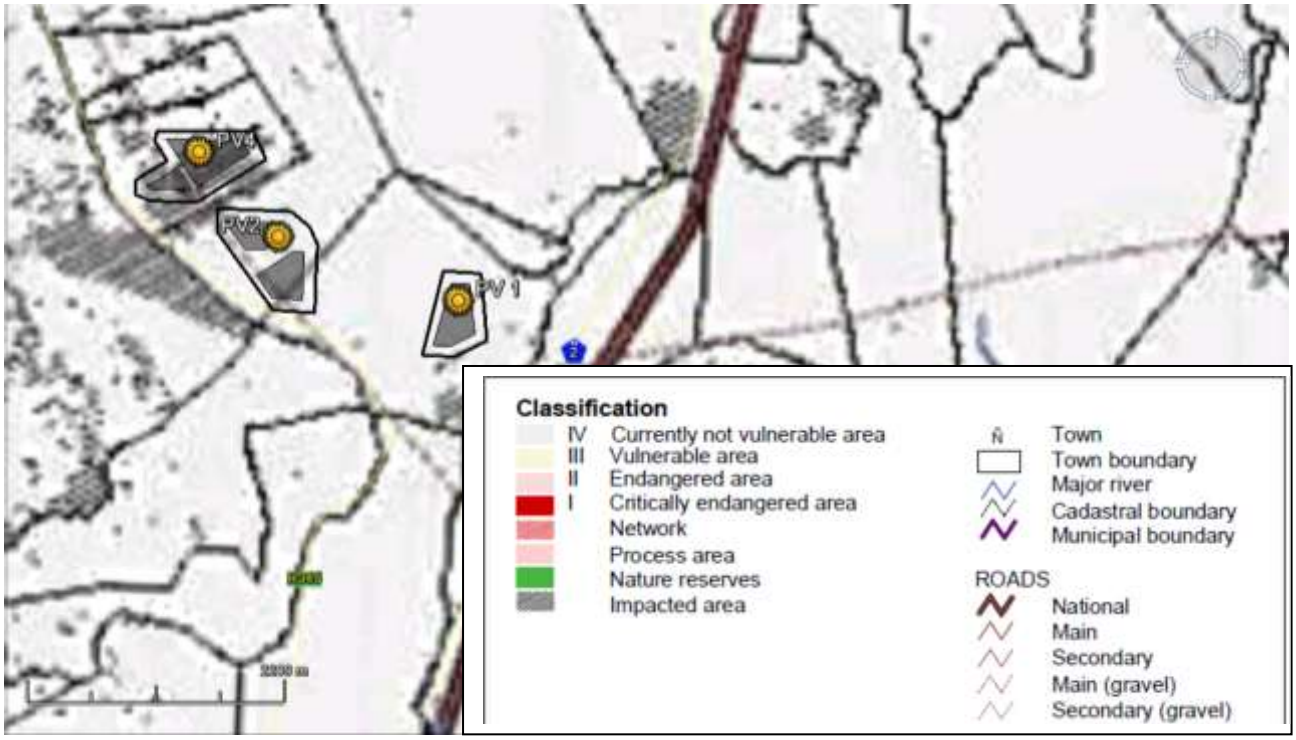


Figure 4.2 STEP Conservation Priority Map.

KEY TO MAP	CONSERVATION PRIORITY (i.e. priority for safeguarding)	CLASSIFICATION (see below[1])	BRIEF DESCRIPTION	GENERAL RULE
	IV	CURRENTLY NOT VULNERABLE AREA	Ecosystems which cover most of their original extent and which are mostly intact, healthy and functioning.	**Depending on other factors, this Class IV land can withstand loss of natural area through disturbance or development.**

LAND USE MANAGEMENT (Reactive decisions)	SPATIAL PLANNING (Forward planning- SDFs)	
PROCEDURES for Municipalities to follow in responding to applications for developments, land use changes etc. (Municipality should check their responsibilities for all activities in Table 2 of the Handbook).	**RESTRICTIONS** on activities which decision makers should impose (Municipality should check their responsibilities for all activities in Table 2 of the Handbook).	**OPPORTUNITIES** for activities which decision makers should encourage.
1. Proposed disturbance or developments should preferably take place on portions which have already undergone disturbance or impacts[3] rather than on portions that are undisturbed or unspoilt by impacts[3]. **2.** In response to an application for a non-listed activity which will have severe or large-scale disturbance on a relatively undisturbed site (unspoilt by impacts[3]), the Municipality should first seek the opinion of the local conservation authority. **3.** For a proposed "listed activity", EIA[2.1] authorisation is required by law.	**1.** Proposed disturbance or developments should preferably take place on portions which have already undergone disturbance or impacts[3] rather than on portions that are undisturbed/undisturbed. **2.** In general, Class IV land can withstand loss of/ disturbance to natural areas through human activities and developments.	Depending on constraints (such as avoidance of spoiling scenery or wilderness, or infra-structure limitations), Class IV land can withstand loss of, or disturbance to, natural areas. Within the constraints, this class may be suitable for a wide range of activities (e.g. extensive urban development, cultivation, tourist accommodation, ecotourism, game faming).

4.1.3 Eastern Cape Biodiversity Conservation Plan (ECBCP)

The ECBCP is a first attempt at detailed, low-level conservation mapping for land-use planning purposes. Specifically, the aims of the Plan were to map critical biodiversity areas through a systematic conservation planning process. The current biodiversity plan includes the mapping of priority aquatic features, land-use pressures, critical biodiversity areas and develops guidelines for land and resource-use planning and decision-making.

The main outputs of the ECBCP are "critical biodiversity areas" or CBAs, which are allocated the following management categories:

1. CBA 1 = Maintain in a natural state
2. CBA 2 = Maintain in a near-natural state

The ECBCP maps CBAs based on extensive biological data and input from key stakeholders. The ECBCP, although mapped at a finer scale than the National Spatial Biodiversity Assessment (Driver *et al.,* 2005) is still, for the large part, inaccurate and "course". Therefore it is imperative that the status of the environment, for any proposed development MUST first be verified before the management recommendations associated with the ECBCP are considered (Berliner and Desmet, 2007). It is also important to note that in absence of any other biodiversity plan, the ECBCP has been adopted by the Provincial Department of Economic Development and Environmental Affairs as a strategic biodiversity plan for the Eastern Cape.

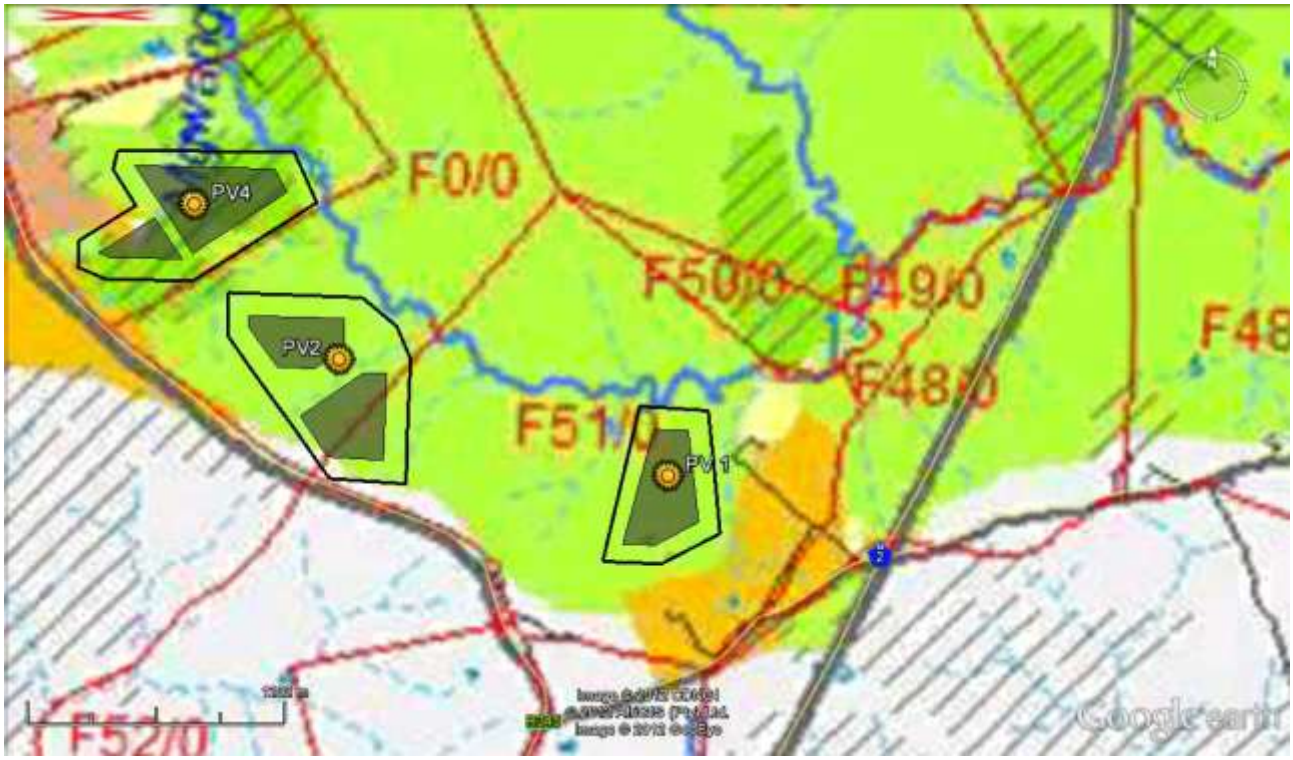


Figure 4.3. ECBCP map of the surrounding area

The ECBCP map (Figure 4.3) for the area shows that most of the surrounding landform is categorised as a CBA 2 area (light green in Figure 4.3), which requires that the land is maintained in a near natural state. As most of the surrounding areas are extremely degraded through years of cattle grazing, this status classification is not effective.

4.2 Current land-use and general state of environment

4.2.1 Alternative PV1

The study site and neighbouring properties in the area are currently engaged with livestock farming (Plate 4.1 & 4.2). The site is bordered by the village of KwaCrossman in the south and Buckman in the east. The vegetation is in poor condition (because of informal stock grazing).

Plate 4.1. The affected area consists of degraded grassland interspersed with *Acacia natalentia.*

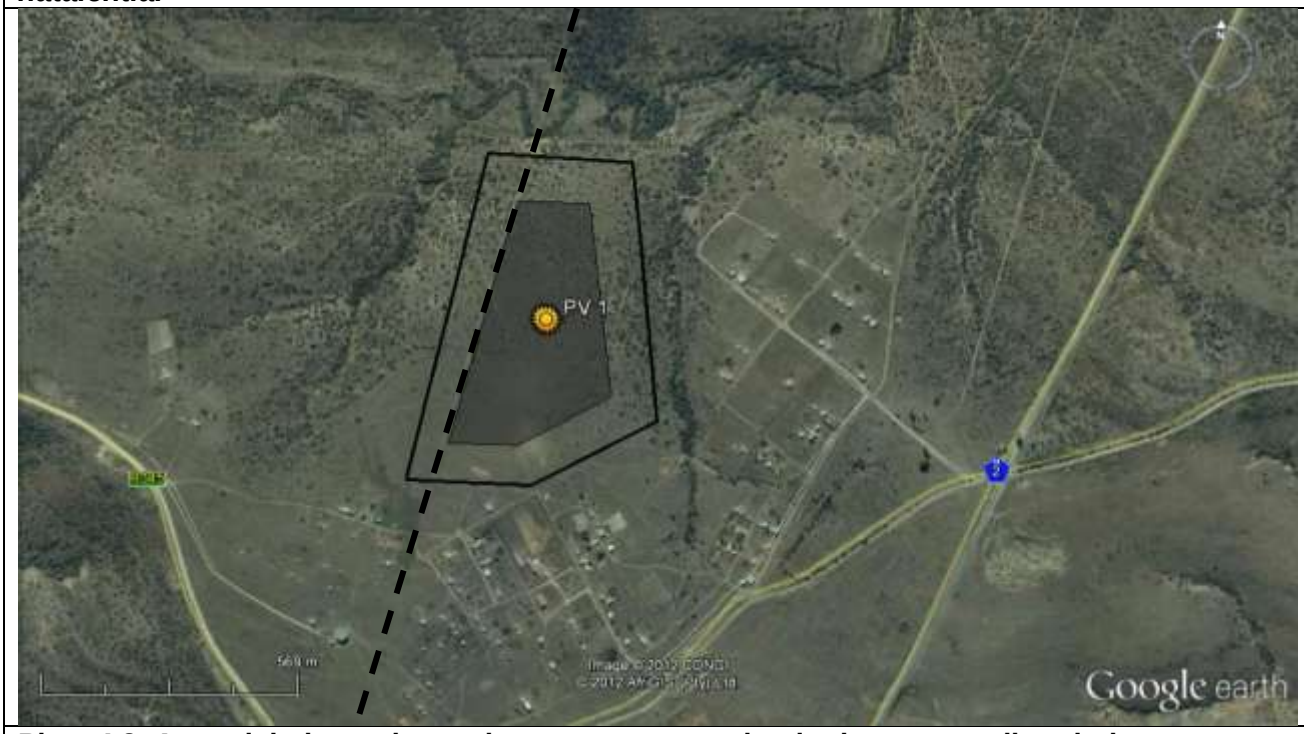


Plate 4.2. An aerial photo shows denser tree vegetation in the surrounding drainage systems. The shaded polygons represent the solar panel's footprint. The dashed line represents the existing power line layout.

4.2.2 Alternative PV2

The study site and neighbouring properties in the area are currently engaged with livestock farming (Plate 4.3 & 4.4). The vegetation is in poor condition is some places (where there is informal stock grazing) and moderate in the north-eastern areas of the property.

Plate 4.3. The affected area consists of degraded grassland in the flat areas and Valley thicket in the drainage system.

Plate 4.4. An aerial photo shows denser tree vegetation in the drainage system. The shaded polygons represent the solar panel's footprint. The dashed line represents the existing power line layout.

4.2.3 Alternative PV4

The study site and neighbouring properties in the area are currently engaged with livestock farming (Plate 4.5-4.7). The site is bordered by the village of Bongweni in the west. The vegetation is in poor condition (because of informal stock grazing).

Plate 4.5. The village of Bongweni that borders the proposed site on the west.

Plate 4.6. The affected area consists of degraded grassland.

Plate 4.7 An aerial photo shows the surrounding degraded grassland with Bongweni bordering on the west. The shaded polygons represent the solar panel's footprint. The dashed line represents the existing power line layout.

4.2.4 Powerlines

The proposed site alternatives PV4 & PV2 will connect to the Peddie substation to the south-east along an existing servitude while the proposed alternative PV1 will connect via the existing north-south servitude (see Figure 4.4 below).

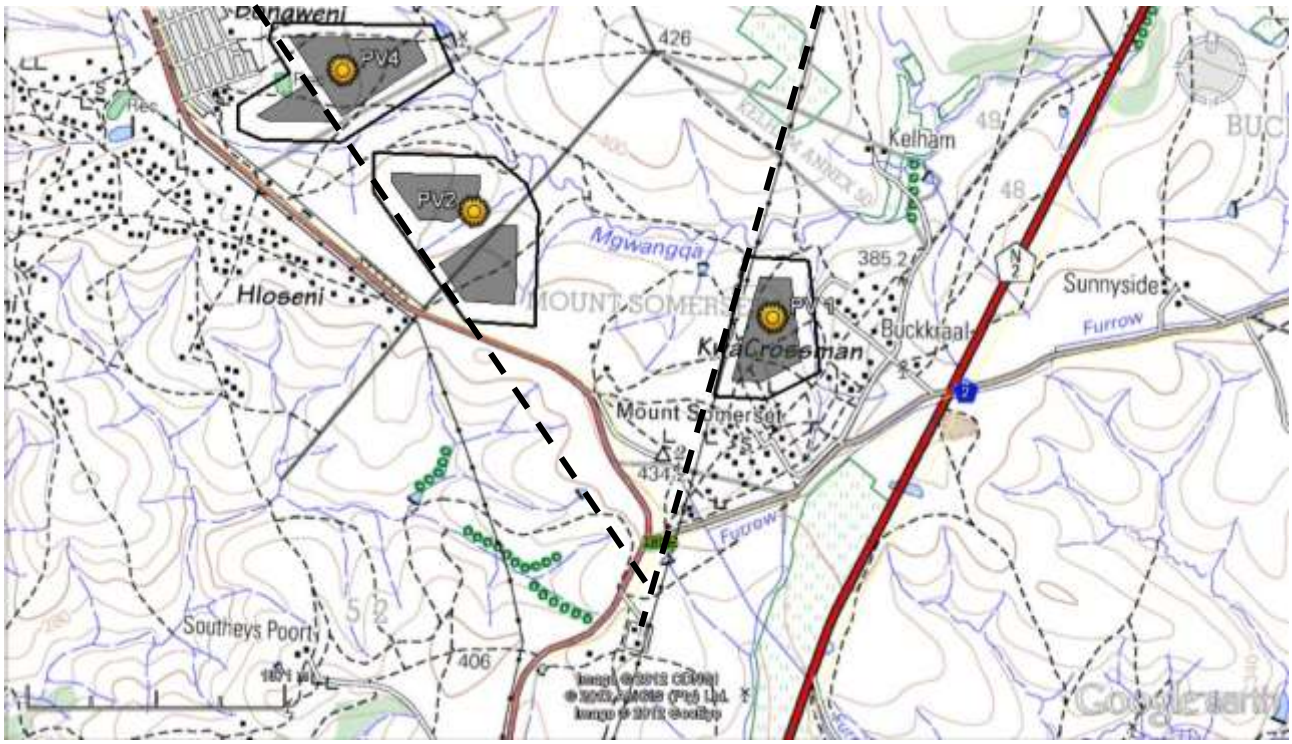


Figure 4.4. Location of the existing powerlines outside the proposed alternative sites (dashed lines).

5 BIODIVERSITY AND SENSITIVITY ASSESSMENT

A site assessment was conducted in order to confirm desktop information and infer accurate descriptions of the current ecological integrity of the site at a more detailed level. A further objective is to assist in impact identification and assessment. This study discusses fauna, flora and potential sensitive ecosystems.

5.1 Fauna

Small mammals such as rodents, ground squirrels, bats and a variety of insects and reptiles are expected to occur on site. The development may cause a shift in faunal community as shade-loving plant species establish beneath the panels. It is envisaged that no significant negative impact may be experienced as a result of the panels, as they may form refugia for many animals (including birds and rodents), whilst maintaining natural grassland.

5.2 Flora

The study area includes the impacted footprint of the development and surrounding areas. The vegetation can be described as degraded grassland that typically consists of graminoids and herbaceous shrubs. A few geophytic species were observed, but undetected species, not flowering at the time nor producing above-ground stems or leaves, are expected to occur. Valley thicket is found in the drainage areas and it is historically known that the entire area was traditionally thicket vegetation that became degraded through domestic animal grazing practises.
The plant species identified have been grouped in Table 5.1 below.

Table 5.1 Plant species identified in the study area.

Graminoids
Aristida congesta
Cynodon imcompletus
Digitaria eriantha
Eragrostis obtuse
Panicum species
Themeda triandra
Eragrostis species
Diospyros dichrophylla
Dovyalis zeyheri
Acacia natalensis
Selago luxurians
Berkheya sp.
Helichrysum spp.
Gazania sp.
Boophane sp. **(only at PV2)**
Asphalathus sp.
Cassine peragua
Putterlickia pyracantha
Herbs and Geophytes
Cyanotis speciosa
Hypoestes aristata
Salvia scabra
Hibiscus pusillus
Crassula expanza
Senecio radicans
Alien invasive
*Opunta ficus-indica (*pricly pear)

Species only found in the drainage line
Euphorbia triangularis
Sideroxylon inerme subsp. inerme
Euclea sp.
Carissa bispinosa

5.3 Sensitive environments

Environmental sensitivity has been assessed by identifying the sensitive ecological or hydrological systems. These sensitive areas are shown in Figure 5.1 below.

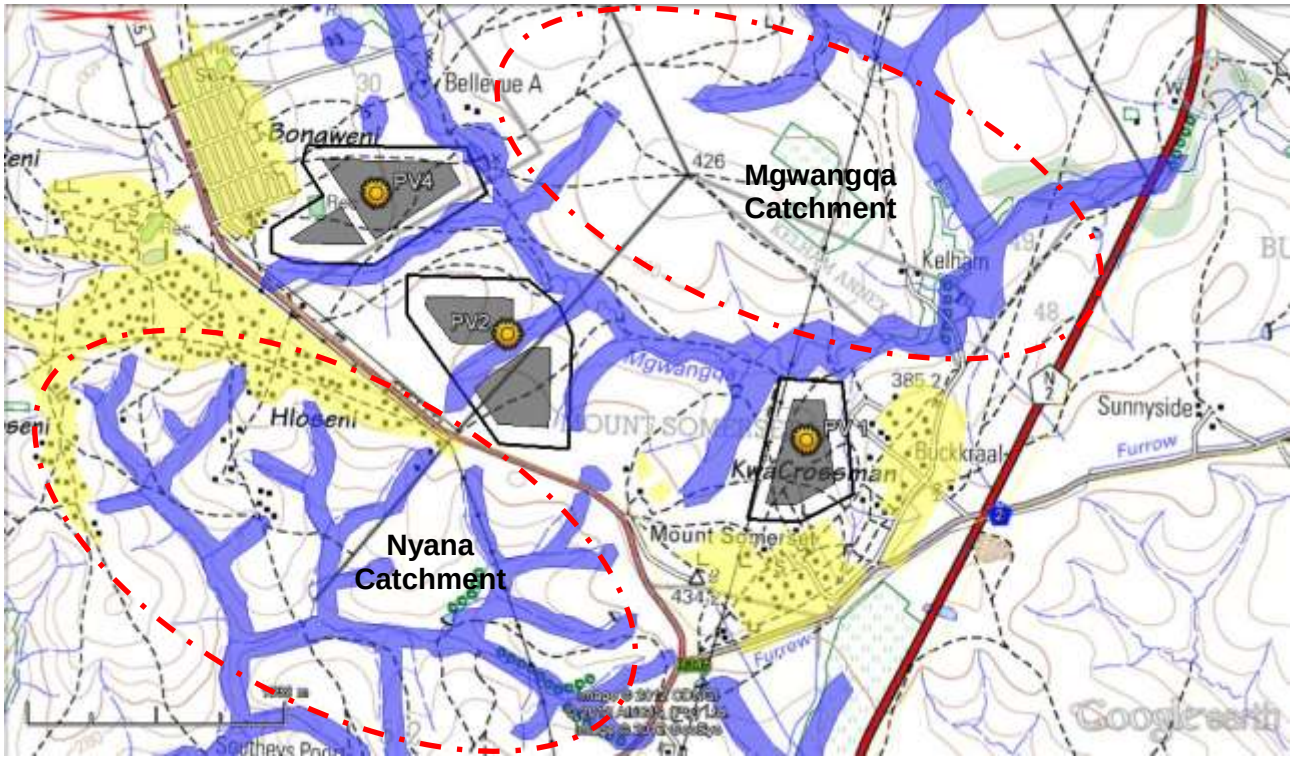


Figure 5.1. Sensitivity map for the proposed Peddie PV development. Blue = sensitive water bodies; Yellow = urban development (not sensitive).

5.4 Recommendations

Various mitigations are recommended to reduce impacts of the proposed new Peddie PV facility on the surrounding natural environment.

5.4.1 Water bodies

These areas are considered as highly sensitive and require specific mitigation to reduce the development impact on the natural environment.

The surrounding area consists of various drainage systems acting as catchments for local river systems. The development footprint was designed to avoid these drainage systems (especially alternative PV2) and should not have an impact on them. Construction activities like work camps etc. must not take place within 32 meters of the drainage lines of the Mgwangqa catchment. If any construction activity – temporary or permanent – takes place within 32 meters of any water body, a Water Use Licence must be applied for as per Section 24 (c) & (i) of the National Water Act (No. 36 of 1998).

Existing power lines and their servitudes should be ulitised to connect the proposed new PV yard to the Energy Grid. This is to reduce impacts on the Nyana River catchment area as shown in Figure 5.1 above. PV1,PV2 & PV4 is not associated with the Nyana catchment.

6 IMPACT IDENTIFICATION AND ASSESSMENT

6.1 Identified Impacts

Ecological impacts were identified during the Planning and Design, Construction and Operation Phase of the proposed Peddie Solar Energy Facility and are described below. These included the consideration of direct, indirect and cumulative impacts that may occur.

Table 6.1 Impact identified during the phases of the Chaba Wind Energy Facility

Phase	Issue	Nature of Impact	Description of Impact
Planning & Design	Loss of indigenous vegetation	Direct	Unnecessary damage and disturbance to natural vegetation (Great Fish Thicket) due to poor planning and placement of infrastructure.
	Soil erosion and sedimentation	Direct	Consistent, high impact water fall from the PV panels will result in direct soil erosion impacts below each panel.
		Indirect	Erosion beneath each panel many result in abrasive run-off storm water, which will continue to erode the soil between and downstream of the PV panels.
		Cumulative	Large scale erosion will result in high stormwater run-off containing a high sediment load. This will cause sedimentation in dams, downstream wetlands.
	Disturbance of sensitive area	Indirect	Erosion and degradation of water-courses and associated habitats due to poor planning and layout design (i.e. inappropriate utilisation of sensitive aquatic systems).
Construction	Loss of vegetation during construction	Direct	Unnecessary damage and disturbance to natural vegetation (Great Fish Thicket) due to uncontrolled construction activities beyond the required footprint of solar panels and associated access infrastructure
		Indirect	Inadvertent or excessive damage and loss of vegetation beyond the development footprint
		Direct	Loss of plant species of special concern
	Disturbance to surrounding wildlife and fauna	Direct	During construction vehicular movement, noise and habitat destruction will disturb animals in the area
		Direct	Poaching of wild animals during construction
Operation	Soil erosion and sedimentation	Direct, indirect and cumulative	Consistent high energy impact from rainfall runoff from the PV panels will result in localised erosion, which may result in larger soil erosion events across the study area, eventually culminating in large scale sedimentation of receiving water bodies.
Decommission	Loss of vegetation during decommissioning	Direct	Unnecessary damage and disturbance to natural vegetation (Great Fish Thicket) due to uncontrolled activities outside of the development footprint.

		Indirect	Poor rehabilitation may result in limited re-vegetation and long-term ecological damage

6.2 Assessment methodology

Identified impacts will be assessed against the following criteria:

- Temporal scale
- Spatial scale
- Risk or likelihood
- Degree of confidence or certainty
- Severity or benefits
- Significance

The relationship of the issue to the temporal scale, spatial scale and the severity are combined to describe the overall importance rating, namely the significance.

Description of criteria

Table 6.2 Significance Rating Table

Significance Rating Table	
Temporal Scale (The duration of the impact)	
Short term	Less than 5 years (Many construction phase impacts are of a short duration).
Medium term	Between 5 and 20 years.
Long term	Between 20 and 40 years (From a human perspective almost permanent).
Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
Spatial Scale (The area in which any impact will have an affect)	
Individual	Impacts affect an individual.
Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
Project Level	Impacts affect the entire project area.
Surrounding Areas	Impacts that affect the area surrounding the development
Municipal	Impacts affect either BCM, or any towns within them.
Regional	Impacts affect the wider district municipality or the province as a whole.
National	Impacts affect the entire country.
International/Global	Impacts affect other countries or have a global influence.
Will definitely occur	Impacts will definitely occur.
Degree of Confidence or Certainty	

(The confidence with which one has predicted the significance of an impact)	
Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.

Table 6.3 Impact Severity Rating

Impact severity (The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)	
Very severe	Very beneficial
An irreversible and permanent change to the affected system(s) or party (ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party (ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.
Severe	Beneficial
Long term impacts on the affected system(s) or party (ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party (ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.
Moderately severe	Moderately beneficial
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party (ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.
Slight	Slightly beneficial
Medium or short term impacts on the affected system(s) or party (ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party (ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect	Don't know/Can't know
The system(s) or party (ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.

Table 6.4 Overall Significance Rating

Overall Significance (The combination of all the above criteria as an overall significance)	
VERY HIGH NEGATIVE	VERY BENEFICIAL
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in **severe** or **very severe** effects, or **beneficial** or **very beneficial** effects. **Example:** The loss of a species would be viewed by informed society as being of VERY HIGH significance. **Example:** The establishment of a large amount of infrastructure in a rural area, which previously	

had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.	
HIGH NEGATIVE	BENEFICIAL
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. **Example:** The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. **Example:** The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.	
MODERATE NEGATIVE	SOME BENEFITS
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. **Example:** The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.	
LOW NEGATIVE	FEW BENEFITS
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. **Example:** The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels. **Example:** The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. **Example:** A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. **Example:** The effect of a particular development on people's psychological perspective of the environment.	

6.3 Impact Assessment

The impacts identified in Section 6.2 are assessed in terms of the criteria described in Section 6.3 and are summarised in the tables below (Table 6.5 – 6.8).

Table 6.5 Assessment and mitigation of impacts identified in the Planning and Design Phase

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
For Alternatives PV1,PV2 & PV4							
Issue: Loss of indigenous vegetation							
Unnecessary damage and disturbance to natural vegetation (Fish River Thicket) due to poor planning and placement of infrastructure.	**Localised**	**Short-term**	**Definite**	**Moderately severe**	**MODERATE**	• The appointment and consultation of an Environmental Control Officer must be incorporated into the detailed planning and design of access roads and associated infrastructure in order to minimise the disturbance of natural vegetation for the development of the solar facility. • All species of special concern, protected or vulnerable must be avoided or transplanted • Rehabilitation with grasses found on site, must be undertaken	**LOW**
Issue: Soil erosion and sedimentation							
Consistent, high impact water fall from the PV panels will result in direct and localised soil erosion impacts below each panel.	**Localised**	**Long-term**	**Probable**	**Severe**	**HIGH**	• Rainwater run-off must be captured and released through lower energy mechanisms. • Rainwater harvesting could be considered • Guttering and localise energy dissipation mechanisms could be implemented • Develop and implement an Erosion Action Programme.	**LOW**
Erosion beneath each panel many result in abrasive run-off storm water, which will continue to erode the soil between and downstream of the PV panels.	**Study area**	**Long-term**	**Probable**	**Moderately severe**	**HIGH**		**POW**
Large scale erosion will result in high stormwater run-off containing a high sediment load. This will cause sedimentation in dams and downstream wetlands.	**Downstream**	**Long-term**	**Probable**	**Moderately severe**	**HIGH**		**LOW**
Issue: Disturbance of sensitive areas							
Erosion and degradation of water-courses and associated habitats due to poor planning and layout design (i.e. inappropriate utilisation of sensitive aquatic systems)	**Study area**	**Long-term**	**Possible**	**Moderately severe**	**HIGH**	• Ensure that a buffer zone of 32 metres is maintained along all existing watercourses. No development activities may occur within this area. • Water courses should be rehabilitated by careful removal of the alien invasive vegetation.	**LOW**

Table 6.6 Assessment and mitigation of impacts identified in the Construction Phase

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
For Alternatives PV1,PV2 & PV4							
Issue: Loss of vegetation during construction							
Unnecessary damage and disturbance to natural vegetation (Great Fish Thicket) due to uncontrolled construction activities beyond the required footprint of solar panels and associated access infrastructure	**Localised**	**Short-term**	**Probable**	**Moderately severe**	**MODERATE**	• The appointed ECO must oversee all construction activity and submit a monthly audit report to the competent authorities. • Construction activities must be limited to the designated development footprint. i.e. construction materials, vehicular storage, construction camps etc, should occur in a footprint which will ultimately be developed as part of the facility. • Actual PV installation should be undertaken with minimal disturbance to areas in the immediate vicinity as successful vegetation recovery will depend on the remaining vegetation. • Ensure that roads on slopes incorporate storm water diversion. • Where vegetation has been cleared, site rehabilitation in terms of soil stabilisation and re-vegetation must be undertaken • Utilise existing power line servitudes, especially through the Nyana River catchment	**LOW**
Inadvertent or excessive damage and loss of vegetation beyond the development footprint	**Study area**	**Short-term**	**Possible**	**Severe**	**MODERATE**	• Construction activities must be demarcated and vegetation clearing and top soil removal (if required) limited to these areas.	**LOW**

Loss of plant species of special concern	**Localised**	**Permanent**	**Possible**	**Severe**	**HIGH**	• The development area must be surveyed prior to topsoil removal (if required) during construction in order to locate protected geophytic plant species and transplant them into the neighbouring undeveloped environment.	**LOW**

Table 6.7 Assessment and mitigation of impacts identified in the Operation Phase

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
For Alternatives PV1, PV2 & PV4							
Issue: Soil erosion and sedimentation							
Consistent high energy impact from rainfall runoff from the PV panels will result in localised erosion, which may result in larger soil erosion events across the study area, eventually culminating in large scale sedimentation of receiving water bodies.	**Localised, study area and downstream**	**Long-term**	**Probable**	**Severe**	**HIGH**	• Rainwater run-off must be captured and released through lower energy mechanisms. • Rainwater harvesting could be considered. • Guttering and localise energy dissipation mechanisms could be implemented • Develop and implement an Erosion Action and Monitoring Programme.	**MODERATE**

Table 6.8 Assessment and mitigation of impacts identified in the Decommission Phase

GENERAL AND SPECIALIST STUDY IMPACTS	SPATIAL SCALE	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
For Alternatives PV1, PV2 & PV4							
Issue: Loss of vegetation during decommissioning of the PV site							
Unnecessary damage and disturbance to natural vegetation (Great Fish Thicket) due to uncontrolled activities outside of the development footprint.	**Localised**	**Short-term**	**Probable**	**Moderately severe**	**MODERATE**	• Decommission activities must be limited to the designated development footprint. • Actual removal of the panels should be undertaken with minimal disturbance to areas in the immediate vicinity as successful vegetation recovery will depend on the remaining vegetation. • Re-vegetation of exposed soil must be undertaken.	**LOW**
Poor rehabilitation may result in limited re-vegetation and long-term ecological damage	**Study area**	**Long-term**	**Possible**	**Severe**	**HIGH**	• Rehabilitation must be undertaken in the following phases: • Applying topsoil and re-landscaping the area to its original condition if modified • Stabilising the soil with synthetic materials or a fast growing plant species • Re-vegetate with plants grown from seed or cuttings from the surrounding vegetation.	**LOW**

7 IMPACT STATEMENT, CONCLUSION & RECOMMENDATIONS

7.1 Conclusions

InnoWind proposes to construct a 10 MW PV solar energy facility on land located near Peddie in the Eastern Cape Province of South Africa. The proposed project will entail the construction and operation of a PV solar energy facility on land currently zoned for agriculture and used for grazing cattle.

It is anticipated that the footprint of the PV facility within this landholding will be approximately 20 Ha (10 x 1.0 MW arrays at 1.5 Ha per array). Associated infrastructure such as a storage facility and access roads may contribute towards another 3-4 Ha footprint. Therefore the **total transformed area is calculated to be at most 23-24 Ha in total**.

The proposed development will connect to the local Ngqushwa Local Municipality electricity grid via a NLM Substation, adjacent to the site.

No excessive ecological impact associated with the Peddie Energy PV Facility (Table 7.1) was identified, but it must be emphasised that an Erosion Action and Monitoring Programme and Rehabilitation Plan *must* be developed prior to construction.

Table 7.1 Assessment of pre- and post-mitigation impact significance.

	PRE-MITIGATION			POST-MITIGATION		
	LOW	MODERATE	HIGH	LOW	MODERATE	HIGH
Planning and Design	0	1	4	5	(+1)	0
Construction	0	2	1	3	0	0
Operation	0	0	1	0	1	0
Decommission	0	1	1	2	0	0
TOTAL	0	4	7	10	1(+1)	0

The post-mitigation MODERATE impacts incurred an extra beneficial assessment. By remaining clear of the 32 metre buffer around aquatic systems and removing alien invasive plant species, the impact of encroaching on the aquatic systems is mitigated *and* a potential benefit is achieved.

The post-mitigation MODERATE impacts are all related to the storm water and localised erosion as a result of high impact run-off from the panels on the soil directly below. The impact can be further mitigated to LOW, if an Erosion Action Plan is enforced through conditions in the Environmental Authorisation.

7.2 Recommendations for the proposed Peddie Energy PV Facility

All the mitigation measures provided below are to be implemented in the Planning and Design, Construction, Operation and Decommissioning Phases of the proposed Peddie Energy PV Facility. **All mitigation measures are valid for Alternatives PV1, PV2 & PV4**

7.2.1 Planning and Design

- Appoint an independent Environmental Control officer to oversee all construction and submit monthly audit reports to the competent Authority.

- All species of special concern, protected or vulnerable must be avoided or transplanted
- Rehabilitation with grasses found on site, in addition to local shade-loving grasses, must be undertaken
- Rainwater run-off must be captured and released through lower energy mechanisms.
- Rainwater harvesting could be considered
- Guttering and localise energy dissipation mechanisms could be implemented
- Develop and implement an Erosion Action Programme.
- Ensure that a buffer zone of 32 metres is maintained. No development activities may occur within this area.
- Water courses should be rehabilitated by careful removal of the alien invasive vegetation.
- The use of turfstone eco bricks with the establishment of access tracks as these help in stabilising soils to reduce run-off, allowing vegetation to thrive and thus a reduction in erosion.

Figure 7.1 Illustration of turfstone eco bricks recommended for the construction of access roads.

7.2.2 Construction

- Construction activities must be limited to the designated development footprint. i.e. construction materials, vehicular storage, construction camps etc, should occur in a footprint which will ultimately be developed as part of the facility.
- Actual installation should be undertaken with minimal disturbance to areas in the immediate vicinity as successful vegetation recovery will depend on the remaining vegetation.
- Ensure that roads on slopes incorporate storm water diversion.
- Construction activities must be demarcated and vegetation clearing and top soil removal (if required) limited to these areas.
- The development area must be surveyed prior to topsoil removal (if required) during construction in order to locate protected geophytic plant species and transplant them into the neighbouring undeveloped environment.
- Restrict construction activities to post-dawn and pre-dusk.
- Construction must be undertaken in the shortest time.
- All staff employed during construction must sign a daily register.
- Construction workers must be transported to and from the site daily.
- No construction residence may be set up on site.
- An independent Environmental Control Officer must inspect the surrounding vegetation for evidence of snares

7.2.3 Operation

- Rainwater run-off must be captured and released through lower energy mechanisms.
- Rainwater harvesting could be considered.

- Guttering and localise energy dissipation mechanisms could be implemented
- Develop and implement an Erosion Action Programme.

7.2.4 Decommission

- Decommission activities must be limited to the designated development footprint.
- Actual removal of the panels should be undertaken with minimal disturbance to areas in the immediate vicinity as successful vegetation recovery will depend on the remaining vegetation.
- Re-vegetation of exposed soil must be undertaken.
- Rehabilitation must be undertaken in the following phases:
    - Applying topsoil and re-landscaping the area to its original condition if modified
    - Stabilising the soil with synthetic materials or a fast growing plant species
- Re-vegetate with plants grown from seed or cuttings from the surrounding vegetation.

7.3 Environmental statement and Opinion of the Specialist

The ecological impacts of all the aspects of the proposed Peddie Energy PV Facility were considered and deemed to be ecological acceptable, provided that the mitigation measures provided in this report are implemented.

Alternative PV4 are the preferred option due to the following:

- Alternative PV2 are divided in 2 sections by a drainage system containing natural Great Fish Thicket vegetation.
- Alternative PV1 contains a higher percentage of trees per area.

8 REFERENCES

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