ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

DRAFT ENVIRONMENTAL IMPACT REPORT

PAULPUTS CSP PROJECT, NEAR POFADDER, CAPE PROVINCE

DEA Ref No: 14/12/16/3/3/2/870

DRAFT FOR PUBLIC REVIEW

4 May 2016 - 3 June 2016

Prepared for:

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/870
Title	:	Environmental Impact Assessment Process Draft EIA Report for the Paulputs CSP Project near Pofadder, Northern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Michelle Moodley Karen Jodas Gabriele Wood
Sub-consultants	:	Ecology (Flora and Fauna) – Adrian Hudson, Hudson Ecology Avifauna - Adrian Hudson, Hudson Ecology Soils and Agricultural Potential – Garry Paterson, ARC-Institute for Soil, Climate and Water Heritage – David Morris, McGregor Museum Department of Archaeology Visual – Jon Marshall, Afzelia Environmental Consultants & Environmental Planning and Design Social – Candice Hunter, Savannah Environmental (with external review by Neville Bews) Water Resources: Brian Colloty – Scherman Colloty and Associates
Client	:	Paulputs CSP RF (Pty) Ltd
Report Status	:	Draft Environmental Impact Assessment Report for public review
Review Period	:	4 May 2016 –3 June 2016

When used as a reference this report should be cited as: Savannah Environmental (2016) Environmental Impact Assessment Report: Paulputs CSP Project near Pofadder, Northern Cape Province

PURPOSE OF THIS SCOPING REPORT

Paulputs CSP RF (Pty) Ltd is proposing the development of a Concentrated Solar Power (CSP) Project and associated infrastructure on Portion 4 of the Farm Scuitklip 92, located approximately 40km north-east of Pofadder within the Khai-Ma Local Municipality in the Northern Cape. The Paulputs Concentrated Solar Power (CSP) Project is proposed to be a CSP facility using molten salt tower technology of up to 200MW in capacity and will be constructed over an area of approximately 900ha in extent within the broader property. The project is to be developed by Abengoa Solar Power South Africa (Pty) Ltd, through Paulputs CSP RF (Pty) Ltd, a Special Purpose Vehicle (SPV) established to be the applicant for the project. The proposed project is to be known as the Paulputs CSP project.

The project is being proposed in response to the requirement for additional electricity generation capacity at a national level and in response to identified objectives of the national, provincial, local and district municipalities to develop renewable energy facilities. From a regional perspective, the greater Pofadder area is considered favourable for the development of commercial solar electricity generating facilities by virtue of the prevailing climatic conditions (primarily as the economic viability of a solar energy facility is directly dependent on the annual solar irradiation values for a particular area), relief and aspect.The proposed project site is situated within the Northern Corridor defined in terms of Eskom's Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) conducted by the CSIR[1].

The nature and extent of the proposed facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases of a facility of this nature are explored in detail in this Environmental Impact Assessment Report. Site specific environmental issues are considered within specialist studies (contained in Appendix D to J) in order to test the environmental suitability of the site for the proposed development, delineate areas of sensitivity within the site, and ultimately inform the placement of the CSP Tower, heliostats and associated infrastructure on the site.

This EIA Report consists of the following sections:

» **Chapter 1** provides background to the Project and the environmental impact assessment, and an introduction to the rationale behind the selected site and technology proposed.
» **Chapter 2** provides the project description, need and desirability, site selection information and identified project alternatives.

[1] Infrastructure Strategic Environmental Assessment (SEA) to be gazetted in mid-2016

» **Chapter 3** outlines the strategic legal context for the energy planning and the Project.
» **Chapter 4** outlines the approach to undertaking the environmental impact assessment process.
» **Chapter 5** describes the existing biophysical and socio-economic environment within and surrounding the Project development footprint.
» **Chapter 6** provides an assessment of the potential issues and impacts associated with the Project and presents recommendations for mitigation of significant impacts.
» **Chapter 7** provides an assessment of cumulative impacts.
» **Chapter 8** presents the conclusions and recommendations based on the findings of the EIA.
  » **Chapter 9** provides a list of reference material used to compile the EIA Report.

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report will incorporate all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project

DEA REQUIREMENTS FOR THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Savannah Environmental has compiled a table (refer to Table 1 below) which outlines the DEA requirements as outlined in the acceptance of the scoping report dated 18 February 2016, and where in the draft EIR the requirements have been addressed within this report for ease of reference.

Table 1: Information Requested by DEA

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
	EIA Process to proceed in accordance with the tasks contemplated in EIA Regulations 2014	The EIA process was conducted in accordance with the 2014 EIA regulations, see chapter 4 for details.
	All comments and recommendations made by all stakeholders and I&APs as part of the DSR and SR must be taken into consideration when drafting the EIR	A Comments & Response Report is included in Appendix C which includes all comments received on the project to date.
	Ensure that mitigation measures and recommendations in the specialists studies must be addressed the EIAr and the EMPr	All mitigation measures in specialist studies are included in both the EMPr and the main EMP.
	Please ensure that comments from all relevant stakeholders are submitted to the Department with the FEIR including: » Northern Cape of Environment and Nature Conservation » Department of Agriculture, Forestry and Fisheries » Provincial Departments of Agriculture » South African Civil Aviation Authority » SENTEC » Department of Transport » Local Municipality » District Municipality » Department of Water and Sanitation » South African National Roads Agency Limited » South African Heritage Resource Agency » Endangered Wildlife Trust » Birdlife South Africa » Department of Mineral Resources » Department of Rural Development and Land Reform » DEA: Directorate Biodiversity and Conservation	Appendix C includes all comments received so far - some comments to be included with EIR in cases where comment has not yet been received"

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
	» Square Kilometre Array	
	Ensure that EIAr and EMPr comply with Appendix 3 and Appendix 4 of 2014 Regulations	The EIAr and EMPr comply with Appendix 3 and Appendix 4 of 2014 Regulations.
	Address all issues raised by organs of state and I&APs 3 December particularly Birdlife SA comments dated 2015	All issues raised by organs of state and I&APs have been addressed in the comments and responses and included in Appendix C. Responses to Birdlife are stated in the Avifauna Report- Appendix E
	Proof of correspondence with various stakeholders/ Proof that attempts were made to obtain comments.	Proof of the attempts were made to obtain comments is included in Appendix C in cases where no comment could be obtained
i.	Provide an indication of the preferred and alternate locations from which the material used for infilling will be sourced and where excavated material will be stored and/or disposed of. Adequately assess impacts associated with activity GN R.983 Item 19.	Cut and fill operations will be pursued as far as possible and offset areas for the storing of sub- and topsoil accordingly on a temporary and permanent basis (if needed) will be considered with the findings and recommendations made in the Ecological Report. A topsoil management plan will be drafted by a specialist and be included in the EMP in order to ensure topsoil conservation. Other aggregates such as gravel, building sand and bedding sand shall be sourced from authorised resources stationed in Kakamas. Impacts are assessed in Chapter 6
ii.	Draft EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	Draft EIAr provides an assessment of the impacts and mitigation measures for each of the listed activities applied for in Chapter 6.
	All listed activities are the same and correct in the EIAr and the application form.	Comment noted. The application form will be amended if required and submitted with the final EIAR.
	Should any activities under GN R.985 be applicable, written comments must be obtained and submitted to the DEA. Graphical representation of the proposed project in the area must be provided.	Graphical representation of the proposed project in the area in Ch 5
	The EIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions.	The EIAr provides the technical details for the proposed facility in a table format as well as their description and/or

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
		dimensions- refer to Chapter 2.
	The EIAr must provide the four corner coordinate points for the proposed development site as well as the start, middle and end points of all linear activities	The four corner coordinate points for the proposed development site have been included in Table 8.1
viii	The EIAr must provide the following: » Clear indication of the envisioned area for the proposed concentrated solar power facility; » Clear description of all associated infrastructure	The EIAr provides a clear indication of the envisioned area for the proposed concentrated solar power facility and a description of all associated infrastructure.
	Comments from the Department of Water and sanitation from the Impact Management and Resource management Directorates to be included in the EIAr	All comments received can be found in Appendix C
	Comments from the Department of Agriculture must be included in the EIAr	All comments received can be found in Appendix C
	The EIAr must include a traffic assessment study that determines the specific traffic needs during the different phases of implementation	Due to the other CSP facilities on the same property traffic impacts are known and a traffic management plan has been compiled and is attached in the EMPr
	The EIAr must assess impacts including noise and geotechnical impacts.	As per Section 7.3.6 and Appendix K of the Scoping report "due to the limited period of and the localised nature of potential impacts, the noise scoping impact assessment sufficiently identified and quantified the significance of potential noise impacts on the surrounding environment. Therefore, no further noise impact assessment is required to be conducted in the EIA Phase. Sufficient information available to allow a relative high confidence in the projected noise levels. No noise impact is predicted" A geotechnical study was undertaken for the existing CSP facility on site. This repot has been appended to Appendix Q.
xii	The following listed activities applied for may trigger Section 19 and S21 of the National Water Act No. 36 of 1998: GN R. 983 Activity 12, and 19. The EAP is advised to include a hydrological Assessment as part of the EIAr	A water resource report forms part of the report- refer to Appendix G
xiii	Provide proof of availability of water for the	An application has been submitted to the

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
	facility from the relevant authority	Department of Water and Sanitation in Upington however written confirmation from DWS is pending
xiv	The EIAr must adequately assess and provide a comparative analysis for alternative water sources and further motivate the preferred technology choice for the facility.	A comparative analysis for alternative water sources and further motivate the preferred technology choice for the facility has been addressed in Chapter 2 section 2.4.5 of this report.
xvi	The impacts of a water abstraction point in the Gariep River and a pipeline to pipe the water to the facility must be assessed.	The impacts of a water abstraction point in the Orange River have been assessed in Chapter 6 and Appendix G of this report. and a pipeline to pipe the water to the facility will be assessed in a separate BA process.
xvii	In terms of reference for the avifaunal assessment must also investigate the following: » Indicate the impacts that the proposed activity may have on avifauna » Must cover at minimum the summer and winter seasons » Mitigation measures to discourage the avifauna from entering the solar field, limit nesting and breeding grounds within the solar field » Assessment of the cumulative impact on avifauna within the site and within the local area.	An avifaunal assessment which covers the wet and dry season was conducted, as considered most appropriate to the area under consideration. The report identified impact and cumulative impacts and mitigation measures were recommended. Please refer to Appendix E and Chapter 6 and 7 of this report.
xviii	The terms of reference for the agricultural study must include the following: » Assessment of the loss of agricultural land; » The current state of agricultural activities on land; and » The impact of the loss of agricultural land within the property as well as the cumulative impact of the loss of agricultural land on the site and within the area.	The agricultural assessment conducted by Garry Paterson who confirmed that the site has low agricultural potential -- refer to Appendix F of this report.
xix	All in-house specialists to be used for any specialists study must be peer reviewed by external specialists (ecological, socio-economic and agriculture etc.)	The Social Assessment conducted by Savannah was peer reviewed by an external review - Neville Bews. Refer to Appendix J of this report.
xxii	The EIAr must also include a comment and	The EIAr also includes a comment and

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
	response report in accordance with Appendix 2h (iii) of the EIA Regulations, 2014.	response report in accordance with Appendix 2h (ii) of the EIA Regulations, 2014- refer to Appendix C of this report.
xxiii	EIAr must also include the detailed inclusive of the PPP in Accordance with Regulation 41 of the EIA Regulation.	The EIAr also includes the detailed inclusive of the PPP in Accordance with Regulation 41 of the EIA Regulation- refer to Appendix C of this report.
xxiv	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	Decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies - refer to Chapter 2 of the EIAr
xxv	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained? Proof of these agreements must be provided.	Information on services required on the site has been included Chapter 2 of this report.
xxv.	The ElAr must provide detailed description of the need and desirability. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites. The need and desirability must take into account cumulative impacts of the proposed development.	The ElAr provides a detailed description of the need and desirability- refer to Chapter 2.
xxvii	A copy of the final site layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads. The layout map must indicate the following: » Tower positions and its associated infrastructure; » Positions of the power island, steam turbine and generator, molten salt storage tanks, water storage reservoir tanks, lined evaporation ponds and water supply pipeline; » Permanent laydown area footprint » internal roads indicating width	A copy of the final site layout map is included in Appendix N (A3 Maps) of this report.

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
	(construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible) » Wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used; » The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure; » Substation(s) and/or transformer(s) sites including their entire footprint; » Connection routes (including pylon positions) to the distribution/transmission network » All existing infrastructure on the site, especially roads » Buffer areas; » Buildings, including accommodation; and » All "no-go" areas.	
xxviii	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process is included in Appendix N (A3 Maps) of this report.
xxix	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	The Final site layout map superimposed (overlain) on the environmental sensitivity map has been included in Appendix N.
xxix	A shapefile of the preferred development layout/footprint must be submitted to this Department. The shapefile must be created using the Hartebeesthoek 94 Datum and the data should be in Decimal Degree Format using the WGS 84 Spheroid. The shapefile must include at a minimum the following extensions i.e. .shp; .shx; .dbf; .prj; and, .xml (Metadata file). if specific symbology was assigned to the file, then the .avl and/or the .lyr file must also be included. Data must be mapped at a scale of 1:10 000 (please	The required information will be Included on a CD on submission of the FEIR.

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
	specify if an alternative scale was used). The metadata must include a description of the base data used for digitizing. The shapefile must be submitted in a zip file using the EIA application reference number as the title.	
	EMP	
i	All recommendations and mitigation measures recorded in the EIAr and the specialist studies conducted	All practicable mitigation measures can be found in chapters: 5.1, 6.2, 7.1 and 8.1.
ii	The final site layout map.	Refer to Chapter 2, Figure 2.2.
iii	Measures as dictated by the final site layout map and micro-siting.	All practicable mitigation measures can be found in chapters: 5.1, 6.2, 7.1 and 8.1.
iv	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Refer to Chapter 2, Figure 2.3.
v	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Figure 2.4
vi	An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Appendix E
vii	A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.	Appendix G was informed through specialist input.
viii	A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.	Appendix F

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
ix	An open space management plan to be implemented during the construction and operation of the facility.	Appendix E
x	A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.	Appendix H
xi	A storm management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	Appendix I
xii	A fire management plan to be implemented during the construction and operation of the facility.	Appendix K
xiii	An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	Appendix J
xiv	An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	Appendix K Section 6.2; Objective 17

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
xv	Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	Appendix K Section 6.2; Objective 17. Section 5.1; Objective 2.
	The EAP must provide detailed motivation if any of the above requirements is not required by the proposed development and not included in the EMP.	All requirements listed above have formed part of the EMPr (refer to Appendix K).
	The EAP must provide the final detailed Site Layout Plan as well as the final EMPr for approval with the final EIAr as this Department needs to make a decision on the EA, EMPr and Layout Plan.	The detailed Site Layout Plan as well as the EMPr form part of this EIAr and will be submitted to the competent authority for approval.
	The EIAr must include a cumulative impact assessment of the facility since there are other similar facilities in and around the proposed site as well as in the region. The specialist studies as outlined in the PoSEIA which is incorporated as part of the SR must also assess the facility in terms of potential cumulative impacts.	The EIAr includes the assessment of cumulative impacts- refer to Chapter 7 of this report.
	Please ensure that all the relevant Listing Notice activities are applied for, that the Listing Notice activities applied for are specific and that they can be linked to the development activity or infrastructure in the project description.	All the relevant Listing Notice activities have been applied for and the Listing Notice activities applied for are specific and they are linked to the development activity or infrastructure in the project description. Refer to Chapter 4 and Chapter 6.
	The applicant is hereby reminded to comply with the requirements of Regulation 45 with regard to the time period allowed for complying with the requirements of the Regulations, and Regulations 43 and 44 with regard to the allowance of a comment period for interested and affected parties on all reports submitted to the competent authority for decision-making.	Comment noted
	Furthermore, it must be reiterated that, should an application for Environmental Authorisation be subject to the provisions of Chapter ll, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then	Comment noted

DEA Ref. #	Items in terms of Scoping Acceptance Requirements	Report Reference
	this Department will not be able to make nor issue a decision in terms of your application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter ll, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999. Authority as described in Chapter ll, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999.	
	You are requested to submit two (2) electronic copies (CD/DVD and two (2) hard copies of the Environmental impact Report (ElAr) to the Department.	Comment noted Two (2) electronic copies and 2 hard copies have been submitted to the DEA.

INVITATION TO COMMENT ON THE EIA REPORT

This **Environmental Impact Assessment Report** has been made available for public review at the following places, which lie in the vicinity of the proposed project area from **4 May 2016 – 3 June 2016:**

» Upington Public Library

The report is also available for download on:

» www.savannahSA.com

Please submit your comments to
Gabriele of **Savannah Environmental** PO Box 148, Sunninghill, 2157 Tel: 011 656 3237 Fax: 086 684 0547 Email: gabriele@savannahsa.com
The due date for comments on the Scoping Report is **14 December 2015**

Comments can be made as written submission via fax, post or e-mail.

EXECUTIVE SUMMARY

Background and Project Overview

Paulputs CSP RF (Pty) Ltd is proposing the development of a Concentrated Solar Power (CSP) Project and associated infrastructure on Portion 4 of the Farm Scuitklip 92, located approximately 40km north-east of Pofadder within the Khai-Ma Local Municipality in the Northern Cape. The Paulputs Concentrated Solar Power (CSP) Project is proposed to be up to 200MW in capacity and will be constructed over an area of approximately 900ha in extent within the broader property. The project is to be developed by Abengoa Solar Power South Africa (Pty) Ltd, through Paulputs CSP RF (Pty) Ltd, a Special Purpose Vehicle (SPV) to be established as the applicant for the project. The proposed project is to be known as the Paulputs CSP project.

The Paulputs CSP Project is proposed to generate up to 200MW in capacity and will be constructed over an area of approximately 900ha in extent within the broader property.

The proposed Paulputs CSP Project will have a contracted capacity of up to 200MW. Molten salt technology will be utilised to allow for at least 5 hours of storage to meet the requirements of the REIPPPP. The Paulputs CSP Project will consist of a field of heliostats and a central receiver, known as a power tower. The Paulputs CSP project will be constructed over an area of approximately 900 ha in extent, and include *inter alia* the following infrastructure:

» Molten salt tower up to 300m in height with surrounding heliostat field
» Power island including salt storage tanks, steam turbine generator, heat exchangers, and dry cooled condenser
» Cabling linking the power block to the on-site substation;
» Water supply abstraction point located at the Gariep River close to Onseepkans
» Filter and booster station at abstraction point
» Water supply pipeline along R357 Onseepkans Road to the site
» On-site lined ground water storage reservoir and various steel water tanks
» Lined evaporation ponds
» Packaged water treatment plant and associated chemical store
» Auxiliary wet cooled chiller plant
» Control room and office building
» Heliostat assembly building and workshop.
» Access roads
» On site substation and overhead power line

The overarching objective for the Paulputs CSP Project is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts.

The regional site identification process undertaken in 2010 included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of the original CSP Projects (KaXu Solar One and Xina Solar One) , including the solar resource, land availability, accessibility and existing grid infrastructure. The remaining area of Portion 4 of the Farm Scuitklip was then earmarked by Paulputs (Pty) Ltd as being potentially suitable for this CSP Project. As a result, no feasible site alternatives have been identified for investigation for the proposed CSP Project, as the site has been screened as being potentially suitable for development of the project. This area was put forward for consideration within this EIA. The site selection process is discussed in further detail in Chapter 2 of this report.

Evaluation of the proposed Prject

The assessment of potential environmental impacts presented in this report is based on a preliminary layout of the tower, heliostats and associated infrastructure (for the 200MW facility) provided by Paulputs CSP RF (Pty Ltd (refer to Figure 8.1). It is anticipated that the Project and its associated infrastructure can be appropriately positioned to avoid areas of environmental sensitivity while taking the location of the authorised facilities into consideration. The environmental sensitivities identified during the EIA phase have informed the layout of the proposed facility (Refer to Figure 8.1). All identified sensitivities were excluded from the proposed development were feasible.

No environmental fatal flaws were identified to be associated with the proposed facility. However the following potentially significant environmental impacts have been identified through the EIA Phase.

» Local site specific impacts resulting from the physical modification/disturbance of the site primarily during the construction phase.
» Impacts on avifauna.
» Impacts on water resources.
» Visual impacts.
» Impacts on the social environment.
» Cumulative impacts.

Impacts on Ecology

The ecological impact assessment was conducted with the understanding that:

- The pipeline alignment will follow the existing alignment of that associated with the two CSP facilities located adjacent to the proposed site, and that the majority of the impact would occur in this already impacted area;
- Vegetation regrowth will be allowed under the heliostats

after construction is completed; and
- All possible mitigation methods advised will be adopted and implemented by the developer.

The impact assessment determined that 8 main impacts are likely to occur due to the development, namely:

- Vegetation Clearing and subsequent loss of species of concern;
- Spillage of harmful or toxic substances;
- Disturbance of biodiversity due to vibration and noise;
- Habitat degradation and fauna impacts due to dust;
- Effects on local migrations;
- Increased prevalence of exotic invasive species;
- Increased erosion; and
- Impact of attracting insects and subsequently bats to the tower due to artificial light at night.

Due to the fact that there are already three existing solar facilities in the area, as well as the fact there are more planned, the cumulative impacts of the impacts general to solar facilities are likely to be of a higher order of magnitude than the significance ratings given here. It must however be noted that none of the other solar facilities are tower facilities and impacts unique to tower facilities are therefore unlikely to have a higher cumulative impact.

With implementable mitigation measures and a functional monitoring – management – implementation – monitoring feedback loop in order to monitor and mitigate impacts, all probable ecological impacts can be managed to a low impact rating. Based on this and the fact that South Africa is experiencing a significant energy crisis, the risks and losses associated with this development can be seen as acceptable and defendable

8.2.2. Impacts on Avifauna

Potential impacts on avifauna as a result of the proposed project include disturbance during construction and operation, loss of habitat and potential for collision with the heliostats and the tower. A total of 29 species were recorded and a total of 1341 individual birds were recorded. Only one species of conservation importance was recorded during the study namely, the Maccoa Duck.

During the study the following factors which could provide biological requirements for local avifauna were identified. These potential factors should therefore be mitigated in order to reduce the number of birds likely to occupy the CSP facility (i.e. deter birds from using the area by making it as unsuitable for meeting avian biological requirements as possible, and therefore less attractive to birds):

- Openings at either end of the proposed horizontal rotating cylinder – may potentially provide nesting sites;

- Flat surfaces at the base of the proposed tower – may provide possible nesting and perching sites for a large number of species; and
- Colour of the proposed tower – may attract insects, which are a food source for insectivorous avifauna.

One of the factors most likely to reduce the risk of mortality in avifauna species is the low average flight height of birds in the area, as most bird species will fly under the proposed heliostats.

With implementable mitigation measures and a functional monitoring – management – implementation – monitoring feedback loop in order to monitor and mitigate impacts, all probable avifauna impacts can be managed to a low impact rating.

8.2.3. Impacts on Agricultural Potential and soils

Two major impacts were assessed. The first impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. However, this impact would in all probability be of limited significance and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

The second impact would be the possibility of increased soil erosion due to the removal of vegetation in the construction process. This would probably be due to wind action on the relatively sandy topsoils.

Two CSP facilities, KaXu Solar One and Xina Solar One are located in the southern portion of the site. The major potential cumulative impact would be the possibility of wind erosion caused by construction activities at the Paulputs CSP site that would cause topsoil to be blown and deposited elsewhere, for example at any nearby facilities, where dust accumulation would be a problem.

Much of the area comprises either shallow to very shallow soils or surface rock outcrops, and only a very small portion of deep soils. The very low rainfall in the area means that the only means of cultivation would be by irrigation there are no signs of any agricultural infrastructure and certainly none of irrigation. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit. No areas were identified as degraded. In addition, no areas of cultivation were identified except for the strip of cultivated orchards and pivots along the Gariep River to the north.

There are no identified highly sensitive areas with regards to agricultural potential and soil and the Paulputs CSP Project will not have a significant impact on the agricultural potential of the area.

8.2.4 Impacts on aquatic resources

With the implementation of suitable mitigation and of the proposed layout, the development should have limited impact on the overall status of the site specific riparian systems. This desktop assessment of the potential impacts of the proposed CSP on the fish biota of Gariep River also did not reveal any significant impacts on the fish fauna and associated aquatic habitats, provided the appropriate mitigation measures are implemented. All impacts that were assessed be reduced to medium or low significance with appropriate mitigation, apart from the moderate impact of water abstraction from the Gariep River. However, in this case the precautionary principle was applied due the lack of data on the Ecological Water Requirements of the Gariep River for this locality.

Impacts on the Gariep River system due to water abstraction, and site-specific impacts on instream biota are difficult to quantify due to the number of unknowns and the highly regulated nature of the system.

In conclusion therefore, the facility is deemed to have a limited direct potential impact on the aquatic environment, considering the number of unknowns and the highly regulated nature of the Gariep River system. It is however assumed that any such changes would be detrimental to the various projects owners, i.e. reduce water availability for all projects. Therefore, based on this assessment the significance of the impacts assessed for the aquatic systems after mitigation would be Medium - Low. While all of the proposed alternatives would have a similar impact on the aquatic environment

8.2.5. Heritage Impacts

The destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. In the long term, the proximity of operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity.

With respect to the magnitude and extent of potential impacts, it has been noted that the erection of power lines would have a relatively small impact on Stone Age sites, in light of Sampson's (1985) observations during surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon), whereas a road or a water supply pipeline would tend to be far more destructive (modification of the landscape surface would be within a continuous strip), albeit relatively limited in spatial extent, i.e. width (Sampson compares such destruction to the pulling out of a thread from an ancient tapestry). A water pipeline, if sourcing water at the river, could traverse more sensitive terrain, i.e. impacting a potentially greater density of archaeological sites.

The rocky outcrops that occur at the north eastern side of the proposed project footprint are regarded as no go areas and a 60m buffer has taken into account around these rocky outcrops. These sites and others like them in the broader landscape provided shelter and variety of resources that attracted human activity through Stone Age times.

Visual impacts

The assessment indicates that the development is likely to have two main areas of visual impact;

1) It will intensify the current industrial character of the area immediately surrounding the proposed development area.
2) The proposed tower at 300m high will form a major new feature in the landscape. It is likely to be a dominant feature up to 15 to 20 km away. It is also likely to be obvious in the landscape up to 30km away.

The impact of the tower is mitigated to a degree by landform in that;

- It will largely be viewed against and within a rock formation that is taller and has substantially greater visual mass than the tower, it will therefore be in scale with its surroundings and seen against a landform backdrop from many viewpoints.
- The landform to the north will provide a large degree of screening from that direction.
- The compartmentalised nature of the landscape will mean that the impact will be limited.
- The steep slopes of the Orange River Valley will screen views of the tower from that area.
- Inselberge will help to further reduce the impact from key viewpoints such as the N14.

Identified cumulative impacts only relate to the low development and associated infrastructure associated with the proposed power tower. The impacts associated with these elements will be similar to and will largely impact the same area as the two existing CSP parabolic trough projects and the Paulputs substation which are located adjacent to which the proposed development. The proposed project will therefore not extend but will intensify the industrial character within a limited impact area.

The proposed development will not affect protected areas and whilst the landscape in which it is set is dramatic and memorable landform serves to compartmentalise views in a progressive way for travellers through the area. This compartmentalisation of the landscape serves to help limit impacts.

8.2.5. Impacts on the social environment

The proposed development site is located within a rural setting and is removed from settlements and homesteads. Impacts on the social environment are expected during both the construction phase and the operation phase of the CSP facility. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the CSP facility can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

Positive impacts associated with the project are largely due to job creation opportunities, business opportunities for local companies, skills development, and training. The proposed project could assist in alleviating poverty amongst some individuals in the study area through the provision of permanent employment opportunities.

The development of a renewable energy facility of this nature will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would fit in with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP).

Potential negative impacts which require mitigation relate to an influx of workers and jobseekers to an area (whether locals are employed or outsiders are employed) and an associated perceived risk of an increase in crime in the area, and traffic and intrusion influences during construction. As a limited number of workers are proposed to be housed on site, certain impacts could arise as a result of worker conduct at this site. Stringent mitigation is required to be implemented to reduce these impacts to acceptable levels.

Impacts on farming activities may occur as a result of the proposed development. However, due to the limited agricultural potential of the proposed development site, and the low rainfall in the area, the impact on agricultural potential as a result of the loss of land associated with the development is not expected to be significant. In fact, the proposed development may present opportunities for additional agriculture on the site and surrounds in that the water supply infrastructure could be utilised to transport water to irrigate crops within these areas. This would be a positive impact.

8.2.6. Assessment of Potential Cumulative Impacts

Based on the information available at the time of undertaking the EIA, there are at least 4 other facilities, 1 of which is a preferred bidder project within a 30 km radius of the site all at various stages of approval.

Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Paulputs CSP Project will be acceptable and the majority are rated as being of low significance with the implementation of appropriate mitigation. On this basis, the following can be concluded considering Paulputs CSP Project

- » The construction of the project will not result in the unacceptable loss of threatened or protected plant species. The proposed development is acceptable from an ecological perspective.
- » Low risk to avifauna through loss of habitat, infringement on breeding areas, or risk to collision-prone species is expected.
- » The construction of the project will not result in unacceptable loss of or impact to agricultural resources.
- » The construction of the project will not result in unacceptable loss of or impact to hydrological resources.
- » The construction of the project will not result in the complete or whole-scale change in sense of place and character of the area nor will the project result in unacceptable visual intrusion. One preferred bidder project is in the area, which creates an existing impact and alteration to the current sense of place.
- » The construction of the project will not result in unacceptable loss of or impact to heritage resources.
- » The project will not significantly increase the negative impact on the social environment. However, an increase in positive impacts, specifically as a result of job creation and socio-economic benefits, can be expected.
- » The project will contribute towards a reduction in greenhouse gas emissions from energy generation and will aid the country in meeting the commitments made under the COP 21 Agreement, to which the Government has committed to become a signatory.

Based on a detailed evaluation, the cumulative impacts associated with the construction and operation of the proposed Paulputs CSP Project and other proposed renewable energy facilities in the region are considered to be acceptable. The low potential for cumulative impacts and risks makes this project desirable for further consideration provided that environmental impacts are mitigated to suitable standards as recommended within this EIA Report. Cumulative impacts discussed above have been considered within

Chapter 7 and the detailed specialist studies (refer to **Appendices D - J**).

OVERALL RECOMENNDATION

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the Paulputs CSP Project can be managed and mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation. The layout plan as presented is considered acceptable.

The following conditions would be required to be included within an authorisation issued for the project:

- As far as possible, the design and layout of the CSP Plant should consider and accommodate areas of high environmental sensitivity.
- Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
- An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMPr for the duration of the construction period.
- Areas disturbed during construction should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
- During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
- All mitigation measures detailed within this report and the specialist reports contained within Appendices **D** to **J** to be implemented.
- The draft Environmental Management Programme (EMPr) as contained within **Appendix K** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed for this project.
- A comprehensive stormwater management plan should be compiled for the developmental footprint prior to construction.
- An ecological walk through survey for the CSP plant and associated infrastructure (such as pipeline, power line and access roads) must be undertaken prior to construction.

» A permit to be obtained for removal of protected trees and provincially protected flora that are affected.
» Post-construction avifaunal monitoring (12 months) should be started as the facility becomes operational, bearing in mind that the effects of the CSP facility may change over time. The results of this monitoring programme should be considered after the first year to inform the need to continue with the programme and/or implement additional mitigation measures.
» A Water Use License for relevant water uses is to be obtained from DWS prior to commencement of the water use.
» All other relevant and required permits must be obtained from the relevant regulating authorities

Table 2: Summary of pre-mitigation and post mitigation impacts of the bio-physical and socio-economic environment during the **planning and construction phase** of the project

Environmental Aspect	Impact	Pre-mitigation Significance	Post Mitigation Significance
Ecology (Flora and Fauna)	Impacts on vegetation and protected plant species	Medium (55)	Low (28)
	Increased dust will occur in all areas where vegetation is cleared.	Medium (50)	Low (18)
	Local migrations of fauna in the area may be affected	High (65)	Low (20)
	Cleared areas colonised by exotic and/or invasive plant species.	High (65)	Low (20)
	Increased erosion	High (65)	Low (20)
Avifauna	Impact on local bird community due to habitat loss	Low (28)	Low (24)
	Impact on local bird community due to disturbance on site and in surrounding area	Low (15)	Low (12)
Agricultural Potential and soils	Loss of agricultural land because the land can no longer be utilised	Low (28)	Low (21)
	Loss of topsoil due to vegetation removal resulting in increased wind erosion potential	Low (24)	Low (18)
	Soil degradation	Low (24)	Low (18)
Aquatic	Impact on water quality in the region	High (55)	Medium (45)
	Impact on dry riverbeds and localised drainage systems	Medium (45)	Low (24)
	Impact on riparian systems through the possible increase in surface water runoff on riparian zone form and function as well as instream habitats	Medium (35)	Low (19)
Heritage	Destruction of archaeological material or objects	Low (28)	Low (6)
Visual	Visual impacts associated with construction	Low (15)	Low (4)
Social	Creation of employment opportunities and skills development opportunities	Medium (+36)	Medium (+44)

	impact from the economic multiplier effects from the use of local goods and services	Low (+27)	Medium (+33)
	Population changes adding pressure on resources, service delivery, infrastructure maintenance and social dynamics	Medium (30)	Low (24)
	Added pressure on economic and social infrastructure and increase in social conflicts	Low (24)	Low (18)
	Temporary increase in traffic disruptions and increase in noise and dust	Medium (30)	Low (24)
	Temporary increase in safety and security concerns	Low (16)	Low (12)
	Temporary negative impacts associated with on-site staff accommodation	Low (21)	Low (14)
	Intrusion impacts	Low (21)	Low (15)

Table 3: Summary of pre-mitigation and post mitigation impacts of the bio-physical and socio-economic environment during the **operation phase** of the project

Environmental Aspect	Impact	Pre-mitigation Significance	Post Mitigation Significance
Ecology (Flora and Fauna)	Attraction of large numbers of insects at night and subsequently bats	High (70)	Low (22)
	Local migrations of fauna in the area may be affected	High (65)	Low (20)
	Harmful or toxic substances that may affect the biota of the area if they were to enter the system	Medium (56)	Low (6)
Avifauna	Impact on local bird community due to disturbance on site and in surrounding area	Low (15)	Low (12)
	Impact of the proposed facility infrastructure on avifauna	Low (16)	Low (8)

	Collisions with overhead power line	Moderate (52)	Low (18)
	Electrocution on overhead power line	Moderate (44)	Low (14)
Agricultural Potential and soils	Soil degradation	Low (24)	Low (18)
Aquatic	Impact on water quality in the region	High (55)	Medium (45)
	Abstraction of water from the Gariep River: timing and volume, i.e. impact on water quantity on the region	High (55)	Medium (45)
Heritage			
Visual	Industrialisation of a natural landscape as seen at night.	Medium (36)	Low (10)
	Possible impact of glint and glare.	Low (16)	Low (5)
	Potential visual intrusion on sense of place	Medium (56)	Medium (52)
	Potential effect on landscape features and scenic resources.	Medium (56)	Medium (52)
	: Potential effect on local inhabitants, visitors to the area and on tourism	Medium (33)	Medium to Low (30)
	Potential effect of related infrastructure	Medium (33)	Low (18)
Social	Creation of employment opportunities and skills development opportunities	Medium (+33)	Medium (+44)
	Benefits to the local area from SED/	Low (+24)	Medium (+30)

	ED programmes and community trust from REIPPPP social responsibilities		
	Development of clean, renewable energy infrastructure	Medium (+40)	Medium (+40)
	Visual impacts and sense of place	Medium (36)	Medium (36)

Table 4: Summary of pre-mitigation and post mitigation impacts of the bio-physical and socio-economic environment during the **decommissioning phase** of the project

Environmental Aspect	Impact	Pre-mitigation Significance	Post Mitigation Significance
Ecology (Flora and Fauna)	Disturbance or persecution of fauna	Low (21)	Low (15)
	Alien plants are likely to invade the site as a result of disturbance	Medium (30)	Low (21)
Avifauna			
Agricultural Potential and soils	Loss of topsoil due to disturbance	Low (24)	Low (18)
Visual			
Social	Retrenchment including loss of jobs and source of income	Medium (36)	Low (28)

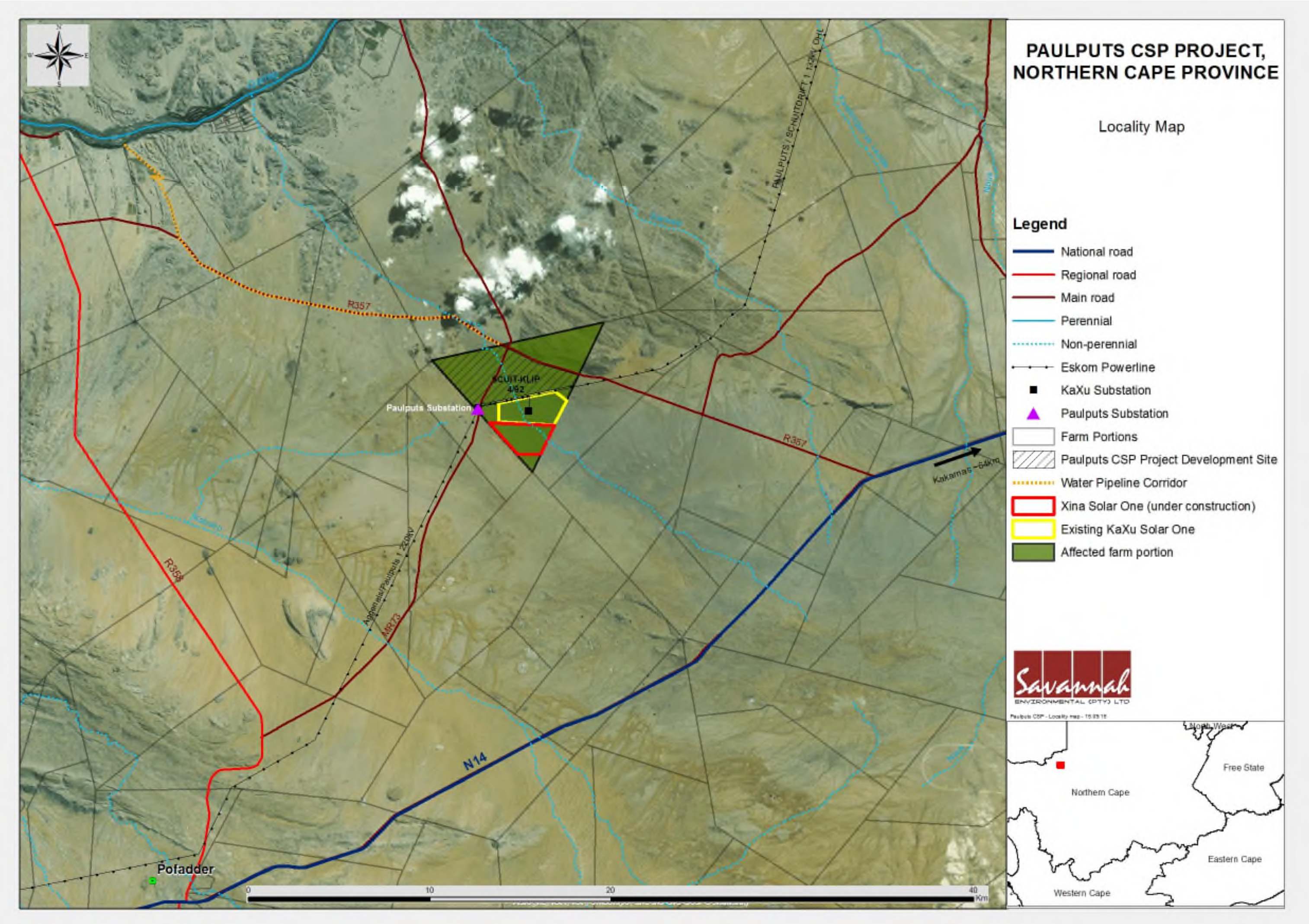

Figure 1: Locality Map of the Paulputs CSP Project(Refer to Appendix N for A3 Maps)

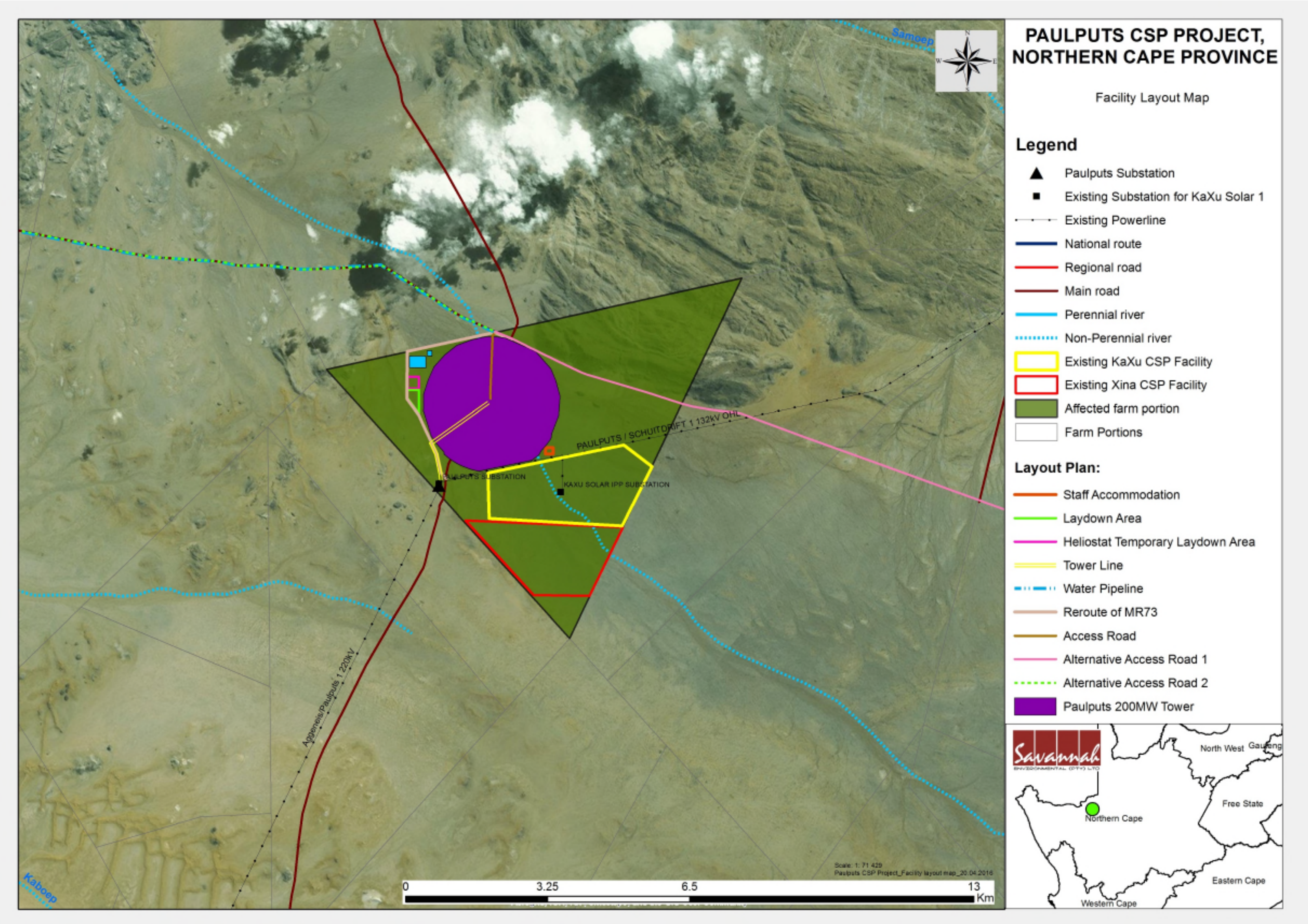

Figure 2: Preliminary Layout Map for the proposed Paulputs CSP Facility (Refer to **Appendix N** for A3 Maps)- to be approved by DEA

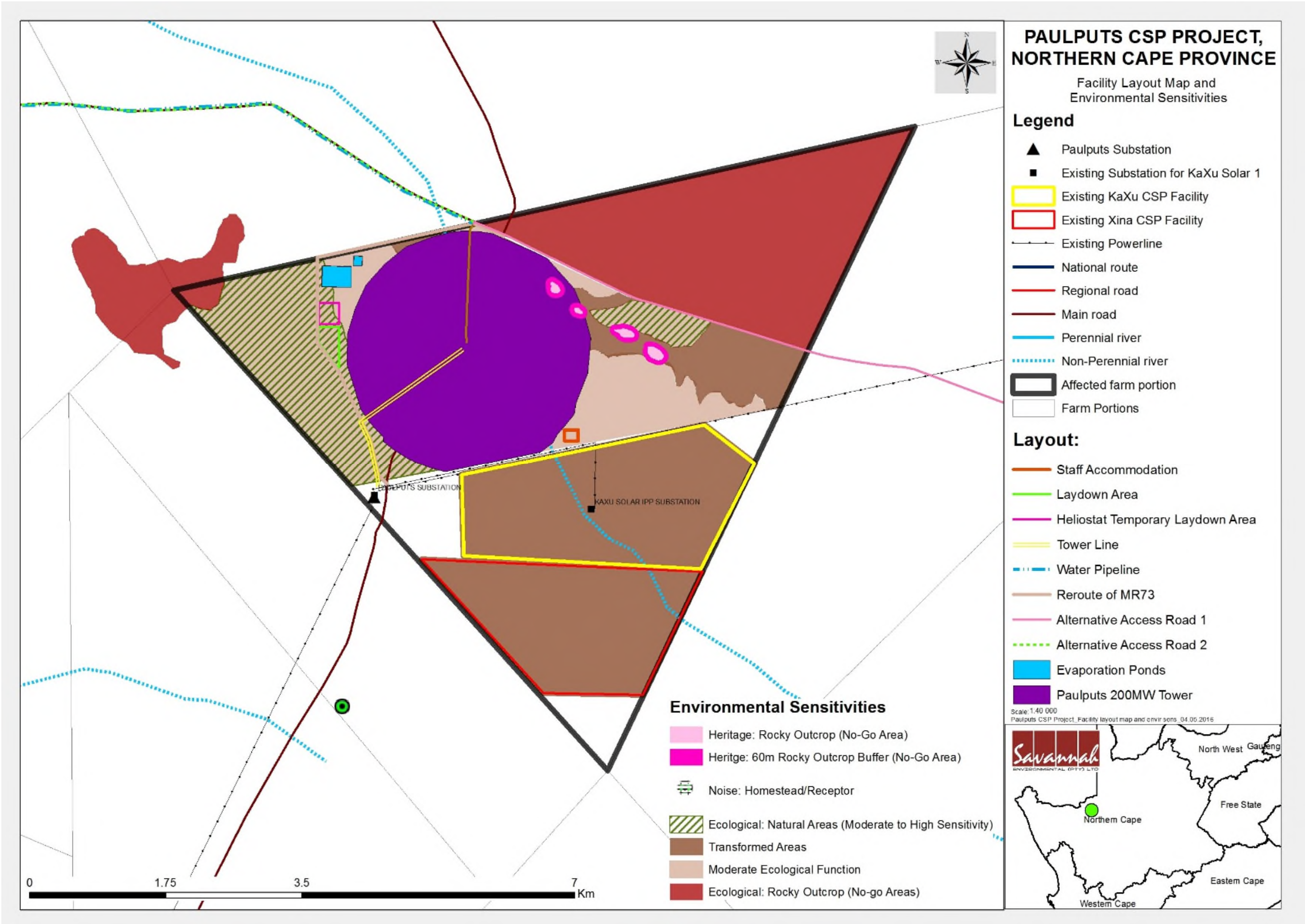

Figure 3: Environmental Sensitivity Map for the Paulputs CSP Project (Refer to Appendix N for A3 Maps)

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DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Concentrating solar power: Solar generating facilities use the energy from the sun to generate electricity. Concentrating Solar Power facilities collect the incoming solar radiation and concentrate it (by focusing or combining it) onto a single point, thereby increasing the potential electricity generation.

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Commissioning: Commissioning commences once construction is completed. Commissioning covers all activities including testing after all components of the wind turbine are installed.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation, or maintenance of an activity and are generally obvious and quantifiable.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Emergency: An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment, as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment (Van der Linde and Feris, 2010;pg 185).

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur because of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Method statement: A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her EO.

No-go areas: Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Pre-construction: The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g. geotechnical surveys).

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

Waste: Any substance, whether or not that substance can be reduced re-used, recycled and recovered; that is surplus, unwanted, rejected, discarded, abandoned or disposed of which the generator has no further use for the purposes of production. Any product which must be treated and disposed of, that is identified as waste by the minister of Environmental affairs (by notice in the Gazette) and includes waste generated by the mining, medical or other sectors, but: A by-product is not considered waste, and portion of waste, once re-used, recycled and recovered, ceases to be waste (Van der Linde and Feris, 2010; p186).

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DAFF	Department of Forestry and Fishery
DEA	National Department of Environmental Affairs
DENC	Department of Economic Development and Nature Conservation
DME	Department of Minerals and Energy
DOT	Department of Transport
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment

EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
Ha	Hectare
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework

INTRODUCTION

CHAPTE

R 1

Paulputs CSP RF (Pty) Ltd is proposing the development of a Concentrated Solar Power (CSP) Project and associated infrastructure on Portion 4 of the Farm Scuitklip 92, located approximately 40km north-east of Pofadder within the Khai-Ma Local Municipality in the Northern Cape. The Paulputs Concentrated Solar Power (CSP) Project is proposed to be a CSP facility using molten salt tower technology of up to 200MW in capacity and will be constructed over an area of approximately 900ha in extent within the broader property. The project is to be developed by Abengoa Solar Power South Africa (Pty) Ltd, through Paulputs CSP RF (Pty) Ltd, a Special Purpose Vehicle (SPV) established to be the applicant for the project. The proposed project is to be known as the Paulputs CSP project.

The project is being proposed in response to the requirement for additional electricity generation capacity at a national level and in response to identified objectives of the national, provincial, local and district municipalities to develop renewable energy facilities. From a regional perspective, the greater Pofadder area is considered favourable for the development of commercial solar electricity generating facilities by virtue of the prevailing climatic conditions (primarily as the economic viability of a solar energy facility is directly dependent on the annual solar irradiation values for a particular area), relief and aspect.The proposed project site is situated within the Northern Corridor defined in terms of Eskom's Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) conducted by the CSIR[2].

The nature and extent of the proposed facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases of a facility of this nature are explored in detail in this Environmental Impact Assessment Report. Site specific environmental issues are considered within specialist studies (contained in Appendix D to J) in order to test the environmental suitability of the site for the proposed development, delineate areas of sensitivity within the site, and ultimately inform the placement of the CSP Tower, heliostats and associated infrastructure on the site.

This Environmental Impact Assessment Report consists of the following sections:

» **Chapter 1** provides background to the Project and the environmental impact assessment, and an introduction to the rationale behind the selected site and technology proposed.

[2] Infrastructure Strategic Environmental Assessment (SEA) to be gazetted in mid-2016

» **Chapter 2** provides the project description, need and desirability, site selection information and identified project alternatives.
» **Chapter 3** outlines the strategic legal context for the energy planning and the Project.
» **Chapter 4** outlines the approach to undertaking the environmental impact assessment process.
» **Chapter 5** describes the existing biophysical and socio-economic environment within and surrounding the Project development footprint.
» **Chapter 6** provides an assessment of the potential issues and impacts associated with the Project and presents recommendations for mitigation of significant impacts.
» **Chapter 7** provides an assessment of cumulative impacts.
» **Chapter 8** presents the conclusions and recommendations based on the findings of the EIA.
» **Chapter 9** provides references used to compile the EIA Report.

It is the developer's intention to bid the Paulputs CSP project under the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The power generated from the Paulputs CSP Project will be sold to Eskom and will feed into the national electricity grid. Ultimately, the project is intended to be a part of the renewable energy projects portfolio for South Africa, as contemplated in the Integrated Resource Plan 2030.

1.1. Background to the project

Paulputs CSP RF (Pty) Ltd is proposing to develop a Concentrated Solar Power (CSP) Project and associated infrastructure on Portion 4 of the farm Scuitklip 92, in the Khai-Ma Local Municipality in the Northern Cape Province (refer to Figure 1.1 and Table 1.1). A broader study area of approximately 3508 ha (Portion 4 of the farm Scuitklip 92) was considered through a feasibility level assessment in 2010, and the area was considered to be highly acceptable for the development of CSP facilities. This farm portion currently contains two CSP facilities owned by Abengoa Solar South Africa, known as KaXu Solar One (operational) and Xina Solar One (under construction). The development footprint for the Paulputs CSP Project (approximately 900 ha in extent) would be appropriately located within the remaining extent of the farm portion (approximately 1600ha in extent). The identified site is accessible via the R357 and MR73 existing access road, via the N14.

Table 1.1: Detailed description of the farm Scuitklip 92

Province	**Northern Cape Province**
District Municipality	Namakwa District Municipality
Local Municipality	Khai-Ma Local Municipality
Ward number(s)	1

Province	**Northern Cape Province**
Nearest town(s)	Pofadder
Farm name(s) and number(s)	The Farm Scuitklip 92
Portion number(s)	Portion 4
SG 21 Digit Code (s)	C03600000000009200004
Landowner	Abengoa Solar South Africa Pty Ltd
Land use	Zoned Special Solar

The proposed Paulputs CSP Project will have a contracted capacity of up to 200MW. Molten salt technology will be utilised to allow for at least 5 hours of storage to meet the requirements of the REIPPPP. The Paulputs CSP Project will consist of a field of heliostats and a central receiver, known as a power tower. The Paulputs CSP project will be constructed over an area of approximately 900 ha in extent, and include *inter alia* the following infrastructure:

» Molten salt tower up to 300m in height with surrounding heliostat field
» Power island including salt storage tanks, steam turbine generator, heat exchangers, and dry cooled condenser
» Cabling linking the power block to the on-site substation;
» Water supply abstraction point located at the Gariep River close to Onseepkans
» Filter and booster station at abstraction point
» Water supply pipeline along R357 Onseepkans Road to the site
» On-site lined ground water storage reservoir and various steel water tanks
» Lined evaporation ponds
» Packaged water treatment plant and associated chemical store
» Auxiliary wet cooled chiller plant
» Control room and office building
» Heliostat assembly building and workshop.
» Access roads
» On site substation and overhead power line

The regional site identification process undertaken in 2010 included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of the original CSP Projects (KaXu Solar One and Xina Solar One) , including the solar resource, land availability, accessibility and existing grid infrastructure. The remaining area of Portion 4 of the Farm Scuitklip was then earmarked by Paulputs (Pty) Ltd as being potentially suitable for this CSP Project. As a result, no feasible site alternatives have been identified for investigation for the proposed CSP Project, as the site has been screened as being potentially suitable for development of the project. This area was put forward for consideration within this EIA. The site selection process is discussed in further detail in Chapter 2 of this report.

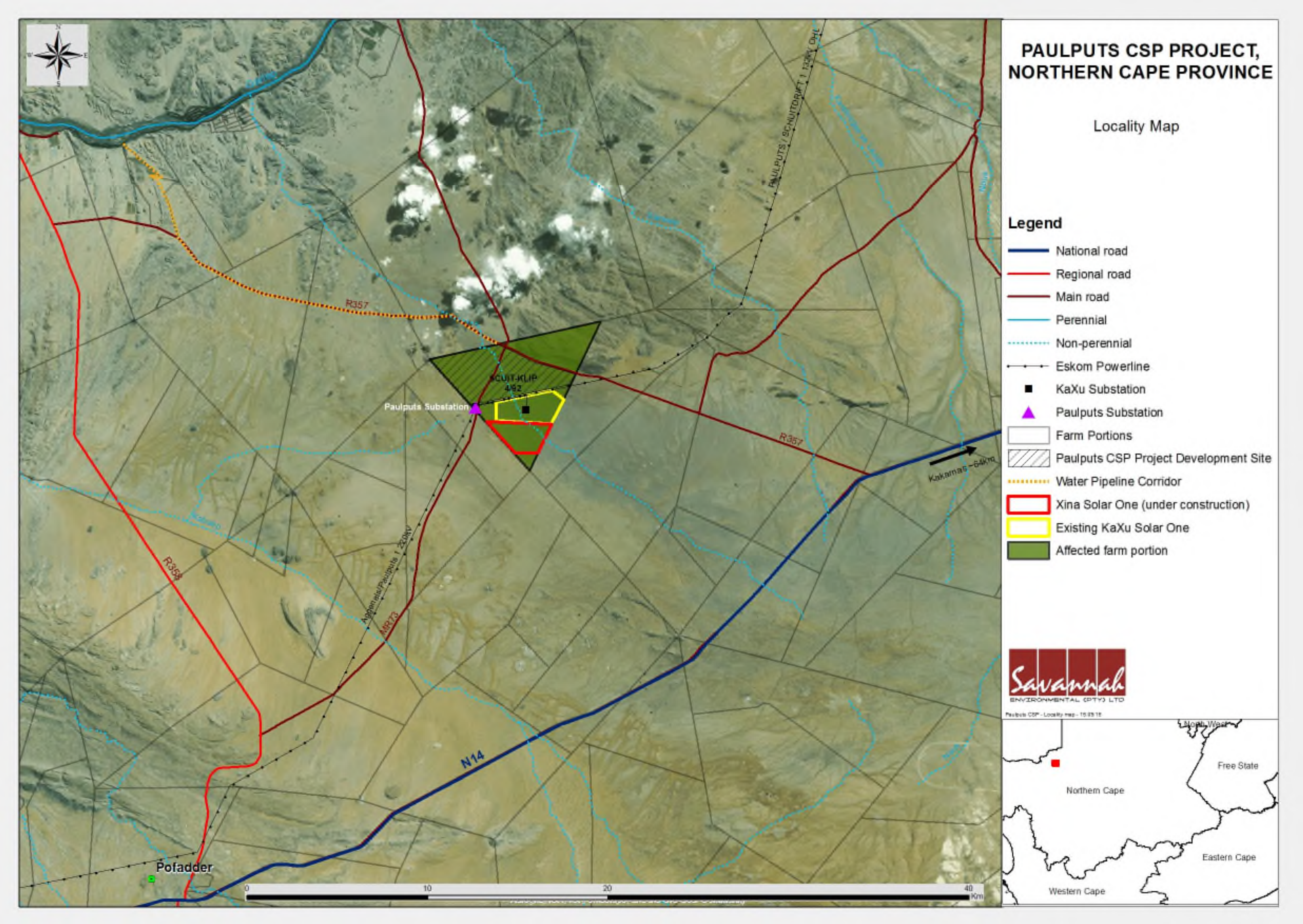

Figure 1.1: Locality map showing the extent of Portion 4 of the Farm Scuitklip and the proposed location of Paulputs CSP project within the extent of the farm portion.

1.2. Conclusions from the Scoping Phase

Several desktop specialist studies were undertaken for the purposes of identifying potential impacts and potential fatal flaws relating to the Paulputs CSP Project. The majority of potential impacts identified to be associated with the construction of the Paulputs CSP Project are anticipated to be localised and restricted to the proposed site itself (apart from social impacts – job creation which could have more of a regional positive impact), while operational phase impacts range from local to regional and national (being the positive impact of contribution of clean energy as part of the energy mix in South Africa).

At a local level, the area has become a node for renewable energy projects due to the viability of the solar resource for the area and the availability of the Paulputs Substation, with the following constructed or preferred bidder projects located directly adjacent to, or in close proximity to, the project development site: KaXu Solar One (CSP trough plant), Xina Solar One (CSP trough plant), Konkoonsies I Solar (PV plant), and Konkoonsies II Solar (PV plant). Key cumulative impacts associated with solar energy development within the immediate vicinity of the Paulputs CSP Project are expected to be associated with the construction impacts and resulting disturbance of the physical footprints of the facilities in one node/area, and the potential for a change in visual quality of the area.

No environmental fatal flaws or impacts of very high significance were identified to be associated with the proposed project on the identified site at this stage in the process. This conclusion must however be confirmed through a detailed investigation of the development footprint within the EIA Phase of the process.

The potentially sensitive areas which have been identified through the scoping study are summarised and illustrated in the sensitivity map in **Figure 1.2**. The sensitivity map provides an informed indication of sensitivity within and around the larger site. The detail is based on the desktop review of the available baseline information for the study area (including information from detailed EIA studies previously undertaken for the property), as well as a 10-day ecological field survey. The sensitivity map is intended to inform the location and layout of the Paulputs CSP Project, and must be used as a tool by the developer to avoid those areas flagged to be of no-go areas or of potential high sensitivity (as far as possible).

The potentially sensitive areas/environmental features that have been mapped in Figure 1.2 include:

- Areas of ecological sensitivity
- Areas of avifaunal sensitivity and
- Potential noise-sensitive developments

» Areas of high ecological function include the more inaccessible or unutilisable areas such as rocky outcrops should be regarded as no-go areas. These areas of high ecological function include Konkoonsiekop in the north western corner of the farm portion as well as Ysterberg located on the north eastern portion of the farm portion.
» The natural areas are considered to be of conservation importance due to the presence of Red Data species in these areas and should be avoided as far is reasonably possible. Such natural areas are located on the south western portion of the farm and to the eastern portion of the farm closer to Ysterberg
» Konkoonsiekop as well as Ysterberg should be regarded as no-go areas due to avifaunal sensitivity. Other areas of high avifauna abundance will be confirmed following the completion of the seasonal monitoring at the site.
» Water abstraction to fulfil the water requirement of the facility may result in indirect impacts on water resources, i.e. the potential changes in water quantity within the Gariep (Orange) River which could impact on the water needs/allocations of downstream users.
» The Paulputs CSP Project will not have a significant impact on the agricultural potential of the area. The current land use of the property is for two CSP projects, and the developer owns and manages the remaining extent. There are no identified highly sensitive areas with regards to agricultural potential and soil.
» Potential areas of heritage sensitivity on the site include terrain close to hills or rocky features and the known road-side grave below Ysterberg.
» One noise sensitive receptor, a farmstead, is located approximately 3 km north of the affected farm portion however due to the limited period of, the localised nature of potential impacts and the sufficient information available to allow a relative high confidence in the projected noise levels no noise impact is predicted
» Visually sensitive landscape features include prominent rocky terrain and rock outcrops, and the R357 view corridor
» Social benefits associated with the construction and operation of the proposed project includes job opportunities and possible socio-economic spin-offs created. Negative social impacts include safety and security impacts, pressure on economic and social infrastructure impacts from an in-migration of people, visual impact and impacts on sense of place.
» Potential issues identified to be associated with the proposed ~2km power line includes impacts on flora, fauna and ecological processes, impacts on avifauna as a result of collisions and electrocutions, impacts on heritage sites and visual impacts. The alignment of the power line adjacent/parallel to existing linear infrastructure may partially mitigate the potential for negative impacts from the linear infrastructure.

» Potential issues identified to be associated with the proposed ~30km pipeline corridor includes impacts on intact flora within the road reserve, and impacts on heritage sites. The alignment of the pipeline within the Onseepkans road reserve, and adjacent/parallel to existing linear infrastructure will mitigate the potential for negative impacts from the linear infrastructure.

It was recommended that infrastructure should be placed within the site so as to consider the identified sensitive areas to minimise impacts. Subsequently, the sensitive environmental features that were identified during the Scoping phase have been taken into consideration by the developer in designing the layout of the Paulputs CSP Project. The proposed layout of infrastructure for the Paulputs CSP Project is discussed further in Chapter 2.

Public Participation: During the public participation process conducted in the Scoping phase, the proposed project was generally well received by the recipient community, interested and affected parties, and stakeholders. No objections to the proposed project were received on any environmental or social basis. However concerns regarding the potential impacts on avifauna, are considered and assessed in this EIA report.

Approval of the Scoping Report: No environmental or social fatal flaws were identified to be associated with the broader site during the Scoping stage of the EIA process and the Final Scoping Report was accepted by DEA on 18 February 2016.

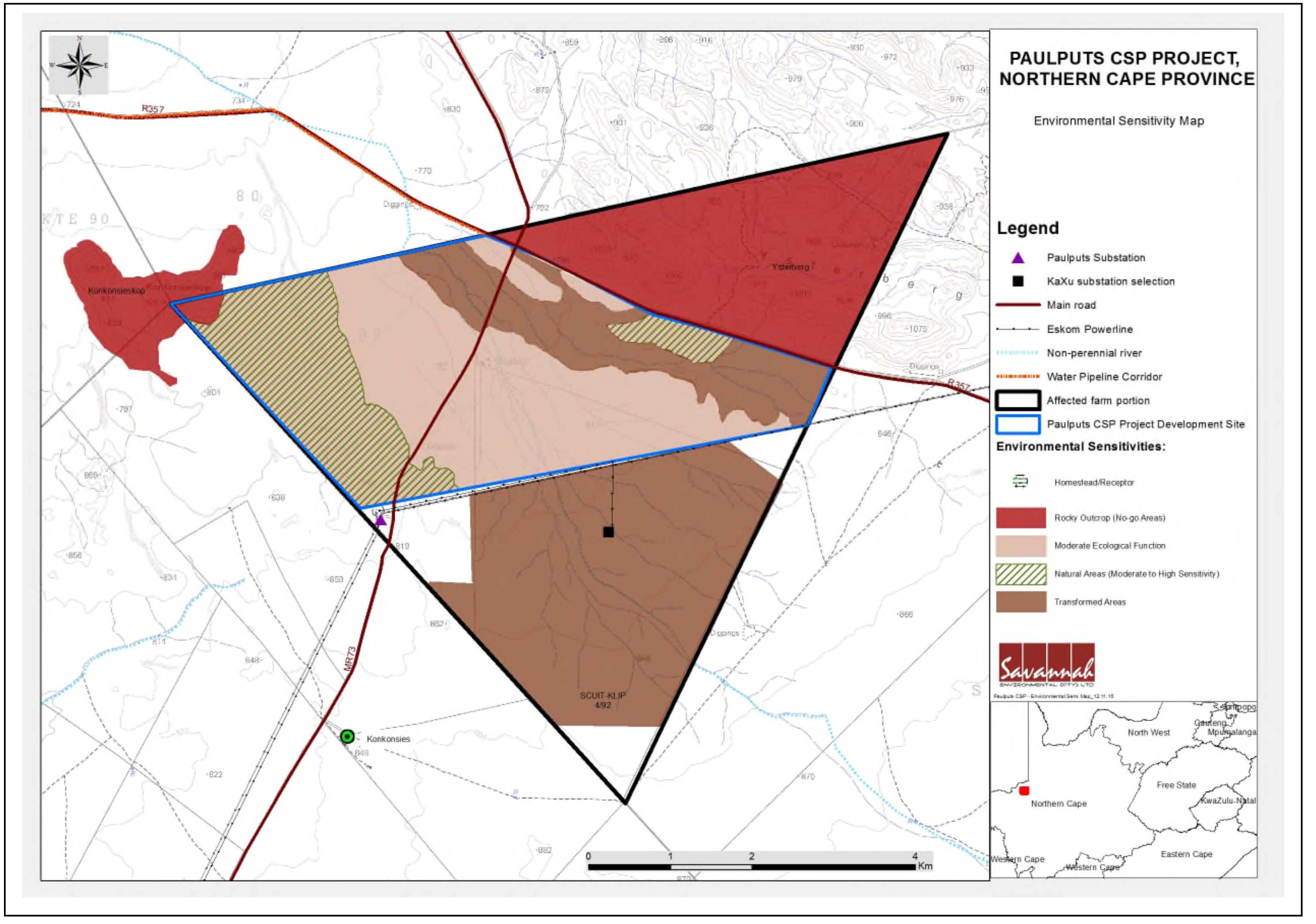

Figure 1.2: Preliminary sensitivity map of the Paulputs CSP Project based on sensitivities identified at Scoping Phase

1.3. Requirement for an Environmental Impact Assessment Process

The construction and operation of the proposed Paulputs CSP project is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA) 107 of 1998. This section provides a brief overview of the EIA Regulations and their application to this project.

NEMA is the national legislation that provides for the authorisation of 'listed activities'. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority[3] and the Northern Cape Department of Environment and Nature Conservation (DENC) will act as a commenting authority.

The need to comply with the requirements of the EIA Regulations ensures that the competent authority is provided with the opportunity to consider the potential environmental impacts of a project early in the project development process and to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. Paulputs CSP RF (Pty) Ltd has appointed Savannah Environmental as the independent Environmental Consultants to conduct an EIA process for the proposed project.

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be fore-warned of potential environmental issues, and allows for resolution of the issues reported on in the Scoping and EIA Reports as well as dialogue with interested and affected parties (I&APs).

The EIA process comprises two phases – i.e. Scoping and Impact Assessment - and involves the identification and assessment of environmental impacts though specialist studies, as well as public participation. The process followed in these two phases is as follows:

[3] In terms of the Energy Response Plan, the DEA is the competent authority for all energy related applications.

» The **Scoping Phase** includes the identification of potential issues associated with the proposed project through a desktop study and consultation with affected parties and key stakeholders. Areas of sensitivity within the broader site are identified and delineated in order to identify any environmental fatal flaws, no-go or sensitive areas. Following a public review period of the report, this phase culminates in the submission of a final Scoping Report and Plan of Study for EIA to the competent authority for acceptance.
» The **EIA Phase** involves a detailed assessment of potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase includes detailed specialist investigations and public consultation. Following a public review period of the EIA report, this phase culminates in the submission of a Final EIA Report and an Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to the competent authority for review and decision-making.

1.4. Details of the Environmental Assessment Practitioner

Savannah Environmental was contracted by Paulputs CSP RF (Pty) Ltd as the independent environmental assessment practitioner to undertake both Scoping and EIA Phases for the proposed Paulputs CSP Project. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to Paulputs CSP RF (Pty) Ltd or Abengoa Solar Power South Africa (Pty) Ltd in any way. Furthermore, Savannah Environmental does not have any interests in secondary developments that could arise out of the authorisation of the proposed projects.

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development, and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team have considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation. The team responsible for the process being undertaken for the current project include:

» *Michelle Moodley* the principle author of this report an Environmental Consultant, holds a BSc Honours degree in Biodiversity and Conservation, is a

Professional Natural Scientist and has 5 years of experience in environmental consulting.

» *Karen Jodas* is a registered Professional Natural Scientist and holds a Master of Science degree and is the registered EAP on the proposed project. She has 20 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country.

» *Gabriele Wood* holds an Honours Degree in Anthropology. She has 9 years consulting experience in public participation and social research. Her experience includes the design and implementation of public participation programmes and stakeholder management strategies for numerous integrated development planning and infrastructure projects. Her work focuses on managing the public participation component of Environmental Impact Assessments and Basic Assessments undertaken by Savannah Environmental.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, the following specialist sub-consultants have provided input into this environmental impact report:

» Ecology (Flora and Fauna) – Adrian Hudson, Hudson Ecology
» Avifauna - Adrian Hudson, Hudson Ecology
» Soils and Agricultural Potential – Garry Paterson, ARC-Institute for Soil, Climate and Water
» Heritage – David Morris, McGregor Museum Department of Archaeology
» Visual – Jon Marshall, Afzelia Environmental Consultants & Environmental Planning and Design
» Social – Candice Hunter, Savannah Environmental (with external review by Neville Bews)
» Water Resources: Brian Colloty – Scherman Colloty and Associates

Appendix A includes the curricula vitae for the environmental assessment practitioners from Savannah Environmental and the specialist consultants.

DESCRIPTION OF THE PAULPUTS CSP PROJECT CHAPTER 2

This chapter provides an overview of the Paulputs CSP Project and details the project scope which includes the planning/design, construction, operation and decommissioning activities. This chapter also explores site and technology alternatives as well as the 'do nothing' option. The use of solar energy as a means of power generation is explained.

2.1. Need and Desirability of the Development at the Preferred Site Location

The overarching objective for the Paulputs CSP Project is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. From a regional site selection perspective, this region is considered to be preferred for solar energy development by virtue of its annual solar irradiation values being comparable to the Atacama desert in Chile which has the highest solar resource in the world (refer to Figure 2.1). From a local perspective, the site has specifically been identified by Paulputs CSP RF (Pty) Ltd as being highly desirable for the development of a CSP Project due to its suitable topography (i.e. in terms of slope and local topography), site access (i.e. to facilitate the movement of machinery during the construction phase and operations staff in the long-term), land availability (i.e. the land is secured for the intended use), the extent of the site (i.e. the land parcel is able to accommodate the 900ha required for the facility), and enabling optimal placement of the infrastructure considering potential environmental sensitivities or technical constraints, as well as the consolidation of renewable projects within an already identified node (i.e. the only site presently in South Africa with two adjacent CSP facilities). These favourable characteristics are further explored in the sections below.

At a local level, the project development site is situated approximately 40 km north-east of Pofadder in the Northern Cape, on Portion 4 of the Farm Scuit-Klip 92 and is located within an area which has become a node for renewable energy projects due to the viability of the solar resource for the area and the proximity of the Paulputs Eskom Transmission Substation which has capacity to accommodate the projects. The following preferred bidder projects (PB) are located directly adjacent to, or in close proximity to, the project development site: KaXu Solar One (Round 1 Preferred Bidder; Operational), Xina Solar One (Round 3 Preferred Bidder; Under construction), Konkoonsies I Solar (Round 1 Preferred Bidder; Operational), and Konkoonsies II Solar (Round 4 Preferred Bidder; Construction to commence shortly).

The Paulputs CSP project is proposed to be constructed outside of the Pofadder urban edge. Portion 4 of the Farm Scuitklip 92 itself has not been considered for an alternative land use owing to its current zoning as Special Solar, and the two other renewable projects located on the same land parcel. The property is owned by Abengoa Solar South Africa.

At a National level, the Northern Cape has been identified as the area with highest potential for solar renewable energy generation, with high solar radiation levels and the availability of vast tracts of land (refer to Chapter 3). There are already a number of CSP projects (and solar PV facilities) constructed and planned in the region. The development of another CSP project in the study area will be in line with the objectives of the Khai-Ma Local Municipality Integrated Development Plan (IDP) (2012-2017) as well as the Namakwa District Municipality IDF (2012-2016), as the need for the development of the renewable sector has been identified in both Municipal plans. A more detailed description of the mandates set out by the Municipalities is included in Chapter 3 of this Report.

2.1.1 Site selection and Pre-Feasibility Analysis

Due to the nature of the development (i.e. a renewable energy facility), the location of the project is largely dependent on technical factors such as the solar irradiation levels (i.e. the fuel source), extent and accessibility of the site and available grid connection. Portion 4 of the farm Scuitklip 92 was identified by Paulputs CSP RF Pty (Ltd) as being technically feasible and, given its attributes, is also thought to be commercially feasible, i.e. able to provide electricity to the citizens of South Africa at a highly competitive tariff.

As part of the EIA for the Pofadder Solar Thermal Facility, under which both the KaXu Solar One and Xina Solar were authorised pre-feasibility assessments were undertaken for the broader area surrounding the Paulputs CSP Project site for the construction of a renewable energy facility.

The larger farm portion was identified as having potential for the installation of CSP infrastructure on the basis of various technical criteria, including the solar resource, accessibility of the site, accessibility to the Eskom grid, and current land use considerations. The intention of the high-level site assessment was to inform Paulputs CSP RF Pty (Ltd) of the environmental suitability of the identified site for the development of a renewable energy facility (i.e. a CSP facility), and highlight or red-flag potential issues of concern prior to initiation of the Environmental Impact Assessment.

In summary the screening study utilised the following methodology:

a) Desk-top level evaluation of those issues considered to be most pertinent or of most concern when considering the placement of a renewable energy facility. The studies were reliant on available literature, as well as reporting from the EIAs for the two CSP facilities owned by Abengoa Solar South Africa, currently on the farm portion known as KaXu Solar One (operational) and Xina Solar One (under construction), as well as other EIAs for neighbouring sites. No field surveys were undertaken at that time. These studies included: Desk-top level evaluation in terms of ecology, avifauna, noise.
b) Compilation of a preliminary sensitivity map (based on the desktop data) to be considered in the pre-feasibility assessment.
c) Solar irradiation level studies (desk-top) commissioned utilising commercially available data (e.g. NASA solar resource at the areas of interest.

2.1.2 Receptiveness of the site to the development of the Paulputs CSP Project

Paulputs CSP RF Pty (Ltd) considers this area, and specifically the demarcated farm, Portion 4 of the farm Scuitklip 92, to be highly preferred for the development of a concentrated solar power project. This is based on the following considerations:

Extent of the site: Availability of relatively level land of sufficient extent can be a restraining factor to CSP development, as a 200 MW solar tower system and associated infrastructure requires up to 1000 ha of land space. The larger farm portion owned by the project developer is approximately 3507 ha in extent, of which ~900 ha is allocated for the siting of the proposed Paulputs CSP project and associated infrastructure. This is approximately 27% of the land surface area within the farm portion. The two existing CSP plants within the same portion occupy approximately 900ha in total, with the remainder of the farm portion available for future development. This site is, therefore, considered sufficient for the installation of the Paulputs CSP Project allowing for avoidance of sensitivities within the greater study area.

Power transmission considerations: There is an existing Eskom transmission substation on site known as the Paulputs Transmission Substation and allows for direct connection of the Paulputs CSP Project. In addition the proposed project site is situated within the Central Corridor defined in terms of Eskom's Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) conducted by the CSIR (refer to Figure 2.2.), indicating the potential for grid connection should connection to the Paulputs Substation not be possible.

Site access: The site can be accessed via the existing tarred access road off the R357 Onseepkans Road via the N14. The existing tarred access road is currently being used for access to the other two CSP facilities on the farm portion.

Current land use considerations: There is no cultivated agricultural land or other commercial agricultural activities within the farm portion which could be impacted upon by the proposed development. Two CSP facilities, KaXu Solar One and Xina Solar One are located in the southern portion of the site. The landowner, Abengoa South Africa (Pty) Ltd has rezoned the farm parcel south of the R357 for Special Solar use, which is consistent with the current and intended land use.

Climatic conditions and solar irradiation: Climatic conditions determine the economic viability of a concentrated solar power project as it is directly dependent on the annual direct solar irradiation values for a particular area. The Northern Cape receives the highest average daily direct normal and global horizontal irradiation in South Africa which indicates that the regional location of the project is appropriate for a concentrated solar power project. In addition, the area which lies to the west of Upington exhibits some of the best solar irradiation in South Africa (refer to Figure 2.1). Direct normal irradiation (DNI) for the Pofadder region is more than 2900 kWh/m^2/annum. The DNI for the Paulputs CSP project site is more than 3000 kWh/m^2/annum as confirmed by long term actual ground station measurements. Factors contributing to the preferred location of the project include the relatively high number of daylight hours and the low number of rainy days experienced in this region.

Square Kilometre Array Considerations: Through interactions with the South African SKA Project Office it has been confirmed that the nearest SKA station has been identified as SKA ID 1896, at approximately 107 km from the proposed installation. Based on distance to the nearest SKA station, and the information currently available on the detailed design of the CSP installation, the Paulputs CSP Project poses a very low risk of detrimental impact on the SKA.

Topography: The site is located on a series of plains which slope in a north-westerly direction. The site is generally flat to gently undulating and lies at a height of approximately 800m - 850m above sea level. The study area includes a single hill in the north-western corner (i.e. Konkonsieskop) and a range of steep hills in the north-eastern corner (i.e. Ysterberg), both of which fall outside of the area of interest considered for the CSP project.

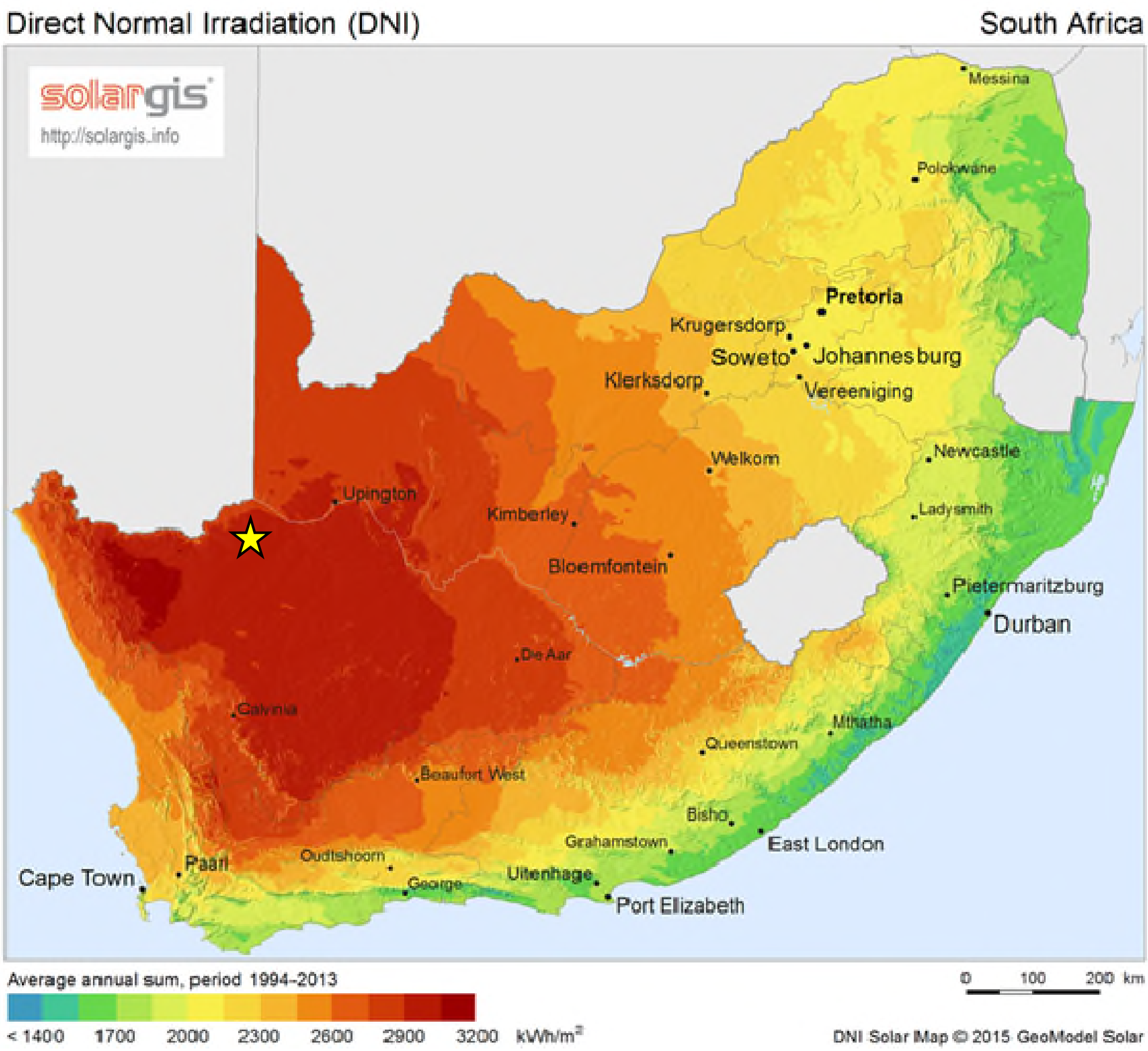

Figure 2.1: Solar irradiation map for South Africa; the proposed Paulputs CSP project position is shown by the yellow star on the map. (Source: adapted from GeoModel Solar, 2011).

Access to the Grid: Ease of access to the Eskom electricity grid is vital to the viability of a CSP project. Projects which are in close proximity to a connection point and/or demand center are favourable, and reduce the losses associated with power transmission. Eskom Transmission's substation known as Paulputs Transmission Substation is located on the same farm portion as the proposed project, and allows for direct connection to the grid via a short connection. In addition, Eskom's '2040 Transmission Network Study' has drawn on various scenarios to determine the grid's development requirements, as well as to identify critical power corridors for future strategic development, of which the Northern corridor is one of these. The national power corridors have been refined and consolidated into five transmission power corridors of 100 km in width.. The Paulputs CSP project site falls into the Northern corridor (refer to Figure 2.2).

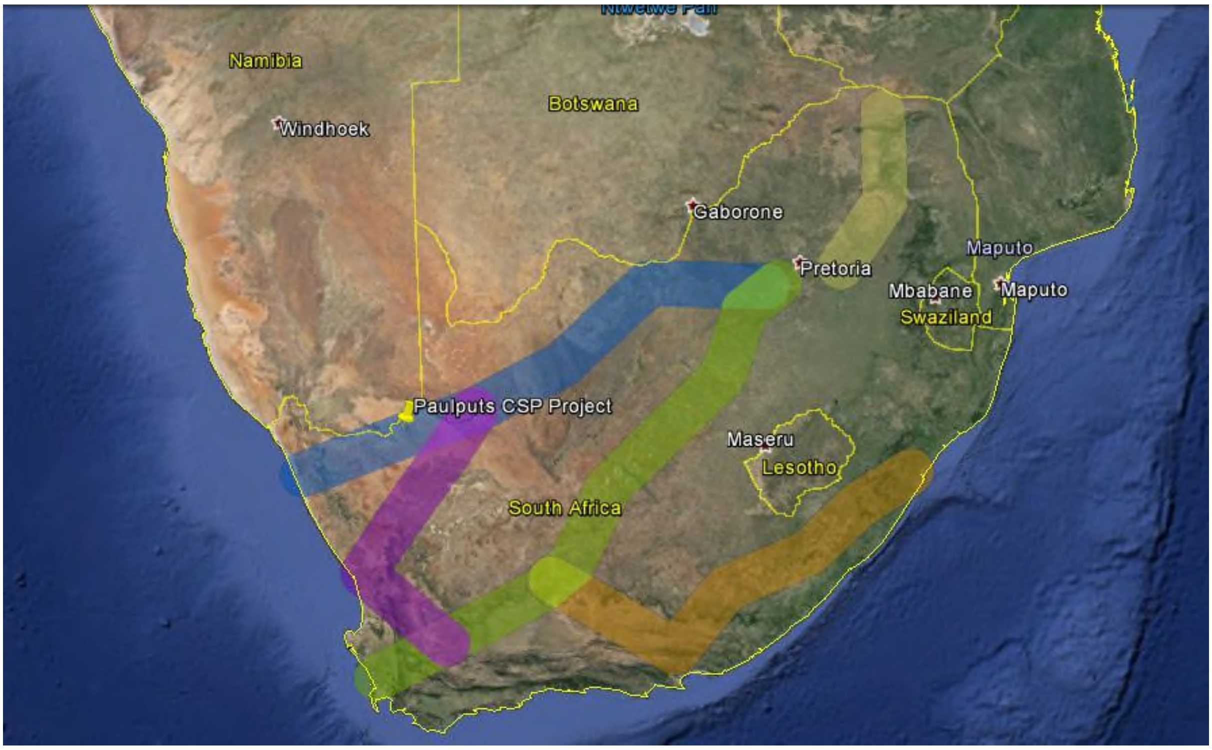

Figure 2.2: Eskom "Critical Power" Corridors as identified through the Eskom SEA. The Paulputs CSP project site falls within the northern corridor as shown.

The project proponent has also consulted with local Eskom technical departments as well as the Eskom planning and transmission expansion departments to understand the future demand centers as well as strategic plans to upgrade and strengthen any local networks. These discussions have been informed to a large extent by the recently published Eskom Transmission Development Plan ("TDP") 2015 – 2024.

Proximity to Towns with a Need for Socio-Economic Upliftment: The Northern Cape Province, like most of South Africa, is marred by unemployment, inequalities and poverty. To this extent the Paulputs CSP project is situated approximately 40 km north-east of Pofadder, 45 km south east of Onseepkans and consequently, local labour would be easy to source, which fits in well with the REIPPPP economic development criteria for socio-economic upliftment. Owing to its proximity to preferred bidder projects which are in various stages of the development and construction cycles, the project would present a new opportunity for local labour skilled through previous work experience on the preferred bidder plants.

Proximity to Access Road for Transportation of Material and Components: The proximity of the site to the N14 decreases the impact on secondary roads from traffic during the construction and operation phases as the site can be readily accessed via the existing tarred access road off the R357 Onseepkans Road via the N14. As material and components would need to be transported to the project site during the construction phase of the project, the accessibility of the site was a key factor in determining the viability of the project, particularly taking transportation costs (direct and indirect) into consideration and the impact of this on project economics and therefore the ability to submit a competitive bid under the DoE's REIPPPP programme.

2.1.3 Benefits of Renewable Energy

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

Increased energy security: The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. As a result of the power constraints in the first half of 2015, power generators meant to be the "barely-ever-used" safety net for the system (diesel-fired gas turbines) were running at > 30% average load factor in the first half of 2015. Load shedding occurred during 82 days in the first half of 2015 (out of 181 days). Results of a CSIR Energy Centre study for the period January to June 2015 (CSIR, August 2015), concluded that the already implemented renewable projects (wind and solar) within the country avoided 203 hours of so-called 'unserved energy'. During these hours the supply situation was so tight that some customers' energy supply would have had to be curtailed ('unserved') if it had not been for the renewables. The avoidance of unserved energy cumulated into the effect that during 15 days from January to June 2015 load shedding was avoided entirely, delayed, or a higher stage of load shedding prevented due to the contribution of renewable projects[4].

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. This also translates into revenue savings of R26.6 million per annum, as fuel for renewable energy facilities is free while compared to the continual purchase of fuel for conventional power stations. As an already

4 http://ntww1.csir.co.za/plsql/ptl0002/PTL0002_PGE157_MEDIA_REL?MEDIA_RELEASE_NO=7526896

water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability. Renewable energy also translates into revenue savings, as fuel for renewable energy facilities is free while compared to the continual purchase of fuel for conventional power stations. Results of a CSIR Energy Centre study for January – June 2015 (CSIR, August 2015) have quantified the contribution from renewable energy to the national power system and the economy over the first 6 months of 2015 compared to the 12 months of 2014:

2015 (6 months)	**2014 (12 months)**
R3.60 billion saving in diesel and coal fuel costs	R3.64 billion saving in diesel and coal fuel costs
200 hours of unserved energy avoided, saving at least an additional R1.20 billion–R4.60 billion for the economy	120 hours of unserved energy avoided, saving at least an additional R1.67 billion for the economy
Generated R4.0 billion more financial benefits than cost	Generated R0.8 billion more financial benefits than cost

Exploitation of South Africa's significant renewable energy resource: At present, valuable renewable resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio in South Africa.

Economics: As a result of the excellent solar resource within South Africa and competitive procurement processes, both concentrated solar power and solar PV power are now proven in South Africa as cheaper forms of energy generation than coal power. Renewables offer excellent value for money to the economy and citizens of South Africa.

Pollution reduction: The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is a non-consumptive use of a natural resource which produces zero emissions during its operation.

Climate friendly development: The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be currently responsible for approximately 1% of global GHG emissions (and circa half of those for which Africa is responsible) and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions. The renewable energy sector saved South Africa 1.4 million tons of carbon emissions over the first 6 months of 2015[5].

Support for international agreements: The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol and COP21 Agreement, and for cementing its status as a leading player within the international community.

Employment creation: The development, procurement, installation, maintenance and management of renewable energy facilities have significant potential for job creation and skills development in South Africa. Employment for South African citizens including people from communities local to the IPP operations in the Northern Cape were 11 652 job years as at the end of June 2015 (Department of Energy, 2015).

Acceptability to society: Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

Support to a new industry sector: The development of renewable energy offers the opportunity to establish a new industry within the South African economy, which will create jobs and skill local communities which have potential for further renewable energy projects.

Protecting the natural foundations of life for future generations: Actions to reduce the country's disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change, thereby securing the natural foundations of life for generations to come. This is the basis of sustainable development.

2.2. Project and Site Description

The project is to be developed by Abengoa Solar Power South Africa (Pty) Ltd, through Paulputs CSP RF (Pty) Ltd, a Special Purpose Vehicle (SPV) to be established as the applicant for the project. The project is proposed to be developed on Portion 4 of the Farm Scuitklip 92 located approximately 40km north-east of Pofadder and 90 km south west of Kakamas in the Khai-Ma Local Municipality (Namakwa District Municipality) of the Northern Cape. Abengoa Solar Power South Africa is the owner of the property, and their two solar thermal energy parabolic trough plants are also located on the greater property (KaXu Solar One is under full commercial operation while Xina Solar One is currently

[5] http://www.iol.co.za/capetimes/renewable-energy-saving-sa-billions-csir-1.1903409#.VkNjdJq6FeU

under construction and expected to be fully operational beginning 2017). This site is highly preferred by virtue of climatic conditions, relief and aspect, the availability of land, and proximity to a viable point of connection to the National grid through Eskom's Paulputs Transmission Substation (located on the same property). The site is within 4km of two PV projects on adjacent properties, one constructed and one a preferred bidder in Round 4 of the REIPPPP Programme. The site is therefore located within a solar energy hub developing around Eskom's Paulputs Transmission Substation.

Table 2.1 below provides details of the proposed project, including the main infrastructure and services.

Table 2.1: Details of the proposed project

Component	**Description/ Dimensions**
Location of the site	Portion 4 of the farm Scuitklip 92
Municipal Jurisdiction	Khai-Ma Local Municipality
SG Code	C03600000000009200004
Contracted capacity of facility	Up to 200MW
Extent of broader site	3507.6 ha in extent
Site access	The site can be accessed via the existing tarred access road off the R357 Onseepkans Road via the N14. The internal access roads will need to be established. As far as possible, existing access roads to the site would be utilised, and upgraded where required.
Services required	» Refuse material disposal - all refuse material generated from the proposed development will be collected by a contractor and will be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required. » Sanitation – all sewage waste will be collected by a local contractor and will be disposed of at a licensed waste disposal site. This service will be arranged with the municipality when required during the construction and operation phases. » Water for the construction phase could be sourced from the following options: • from the Gariep River through abstractionTransporting water to site, using water tankers During the operational phase water will be sourced from the Gariep River through abstraction.
Temporary infrastructure required during the construction phase (which is estimated to be 24 months)	» Construction camps; » Construction yard and offices; » Storage areas; and » Temporary access roads.

2.3. Alternatives Considered for the Paulputs CSP Project

In accordance with the requirements outlined in Appendix 3 of the EIA Regulations 2014, the consideration of alternatives including site and technology alternatives, as well as the "do-nothing" alternative should be undertaken.

2.3.1. Site specific Alternatives

The regional site identification process undertaken in 2010 included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of the original CSP Projects (KaXu Solar One and Xina Solar One) , including the solar resource, land availability, accessibility and existing grid infrastructure. The remaining area of Portion 4 of the Farm Scuitklip was then earmarked by Paulputs (Pty) Ltd as being potentially suitable for this CSP Project. As a result, no feasible site alternatives have been identified for investigation for the proposed CSP Project, as the site has been screened as being potentially suitable for development of the project. This area was put forward for consideration within this EIA.

The site is also located within an area which has become a node for renewable energy projects, with the following preferred bidder projects located directly adjacent to, or in close proximity to, the project development site: Konkoonsies Solar I, Koonkoonsies II Solar Project Xina Solar One and KaXu Solar One.

Portion 4 of the Farm Scuitklip 92 was purchased by the developer for development. The development portion of the property has been rezoned for this intended use. Following the successful development and construction of the KaXu Solar One and Xina Solar One projects on the same farm, Abengoa Solar Power South Africa (Pty) Ltd is proposing the Paulputs CSP Project on the remainder of the farm portion.

Based on these considerations, Paulputs CSP RF (Pty) Ltd considers the proposed site as *highly preferred* in terms of the development of CSP projects and able to draw on synergies with the projects currently under construction. No site alternatives are available for assessment. Appendix O contains a detailed motivation from Paulputs CSP RF (Pty) Ltd.

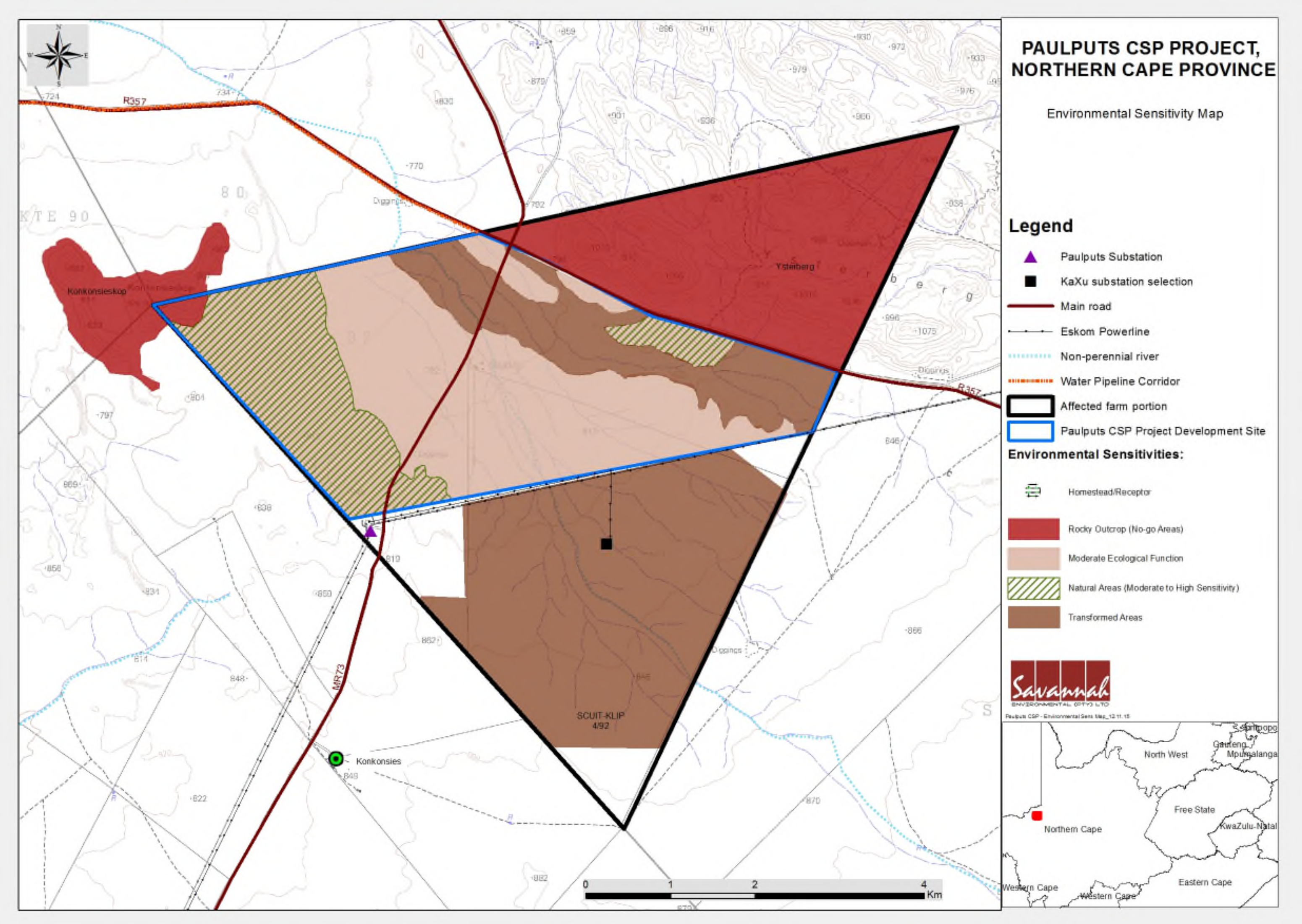

Figure 2.3: Preliminary sensitivity map of the Paulputs CSP Project based on sensitivities identified at Scoping Phase

2.3.2. Layout and Design Alternatives

The consideration of the suitability of the site for the proposed project was in line with a typical mitigation hierarchy:

1. First Mitigation: avoidance of adverse impacts as far as possible by use of preventative measures (in this instance a sensitivity analysis assisted in the avoidance of identified ecological and avifaunal sensitive areas)
2. Second Mitigation: minimisation or reduction of adverse impacts to 'as low as practicable' (in this instance minimisation of impact on identified ecological and avifaunal sensitive areas through implementing mitigation)
3. Third Mitigation: remedy or compensation for adverse residual impacts, which are unavoidable and cannot be reduced further.

In determining the preferred layout for the proposed CSP Plant, a 'funnel-down approach' was used and commenced with the consideration of the larger 3507 ha farm portion.

Step 1: The full extent of the 3507.6 ha farm portion was considered in the EIA undertaken for the Pofadder Solar Thermal Facility, under which both the KaXu Solar One and Xina Solar One projects were authorised. In investigating the location of the proposed Paulputs CSP project the same approach was adopted where potentially sensitive areas identified through the environmental scoping study for Xina Solar One and KaXu Solar One were considered in order to define the areas which a) are to be avoided (i.e. no development considered acceptable), b) areas of some considered sensitivities which can be mitigated to acceptable environmental levels, and c) areas which are considered to be acceptable loss. The scoping phase sensitivity map (refer to Figure 2.3) provided detail from the ecological, avifaunal and noise surveys undertaken. Those potentially sensitive areas identified through the scoping study and the ecology and bird pre-construction monitoring across the full extent of the broader study area included:

» Areas to be avoided (i.e. no development considered acceptable):
  » Areas of high ecological function include the more inaccessible or unutilisable areas such as rocky outcrops should be regarded as no-go areas. These areas of high ecological function include Konkoonsiekop in the north western corner of the farm portion as well as Ysterberg located on the north eastern portion of the farm portion.
  » Konkoonsiekop as well as Ysterberg should be regarded as no-go areas due to avifaunal sensitivity.

» Areas of some considered sensitivities which could be mitigated to acceptable environmental levels

  - The natural areas remaining on the site are considered of moderate to high ecological sensitivity due to conservation importance as a result of the presence of Red Data species in these areas and should be avoided as far is reasonably possible. Such natural areas are located on the south western portion of the farm and in the eastern portion of the farm closer to Ysterberg.

- Areas which were considered to be acceptable loss:
  - Areas of moderate ecological function are considered of moderate sensitivity. Majority of the study area is of moderate sensitivity.
  - Areas that are already transformed due to slash and burn cropping techniques are considered of low sensitivity. Such transformed areas are located along the north-western border of the farm portion closer to Konkoonsieskop and towards the centre of the farm portion closer to Ysterberg. These areas are of moderate ecological sensitivity, and therefore development within this area is considered acceptable loss

Step 2: The potentially sensitive areas already identified through the scoping study and the EIAs undertaken for the Pofadder Solar Thermal Facility, provided No-Go areas (i.e. avoidance of identified avifaunal and ecologically sensitive areas – First Mitigation in the proposed methodology). These areas were excluded from the developable area. The larger farm portion is approximately 3507.6 ha in extent, with 1600ha available for the Paulputs CSP Project which requires just 900ha. Based on the specialist findings and sensitivities identified during the scoping phase, the completed EIA for the Pofadder Solar Thermal Facility and avoidance of site sensitivities the development footprint of the Project comprises just approximately 25% of the total extent of the farm The site can adequately accommodate the proposed 200MW Paulputs CSP Project. It is anticipated that the Project and its associated infrastructure can be appropriately positioned to avoid areas of environmental sensitivity and taking the location of the authorised facilities into consideration. The environmental sensitivities identified during the scoping phase have informed the layout of the proposed facility (refer to Figure 2.4). Therefore no layout alternatives were considered.

2.3.3. Technology Options

Details of the technology alternatives considered and the decision of technology for this project are explained below:

i) CSP technology options

Abengoa Solar is the only solar company that commercially implements all CSP technological solutions in projects worldwide. As such, projects are designed to most optimally suit the techno-economic needs of the specific situation or customer. Paulputs CSP RF (Pty) Ltd considered two CSP technology types for implementation on the site in order to maximise the capacity and land available on the site, namely: heliostats and a power tower system (Solar Tower technology) and parabolic trough technology (Trough technology).

Both CSP technologies[6] are based on the operating principle that the power gained from the sun can be maximised if the radiant energy of the sun is gathered and concentrated on a single point. By concentrating the sun's rays, CSP technologies maximise the amount of sunlight that can be converted into electricity, thereby reducing wastage and increasing output. Technological similarities between power tower and parabolic trough plants include:

» Both technologies operate on a steam turbine system to generate electricity.
» The energy can be stored to enhance despatchability for both technologies.

Technological differences between solar tower and parabolic trough plants include:

[6] CSP tower and CSP trough technologies are not considered to be alternative technology choices as they are fundamentally different solar thermal power technologies.

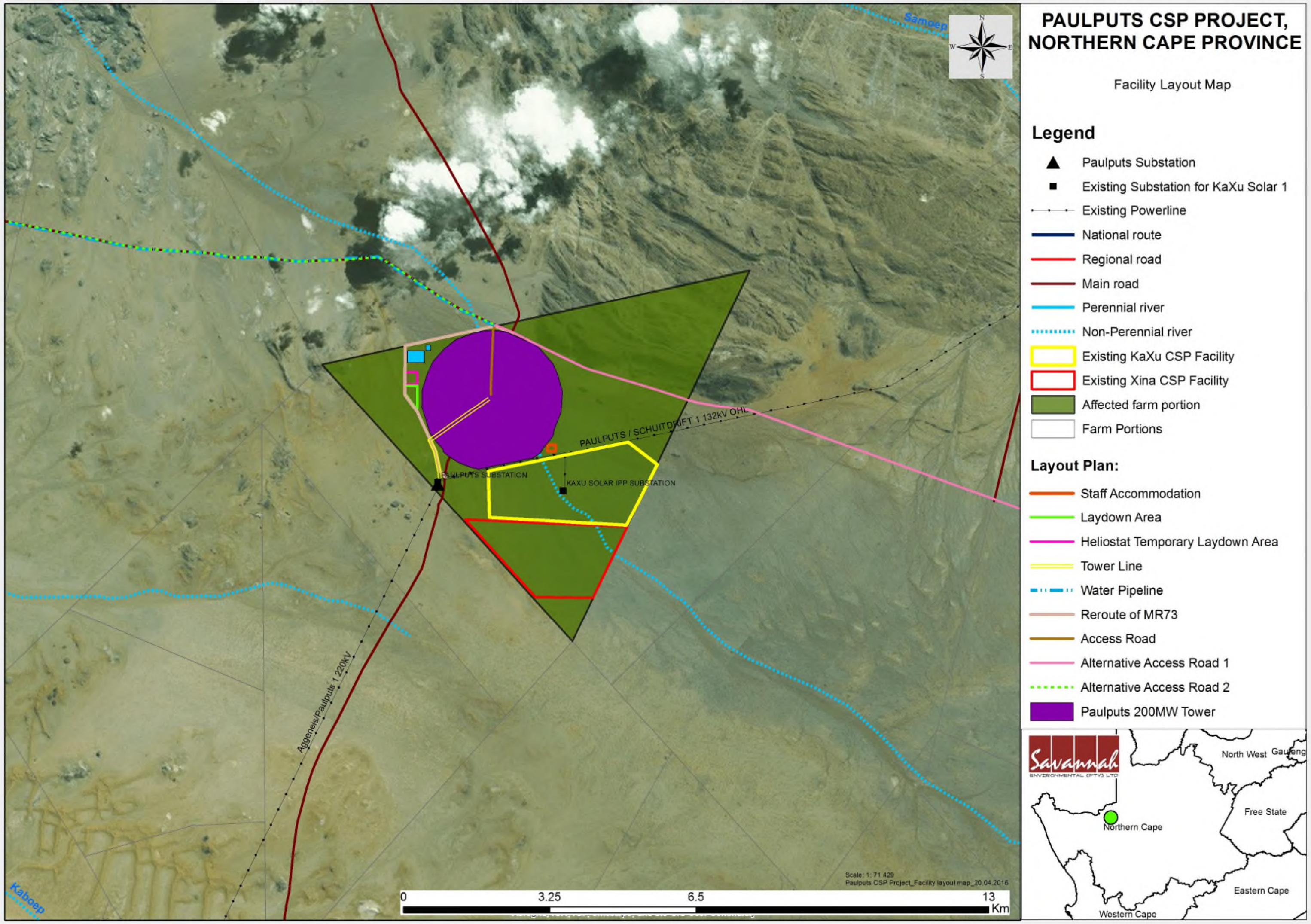

Figure 2.4: Preliminary layout for the proposed Paulputs CSP Project in the Northern Cape Province

» Parabolic troughs are typically 8m to 10m in height and a heat transfer fluid is heated within the trough receiver tubes (i.e. has no 'central receiver', but rather a continuous loop at approximately 5m from ground level).
» Heliostats used in twer technology are mirrors which reflect the sunlight onto one 'central receiver' which is located on top of the power tower which is up to 300m in height.
» Both technologies result in a change in land use. Trough plants, however, require absolute levelling of the land as the troughs are required to be level (heat transfer fluid moves through the receiver tubes), therefore the site is terraced and may have excessive cut-and-fill operations. A heliostat field does not require terracing, and has a lower impact as a result of direct footprint alteration.
» Molten salt towers have a 5% -10% overall efficiency advantage over parabolic troughs, with an associated *5% -10% less water consumed per MW generated* - estimated to be as much as 50 000 m^3 of water saved annually for a 200MW plant.

The Renewable Energy Independent Power Producer Procurement (REIPPP) Programme selection process (details of which are not yet finalised for future bidding rounds), IRP from Government, and the economics of the concentrated solar power project are key factors in determining the final technology combination and the schedule of implementation for the Project. The preferred/optimal technology option (from a technical, financial and socio-economic perspective) for the Paulputs CSP project is considered by the Applicant to be a Solar Thermal Energy (STE) Molten Salt Tower (MST). The progress achieved by molten salt tower technology in recent years has resulted in Abengoa Solar considering this technology choice a preferred technology for application in South Africa to meet the specific requirements as outlined by the DoE (and the REIPPP Programme).

Molten salt towers have become the CSP technology of choice for implementation in markets requiring *significant energy storage* by Abengoa and other CSP developers due to significant technology advances occurring over the last couple of years. This is illustrated in projects that are currently being developed and constructed in markets such as Chile, North Africa and the Middle East.

The molten salt tower technology provides an optimal techno socio-economic solution when considering CSP alternatives, highlighted by the salient indicators of higher efficiency, associated reduced water consumption per MW generated and lower direct footprint alteration (the heliostat field does not require absolute levelling of the land as trough plants do with the associated terracing and cut-and-fill operations).

The recent international preference for molten salt towers, prompted the National Renewable Energy Laboratory in the USA (NREL) to conduct a comparative analysis of molten salt tower and parabolic trough with storage technology. The findings in the study titled "Estimating the performance and economic value of multiple CSP technologies in a production cost model" dated December 2013, found that parabolic trough CSP-TES plants may require a higher capacity, at a greater expense, than a similar rated molten salt power tower to achieve the same annual output, largely due to a larger seasonal variation in output, lower thermal efficiency, and greater storage losses, which support the findings as presented here.

Paulputs CSP RF (Pty) Ltd consider the CSP salt tower technology choice to meet the requirements of the DOE and deliver the greatest value to the country as a whole through maximising electricity production utilising the available solar resource while minimising associated infrastructure, O&M costs as well as social and environmental impacts. Therefore Solar Thermal Energy (STE) Molten Salt Tower (MST) is considered the preferred technology for the Paulputs CSP project.

ii) CSP cooling technology alternatives

CSP plants are designed to use water for cooling at the back-end of the thermal cycle. There are different types of cooling technologies available (discussed below for comparative purposes). Dry cooled technology is, however, the cooling technology that will be used for the Paulputs CSP Project.

Dry Cooling

Dry cooling by air cooled condensers (ACC) consists of large sections of finned air cooled heat exchangers (with mechanical draft), and the turbine exhaust steam passes through the heat exchangers forming condensate. This arrangement uses no cooling water, and therefore requires no makeup for evaporation losses. ACC cooling can reduce the total make-up water demand considerably, leaving only the process consumption and service water as major users, but is limited by its sensitivity to ambient temperature, negative effect on performance and capital expenditure. Water requirements would be approximately 400 000m^3 per annum utilising this technology.

Hybrid Cooling Tower

A hybrid cooling tower is an option that uses cooling coils with a regular cooling tower to condense a portion of the plume. This serves two purposes: a) to reduce the overall make up water by reclaiming evaporated water and b) plume abatement by reducing the humidity of the exiting air, preventing the formation of visible plume.

Air enters from the side, heats up as it passes across the coils, and then is mixed via baffles with the rest of the tower draft, lowering the draft to below saturation, thus eliminating the visible plume. This type of tower has the ability to reduce the evaporative losses by 20% to 30%. This type of tower reduces the water load with minor impact on performance, but cannot reduce the evaporation to meet the make-up demand requirement. A consideration for this type of tower is that at higher ambient temperatures the amount of cooling coils necessary to achieve the desired reduction can become cost prohibitive.

This, like all cooling towers, operates more efficiently at lower ambient temperatures, and as the ambient temperature rises, less condensation occurs across the coils. The hybrid tower is less expensive than the ACC, and has aesthetic and water reduction benefits, but is unable to meet the total make-up demand requirement.

Water requirements would be approximately 800 000m^3 per annum utilising this technology. This technology is not preferred based on efficiencies at high temperatures and water requirements.

Wet cooling system

A wet cooling tower is a conventional design and is the most common and economic alternative. This form of technology application and system design is based on the one hand by convective heat transfer, and on the other hand, evaporation of the water (increase in the air's humidity). As a result, the cooling water temperature that can be obtained from a wet cooling tower is not solely operative from the ambient temperature but also from the air humidity (air with 100% humidity). This type of technology results in severe water loss of which the primary reasons for loss of water in the cooling tower. Water requirements would be approximately 1 200 000m^3 per annum utilising this technology. This technology is not preferred based on water requirements and the need for cooling towers.

Dry cooled technology is the cooling technology that is preferred for the Paulputs CSP Project. This is also consistent with the Department of Water and Sanitation requirements. Therefore no alternative technology is considered.

2.3.4. Grid connection Alternatives

The following grid connection alternatives have been considered though prefeasibility assessments. The grid connection for the project will be finalised based on input from Eskom and the environmental assessment. Due to the proximity of the Paulputs Transmission Substation (less than 3km away), only one viable option is considered at this point of the assessment process: i.e., a direct connection to the proposed plant substation (50m x 50m in extent) and a new 132kV overhead power line to Eskom's existing Paulputs Transmission Substation over a distance of approximately 1km.

The Paulputs Transmission Substation currently has the capacity to accommodate the power from the Paulputs CSP project. Therefore no connection alternative is required. However, an alternative point of connection for the project would be the Aggeneis Substation located 90km west of the site at Aggeneys. This grid connection alternative is not preferred or considered further based on the need for a new power line nothing less than 90km in length, and the availability restrictions at the Aggeneis Substation.

2.3.5. Access Road(s) Alternatives

The following site access alternatives have been considered though prefeasibility assessments.

1. Access road 1: Access to site from the N14 national road via the existing R357 Onseepkans road used to access the farm, and the CSP facilities on this farm. This road is located to the east of the farm portion. The access point to the site off this road is 17km from the N14, with a formal entrance to the existing CSP facilities off of this public road. This section of the R357 is a tarred road.
2. Access road 2: Access to site from the N14 national road via the existing R358 and minor road MR73. This road is to the west of the farm portion. The access point to the site off this road is 30km from the N14. This is a gravel road.

These two alternative access routes to access the site are considered in this report A realignment of the MR37 road where it traverses the Scuitklip farm is proposed and discussions regarding the realignment are underway with the Northern Cape Department of Roads and Public Works (NC DR&PW).

2.4.5. Water source alternatives

The CSP technologies function through the generation of steam to drive a conventional steam turbine and generator. Therefore, suitable and sufficient water resources will be required. During its operation the Paulputs CSP Project will require approximately 400 000m^3 of water per annum. During its 3 year construction phase 200 000m^3 to 300 000 m^3 per annum will be required.

For the proposed project, Paulputs CSP RF (Pty Ltd) investigated abstraction from a point on the Gariep River and conveyed via a water pipeline. The abstraction point would be located adjacent to the existing abstraction point which is utilised by commercial fruit farming activities. Potential water sources that were considered but proved to be unfeasible included:

» Abstraction from boreholes located within the study site or on adjacent farms. Previous Scoping and EIA studies for KaXu Solar One and Xina Solar One revealed that yield from boreholes would not meet the water requirements for the Paulputs CSP project.

» Purchase of water from the Khai Ma Municipality. Previous Scoping and EIA studies for KaXu Solar One and Xina Solar One revealed that purchase of water from the Municipality would not be a viable source

The Gariep River is considered to have sufficient availability of water to provide the annual water requirement for the Paulputs CSP project. Correspondence has been submitted to the Department of Water and Sanitation in Upington however written confirmation from DWS is pending (refer to Appendix P for proof of correspondence submitted to DWS). No water source alternative is to be assessed.

2.4.6. The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Paulputs CSP project. The main reasons why the do-nothing alternative is not preferred in relation to the Paulputs CSP Project are discussed below, namely:

» The need for additional energy generation capacity in South Africa; and
» The need to diversify the energy mix in South Africa.

The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity and the resultant restrictions are severely damaging the economy. There is, therefore, a need for additional electricity generation options to be developed throughout the country. The 'do nothing' option in terms of implementing renewable energy projects results in a scenario where a fossil fuel or nuclear facility must rather be developed as the need for power does not go away. Environmental considerations aside, these have long lead times (considerably longer than the time required to implement renewable energy projects) and hence the South African economy and its citizens will suffer. Furthermore, the development of a renewable energy source, as promoted by the South African Government would also not be realised, and the reliance on fossil fuel energy sources would not be reduced, as has been committed to.

The purpose of the proposed Paulputs CSP Project is to add new capacity for generation of renewable energy to the national electricity mix and to aid in achieving the goal of a 43% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE). It is fully aligned with government policy – aligns with policy at all three levels of government (see Chapter 3 of this Environmental Impact Assessment Report).

2.4. Concentrated Solar Power as a Power Generation Technology

Concentrated Solar Power (CSP) systems use mirrors or lenses to collect and concentrate the incoming solar radiation (or solar thermal energy (STE)) onto a small area. Electricity is produced when the concentrated light is converted to heat and steam, which drives a steam turbine connected to an electrical power generator. The sections below describe the technology and infrastructure comprising the facility.

2.4.1 Heliostats and Power Tower Technology proposed for the 200MW Project

The proposed Paulputs CSP Project (within a contracted capacity of 200MW) will consist of a field of heliostats and a central receiver, known as a power tower. The project will be constructed over an area of 900ha in extent, and include the following infrastructure:

» Power plant: Salt tower central receiver and tracking heliostats, including a power block with a steam turbine generator and thermal salt storage tanks.
» Associated infrastructure: power island with steam turbine generator, heat exchangers and steam vessels, access roads, on-site substation, power line, water abstraction point and supply pipeline, lined earth water reservoir, steel water storage tanks, packaged water treatment plant, lined evaporation ponds, salt storage vessels, auxiliary fossil fuel boilers and workshop and office buildings.

Concentrated Solar Power (CSP) Tower technology uses thousands of mirrors to reflect and concentrate sunlight onto a central point to generate heat, which in turn is used to generate electricity. A tower system is comprised of two main component groups, i.e. a) a heat collection system, and b) a conventional generating plant portion. The heat collection system is comprised of mirrors which reflect concentrated sunlight onto a large heat exchanger called a receiver that sits on an up to 300m tower. Within the receiver, fluid flows through the piping that forms the external walls; this fluid absorbs the heat from the concentrated sunlight. The fluid utilised is molten salt, which is heated from approximately 250° to 550° Celsius.

The collected energy is used to generate steam through a conventional heat exchanger system that is in turn used for electricity generation in a conventional steam turbine and generator[7].

Molten salt is an ideal heat capture medium, as it maintains its liquid state up to 600° Celsius, allowing the system to operate at low pressure for convenient energy capture and storage. After passing through the receiver, the molten salt then flows down the piping inside the tower and into a thermal storage tank, where the energy is stored as high-temperature molten salt until electricity is needed.

This technology leverages liquid molten salt as both the energy collection and the storage mechanism, which allows it to separate energy collection from electricity generation. When electricity is generated, the high-temperature molten salt flows into the steam generator (heat exchanger), as water is piped in from the condensate storage tank, to generate steam. Once the hot salt is used to create steam, the cooled molten

[7] Water is heated, turns into steam and spins a steam turbine which drives an electrical generator. After it passes through the turbine, the steam is condensed in a condenser and recycled to where it was heated; this is known as a Rankine cycle.

salt is then piped back into the cold salt storage tank where it will then flow back up the receiver to be reheated as the process continues.

After the steam is used to drive the steam turbine, it is condensed back to water and returned to the condensate holding tank, where it will flow back into the steam generator (heat exchanger) when needed. After the molten salt passes though the steam generator, it flows back to the cold tank and is re-used throughout the life of the project. The hot molten salt generates high-quality superheated steam to drive a standard steam turbine at maximum efficiency to generate reliable, non-intermittent electricity during peak demand hours.

A conceptual illustration showing the power tower operating system is shown in Figure 2.3.

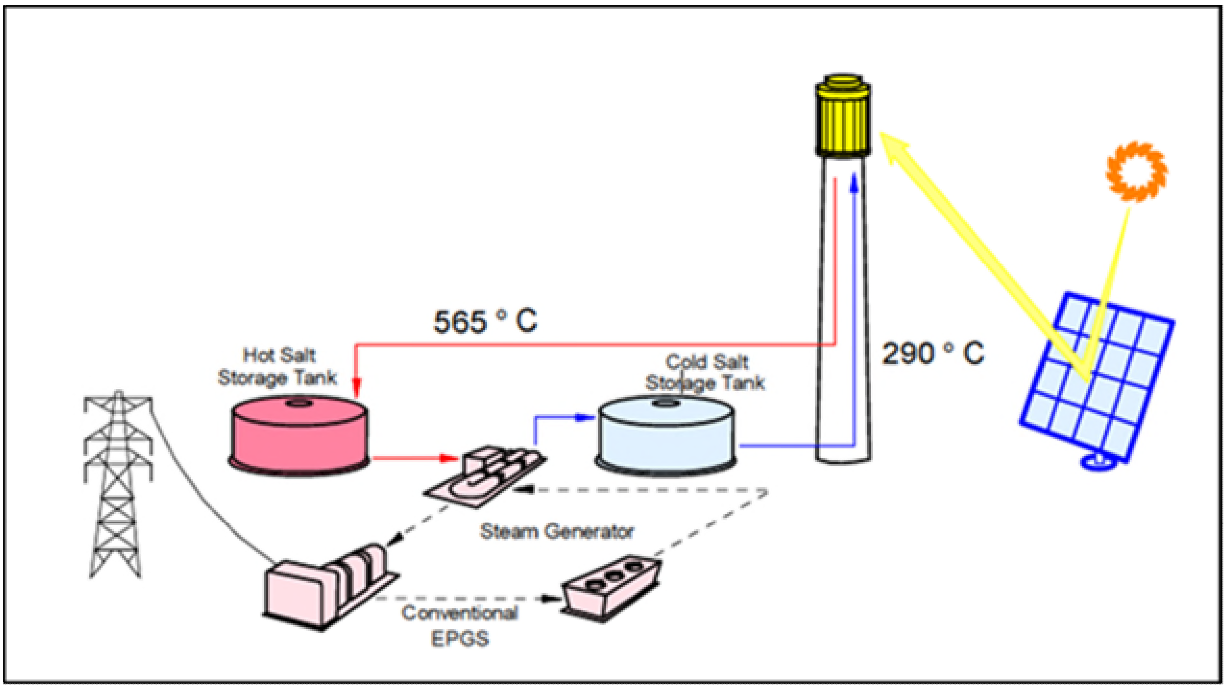

Figure 2.3 Illustration of the CSP system

In a typical installation, solar energy collection occurs at a rate that exceeds the maximum required to provide steam to the turbine. The thermal storage system can, therefore, be charged at the same time that the plant is producing power at full capacity. The ratio of the thermal power provided by the heliostat field and receiver to the peak thermal power required by the turbine generator is called the solar multiple. A power tower could potentially operate for 40% - 80% of the year (as from such storage, the system could provide energy, even in cloudy conditions or at night) without the need for a back-up fuel source. However, without energy storage, solar technologies are limited to annual capacity factors near 25% - 30%. Today, the most used solution is the usage of steam or molten salt storage vessels that store the energy to then be distributed when required. Determining the optimum storage size to meet power-dispatch requirements is an important part of the system design process. Storage vessels can be designed with sufficient capacity to power a turbine for up to 8 to 10 hours economically.

The final waste product from the entire plant will be a water treatment plant effluent (brine) that will be handled in a zero discharge method, i.e. the final effluent will be evaporated by means of an evaporation pond. A series of evaporation ponds will be constructed over an area of approximately 6 to 10 ha.

Figure 2.4: Photograph illustrating one of Abengoa Solar's CSP tower plants close to Upington in the Northern Cape, courtesy of Abengoa Solar S.A.

2.4.2 Description of the Associated Infrastructure

Associated infrastructure includes the power island with steam turbine generator, Heat exchangers and steam vessels, access roads, on-site substation, power line, water abstraction point and supply pipeline, lined earth reservoir and steel water storage tanks, packaged water treatment plant, lined evaporation ponds, salt storage vessels, auxiliary fossil fuel boilers and workshop and office buildings.

A summary of the details and dimensions of the planned infrastructure associated with the Project is provided in Table 2.2.

Table 2.2: Details or dimensions of typical structures required for the Paulputs CSP project

Infrastructure	Footprint and dimensions
Salt Tower	~10ha Up to 300m (maximum height)

Infrastructure	Footprint and dimensions
Heliostat field	up to 800 ha up to 10m pedestal
Power island and steam turbine and generator	6.5ha
Molten salt storage tanks	4 tanks each 40m diameter
Auxiliary boilers	10m x 10m
Water storage reservoir and tanks (combined capacity up to 15 000m^3) and associated infrastructure	Tanks 15m to 20m diameter
Substation	50m x 50m
132 kV power line	32 m wide servitude, up to 3km in length 25 - 35m high towers
Workshop building (maintenance) and office buildings	20m x 50m each
Packaged waste treatment plant	30m x 30m
Lined evaporation ponds	6 ha - 6 ponds at 1ha each
Mirror assembly facility	100m x 50m
Internal access roads	8m wide, 1.5km in length
Water abstraction point located at the Gariep River, plus filter station	20m x 30m
Water supply pipeline	~30km in length
Temporary laydown area and construction camp.	200m x 200m

2.5. Proposed Activities during the Project Development Stages

In order to construct the concentrated solar power project and its associated infrastructure, a series of activities will need to be undertaken during the design, pre-construction, construction, operation, and decommissioning phases which are discussed in more detail below.

2.5.1. Design and Pre-Construction Phase

Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to:

» Geotechnical survey - the geology and topography of the development footprint will be surveyed. The geotechnical study will focus on topographical constraints, foundation conditions, potential for excavations, and the availability of natural construction materials. The geotechnical examination will include surface and subsurface exploration, soil sampling and laboratory analysis.

» Site survey - will be done for the finalisation of the design layout of the heliostat field and the other associated infrastructure. The micro-siting footprint will consider environmental sensitivities identified during the EIA Phase investigations and will need to be confirmed in line with the Environmental Authorisation issued for the Project.

2.5.2. Construction Phase

Establishment of Access Roads to the Site

The site is traversed by the R357 (a secondary road to Onseepkans) branching off the N14. Within the site itself, access exists from this secondary road to the individual proposed Project components for construction purposes (and later limited access for maintenance). Access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top. The strength and durability properties of the rock strata at the proposed site are not known at this stage, this will need to be assessed via a geotechnical study. Depending on the results of these studies, it may be possible, in some areas, to strip off the existing vegetation and ground surface and level the exposed formation to form an access track surface.

There will be a 1.5 km internal tarred access road of approximately 8 m wide which will lead directly to the power island. Between the heliostats there will be a stabilised gravel track that would be used for maintenance purposes during the operational phase.

Undertake Site Preparation

Site preparation activities will include clearance of vegetation at the footprint of each component and the establishment of internal access roads. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

Transport of Components and Equipment to Site

The components for the proposed Project will be transported to site in sections by road. Some of the Project components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[8] by virtue of the dimensional limitations (i.e. length and weight). Components of various specialised construction and lifting equipment are required (e.g. for the tower construction) and will need to be transported to site. In addition to the specialised lifting equipment/cranes, the typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the establishment of the substation and power line.

The equipment will be transported to the site using appropriate National, Provincial and local roads, and then the dedicated access/haul road to the site itself. In some instances, the dimensional requirements of the loads to be transported during the construction phase (length/height) may require alterations to the existing road infrastructure (e.g. widening on corners), and protection of road-related structures (i.e. bridges, culverts, etc.) as a result of abnormal loading.

[8] A permit will be required for the transportation of these abnormal loads on public roads.

Establishment of Laydown and Assembly Areas on Site

Laydown and assembly (including the mirror assembly area) areas including storage areas of approximately 10ha will be required for the typical construction equipment which will be required on site. Hardstand areas will need to be established for operation of cranes used on the site.

Handling and storage of materials

The construction phase will require the handling and storage of materials including hydraulic oil, fuel, cement and fly ash (for use in concrete batching plant) with an estimated volume of 300-400 m^3 (cubic meters) at any one time (mainly made up of the batching material).

Construct Power Island and Substation

A steam turbine and generator will be housed in the power island. A generator transformer and a small substation will be established outside the building. The position of the power island and substation within the site footprint will be informed by the final positioning of the solar generating components.

The construction of the power island and substation would require a survey of the site, site clearing and levelling and construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Establishment of Ancillary Infrastructure

Ancillary infrastructure includes water abstraction point and supply pipeline, packaged waste treatment plant, a water treatment plant and water storage facilities on the site, and evaporation ponds (for wastewater from the generation process). A heliostat assembly plant, temporary storage area, control room, office area, chemical storage area, security gate building, contractor's temporary offices, and critical staff accommodation, will also be required.
The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction.

Water Usage Associated with the Paulputs CSP Project

A water treatment works will be required, as well as blow down brine handling. The water treatment works will include a primary treatment or basic sand filtration plant at the supply source, as well as a reverse osmosis and deionisation packaged water treatment plant at the site. A water supply pipeline will be established from the abstraction point on the Gariep River to the site. Abstracted water will be pumped to a holding reservoir for supply buffering. A second storage reservoir will be located on the CSP site itself..

Connect Substation and Power line to Power Grid

A 132 kV distribution line of up to 3km will cross the site and will connect to Eskom's existing Paulputs Transmission Substation, which lies within the Scuitklip farm portion.

Undertake Site Rehablitation

Once construction is completed and once all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the Project, any access points to the site which are not required during the operational phase must be closed and prepared for rehabilitation.

2.5.3. Operation Phase

The proposed CSP Project is expected to be operational for a minimum of 20 years with a typical design life of 35 years plus. The project will operate continuously, 7 days a week, mainly during daylight hours. While the project will be largely self-sufficient upon completion of construction, monitoring and periodic, as needed maintenance activities will be required. Key elements of the Operation and Maintenance plan include monitoring and control of all components, reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project.

The operation phase is discussed in more detail below. A simplified flow chart of the general operation of a CSP Plant showing inputs and outputs of the process is shown in the table below.

Table 2.3: Process Flow for a Solar Thermal Plant – Operational Phase Only

INPUT	PROCESS	OUTPUT
Solar energy	**Solar thermal energy generation process**	*Positive outputs:* Energy / electricity
Water		*Negative outputs:* Wastewater
Fossil fuel to start up		*Negative outputs:* Exhaust fumes / CO_2
Dosing chemicals for water treatment plant		*Negative outputs:* Waste water / brine stream to evaporation ponds

Water Usage Associated with the Paulputs CSP Project

A water treatment works will be required, as well as blow down brine handling. The water treatment works will include a primary treatment or basic sand filtration plant at the supply source, as well as a reverse osmosis and deionisation packaged water treatment plant at the site. A water supply pipeline will be established from the abstraction point on the Gariep River to the site. Abstracted water will be pumped to a holding reservoir for supply buffering. A second storage reservoir will be located on the identified site itself. The water use of the Project for the 200MW CSP Plant will include:

» Makeup water for the steam generator
» Water for mirror washing
» Service water
» Potable water
» Fire protection water

Table 2.4: Estimated water consumption for a 200MW CSP Plant

Description: consumption	Approximate annual use (m^3/year)
Raw water consumption	Up to 400 000
Description: water uses	**Approximate annual use (m^3/year)**
Mirror washing	75 000
Boiler makeup	80 000
Potable and other	10 000
Evaporation losses	85 000
Wastewater to evaporation ponds	Up to 150 000

In order to reduce the overall water consumption and the requisite sizing of the evaporation ponds, service water will first be used as makeup. Water conditioning chemicals may be fed into the makeup water to minimise corrosion and to inhibit mineral scale formation. The blow down from the circulating water will be continually treated by lime-softening clarification and filtration processes and then delivered to a clear well where the water will be treated by reverse osmosis prior to being used for other plant requirements. Prior to the reverse osmosis process, ion-exchange softeners will be used to remove any dissolved hardness minerals that remain after the clarifier. The discard brine stream will be delivered to the evaporation ponds

Handling and storage of materials
The operation phase will require the handling and storage of materials such as sodium hydroxide, hydrochloric acid, sulphuric acid, ferric chloride, lubrication oil, amine, phosphate, carbohydrazide, closed corrosion inhibitor with an approximate total of 150m^3 (cubic meters) at any one time, fuel for the auxiliary steam boiler with an estimated total of 50m^3 (cubic meters) at any one time.

2.5.4. Decommissioning Phase

The CSP Project is expected to have a design lifespan of approximately 35 years (extendable with appropriate refurbishment), and the power plant infrastructure would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the Project discussed in this

EIA would comprise the disassembly and replacement of the individual components with more appropriate technology/infrastructure available at that time.

The following decommissioning activities will form part of the project scope.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment (e.g. lay down areas, construction platform) and the mobilisation of decommissioning equipment.

Disassemble and Replace Existing Components

When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will be, and the surface restored to the original contours. Much of the above ground wire and steel, of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated and can be returned to the agricultural or other beneficial land-use.

Future plans for the site and infrastructure after decommissioning

The plant will have the opportunity to generate power for a Merchant Market operation (i.e. the client would sell power on bid basis to the market). If the site is decommissioned the planned end use for the property is low intensity agriculture.

REGULATORY AND PLANNING CONTEXT CHAPTER 3

3.1. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and is informed by on-going strategic planning undertaken principally by the Department of Energy (DoE), who in turn are supported by many other organs of government. The hierarchy of policy and planning documentation that support the development of renewable energy projects such as the Paulputs CSP Project is illustrated in **Figure 3.1**.

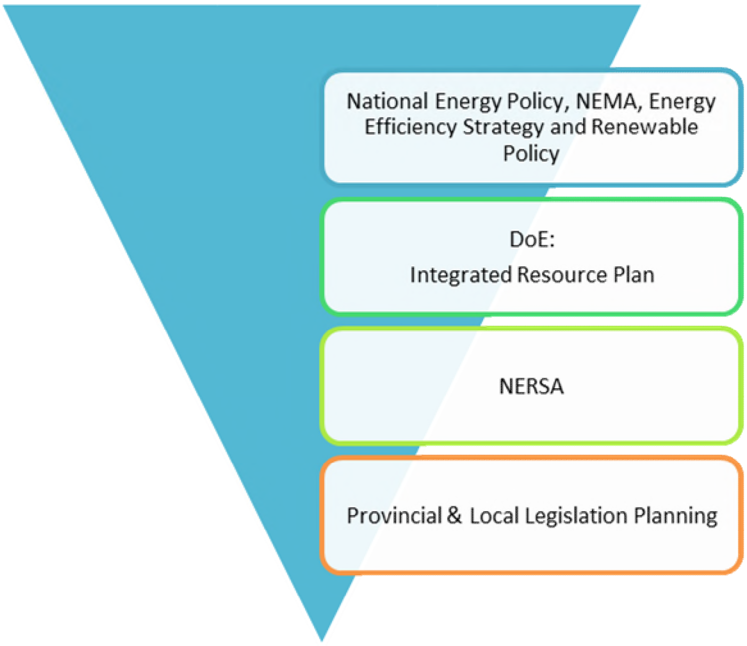

Figure 3.1: Hierarchy of electricity policy and planning documents

The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and local levels.

At **National Level**, the main regulatory agencies are:

» *Department of Energy (DoE)*: This Department is responsible for policy relating to all energy forms, including renewable energy, and is responsible for forming and approving the IRP (Integrated Resource Plan for Electricity).

» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for renewable energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* SAHRA is a statutory organisation established under the National Heritage Resources Act, No 25 of 1999, as the national administrative body responsible for the protection of South Africa's cultural heritage.
» *Department of Transport – South African Civil Aviation Authority (SACAA):* This department is responsible for aircraft movements and radar, which are aspects that influence solar thermal energy development location and planning.
» *South African National Roads Agency Limited (SANRAL):* This Agency is responsible for the regulation and maintenance of all national routes.
» *Department of Water and Sanitation:* This Department is responsible for water resource protection, water use licensing and permits.
» *The Department of Agriculture, Forestry and Fisheries (DAFF):* This Department is the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector. This Department is also responsible for the issuing of permits for impacts on protected tree species.
» *The Department of Science and Technology:* This department is the administrating authority for the Astronomy Geographical Advantage Act (Act 21 of 2007).

At **Provincial Level**, the main regulatory agencies are:

» *Provincial Government of the Northern Cape – Department of Environment and Nature Conservation (Northern Cape DENC).* This department is the commenting authority for the EIA process for this project, as well as being responsible for issuing of other biodiversity and conservation-related permits.
» *Department of Transport and Public Works - Northern Cape.* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Northern Cape Department of Agriculture and Rural Development:* This is the provincial authority responsible for matters affecting agricultural land.
» *Ngwao Boswa ya Kapa Bokone (Northern Cape Heritage Authority):* This body is responsible for commenting on heritage related issues in the Northern Cape Province.

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape, the Khai Ma Local Municipality and the Namakwa District Municipality play a role.

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

3.2. National Policy and Planning

Further to the South African government's commitment in August 2011 to support the development of renewable energy capacity, the Department of Energy ("DoE") initiated the Renewable Energy Independent Power Producer Procurement Program ("REIPPPP") to procure renewable energy from the private sector in a series of rounds. To date, the DoE has procured more than 6 000MW of renewable energy capacity from 92 independent producers, with 37 having started commercial operation, adding 1 860MW to the grid

3.2.1 The Kyoto Protocol, 1997

Currently Africa's electricity is mainly generated from coal-based technologies. South Africa accounts for ~38 % of Africa's CO_2 (a greenhouse gas contributing to climate change) from burning of fossil fuels and industrial processes. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. South Africa ratified the Kyoto Protocol in 2002. The Kyoto Protocol requires developing countries to reduce its greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. Therefore certain guidelines and policies (discussed further in the sections below) were put in place for the Government's plans to reduce greenhouse gas emissions. The development of renewable energy projects (such as the proposed Paulputs CSP Project) is therefore in line with South Africa's international obligations in terms of the Kyoto Protocol. A second commitment period commenced from 1 January 2013, and extends to 31 December 2020.

3.2.2 United Nations Framework Convention on Climate Change and COP21 – Paris Agreement

Climate change is one of the major global challenges of the 21st century that require global response. The adverse impacts of climate change include persistent drought and extreme weather events, rising sea levels, coastal erosion and ocean acidification, further threatening food security, water, energy and health, and more broadly efforts to eradicate poverty and achieving sustainable development. Combating climate change would require substantial and sustained reductions in greenhouse gas emissions (GHGs), which, together with adaptation, can limit climate change risks. The convention responsible for dealing with climate change is called United Nations Framework Convention on Climate Change (UNFCCC).

The UNFCCC was adopted in 1992 and entered into force in 1994. It provides the overall global policy framework for addressing the climate change issue and marks the first international political response to climate change. The UNFCCC sets out a framework for action aimed at stabilizing atmospheric concentrations of greenhouse gases to avoid dangerous anthropogenic interference with the climate system.

The Convention has established a variety of arrangements to govern, coordinate and provide for oversight of the arrangements described in this document. The oversight bodies take decisions, provide regular guidance, and keep the arrangements under regular review in order to enhance and ensure their effectiveness and efficiency. The Conference of Parties (COP), established by Article 7 of the Convention, is the supreme body and highest decision-making organ of the Convention. It reviews the implementation of the Convention and any related legal instruments, and takes decisions to promote the effective implementation of the Convention.

COP 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. This Agreement shall be open for signature and subject to ratification, acceptance or approval by States and regional economic integration organizations that are Parties to the Convention from 22 April 2016 to 21 April 2017. Thereafter, this Agreement shall be open for accession from the day following the date on which it is closed for signature. The agreement can only enter into force once it has been ratified by 55 countries, representing at least 55% of emissions.

This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;
(c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

In order to achieve the long-term temperature goal set out in Article 2 of the Agreement, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

In working towards this goal, advanced economies have already included renewables in their energy mix and have planned to increase their use in order to meet their mitigation goals: Japan aims to derive 22-24% of its electricity production from renewable sources by 2030 and the European Union plans for them to reach 27% of its final energy consumption. Developing countries are also playing their part, including South Africa which has included a goal of 17,8GW of renewables by 2030 within the IRP.

South Africa supports the adoption of the Paris Agreement and will be required to communicate a nationally determined contribution to the global response to climate change every five years from 2020. Therefore the Paris Agreement supports the advancement of renewable energy sources such as the proposed CSP Project.

3.2.3. White Paper on the Energy Policy of the Republic of South Africa, 1998

The White Paper on Renewable Energy Policy supplements the Government's overarching policy on energy as set out in its White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The White Paper on Renewable Energy Policy recognises the significance of the medium and long-term potential of renewable energy. The main aim of the policy is to create the conditions for the development and commercial implementation of renewable technologies. The position of the White Paper on Renewable Energy is based on the integrated resource planning criterion of:

> *"Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options."*

The White Paper on Renewable Energy sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. South Africa relies heavily on coal to meet its energy needs because it is well-endowed with coal resources in particular. However South Africa is endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, but which have so far remained largely untapped. This White Paper fosters the uptake of renewable energy in the economy and has a number of objectives that include:

- ensuring that equitable resources are invested in renewable technologies;
- directing public resources for implementation of renewable energy technologies;
- introducing suitable fiscal incentives for renewable energy and;
- creating an investment climate for the development of renewable energy sector.

The objectives of the White Paper are considered in six focal areas, namely: financial instruments, legal instruments, technology development, awareness raising, capacity building and education, and market based instruments and regulatory instruments. The policy supports the investment in renewable energy facilities as they contribute towards ensuring energy security through the diversification of energy supply, reducing GHG emissions and the promotion of renewable energy sources.

The White Paper set a target of 10 000GWh to be generated from renewable energy by 2013.

3.2.4. The National Energy Act (2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar thermal energy:

"*To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (…); to provide for (…) increased generation and consumption of renewable energies…*(Preamble)."

The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The Act provides the legal framework which supports the development of renewable energy facilities for the greater environmental and social good.

3.2.5. Renewable Energy Policy in South Africa

Internationally there is increasing development of the use of renewable technologies for the generation of electricity due to concerns such as climate change and exploitation of resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed Paulputs CSP Project, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with meeting the following challenges:

» Ensuring that economically feasible technologies and applications are implemented;

» Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
» Addressing constraints on the development of the renewable industry.

3.2.6 National Development Plan

The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030. The NDP identifies 9 key challenges and associated remedial plans. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

The Paulputs CSP Project will support many of the objectives of the National Development Plan (NDP). Some of these objectives are:
» Create 11 million jobs by 2030; and
» Procuring about 20 000MW of renewable electricity by 2030.

Infrastructure is a key priority of the NDP, which identifies the need for South Africa to invest in a strong network of economic infrastructure to support the country's medium- and long-term economic and social objectives. The NDP has been approved and adopted by government and has received strong endorsement from broader society. The plan sets out steps that aim to ensure that, in 20 years, South Africa's energy system looks very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar and imported hydroelectricity – will play a much larger role.

3.2.7. Integrated Energy Plan (IEP)

The development of a national Integrated Energy Plan (IEP) was envisaged in the White Paper on Energy Policy of 1998 and the Minister of Energy, as entrenched in the National Energy Act of 2008, is mandated to develop and publish the IEP on an annual basis. The IEP takes existing policy into consideration and provides a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development.

The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include:

- » To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector.
- » To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels).
- » To guide investment in and the development of energy infrastructure in South Africa.
- » To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

Eight key objectives for energy planning were identified:

- » Objective 1: Ensure the security of supply
- » Objective 2: Minimise the cost of energy
- » Objective 3: Increase access to energy
- » Objective 4: Diversify supply sources and primary sources of energy
- » Objective 5: Minimise emissions from the energy sector
- » Objective 6: Promote energy efficiency in the economy
- » Objective 7: Promote localisation and technology transfer and the creation of jobs
- » Objective 8: Promote the conservation of water

The IEP recognises the potential of renewable energy for power generation.

3.2.8. Final Integrated Resource Plan 2010 - 2030

The Integrated Resource Plan (IRP) 2010-30 was promulgated in March 2011. The primary objective of the IRP 2010 is to determine the long term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. However, the IRP 2010 also serves as input to other planning functions, *inter alia* economic development, and funding, environmental and social policy formulation. The accuracy of the IRP 2010 is to be improved by regular reviews and updates. The IRP 2010 projected that an additional capacity of up to 56 539MW of generation capacity will be required to support the country's economic development and ensure adequate reserves over the next 20 years. The required expansion is more than two times the size of the existing capacity of the system.

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation. In addition to all existing and committed power plants, the RBS included a nuclear fleet of 9.6 GW; 6.3 GW of coal; 17.8 GW of renewables (including wind and solar); and 8.9 GW of other generation sources. This means that 75% of new generation capacity by 2030 will be derived from energy sources other than coal.

3.2.9 Strategic Integrated Projects

The South African Government adopted a National Infrastructure Plan in 2012 with the objective that government aims to transform South Africa's economic landscape whilst simultaneously creating significant numbers of new jobs, and strengthening the delivery of basic services. The plan also supports the integration of African economies. Socio-economic issues identified within the National Development Plan were placed under 18 different Strategic Integrated Projects (SIPs) to address the spatial imbalances of the past by addressing the needs of the poorer provinces and enabling socio-economic development. The SIPs cover social and economic infrastructure across all nine provinces (with an emphasis on lagging regions). The SIPs include catalytic projects that can fast-track development and growth.

Amongst these is SIP 8 - *Green energy in support of the South African economy).* This SIP aims at supporting sustainable green energy initiatives on national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP, 2010). The proposed Paulputs CSP Project falls within the ambit of this SIP.

3.3. Provincial and Local Level Developmental Policy

3.3.1. Northern Cape Provincial Growth and Development Strategy

The Northern Cape Provincial Growth and Development Strategy (PGDS) sets the tone for development planning and outlines the strategic planning direction in the province. Planning for the promotion of economic growth and social development lies at the core of the Government's responsibility to provide a better life for the nation. It is essential to ensure that planning is integrated across disciplines, coordinated within and between different planning jurisdictions and aligned with the budgeting processes of national, provincial and local government. The core purpose of the Northern Cape PGDS is to enable stakeholders from public and private sectors, together with labour and civil society, to determine a plan for sustainable growth and development of the Northern Cape. The main objectives set by the Northern Cape PGDS for development planning in the province are as follows:

- » Promoting growth, diversification and transformation of the provincial economy
- » Poverty reduction through social development
- » Developing requisite levels of human and social capital
- » Improving the efficiency and effectiveness of governance and other development institutions
- » Enhancing infrastructure for economic growth and social development

The Northern Cape PGDS aims at building a prosperous, sustainable, growing provincial economy to eradicate poverty and improve social development. The proposed solar energy facility will contribute to growth and development of the province by expanding the economic base, diversifying the economy and creating employment opportunities, which will contribute towards reducing poverty.

3.3.2. Northern Cape Provincial Local Economic Development (LED) Strategy (2009)

The Northern Cape Local Economic Development (LED) strategy is intended to build a shared understanding of LED in the province and put into context the role of local economies in the provincial economy. It seeks to mobilise local people and local resources in an effort to fight poverty. The Northern Cape LED strategy investigated the options and opportunities available to broaden the local economic base of the province in order to promote the creation of employment opportunities and the resultant spin-off effects throughout the local economy. Areas of opportunity include:

- » Livestock products
- » Game farming
- » Horticulture
- » Agriculture
- » Ago-related industries
- » Tourism
- » Manganese and iron Ore
- » Beneficiation of minerals
- » Renewable energy

The purpose of the LED is to build up the economic capacity of a local area to improve its economic future and quality of life for all. The LED provides local municipalities with leadership and direction in policy making, in order to administer policy, programmes and projects, and to be the main initiator of economic development programmes through public spending. It is noted in the LED that renewable energy is an area of opportunity to broaden the local economic base and promote the creation of employment opportunities as well as local economy spin-off effects.

3.3.3. *Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (PSDF) (2012)*

The PSDF not only gives effect to national spatial development priorities but it also sets out a series of provincial, district and local development priorities for the space economy of the Northern Cape.

The Northern Cape PSDF is premised upon and gives effect to the following five strategic objectives of the National Strategy for Sustainable Development (NSSD 2011-2014):

» Enhancing systems for integrated planning and implementation
» Sustaining our ecosystems and using natural resources efficiently
» Towards green economy
» Building sustainable communities
» Responding effectively to climate change

The PSDF makes reference to the need to ensure the availability of energy. Under the economic development profile of the Northern Cape PSDF, the White Paper on Renewable Energy Policy (2003) discussed a target of 10 000GWh of energy to be produced from renewable energy sources. It was also stated that the total area of high radiation in South Africa amounts to approximately 194 000km^2, of which the majority falls within the Northern Cape. It is estimated that, if the electricity production per km^2 of mirror surface in solar thermal power stations were 30.2MW and only 1% of the area of high radiation were available for solar generation, then generation potential would equate to approximately 64GW. A mere 1.25% of the area of high radiation could therefore meet projected South African electricity demand in 2025 (80GW). It was also stated in the Northern Cape PSDF that the implementation of large Concentrating Solar Power (CSP) plants has been proposed as one of the main contributors to reducing greenhouse gas emission in South Africa. One of the policies in the NC PSDF is for renewable energy sources to comprise 25% of the Province's energy capacity by 2020. Therefore the proposed development will assist in contributing to the Province's renewable energy target.

3.4. District and Local Authority Level Developmental Policy

These strategic policies at the district and local level have similar objectives for the respective areas, namely to accelerate economic growth, create jobs, uplift communities and alleviate poverty. The proposed development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

3.4.1 Namakwa District Municipality Integrated Development Plan (IDP)

The vision for the Namakwa DM as set out in the Namakwa District Municipality (NDM) Integrated Development Plan (IDP) (2012-2016) is for the "The establishment of a development-orientated and economically viable district through sustainable growth".

In order to comply with the vision, the mission statement concentrates on certain key focus areas, namely: Promotion of the quality of life of the Namakwa community through purposeful and quality service, and the effective and optimal utilisation of resources, focussing especially on:

- Economic development;
- Development, upgrading and maintenance of basic infrastructure;
- Development of human resources;
- Sustainable management and optimal utilisation of operational and natural resources;
- Creating of a safe, healthy and investment-friendly environment;
- Development of opportunities for local entrepreneurs; and
- Ensuring friendly, credible and transparent services and client satisfaction.

The NDM IDP also identifies a number of key performance areas (KPA). The KPA that is relevant to the proposed project is KPA 3: Local Economic Development. A number of projects are listed under the Local Economic Development KPA of these the following are of specific relevance to the project:

- Project No. LE02: Renewable Energy Cluster: The Development of a synergy between the energy resources within Namakwa Region.
- Project No. LE05: SMME Development Cluster: The development of a Management support system for SMME'S.

The objective of Project No: LEO2 is to ensure the participation of the NDM in the development of a synergy between wind energy, natural gas, solar, bio-fuel and wave energy so that the energy sector can enhance competitive and comparative advantage of the Namakwa region. The performance indicators listed in the IDP include the facilitation of quarterly Local Economic Development Forum (LED) Forum meetings with stakeholders/future partners in solar, wave and natural gas (Forest International) in order to exchange information. The key outputs of the project listed in the IDP include:

» Establishment of renewable energy resources like natural gas, wind, bio-fuel, waves, solar, hydro and waste recycling in the key municipalities and the NDM as whole.

The proposed Paulputs CSP Project is therefore supported by and supports the energy related objectives set out in the NDM IDP.

3.4.2. Namakwa District Municipality Environmental Management Framework (EMF) and Strategic Environmental Management Plan (SEMP) (2011)

The Namakwa District Municipality Environmental Management Framework (EMF) and Strategic Environmental Management Plan (SEMP) was developed in order to provide a high level plan for sustainable development.. The management framework acknowledges the need for social and economic development and provides strategic issues which should be addressed to take advantage of environmental goods and services. The EMF and SEMP do not prohibit development. The focus of the EMF is to restrict development in zones with the greatest sensitivity and allow development in the zones of low sensitivity. The report makes reference to the fact that large portions of land need to be cleared for energy generation projects. The need for sustainable energy is acknowledged in the EMF and it is recommended that energy generation projects be limited to Environmental Management Zone (EMZ) D (medium sensitivity area) – G (very low to not applicable sensitivity) area.

3.4.2 Khai Ma Integrated Development Plan (IDP)

The vision set out in the Khai Ma Local Municipality IDP 2012-2017 is "Creating an economically viable and fully developed municipality, which enhances the standard of living of all the inhabitants / community of Khai Ma through good governance, excellent service delivery and sustainable development." The vision of the LM is "Improved and sustainable standard of living for all". Linked to the Vision is the Mission statement, which is the "Provision of transparent, accountable and sustainable service delivery." The IDP identifies a number of Key Performance Areas (KPAs). The KPAs that are relevant to the proposed project include:

» KPA 1: Service Delivery and Infrastructure Development
» KPA 2: Local Economic Development

The priority issues identified in the IDP that are relevant to the project and are linked to the KPAs include:
» Lack of Basic Services
» Poverty and Unemployment

» Lack of sport and recreational facilities and services
» Lack of sufficient and proper health services

The renewable energy sector is also recognised as a key sector. The IDP notes that a number of new opportunities have opened up for LM area since the need to facilitate the generation of sustainable energy was introduced in South Africa by Eskom and the South African government. The IDP notes that there are a number of solar projects proposed in the area and that the economic benefits from these projects are eagerly anticipated.

3.5. Legislation and Guidelines

The following legislation and guidelines have informed the scope and content of this Environmental Impact Assessment Report:

» National Environmental Management Act (Act No. 107 of 1998)
» EIA Regulations, published under Chapter 5 of NEMA (GNR R982 in Government Gazette No 38282 of December 2014)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Public Participation in the EIA Process (DEA, 2010)
  * Integrated Environmental Management Information Series (published by DEA);
» Namakwa District Municipality Integrated Development Plan (IDP) (2012-2016);
» Khai Ma Local Municipality Integrated Development Plan (2012-2017);
» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Guidelines;

Several other Acts, standards or guidelines have also informed the project process and the scope of issues evaluated in the EIA report, and addressed in the EIA. A listing of relevant legislation identified is provided in Table 3.1.

Table 3.1: Relevant legislative permitting requirements applicable to the Paulputs CSP Project

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. In terms of NEMA: EIA Regulations 2014, a scoping and EIA process was required to be undertaken for the proposed project.	» National Department of Environmental Affairs » Department of Environmental and Nature Conservation (DENC) – commenting authority	The listed activities triggered by the proposed Project has been identified and assessed in the EIA process being undertaken. This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.		
National Environmental Management: Waste Act (Act No 59 of 2008)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 912 of November 2013), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is	DEA (hazardous waste) Provincial Department of Environmental Affairs (general waste)	As no waste disposal site is to be associated with the project. In terms of GNR921, no permit is required for this project. Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in this EMPr (refer to Appendix K).

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		
National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under general authorisation in terms of S39 and GN 1191 of GG 20526 October 1999. In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water and Sanitation (DWS)	A Water Use Licence (WUL) is required as water for the project will be sourced from the Gariep River. Other water uses relate to the storage of wastewater and impacts on ephemeral drainage lines on the site. Application for a WUL will be made with the DWS in terms of Section 21 of the Act.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	» A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a	Department of Mineral Resources (DMR)	Should material not be sourced from a commercial source and a borrow pit(s) be considered necessary, the

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	borrow pit) in accordance with the provisions of the Act.		Contractor shall source and apply for the relevant permit from the DMR.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	S18, S19, and S20 of the Act allow certain areas to be declared and managed as "priority areas." Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. GN R 827 – National Dust Control Regulations prescribes general measures for the control of dust in all areas	DEA Khai-Ma Local Municipality	No permitting or licensing requirements arise from this legislation. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act. The air quality officer may require a dust monitoring programme as per the Regulations for dust control. The draft EMPr however makes provision for managing and mitigating potential dust impacts (Refer to Appendix O).
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which	South African Heritage Resources Agency (SAHRA) Northern Cape Heritage Resources Authority	A Heritage and Paleontological Impact Assessment (HIA) was undertaken as part of the EIA Process to identify heritage sites. The overall area is considered as having a low archaeological significance. The relevant mitigation measures are included in the EMPr

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	will change the character of a site exceeding 5 000 m^2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		(refer to appendix K).
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» In terms of Section 57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected	National Department of Environmental Affairs DENC	As the applicant will not carry out any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. » In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA Phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA Phase. » The Act provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to		regard. A Specialist Ecological Assessment was undertaken as part of the Environmental Impact Assessment process (refer to Appendix D). As such the potential occurrence of critically endangered, endangered, vulnerable, and protected species, as well as critically endangered (CR), endangered (EN), vulnerable (VU) or protected ecosystems and species and the potential for them to be affected has been considered.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (GG 34809, GN 1002), 9 December 2011).		
National Veld and Forest Fire Act (Act 101 of 1998)	» In terms of S12 the landowner would be required to burn firebreaks to ensure that should a veldfire occur on the property, that it does not spread to adjoining land. » In terms of S13 the landowner must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. » In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the project The relevant management and mitigation measures has been included in the EMPr.
Conservation of Agricultural Resources Act (CARA) (Act No 43 of	» Prohibition of the spreading of weeds (S5). » Classification of categories of weeds &	Department of Agriculture, Forestry and Fisheries (DAFF)	An Ecology study was undertaken (refer to Appendix D). The relevant mitigations measures for the

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
1983)	invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).		management of alien and invasive species were identified and are included in the EMPr (Appendix K).
National Forests Act (Act No 84 of 1998)	» In terms of S5 (1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated". » The list of protected tree species was published in GN 877 of 22 November 2013.	» Department of Agriculture, Forestry and Fisheries (DAFF) » NC DENC	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. No Protected tree species or indigenous tree species were identified on site.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure.	Civil Aviation Authority (CAA)	While no permitting or licence requirements arise from the legislation, this act will find application during the operational phase of the project. Appropriate marking is required to meet the

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft. Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities.		specifications as detailed in the CAR Part 139.01.33.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping	Department of Health Khai-Ma Local Municipality	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation / Policy / Guideline	**Applicable Requirements**	**Relevant Authority**	**Compliance requirements**
	of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed.	Provincial Department of Transport (provincial roads) South African National Roads Agency Limited (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts. The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		(length) of 22m. » Depending on the trailer configuration and height when loaded, some of the components may not meet specified dimensional limitations (height and width).
Astronomy Geographic Advantage Act (Act 21 of 2007)	» The Astronomy Geographic Advantage Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto.	Department of Science and Technology	The study area falls outside the Sutherland Central Astronomy Advantage Area gazetted in GN R140 of 28 February 2015, the 75km circular buffer centred on the SALT. The study area falls nearest SKA station has been identified as SKA ID 1896, at approximately 107 km from the proposed installation therefore Paulputs CSP Project poses

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» Chapter 2 of the act allows for the declaration of astronomy advantage areas while Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following: » Restrictions on use of radio frequency spectrum in astronomy advantage areas; » Declared activities in core or central astronomy advantage area; » Identified activities in coordinated astronomy advantage area; and » Authorisation to undertake identified activities. In terms of section 7(1) and 7(2) of this Act, the Minister declared core astronomy advantage areas on 20 August 2010 under Regulation No. 723 of Government Notice No. 33462. In this regard, all land within a 3 kilometres radius of the centre of the Southern African large Telescope dome falls under the Sutherland Core Astronomy Advantage Area. The declaration also applies to the core astronomy advantage area containing		a very low risk of detrimental impact on the SKA

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	the MeerKAT radio telescope and the core of the planned Square Kilometre Array (SKA) radio telescope. The study area does not fall within the 3 km radius of SALT or within an area which could affect the MeerKAT and SKA developments. » Under Section 22(1) of the Act the Minister has the authority to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. As such, the Minister may still under section 23(1) of the Act, declare that no person may undertake certain activities within a core or central astronomy advantage area. These activities include the construction, expansion or operation of any fixed radio frequency interference source, facilities for the generation, transmission or distribution of electricity, or any activity capable of causing radio frequency interference or which may detrimentally influence the astronomy and scientific endeavour.		
Provincial Legislation/ Policies / Plans			
Northern Cape Nature	» Provides inter alia for the sustainable	» NC DENC	A permit is required for any activities

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Conservation Act (Act No. 9 of 2009)	utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require. **Manipulation of boundary fences** 19. No Person may – (a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom; The Act also lists protected fauna and flora under 3 schedules ranging from Specially protected (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are		which involve species listed under schedule 1 or 2. The NC DENC permit offices provide an integrated permit which can be used for all provincial and Threatened or Protected Species (TOPS)-(flora and fauna) related permit requirements. If Provincially protected plant species are found within the study area during the site walkthrough, a permit would be applied for, for the removal or relocation of such species.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	listed under Schedule 2, except for listed species which are under Schedule 1.		
Local Legislation / Policies / Plans			
Khai-Ma Local Municipality Integrated Development Plan (IDP)	» The IDP notes that the Khai Ma LM is primarily an agricultural community. Conservation of the environment and sustainable development are identified as primary points of departure in policy. » The main socio-economic developmental issues are identified as lack of basic services , poverty and unemployment, lack of sport and recreational facilities and services and lack of sufficient and proper health services	Khai-Ma Local Municipality	New developments in the municipality to be in line with the IDP.
Standards			
Noise Standards	Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noise from a Wind Energy Facility. They are: » SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'. » SANS 10210:2004. 'Calculating and predicting road traffic noise'. » SANS 10328:2008. 'Methods for environmental noise impact	Local Municipality	The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not necessarily render an activity unlawful per se.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	assessments'. » SANS 10357:2004. 'The calculation of sound propagation by the Concave method'. The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes.		

APPROACH TO UNDERTAKING THE SCOPING PHASE CHAPTER 4

An Environmental Impact Assessment (EIA) process refers to that process (dictated by the EIA Regulations) which involves the identification of and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project. The EIA process comprises two main phases: i.e. **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an Environmental Management Programme (EMPr)) to the competent authority for decision-making. The EIA process is illustrated below:

Figure 4.1: The Phases of an EIA Process

The EIA process for the proposed Paulputs CSP Project is being undertaken in accordance with sections 24(5) of NEMA (No 107 of 1998). In terms of the EIA Regulations (2014) of GN R982 - GN R985, a Scoping and EIA Study are required to be undertaken for this proposed project. The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

4.1. Relevant Listed Activities

Listing Notices 1, 2 and 3 under the EIA Regulations, 2014 (GN R983, GN R984 and GN R985) identify activities that would require environmental authorisation prior to commencement of such activities. The following 'listed activities' are triggered by the proposed Paulputs CSP Project:

Table 4.1: Listed activities triggered by the proposed Paulputs CSP project

Listed Activity	Relevant aspects of the project
GN983, activity 9 (i) The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water – (i) With an internal diameter of 0.36 metres or more	The proposed development will include the construction of a water supply pipeline to the facility from the Gariep River, approximately 30km in length.
GN983, activity 11 (i) The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts	The proposed facility will be required to evacuate electricity into the national grid and include the construction of an on-site substation and a 132 kV power line to Eskom's existing Paulputs Substation.
GN983, activity 12 (xii) (a) (c) The development of (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	Heliostats, access road, water supply pipeline,abstraction point and other infrastructure exceeding 100 m² will be required to be constructed within or within 32m of watercourse features.
GN983, activity 13 The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.	Ancillary infrastructure includes water storage reservoir/s (for clean water storage) and evaporation ponds, (wastewater from the generation process and water treatment plant) on the site. The combined capacity of these exceeds 50 000 m^3.
GN983, activity 19 (i) The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse.	Construction activities associated with the access road, water supply pipeline, other infrastructure and abstraction point will require the infilling or excavation, removal or moving of any material into or from a watercourse.
GN983, activity 24(ii) The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres	Access and internal roads of ~8m in width are required to be constructed in order to access the project site and power block from the public road.

Listed Activity	Relevant aspects of the project
GN 983, activity 28 (ii) Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;	The Paulputs CSP Project will be constructed over an area of 900ha.
GN984, activity 1 The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.	The Paulputs CSP Project will consist of heliostats and a molten salt tower system with a contracted capacity of 200MW.
GN984, activity 6 The development of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.	Abstraction of water from the Gariep River and storage of wastewater within evaporation ponds require a Water Use License.
GN984, activity 15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	An area of 2- ha or more of indigenous vegetation will need to be cleared
GN985, activity 2 (a) (iii) (bb) and (dd) The development of reservoirs for bulk water supply with a capacity of more than 250 cubic metres (a) In the Northern Cape (ii) outside urban areas (bb) in sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority (dd) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or	Ancillary infrastructure includes water storage reservoir/s on the site will be in a sensitive area (Ecological Support Area) as identified in the Environmental Management Framework (EMF) for the Namakwa District Municipality and the Namakwa District Biodiversity Sector Plan (Critical Biodiversity Area) (which is in the process of being gazetted)

Listed Activity	Relevant aspects of the project
in bioregional plans;	
GN985, activity 4 (a) (ii) (cc) and (ee) The development of a road wider than 4 metres with a reserve less than 13,5 metres. (a) in the Northern Cape (ii) Outside urban areas (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority. (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	A road wider than 4 m will need to be constructed in a sensitive area (Ecological Support Area) as identified in the Environmental Management Framework (EMF) for the Namakwa District Municipality and the Namakwa District Biodiversity Sector Plan (Critical Biodiversity Area) (which is in the process of being gazetted)
GN 985 Item 10 (a) (ii) (cc) and (ee): The development of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (a) in the Northern Cape, (ii) outside urban areas in (cc) sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority. (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	Fuel and dangerous good with a combined capacity of 30m^3 but not exceeding 80 m^3 will be stored on-site in a sensitive area (Ecological Support Area) as identified in the Environmental Management Framework (EMF) for the Namakwa District Municipality and the Namakwa District Biodiversity Sector Plan (Critical Biodiversity Area) (which is in the process of being gazetted)
GN 985, activity 14 (a) (xii) (dd) and (ff) The development of (xii) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32m measured from the edge of the watercourse; in a) Northern Cape (ii) Outside urban areas, in (dd) sensitive areas as identified in an	Infrastructure covering an area greater than 10 m^2 which occur within 32 m of a drainage line or a watercourse will be required to be built in an ecosystem service area (Ecological Support Area) as identified in the Environmental Management Framework (EMF) for the Namakwa District Municipality and the Namakwa District Biodiversity Sector Plan (Critical Biodiversity Area) (which is in the process of being gazetted)

Listed Activity	Relevant aspects of the project
environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adapted by the competent authority or in bioregional plans.	
GN 985, 18 (a) (ii) (cc) and (ee) The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. (a) In the Northern Cape (ii) Outside urban areas, in: (cc) sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre in a sensitive area (Ecological Support Area) as identified in the Environmental Management Framework (EMF) for the Namakwa District Municipality and the Namakwa District Biodiversity Sector Plan (Critical Biodiversity Area) (which is in the process of being gazetted)

On the basis of the above listed activities, a Scoping and an EIA Phase is required to be undertaken for the proposed project. This process is to be undertaken in two phases as follows:

- The Scoping Phase includes the identification of potential issues associated with the proposed project through a desktop study and consultation with affected parties and key stakeholders. Areas of sensitivity within the broader site are identified and delineated in order to identify any environmental fatal flaws, and sensitive or no go areas. Following a public review period of the report, this phase culminates in the submission of a Scoping Report and Plan of Study for EIA to the DEA.
- The EIA Phase involves a detailed assessment of potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase includes detailed specialist investigations and public consultation. Following a public review period of the report, this phase culminates in the submission of a final EIA Report and an Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to DEA for review and decision-making.

4.2. Scoping Phase

A Scoping Report was released for public review from 13 November 2015 – 14 December 2015 for a 30-day comment period. Following the review period, a final scoping report was submitted to DEA in January 2016. This together with the Plan of Study for the EIA was accepted by the DEA, as the competent authority, in February 216. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

The Scoping Study provided interested and affected parties (I&APs) with the opportunity to receive information regarding the proposed project, participate in the process, and raise issues of concern. The Scoping Report aimed at detailing the nature and extent of the proposed Paulputs CSP Project, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and I&APs.

4.3. Environmental Impact Assessment Phase

The EIA Phase aims to achieve the following:

» Provide a comprehensive assessment of the social and biophysical environments affected by the proposed phases put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
» Comparatively assess any alternatives put forward as part of the projects.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public participation process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA Report addresses potential direct, indirect, and cumulative[9] impacts (both positive and negative) associated with all phases of the project including design, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

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[9] "Cumulative environmental change or cumulative effects may result from the additive effect of individual actions of the same nature or the interactive effect of multiple actions of a different nature" (Spaling and Smit, 1993).

4.3.1. Tasks completed during the EIA Phase

The EIA Phase for the proposed Paulputs CSP Project has been undertaken in accordance with the EIA Regulations published in GN 38282 in December 2014, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Chapter 6 of Government Notice R982 of 2014 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process.
» Undertaking of independent specialist studies in accordance with Appendix 6 of Government Notice R982 of 2014.
» Preparation of an EIA Report in accordance with Appendix 3 of Government Notice R982 of 2014.

These tasks are discussed in detail below.

4.3.2. Authority Consultation

In terms of the Energy Response Plan, the National Department of Environmental Affairs (DEA) is the competent authority for all energy related projects. As the project falls within the Northern Cape, the Department of Environment and Nature Conservation (DENC) is the commenting authority for the project. A record of all authority consultation undertaken is included within this EIA report. Consultation with the regulating authorities (i.e. DEA and Northern Cape DENC) has continued throughout the EIA process. On-going consultation included the following:

» Submission of the application for authorisation to DEA.
» Submission of the Scoping Report for review by the competent authority from 13 November 2015 – 14 December 2015.
» The Final Scoping Report for the proposed project was submitted in January 2016. The Scoping Report was accepted by DEA in February 2016.
» The EIA Report will be made available for a 30-day public review period.

The following will also be undertaken as part of this EIA process:

» Submission of a final EIA Report to DEA following the 30-day public review period for the draft EIA and the receipt of the comments from the DEA on the draft EIA report.
» If required, an opportunity for DEA and DENC representatives to visit and inspect the proposed project site.
» Notification and consultation with Organs of State (refer to Table 4.2) that may have jurisdiction over the project, including:
  * Provincial departments
  * Parastatals and Non-Governmental Organisations
  * Local Municipality and District Municipality

A record of the authority consultation in the EIA process is included within Appendix B.

4.3.3. Public Involvement and Consultation

The aim of the public participation process is primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project is made available to potential stakeholders and I&APs.
» Participation by potential I&APs is facilitated in such a manner that all potential stakeholders and I&APs are provided with a reasonable opportunity to comment on the proposed project.
» Comments received from stakeholders and I&APs are recorded and incorporated into the EIA process.

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the EIA Phase of the process have been provided, as follows:

» Focus group meetings and a public meeting (pre-arranged and stakeholders invited to attend - for example with directly affected and surrounding landowners).
» Telephonic consultation sessions (consultation with various parties from the EIA project team, including the project participation consultant, lead EIA consultant as well as specialist consultants).
» Written, faxed or e-mail correspondence.
» The Draft EIA Report has been released for a 30-day public review period from 4 May 2016 – 3 June 2016. The comments received from I&APs will be captured within a Comments and Response Report, and will be included within the EIA Report, for submission to the authorities for decision-making.

In terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, the following key public participation tasks are required to be undertaken:

» Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of—
  (i) the site where the activity to which the application relates is or is to be undertaken; and
  (ii) any alternative site mentioned in the application;
» Giving written notice to:
  (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
  (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iii) owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
  (v) the municipality which has jurisdiction in the area;
  (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
  (vii) any other party as required by the competent authority.
» Placing an advertisement in:
  (i) one local newspaper; and
  (ii) in at least one provincial newspaper.
» Open and maintain a register/ database of interested and affected parties and organs of state.
» Release of a Draft EIA Report for Public Review
» Preparation of a Comments and Responses Report which documents all of the comments received and responses from the project team.

In compliance with the requirements of Chapter 6 of the EIA Regulations, 2014, the following summarises the key public participation activities conducted to date.

i. <u>Stakeholder identification</u>

The first step in the public involvement process was to initiate the identification of relevant stakeholders and interested and affected parties (I&APs). This process was undertaken through existing contacts and databases, as well as through the process of networking. Stakeholders identified are listed in Table 4.2 below:

Table 4.2: List of Stakeholders identified during the EIA Process

Organs of State

National Government Departments
Department of Agriculture, Forestry and Fisheries
Department of Communications
Department of Energy
Department of Mineral Resources
Department of Public Works
Department of Rural Development and Land Reform
Department of Water and Sanitation
Department of Science and Technology
Government Bodies and Institutions
Eskom
National Energy Regulator of South Africa (NERSA)
Sentech
South African Civil Aviation Authority (CAA)
South African Heritage Resources Agency (SAHRA)
Square Kilometre Array: Southern Africa
Telkom SA Ltd
Provincial Government Departments
Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
Northern Cape Department of Agriculture, Land Reform and Rural Development
Northern Cape Department of Environment and Nature Conservation (DENC)
Northern Cape Department of Roads and Public Works
Local Government Departments
Khai-Ma Local Municipality
Namakwa District Municipality
Conservation Authorities
BirdLife South Africa
Landowners
Affected landowner
Neighbouring landowners and tenants

ii. Stakeholder Database

All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix C for a listing of recorded parties). While I&APs have been encouraged to register their interest in the project from the start of the process, the identification and registration of I&APs will be on-going for the duration of the EIA process. The project database will be updated on an on-going basis throughout the project process, and will act as a record of the parties involved in the public involvement process.

iii. Adverts and Notifications

During the scoping phase, newspaper adverts was placed to notify and inform the public of the propose project and the availability of the Scoping report for public review. These adverts were placed in the following newspapers:

» Volksblad newspaper (9 September 2015); and
» Die Gemsbok newspaper (11 September 2015).

During the EIA phase, a second round of newspaper adverts has been placed to inform the public of the availability of the Draft EIA report in the following newspapers:

» Volksblad newspaper (6 May 2016); and
» Die Gemsbok newspaper (11 May 2016

Site notices (in English and Afrikaans) were placed at visible points at the entrance to Portion 4 of the farm Scuitklip 92 as well as at the Paulputs Substation, in accordance with the requirements of the EIA Regulations. Further notices were placed on the Pofadder KLK notice board and on the notice board outside Pofadder Save Right Shipping, which are most frequented areas by the public within the area.

iv. Public Involvement and Consultation

In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA process as outlined in Table 4.3 below:

Table 4.3: Consultation undertaken with I&APs for the Paulputs CSP Project

Scoping Phase	Activity	Date
	Placement of site notices on-site.	28 August 2015
	Distribution of letters announcing the EIA process and distribution of the BID to identified stakeholders and I&APs, and posted electronically on the Savannah Environmental website.	25 September 2015
	Distribution of letters announcing the availability of the Scoping Report for review for a 30-day comment period. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups.	13 November 2015
	30-day review period for the Scoping Report for public comment.	13 November 2015 – 14 December 2015
	Focus Group Meeting with Stakeholders	18 -19 November 2015
	Distribution of letters announcing the availability of the EIA Report for review for a 30-day comment	4 May 2016

	period. These letters will be distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups.	
	The availability of the EIA Report advertised in the Gemsbok and the Volksblad	» Volksblad newspaper (9 September 2015); and » Die Gemsbok newspaper (11 September 2015).
	30-day review period of the EIA Report for public comment	4 May 2016 – 3 June 2016
	Public Participation meetings to be held during the 30-day review period: » Focus Group meetings will be held with the Khai-Ma Local Municipality and relevant ward councillors » One-on-one meetings to be held with impacted and adjacent landowners » Public Meeting	26 May 2016

Records of all consultation undertaken are included in **Appendix C**.

v. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into a Comments and Response Reports and summarised in in the Table 4.4 below. The Comments and Response Report includes detailed responses from members of the EIA project team and/or the project proponent. This is included in Appendix C.

Table 4.4: Summary of issues raised during the public participation process to date

Summary of main issues raised by I&APs	Summary of response from EAP
Dust pollution on neighbouring properties during construction Dust will be an issue during the construction of the pipeline as it settles on the grass and livestock do not eat grass covered in dust.	Mitigation measures to suppress dust emissions as a result of the proposed project will be investigated during the EIA Phase and mitigation measures to suppress dust emissions will be included as part of the EMPr.
The possibility of stock theft will increase.	Construction workers are supervised. Incidences of stock theft should be reported to the construction team.

Tremors caused by blasting that took place for the previous project have resulted in cracks occurring in the walls of infrastructure on my farm. Will blasting take place for the CSP project?	The need for blasting during construction is not confirmed. This would be confirmed through the findings of the geotechnical assessment.
There are geotechnical issues within the area. Hard rock (klipbanke) as large as 50m x 100m occurs within the vicinity. It will be very costly to lay the pipeline as a lot of blasting will have to be undertaken.	The pipeline will run parallel to the existing KaXu Solar One pipeline within the servitude of the existing R357 Onseepkans road therefore due to previous geotechnical investigations undertaken for the KaXu Solar One pipeline, the underlying geology is already known. This information has been forwarded to the project developer.
A non-binding confirmation of water availability letter, stating that a reserve determination study would need to be undertaken, will be provided to the applicant. If there is an existing reserve, permission must be acquired from RDM to use this reserve, as long as the existing reserve is not older than 5 years. Existing reserves were identified for the surrounding projects in the area and could be used to determine the water availability for the project.	A water use license application has been submitted by the applicant to DWS Upington in preparation for bidding the project to the Department of Energy's (DoE) Renewable Energy Independent Power Producers Procurement (REIPPP) programme. Confirmation from DWS is pending

4.3.4. Assessment of Issues Identified through the EIA Process

Issues which require investigation within the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 4.5 below.

Table 4.5: Specialist consultants appointed to evaluate the potential impacts associated with the Paulputs CSP Project

Specialist (Company)	Area of Expertise	Refer Appendix
Adrian Hudson of Hudson Ecology	Ecology (flora and fauna) and	Appendix D
Adrian Hudson of Hudson Ecology	Avifauna	Appendix E
Garry Paterson of ARC-Institute for Soils and Agricultural Potential	Soils and agricultural potential	Appendix F
Brian Colloty of Scherman Colloty & Associates	Water resources	Appendix G
David Morris of McGregor Museum Department of Archaeology	Heritage	Appendix H
Jon Marshall of Afzelia Environmental Consultants & Environmental Planning and Design	Visual	Appendix I

Candice Hunter of Savannah Environmental and Neville Bews from Neville Bews and Associates	Social	Appendix J

In order to evaluate issues and assign an order of priority, it was necessary to identify the characteristics of each potential issue/impact:

» The *nature,* a description of what causes the effect, what will be affected, and how it will be affected
» The *extent,* wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high)
» The *duration,* wherein it is indicated whether:
  * The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
  * The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
  * Medium-term (5–15 years) – assigned a score of 3
  * Long term (> 15 years) - assigned a score of 4
  * Permanent - assigned a score of 5
» The *magnitude*, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment
  * 2 is minor and will not result in an impact on processes
  * 4 is low and will cause a slight impact on processes
  * 6 is moderate and will result in processes continuing but in a modified way
  * 8 is high (processes are altered to the extent that they temporarily cease)
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes
» The *probability of occurrence*, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
  * Assigned a score of 2 is improbable (some possibility, but low likelihood)
  * Assigned a score of 3 is probable (distinct possibility)
  * Assigned a score of 4 is highly probable (most likely)
  * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)
» The *significance*, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
» The status, which is described as either positive, negative or neutral

» The degree to which the impact *can be reversed*
» The degree to which the impact *may cause irreplaceable loss of resources*
» The degree to which the impact *can be mitigated*

The significance is determined by combining the criteria in the following formula:

S = (E+D+M) P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The significance weightings for each potential impact are as follows:

» *< 30 points*: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
» *30-60 points:* Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» *> 60 points*: High (i.e. where the impact must have an influence on the decision process to develop in the area)

As the developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An EMPr is included as Appendix K

4.3.5. Assumptions and Limitations

The following assumptions and limitations are applicable to the studies undertaken within this EIA Phase:

» All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
» It is assumed that the development site identified by the developer represents a technically suitable site for the establishment of the proposed Paulputs CSP Project.
» It is assumed correct that the proposed connection to the National Grid is correct in terms of viability and need.
» Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.

» This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

Every possible precaution was taken to reduce the effect of the above-mentioned limitations on the data collected for this study.

Refer to the specialist studies in **Appendices D – J** for specialist study specific limitations.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 5

This section of the EIA Report provides a description of the environment that may be affected by the Paulputs CSP Project against which the potential impacts of the proposed facility can be assessed and future changes monitored. This information is provided in order to assist the reader and the competent authority in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described Aspects of the regional, local, and site-specific biophysical, social, and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted.

The farm Portion 4 of Scuitklip 92 was assessed in 2010 for the siting of the existing CSP facilities known as KaXu Solar One (operational) and Xina Solar One (under construction). The 2010 studies found no environmental flaws for the siting of KaXu Solar I and Xina Solar I. For the Paulputs CSP Project updated studies have been undertaken on Portion 4 of Scuitklip 92 to ensure that the siting of the proposed project is environmentally acceptable for the proposed development.

A comprehensive description of each aspect of the affected environment is included within the specialist reports contained within **Appendices D - J**.

5.1.1. Regional Setting: Location of the study area

The Northern Cape has the country's smallest population with a little over 1 million people (population 1 145 861), which is 2.2% of South Africa's population, and an extremely low population density of three people per square kilometre. The capital of the Northern Cape is Kimberley, located on the province's eastern border. Other important towns are Noupoort, the centre of the karakul sheep and dried fruit industries, and the most northerly wine-making region of South Africa, Springbok, located in the heart of the Namaqualand spring flower country, and De Aar, the hub of the South African railway network.

The proposed site falls within the Khai-Ma Local Municipality (KMLM). This local municipality is one of seven local municipalities that fall within the greater Namakwa District Municipality. The Gariep River plays a key role in the regions

agricultural activities and alluvial diamond mining activities. The highest number of individuals in the NDM is employed within the agriculture, hunting, forestry and fishing sector followed by the mining and quarrying sector. Agriculture is the dominant employment sectors within the District and with few employment opportunities within alternative industries.
The KMLM has four main economic sectors: livestock grazing, mining, agriculture and tourism. The two emerging sectors are renewable energy and conservation and ecological restoration. The main economic activities are in Aggeneys, granite works and farming along the Gariep River. The main town in the KMLM is Pofadder, which is both an economic hub and the seat of local government. Towns in the vicinity of the site include Pofadder which is 45km south west of the site and Onseepkans which is 30km north west of the site.

The identified site is situated Portion 4 of the Farm Scuit-Klip 92. The site lies about 30 km south east of the Gariep River which forms the border with Namibia. The project site is accessed via the N14 and then ~17km along the R357 district road located to the east of the farm portion. Both roads are tarred. The MR73 minor road to the west of the farm portion bisects the site. Prominent features in the immediate vicinity include the KaXu One Solar Energy Facility and Xina Solar One located within Portion 4 of the Farm Scuitklip and Konkoonsies Solar I and Konkoonsies Solar II PV plants which located on the adjacent farmland within 2km south of the proposed site.

5.1.2. Physical landscape

The general area is known as the Bushmanland peneplain, an eroded plain punctured by rocky inselbergs. The general area forms part of the Gariep River basin, an arid landscape with red sand dunes drained by numerous dry tributaries. The land slopes gently from about 800m above MSL at the site towards the Gariep River at about 500m. The site is divided by the R357 district road, with the proposed development located on the south-west portion, the Ysterberg rock outcrop being on the north-east portion.

5.1.3. Land use

The area is sparsely vegetated and combined with the variable low rainfall there is limited agricultural potential in the desert-like landscape. Farm portions tend to be large in area and settlements far apart. The Paulputs CSP Project property is owned by Abengoa Solar South Africa (Pty) Ltd and the land use is zoned as Special Solar. The proposed CSP facility will connect to the Paulputs Substation, a proposed ~2km overhead power line (132 kV distribution line) will be required from the facility's substation to the existing Eskom Paulputs Substation. This impacted farm portion currently contains two CSP facilities owned by Abengoa

Solar South Africa, known as KaXu Solar One (operational) and Xina Solar One (under construction). Prominent features within the proposed study area (Farm Scuit-klip 4/92) include

» KaXu Solar One is a 100MW concentrated solar thermal plant located on Portion 4 of farm Scuit-klip. It covers an area of 1 100 hectares and is currently located south of the proposed site within the same affected farm portion.
» Xina Solar One, has a total installed capacity of 100MW. The construction of this plant started at the end of 2014, and it is expected that it will start operating in 2017. Xina Solar One is located close to Pofadder, in the Northern Cape Province, next to KaXu Solar One.
» The Paulputs substation is located approximately 1km south west of the proposed Paulputs CSP facility within portion 4 of Farm Scuit-klip
» The KaXu Solar IPP substation is located south east of the proposed Paulputs CSP facility within portion 4 of farm Scuit-klip.
» South of the proposed site is an existing power line that traverses portion 4 of farm Scuit-klip.
» The proposed site is relatively isolated and is located approximately 17km north of the N14 (the N14 connects Pofadder and Kakamas).
» The site is located approximately 20km east of the R358 (the R358 connects Pofadder and Onseepkans).
» The triangular shaped site overlaps a four-way intersection of secondary roads on the farm Skuit-Klip. Two of the secondary roads that traverse the proposed site are the two alternative access road options being assessed for the Paulputs CSP facility.

5.1.4. Visual influence

A number of farmsteads are located in the broader area (refer to Figure 5.1) ranging from 5 to 20km distance from the proposed Paulputs CSP Project. Pofadder is approximately 35km south east of the site and out of visual range of the proposed CSP development. The Augrabies National Park is more than 50km north east of the site and would also not be affected. The wilderness character of the area has been altered to some degree by the existing CSP trough developments, substation and Eskom powerline on the property.

The site is fairly remote and in an arid, sparsely populated area. The CSP tower would potentially be visible from the N14 National Road 20km to the south, but distance would be a mitigating factor. The CSP tower is also 30km from the Gariep River, but the river is in a low-lying area and visibility is unlikely to be an issue.

Visually sensitive landscape features include prominent rocky terrain and rock outcrops, and the R357 view corridor.

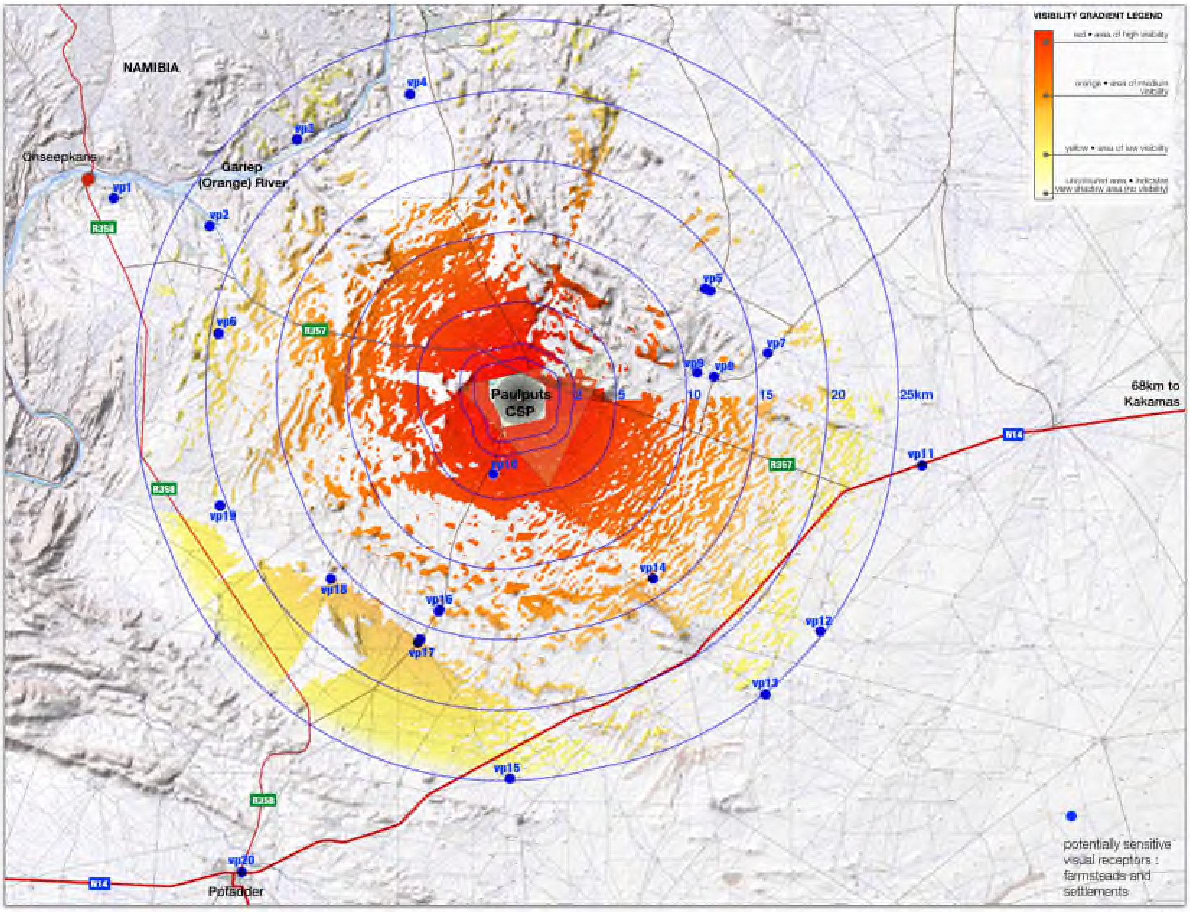

Figure 5.1: Viewpoints, viewsheds, and distance radii in relation to the Paulputs CSP Project site

5.2. Noise

5.2.1. Topographical influence

There are two hills on the study area, one (north-east) approximately 100m high and the other (west) 50m high. The land falls gently in a north-westerly direction towards the Gariep River. There are little natural features that could act as noise barriers considering practical distances at which sound propagates.Traffic in the area is used infrequently by the surrounding farmers. Excluding the scattered farming residences, there are no formal communities within 5 000m from the facility.

5.2.2. Existing Ambient sound levels

Ambient sound levels were measured at two locations during day-light hours in April 2010 following the SANS 10103 methodology. These measurements were recorded before any construction activities started for the existing renewable projects in the area. Audible sounds were mainly insects and noises induced due to wind blowing in the background. The area was very quiet, with very low equivalent sound levels and maximum noises never exceeding 38 dBA. As measurements were collected far from any homesteads the sound levels represents the sound character of a very natural and rural area. It can be assumed that sound levels will also be very low during the night.

5.2.3. Potentially sensitive receptors, also known as noise-sensitive developments (NSDs)

A potential noise-sensitive receptor is located almost 2000m from the boundary of portion 4 of the farm Scuit-Klip 92 and more than 4500m from the operational noise generating activities of the Paulputs CSP Project. This potential receptor in relation of the noise generating activities is presented on Figure 5.2 with Figure 5.3 illustrating receptors staying close to the abstraction point on the Gariep River.

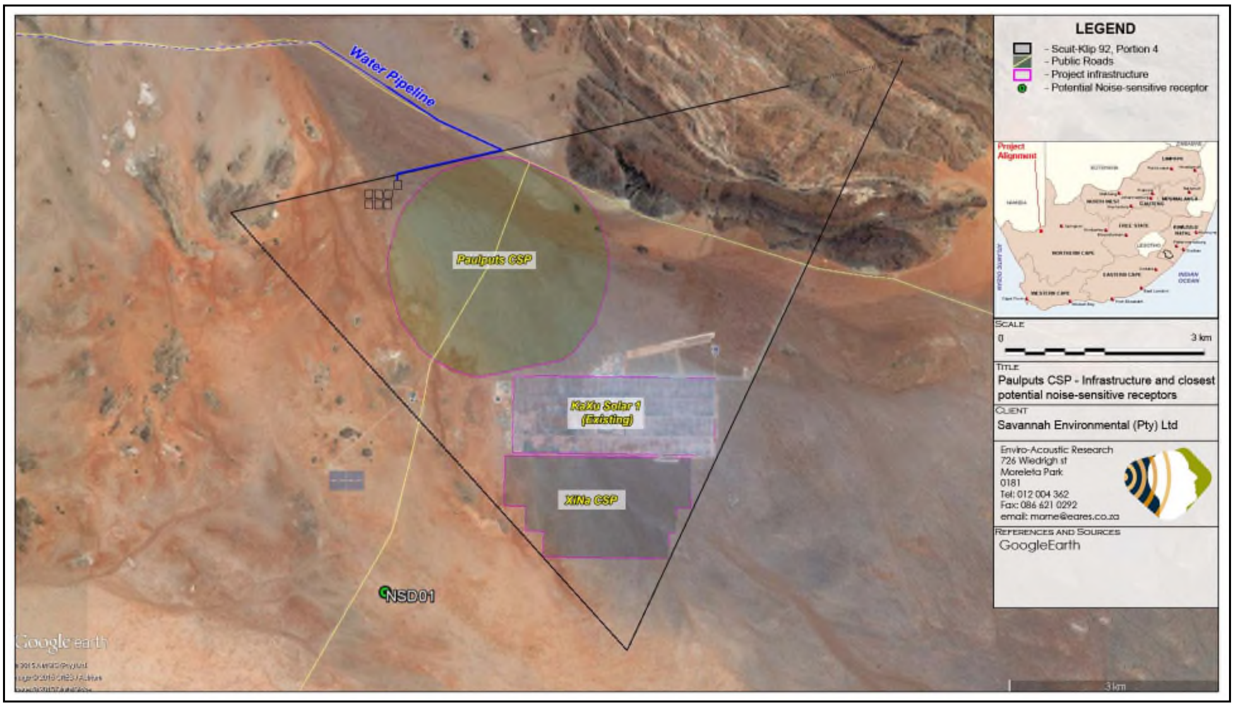

Figure 5.2: Aerial image indicating potentially noise-sensitive receptors close to proposed development

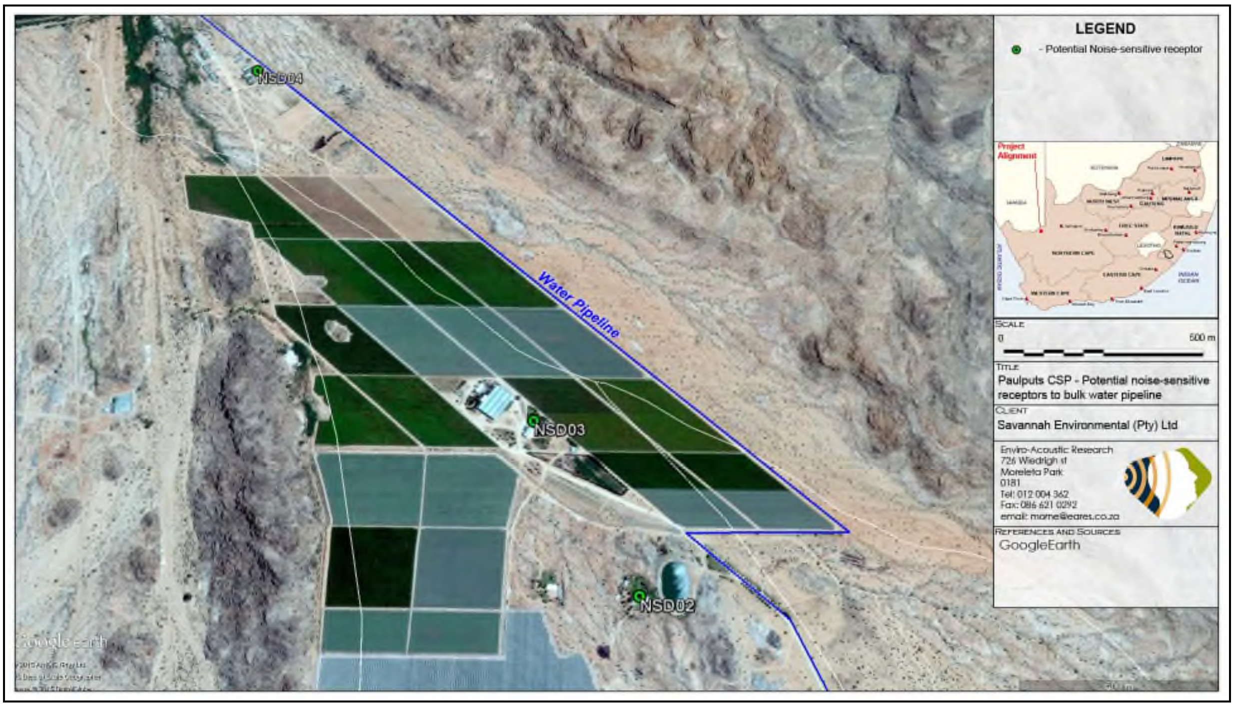

Figure 5.3: Aerial image indicating potentially noise-sensitive receptors close to bulk water pipeline

5.3. Ecological Environment

The description of the ecological environment is supported by desk-top data as well as 10 days of field work undertaken in August 2015 during the Scoping Phase and 9 days of field work undertaken in April 2016 The ecological environment is described holistically, and encompasses all aspects of the biophysical environment, including flora, fauna and avifauna.

5.3.1. Physical setting

Climatic conditions

Rainfall is largely in late summer/early autumn (major peak) and very variable from year to year. MAR ranges from about 70 mm in the west to 200 mm in the east. Mean maximum and minimum monthly temperatures for Kenhardt are 40.6°C and −3.7°C for January and July respectively. Corresponding values for Pofadder are 38.3°C and −0.6°C. Frost incidence ranges from around 10 frost days per year in the northwest to about 35 days in the east. Whirl winds (dust devils) are common on hot summer days.

Biome and vegetation types

The study area falls within the Karoo Biome and contains two major vegetation types, namely Bushmanland Arid Grassland (i.e. the plains within the study site) and Lower Gariep Broken Veld (i.e. the hills/koppies within the study site), (refer to Figure 5.4) both of which are classified as Least Threatened. Bushmanland

Arid Grassland occurs on extensive, relatively flat plains and is sparsely vegetated by tussock grasses as well as abundant displays of annual herbs following heavy rain). This vegetation type contains endemic species belonging to the Griqualand West or Gariep Centres of Endemism. At a national scale this vegetation type has been transformed to a slight degree and approximately 27% is conserved within the Augrabies Falls National Park; it is not therefore considered to be a threatened vegetation type. Lower Gariep Broken Veld consists of sparse vegetation dominated by shrubs, dwarf shrubs, annuals and to a lesser degree by perennial grasses and herbs. This vegetation type contains endemics belonging to the Griqualand West or Gariep Centres of Endemism). At a national scale this vegetation type has also been transformed to a slight degree and is also conserved within the Augrabies Falls National Park.

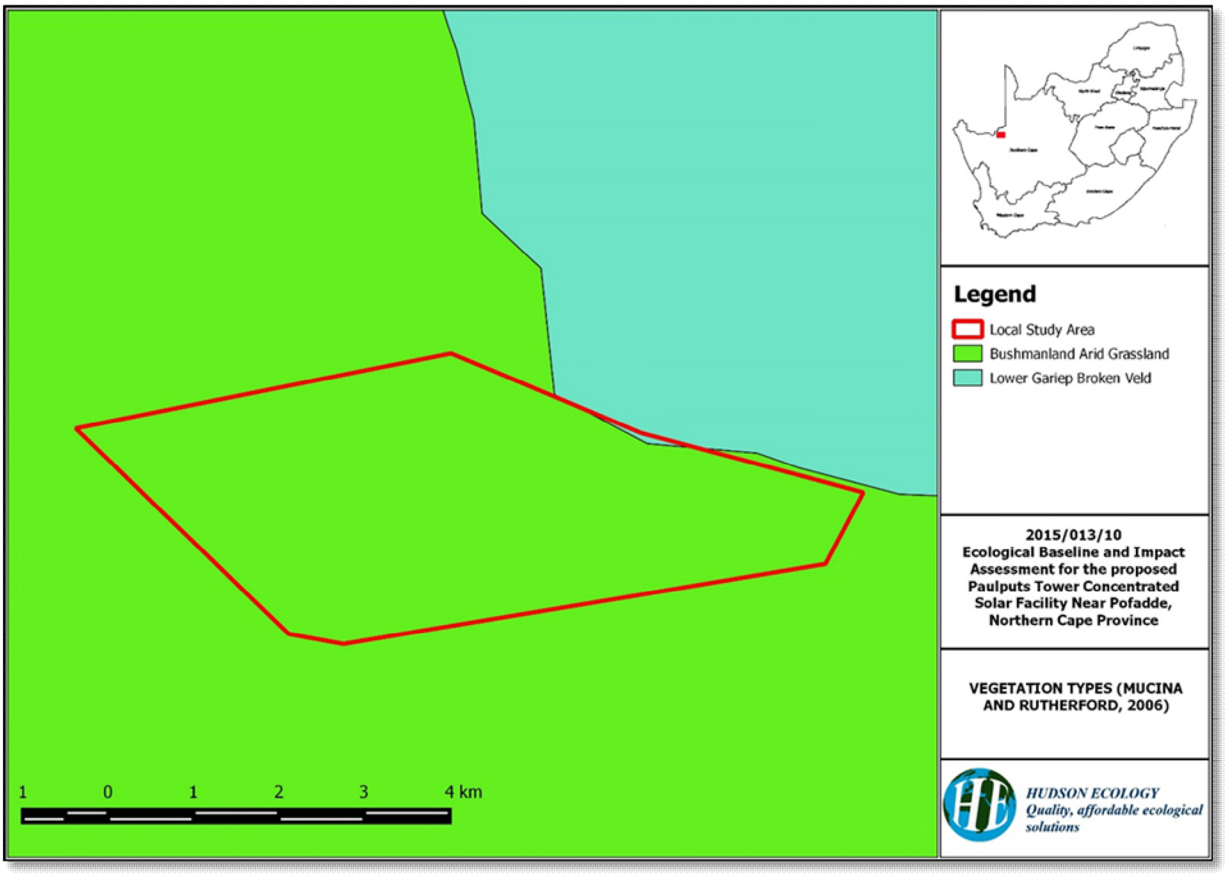

Figure 5.4.: Vegetation types occurring in the study area (Mucina and Rutherford, 2006)

5.3.2. Floral profile

A floral survey was conducted in August 2015 (the dry season survey) and during the wet season (March – April 2016). . Based on species composition, physiognomy, moisture regime, rockiness, slope and soil properties, three main vegetation communities were recognised (refer to Figure 5.5). The vegetation communities are described below and named according to dominant species and underlying substrate. The majority of the site is covered by *Stipagrostis ciliata* – *Aristida congesta* open grassland

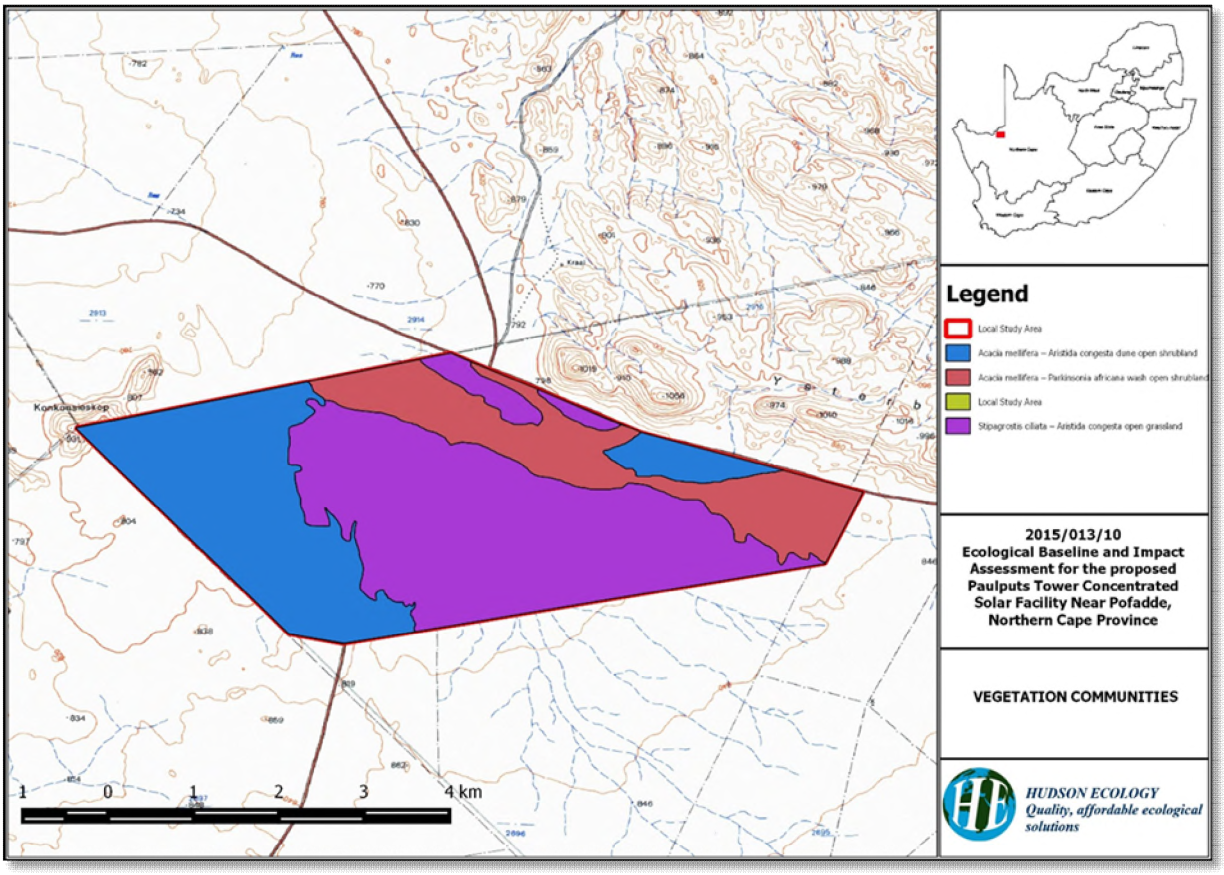

Figure 5.5: Paulputs CSP Project site showing distribution of the identified vegetation communities

Acacia mellifera – Aristida congesta dune open shrubland)

This vegetation community is typically covered by sparse open grassland, with *Stipagrostis ciliata* and Aristida *congesta* being the dominant grass species. Due to the deeper soils, as well as soil chemistry and an increased water retention potential, larger *Acacia mellifera* are dominant in this vegetation community, with scattered, drought resistant dwarf shrubs or small trees, e.g. *Rhigozum trichotomum* and Boscia *foetida* (refer to Figure 5.5). Species of concern found to occur in this vegetation community are the protected species *Aloe dichotoma* and *Boscia foetida*.

Figure 5.6: *Acacia mellifera – Aristida congesta* dune open shrubland in the northern part of the study area

***Acacia mellifera – Parkinsonia africana* wash open shrubland**

The drainage lines within the plains of the study area are regarded as washes, as water will only flow after good rains, and soon they will be dry again. The increased water retention in the underlying substrate allows for the growth of larger individuals of the species *Acacia mellifera* and *Parkinsona africana*. These washes are wide and sandy, and blend into the landscape, merging with the adjacent grassland vegetation, but are nevertheless visible due to their microtopography and change in species composition (refer to Figure 5.6).

The vegetation is often somewhat heterogeneous and with weeds, due to the disturbance of the periodic flooding. Washes are of conservation concern and regarded as sensitive ecosystems, due to the ecosystem processes linked to provision and transport of water in the landscape.

Figure 5.7: Wash shrubby grassland running from left to right in the central part of the photo

***Stipagrostis ciliata – Aristida* congesta open grassland**

The open, sparse grassland is dominated by *Stipagrostis ciliata* and *Aristida congesta*. The shrubby *Rhigozum trichotomum* is prominent on the sandy localities while *Salsola aphylla* is more prominent where calcrete is exposed (refer to **Error! Reference source not found.**5.7*).* Other dominant grass species occurring in this vegetation community include *Stipagrostis obtusa, Aristida adscensionis* and*,* to a much lesser extent*, Fingerhuthia africana* and *Eragrostis lehmanniana.*

Figure 5.8: Calcrete shrubby vegetation

Sparse *Acacia mellifera – Aristida congesta* rocky outcrop vegetation

The vegetation on the slopes and crests of the mountains and hills is a shrubland with both succulent and non-succulent bushes and a sparse grassy layer(refer to Figure 5.9). This vegetation community was not mapped as a separate vegetation community as it is a subset of the *Acacia mellifera – Aristida congesta* dune open shrubland vegetation community in which it occurs. These vegetation communities are dominated by *Acacia mellifera* and *Aristida congesta* with, to a lesser extent, *Stipagristis ciliata, Aristida adscensionis, Stipagrostis obtusa* and *Eragrostis lehmanniana,* with isolated stunted *Boscia foetida* and *Parkinsona africana* near the foothills of the outcrops

Figure 5.9: Rocky outcrop vegetation

5.3.3. Terrestrial Faunal profile

The faunal survey was conducted in in August 2015 (the dry season survey) and in the wet season during April 2016.

Reptiles

Reptile diversity in the area is high with approximately 45 reptile species occurring in the area and reptile endemism is especially high in the region with 19 species (42%) being endemic. Ten were confirmed during the wet and dry season site surveys (Table 5.1. Most of the expected species in the area are common and widespread, with only the Black-necked spitting Cobra (*Naja nigricollis*) being classified as rare.

Table 5.1: Reptile species recorded during the August 2015 and April 2016 surveys

Biological Name	**Common Name**	**Status**
Lamprophis fuliginosus	Brown House Snake	
Psammophis notostictus	Karoo Whip Snake	
Naja nivea	Cape Cobra	Endangered
Naja nigricollis	Black-necked Spitting Cobra	Rare
Bitis arietans	Puff Adder	

Bitis caudalis	Horned Adder	
Mabuya striata	Striped Skink	
Mabuya variegata	Variegated Skink	
Agama aculeata	Ground Agama	
Cordylus polyzous	Karoo Girdled Lizard	Endangered

Amphibians

The study area is a fair distance from any permanent open water bodies and therefore, as expected amphibian diversity is low. Only seven species are expected to occur in the study area and during the wet and dry season surveys no amphibian species were recorded. Due to the dry conditions, distance from any open water bodies and distance from the Gariep River, the lack of amphibian species in the study area was expected. The study site area falls outside the natural range of giant bullfrogs, desert rain frog and the Karoo caco, and these species should not occur on the study site.

Mammals

Of the 67 mammal species expected to occur in the study area only 16 were confirmed during the site survey (refer to Table 1.2).

Table 1.2: Mammal species recorded during the site survey in August 2015

Family	Biological Name	Common Name
MACROSCELIDIDAE (Sengis/Elephant Shrews)	*Elephantulus rupestris*	Western Rock Sengi
SORICIDAE (Shrews)	*Crocidura cyanea*	Reddish-grey Musk Shrew
LEPORIDAE (Hares and Rabbits)	*Lepus saxatillis*	Scrub Hare
BATHYERGIDAE (Rodent Moles / Mole Rats)	*Cryptomys hottentotus*	Common (African) Mole-rat
HYSTRICIDAE (Porcupine)	*Hystrix africaeaustralis*	Cape Porcupine
MURIDAE (Rats and Mice)	*Saccostomus campestris*	Pouched Mouse
MURIDAE (Rats and Mice)	*Michaelamys namaquensis*	Namaqua Rock Mouse
MURIDAE (Rats and Mice)	*Rhabdomys pumilio*	Four-striped Grass Mouse
MURIDAE (Rats and Mice)	*Mastomys natalensis*	Natal Multimammate Mouse
CANIDAE	*Otocyon megalotis*	Bat Eared Fox
HERPESTIDAE	*Galerella pulverulenta*	Small Grey Mongoose
HERPESTIDAE	*Suricata suricatta*	Suricate (Meerkat)
ORYCTEROPODIDAE	*Orycteropus afer*	Aardvark
PROCAVIIDAE	*Procavia capensis*	Rock Dassie (Hyrax)
RUMINANTIA	*Raphicerus campestris*	Steenbok
RUMINANTIA	*Sylvicapra grimmia*	Common Duiker

Mammals reliant on wetland and arboreal habitats are absent from the study site as these habitat-types do not occur. All 16 species recorded are robust and widespread, mostly with the proviso that suitable habitat and sufficient space to maintain home ranges / territories are available. The nearby roads are obviously a main source of fatalities – several carcasses were recorded during transit to and from the study area.

A number of bat species are known to occur in the region. Bat species recorded in the area during the surveys area are *Rhinolophus darlingi, Neoromicia capensis, Pipistrellus rueppelli* and *Tadarida aegyptiaca* of these species only Tadarida aegyptiaca is likely to be attracted to the infrastructure for roosting purposes.

5.3.4. Ecological Integrity

The ecological function of the study area can generally be described as moderate for the majority of the study area, although this does vary from low (in the highly transformed areas due to slash and burn cropping techniques) to high in the more inaccessible or unutilisable areas. Areas in which overgrazing and clearing have taken place, as well as areas in which settlements have been established are considered as areas where ecological function is reduced. The ecological function of the study area is indicated in Figure 5.10. Majority of the site is of moderate ecological integrity.

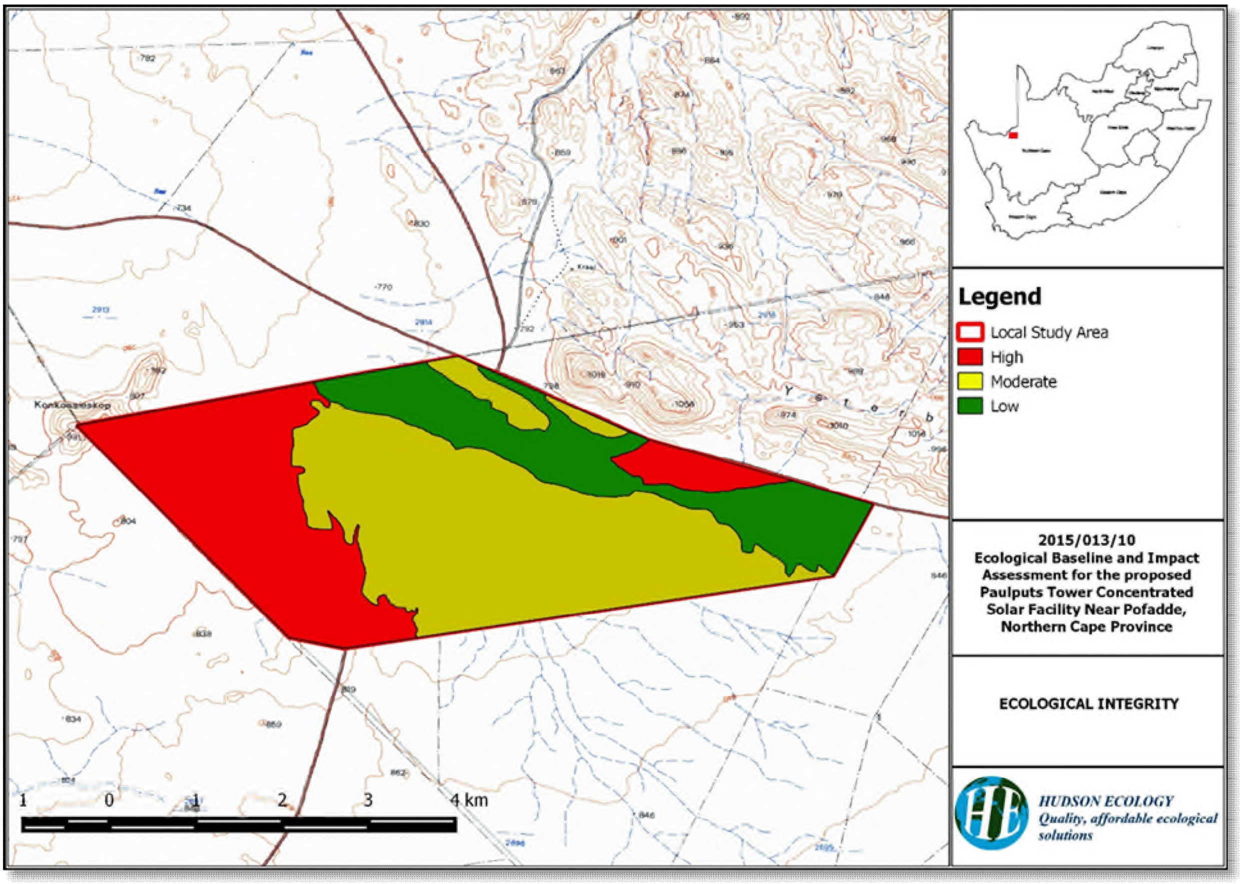

Figure 5.10: Ecological integrity within the study area

5.3.5. Areas of conservation importance

Areas that have been severely disturbed such as settlements are considered of low conservation importance. Thee areas are, however, quite small in relation to the overall study area (<30% of the study area). Areas that have been disturbed by farming are considered of moderate conservation importance due to the fact that rehabilitation of these areas is possible. The natural areas are considered of very high conservation importance due to the presence of Red Data species in these areas and the intrinsic importance of these areas. The majority of the site is of moderate conservation importance.

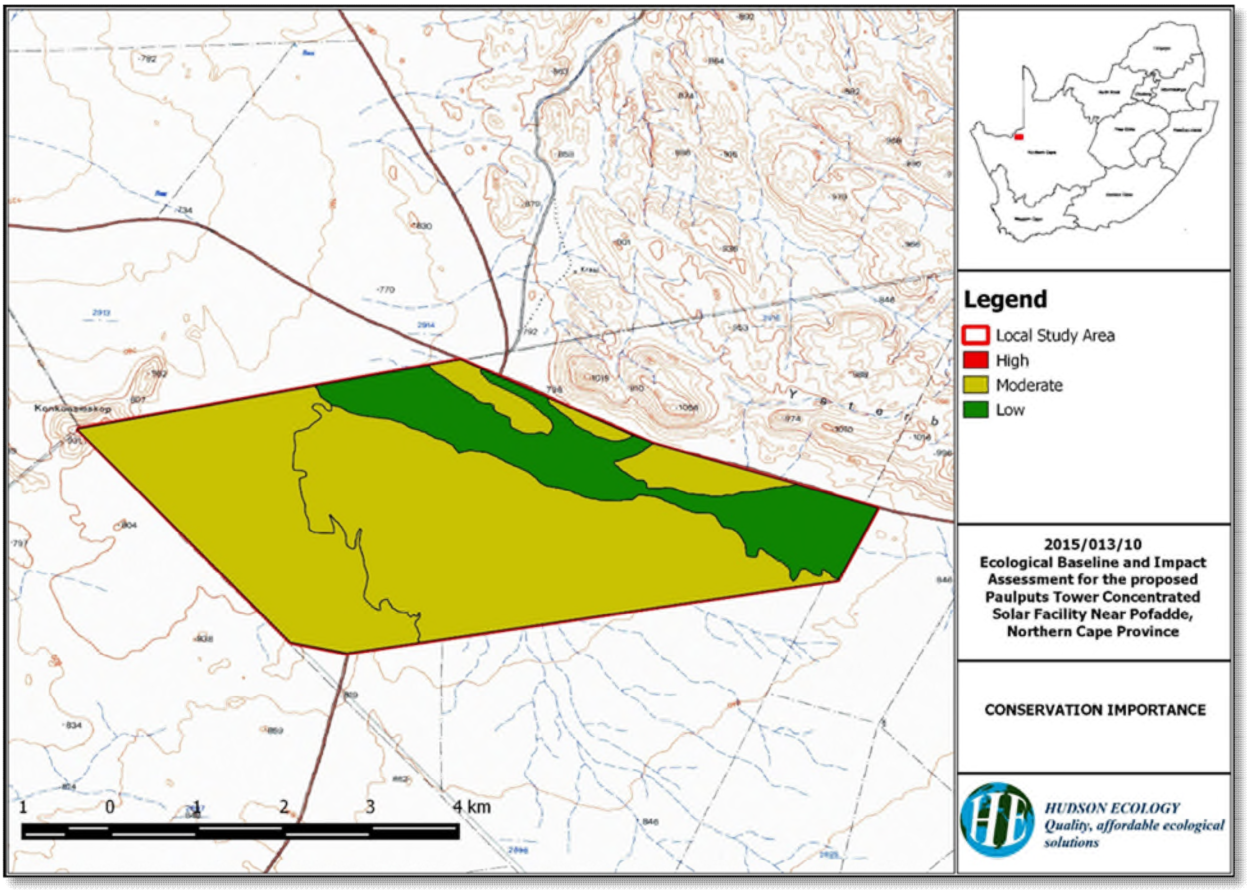

Figure 5.11: Conservation importance within the study area

Critical Biodiversity Areas

The identification and mapping of CBAs form part of the biodiversity assessment of the Northern Cape Province which is used to inform the development of the Provincial Biodiversity Sector plans, bioregional plans, and also be used to inform Spatial Development Frameworks (SDFs), Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and in the Environmental Impact Assessment (EIA) process in the province.

» Definition and purpose of CBAs

Critical Biodiversity Areas (CBAs) are defined as areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannon be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.

The purpose of the CBA is to indicate spatially the location of critical or important areas for biodiversity in the landscape. The CBA, through the underlying land management objectives that define the CBA, prescribes the desired ecological state in which the province would like to keep this biodiversity. Therefore, the desired ecological state or land management objective determines which land-use activities are compatible with each CBA category based on the perceived impact of each activity on biodiversity pattern and process.

According to the guidelines for bioregional plans, three basic CBA categories can be identified based on three high-level and management objectives. CBA 2 borders the Paulputs CSP site (Figure 5.12). CBA 2 is defined as Near-natural landscapes: Ecosystems and species largely intact and undisturbed. Areas with intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change.

Ecological Support Areas

ESAs are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and / or in delivering ecosystem services that support socio-economic development, such as water provision, food mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

According to the Khai-Ma Land Use Decision Support tool, the study area falls with an Ecological Support Area (ESA) (Figure 5.12). The ESA is listed as a migration route, although the species utilising this migration route are not indicated. The migration route does seem to be counter-intuitive as it seems to start in the lowlands of the Gariep River, crosses over rocky mountainous areas only to return to the lowlands of the Gariep River lowlands again. Notwithstanding this the development will affect less than 30% of the width of the migration route and should have very little effect on species using this route.

» **Definition and purpose of ESAs**

According to the Biodiversity Sector Plan, ESAs are defined as "*areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and / or in delivering ecosystem services that support socio-economic development, such as water provision, food mitigation or carbon sequestration.*" And it is stated that "*The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas*" It is also stated that "*some*" level of change in the biodiversity indicators for ESAs is allowed.

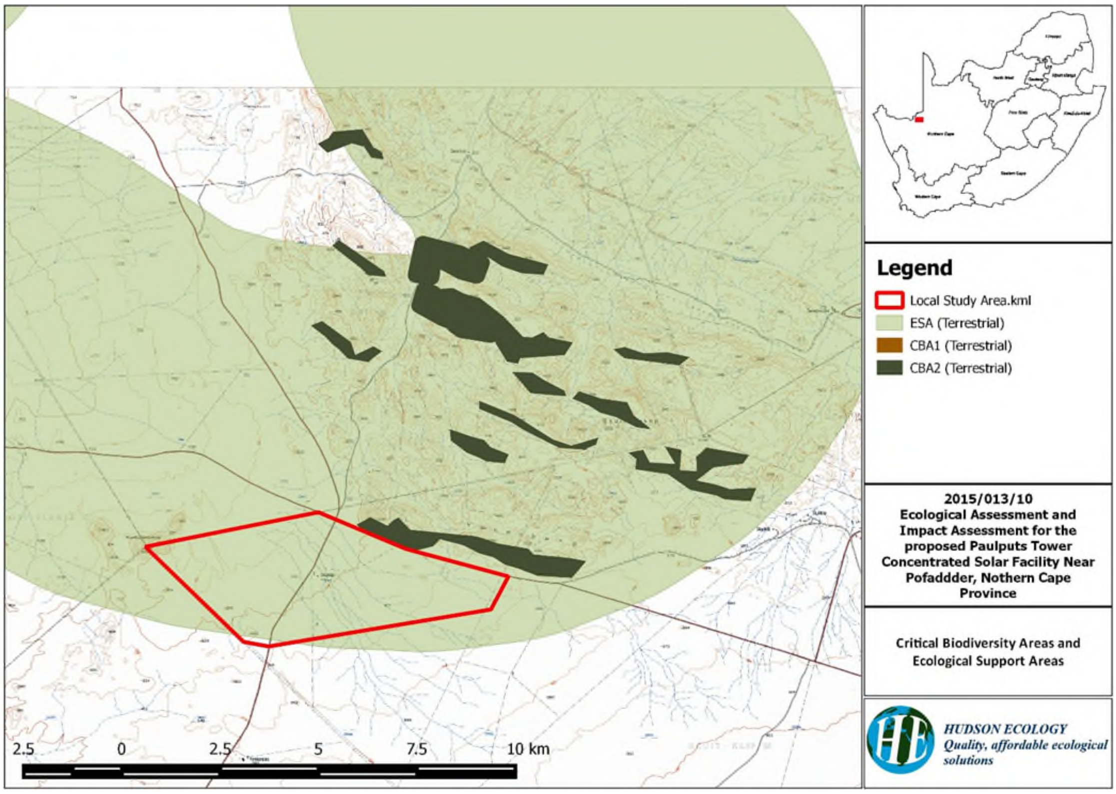

Figure 5.12: Ecological Support Area as per the LUDS in relation to the Paulputs CSP project site

5.4. Soil, land use, land capability and agricultural potential

5.4.1. Terrain type

The proposed development is located on the terrain type D5: low mountains, and A3: The site is generally flat to gently undulating and lies at a height of approximately 800-850 meters above sea level although there is an area of steeply undulating topography of the Ysterberg range of hills, with slopes of up to 100% (45°), in the north-eastern corner of the study area (although no infrastructure is proposed for this area).

5.4.2. Soils

Within a broad 20 km buffer area, the Paulputs CSP Project site is covered by only five land types, as shown on the map in Figure 5.13, namely:

- Ae67 (Red, freely-drained soils, high base status)
- Ag2, Ag37 (Shallow, red, freely-drained soils, high base status)
- Fb142 (Shallow lithosols and rock, mostly calcareous)
- Ic136 (Mostly rock, little soil)

The distribution of soils with high, medium and low agricultural potential within each land type is also given, with the dominant class shown in **bold type**

A summary of the dominant soil characteristics is given in **Table 5.3** below.

Table 5.3 Land types occurring (with soils in order of dominance)

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Potential (%)
Ae67	Hutton 32/25/42/45 Hutton 32/25/42/45 Rock	500-1000 200-300 -	49% 30% 13%	Red, sandy soils on hard rock and calcrete Red, sandy topsoils on hard rock and calcrete -	High: 0.0 Mod: 49.0 **Low: 51.0**
Ag2	Hutton 34/44/45/46 Mispah 10/12/14/22 Rock	100-300 50-150 -	48% 29% 7%	Red, sandy topsoils on hard rock and calcrete Grey-brown, sandy/loamy topsoils on hard rock/calcrete –	High: 0.0 Mod: 12.0 **Low: 88.0**
Ag37	Hutton 32/35/42/45	200-300 -	48% 20%	Red, sandy topsoils on hard rock and calcrete	High: 0.0

	Rock Dundee 10 + Oakleaf 24	500-1000	15%	- Red-brown, alluvial soils on calcrete	Mod: 23.0 **Low: 77.0**
Fb142	Rock Mispah + Glenrosa Hutton 32/35	- 100-350 100-300	54% 25% 13%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Red, sandy topsoils on hard rock and calcrete	High: 0.0 Mod: 8.0 **Low: 92.0**
Ic136	Rock Mispah 10/20	- 50-150	89% 7%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete	High: 0.0 Mod: 3.5 **Low: 96.5**

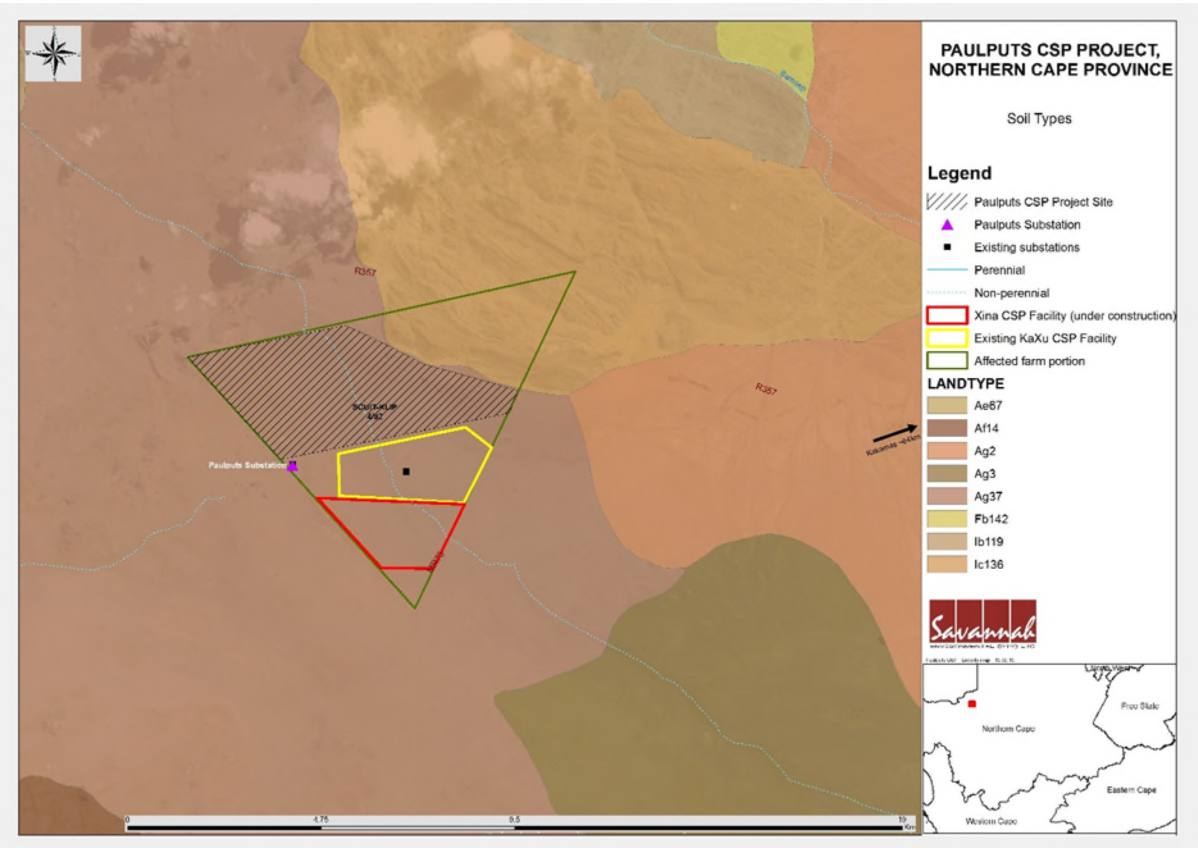

Figure 5.13: Land types of the proposed area for the Paulputs CSP Project site

5.4.3. Geology

The study area is located within the Namaqualand Metamorphic Belt which comprises very old and very highly deformed sedimentary (Khesian Group) and igneous (Namaquan Group) rocks of the Mokolian Erathem (2100 - 1200Ma) that form part of the Southern African Basement Complex rocks. The upland area in the north-eastern portion of the study area is underlain by Koenap Formation meta-pelitic rocks; Polisiehoek gneiss and the Scuitklip granite suite (refer to Figure 5.14). Thick accumulations of transported red sands, scree and gravelly sands are deposited below the western slopes of this upland area. The central, western and southern lowland areas of the study area are dominantly underlain by thick deposits of Quaternary soils of residual and transported origin. The central area is dominated by residual coarse grained, pink feldspathic gravels weathered from the Sckuitklip granite suite. The western-most portion is dominated by red aeolian sands which form lenticular dune cordons. Protruding through this aeolian sand cover is Oupvlakte Formation granulites and Gemsbokvlakte gneiss. These rocks are intensely deformed due to a shear zone that runs along the western boundary of the study area. This shear zone is considered inactive, based on available historic seismic data.

Rocky outcrops are likely to be limited to the north-eastern portion and, to a lesser extent, the western portion of the study area. Talus/scree (gravelly soils transported downslope due to gravity) are expected to exist on slopes in these rocky areas. It is estimated that 20% of the study area has rock outcropping at surface, 10% is underlain by shallow rock, and the remaining 70% has relatively thick soil.

The Erosion Index for South Africa indicates that the site is ranked between 11 and 15 on a scale from 1 (highest potential) to 19 (lowest). This means that the erodibility potential is moderate to low. A wide braided non-perennial stream exists as a feature across the central portion of the study site where thick Quaternary soils occur, and moderate erosion can be expected in this area during heavy downpours (which are generally very rare).

Figure 5.14: Geology of the site

Q-s1: Aeolian sand; Q-r2: Feldspathic gravelly sands; Q-s2: Colluvium. Scree, gravelly soil and red sand. Jd: Jurassic Karoo Dolerite. Namaquan Intrusives: Nkon: Konkonsies Granite; Nsku: Scuitklip Granite. Ngv: Gemsbokvlakte Gneiss; Npo: Polisiehoek Gneiss; Nbn: Beenbreek Gneiss. Arribees Group – Kheisian supracrustal metasediments: Kkn: Koenap Formation. Kinzigite*, calc-silicate rocks, marble; Kop: Oupvlakte Formation. Two-pyroxene granulite: in places amygdaloidal or garnetiferous; metapelitic granulite, minor quartz-feldspar gneiss and calc-silicate rocks.

5.4.4. Agricultural potential

Much of the area comprises either shallow to very shallow soils or surface rock outcrops, and as can be seen from the information contained in Table 5.3, only a very small portion of deep soils. The very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation. Two CSP facilities, KaXu Solar One and Xina Solar One are located in the southern portion of the site.

Figure 5.15 Natural vegetation in study area

Figure 5.15 shows clearly the sparse nature of the vegetation present in the vicinity of the proposed project. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit.

5.4.5. Areas of Degradation or Cultivation

According to the latest version of the national Land Cover (GTI, 2015), while the vegetation class in the vicinity of the project is largely confined to either "Bare, non-vegetated" or "Low shrubland" (Figure 5.15), no areas identified as degraded, such as dongas or other erosion features, were identified. In addition, no areas of cultivation were identified except for the strip of cultivated orchards and pivots along the Gariep River to the north

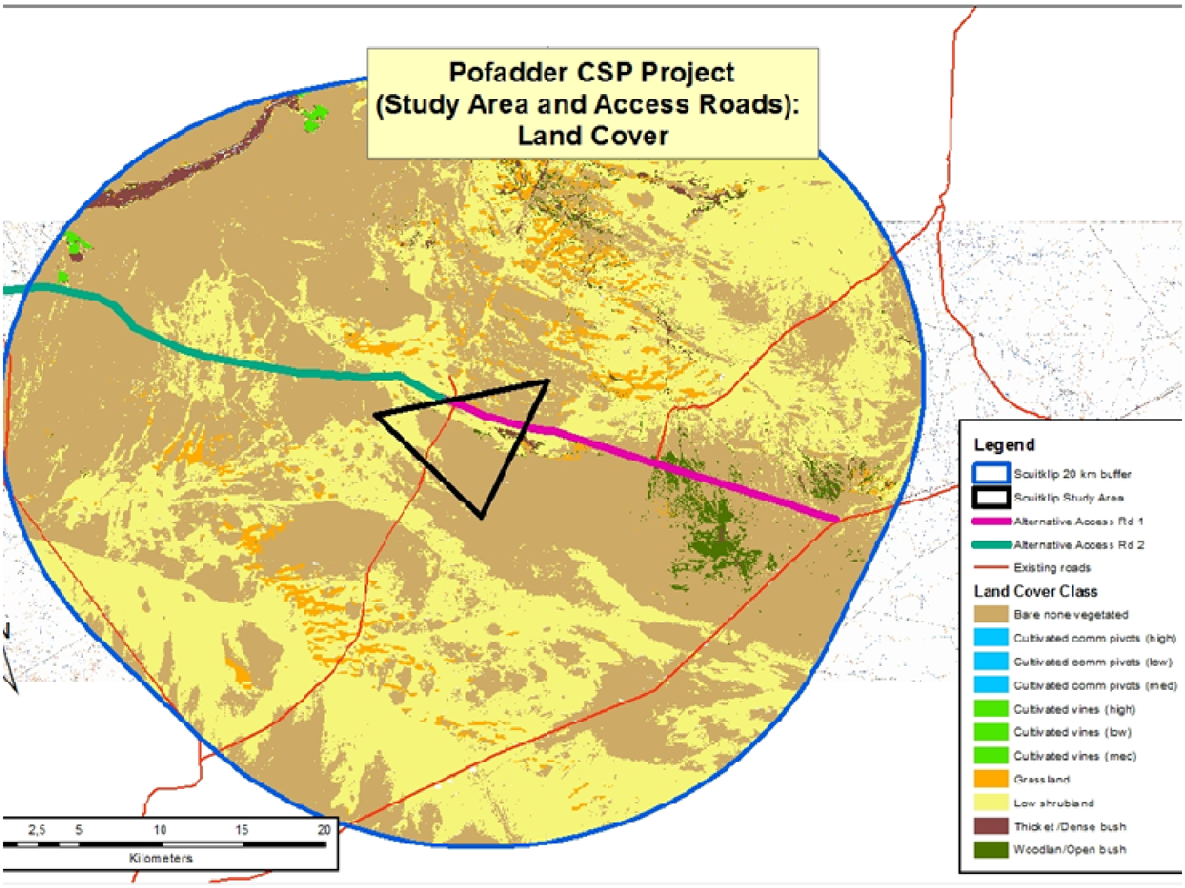

Figure 5.15: Land Cover map

5.4.6. Susceptibility to erosion

Soils on the site have below 5% dominant clay in the top soils. The soils are moderately susceptibility to water erosion which varies across the site. The general assumption is that the erosion susceptibility increases with an increase in the slope angle and/if the slope length is constant.

5.5. Heritage

The environment is arid, comprising relatively flat drainage plains with dunes to the west of the proposed development and several outcropping rocky features in the north eastern part of the development footprint. A water pipeline is to be situated westwards to the Gariep River. The landscape is sparsely vegetated, hence any surface archaeological traces are likely to be highly visible.

5.5.1. Description of Heritage features of the region

The environment is arid, comprising relatively flat drainage plains with dunes to the west of the proposed development and several outcropping rocky features in the north eastern part of the development footprint and a 60m buffer has been taken into account around these rocky outcrops. A water pipeline is to be situated westwards to the Gariep River. The landscape is sparsely vegetated, hence any surface archaeological traces are likely to be highly visible.

Archaeological remains dating to the following periods can be expected within the study area

Colonial Frontier: Genocide against the indigenous San people is documented in this area with certain mountainous areas being the likely settings of massacre sites. An isolated grave of a member of the Northern Border Police, which has yet to be relocated has been recorded and located on the Farm Scuit-Klip, there is a road-side twentieth century grave

Later Stone Age: Later Sone Age (LSA) sites are the predominant archaeological trace noted in surveys in the Aggeneys-Pofadder region. Surveys have located signs of human occupation, ample pottery near Aggeneys and, east of Pofadder and fairly minimal traces of LSA on dunes immediately west of the KaXu Solar One project

Middle and Earlier Stone Age: A handaxe and isolated large flakes were previously found near a rocky outcrop in the KaXu Solar One footprint

Potential areas of heritage sensitivity include:

» The terrain close to hills or rocky features, particularly sandy spots near sheltering rocks, may tend to have traces of precolonial Stone Age occupation/activity and a 60m buffer has been taken into account around these rocky outcrops
» Minimal evidence of LSA occupation has been noted on a dune between the KaXu Solar 1. A handaxe and a few large ESA/MSA flakes were found adjacent to a rock outcrop north of the KaXu Solar 1 development (Figure 5.16)
» The open plains have been found to have sparsely scattered artefacts (such as at Konkoonsies near the Paulputs Substation site. These areas are expected to be less significant. An exception to this is where rocky outcrops at the surface on the plains with traces of artificial grinding grooves in the bedrock and ample evidence of stone artefacts and pottery.
» The sand dunes in the north western part of the area may also have been a focus for past human occupation.
» Colonial era sites or features within the study area include the known road-side grave below Ysterberg, a presently unknown grave recorded by Dunn of a member of the Northern Border Police (near Zwart Modder), and a farm cemetery and homestead/kraal ruins at the old Scuit-Klip farm between the study area and Zwart Modder. Strauss and Esterhuizen family graves in the cemetery date between 1914 and 1974.

Figure 5.16. Stone artefacts found downslope from the rocky outcrop

5.5.2. Palaeontological Environment

In December 2010, a Palaeontological Impact Assessment (PIA) was prepared for the existing KaXu Solar One facility, which is located on the same farm portion as the proposed Paulputs CSP Project. The 2010 PIA findings remain consistent, and have been referenced for the Paulputs CSP Project Palaeontological Scoping Statement (refer to Appendix I) as follows:

The property is a triangular area straddling a sediment-choked drainage line that traverses the gentle decline from th Bushmanland Plateau down towards the Gariep River. The area is an almost flat plain crossed by ephemeral, braided stream flows that converge in the north and smaller-scale local flow features produced in a sheetflood and flashflood sediment-transport regime.

The area would have been more regularly active for periods in the past and may well have a sparse fossil content. Freshwater clams and snail fossils have often been found in such "near-abandoned" areas, as well as bones occasionally, but the contexts have seldom been properly described. Deposits are poorly fossiliferous, but abraded bone fragments and loose teeth may occur sparsely in channel lags. The history of these vast tracts of sands, gravels and pedocrete is very poorly known, with very few fossils to rely on (e.g. Kangnas dinosaur, Areb *Hipparion* (three-toed ancestor of the horse). Hence, though of low probability, any find will be considerable importance.

5.6. Aquatic profile

The study area site is situated within quaternary catchment D81E (Figure 5.17) and is dominated by highly ephemeral river systems (DWAF, 2004). Potential runoff would flow in a North Westerly direction towards the Gariep River, while runoff from the elevated portions of the Skuitklip ridges flows in a Northerly direction towards the Kaboep River, which then flows into the Gariep River.

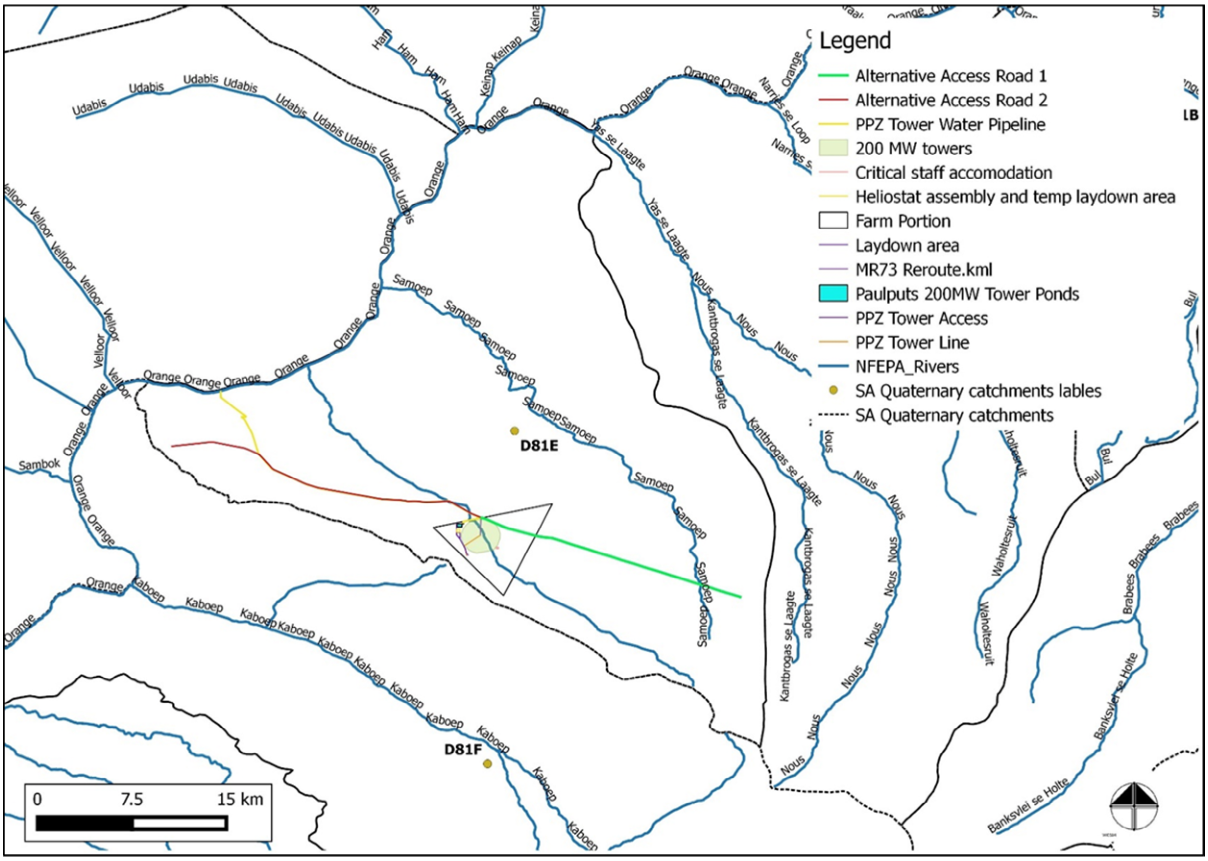

Figure 5.17: Project locality map indicating various quaternary catchments within the region (NFEPA & DWS)

No natural wetlands were observed within 500m of the proposed CSP site, i.e. more than 3km away, while wetlands / reedbeds (*Phragmites australis*) were observed near the proposed abstraction point along the Gariep River floodplain (Figure 5.18).

Figure 5.18: A view of the reed (Phragmites australis) lined banks of the Gariep River near the proposed abstraction point

The region is however dominated by several dry alluvial water courses which only flow during high rainfall events. The proposed CSP site itself is mostly dry, although a large number of drainage lines were observed and will thus be impacted upon by the proposed layout (Figure 5.19). These systems were highly fragmented by the roads and farming practices in the past while the adjacent projects have now disrupted any flows within these systems. The significance of this impact at the time of assessing the adjacent projects was low, due to the impacts and high degree of fragmentation coupled to the general lack of any important / visible aquatic habitat.

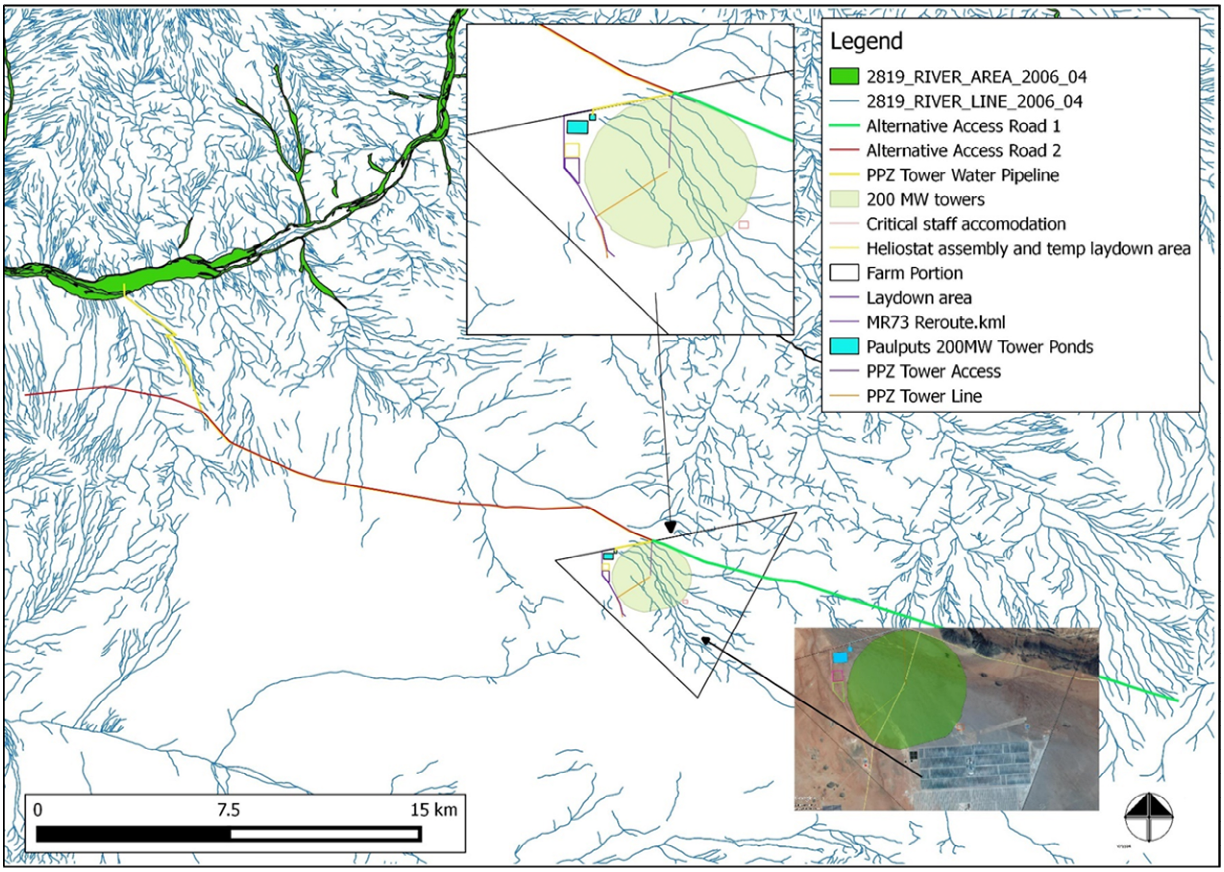

Figure 5.19: Delineated water courses in relation to the study area, CSP site (inset above) and present day impacts posed by the adjacent sites (inset below

5.6.1. Water Abstraction resources

The non-perennial Mean Annual Rainfall (MAR) for the D81E quaternary catchment has been estimated by Middleton & Bailey (2008) as low as 0 – 200 mm/a. Surface water runoff would therefore not meet the water demands of the proposed project (2.5 million m3/a) and water would have to be sourced from the Gariep River as is the case with the existing CSP developments on the farm portion - KaXu Solar One and Xina Solar One.

Surface water quantity

As no available surface water flows within the study site, water will thus have to be sourced from the Gariep River. Currently water demand is dominated by use for irrigation along the river at various points and small quantities for urban use and stock watering within the Onseepkans / Pofadder region (ORASECOM, 2007).

Most of the flow in the Gariep River originates from the Gariep Water Management Area (WMA) (and Lesotho). The Vaal River only contributes small quantities of high salinity irrigation return flows and flood spillage/releases from the Bloemhof Dam to the Lower Gariep River system.

Latest data indicates that only 5 500 million m^3/a of the natural flow actually reaches the mouth as opposed to the expected estimate of 11 490 million m^3/a. The difference is possibly as a result of the extensive water utilisation in the Vaal River basin for domestic and industrial use. Irrigation accounts for a further 1 800 million m^3/a) while mining activities require 40 million m^3/annum, occurring along the Gariep River downstream of the Gariep/Vaal confluence. Additional water demands also include the Fish River transfer scheme via the Gariep/Fish Canal, which in periods of drought, is the only source of water for certain hinterland regions (e.g. Cookhouse, Cradock and Grahamstown) of the Eastern Cape. Evaporative losses from the Gariep River and the associated riparian vegetation account for between 500 million m^3/a and 1 000 million m^3/a depending upon the flow of water (and consequently the surface area) in the river (Mckenzie *et al*, 1993, 1994 and 1995, cited in ORASECOM, 2007). An approximate water balance for the Gariep River is provided in Table 5.4 to provide perspective on the various demands supported from the river.

Table 5.4: Gariep River water balance as of 2005 (ORASECOM 2007)

Water Balance component	**Volume (million m^3/a)**
Environmental requirement	900 (Incl of natural evaporative losses from Gariep River
Namibia	120 (Incl water use from Gariep & Fish Rivers)
Lesotho & transfers to South Africa	820 (With full LHWP Phase 1 active)
South Africa Gariep River demand	2560 (Includes transfers to the Eastern Cape)
South Africa Vaal River demand	1560 (Vaal demand supplied from locally generated runoff)
Evaporation & losses	1750 (Evaporation not accounted for in the Environmental Requirement)
Spillage	3780
TOTAL	**11490**
Spillage under natural conditions	10900

Surface water quality

Although the inflows from the Vaal River systems are low, the poor water quality from this system would seem to have a significant impact on the sub-basin and the Lower Gariep WMA. The Vaal River receives high salinity irrigation return flows and flood spillage/releases from Bloemhof Dam. The Lower Gariep is also characterised by high turbidity waters during flood flows; in its natural state, water in the Gariep River is of good quality (ORASECOM, 2007).

The ORASECOM (2007) study indicated that the salinity in this sub-basin deteriorates downstream of the confluence of the Vaal and Gariep rivers, but remains acceptable for human use. There is an increase in Electrical Conductivity (EC) from the Prieska station to Vioolsdrift along the reaches of the Lower Gariep River. This is again due to irrigation return flows and losses from evaporation along the river.

Local Water recourses and social needs

Three major areas within the vicinity of the study area receive water directly from the Gariep River, namely Pofadder, Witbank and Onseepkans. Both Pofadder and Aggeneys are supplied by the **t**he Pelladrift Water Supply scheme of the Pelladrift Water Board. The combined projected water requirements for Aggeneys, Pella and Pofadder for the year 2030 is 5 640 000 kl per year, which is less than the allocation of 16 060 000 m^3/annum for which Pelladrift Water Board are authorised to abstract from the Gariep River. The Onseepkans irrigation area is supplied through a canal on the left bank of the Gariep River. Witbank is supplied with raw water, which is abstracted from the Gariep River using submersible pumps and then purified using a solar/diesel powered package water treatment plant.

5.6.2. Present Ecological State of the Gariep River

The Present Ecological State of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The Present Ecological State scores (PES) for the drainage lines and the rivers in the study area were rated as follows (DWS, 2014 – where C = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
3349	C	High	High

It is thus evident systems are largely functional. These systems although dry then support the downstream areas and the respective Ecological Importance and Ecological Sensitivity Scores were rated as HIGH.

However, the DWS, 2014 results would seem to be an over estimation when considering the degree of habitat fragmentation that has already occurred, thus the Ecological Importance (EI) & Ecological Sensitivity (ES would be rated as moderate within the study area.

5.6.3. Regional Aquatic Environment

The ecology in the Lower Gariep sub-basin is dominated by the presence of dams and irrigation water use along most sections of the Gariep River. Increased populations of invasive alien plant species contribute significantly to land degradation in the sub-basin (ORASECOM, 2007). Growing numbers of Mesquite (*Prosopis spp*.) are also affecting the more arid part of the Lower Gariep River and the prevalence of dense stands of alien species on river banks and floodplains have reduced basal vegetation cover, causing erosion of the top clayey soil layers (ORASECOM, 2007). However certain unique features such as the Onseepkans Falls and three fish species with conservation concern are found in close proximity to the proposed site in the Gariep River. Abstraction from this resource could then place additional pressures on these, together with any expected return flows from the facility.

The Gariep River system as a whole is relatively poor in indigenous freshwater fish species diversity. Presently, eight fish families are represented by 22 species. Five of the six endemic Gariep River fish species occur in this lower river section, of which one, Namaqu Barb (*Barbus hospes*), is unique to the Gariep River section between Aughrabies Falls and the Gariep River Mouth. Three of the five endemic species, *B. hospes*, Largemouth yellowfish (*Labeobarbus kimberleyensis*) and Rock catfish (*Austroglanis sclateri*) are Red Data listed. Although the other two endemics, Smallmouth Yellowfish (*Labeobarbus aeneus*) and Gariep River mudfish (*Labeo capensis*), are fairly abundant and thus appear not to be threatened, they remain of concern because of their endemic status.

The invertebrate populations appear to be rather homogenous throughout the entire length of the Gariep River and are described as mostly unpredictable, due to the erratic nature of the system

5.7. Social economic profile

The proposed site for the Paulputs CSP Project is located in the Khai-Ma Local Municipality which falls within the greater Namakwa District Municipality in the Northern Cape Province.

5.7.1. Regional context:

Northern Cape Province: The vast and arid Northern Cape is the largest province in South Africa. The capital is Kimberley. Other important towns are Upington, Springbok, Kuruman, and De Aar. The province lies to the south of its most important asset, the Gariep River. The Northern Cape is rich in minerals, with mining contributing nearly a quarter of the GDP. The economy of a large part of the Northern Cape, the interior Karoo, depends on sheep-farming. In the Gariep River Valley, especially at Upington, Kakamas and Keimoes, grapes and fruit are cultivated intensively. Wheat, fruit, peanuts, maize and cotton are produced at the Vaalharts Irrigation Scheme near Warrenton. The Northern

Cape has been identified as the area with highest potential for solar renewable energy generation, with high solar radiation levels and the availability of vast tracts of land.

Namakwa District Municipality (NDM: Namakwa District Municipality is one of five districts in the Northern Cape Province. Geographically, the NDM constitutes a large area of approximately 126 747km^2, making it the largest District in South Africa. Namakwa DM is characterised by an undiversified economy, with over reliance on a primary sector activity being mining at 52.36% Wholesale and retail trade, catering and accommodation is the next largest GDP contributor, at 13.2%, followed by finance and business services (7.87%), general government services (6.74%) and community, social and personal services (5.96%). The area also has a competitive advantage in the renewable energy industry, in that wind, solar, wave and nuclear power have all been identified as potentially successful in the District

5.7.2. Local context

The proposed site falls within the Khai-Ma Local Municipality (KMLM). The main towns in the KMLM include Pofadder, Aggeneys, Pella, Witbank, and Onseepkans. The KMLM has four main economic sectors: livestock grazing, mining, agriculture and tourism. The two emerging sectors are renewable energy and conservation and ecological restoration. The main economic activities is in Aggeneys, granite works and farming along the Gariep River.

Baseline description of the social environment in the KMLM

» Population

The population for KMLM is estimated at 12 465 people. The municipality is sparsely populated (+/- 0.7 person/km2); most people are settled in its five towns (Aggeneys, Onseepkans, Pella, Pofadder and Witbank). Pofadder, the main town located near the proposed site in the KMLM is a very small town with an important local economic centre in the region

» Population groups

KMLM has a total population of 12 465, of which the population breakdown consists of 75.1% coloured and 17.6% are black African. Afrikaans is the most prominent spoken language in the KMLM.

» Age composition and gender differentiation

The age structure of a population is extremely important for planning purposes. Table 5.5 indicates the age and sex profile of citizens living in the KMLM.

Table 5.5: Age distribution

2011	KMLM		
	Male	Female	Total
0-14	13.4%	12.3%	**25.9%**
15-24	9.7%	8.7%	**18.4%**
25-64	27%	23.4%	**50.4%**
65+	2.2%	3.3%	**5.5%**

Generally the population can be regarded as having a high dependency ratio; with 7.39% of the population over the age of 65 and 25% are under 15 years. The latter youth group will be demanding education, housing and jobs in the near future

» Education levels

Education plays a pivotal role in community development. It provides a set of basic skills for development, creativity and innovative abilities. The level of education influences growth and economic productivity of a region. Table 5.6 indicates the adult education levels (individuals aged 20 years and older) of citizens residing in the KMLM.

Table 5.6: Education levels

2011	KMLM
No Schooling	2%
Some Primary	43.1%
Completed Primary	7.1%
Some Secondary	34.4%
Completed Secondary	9.8%
Higher Education	1.2%
Not Applicable	2.5%

» **Employment:**

There is an unemployment rate of 22.1% in the KMLM. There is also a total of 23.6% youth unemployment rate in KMLM. Table 5.7 demonstrates that there is human capital available for any kind of work in the KMLM, there is also room for training and developing young and economically active people in occupations in the relevant fields needed. This could increase the employment level of the area.

Table 5.7: Employment status

2011	KMLM
Employed	4600
Unemployed	1304
Discouraged work seeker	322
Not economically active	2327

» Income levels:

The average household incomes of the LM are as follows:

- » Within the KMLM 56% of household income falls within the poverty level
- » 39.1% of the KMLM households earn a middle income salary;
- » 4.9% of the KMLM households earn a high income.

The high poverty level has social consequences such as not being able to pay for basic needs and services. The skill levels are less likely to improve unless education levels improve which will lead to more skilled people which will in turn lead to the opportunity to earn higher income levels.

» Health

NDM official figures show that 5.1% of the population have HIV/AIDS and this is continually growing as well as the statistics may be higher due to a lack of accessible testing facilities in the municipality. According to the Department of Health, Namakwa District the satellite facilities are understaffed and only three professional nurses serve all the clinics within the area.

» Households and access to Services

There are 3 796 households in the KMLM, with an average household size of 3.2 persons per household. According to the KMLM IDP 2012-2017 there is a backlog of basic service delivery and improvement of existing infrastructure is required.

» Economic Profile

The main economic activities within the NDM are agriculture and mining. Stock farming in the District includes sheep, cattle and goat farming and is the key contributor to the agricultural sector. The Gariep River plays a key role in the regions agricultural activities and alluvial diamond mining activities. The highest number of individuals in the NDM is employed within the agriculture, hunting, forestry and fishing sector followed by the mining and quarrying sector. The KMLM has four main economic sectors: livestock grazing, mining, agriculture and tourism. The two emerging sectors are renewable energy and conservation and ecological restoration.

Areas of influence around the site

The direct area of influence is a project's area of influence that extends to a 50km radius from the project site. Renewable energy projects under the Renewable Energy Independent Power Producer Procurement programme (REIPPP) are obliged to make a real contribution to local economic development in the area. The settlements within the project's direct area of influence include Onseepkans, Pofadder and Pella.

The indirect areas of influence extends to all areas that will be indirectly affected by the proposed development. These include road users that use the N14 or R358 on a frequent basis as well as road users that utilise the secondary access road to access their farms. Construction vehicles and trucks will be utilising these roads during the construction phase of the development, which will increase the traffic and may increase the wear and tear on these roads. The development will also have an indirect effect on the town's local residents; with influx of in-migrants and growth in the local economy. Another indirect area of influence may be the tourism industry in the local area. The area is developed around sense of place, natural beauty and natural resources. The most significant tourism activities in the area include eco-tourism and heritage sites.

5.7.3. Impacted and Adjacent Landowners

There are seven impacted landowners that are likely to be affected by the construction of the proposed water pipeline.

- » **Farm Vaal Koppies RE/80:** The water pipeline servitude traverses the southern corner of the farm.
- » **Farm Paardeneiland RE/90:** The water pipeline route along the R357 traverses the northern portion of this impacted farm.
- » **Farm Paardeneiland 1/90:** The proposed water pipeline route along the R357 traverses the northern portion of this impacted farm.
- » **Farm Astof 2/421:** The proposed water pipeline route along the R357 is located along the north east boundary of this farm.
- » **Farm Vrugbaar RE/422:** The proposed water pipeline route will predominantly run along the eastern boundary of this farm.
- » **Farm Afstof RE/421:** The proposed water pipeline route will predominantly be located long a small portion on the north east corner of Farm Afstof RE/421.
- » **Farm Paardeneiland 1/84:** The proposed water pipeline is located along the western boundary of the farm.

Apart from the area along the banks of the Gariep River where irrigation takes, the Khai-Ma Local Municipal area has a low agricultural potential and is characterised by livestock (sheep and cattle) farming. Majority of the study area has a low number of farmsteads that are sparsely populated. Farmsteads occur within the study area and within the surrounding areas. There are five adjacent landowners that are likely to be affected by the proposed CSP facility and associated infrastructure, these include:

- » Remaining portion of Farm Vaal Koppies 80, is located north of the proposed development.
- » Portion 1 of Farm Scuit-klip, located east of the proposed site.
- » Portion 6 of Farm Konkoonsies 91 is located south west of the proposed site
- » Remaining portion of Farm Paardeneiland 90 is located north west of the proposed site.
- » Portion 1 of Farm Konkoonsies 91, is located south of the proposed site.

Figure 5.20 provides an overview of the location of these adjacent farms in relation to the site.

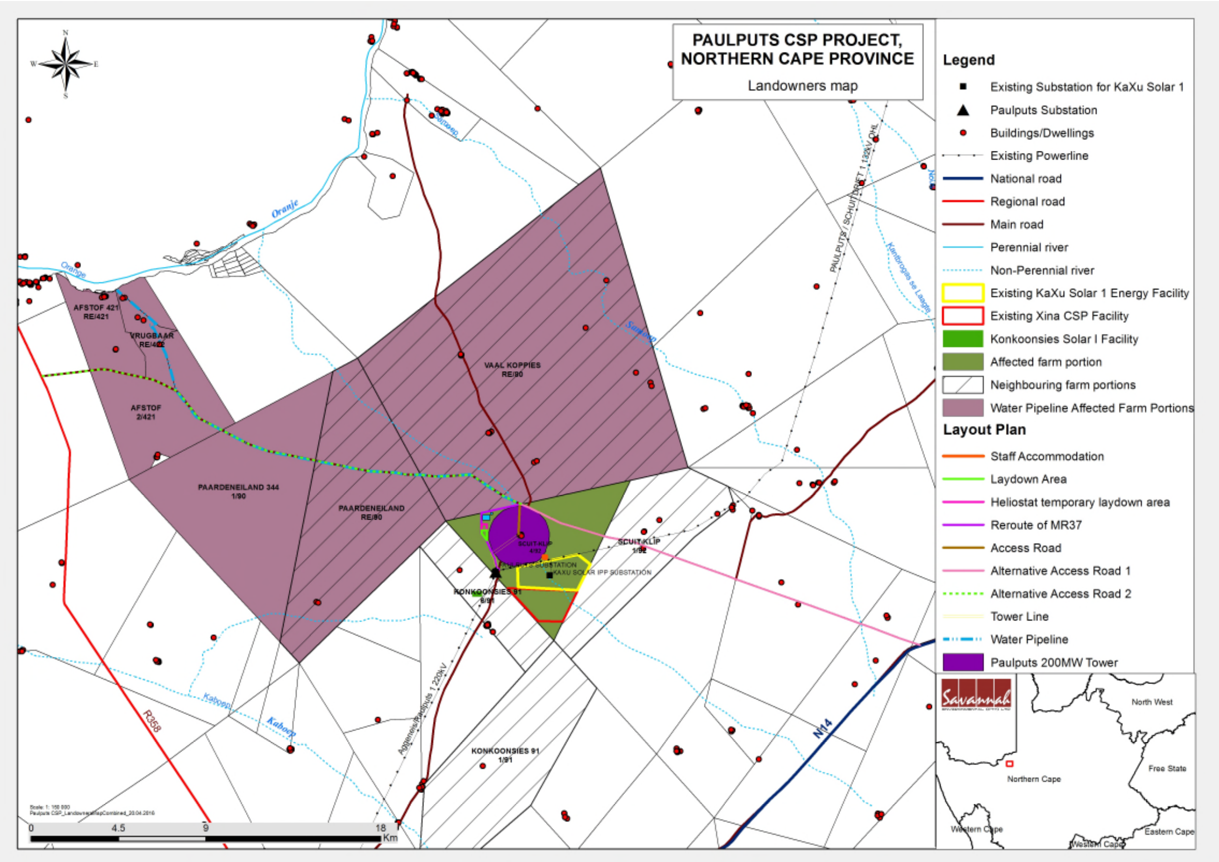

Figure 5.20: Paulputs CSP facility- landowner's map

5.8. Avifauna

During the surveys a total of 29 species were recorded and a total of 1341 individual birds were recorded. Only one species of conservation importance was recorded during the study namely, the Maccoa Duck (*Oxyura maccoa*). The Maccoa Duck was recorded to the south of the study area, flying towards the evaporation ponds at the Kaxu facility (refer to Table 5.8).

Table 5.8: Avifauna species diversity on site during the study

Full Name	*Scientific Name*	Total number of individuals recorded
South African Shelduck	*Tadorna cana*	35
Maccoa Duck	*Oxyura maccoa*	5
Lanner Falcon	*Falco biarmicus*	4
Namaqua Sandgrouse	*Pterocles namaqua*	54
Rock Dove	*Columba livia*	33
Speckled Pigeon	*Columba guinea*	25
Cape Turtle Dove	*Streptopelia capicola*	17
Laughing Dove	*Streptopelia senegalensis*	25
Namaqua Dove	*Oena capensis*	14
Red-faced Mousebird	*Urocolius indicus*	78

Full Name	Scientific Name	Total number of individuals recorded
Red-capped Lark	*Calandrella cinerea*	21
Sabota Lark	*Calendulauda sabota*	16
Spike-heeled Lark	*Chersomanes albofasciata*	149
Pied crow	*Corvus albus*	40
Familiar Chat	*Cercomela familiaris*	27
Ant-eating Chat	*Myrmecocichla formicivora*	19
Karoo Scrub Robin	*Erythropygia coryphoeus*	10
Chestnut-vented Tit-Babbler	*Sylvia subcaerulea*	5
Zitting Cisticola	*Cisticola juncidis*	12
African Pied Wagtail	*Motacilla aguimp*	27
Bokmakierie	*Telophorus zeylonus*	9
Cape Sparrow	*Passer melanurus*	187
Southern Grey-headed Sparrow	*Passer diffusus*	142
White-browed Sparrow-Weaver	*Plocepasser mahali*	121
Sociable Weaver	*Philetairus socius*	221
Yellow Canary	*Crithagra flaviventris*	31

During the avifauna surveys, data was collected on the number of species and abundance at each of the vantage point surveys. Due to the homogeneity of the vegetation throughout the study area there was no significant difference in the species richness or species diversity at any of the vantage points. Noteworthy information pertinent to the study was also recorded, namely flight height.

Avifauna flight height

The average flight height data rounded to the nearest whole number collected during the surveys are represented graphically in Figure 21. It can be noticed that most of the species recorded in the area fly at an average height of 7m, while the average minimum height is 0.5m and the average maximum height is 12.1m. What is noticeable is that the vast majority of species show and average flight height (based on the actual flying height excluding the ground level data) of below 10m. This is likely due to the vegetation being low shrubs and grass with few or no trees, all feeding, nesting and protection against predation thus occurs at very low altitudes.

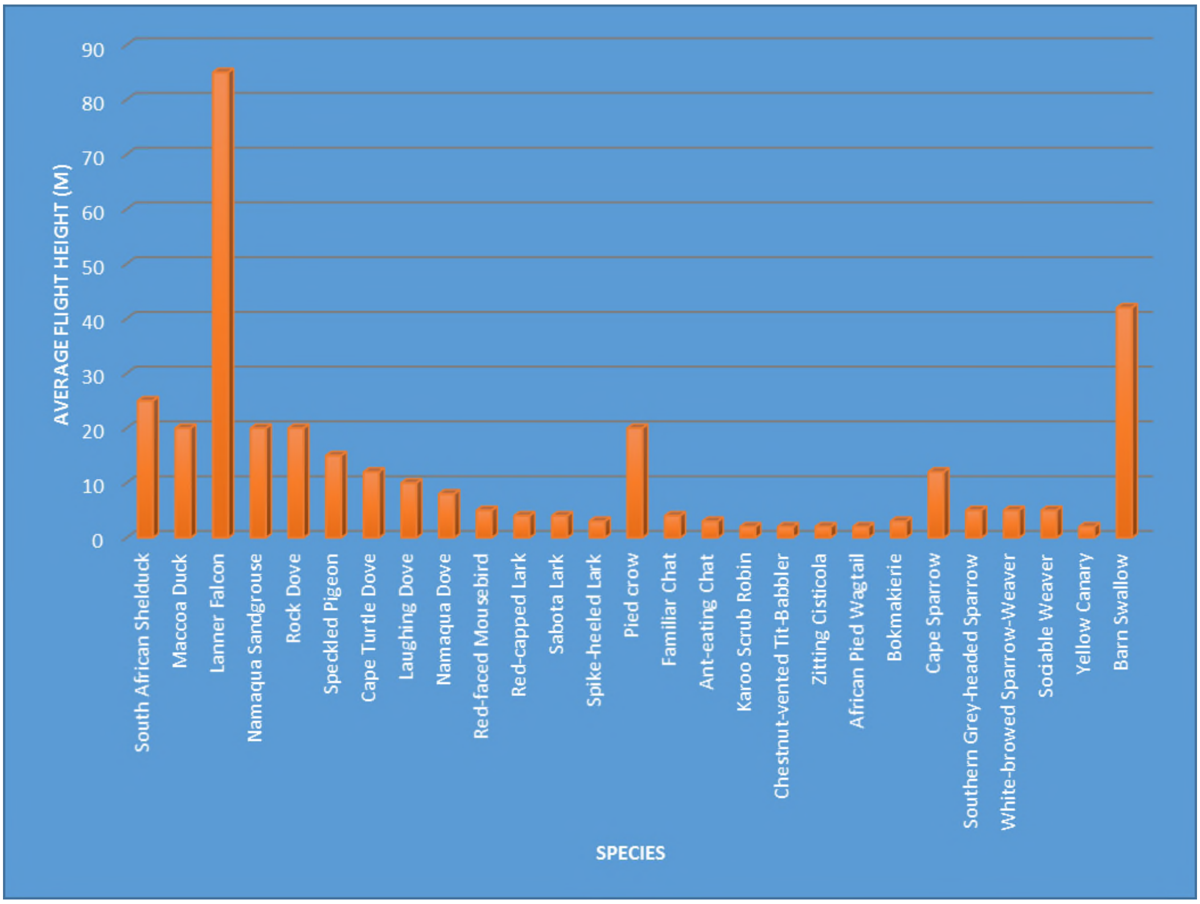

Figure 5.21: Average flight heights per species according to data collected during the surveys

Important Bird Areas

The Matheus-Gat IBA borders on the southern border of the proposed development site. This IBA is approximately 66 670ha in size and stretches from north east of Pofadder to south of the study area (**Error! Reference source not found.**).

The Mattheus-Gat IBA is one of a few sites protecting both the Red Lark (*Certhilauda burra*; globally Vulnerable) and Sclater's Lark (*Spizocorys sclateri*; near-threatened). Both are endemic species with restricted ranges. Red Lark inhabits red sand dunes and sandy plains with a mixed grassy dwarf shrub cover while Sclater's Lark occurs erratically on gravel plains. The area around the IBA has been poorly atlassed, but the IBA potentially supports 16 of the 23 Namib-Karoo biome-restricted assemblage species and a host of other arid-zone birds. It is seasonally important for nomadic larks, such as Stark's Lark, and sparrow-larks, which are abundant after good rains.

IBA trigger species include globally threatened Red Lark, Sclater's Lark, Kori Bustard *Ardeotis kori*, Ludwig's Bustard *Neotis ludwigii* and Black Harrier *Circus maurus,* and regionally threatened Karoo Korhaan *Eupodotis vigorsii*. Biome-restricted species include Stark's Lark, Karoo Long-billed Lark *Certhilauda subcoronata*, Black-eared Sparrow-lark *Eremopterix australis*, Tractrac Chat *Cercomela tractrac*, Sickle-winged Chat *C. sinuata*, Karoo Chat *C. schlegelii*, Layard's Tit-Babbler *Sylvia layardi,* Karoo Eremomela, *Eremomela gregalis*, Cinnamon-breasted Warbler *Euryptila subcinnamomea,* Namaqua Warbler *Phragmacia substriata*, Sociable Weaver *Philetairus socius,* Pale-winged Starling *Onychognathus nabouroup* and Black-headed Canary *Serinus alario*. Additional priority species in the IBA include Martial Eagle *Polemaetus bellicosus*, Secretarybird *Sagittarius serpentarius*, Verreauxs' Eagle3*Aquila verreauxii*, Booted Eagle *Hieraaetus pennatus*, Black-chested Snake Eagle *Circaetus pectoralis*, Cape Eagle-Owl *Bubo capensis*, and Spotted Eagle-Owl *B. africanus*.

It must be noted that none of these species were recorded during the extensive avifauna surveys that were conducted on site. It must also be noted that the vegetation to the south of the study area is far more accommodating to avifauna than the vegetation on site.

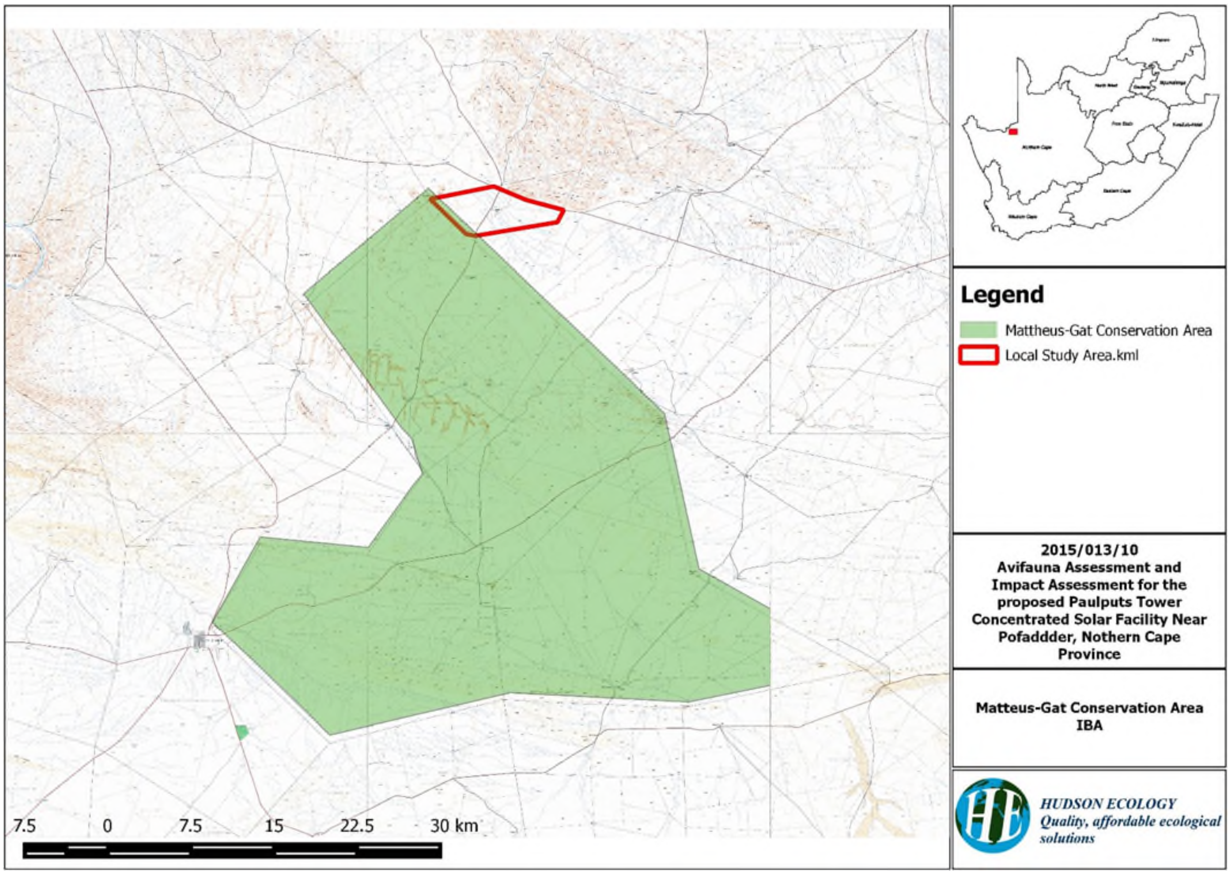

Figure 5.22: Mattheus Gat-Conservation Area in relation to the study area

ASSESSMENT OF IMPACTS ASSOCIATED WITH THE PAULPUTS CSP PROJECT CHAPTER 6

The proposed Paulputs CSP Project will have a contracted capacity of up to 200MW. Molten salt technology will be utilised to allow for at least 5 hours of storage to meet the requirements of the Department of Energy. The Paulputs CSP Project will consist of a field of heliostats and a central receiver, known as a power tower. The Paulputs CSP project will be constructed over an area of approximately 900 ha in extent, and include *inter alia* the following infrastructure:

» Molten salt tower up to 300m in height with surrounding heliostat field
» Power island including salt storage tanks, steam turbine generator, heat exchangers, and dry cooled condenser
» Cabling linking the power block to the on-site substation
» Water supply abstraction point located at the Gariep River close to Onseepkans
» Filter and booster station at abstraction point
» Water supply pipeline along R357 Onseepkans Road to the site
» On-site lined ground water storage reservoir and various steel water tanks
» Lined evaporation ponds
» Packaged water treatment plant and associated chemical store
» Auxiliary wet cooled chiller plant
» Control room and office building
» Heliostat assembly building and workshop
» Access roads
» On-site substation and overhead power line

The establishment of a CSP facility project is comprised of various phases, including pre-construction, construction, operation, and decommissioning. The **construction activities** involved for the proposed CSP plant will include the following:

» Conduct pre-construction surveys.
» Establishment of access roads.
» Undertaking site preparation (i.e. including clearance of vegetation; and stripping and stockpiling of topsoil).
» Transportation of equipment to site and establishment of construction camps; laydown areas (i.e. including storage facilities, batching facilities and mirror assembly plant).
» Assemble and construct heliostats.
» Construct power-island and substation.

» Establish and implement a stormwater management plan.
» Undertake site rehabilitation.

The construction phase is expected to take approximately 3 years.

The **operation activities** will include the following:

» The operation of the CSP facility.
» The operation of the power block.
» The abstraction, treatment, pumping and storage of water for use in the facility.
» Wastewater handling.
» Site operation and maintenance.
» Operation of the power line

The operation phase is expected to extend beyond 20 years.

The **decommissioning activities** will include the following:

» Removal and disposal of project infrastructure.
» Site rehabilitation.

Environmental impacts of the proposed Paulputs CSP Project and its associated infrastructure are expected during all phases of the facility life cycle. The majority of the environmental impacts associated with the facility will occur during the construction phase. Environmental issues associated with **construction and decommissioning** activities of the CSP Project are similar and include, among others:

» Impact on ecology (flora, fauna and avifauna) and loss of protected species.
» Potential loss of agricultural land.
» Impact on heritage resources.
» Social impacts (positive and negative).
» Visual impacts.

Environmental issues specific to the **operation** of the CSP Plant include, among others:

» Visual impacts (intrusion, negative viewer perceptions and visibility of the facility).
» Avifaunal Impacts (fatalities due to collision with the heliostats and as a result of flying through the focal point; impacts associated with the power line).
» Social impacts (positive and negative).

These and other environmental issues were originally identified through a scoping evaluation of the proposed Paulputs CSP Project (Savannah Environmental, 2015). Potentially significant impacts have now been assessed during this EIA Phase. This EIA process has involved key input from specialist consultants, the project developer, and from key stakeholders and interested and affected parties. The significance of impacts associated with a facility of this nature is project specific, and therefore impacts may vary significantly between facilities.

The **cumulative impacts** associated with the proposed facility are expected to be associated with two other CSP facilities and a Transmission Substation on the same farm portion, as well as the presence of two other smaller PV developments within the area. The potential cumulative impacts associated with the project are expected to be associated predominantly with the visual impact, impacts on ecology and avifauna in the surrounding area due to loss of habitat, and the social environment within the vicinity of the project and the other similar developments within the region.

This chapter serves to assess the identified potentially significant environmental impacts associated with the development of the proposed Paulputs CSP Project, and to make recommendations for the management of these impacts for inclusion in the draft Environmental Management Programme (refer to Appendix K). This assessment is based on the proposed facility layout provided by the applicant (refer to Figure 6.1). Cumulative impacts are assessed within Chapter 7.

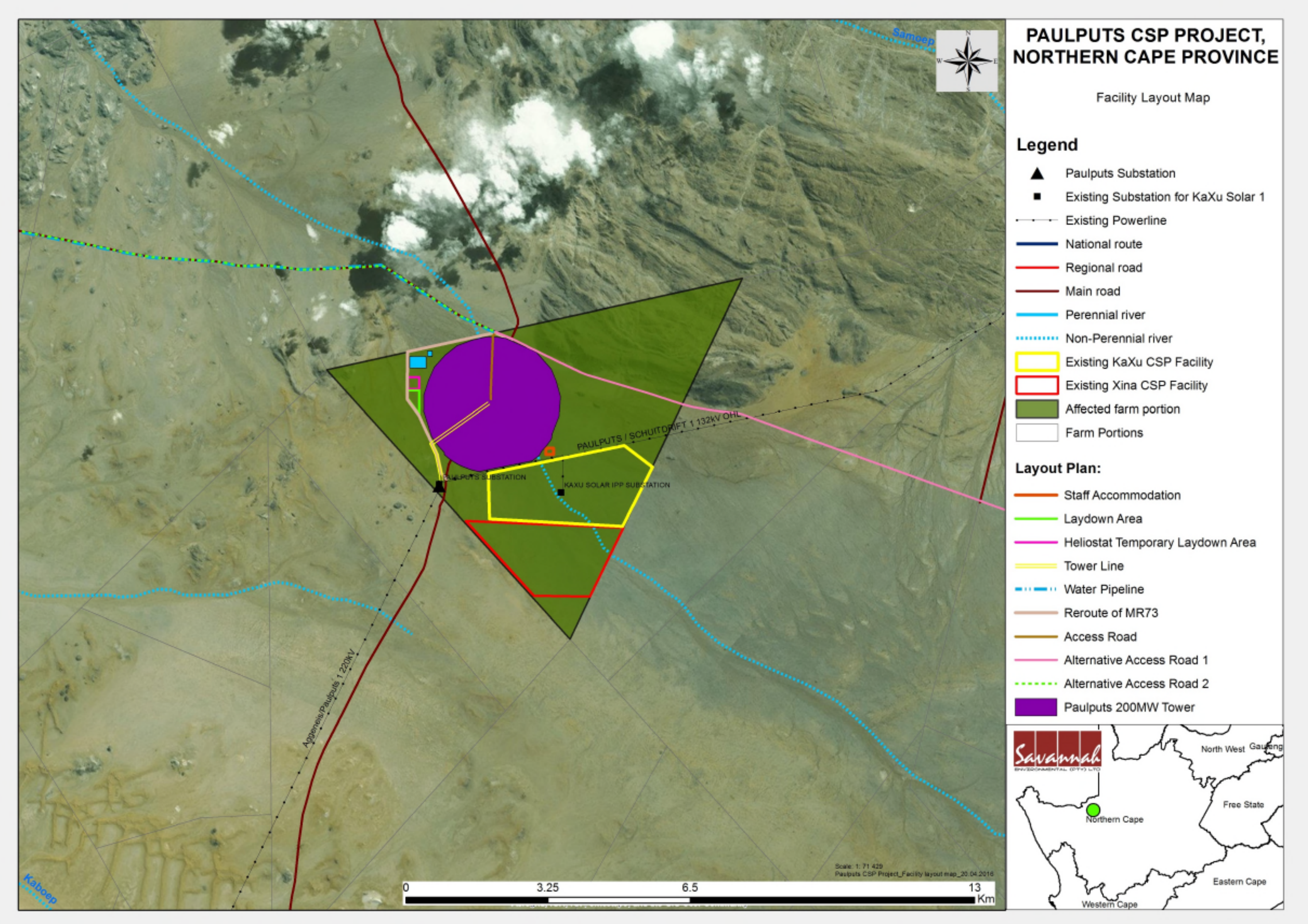

Figure 6.1: Map showing the preliminary layout of the 200MW Paulputs CSP Project and associated infrastructure

6.1. Impacts on Ecology

The expected impact on flora and terrestrial fauna as a result of the proposed development will be associated with the loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to Appendix D- Ecology Report for more details).

6.2.1. Results of the Ecological Study

A total of 13 plant species of conservation concern were determined to possibly be occurring in the study area. Of these, there were five species that could occur in habitats that are available in the study area. Two of these are listed as Vulnerable, one as Near Threatened and two as Declining. One of the vulnerable species, *Aloe dichotoma*, was recorded in the study area and could occur anywhere within the hills in the study area, or in rocky areas in Bushmanland Arid Grassland. The one Declining species, *Acacia erioloba*, also a protected tree, has a high probability of occurring in the study area, while *Hoodia gordonii* was recorded in the study area in a number of places.

Herpetofauna diversity is generally low in the study area as can be expected in arid areas with approximately 45 reptile species occurring in the area. Ten species were confirmed during the site surveys. No exotic herpetofauna species are expected to occur on the study site. Two of the species recorded, namely *Naja nivea* and *Cordylus polyzous,* are considered endemic to southern Africa. It was noted that there is a high similarity between the species occurring in the different vegetation communities. Most of the expected species in the area are common and widespread, with only the Black-necked spitting Cobra (*Naja nigricollis*) being classified as rare.

As expected, amphibian diversity is low as the study area is a fair distance from any permanent open water bodies (approximately 30km). Only seven species are expected to occur in the study area, and during the wet and dry season surveys undertaken for this study no amphibian species were recorded.

Of the 67 mammal species expected to occur in the study area 16 were confirmed during both the site visits. Mammal diversity is low as can be expected in arid areas. Evenness is high, indicating that there is a high similarity between the species occurring in the different vegetation communities. A number of bat species are known to occur in the region. Bat species recorded in the area during the surveys are *Rhinolophus darlingi, Neoromicia capensis, Pipistrellus rueppelli* and *Tadarida aegyptiaca* of these species only *Tadarida aegyptiaca* is likely to be attracted to the infrastructure for roosting purposes.

The ecological function of the study area can generally be described as moderate for the majority of the study area, although this does vary from low (in the highly transformed areas) to high in the more inaccessible or unutilisable areas. Areas in which overgrazing and clearing have taken place, as well as areas in which settlements have been established are considered as areas where ecological function is reduced (refer to Figure 5.10)

Areas that have been severely disturbed such as settlements are considered of low conservation importance. These areas are, however, quite small in relation to the overall study area (<30% of the study area). Areas that have been disturbed by farming are considered of moderate conservation importance due to the fact that rehabilitation of these areas is possible. The natural areas are considered of very high conservation importance due to the presence of Red Data species in these areas (refer to Figure 5.11).

6.2.2. Description of Ecological Impacts

The impact assessment determined that 8 main impacts are likely to occur due to the development, namely:

» Vegetation Clearing and subsequent loss of species of concern;
» Spillage of harmful or toxic substances;
» Habitat degradation and fauna impacts due to dust;
» Effects on local migrations;
» Increased prevalence of exotic invasive species;
» Increased erosion; and
» Impact of attracting insects and subsequently bats to the tower due to artificial light at night.

The majority of these impacts are expected to occur during the construction phase.

Due to the fact that there are already three existing solar facilities in the area, as well as the fact that there are more planned, the cumulative impacts of the impacts general to solar facilities are likely to be of a higher order of magnitude than the significance ratings given here. It must however be noted that none of the other solar facilities are tower facilities and impacts unique to tower facilities are therefore unlikely to have a higher cumulative impact.

6.2.3. Impact tables summarising the significance of the ecological impacts (with and without mitigation)

Nature of impact: Vegetation clearing during construction is likely to be the greatest impact on the vegetation communities affected by the proposed development and activities. All vegetation communities are likely to be affected by this impact, with the *Stipagrostis ciliata – Aristida congesta* open grassland vegetation community being the vegetation community with the most vegetation cleared. Habitats affected are mainly those with moderate ecological integrity and moderate conservation importance.

High, moderate and low ecological integrity and -conservation importance of the areas that will be affected by this impact are low to moderate, however species of concern (such as *Hoodia gordonii, Boscia foetida and Aloe dichotoma*) may be impacted upon.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Site only (1)
Duration	Permanent (5)	Long term (4)
Magnitude	Moderate (5)	Minor (2)
Probability	Definite (5)	Highly probable (4)
Significance	**Medium (55)**	**Low (28)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- Vegetation clearing is inevitable and unavoidable. Mitigation of this impact can, however, be implemented by keeping the area cleared to a minimum and careful removal and replanting of plants and trees of conservation importance. Seed collection, propagation and re-planting of saplings to make up for lost species should also be considered.
- Areas of high conservation importance and/or ecological integrity should be avoided or kept to a minimum and any species of concern relocated, or demarcated to prevent destruction, before the ground clearing begins.
- Ground clearing should take place at the beginning of winter in order to minimise impacts on young of burrowing animals and nesting birds.
- The impact of vegetation clearing is likely to be a long term impact, but through careful planning and rehabilitation can be greatly reduced. Changing the rerouting of the M73 to the east of the infrastructure instead of through areas of greater biodiversity importance to the west of the infrastructure will reduce this impact.
- Topsoil should be kept for revegetation once construction is completed.

Residual Impacts:

Localised loss of vegetation

Nature of impact: Harmful or toxic substances that may affect the biota of the area if they were to enter the system include: diesel, hypoid oil, motor oil, polluted water used during the operations and chemicals transported to and from site and used in the operations. Habitats affected are mainly those with moderate ecological integrity and moderate conservation importance. The spillage of harmful or toxic substances may impact on the fauna and flora of the area in a number of ways. Direct pathways include ingestion of the substances by fauna species resulting in toxicity in that individual, uptake of toxic chemicals by the roots plants which may lead to toxicity in the plants and the chemicals entering the plant or animals system due to contact (through the skin, leaves or stems). Indirect pathways include the ingestion of contaminated plants or animals by other herbivorous or predatory species. The predation of contaminated animals by both other animals and humans is a common occurrence during chemical contamination due to these animals being sluggish, and less likely to escape predation, due to chemical toxicity. Impacts on high ecological integrity and -conservation importance areas are low to moderate, however species of concern (such as *Hoodia gordonii, Boscia foetida* and *Aloe dichotoma*) may be impacted upon.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Site only (1)
Duration	Long term (4)	Short term (1)
Magnitude	High (8)	Low (4)
Probability	Highly probable (4)	Very improbable (1)
Significance	**Medium (56)**	**Low (6)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: The spillage of harmful or toxic substances can be mitigated by the implementation of best practice management measures for the storage and handling of all hazardous substances as well as through the implementation of a sound emergency spillage containment plan, which can be implemented as soon as a spill of harmful or toxic substances occurs.		

Nature of impact: Increased dust will occur in all areas where vegetation is cleared. Dust will be caused by excavation, and construction. Dust in the area will be greatly increased due to the dry weather conditions and the nature of the soil in the area. Dust settling on plant material can reduce the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment.		
	Without Mitigation	**With Mitigation**

Extent	Local (2)	Site only (1)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Definite (5)	Improbable (2)
Significance	**Medium (50)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

The following methods can be used to prevent conditions conducive to dust generation and suppress dust should it occur:

» Dust suppression on roads by water bowsers or the use of other appropriate dust suppressants, if no water is available.
» Adjacent paved areas and roads used for construction traffic can be maintained free of tracked soil or fill materials. At minimum, paved traffic areas, can be cleaned on a daily basis by wet sweeping and/or washing. More frequent cleaning can be provided as necessary. Adjacent paved areas and roads can be left clean at the end of each day.
» Exposed excavations, disturbed ground surfaces, and unpaved traffic areas can be maintained in a moist condition.
» During non-working hours, the site should be left in a condition that will prevent dust from being generated. Security fencing should be installed and maintained to prevent access and additional disturbance.
» Provide temporary cover and daily maintenance for soil stockpiles and keep active surfaces moist.
» A temporary decontamination pad and/or a stabilized construction entrance should be provided at active site entrance/egress locations to keep adjacent paved areas clean.
» Construction activities should be conducted using methods that minimize dust generation.

The following Best Management Practices (BMPs) can also be followed to aid in minimising and control dust emissions at the Site to the greatest extent possible:

» All onsite traffic must be restricted to specific designated roads. Off-road travel must only be authorized on a case-by-case basis (e.g. access to a remote monitoring well, etc.).
» Traffic speed must also be restricted to an appropriate level on all designated roads.
» All gravel roads must be considered as high potential dust source areas, and as such, should be a priority for dust controls utilizing water and/or other appropriate means.
» This plan can be in effect during all hours of operation at the site. During non-business hours, there can be no activities generating dust; therefore, dust control actions can be restricted to hours of operation only. However, as a best management practice, if high winds are evident at the close of a business day (or immediately prior to a weekend, holiday, etc.), site personnel should evaluate vulnerable areas and implement controls, as appropriate, to minimize off-hours

emissions
Residual Impacts: None

Nature of impact: Local migrations of fauna in the area may be affected during both the construction and operation phases by linear infrastructure, fences and buildings, due to these areas forming a barrier to migrating animals or reducing the chance of an animal surviving its migration due to collisions with vehicles on roads. Desert animals are particularly migratory due to variations in food and water availability, and species of concern may be affected by this impact. This impact is likely to be low due to the greatly reduced wildlife in the area as a result of previous disturbances in the area causing a greatly reduced species. Furthermore, many of the roads are already in use. The study area is recognised as an ESA due to being a migratory route, this requires further investigation.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Site only (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Improbable (2)
Significance	**High (65)**	**Low (20)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » The construction area and subsequent functional facility can be isolated by means of a chain link fence in order to prevent animals on local migrations entering the area and being killed. » Evaporation ponds should be fenced to prevent access by animals and reduce the risk of animals drowning in the evaporation ponds. » The effect of roads on local migrations can be mitigated by the installation of culverts at regular intervals along the roads and the installation of drift fences towards the culverts, although these methods may not eliminate the mortalities among migrating animals, they should greatly reduce the number of animals killed on roads. » A low speed limit can be strictly enforced in order to reduce collisions with animals on the roads.		
Residual Impacts: None		

Nature of impact: The fact that the area will be cleared for construction creates niches that can be colonised by exotic and/or invasive plant species. This is compounded by the fact that trucks and other heavy machinery often act as vectors for seeds of these species. Desert and semi-desert areas are very susceptible to invasion by exotic species due to the slow growth rate of indigenous vegetation due to low rainfall and this impact needs to be monitored and mitigated. Areas of high conservation importance and/or

ecological integrity should be avoided.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Site only (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Improbable (2)
Significance	**High (65)**	**Low (20)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » An exotic/invasive species monitoring and management plan should be put in place to manage exotic and invasive species. » Areas of high conservation importance and/or ecological integrity should be avoided.		
Residual Impacts: None		

Nature of impact: Increased erosion can eventually lead to the loss of vegetation and habitats for fauna species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Site only (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Improbable (2)
Significance	**High (65)**	**Low (20)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Rehabilitation of disturbed areas should be undertaken as soon as construction is completed in an area. » An erosion monitoring and mitigation plan must be put in place to help with the early detection of erosion and advising management on problem areas and remediation plans. » The implementation of a stormwater management plan and the management of stormwater to prevent large volumes of high energy water flowing over or off site will		

aid in mitigating impacts associated with erosion.
Residual Impacts: None

Nature of impact: Light shining against the tower during the operation phase (especially if it is painted white) will attract large numbers of insects at night especially during the wet season. This increase in insect activity may subsequently attract bats to the operational area. Bats are unlikely to be impacted upon through collisions with the heliostats and, because they will usually be at the plant at night, they are unlikely to be affected by solar flux. There is, however, the chance that they may use the tower as a roosting site and be flushed during the day when activity starts and then be injured.		
	Without Mitigation	**With Mitigation**
Extent	Regional (3)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Improbable (2)
Significance	**High (70)**	**Low (22)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Not illuminating the tower at night and thereby reducing the number of insects attracted would reduce the potential for the impact. » Painting the tower a darker colour (not white) should be considered so that any light shining on the tower is not so effectively reflected. » Closing up any openings and/or crevices that bats may use to roost in or gain entry to the tower would reduce the potential for the occurrence of bats at the facility. » Placement of bat boxes around the tower and rest of the plant to provide a more suitable and safer roosting area for bats that may choose to inhabit the area will reduce the potential for to bats to use the infrastructure fr this purpose. » Regular monitoring of the power facility for any signs of bat roosting or activity should be undetaken.		
Residual Impacts: None		

Impact Nature: Disturbance or persecution of fauna during the decommissioning phase may occur. The operation of heavy machinery and human presence at the site during decommissioning would impact fauna.		
	Without Mitigation	**With Mitigation**

Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (4)	Low (2)
Probability	Probable (3)	Improbable (3)
Significance	**Low (21)**	**Low (15)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes.	
Mitigation » Site access to be controlled and no unauthorised persons should be allowed onto the site. » The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. » Undesirable and problem fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location. An appropriate permit must be obtained for the relocation of fauna. » Any accidental chemical, fuel, and oil spills that occur at the site during decommissioning should be cleaned up in the appropriate manner as related to the nature of the spill. » No open excavations, holes or pits should be left at the site as fauna can fall in and become trapped. » All disturbed areas should be rehabilitated with a cover of indigenous grass.		
Residual Impacts: » With avoidance measures there should be no residual impact on fauna.		

Impact Nature: Alien plants are likely to invade the site as a result of disturbance created during decommissioning. This impact would be likely to persist from several years after decommissioning until such time as a cover of indigenous species has recovered. The area is however very arid and this limits which species would potentially invade the site.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Probable (3)	Improbable (3)
Significance	**Medium (30)**	**Low (21)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	

Mitigation
» Due to the disturbance at the site during decommissioning, alien plant species are likely to invade the site and a long-term control plan will need to be implemented for several years after decommissioning » Regular monitoring (bi-annual) for alien plants within the development footprint for 2-3 years after decommissioning. » Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. » Cleared and disturbed areas should be revegetated with a cover of indigenous grass or shrubs.
Residual Impacts
If alien species at the site are controlled, then there will be very little residual impact

6.2.4. Implications for Project Implementation

The ecological function of the study area can generally be described as moderate for the majority of the study area, although this does vary from low (in the highly transformed areas) to high in the more inaccessible or unutilisable areas. Areas in which overgrazing and clearing have taken place, as well as areas in which settlements have been established are considered as areas where ecological function is reduced.

Areas that have been severely disturbed such as where settlements occur are considered of low conservation importance. These areas are, however, quite small in relation to the overall study area (<30% of the study area). Areas that have been disturbed by farming are considered of moderate conservation importance due to the fact that rehabilitation of these areas is possible. The natural areas are considered of very high conservation importance due to the presence of Red Data species in these areas and the intrinsic importance of these areas. In keeping with the Precautionary Principle, a higher conservation importance is assumed when in doubt.

Provided the developer adheres to the recommendations provided in the environmental management plan impacts can be mitigated to an acceptable level and this area can be considered one of the few areas in the region that can constitute "acceptable and defendable loss" associated with this kind of development.

6.2. Impacts on Avifauna

Based on the information gathered, several impacts have been identified and will be quantified in sections below. These relate to both construction and operation of the facility. Potential impacts and the relative significance of the impacts are summarised below (refer to Appendix E - Avifaunal Report for more details).

6.5.1. Results of the Avifaunal Study

During the study a total of 29 bird species were recorded and a total of 1341 individual birds were recorded. Only one species of conservation importance was recorded during the study namely, the Maccoa Duck. This species was recorded to the south of the study area flying towards the Kaxu evaporation ponds. Secretarybird (*Sagittarius serpentarius*), Sclater's Lark, (*Spizocorys sclateri*), Kori Bustard (*Ardeotis kori*) and Ludwig's Bustard (*Neotis ludwigii*) appeared absent from the study area. All these species are likely to be resident species and the fact that they were not recorded does strongly suggest that they are in fact not present within the study area. The fact that many of the species of concern appear to be absent from the study area further reduces the likely impacts of the facility.

One of the main aspects of avifauna behaviour noted was that 78% of bird species, and 98% of individual birds, recorded during the study flew at an average height of 6m (rounded off to the closest meter) and were observed at an average minimum height of 0.5m and an average maximum height of 12m. When applied, to what was learned about the CSP facility, this means that most resident bird species usually fly below the height of the heliostats, this was confirmed during the vantage point surveys at another CSP facility, where most species were found to be active below the heliostats and very few species flew over them. Another noteworthy observation was the lack of activity in the open field areas between 11:00 and 16:00 every day, during this time most species were found to be active in the riparian or wash areas traversing the study area. As was expected, species activities were restricted to foraging and feeding or searching for food. No nesting or mating behaviour was observed.

6.5.2. Description of the Avifaunal Impacts

Although there may be considerable impact due to the clearing of vegetation and the large footprint required for commercial-scale energy production, which would refer to the habitat loss and disturbance created during the construction phase of the facility, birds are the most mobile of vertebrate species and there is a considerable amount of the same vegetation in adjacent areas to which avifauna will move. Furthermore, in this case, the vegetation of the area is very low and revegetation the area of the heliostat field can result in recovering some of the lost vegetation. Secondary impacts relate to the operation of the facility and include avian mortality due to direct interactions with the facility and its associated infrastructure.

Based on the information gathered, several impacts have been identified and will be quantified in sections below:

- » Impact on local bird community due to habitat loss;
- » Impact on local bird community due to disturbance;
- » Impact on birds attracted to solar thermal plant infrastructure;
- » Birds may be singed or killed flying into the focal point;
- » Collision of birds with infrastructure associated with the CSP facilities;
- » Collision of birds with the associated power line; and
- » Electrocution of birds on associated power line tower structures.

6.5.3. Impact tables summarising the avifaunal impacts (with and without mitigation)

Impact Nature: Vegetation clearing for construction of the CSP facility, access roads and power lines Impact on local bird community due to habitat loss from the construction of the CSP plant and associated infrastructure including power lines. In order for solar energy facilities to be commercially viable, they require large tracts of land, in this case ±900ha. It can therefore be assumed that habitat will be lost during the establishment of the facility and its associated infrastructure (including clearing for access roads and power lines). Habitat loss reduces the carrying capacity of a habitat, often resulting in localised population declines. Such habitat loss can impact on local as well as, to a lesser degree, migratory species. The general nature of the study area (already relatively disturbed, and extremely uniform throughout the wider area) means that this is not likely to impact significantly on the avifauna of the area.		
	Without Mitigation	**With Mitigation**
Extent	Site only (1)	Site only (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Minor (2)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (28)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation		

» Where possible, avoid clearing vegetation in drainage channels or washes, where bird density and diversity has the potential to be higher (although this higher diversity was not recorded during the site visit). » If possible, the servitude of the power line exiting the site should follow existing roads and not cut across habitat. » All construction and maintenance activities must be undertaken in accordance with Eskom's Environmental Best Practise Standards. » The construction footprint and access roads should be restricted to within the development footprint.

Impact Nature: Impact on local bird community due to disturbance on site and in surrounding area during construction. Sensitive and threatened species are of most concern and particularly while breeding Disturbance from human activity, during the construction and operation phases, has the potential to modify bird behaviour on site. For shy and sensitive species, this may result in displacement or exclusion		
	Without Mitigation	**With Mitigation**
Extent	Site only (1)	Site only (1)
Duration	Short duration (2)	Medium-term (3)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (15)**	**Low (12)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation » Contractors need to minimise the amount of disturbance during the construction phase of the facility, by staying within the demarcated ±900ha construction area. » If an active nest of a large species is detected within the vicinity of the area to be disturbed, then all attempts made to minimise the amount of disturbance near it.		

Impact Nature: Impact of the proposed facility infrastructure on avifauna The facility will cover an area of ±900ha and will include a series of heliostats/mirrors which will reflect sunlight. Various opportunities for birds to make use of the infrastructure could be provided, thereby attracting birds to the site. These opportunities and possible impacts could include: » Openings at either end of the horizontal rotating cylinder - could provide ideal nesting sites, but may lead to a local reduction of fecundity of species due to the rotation of the cylinder causing eggs or chick to fall out of the nests. » Heliostats in the vertical position - very likely to cause collisions due to the fact

that, in this position, the mirrors give an illusion of an extension of the heliostat field behind the observer.

- Flat surfaces at the base of the tower - Any elevated flat surfaces are seen by many avian species as potential nesting sites.
- Colour of the tower - white light reflects ultraviolet light it is likely that any white areas will attract insects and consequently aerial insectivores.
- Focusing the heliostats above the tower during maintenance –may increase the likelihood of singeing or death of birds. When focussed on the central receiver there will be a "heat bubble caused by radiation of heat from the receiver. The radiation from the receiver will cause a gradually increasing "heat bubble" around the receiver which will be sensed by most birds before it is potentially fatal allowing birds to take evasive action. This radiating heat bubble will be a lot less distinct when the focal point is above the tower and this focal point may be perceived as a more sudden, potentially fatal, hotspot, thus not allowing birds to take evasive action in time.

	Without Mitigation	**With Mitigation**
Extent	Site only (1)	Site only (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very improbable (1)
Significance	**Low (16)**	**Low (8)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation

- Openings at either end of the horizontal rotating cylinder – The simplest way to mitigate this impact would be to seal the openings at each end of the cylinder. This can be done by tack-welding appropriately sized discs onto either end.
- Heliostats in the vertical position – the heliostats should be limited to being in the vertical position for as short a time as possible. The trucks which clean the heliostats should follow each other as close as possible and the heliostats returned to a static (horizontal) or focussed position as soon as possible after cleaning.
- Flat surfaces at the base of the tower – all ledges should be built or panelled so that they slope at an angle downwards to the outside to prevent nesting on these ledges.
- Colour of the tower– a neutral brown, concrete colour or grey would prevent the reflection of UV light and thus mitigate the possible impact of the white tower.
- Focusing the heliostats above the tower during maintenance – ideally the heliostats should be in one of three positions vertical (washing position – for as short a time as possible), static position or focussed in order to prevent the undetectable "hotspot" above the tower.

Impact Nature: Collisions with overhead power line

Collisions are one of the biggest single threat posed by overhead power lines to birds in southern Africa. In South Africa, bird collisions with power lines are a major form of unnatural mortality, affecting several threatened species as well as other species. The majority of species that are susceptible to collisions tend to be long-lived, slow reproducing species such as bustards, cranes, korhaans and various water bird species who are not the most agile flyers. Due to the slow reproductive nature of many of the susceptible species, long-term mortalities caused by collisions may result in future population's abilities to sustain themselves. Birds usually avoid the highly visible bundled conductors, but often fail to see the thin earth wires, with typical injuries resulting from collisions including broken necks and legs. Threatened species that have the potential to occur in the study area and that may be involved in collision events include:

- Secretarybirds *Sagittarius serpentarius* – Near Threatened
- Kori Bustard *Ardeotis kori* – Vulnerable
- Ludwig's Bustard *Neotis ludwigii* – Vulnerable
- Maccoa Duck *Oxyura maccoa* Near Threatened

While the aforementioned species only include endangered species, all korhaan and bustard populations are currently under pressure. Birdlife SA lists the collision of large terrestrial birds with power lines as one of the highest mortality factors for these particular birds in South Africa – with this single mortality factor leading to the decline of Ludwig's Bustard *Neotis ludwigii*. For larger ground dwelling avifauna species collision mortalities would probably not have a hugely significant impact on their regional populations. Ongoing mortalities on a large-scale may however result in long term effects on these species and as such, an effort should be made to minimise the impacts upon these populations.

Susceptible species to collisions with power lines utilise waterways as flyways and the proximity of the Gariep (Orange) River accentuates the potential for interactions with power lines.

	Without Mitigation	**With Mitigation**
Extent	Site only (1)	Site only (1)
Duration	Long term (4)	Long-term (4)
Magnitude	High (8)	Low (4)
Probability	Highly probable (4)	Improbable (2)
Significance	**Moderate (52)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation

» The power line should be kept as low as possible taking into account engineering and legal requirements.
» The span lengths should be kept as short as is reasonable.
» Bird flappers must be placed as markers on the earth wire, which will increase the visibility of the power line.
» Markers should be placed with sufficient regularity (at least every 5-10m).

» Eagle eye devices may be used, if feasible to deter birds from the CSP plant area/ solar field.

Impact Nature: Electrocution on overhead power line

The design has allowed for an overhead power line, feeding into the Eskom network at the Paulputs Substation (a distance of approximately 3km). Power lines have a range of bird related impacts, one of which is electrocution events, which occur when a bird perches on an electrical structure and causes an electrical short circuit by bridging the gap between live components and/or live and earthed components. The larger transmission lines (220kV to 765kV) are not a threat to large raptors and other birds which are vulnerable to electrocutions – often proving to be beneficial by providing roosting and nesting sites. The smaller distribution lines, such as the 132kV proposed for the development, can however be dangerous to birds. Birds that are typically at risk are those with large wingspans which can bridge the gaps between lines, such as raptors, bustards and storks. Threatened species that have the potential to occur in the study area and that may be involved in electrocution events include:

- Secretarybird *Sagittarius serpentarius* – Near Threatened
- Kori Bustard *Ardeotis kori* – Vulnerable
- Ludwig's Bustard *Neotis ludwigii* – Vulnerable
- Martial Eagle *Polemaetus bellicosus* - Vulnerable
- Maccoa Duck *Oxyura maccoa* Near Threatened

In flat landscapes, typical of the study area, large raptors will instinctively look for the highest vantage point on which to perch. Given that the power line towers will be one of the highest structures in the area, there is a high probability that raptors will be landing on the structures and using them to survey the surrounding habitat or to nest on.

Electrocution is possible on lines such as those proposed, depending on the exact pole structure used. Since the developer has not yet committed to a tower structure, this impact cannot be fully assessed. The minimum phase – phase and phase – earth clearance of 2000mm should be adhered to for whichever structure is used, in order to mitigate for electrocution.

	Without Mitigation	**With Mitigation**
Extent	Site only (1)	Site only (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Moderate (44)**	**Low (14)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation

» Mono pole bird friendly tower structures must be utilised in the development. This

will significantly minimise the number of electrocutions

6.5.4. Implications for Project Implementation

One of the factors most likely to reduce the risk of mortality in avifauna species is the low average flight height of birds in the area, as most bird species will fly under the proposed heliostats. The fact that many of the species of concern appear to be absent from the study area further reduces the likely impacts of the facility.
In order to mitigate any possible impacts we suggest that the following measures are implemented:

» Openings at either end of the proposed horizontal rotating cylinder – The simplest way to mitigate this impact would be to seal the openings at each end of the proposed cylinder. This can be done by tack-welding appropriately sized discs onto either end;
» Proposed heliostats in the vertical position – the proposed heliostats should be limited to being in the vertical position for as short a time as possible. The trucks which clean the proposed heliostats should follow each other as close as possible and the proposed heliostats returned to a static (horizontal) or focussed position as soon as possible after cleaning;
» Flat surfaces at the base of the proposed tower – all ledges should be built or panelled so that they slope at an angle downwards to the outside to prevent nesting on these ledges;
» Colour of the proposed tower– a neutral brown, concrete colour or grey would prevent the reflection of UV light and thus mitigate the possible impact of the white tower; and
» Focusing the proposed heliostats above the tower during maintenance – ideally the heliostats should be in one of three positions: vertical (washing position – for as short a time as possible), static position; or focussed in order to prevent the undetectable "hotspot" above the tower.

Further recommendations for consideration prior to operation are:

» A detailed avifauna monitoring plan should be compiled prior to operation and implemented in order to constantly monitor the CSP facility and all associated infrastructure, including the power lines. Any and all avifauna mortalities should be investigated. This should be undertaken for a 1-year period after which the results should be reviewed in order to inform the requirement for further monitoring and/or mitigation.
» The results of these investigations should then inform the management of the CSP facility and associated infrastructure, regarding the implementation, update and/or upgrade to any mitigation measures at the facility as necessary.

In conclusion, with implementable mitigation measures and a functional monitoring – management – implementation – monitoring feedback loop in order to monitor and mitigate impacts, all probable avifauna impacts can be managed to a low impact rating. Based on this and the fact that South Africa is experiencing a significant energy crisis, the risks and losses associated with this development can be seen as acceptable and defendable. Based on all these factors, and with the proviso that we assume that all information available is correct and up to date, no changes will be made to the proposed project, no unforeseeable impact synergies arise and all mitigations proposed will be implemented and adhered to, we are of the opinion that this project could be implemented without causing significant unsustainable damage to the natural environment of the region.

6.3. Impacts on Soils and Agricultural potential

6.3.1. Results of the Agricultural Potential Study

Much of the area comprises either shallow to very shallow soils or surface rock outcrops, and only a very small portion of deep soils. The very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure nor any of irrigation. Two CSP facilities, KaXu Solar One and Xina Solar One are located in the southern portion of the site.

There is sparse amounts of the vegetation present in the vicinity of the proposed project. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit.

No areas identified as degraded, such as dongas or other erosion features, were identified within the study area. In addition, no areas of cultivation were identified except for the strip of cultivated orchards and pivots along the Gariep River to the north.

6.3.2. Description of the impacts on soils and the agricultural potential of the Paulputs CSP Project site

Two major impacts are assessed. The first impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. This impact would in all probability be of limited significance and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

The second impact is the possibility of increased soil erosion due to the removal of vegetation in the construction process. This would probably be due to wind action on the relatively sandy topsoils.

6.3.3. Impact tables summarising the impacts on agricultural poetical of the Paulputs CSP Project site

Nature of impact: Loss of agricultural land because the land can no longer be utilised due to the construction of infrastructure		
	Without Mitigation	**With Mitigation**
Extent	Site only (1)	Site only (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Highly probable (4)	Probable (2)
Significance	**Low (28)**	**Low (21)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation: The main mitigation would be to ensure that as little pollution or other non-physical disturbance occurs such that the land can be returned to a more or less natural state following decommissioning.		

Nature of impact: Loss of topsoil due to vegetation removal resulting in increased wind erosion potential		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Project footprint kept as small as possible, with minimal vegetation removal » Keep soil moist if possible during construction activities » Soil conservation measures (windbreaks, geotextiles etc.) if required to protect bare areas » Re-vegetation as soon as possible, using irrigation as required		

» Regular monitoring (at least every 6 months) until vegetation cover re-established

Nature of impact: Soil degradation may occur during the construction and operation phase through erosion and/or siltation. The loss of soil and damage to associated ecosystems may occur due to erosion of soil in areas of activity (i.e. 70% of the study area is presently susceptible to potentially moderate levels of erosion (wind and water). Furthermore, damage of soil and associated ecosystems due to siltation arising from accelerated erosion		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	
Mitigation: » The project footprint should be kept as small as possible, with minimal vegetation removal during construction. » In areas susceptible to wind erosion, keep soil moist if possible during construction activities. » Soil conservation measures (windbreaks, geotextiles etc.) must be implemented if required to protect bare areas » Re-vegetation should occur as soon as possible, using irrigation as required » Regular monitoring (at least every 6 months) must be undertaken until vegetation cover re-established		

Nature of impact: Loss of topsoil due to disturbance during decommissioning activities and infrastructure removal resulting in increased wind erosion		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be	Yes	

mitigated?	
Mitigation: » Decommissioning footprint should be kept as small as possible, with minimal topsoil disturbance » In areas susceptible to wind erosion, keep soil moist if possible during decommissioning activities » Soil conservation measures (windbreaks, geotextiles etc.) must be implemented if required to protect bare areas » Re-vegetation must be undertaken as soon as possible, using irrigation as required » Regular monitoring (at least every 6 months) must be undertaken until vegetation cover re-established	

6.3.4. Implications for Project Implementation

The overall impacts of the proposed facility on agriculture and soil conditions will be fairly low, principally because of the climatic conditions and the low agricultural and grazing potential of the site. There have never been any substantial industrial farming practices (agriculture or grazing) on the property because of the dominant climatic conditions and prevailing soil conditions. Very low rainfall, along with other soil-related factors lead to low vegetative cover throughout the area.

Topsoil management is necessary or else wind will lead to surface creep of the sand and loss of nutrient rich top soil. Mitigation procedures as well as hand on maintenance will ensure that medium to long term impacts may be avoided or at least reduced.

6.3. Impacts on Water Resources

6.3.1. Results of the Water Study

The proposed CSP site itself is mostly dry, although a large number of drainage lines were observed and will thus be impacted upon by the proposed layout These systems were highly fragmented by the roads and farming practices in the past while the adjacent projects have now disrupted any flows within these systems. The significance of this impact at the time of assessing the adjacent projects was low, due to the impacts and high degree of fragmentation coupled to the general lack of any important / visible aquatic habitat. Figure 5.19 indicates significant watercourses observed within the site. Any activities within 32m of the centreline (or the 1:100 floodline, whichever is the greatest) will require a Water Use license.

6.3.2. Description of impacts to Aquatic resources

As no permanent surface water or associated aquatic habitats occur within the study site, and the abstraction of water is of key importance it is thus needed to briefly describe the greater regional aquatic environment. The ecology in the Lower Gariep sub-basin is dominated by the presence of dams and irrigation water use along most sections of the Gariep River. Increased populations of invasive alien plant species contribute significantly to land degradation in the sub-basin (ORASECOM, 2007). Growing numbers of Mesquite (*Prosopis spp*.) are also affecting the more arid part of the Lower Gariep River and the prevalence of dense stands of alien species on river banks and floodplains have reduced basal vegetation cover, causing erosion of the top clayey soil layers (ORASECOM, 2007). However certain unique features such as the Onseepkans Falls and three fish species with conservation concern are found in close proximity to the proposed site in the Gariep River.

The invertebrate populations appear to be rather homogenous throughout the entire length of the Gariep River and are described as mostly unpredictable, due to the erratic nature of the system (LORMS, 2005).

The occurrence of freshwater fish being infested by parasites, as well as an increase in fish parasite diversity in the study area had been observed during fish surveys between 1985 and 1989 (Benade, unpublished data, cited in LORMS, 2005). This phenomenon is indicative of water quality deterioration. The Gariep River system as a whole is relatively poor in indigenous freshwater fish species diversity. Presently, eight fish families are represented by 22 species.

Five of the six endemic Gariep River fish species occur in this lower river section, of which one, Namaqu Barb (*Barbus hospes*), is unique to the Gariep River section between Augrabies Falls and the Gariep River Mouth. Three of the five endemic species, *B. hospes*, Largemouth yellowfish (*Labeobarbus kimberleyensis*) and Rock catfish (*Austroglanis sclateri*) are Red Data listed. Although the other two endemics, Smallmouth Yellowfish (*Labeobarbus aeneus*) and Gariep River mudfish (*Labeo capensis*), are fairly abundant and thus appear not to be threatened, they remain of concern because of their endemic status (LORMS, 2005). It should also be remembered that Gariep River mouth is a Ramsar site, being a wetland of international importance, managed in partnership with Namibia (LORMS, 2005).

The following key issues and related impacts were assessed:

Issue - Physical environment
- Impact on water quality of the region
- Impact on water quantity of the region (see note below)
- Impact on dry riverbeds and localised drainage systems
- Impact on riparian and instream systems on form and function

Issue – Biological environment (e.g. vegetation, macro-invertebrates & fish)
- Impact on water quality of the region
- Impact on water quantity of the region (see note below)
- Impact on riparian systems (conservation & biodiversity)
- Impact on fish biodiversity & species of conservation concern

Issue – Social environment (human needs)

- Impact on water quality of the region
- Impact on water quantity of the region (See note below)

Note:
Water quantity issues need to be addressed on a regional basis, especially considering that there is no surface water within the study area. This will be conducted in detail as part of the Water Use License process, but an indicative assessment is presented below. The WULA process will also largely address the cumulative impact of the project, both considering the needs of the adjacent projects, downstream social, agricultural and the environmental needs. Thus this level of cumulative assessment is beyond the scope of this study as the WULA process is driven by the DWS at this given point. Although based on the available information (low confidence), the cumulative impact of water use is anticipated to be low

6.3.3. Impact tables summarising the impacts to water resources

Impacts to the physical environment

Nature: Impact 1 – Impact on water quality in the region Any surface water run-off from the site has the potential to impact on the water quality of the region, particularly during flood conditions or via groundwater infiltration. However, in assessing annual records from the adjacent facility (Kaxu) limited amounts of effluent were produced (ca. 65 000cm^3 per annum). These volumes, which would be similar to the proposed project, are contained in lined ponds which are then allowed to evaporate, minimising the potential need to discharge and or seep into the environment.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: The most significant form of mitigation would be to select a development area, which contained no drainage lines. This is not feasible considering the terrain and the high number of watercourses found present thus the following must occur: • Site clearing and preparation for the construction of the solar facility should take steps to avoid surface run-off and storm-water erosion of cleared areas where practicable.		

- A comprehensive Storm Water Management Plan (SWMP) incorporating anti-erosion measures on site should be put in place.
- All surface run-off should be discharged via detention dams to allow sediment to settle out before leaving the site
- Wastewater from the power generation process must be contained within appropriately lined evaporation and these should be located outside of any drainage lines or water courses.

Cumulative impacts:
The potential for any water quality changes is unlikely to occur, considering that the site is not near the main drainage channel and the annual rainfall figures are low.

Residual impacts:
Possible impact on the remaining catchment due to changes in run-off characteristics in the development site is unlikely to occur, considering that the site is not near the main drainage channels and the annual rainfall figures are low.

Nature: Impact 2 - Abstraction of water from the Gariep River: timing and volume, i.e. impact on water quantity on the region

The proposed abstraction of volumes of water from the Gariep River (ca 230 000 m^3/a based on Kaxu raw water use volumes) and may reduce present day flows and impact negatively on available habitat within the river. This impact would then impact on the regional biota.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
Mitigation measures may be difficult and expensive, however, the possible measures to reduce volumes of water abstracted from the Gariep River could include the following:

» Optimise the design or technology of the solar power facility to reduce consumptive water requirements as far as possible.
» Adapt the abstraction regime to meet the EWR and requirements of other users where required.

Cumulative impacts:
Cumulative impacts due to water abstraction in the Lower Gariep River are already considered to be high and could be exacerbated by the abstractions for this project. Note that the water use required by this project is relatively small in a regional context.

Residual impacts:
No residual impacts expected if mitigation is implemented.

Nature: Impact 3 - Impact on dry riverbeds and localised drainage systems

The physical removal of narrow strips of woody riparian zones being replaced by hard engineered surfaces will alter the hydrological nature of the area, by increasing the surface run-off velocities, while reducing the potential for any run-off

to infiltrate the soils. This impact would however be localised, as a large portion of the remaining farm and the downstream catchment would remain intact.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: The most significant form of mitigation would be to select a development area which contained no drainage lines. However due to the nature of the site, this was not possible. Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities.		
Cumulative impacts: The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is unlikely to occur, considering that the site is not near the main drainage channel and the annual rainfall figures are low.		
Residual impacts: Diversion of run-off away from downstream systems is unlikely to occur as the site is not near the main drainage channel and the annual rainfall figures are low.		

Nature: Impact 4 - Impact on riparian systems through the possible increase in surface water runoff on riparian zone form and function as well as instream habitats		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (19)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant. It is also recommended that stilling basins to capture large volumes of run-off, trap sediments, and reduce flow velocities (e.g. water used when washing the mirrors) are installed. The project should also try to capture and recycle any form of run-off created by the daily operations. This would minimise the amount of water required by the project, but also serve to limit the downstream impacts on the riparian systems		

through an increase in run-off, a situation that these systems are currently unaccustomed to.
Cumulative impacts: Downstream alteration of hydrological regimes due to the increased run-off from the area.
Residual impacts: Possible impact on the remaining catchment due to changes in run-off characteristics in the development site assuming the predevelopment ground levels are reinstated.

Impacts on the Biological Environment

Nature: Impact 1 – Impact on water quality of the region

Any surface water run-off from the site has the potential to impact on the water quality of the region further reducing the quality of the water column impacting on the biota. However, in assessing annual records from the adjacent facility (KaXu) limited amounts of effluent were produced (ca. 65 000cm^3 per annum). These volumes, which would be similar to the proposed project are contained in lined ponds and are allowed to evaporate, minimising the potential need to discharge to the environment.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
The most significant form of mitigation would be to select a development area, which contained no drainage lines. This is not feasible considering the terrain and the high number of watercourses found present thus the following must occur:

- Site clearing and preparation for the construction of the solar facility should take steps to avoid surface run-off and storm-water erosion of cleared areas where practicable.
- A comprehensive Storm Water Management Plan (SWMP) incorporating anti-erosion measures on site should be put in place.
- All surface run-off should be discharged via detention dams to allow sediment to settle out before leaving the site.
- Wastewater from the power generation process must be contained within appropriately lined evaporation ponds.

Cumulative impacts:
The potential for any water quality changes is unlikely to occur, considering that the site is not near the main drainage channel and the annual rainfall figures are low.

Residual impacts:
Possible impact on the remaining catchment due to changes in run-off characteristics in the development site is unlikely to occur, considering that the site is not near the main drainage channels and the annual rainfall figures are low.

Nature: Impact 2 - Abstraction of water from the Gariep River: timing and volume, i.e. impact on water quantity on the regional biota

The proposed abstraction of volumes of water from the Gariep River (ca 250 000 m^3/a based on Kaxu raw water use volumes) and may reduce present day flows and impact negatively on available habitat within the river. This impact would then impact on the regional biota. This impact would be particularly evident in summer when high river flows are required for fish spawning migrations and egg incubation. Several of the known fish species that occur near the abstraction site are protected (Threatened or Endangered). However, without detailed data on present-day flows, volumes abstracted by other users or Ecological Water Requirements, this impact is difficult to quantify. The system is also highly regulated (i.e. many dams upstream in the system), making an assessment more difficult. However, it is anticipated that constant pumping during droughts may impact on drought flow requirements needed to meet the EWR. Cognisance will have to be taken of other user requirement and will form part of the Water Use License process when evaluated by DWS.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
Mitigation measures may be difficult and expensive, however, the possible measures to reduce volumes of water abstracted from the Gariep River could include the following:

» Optimise the design or technology of the solar power facility to reduce consumptive water requirements as possible.
» Adapt the abstraction regime to meet the EWR and requirements of other users where required.

Cumulative impacts:
Cumulative impacts due to water abstraction in the Lower Gariep River are already considered to be high and could be exacerbated by the abstractions for this project. Note that the water use required by this project is relatively small in a regional context.

Residual impacts: No residual impacts expected if mitigation possible.

Nature: Impact 3 - Impact on dry riverbeds and localised drainage systems

The physical removal of narrow strips of woody riparian zones being replaced by hard engineered surfaces will alter the hydrological nature of the area, by increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils. This impact would however be localised, as a large portion of the remaining farm and the downstream catchment would remain intact.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative

Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: The most significant form of mitigation would be to select a development area which contained no drainage lines. However due to the nature of the site, this was not possible. Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities.		
Cumulative impacts: The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is unlikely to occur, considering that the site is not near the main drainage channel and the annual rainfall figures are low.		
Residual impacts: Diversion of run-off away from downstream systems is unlikely to occur as the site is not near the main drainage channel and the annual rainfall figures are low.		

Nature: Impact 4 - Impact on riparian systems through the possible increase in surface water runoff on riparian zone form and function as well as instream habitats		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (19)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation: Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant. It is also recommended that stilling basins to capture large volumes of run-off, trap sediments, and reduce flow velocities (e.g. water used when washing the mirrors) are installed. The project should also try to capture and recycle any form of run-off created by the daily operations. This would minimise the amount of water required by the project, but also serve to limit the downstream impacts on the riparian systems through an increase in run-off, a situation that these systems are currently unaccustomed too.		
Cumulative impacts: Downstream alteration of hydrological regimes due to the increased run-off from the area.		
Residual impacts: Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.		

Social Environment

There are largely cumulative impacts associated with water quantity and quality issues. Based on the available information, the additional water needs on the project would not result in any significant impacts on the social environment (human use and agricultural), however this can only be confirmed on a strategic regional basis through the Water Use License Application Process and beyond the scope of this study, as we are unware of the exact current needs as well as other renewable projects needs at this time.

However, based on the water use requirement of Kaxu CSP, the overall impact is anticipated to be low (low confidence)

6.3.4. Implications for Project Implementation

With the implementation of suitable mitigation and of the proposed layout, the development should have limited impact on the overall status of the site specific riparian systems. This desktop assessment of the potential impacts of the proposed CSP on the fish biota of Gariep River also did not reveal any significant impacts on the fish fauna and associated aquatic habitats, provided the appropriate mitigation measures are implemented. All impacts that were assessed be reduced to medium or low significance with appropriate mitigation, apart from the moderate impact of water abstraction from the Gariep River. However, in this case the precautionary principle was applied due the lack of data on the Ecological Water Requirements of the Gariep River for this locality. Figure 5.19 indicates aquatic features, that would trigger the need for a Water Use License application in terms of Section 21 c and i of the National Water Act, should any construction take place within these areas, i.e. impeding and diversion of flows or alteration of bed and banks.

6.4. Impacts on Heritage Resources

6.4.1. Results of the Heritage Study

The study which has been conducted on this landscape over some years has identified sensitive locales with respect to heritage. For the present study, the sensitive sites that should be avoided are the rocky outcrops that occur at the north eastern side of the proposed project footprint and a 60 m buffer has been considered around the outcrops. These sites and others like them in the broader landscape provided shelter and variety of resources that attracted human activity through Stone Age times. Potential areas of heritage sensitivity on the site include terrain close to hills or rocky features and the known road-side grave below Ysterberg. The open plains have been found to have sparsely scattered artefacts. The construction of the project could have a low impact on a local scale. Limited impact on palaeontological resources is envisaged due to the poor fossil assemblage in the local lithology. The most significant potential impact expected is disturbance and destruction of archaeological sites and graves.

Regarding the proposed pipeline this study reiterates the findings of the study in 2014 on the Xina Solar Thermal Facility (Morris 2014), which included an archaeological impact assessment of the pipeline route from the extraction point at Onseepkans. It follows an already disturbed route mostly within the road reserve.

6.4.2. Description of the Impacts to Heritage

The destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period of the facility. In the long term, the proximity of operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity.

With respect to the magnitude and extent of potential impacts, it has been noted that the erection of power lines would have a relatively small impact on Stone Age sites, in light of Sampson's (1985) observations during surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon), whereas a road or a water supply pipeline would tend to be far more destructive (modification of the landscape surface would be within a continuous strip), albeit relatively limited in spatial extent, i.e. width (Sampson compares such destruction to the pulling out of a thread from an ancient tapestry). A water pipeline, if sourcing water at the river, could traverse more sensitive terrain, i.e. impacting a potentially greater density of archaeological sites.

6.4.3. Impact table summarising the impacts to heritage (with and without mitigation)

<table>
<tr><td colspan="3">Nature: Destruction of archaeological material or objects

Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or objects (what affected).

These potential impacts would tend to be direct, once-off events occurring during the initial construction period. In the long term, the proximity of operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity. Certain activities would generally have a lower impact than others (i.e. power lines tend to be less destructive on Stone Age sites than access roads).</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
</table>

Extent	Local (1)	Local (1)
Duration	Permanent (5)	Short (1)
Magnitude	High (8)	Low (4)
Probability	Improbable (2)	Very improbable (1)
Significance	Low (**28**)	Low (**6**)
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Yes, if and where present – but occurrence is between zero and extremely low density, no or low significance. Sensitive areas at and around rocky outcrops have been excluded from the development because of sensitivity. A 60m buffer around the outcrops has been taken into consideration	
Can impacts be mitigated?	Yes but not considered necessary.	
Mitigation: Artefact densities are zero to extremely low over the development footprint and along the pipeline route. Unlike biological processes, heritage destruction generally has a once-off permanent impact and in view of this the figures given in the "Without mitigation" column err on the side of caution. Even so, the criteria for significance indicated in this matrix give a Low significance weighting (<30 points). Mitigation measures are not considered necessary.		

6.4.4. Implications for Project Implementation

Anticipated locations for both area and linear, primary and secondary, developments should be examined on foot, particularly on dunes and around rocky outcrops – both of which features occur in the area of proposed development. Any disturbance of surfaces in the development area could have a destructive impact on heritage resources. In the event that such resources are found, they are likely to be of a nature that potential impacts could be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, the Northern Cape Heritage Resources Authority. Should exceptional heritage features be found (not considered likely), some could require preservation in situ and hence modification of intended placement of development components. Disturbance of any surface includes any construction: of a road, a pipeline, erection of a pylon, or preparation of a site for a sub-station, or plant, or building, or any other *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible). Without context, archaeological traces are of much reduced significance.

6.5. Visual Impacts

The 200MW Paulputs CSP Project has a development footprint of 900 ha. Negative impacts on visual receptors are expected during construction activities and when the facility is in place. Potential impacts and the relative significance of the impacts are summarised below (refer to Appendix I - Visual Report for more details).

6.6.1. Results of the Visual Study

Possible visual receptors within the landscape which due to use could be sensitive to landscape change include:

Area Receptors
Within the vicinity of the project, the only potential area receptor is the urban area of Pofadder. Areas associated with this use are likely to be the most sensitive to possible changes in outlook associated with the proposed development.

Linear Receptors
The N14 is probably the most important road within the study area as it is a strategic national route that is likely to carry a high proportion of recreational and tourism related traffic. There are also three local roads that provide access from the N14 to the Orange River and to a border crossing at Onseepkans. The R358 is an unsurfaced road that provides access from the N14 at Pofadder directly to Onseepkans. This road becomes the C10 after the border crossing in Namibia. The R357 which is surfaced between the N14 and the site provides access to the site and continues on to Onseepkans as an unsurfaced road. Close to the site a local road connects the R357 to the Orange River Corridor to the north west. There is a Guesthouse signposted along this road which indicates that these local roads are likely to have some tourism significance.

Point Receptors
Approximately 100 homesteads have been identified within the study area. These are likely to be used largely by local stock farmers. It is possible though that a limited number will have a secondary tourism use.

6.5.2. Description of the Visual Impacts

Impacts on Landscape character
In the flat landscape it is unlikely that the heliostats will be obvious from greater than 4 – 5km distance. Reflection, glint and glare are however likely to make the heliostats more obvious in the landscape from the east, west and north at certain times of the day. Subject to time of day and weather conditions, it is likely that the tower will become less dominant at around 15-20km and not obvious at around 30-35km distance. The sunlight focused on the tower's receiver by the heliostats during normal operations causes the surface of the receiver to appear to glow with sufficient intensity to be visible for long distances. It is likely therefore that this will make the tower more obvious to the south east, south and south west.

Impacts on visual receptors

Implications for visual receptors can be divided into possible changes in views over the landscape that could affect sensitive users or general enjoyment of views; and glint and / or glare that could cause eye damage or nuisance to receivers.

6.5.1. Impact tables summarising the visual impacts (with and without mitigation)

Nature of impact: Potential effect of lights at night - Industrialisation of a natural landscape as seen at night.

Aviation warning lights are likely to be required on the top of the power tower.

Aviation warning lights are likely to be red and they are likely to be visible for a significant distance. In areas where there is no regular air traffic it may be possible to utilise pilot activated lighting which means that they are only activated when there is an aircraft in the vicinity. If this is used then aviation warning lights will have negligible impact.

It is also likely that operational lighting will be required at buildings and security lighting may be required within the heliostat field.

Lighting associated with the proposed project will be seen in the context of lighting that will occur due to the current two CSP projects and the transmission substation located on the property. It is unlikely to extend this impact significantly. The additional impact is therefore likely to be low.

If flood lighting is deemed necessary throughout the hours of darkness then general impact is likely to be significant. However if low level operational lighting is required at buildings only, then it is likely that the plant will not appear significantly different than the farmsteads that are scattered through the landscape.

If the former approach is adopted then floodlighting of the site will be noticeable. If however only low level lighting around buildings is required then the proposed project is likely to have negligible impact on the night time landscape.

	Without mitigation	**With mitigation**
Extent	Region (3)	Local, (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low to moderate (5)	Small, (0)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (10)**
Status	The appearance of a large lit area in an otherwise dark, natural landscape is likely to be seen as a negative factor particularly by people wanting to experience the natural landscape.	If the lights are generally not visible then the occasional light is unlikely to be seen as negative.

Irreplaceable loss	It would be possible to change the lighting system so the impact cannot be seen as an irreplaceable loss.	No irreplaceable loss
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

» Use pilot activated aviation warning lights where feasible;
» Plan to utilise infra-red security systems or motion sensor triggered lighting;
» Ensure that lighting is focused on the development with no light spillage outside the site; and
» Keep lighting low, no tall mast lighting should be used.

Nature of impact: Visual impacts associated with construction

Construction will be comprised of:

» Clearance of site;
» Construction of associated infrastructure;
» laying of concrete bases for the tower, heliostats and power plant;
» Erection and fixing of structures; and
» Laying of cable / pipe runs and connections.

This work is likely to be completed in 3 years. As the site and surrounding area is relatively flat, an overview of the construction work from the surrounding area is unlikely. Activity on site is likely to be obvious from vehicles and plant. Once ground work and concrete bases are complete, the structures are likely to progress rapidly.

Interim impacts are likely to include dust from site operations once the site has been cleared, storage areas which may be as high as the heliostat development and delivery trucks using local roads.

It is obvious that the site and ground level development is unlikely to be obvious except from the R357. Wind-blown waste, delivery vehicles on local roads and dust could make the development more obvious during construction.

In terms of addressing the local impact associated with construction, the minimising of disturbance and good rehabilitation are key.

	Without mitigation	**With mitigation**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Very short duration (1)	Very short duration (1)
Magnitude	Minor (2)	Small (0)
Probability	Probable (3)	Possible (2)
Significance	**Low (15)**	**Low (4)**
Status	Negative	Negative
Irreplaceable loss	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Minimise clearance of vegetation;
» undertake dust prevention measures;
» Maintain stockpiles to less than 3 m high; and
» Manage waste effectively and prevent waste blowing around and off site.

Nature of impact: Possible impact of glint and glare.

All large scale solar facilities are capable of causing offsite glare that may cause annoyance and visual discomfort. Typically the main risk of glint and glare associated with Power Tower developments include:

1. Viewed from certain angles, specular reflection from heliostats might result in glint or glare from these surfaces, particularly from elevated viewpoints. Power tower facilities usually have the heliostats arrayed in a circle around the central tower. Where this heliostat configuration is used, some portion of the heliostat field would face viewers regardless of their direction of view, which could increase the potential for glinting and glare from the heliostats.
2. Observations of reflections from power tower receivers have shown the sunlight focused on the tower's receiver by the heliostats during normal operations causes the surface of the receiver to appear to glow with sufficient intensity to be visible for long distances; however, the apparent glow is actually diffuse reflected sunlight. The tower receivers can appear brilliantly white at close distances, and the light from relatively small-scale existing facilities has been observed at distances of 25 miles (40km)[10]. Whilst visible over a long distance, this effect is likely to be less intense than glare observed from other CSP facilities such as parabolic troughs.

In order for there to be a problem it is necessary for the facility to be visible to receivers. From the review of visibility undertaken in assessment of other impacts, it is obvious that the only identified receivers that have the potential to be impacted are:

- Local homesteads particularly the homestead to the north that currently appears to be being used by a transport company.
- Roads from which the heliostats may be visible from and particularly the R357 to the north of the development.

It is possible that glint and glare could be problematic to the areas indicated above.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings, (2)	Local, (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Small (0)
Probability	Improbable (2)	Very improbable (1)
Significance	**Low (16)**	**Low (5)**

[10] Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM Administered Lands, United States Department of Interior, Bureau of Land Management (BLM), first edition, 2013.

Status	Negative	Negative
Irreplaceable loss	No	No
Can impacts be mitigated?	Yes.	
Mitigation: » Screening with opaque fencing / earth berms; and / or		

Nature of impact: Potential visual intrusion on sense of place

The CSP facility could potentially transform the semi-arid wilderness and farmland locally into an industrial landscape. The various components of the project will influence the landscape character of the area in different ways and to different degrees.

The proposed water pipeline are likely to have greatest impact while under construction due to the extent of this infrastructure outside of the site. Impacts of other components of the project will be very local. Once completed and as long as rehabilitation is undertaken appropriately there will be no long term influence on landscape character.

The 132kV overhead power line is likely to influence character of the landscape over a maximum distance of approximately 3km. It will be seen within an area that already has an industrial character due to existing CSP plants and the Paulputs Substation. It could be argued that it will slightly intensify this existing character but its influence is likely to be minimal.

The heliostats and the buildings and facilities at the base of the tower are expected to be of a similar scale to the existing two CSP projects within the property and they are likely to be visible over a similar area. This development will intensify the industrial character within the area immediately surrounding the site. Whilst the Zones of Theoretical Visibility indicates that the development might be visible up to 6km away, because the majority of elements are relatively low and because the tower will be a much more dominant feature, this intensification is likely to be limited to areas immediately surrounding the site.

The proposed tower at 300m high will form a major new feature in the landscape. It is likely to be a dominant feature up to 15 to 20 km away. It is also likely to be obvious in the landscape up to 30km away. Outside the area of influence of the heliostats and the development at its base however it will be seen as a relatively simple vertical structure that is surrounded by natural landscape. The degree to which this detracts from the character of the landscape within which it is viewed is a subjective judgement; purists are likely to see it as a major detractor whereas others might view it as one would a lighthouse in a coastal landscape. It will however influence the character of the landscape over a broad area. It also has to be considered that the landscape within which it is set is not a wilderness landscape but rather a natural rural landscape. From the east, the N14 has a major influence on the character of the area and from the west, development along the river particularly in the form of shade houses introduce large scale development into the rugged landscape.

<table>
<tr><td colspan="3">The impact of the tower is mitigated to a degree by landform in that;
» The landform to the north will provide a large degree of screening from that direction.
» The compartmentalized nature of the landscape will mean that the impact will be limited.
» The steep slopes of the Orange River Valley will screen views of the tower from that area.
» Inselberge will help to further reduce the impact from key viewpoints such as the N14.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Regional (3)</td><td>Regional (3)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Moderate to high (7)</td><td>Moderate (6)</td></tr>
<tr><td>Probability</td><td>Highly probable (4)</td><td>Highly probable (4)</td></tr>
<tr><td>Significance</td><td>Medium (56)</td><td>Medium (52)</td></tr>
<tr><td>Status</td><td>The character of the rural landscape will be modified.
For those people that are attracted to the area for its natural attributes and those travelling through the area for recreational and tourism reasons, it is likely that development of natural areas will be seen as a negative impact.</td><td>Negative</td></tr>
<tr><td>Irreplaceable loss</td><td>The proposed development can be dismantled and removed at the end of the operational phase.
There will therefore be no irreplaceable loss. However, given the likely long-term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.</td><td>No irreplaceable loss</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes to a small degree the impact of the pipe line, the road realignment and lower structures around the base of the tower may be mitigated.</td></tr>
<tr><td colspan="3">Mitigation / Management:
Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated.
» Plan to maintain the height of structures as low as possible.
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around and within the development.

Operations:
» Reinstate any areas of vegetation that have been disturbed during construction.
» Remove all temporary works.
» Monitor rehabilitated areas post-construction and implement remedial actions.
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.
» Colouring of mirror backs.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;</td></tr>
</table>

» Return all affected areas to productive agricultural use;
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Nature of impact: Potential effect on landscape features and scenic resources.

The solar energy facility will be located on an expansive plain with a number of prominent landscape features. The proposed tower will be the main concern as the lower elements will affect an area that is already industrialised and the water pipeline should have temporary impacts only.

The landscape in which the proposed tower will be set is dramatic and memorable. This is largely due to the contrasting elements and particularly the near vertical landforms, comprised of the inselberge and ridgelines, rising from a near planar surface. The simplicity and natural character of the vegetation also add to this scene.

The proposed development will add a major new and obviously man-made feature into this landscape which will undoubtedly detract from the naturalness of the scene.

It is possible that some may see the inclusion of an obvious focal point within the landscape as a positive addition. It is also likely that those who cherish the natural environment will see the addition as an imposition.

The impact is to a degree mitigated by the compartmentalised landscape meaning that it will only be seen within a limited section of the landscape. Even within the compartment that it impacts the rugged landform provides screening form many receptors and for others the tower will be seen against a landform backdrop.

The Orange River Corridor is likely to be largely unaffected.

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate to high (7)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (56)**	**Medium (52)**
Status	For those people that are attracted to the area for its natural attributes and those travelling through the area for recreational and tourism reasons, it is likely that development of natural areas will be seen as a negative impact.	Negative
Irreplaceable loss	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long-term nature of the project, it is possible that a proportion of stakeholders will view the	No irreplaceable loss

	loss of view as irreplaceable.	
Can impacts be mitigated?	Yes to a small degree the impact of the pipe line, the road realignment and lower structures around the base of the tower may be mitigated.	

Mitigation:

Planning:

- » Plan levels to minimise earthworks to ensure that levels are not elevated.
- » Plan to maintain the height of structures as low as possible.
- » Minimise disturbance of the surrounding landscape and maintain existing vegetation around and within the development.

Operations:

- » Reinstate any areas of vegetation that have been disturbed during construction.
- » Remove all temporary works.
- » Monitor rehabilitated areas post-construction and implement remedial actions.
- » Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

- » Remove infrastructure not required for the post-decommissioning use of the site.
- » Return all affected areas to productive agricultural use.
- » Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Nature of impact: Potential effect on local inhabitants, visitors to the area and on tourism

The proposed development will not be visible from the settlement of Pofadder. The proposed facility will be visible to a number of homesteads and to travellers on the N14 and on local roads.

The lower section of the development will be visible to two homesteads, one of which is currently being used by a transport company and the other is focused on agriculture. Both currently have views over the industrialised area. It is unlikely that residents of these homesteads will be concerned regarding the extension of similar scale development to the existing substation and two CSP facilities on the same farm.

Residents within the broader area will have views of the proposed tower. However their focus is likely to be on agricultural productivity of the area which will be unaffected.

Tourism related facilities (existing guesthouse and river rafting) are focused on the Orange River Corridor. There will be minimal impact on this area as previously discussed.

The N14 will carry a proportion of tourism related travellers most of whom will be travelling through the area to the main centres including Springbok and Upington and on to the Kalahari and Namibia. This group is likely to have a passing interest in the surrounding landscape.

A small number of people are likely to be travelling to the area for tourism purposes including staying at the existing guest houses in the Orange River Corridor or for river rafting which is advertised in the area. This group of people will travel past the existing industrial development (CSP projects and Paulputs Substation) and, if approval is granted,

the proposed tower and associated development. Whilst these existing and proposed facilities will be highly obvious on the drive through the area, they will not be obvious from their destination.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low to minor (3)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Medium to Low (30)**
Status	For those people that are attracted to the area for its natural attributes and those travelling through the area for recreational and tourism reasons, it is likely that development of natural areas will be seen as a negative impact.	Negative
Irreplaceable loss	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long-term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss
Can impacts be mitigated?	Yes to a small degree the impact of the pipe line, the road realignment and lower structures around the base of the tower may be mitigated.	

Mitigation

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated.
» Plan to maintain the height of structures as low as possible.
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around and within the development.

Operations:

» Reinstate any areas of vegetation that have been disturbed during construction.
» Remove all temporary works.
» Monitor rehabilitated areas post-construction and implement remedial actions.
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Return all affected areas to productive agricultural use.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Nature of impact: Potential effect of related infrastructure

The water pipelines, water tanks and pump house, as well as related powerlines, particularly where these are above-ground, could have a negative visual effect on the surroundings.

The impact of the water pipeline and road realignment will be subject to appropriate rehabilitation which, if undertaken properly, will mitigate all impacts. No information has been provided regarding the pump house facility. The development of an additional small riverside structure is unlikely to appear out of place. The minimisation of disturbance of the river bank and successful rehabilitation are key to mitigating the potential impact. The lower structures around the base of the tower including the overhead power line will impact on the current area that is impacted by industrial development. This will intensify the industrial character, but will not extend the area of impact.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (18)**
Status	Negative	Negative
Irreplaceable loss	No irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes	
Mitigation: Planning: » Plan levels to minimise earthworks to ensure that levels are not elevated. » Plan to maintain the height of structures as low as possible. » Minimise disturbance of the surrounding landscape and maintain existing vegetation around and within the development. Operations: » Reinstate any areas of vegetation that have been disturbed during construction. » Remove all temporary works. » Monitor rehabilitated areas post-construction and implement remedial actions. » Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site. » Return all affected areas to productive agricultural use. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.		

6.5.2. Implications for Project Implementation

The affected landscape has a degree of visual absorption capacity due to minor ridgelines that bisect the plain. This will help to mitigate visibility of the lower levels of the development, including the heliostat field, from the closest receptors.

Visual absorption capacity is also provided by the inselberge within the plain surrounding the development, by the steep valley slopes of the Orange River

Corridor and by the rugged topography immediately to the north of the development and to the north of Pofadder. This will help to screen and limit views of the power tower.

Where visible, the lower elements associated with the development will almost always be viewed from a similar level as the development meaning that they will largely be seen in elevation. This will mean that overviews of the full extent of development will not be possible from most public access areas. Mitigation should therefore be focused on minimising the affected area, maintaining natural vegetation which will minimise the area of influence and ensuring that development levels are not elevated above the natural landform.

It will not be possible to mitigate visual impact associated with the power tower.

6.6. Social Impacts

A social impact assessment was conducted for the proposed Paulputs CSP Project. The assessment provided (a) a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed facility; (b) a description and assessment of the potential social issues associated with the proposed facility; and (c) Identification of enhancement and mitigation aimed at maximising opportunities and avoiding and or reducing negative impacts. Potential social impacts and the relative significance of the impacts are summarised below (refer to Appendix J- Social Report for more details).

6.7.1. Results of the Social Study

The following is a summary of the key baseline findings as a result of the study conducted on the KMLM, in the Northern Cape. In summary, the area was found to have the following general characteristics and challenges within the local area:

» Poverty levels are high, due to high levels of unemployment, and increasing rates of illness (HIV/AIDS and TB).
» Communal farming on municipal peri-urban land is creating environmental challenges.
» A large proportion of income is derived from social grants, with social consequences that are not fully understood and no proactive plans is put in place.
» Local economies of small towns in the municipal area are characterized by weak multipliers, because a great deal of purchasing power is spent in the larger centres, or metropolitan areas situated outside these areas.

» Due to the arid nature of the area, surface and underground water supplies are insufficient to provide higher levels of infrastructure (such as waterborne sanitation).
» The conditions of life of remote settlements of farm workers tend to be poor, with low mobility, and difficult access to health, education, recreation and shopping amenities.
» HIV/AIDS levels are reputed to be high, particularly on national transport routes, and mortality rates are already reflecting this.
» There is an out-migration of skilled people, due to a lack of local economic opportunities.
» Increasing aridity, due to global warming, may lead to rising unemployment, declining underground water levels, and greater difficulties for commonage farmers.
» The socio-economic conditions of the municipal area are poor. More 56% of the municipal population earns less than R38 400.00 per annum (or less than R3200.00 per month) consequently receiving payment for municipal services can be challenging. This in turn can have a negative effect on the sustainability of infrastructure and the delivery of services overall.
» Generally the population can be regarded as having a high dependency ratio; with 7.39% of the population over the age of 65 and 25% are under 15 years. The latter youth group will be demanding education, housing and jobs in the near future.

The major service providers which will be affected by the project include the local municipality and local businesses in the area. The local municipality that will be directly impacted by the proposed development will be Khai-Ma Local Municipality (Ward 1). The municipality will absorb a number of social impacts (positive and negative), especially impacts related to an influx of people, since they will be responsible to deliver services to people residing within their municipal area. Negative dimensions of impacts such as influx of jobseekers into the area putting pressure on the provision of basic services and poverty level will need to be weighed.

The proposed development supports the social and economic development through enabling skills development and training in order to empower individuals and promote employment creation within the local area. The development would mainly focus on economic benefits to the area and introduce a new industry into the local economy. There are a number of local businesses in the area that could benefit from the proposed development in terms of an increase in demand for goods and services (positive cumulative impacts).

6.7.2. Description of the Social Impacts

Impacts on the social environment are expected during both the construction and operation phases of the project.

i) Construction phase impacts

Impacts associated with the construction phase of a project are usually of a short duration (approximately 27-30 months), temporary in nature, but could have long-term effects on the surrounding social environment if not managed appropriately. Potential impacts identified include:

a) Direct employment and skills development

The construction of the proposed project will require a workforce and therefore direct employment will be generated. The proposed development will create employment opportunities for the local community. CSP technology is generally more labour intensive than PV technology; therefore CSP facilities generally employ more people during construction and operation phases. The nearest town to the proposed site is Pofadder (population of 3 287 people) and the nearest settlements are Onseepkans (population of 2 090 people) and Pella (population of 2 470 people). The population of the closest town / settlements are relatively small; however there is a large economically active population in search for employment opportunities in the impacted local municipality and district municipality. This is therefore a positive social impact. The proposed Paulputs CSP Facility is likely to create approximately 600 -1400 employment opportunities, however not all of these employment opportunities will be fulfilled for the entire duration of the constructions phase. On average there will be approximately 600 employment opportunities (however the size of the workforce will vary during the different phases of construction. For example during the second year of construction the number of employees will peak to 1400 people). Therefore not all of these employment opportunities will be fulfilled for the entire duration of the constructions phase, it will fluctuate between 600-1400 employees over a period of 27-30 months. Approximately 30% of the workforce will be sourced from the local area. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the local area. Approximately 90% the labour force will be available to low-skilled/ semi-skilled workers (construction labourers, security staff), 10% will be available to skilled personnel (electricians, site managers, drivers, equipment operators etc.) and highly skilled individuals (engineers, project managers, site managers etc.).

The KMLM is characterised by low levels of unemployment and poverty and the unemployment rates at 22.10%. There will be significant job opportunities available for low skilled (construction, security and maintenance workers) and semi-skilled workers, which can be sourced from the local area. Construction workers could be sourced from the nearest local towns / settlements, this being

Pofadder, Onseepkans and Pella. However due to the small population sizes of these towns / settlements, the number of employees required and the limited skills available at local level; the required labour may need to be sourced from outside the immediate local area within the KMLM. Therefore it could be expected that some of the workers from outside the local area would form part of the construction team. Local labour should be sourced from within the towns of Pofadder, Onseepkans and Pella first and if need be extend the search to KMLM. If employees for the construction phase are sourced from other municipalities or provinces this could result in cultural change and social conflicts. Adverse impacts could occur if a large in-migrant workforce, culturally different from the local communities within KMLM, are employed and brought in during the construction phase. While the local labour pool may be qualified for less-skilled jobs, often local hiring will not meet the demands in professional, technical and supervisory areas. A number of specialist contractors would most likely be brought in from other areas.

It should be encouraged that the majority of the labour be sourced from within the local pool and if the relevant skills are not available then these should be sought out from surrounding local municipalities or provincial basis. The proponent will need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members of the local community. It is likely that an Engineering, Procurement and Construction (EPC) contractor will be appointed by the developer who will hire the necessary employees. The applicant has indicated that training will also be provided to employees to train individuals to perform required tasks specific to construction. Specific skills training for local communities have the opportunity to develop local employee potential. This is crucial to long-term development of skills and education in the area. This will accelerate the positive benefits and impacts of the development on the regional economies.

Another positive impact is the indirect employment opportunities that will be created. Key personal will be housed on site in temporary staff accommodation. Critical staff of approximately 40-60 people will reside on site for the duration of the construction phase. The remainder of the workforce will be staying in nearby towns (i.e. Pofadder) and will be transported to and from site with buses. These indirect opportunities will be experienced in the industries that will provide services to the construction team where more women can be involved and employed in the process through catering and laundry services that will be needed in the temporary staff accommodation etc. Other indirect employment opportunities that will be created during construction phase will relate to increased demand for transportation, equipment rental, sanitation and waste removal etc.

b) Economic multiplier effects

There are likely to be opportunities for local businesses to provide services and materials for the construction phase of the development. The local service sector will also benefit from the proposed development. The site is located approximately located approximately 40km north-east of Pofadder the main town in the KMLM. Off-site accommodation in the nearest towns (i.e. Pofadder) would also be required for contract workers and certain employees. . On-site accommodation would also be required for critical staff, approximately 40-60 people. Staff accommodation will be set up where all the necessities will be provided to employees. The economic multiplier effects from the use of local goods and services opportunities will include, but is not limited to, construction materials and equipment and workforce essentials such as services, catering, safety equipment, accommodation, transportation and other goods. Some accommodation will be made available on site, while the bulk of the workforce will be housed off-site. There would be expenditure on the staff accommodation as it would require temporary/portable housing, ablution and sewage treatment, and catering facilities. In addition, it is expected that labourers who move into the area will need to purchase various consumables and personal items while living and working in the area. The proponent has indicated that an estimate of 45% of the capital expenditure will be spent on local goods and services required for the development of the CSP facility and associated infrastructure.

The capital expenditure associated with the construction of the CSP facility and associated infrastructure (pipeline, power line etc.) is estimated to be in the region of R8-10 billion at current prices. About 45% of the capital expenditure will be spent locally on goods and services required for the development of the CSP facility. In terms of business opportunities for local companies, expenditure during the construction phase will create business opportunities for the regional and local economy. The increase in demand for new materials and services in the nearby area may stimulate local business and local economic development (however locally sourced materials and services will be limited due to availability). There is likely to be a direct increase in industry and indirect increase in secondary businesses. The implementation of the enhancement measures below can enhance the opportunities for locally based companies.

The proponent or contractors should source services needed from the local area as far as possible. These necessities should be sourced from nearby towns and local service providers. Experience from other large renewable energy construction projects indicates that the potential opportunities for local economies, decrease in unemployment and increase in incomes will in turn stimulate further expenditure and sales within the local economies. The impacts on production and value added experienced during construction will be temporary and will expire once the construction phase is complete.

Direct impacts would include the creation of employment opportunities and the associated income generated by the solar project that would have a positive impact on the local region. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area. Through the stimulation of employment and income is the creation of new demand within the local and regional economies. With increased income comes additional income for expenditure on goods and services supplied. Indirect impacts would occur as a result of the new economic development, and would include new jobs at businesses that support the expanded workforce or provide project materials, and associated income. The intention is to maximise local labour employment opportunities, this is likely to have a positive impact on local communities and have downstream impacts on household income, education and other social aspects.

c) Population change

Population change refers to the size, structure, density as well as demographic profile of the local community. There will be approximately 600-1400 employment opportunities, however not all of these employment opportunities will be fulfilled from the local population. There will be temporary in-migration of labourers coming into the area, approximately 30% of the workforce will be sourced from the local area (predominantly low-skilled and semi-skilled labourers). The remainder of the workforce will be brought into the area and would be housed in Pofadder and/or Kakamas and transported to and from site each day via buses for the duration of the construction phase. Also, staff accommodation will be provided to accommodate critical staff on site (approximately 40-60 people), for approximately 27-30 months for the construction of the proposed CSP facility and associated infrastructure. Bringing in construction workers will change the population dynamics in the immediate local area. The nearest town to the proposed site is Pofadder, located approximately 40km away. The influx of construction workers will result in a population increase over the medium-term in the local area, placing pressure on local resources and pressure social networks. This will also put pressure on existing services and infrastructure in the local area. The critical on-site staff accommodation would result in solid waste that will be disposed of off-site at the Pofadder solid waste site. Liquid waste / waste water will be treated by a package plant on site. Electricity for the construction site and staff accommodation would need to be sourced either from Eskom or from an off grid solution. Construction water will be sourced from municipal supply (by truck or via pipeline). The construction of the proposed water pipeline from the Gariep River to the proposed site will occur during the construction phase. Additional consequences of an outside workforce are that they often remain in the area after completion of the project, thereby posing a negative long-term impact on local services and infrastructure. A population increase in the current rural area would have a negative impact in terms of service delivery, pressure on resources and social dynamics.

d) Influx of job seekers

The proposed development will create a range of employment possibilities and thus it will attract jobseekers. An influx of people looking for economic opportunities could result in pressure on economic and social infrastructure on the local population (rise in social conflicts and change in social dynamics). Influx of jobseekers into the area, could lead to a temporary increase in the level of crime, cause social disruption and put pressure on basic services. Influx of jobseekers could potentially create conflict between locals and outsiders mainly due to difference in racial, cultural and ethnic composition. The high unemployment rate and expectations of job creation is already a potential source of competition among locals and could be exacerbated through outsiders coming into the area resulting in conflict. A further negative impact that could result due to an inflow of jobseekers is that local unemployment levels could rise due to an oversupply of an available workforce, particularly with respect to low-skilled and semi-skilled workers.

The small town closest to the proposed site (Pofadder) and small settlements (Pella and Onseepkans) are seen as sensitive social receptors and jobseekers coming into the area could put pressure on social infrastructure; create social problems, tensions and conflicts. The impact associated with in-migration of jobseeker includes pressure on local services and infrastructure. This includes municipal services such as sanitation, electricity, water, waste management, health facilities, transportation and availability of housing. Informal settlements may develop near towns to accommodate jobseekers. It is very difficult to control the influx of people into an area, especially in a country where there's high levels of unemployment. An influx of jobseekers to an area often results in an increase in prostitution activities and temporary sexual relations with locals; this could result in the spreading of HIV/Aids and STDs and unwanted pregnancies. The proposed CSP facility disrupting the societies largely depends on the level of local employment achievable and clearly stipulating a local employment regime to limit outsiders coming into the area. Employment opportunities should be provided to communities from the surrounding local towns/ settlements first, Pofadder, Onseepkans and Pella, and if availability of labour is limited then extend search to KMLM. It is expected that communities within the KMLM population could fulfil the majority of the low and semi-skilled employment opportunities that emerge.

e) Nuisance impacts (noise, dust and traffic)

The construction phase will include the development of the CSP facility and associated infrastructure. The nuisance impacts associated with the pipeline have been assessed separately under Section 5.1.10 and the impacts of the proposed access road alternatives have been assessed in Section 5.1.9. The nuisance impacts assessed in this section primarily focus on the nuisance impacts generated from the construction activities on Farm Scuit-Klip 4/92 (construction of the CSP plant infrastructure and associated infrastructure).

Impacts associated with construction related activities include noise, dust and disruption to adjacent properties. Experience from other solar energy facilities (CSP and PV) projects indicate that site clearing does increase the risk of dust and noise being generated, which can in turn impact on adjacent properties. The potential impacts can be addressed by implementing effective mitigation measures. The primary sources of noise during construction would be from the construction equipment and other sources of noise include vehicle/truck traffic, blasting and ground vibration. Noise levels can be audible over a large distance however are generally short in duration. Generation of dust would come from construction activities as well as from trucks/ vehicles driving on internal roads (see Section 5.1.9 - assessment of the access road alternatives). This impact will negatively impact social sensitive receptors. Adjacent landowners have concerns of dust impacts as the grazing areas located closest to the CSP facility will be affected as sheep will not eat dust covered grass. The impact of dust on farming areas can only be reduced through mitigation measures and not avoided. The noise, dust and the increased use of the local roads are expected to be negative, mainly impacting the nearby social receptors but are short term impacts.

Increased traffic due to construction vehicles could cause disruptions to the local community and increase safety hazards. The use of local roads and transport systems may cause road deterioration and congestion. An increase of traffic from the rise in construction vehicles is a potential safety concern for road users and local communities in the area. The movement of construction related activities crossing over the N14 does have the potential to increase the risk for road users. Also with wear and tear on roads that are not maintained / repaired; the safety risk also increases. The N14 and the access road would mainly be affected and the use of unroadworthy vehicles and drivers disobeying traffic rules and the will contribute to this potentially negative impact. Noise, vibrations, dust and visual intrusion from heavy vehicle traffic during the construction phase could cause temporary disruptions in daily living, movement patterns and quality of life for local community.

f) Safety and security impacts

An increase in crime is often associated with construction activities. The perceived loss of security during the construction phase of the proposed project due to the influx of workers and/ or outsiders to the area (as in-migration of newcomers, construction workers or jobseekers are usually associated with an increase in crime), may have indirect effects such as increased safety and security issues for neighbouring properties and damage to property, increase risk of veld fire, stock theft, poaching, crime and so forth. Staff accommodation for approximately 40-60 people will be provided on site for the duration of the construction phase for critical staff members. The construction of the proposed CSP facility will require a labour force of approximately 600 -1400 workers, however not all of these labourers will be working for the entire duration of the constructions phase. On average there will be approximately 600 labourers on site (however the size of the workforce will vary during the different phases of construction. For example during the second year of construction the number of employees will peak to 1400 people). The influx of labour over this period could potentially result in increased safety security risks. There will be temporary in-migration of labourers coming into the area, approximately 30% of the workforce will be sourced from the local area (predominantly low-skilled and semi-skilled labourers). The remainder of the workforce will be brought into the area and would be housed in Pofadder and or Kakamas and transported to and from site each day via buses for the duration of the construction phase. It will be mandatory on the project developer to foster and maintain good relationships with neighbouring land owners and institute adequate grievance control mechanisms.

Apart from construction crew that poses a potential increased risk there may also be an influx of people looking for economic opportunities. Safety and security impacts are a reality in South Africa which needs to be addressed through appropriate security measures. Majority of the adjacent farm owners utilise their farms for sheep farming, there are also grape cultivation activities on nearby farms closer to the Gariep River. During the stakeholder consultation process adjacent landowners mentioned the concern of livestock theft increasing in the area. Adjacent farm owners are thus concerned that criminal activity would increase during the construction phase which poses a potential risk to surrounding farming operations. It is therefore recommended that the appointed EPC contractor takes these points into consideration and it is important that a security company is appointed and appropriate security procedures and measures implemented. The appointed EPC contractor should take these issues into consideration within the stakeholder engagement and management plan.

g) Impacts associated with the critical staff accommodation on site

According to information provided by the proponent, on-site accommodation for the critical construction crew during the construction phase will be provided, which will provide all basic necessities for these staff members, such as sanitation, water, accommodation and catering. The staff accommodation on site will put pressure on existing services and infrastructure in the local area. Solid waste will be disposed of off-site at a solid waste site. Liquid waste / waste water will be treated by a package plant on site. Electricity for the critical staff accommodation on site would need to be sourced either from Eskom or from an off grid solution. Water would either need to be sourced from the Gariep River. .

If the staff accommodation is not managed efficiently this may lead to localised pollution, lack of sanitation, lack of adequate water, litter and lack of solid waste management. This could lead to unhygienic living conditions and could create health issues for workers and the surrounding communities. Other impacts associated with the on-site staff accommodation include degradation of the natural environment, risk of fires, increase risk of crime in the area, security and safety concerns and increased noise levels. Workers living in the staff accommodation on site will be separated from their families and/or place of residence for a significant period of time. This could lead to misbehaviour of construction workers; alcohol abuse, prostitution, temporary sexual relationships with locals that could lead to unwanted pregnancies and the spreading of HIV and other sexually transmitted diseases.

h) Impacts on sense of place

Intrusion impacts such as aesthetic pollution (building material, construction vehicles), noise and light pollution and impacts on the present rural nature of the area (grazing of livestock, sparsely populated farmsteads) will impact the 'sense of place' for the local community. The construction related activities will negatively change the local 'areas sense' of place. However the impact is assessed to be low due to the already constructed solar energy facilities on the impacted farm (Farm Scuit-Klip 4/92- Kaxu Solar 1 Energy Facility) and adjacent farm (Farm Konkoonsies 6/91- Konkoonsies PV facility).

i) Impacts associated with the Access Road Options

Access road option 1:

The access road 1 route would connect to the farm Scuit-Klip 4/92 from the N14 national road via the existing surfaced R357 Onseepkans road that is currently utilised to access the farm and the CSP facilities on this farm. This road is to the east of the farm portion. The access point to the site off this road is 17km from the N14, with a formal entrance to the existing CSP facilities. This section of the R357, to the east of the Farm Scuit-Klip 4/92 is a tarred road. This is the access road 1 option to the proposed CSP facility. This route is currently utilised by developers (Abengoa Solar Power South Africa (Pty) Ltd) to access their solar energy facilities located on the same impacted farm (Farm Scuit-Klip 4/92). There are currently two solar energy facilities on farm Scuit-Klip 4/92. The first solar energy facility located on the impacted farm is Kaxu Solar 1, which is an existing CSP trough facility that is currently in operation. The second solar energy facility on the same farm portion is Xina Solar One which is currently under construction and the operation phase of the project is due to commence in 2017. The access road that is utilised to access Farm Scuit-Klip 4/92 is the tarred R357 Onseepkans road, located to the east of the farm.

This access road option is deemed feasible and the preferred access road to the proposed site as the construction of the Paulputs CSP Tower facility will only take place after construction of the Xina Solar One facility is completed, and hence no conflict of construction vehicles will occur. It furthermore makes sense from an access management point of view that solar facilities located on the same farm share an access road to limit the number of access roads (provided that construction phases are at different times). This access road option 1 is also deemed to be highly feasible as construction vehicles travelling along the tarred section of the R357 will reduce the impacts of dust pollution on neighbouring farms from the movement of vehicles and trucks on gravel roads. Many of the neighbouring landowners have raised the issue of dust pollution being a problem created from construction vehicles travelling on gravel roads as dust pollution has a negative impact on grazing and cultivated farmlands. The access road option 1 will reduce the impacts of dust pollution from the movement of construction vehicles for the construction and operation phase of the development as this access road option 1 is already a tarred route. The only minor impact will be the increased wear and tear on the road with the number of heavy vehicles increasing during the construction phase that may affect road users.

Access road option 2:

The access road 2 route would connect to the farm Scuit-Klip 4/92 from the N14 national road via the existing R358 and via the minor road R357. This road is to the west of the impacted farm portion, where the CSP facility and associated infrastructure is proposed. The access point to the site is 45km from N14 along the R358 gravel road and then an additional 30km along the R357 gravel road to the west of the proposed site. The R358 and the R357 to the west of the proposed site are existing gravel roads. The construction vehicles would need to turn off the N14 onto the gravel R358 which is approximately 45km long and then travel an additional 30km on the R357 gravel road to reach the proposed site. The construction vehicles will be travelling a total of 70km on gravel roads to reach the site. Gravel roads are more prone to erosion and wear and tear. Construction vehicles and heavy trucks travelling on gravel roads for such a long distance will have a significant impact on dust pollution in the area. The surrounding area is primarily utilised for livestock grazing and grape cultivation closer to the Gariep River. The area is already dry and dust pollution will have an increased negative impact on the agricultural production. The movement of heavy trucks and construction vehicles along the access road 2 will generate dust pollution and increase the wear and tear on the existing gravel roads for the duration of the construction phase of 27-30 months). The dust pollution and increased use of the local gravel roads are expected to be negative impacts. The surrounding landowners have requested that dust pollution on vineyards and grazing areas should be prevented (dust pollution from the movement of construction vehicles on the gravel road).

The proposed water pipeline will also run along the servitude of this existing gravel road on the M357. This route would need to be utilised by construction vehicles for the construction of the water pipeline (see Section 5.1.10 for a separate assessment of the impacts associated with the water pipeline). However it is not necessary for this gravel road to be utilised for the construction of the CSP facility and power line and other associated infrastructure. The landowners along this western side of the R357 have indicated that dust pollution from the movement of construction vehicles will negatively impact vineyards as well as grazing areas for livestock. The increase in the movement of vehicles and trucks along the gravel road will create a significant dust pollution issue. It is important that this impact is reduced as far as possible.

j) Impacts associated with the water pipeline

The water pipeline is planned to run along the R357 Onseepkans Road from the proposed CSP site to the Gariep River and will be approximately 30km in length. The pipeline will run parallel to the existing KaXu Solar One pipeline within the servitude of the existing R357 Onseepkans road until it reaches the abstraction point. The abstraction point on the Gariep River will be located on the remaining extent of the farm Vrugbaar 422 adjacent to the existing abstraction point which is utilised by commercial fruit farming activities. The landowner of Farm Vrugbaar RE/422 has requested that the pipeline traverses as close as possible to the property edge to keep the current land vacant for future farming purposes. No alternative pipeline routes have been identified by the applicant. There are seven impacted landowners that are likely to be affected by the construction of the proposed water pipeline. There are sensitive social receptors, sensitive farming areas, activities and infrastructure that may be negatively impacted by the construction of the proposed pipeline.

The construction activities of the water pipeline and movement of construction vehicles along the pipeline route will generate dust pollution which will negatively impact vineyards and livestock grazing areas. The impacted landowners along the water pipeline route have requested for dust pollution to be prevented. The movement of heavy trucks on the gravel road can create extensive dust along the pipeline route that passes through the agricultural areas. This has the potential to negatively impact on the current grape cultivation activities and grazing lands.

A few of the landowners along the pipeline route raised the following issues regarding dust pollution:

» "Dust will be an issue during the construction of the pipeline as it settles on the grass. Grazing activities will be impacted." (Mr Willem Burger- Farm Paardeneiland RE/90.
» "Dust caused by construction activities and an increase in traffic and abnormal loads is a serious concern. The surrounding land is used for grazing purposes and livestock do not eat grass covered in dust." (Mr Fanie van der Heever- Farm Scuit-Klip RE/422)
» "I am concerned about the impact that the potential increase in dust would have on the vineyards during the construction of the pipeline. Dust pollution can have a negative impact on the grape production." (Lukas van Zyl- Farm Vrugbaar RE/422)

It is important that dust suppression measures are implemented to minimise the impacts of the construction of the water pipeline on farming areas. The dust impacts from the construction activities of the pipeline are expected to be negative but temporary for the duration of the construction of the water pipeline.

As a result of the construction of the water pipeline along the M357 servitude (gravel road) and Farm Vrugbaar RE/422 this may negatively impact farm fences and gates along the road as well as other infrastructure such as existing pipelines or buildings. Blasting may need to be undertaken for the construction of the new pipeline which increases the risk of damage to infrastructure in the area. It was also noted during the stakeholder consultation process that tremors caused by blasting that took place for the previous projects in the area have resulted in cracks occurring in the walls of infrastructure on farms. Infrastructure such as roads, fencing, gates, existing pipelines and buildings should either be maintained in the present condition or repaired if disturbed or damaged due to project activities. The developer and contractor should be responsible for managing this impact on private property.

Another issue that was raised by surrounding landowners was the increased risk of stock theft with the increase of construction workers coming into the area. The perceived loss of security during the construction phase of the water pipeline due to the influx of workers and/ or outsiders to the area (as influx of newcomers or jobseekers are usually associated with an increase in crime), may have indirect effects, such as increased safety and security risk for farmers in the area, damage to property, increased risk of veld fire, stock theft, crime and so forth. The perception exists that construction related activities (influx of jobseekers, and construction workers and so forth) is a contributor to increased criminal activities in an area. All of the farms in the study area are utilised for livestock farming and/or grape cultivation farming, therefore the development coming into the rural area may expose these farming activities to potential stock theft and grapes being stolen. It is important that a security company is appointed and that appropriate security measures are implemented that are agreed upon with the impacted landowners in the area.

ii) Operation phase

a) Direct employment and skills development

The operation phase of the project will require a workforce and therefore direct employment will be generated. Although the exact number of construction workers is not confirmed at this stage, it is estimated that approximately ~60-70 jobs will be generated for the lifetime of the project (approximately 20 years). Given that CSP facilities are relatively new in South Africa, a number of highly skilled personnel may need to be recruited from outside the local labour force. If the local labour force does not have sufficient skills by the time the project is operational, experts from outside the local area will be employed for a few years to transfer the necessary skills. Less skilled employees will also be required for the operation of the CSP facility, such as safety and security personal, cleaning crew and engineering assistants. It is estimated at approximately 30% of the labour force will be available to low-skilled and semi-skilled personnel and 70% will be available for skilled workers. Maintenance will be carried out throughout the lifetime of the CSP facility and associated infrastructure. Typical activities during maintenance include washing heliostats routinely and vegetation control and maintenance (for the CSP facility and associated infrastructure). Employment opportunities will be generated during the operation phase from the local community (approximately 30% will be locally sourced labour), although there will be a relatively small number of jobs created, these jobs will have a positive impact on the local economy (in terms of revenue generated and the unemployment situation).

It should be encouraged that majority of the employees be sourced from within the local and regional municipal pool and if the relevant skills are not available then these should be sought out on a national basis. The proponent will need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members of the local community. The focus for employment should be on local people, including women; this will have a maximum positive long-term impact (and if there is sufficient transfer of skills the positive impact can be extended). As the employment opportunities generated during the operation phase are more permanent and sustainable in the long run, as opposed to those generated during the construction phase (which are only temporary), sourcing of local labour during this phase will have long term beneficial impacts. The applicant has indicated that training will also be provided to employees. Establishing and operating the plant will result in improved skills amongst the staff as the facility will include training employees. On-the-job training is a key element of the staff development; many of the required skills during the operational phase will be taught to staff through day-to-day operations. Specific skills training for local employees have the opportunity to develop local employee potential. This is crucial to long-term development of skills and education in the area. This will accelerate the positive benefits and impacts of the development on the economy.

c) Benefits associated with REIPPPP – SES and ED programmes and community trust

According the Department of Energy (DoE) renewable energy projects under the Renewable Energy Independent Power Producer Procurement programme (REIPPPP) are obliged to make a real contribution to local economic development in the area. Awarded projects are required to spend a certain amount of their generated revenue on Socio-Economic Development (SED) and Enterprise Development (ED) and share ownership in the project company with local communities (DoE, 2011).

The developer is required establish a community trust funded by revenue generated from the sale of energy. The community trust will generate a reliable and steady income stream over a 20 year period. The trust will be used to fund development initiatives in the area and support local economic and community development. As the community trust will run for the entire operational phase of 20 years, it allows the local municipality and communities to undertake long term planning. This provides opportunities for positive benefits to the local area. However these benefits can be enhanced. Key issues relevant authorities are facing include external workforces being brought into the local areas, social responsibilities not being met properly and a lack of communication with the relevant local authorities in terms of the community trust and socio-economic development plans. It is important for the developers to engage and communicate with the local municipality so that the municipality can provide guidance on what’s required in the local area for socio-economic development plans. It is also important that the correct representatives are appointed to be part of the community trust. The solar energy developments are supported by the local authorities and it was noted that these developments have the potential to bring in more positive impacts to the local area however the issue raised need to be addressed with new developments coming into the area. Socio-economic spin-offs from the proposed development could contribute to better infrastructure provision and educational investment in the local area.

An in-depth Community Needs Analysis (CNA) will need to be carried out at a later stage to make sure that the real needs of communities are addressed (in line with the local government) and the correct representatives of the community are appointed to run the community trust, in order for development programmes to significantly contribute towards local economic growth, SED and ED.

d) Development of clean renewable infrastructure

Energy production has been and still is one of the main pivots of the social and economic development of South Africa. South Africa currently relies on coal-generated energy to meet its energy needs. Almost 72% of South Africa's primary energy is from coal, over half used to generate electricity and a quarter used for synfuels production. South Africa's carbon emissions are higher than those of most developed countries partly because of the energy-intensive sectors which rely heavily on low quality coal. Use of low quality coals is the main contributor to GHG emission. The energy-intensive sectors of the economy emit carbon emissions that are higher than those of most developed economies. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions. The generation of renewable energy will contribute to South Africa's electricity market. The advancement of renewable energy is a priority for South Africa. The government considers the use of renewable energy as a contribution to sustainable development (White Paper on Renewable Energy). As most of the sources are indigenous and naturally available, its use will strengthen energy security as it will not be subjected to disruption by international crisis. Furthermore, recent policy highlights the desirability of clean; green energy and solar generated energy will play a significant role in reaching these quotas (Energy Research Centre UCT, 2004). Given South Africa's reliance on Eskom as a power utility, the benefits associated with an Independent Power Producer based on renewable energy are regarded as an important contribution.

Increasing the contribution of the renewable energy sector to the local economy may contribute to the diversification of the local economy and provide greater economic stability. The growth in the solar energy sector could introduce skills and development into the area. The development of a CSP facility could therefore add to the stability of the economy, and even though this project is small scale in comparison to the overall potential of the sector, it could contribute to the local economy. The overall contribution to South Africa's total energy requirements of the proposed CSP facility is small; however, the 200MW facility will help contribute to offset the total carbon emissions associated with energy generation in South Africa.

e) Visual impact on sense of place

The sense of place is developed over time as the community embraces the surrounding environment, becomes familiar with its physical properties, and creates its own history. The sense of place is created through the interaction of various characteristics of the environment, including atmosphere, visual resources, aesthetics, climate, lifestyle, culture and heritage. Importantly though it is a subjective matter and is dependent on the demographics of the population that resides in the area and their perceptions regarding trade-offs. An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. The social impacts associated with the impact on sense of place relate to the change in the landscape character and visual impact of the proposed CSP facility and associated infrastructure. The alteration of the sense of place in view of the local residents and road users will start during the construction phase; visual impacts will remain during the entire operation period. Sense of place impacts from the CSP facility and associated infrastructure is difficult to mitigate. The area is developed around sense of place, natural beauty and natural resources. Impacts associated with the tourism industry include visual interferences and negatively impacting the sense of place. The most significant tourism activities in the nearby area include eco-tourism and heritage sites. Attractions in the nearby area include:

» The Quiver tree forest near Onseepkans, is one of the natural highlights in the area which is dominated by the stark desert landscape and unusual granite outcrops (DWS, 2016). The Quiver Tree (Kokerboom in Afrikaans) forest lies between Pofadder and Onseepkans and is the largest forest of its type in the Southern hemisphere. It is one of the natural highlights in the area which is dominated by the stark desert landscape and unusual granite outcrops (DWS, 2016). However, this quiver tree forest is not listed as a protected area. It does add to the areas rural sense of place and eco-tourism character. The Quiver Tree forest is located on Farm Copoob, approximately 20km west from the proposed Paulputs CSP site. The Quiver tree forest is visible from the R358 and MR357 roads. The proposed tower may impact the rural nature and eco-tourism associated with the Quiver Tree forest as the view from the R358 will be transformed.

There are not many options as to the mitigation of the visual impact of the proposed tower infrastructure, as no amount of vegetation screening or landscaping would be able to hide the structure of the CSP dimensions (especially within the receiving environment). Therefore the receiving environment will be transformed for the lifespan of the project.

It is envisaged that farmers residing adjacent to the proposed site and commuters travelling on the R357 will be predominantly impacted visually and impacted in terms of the areas sense of place from the proposed CSP facility. There is some infrastructural character within the area. Prominent features surrounding the proposed site and associated infrastructure include:

» Existing Kaxu Solar 1 Energy Facility (on Farm Scuit-Klip RE/422)
» Existing Konkoonsies 1 PV facility (on Farm Konkoonsies 6/91)
» Kaxu Solar IPP substation (on Farm Scuit-Klip RE/422)
» Paulputs substation (on Farm Scuit-Klip RE/422)
» Electricity transmission line traversing Farm Scuit-Klip 4/92 and Farm Scuit-Klip 1/92
» Minor road R357 and MR73

These are infrastructural elements that currently have an impact on the sense of place and visual resources in the area.

iii) Decommissioning phase

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the proposed facility the decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20 - 25 years post commissioning. The decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning however for a limited period of time.

Given the relatively small number of people employed during the operation phase (~45), the social impacts at a community level associated with decommissioning are likely to be limited. In addition, potential impacts associated with the decommissioning phase can be effectively managed with the implementation of a retrenchment and downscaling programme.

6.7.3. Impact tables summarising the social impacts (with and without mitigation)

Planning and Construction Phase Impacts

Construction Phase		
Nature: The creation of employment opportunities and skills development opportunities during the construction phase for the country and local economy		
	Without enhancement	**With enhancement**
Extent	Local- Regional (3)	Local- Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Highly probable(4)	Highly probable(4)
Significance	**Medium (36)**	**Medium (44)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement measures: » If possible, efforts should be made to employ local contractors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria » It is recommended that local employment policy is adopted to maximise the opportunities made available to the local labour force (sourced from nearest towns (Pofadder, Onseepkans and Pella) or within the KMLM).		

» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. » Where feasible, training and skills development programmes should be initiated prior to the commencement of the construction phase. » A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts » Improved pool of skills and experience in the local area. » Economic growth for small-scale entrepreneurs. » Temporarily employment during construction phase will result in jobs losses and struggles for construction workers to find new employment opportunities post construction.

Construction Phase		
Nature: Significance of the impact from the economic multiplier effects from the use of local goods and services		
	Without enhancement	**With enhancement**
Extent	Local- regional (3)	Local- Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly probable (4)
Significance	**Low (27)**	**Medium (33)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement » It is recommended that a local procurement policy is adopted by the developer to maximise the benefit to the local economy. » Where feasible, the developer should create a database of local companies, specifically Historically Disadvantaged (HD) which qualify as potential service providers (e.g. construction companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors; these companies should be notified of the tender process and invited to bid for project-related work where applicable. » It is recommended that good and services are sourced from the local area as much as possible; engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers, where feasible.		
Residual impacts Improved local service sector, growth in local business		

Construction Phase		
Nature: Population changes adding pressure on resources, service delivery, infrastructure maintenance and social dynamics during the construction phase as a result of an influx of construction workers into the study area		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. » The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. » A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.		
Residual impacts Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure, resources and services		

Construction Phase		
Nature: Added pressure on economic and social infrastructure and increase in social conflicts during construction as a result of in-migration of jobseekers		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » It is recommended that local employment policy is adopted to maximize the opportunities made available to the local labour force. » This 'locals first' policy should be advertised for construction employment opportunities, especially for semi and low-skilled job categories. Enhance employment opportunities for the immediate local area; Pofadder, Onseepkans and Pella, and if this is not		

possible, then the broader focus areas such as KMLM should be considered for sourcing workers. » Tender documents should stipulate the use of local labour as far as possible » Prior to construction commencing representatives from the local community (e.g. ward councillor, surrounding landowners) should be informed of details of the construction schedule and the exact size of the workforce and various skills levels required. » Recruitment of temporary workers at the gates of the development should not be allowed. A recruitment office should be established by the contractor in a nearby town to deal with jobseekers. » A security company is to be appointed and appropriate security procedures to be implemented. » Establish procedures for the control and removal of loiterers at the construction site. » A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure and services

Construction Phase		
Nature: Temporary increase in traffic disruptions and increase in noise and dust during the construction phase		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » Dust suppression measures must be implemented on a regular basis along the internal access roads and on the proposed site. » Vehicles used to transport sand and building materials must be fitted with tarpaulins or covers when travelling on roads. » Speed limits must be imposed on internal roads to limit dust generation » Working hours to be appropriately arranged during the construction phase, and/or that any deviation is approved by the surrounding landowners. » All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and made aware of the potential road safety issues. » Heavy vehicles should be inspected regularly to ensure their road safety worthiness. » Provision of adequate and strategically placed traffic warning signs and control		

measures along the N14 and R357 to warn road users of the construction activities taking place for the duration of the construction phase. Warning signs must be visible at all times.

» Implement penalties for reckless driving for the drivers of heavy vehicles as a way to enforce compliance to traffic rules.
» The developer and engineering, procurement and construction (EPC) contractors must ensure that any damage / wear and tear to the roads caused by construction related traffic/ project activities is repaired.
» A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.

Residual impacts

Only damage to roads that are not fixed could affect road users

Construction Phase		
Nature: Temporary increase in safety and security concerns associated with the influx of people during the construction phase		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation

» Working hours should be kept to daylight hours during the construction phase, and/or as any deviation that is approved by the surrounding landowners.
» The perimeter of the construction site and staff accommodation should be appropriately secured to prevent any unauthorised access to the site; the fencing of the site should be maintained throughout the construction phase
» Access in and out of the construction site should be strictly controlled by a security company
» The appointed EPC contractor must appoint a security company and ensure that appropriate security procedures and measures are implemented
» The appointed EPC contractor must provide workers with identity tags and prohibit the access of unauthorized people to the construction site.
» The contractor must ensure that open fires on the site for heating, smoking or cooking are not allowed except in designated areas.
» Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff.
» A comprehensive employee induction programme would cover land access protocols,

fire management and road safety. This must be addressed in the construction EMPr as the best practice. » The contractor should have personal trained in first aid on site to deal with smaller incidents that require medical attention » A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts None anticipated

Construction Phase		
Nature: Temporary negative impacts associated with on-site staff accommodation during the construction phase		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Low (21)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » Safety at and around the construction site and staff accommodation area should be ensured by fencing off the construction area to avoid unauthorised access and employing security personnel » The perimeter of the construction site and staff accommodation should be appropriately secured to prevent any unauthorised access to the site; the fencing of the site should be maintained throughout the construction phase. » Access in and out of the staff accommodation area should be strictly controlled by a security company. » Each person entering the project site should be required to present an access cards. » Family members and friends should not to be permitted access into the staff accommodation on site. » Security Company to be appointed and appropriate security procedures to be implemented. » A comprehensive employee induction programme must be implemented and must cover land access protocols, fire management and access controls. This must be addressed in the construction EMPr as the best practice. » Rubble and other solid waste should be appropriately stored on site and disposed of appropriately on a regular basis. » Appropriate sanitation and waste facilities to be provided to eliminate possible pollution problems. These facilities should be cleaned and maintained on a regular basis. No		

discharge of effluent to the surrounding environment should be allowed. » A comprehensive employee induction programme should address issues such as HIV/ AIDS and sexually transmitted diseases as well as alcohol and substance abuse. The induction should also address a code of conduct for employees that would align with community values. » Appoint a Health and Safety Officer. Contact details of this person should be made available to the construction workers and local community and procedures to lodge complaints set out. » A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts None anticipated

Construction Phase		
Nature: Intrusion impacts from construction activities will have an impact on the area's 'sense of place'		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » Limit noise generating activities in close proximity to sensitive receptors to daylight working hours and avoid weekends and public holidays. » Where feasible, the movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays and holiday periods. » Dust suppression measures must be implemented for heavy vehicles such as implementing appropriate dust suppressant measures on gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. » All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits. » Implement mitigation measures stipulated in the Visual Impact Assessment (VIA). » A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and		

monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts None anticipated

Construction Phase				
Nature: Impacts from dust pollution, the impacts on farm infrastructure and the wear and tear on the access road				
	Access Road 1		**Access Road 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Minor (2)	High (8)	Moderate (6)
Probability	Probable (3)	Improbable (2)	Probable (3)	Probable (3)
Significance	**Low (15)**	**Low (10)**	**Medium (33)**	**Low (27)**
Status (positive or negative)	Negative			
Reversibility	Yes			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			
Mitigation » If the access road 2 is utilised, the developer would need to establish appropriate agreements with the surrounding landowners along the R357 gravel road to ensure that the dust pollution is prevented. Possible options for dust mitigation include either: o Consider upgrading the access road to tar surfaced road on the gravel section of the R357, o Consider applying dust suppressants - There are many types and brands of chemical dust suppressants which work by binding lighter particles. Biodegradable suppressants may be applied as a surface treatment to "seal" the top of an area, or may be applied using a mixing method that blends the product with the top few inches of the land surface material, or o Consider using water sprays to keep dust under control with reduced vehicle speeds - High vehicle speeds increase the amount of dust created from unpaved areas. Reducing the speed of a vehicle to 20kmph can reduce dust emissions by a large extent. Speed bumps are commonly used to ensure speed reduction. » The contractor must ensure that damage / wear and tear caused by construction related traffic to the access road is repaired before the completion of the construction phase. » Ensure all vehicles are road worthy, speed limits are followed, and drivers are				

qualified and are made aware of the potential dust issues. » Ensure that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. » A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts Only damage to roads that are not fixed could affect road users

Construction Phase		
Nature: Temporary increase in dust pollution, security risks and impacts on farm infrastructure associated with the construction of the water pipeline		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » The EPC contractor must implement dust mitigation measures that include either: o Consider upgrading the R357 from a gravel road to tar surfaced road, o Consider applying dust suppressants - There are many types and brands of chemical dust suppressants which work by binding lighter particles. Biodegradable suppressants may be applied as a surface treatment to "seal" the top of an area, or may be applied using a mixing method that blends the product with the top few inches of the land surface material, or o Consider using water sprays to keep dust under control with reduced vehicle speeds - High vehicle speeds increase the amount of dust created from unpaved areas. Reducing the speed of a vehicle to 20kmph can reduce dust emissions by a large extent. Speed bumps are commonly used to ensure speed reduction. » Ensure all vehicles are road worthy, speed limits are followed, and drivers are qualified and are made aware of the potential dust issues. » Ensure that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. » The developer and engineering, procurement and construction (EPC) contractors must ensure that the fencing / entrance gates or any other infrastructure along the water pipeline route is either maintained in the present condition, improved upon if necessary to ensure security, or repaired if disturbed or damaged due to project activities.		

» A security company is to be appointed and appropriate security procedures are to be implemented. » A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.
Residual impacts Only damages to infrastructure that aren't repaired could affect farmers

Operation Phase Impacts

Operation Phase		
Nature: The creation of employment opportunities and skills development opportunities during the operation phase		
	Without enhancement	With enhancement
Extent	Local- regional (3)	Local- Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Highly probable (4)
Significance	**Medium (33)**	**Medium (44)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement » It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community as far as possibkle. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. » Vocational training programs for employees should be established to promote the development of skills.		
Residual impacts Improved pool of skills and experience in the local area		

Operational Phase		
Nature: Benefits to the local area from SED/ ED programmes and community trust from REIPPPP social responsibilities		
	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Medium (30)**

Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	No	
Enhancement » An in-depth Community Needs Analysis (CNA) will need to be carried out to make sure that the real needs of communities are addressed (in line with the local government) and the correct representatives of the community are appointed to run the community trust » Engagement and involvement of the local municipality (KMLM) with social responsibility plans		
Residual impacts Improvements in local communities through socio-economic development and enterprise development		

Operational Phase		
Nature: Development of clean, renewable energy infrastructure		
	Without enhancement	**With enhancement**
Extent	Local- Regional- National (4)	Local- Regional- National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (40)**	**Medium (40)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	Yes (impact of climate change)	
Can impacts be enhanced	No	
Enhancement None anticipated		
Residual impacts Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming		

Operational Phase		
Nature: Visual impacts and sense of place impacts associated with the operation phase of the CSP facility and associated infrastructure		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (36)**	**Medium (36)**

Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation » Implement mitigation measures and recommendations proposed by the visual specialist as part of the VIA.		
Residual impacts None anticipated if the visual impact will be removed after decommissioning, provided the CSP and associated infrastructure is removed and the site is rehabilitated to its original (current) status.		

Decommissioning and Closure

Nature: Social impacts associated with retrenchment including loss of jobs and source of income		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (1)	Short Term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (36)**	**Low (28)**
Status	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation » Implementation of a retrenchment and downscaling programme » All structures and infrastructure associated with the proposed facility should be dismantled, removed and transported off-site on decommissioning; & the landscape rehabilitated/ re-vegetated.		
Cumulative impacts Loss of jobs and associated loss of income etc. can impact on the local economy and other businesses. However, decommissioning can also create short term, temporary employment opportunities associated with dismantling etc.		
Residual impacts Loss of jobs and associated loss of income, can impact on local economy and other businesses.		

6.7.4. Implications for Project Implementation

Based on the social impact assessment, the following general conclusions and findings can be made:

» The preferred access road option from a social perspective is the access road option 1. This is the preferred access road option to access the proposed Paulputs CSP facility taking into account the matter of protecting the vineyards and grazing areas from dust pollution impacts along the gravel route of access road 2. It furthermore makes sense from an access management point of view that neighbouring solar farms share an access point to limit the number of access routes (provided that construction phases are at different times).
» The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focussed on the construction of CSP facility (these relate to influx of non-local workforce and jobseekers, intrusion and disturbance impacts (noise and dust, wear and tear on roads) and safety and security risks) and could be reduced with the implementation of the mitigation measures proposed. Although this will impact the local farming community, the impacts can be mitigated.
» The development will introduce a significant number of employment opportunities during the construction phase (temporary employment) and a limited number of permanent employment opportunities during operation phase.
» Capacity building and skills training among employees are critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other sectors.
» The proposed project could assist the local economy in creating entrepreneurial growth and opportunities, especially if local business is involved in the provision of general material, goods and services during the construction and operational phases.
» The proposed development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» The largest negative social impacts associated with the proposed development will result from the nuisance impacts and an influx of people into the local area.
» The proposed project does not result in an unacceptable increase in cumulative impacts. However, when considering the proposed CSP facility, it is also important to consider the cumulative social impacts that may arise with other proposed solar energy facilities in the area.

6.7. The No-Go Alternative

The no go alternative would result in no impacts on the social and biophysical environment.

The National Integrated Resource Plan (IRP) developed by the Department of Energy has identified the need for power generation from renewable resources such as solar as part of the technology mix for power generation in the country in the next 20 years. The need for the project at a national scale has therefore been determined. The location of the proposed project is further supported by national and provincial planning initiatives in that it is located within a zone identified for such development (i.e. within REDZ 7 as defined by the national government and within the Solar Corridor as defined by the Provincial SDF).

South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to reliance on fossil fuels. The proposed project will contribute to South Africa achieving goals for implementation of renewable energy and 'green' energy and will aid in meeting national commitments for reduction of greenhouse gas emissions (as per the Kyoto Protocol and COP21 agreements). With South Africa's commitment to reducing its CO_2 emissions (in terms of the COP21 Agreement), coupled with the increasing demand for electricity, the 'no-go option' is not considered a viable alternative.

At both a provincial and national level, it should be noted that the Paulputs CSP Project is not unique. In that regard, a significant number of solar energy facility developments are currently proposed in the region. Therefore, when considering the desirability of the no go option for the specific project, the costs and benefits of the proposed project must be considered.

The implementation of the project is expected to result in a number of environmental costs, as detailed within this report. This could include:

» Direct loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the Paulputs CSP Project (which is limited to the development footprint of 900ha). The cost of loss of biodiversity is expected to be limited as a result of the wide distribution of the affected vegetation type and the limited presence of species of conservation concern within the development area.
» Visual impacts associated with the CSP Facility. The cost of loss of visual quality to the area is expected to be medium-low as a result of the location of the facility in relation to sensitive visual receptors, as well as the nature of the topography of the area.
» Change in land-use and loss of land available for agriculture on the development footprint. The cost in this regard is expected to be limited due to the low agricultural potential of the property and the fact that part of the land has been rezoned Special Solar.

These costs are expected to occur at a local and site level and are considered acceptable provided the mitigation measures as outlined in this EIA and the EMPr are implemented. No fatal flaws associated with the proposed project have been identified.

The positive implications of establishing the Paulputs CSP Project on the demarcated site include:

» The project will result in important socio-economic benefits at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development (as detailed in Chapter 2 of this report). These will persist during the preconstruction, construction and operational phases of the project.
» The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective SDFs and IDPs.
» The project is located within an area demarcated for solar development at a Provincial and Local scale, and is located within an area where two CSP facilities are already authorised (facilitating consolidation of similar infrastructure). The location is therefore considered desirable
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix. As a result of the on-site storage associated with the project, it has the potential to provide extended periods of power to the grid. This will assist in stabilising the power supply during the periods of the day when this is required most.

The benefits of the project are expected to occur at a national, regional and local level. As the costs to the environment at a site specific level have been largely limited through the appropriate placement of infrastructure on the site within lower sensitivity areas, the expected benefits of the project are expected to partially offset the localised environmental costs of the project.

The No-Go Alternative would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, as well as its commitments to reduction in greenhouse gas emissions, this would represent a negative social cost. In addition, the implementation of the no go option would result in a lost opportunity at a local and regional level from a socio-economic perspective as a result of no opportunities for employment or socio-economic upliftment.

The no go alternative is therefore not considered desirable at a local, regional and national scale

ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS CHAPTER 7

As discussed in the previous chapter, the Paulputs CSP Project may have effects (positive and negative) on natural resources, the socio-economic environment and on the people living in a project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with the Paulputs CSP Project largely in isolation (from other similar developments).

As detailed within this report, the development of renewable energy generation capacity is supported at a National and Provincial level from a policy perspective. As a result of the location of the Paulputs CSP Project within an established solar energy development node, it can be expected that projects of a similar nature will be developed in this node. As a result, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and minimised where required and possible. This chapter provides an assessment of the cumulative impacts expected to be associated with the proposed project when considered together with other similar developments in the area.

7.1 Approach Taken to Assess Cumulative Impacts

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

The cumulative impacts that have the potential to be compounded through the development of the proposed CSP facility and its associated infrastructure in proximity to other similar developments include impacts such as those listed below. The role of the cumulative assessment is to test if such impacts are relevant to the Paulputs CSP Project in the proposed location when considered together with other similar developments:

» Unacceptable loss of threatened or protected vegetation types or species through clearing, resulting in an impact on the conservation status of such flora or ecological functioning;
» Unacceptable risk to aquatic habitat resulting due to the increase in the extent of hard or impermeable surfaces in the greater area;

» Unacceptable risk to avifauna through loss of habitat, infringement on breeding areas, or risk to collision-prone species;
» Unacceptable loss of heritage resources;
» Complete or whole-scale change in sense of place and character of an area and unacceptable visual intrusion;
» Positive and negative contribution from a socio-economic perspective; and
» Contribution to climate change mitigation.

The scale at which the cumulative impacts are assessed is important. For example the significance of the cumulative impact on the regional or national economy will be influenced by solar developments throughout South Africa, while the significance of the cumulative impact on visual amenity may only be influenced by solar developments that are in closer proximity to each other, up to 30 km apart in this instance. For practical purposes a sub-regional scale has been selected for this cumulative evaluation.

Figure 7.1 indicates the location of the Paulputs CSP Project in relation to all other known renewable energy project developments within a 30km radius of the site. These projects were identified using the Department of Environmental Affairs Geographic Information System digital data developed by the CSIR[11] and current knowledge of projects being proposed in the area. In the case of the proposed Paulputs CSP Project, there are at least 4 other facilities, all of which is a preferred bidder project (refer to **Figure 7.1** and **Table 7.1**), all at various stages of development.

Table 7.1: Other projects/ developments within 30km from the Paulputs CSP Project site

Project Name	Approximate distance from the Paulputs CSP Project site	Project Status
Konkoonsies II Solar Facility	PV facility located <1km south-west of the development footprint	Preferred Bidder Round 4; construction to commence mid-2016
Konkoonsies I Solar Facility	PV facility located ~2km south-west of the development footprint	Constructed and operational
Xina Solar One	CSP facility located on Portion 4 of the farm Scuitklip 92 located ~1km south-east of development footprint	Under construction
KaXu Solar One	CSP facility located on Portion 4 of the farm Scuitklip 92 located ~1.5km south-east of the development footprint	Constructed and operational

[11] Available online at https://dea.maps.arcgis.com/

The potential for cumulative impacts are summarised in the sections which follow and have been considered within the detailed specialist studies, where applicable (refer to **Appendices D – J**.

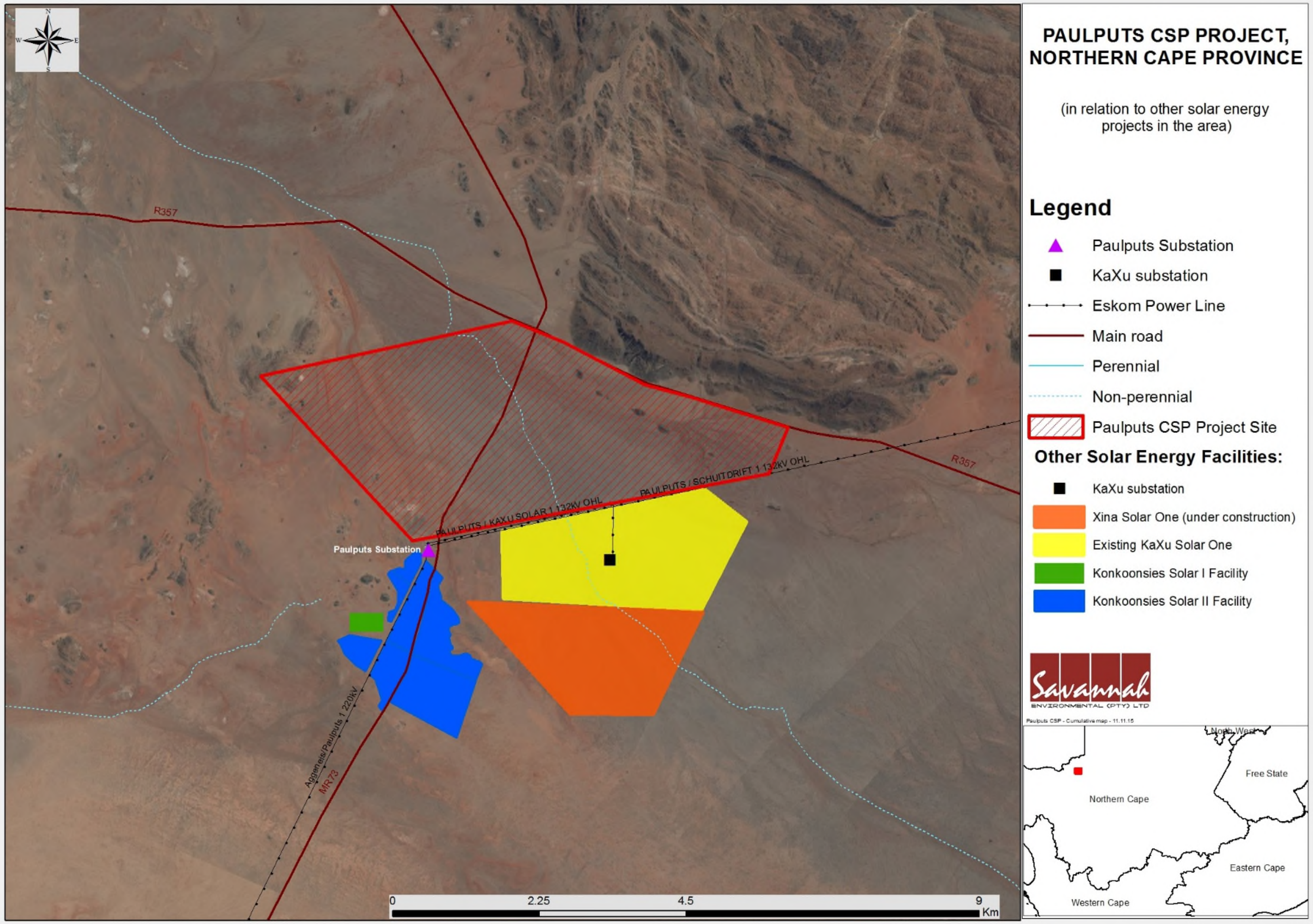

Figure 7.1: Solar energy projects surrounding the Paulputs CSP Project (these projects areas were identified using the Department of Environmental Affairs Geographic Information System digital data developed by the CSIR. It must be noted that this secondary product has not yet been verified by DEA)

The cumulative impacts of the above mentioned renewable energy developments in the broader area and the Paulputs CSP Project are qualitatively assessed in this Chapter. As these cumulative impacts are explored in more detail, the trade-offs between promoting renewable energy (and the associated benefits in terms of reduction in CO_2 emissions – a national interest) versus the local and regional environmental and social impacts and benefits (i.e. impacts on bird populations, landscape, tourism, flora, local economy, employment etc.) will become evident. It is only when these trade-offs are fully understood, that the true benefits of renewable energy can be assessed.

7.2 Cumulative Impacts on Ecological Processes

Due to the fact that there are already three existing solar facilities in the area, as well as the fact there are more planned, the cumulative impacts are likely to be of a higher order of magnitude than the significance ratings given in the impact assessment section considering the project alone. It must however be noted that none of the other solar facilities are tower facilities and therefore impacts unique to tower facilities are unlikely to have a higher cumulative impact. The cumulative impacts given here are based on all other projects' unmitigated impacts cumulated with this project's mitigated impacts.

Nature of impact: Vegetation clearing is likely to be the greatest impact on the vegetation communities affected by the proposed development and activities. All vegetation communities are likely to be affected by this impact, with the *Stipagrostis ciliata – Aristida congesta* open grassland vegetation community being the vegetation community with the most vegetation cleared. Habitats affected area mainly those with moderate ecological integrity and moderate conservation importance. High, moderate and low ecological integrity and -conservation importance of the areas that will be impacted by this impact are low to moderate, however species of concern (such as *Hoodia gordonii*, *Boscia foetida* and *Aloe dichotoma*) may be impacted upon		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (22)**	**Moderate (42)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Provided that all similar projects are held to the same standards of mitigation this		

impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region

Nature of impact: Harmful or toxic substances that may affect the biota of the area if they were to enter the system include: diesel, hypoid oil, motor oil, polluted water used during the operations and chemicals transported to and from site and used in the operations. Habitats affected area mainly those with moderate ecological integrity and moderate conservation importance. The spillage of harmful or toxic substances may impact on the fauna and flora of the area in a number of ways. Direct pathways include ingestion of the substances by fauna species resulting in toxicity in that individual, uptake of toxic chemicals by the roots plants which may lead to toxicity in the plants and the chemicals entering the plant or animals system due to contact (through the skin, leaves or stems). Indirect pathways include the ingestion of contaminated plants or animals by other herbivorous or predatory species. The predation of contaminated animals by both other animals and humans is a common occurrence during chemical contamination due to these animals being sluggish, and less likely to escape predation, due to chemical toxicity.

High, moderate and low ecological integrity and -conservation importance areas may be impacted by this impact are low to moderate, however species of concern (such as *Hoodia gordonii*, *Boscia foetida* and *Aloe dichotoma*) may be impacted upon.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Regional (3)
Duration	Very Short term (1)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Very improbable (1)	Highly probable (4)
Significance	**Low ()**	**Moderate (52)**
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region

Nature of impact: Increased dust will occur in all areas where vegetation is cleared. Dust in the area will be greatly increased due to the dry weather conditions and the nature of the soil in the area. Dust settling on plant material can reduce the amount of light reaching the chlorophyll in the leaves, thereby reducing photosynthesis, which in turn reduces plant productivity, growth and recruitment

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**

Extent	Site only (1)	Regional (3)
Duration	Short term (2)	Medium term (3)
Magnitude	Low (4)	Moderate (6)
Probability	Very improbable (1)	Probable (3)
Significance	**Low (18)**	**Moderate (36)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region		

Nature of impact: Local migrations of fauna in the area may be affected by linear infrastructure, fences and buildings, due to these areas forming a barrier to migrating animals or reducing the chance of an animal surviving its migration due to collisions with vehicles on roads. Desert animals are particularly migratory due to variations in food and water availability, and species of concern may be affected by this impact. This impact is likely to be low due to the greatly reduced wildlife in the area due to previous disturbances in the area causing a greatly reduced species. Furthermore, many of the roads are already in use. The larger study area (including the location of all projects within 30km of the proposed site) is recognised as an ESA due to being a migratory route, this requires further investigation.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (20)**	**Moderate (42)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region		

Nature of impact: The fact that the area will be cleared for construction creates niches

that can be colonised by exotic and/or invasive species. This is compounded by the fact that trucks and other heavy machinery often act as vectors for seeds of these species. Desert and semi-desert areas are very susceptible to invasion by exotic species due to the slow growth rate of indigenous vegetation due to low rainfall and this impact needs to monitored and mitigated. Areas of high conservation importance and/or ecological integrity should be avoided.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	High (8)
Probability	Improbable (2)	Highly probable (4)
Significance	**Low (18)**	**High (68)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region		

Nature of impact: Increased erosion can eventually lead to the loss of vegetation and habitats for fauna species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion. Increased erosion can eventually lead to the loss of vegetation and habitats for further species. Soils in the area are prone to erosion in areas where vegetation is cleared, this is further compounded by the fact that precipitation in the area occurs through heavy rainfall events in in the form of thundershowers in summer. Furthermore large areas will be cleared before construction leaving these areas prone to erosion.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Moderate (6)
Probability	Improbable (2)	Highly probable (4)
Significance	**Low (20)**	**Medium (56)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources	Yes	Yes

Can impacts be mitigated?	Yes
Mitigation: » Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region	

7.2.1. Implications for Project Implementation

Cumulative impacts on ecological processes considering the proposed project and other similar projects in the area are expected to be of medium significance without the implementation of appropriate mitigation measures. Therefore, with mitigation cumulative impacts are expected to be of a lower significance. As a result, there are not expected to be any ecological fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

7.3 Cumulative Impacts on Avifauna

Due to the fact that there are already three existing solar facilities in the area, as well as the fact there are more planned, the cumulative impacts are likely to be of a higher order of magnitude than the significance ratings given in the impact assessment section. It must however be noted that none of the other solar facilities are tower facilities and therefore impacts unique to tower facilities are unlikely to have a higher cumulative impact. The cumulative impacts given here are based on all other projects' unmitigated impacts cumulated with this project's mitigated impacts.

Nature of impact: Impact on local bird community due to habitat loss from the construction of the CSP plant and associated infrastructure including power lines. There are a number of solar projects proposed in the region. All of these are likely to involve clearing of vegetation and therefore the cumulative impact of this activity could be significant.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Regional (3)
Duration	Long term (4)	Medium term (3)
Magnitude	Minor (2)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (28)**	**Moderate (32)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-
Mitigation: » Provided that all similar projects are held to the same standards of mitigation this		

impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region

Nature of impact: Impact on local bird community due to disturbance on site and in surrounding area during construction and operation. Sensitive and threatened species are of most concern and particularly while breeding.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (15)**	**Low (21)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-

Mitigation:

» Provided that all similar projects are held to the same standards of mitigation this impact can be further mitigated in its entirety across all projects. This could reduce the overall probability and magnitude of this impact in the region

Nature of impact: Due to the fact that this facility will be the only tower facility in the area, cumulative impacts will be no higher than the impacts of the proposed project.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Site only (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (16)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-

Mitigation:

» Openings at either end of the horizontal rotating cylinder – The simplest way to mitigate this impact would be to seal the openings at each end of the cylinder. This can be done by tack-welding appropriately sized discs onto either end.

» Heliostats in the vertical position – the heliostats should be limited to being in the vertical position for as short a time as possible. The trucks which clean the heliostats should follow each other as close as possible and the heliostats returned to a static (horizontal) or focussed position as soon as possible after cleaning.

- Flat surfaces at the base of the tower – all ledges should be built or panelled so that they slope at an angle downwards to the outside to prevent nesting on these ledges.
- Colour of the tower– a neutral brown, concrete colour or grey would prevent the reflection of UV light and thus mitigate the possible impact of the white tower.
- Focusing the heliostats above the tower during maintenance – ideally the heliostats should be in one of three positions vertical (washing position – for as short a time as possible), static position or focussed in order to prevent the undetectable "hotspot" above the tower.

Nature of impact: Collisions of birds with overhead power lines. There are a number of power lines in the vicinity of the site as well as throughout the Northern Cape. Power lines that cross remote areas should be fitted with bird diverters (diurnal and nocturnal) to reduce the high incidence of collisions. As the number of power lines increase so the number of deaths of bustards and other birds will increase. With mitigation, it is considered unlikely that the addition of the proposed length of power line will significantly add to the cumulative impact of collision events in the region.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Moderate (42)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-

Mitigation:

All projects in the area should adhere to the following mitigation measures:

- The power line should be kept as low as possible taking into account engineering and legal requirements.
- The span lengths should be kept as short as is reasonable.
- Bird flappers should be placed as markers on the earth wire, which will increase the visibility of the power line.
- Markers should be placed with sufficient regularity (at least every 5-10m).
- Eagle eye devices may be used, if feasible to deter birds from the CSP plant area/ solar field.

Nature of impact: Power lines have a range of bird related impacts, one of which is electrocution events, which occur when a bird perches on an electrical structure and causes

an electrical short circuit by bridging the gap between live components and/or live and earthed components. There are a number of power lines in the vicinity of the site, as well as throughout the Northern Cape. Power lines that cross remote areas should be fitted with bird guards to reduce the incidence of perching on towers. With mitigation, it is considered unlikely that the addition of the proposed length of power line will significantly add to the cumulative impact of electrocution events in the region.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site only (1)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (14)**	**Moderate (39)**
Status	Negative	Negative
Reversibility	Moderate	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-
Mitigation: » All projects in the area should adhere to the following mitigation measures: Mono pole bird friendly tower structures will be utilised in the development. This will significantly minimise the number of electrocutions		

7.3.1. Implications for Project Implementation

Cumulative impacts on avifauna considering the proposed project and other similar projects in the area are expected to be of low – moderate significance without the implementation of appropriate mitigation measures. Therefore, with mitigation the significance of cumulative impacts will be lower. As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

7.4 Cumulative Impacts on Soil and Agricultural Potential

The major potential cumulative impact would be the possibility of wind erosion caused by construction activities at the Paulputs CSP site and other facilities in the area.

Nature of impact: Loss of topsoil due to vegetation removal resulting in increased wind erosion potential		
	Cumulative Contribution of Proposed Project	**Cumulative Impact without Proposed Project**
Extent	Local (2)	Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)

Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Moderate (33)**
Status	Negative	Negative
Reversibility	Medium	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: As specified for the impact in isolation, namely: » Project footprint must be kept as small as possible, with minimal vegetation removal. » In areas susceptible to wind erosion, keep soil moist if possible during construction activities. » Soil conservation measures (windbreaks, geotextiles etc) should be implemented if required to protect bare areas. » Re-vegetation must be undertaken as soon as possible after construction is completed in an area, using irrigation as required. » Regular monitoring (at least every 6 months) must be undertaken until vegetation cover re-established		

Nature of impact: Loss of agricultural land due to construction of infrastructure		
	Cumulative Contribution of Proposed Project	**Cumulative Impact without Proposed Project**
Extent	Site only (1)	Site only (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (28)**	**Low (28)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Ensure minimum extent of construction footprint. However, low prevailing agricultural potential means impact will not be significant within wider area.		

7.4.1 Implications for Project Implementation

Cumulative impacts on agricultural potential and soils considering the proposed project and other similar projects in the area are expected to be of low – moderate significance without the implementation of appropriate mitigation measures. Therefore, with mitigation the significance of cumulative impacts will be lower. As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

7.5 Cumulative Aquatic impacts

Water quantity issues need to be addressed on a regional basis, especially considering that there is no surface water within the study area. This will be conducted in detail as part of the Water Use License process, but an indicative assessment is presented in Chapter 6. The WULA process will also largely address the cumulative impact of the project, both considering the needs of the adjacent projects, downstream social, agricultural and the environmental needs. Thus this level of cumulative assessment is beyond the scope of this study as the WULA process is driven by the DWS at this given point. Although based on the available information (low confidence), the cumulative impact of water use is anticipated to be low.

7.6 Cumulative Visual Impacts

As there are no other tower facilities within the broader area, identified cumulative impacts only relate to the low development and associated infrastructure associated with the proposed power tower. The impacts associated with these elements will be similar to and will largely impact the same area as the two existing CSP parabolic trough projects and the Paulputs substation which are located adjacent to the proposed development. The proposed project will therefore not extend but will intensify the industrial character within a limited impact area.

There is nothing of a similar scale or nature in the affected landscape as the proposed power tower. On a basic level it might be argued that it extends the influence of development over a significant area. Whilst this is the case it provides too simplistic a view. It cannot really be considered that this will result in a significant increase of urbanisation or industrial influence as the setting will still be the existing, extensive semi-natural rural landscape. Because of this it may also be argued that it will not detract from the rural setting.

The introduction of a major and obviously man made, single focal point will however change the nature of the view over a wide area. This is a new type of impact within the affected landscape that in the absence of anything that is likely to have a similar affect can only be considered on an individual rather than a collective basis.

Nature: Adding to the industrialisation of the area. The assessment has shown that the lower sections of the proposed project will intensify industrial character within an area that is already industrial in nature. The tower will add a significant area that will be affected by development. However this impact will be of a different nature and scale than existing industrial development. It will therefore be a new impact and not a cumulative one. Existing industrial development

creates a relatively intense impact over a small area whereas the proposed tower will create a single element that will be visible over a very wide area. These two impacts are not comparable. The tower therefore will create a new type of impact rather than create an extension to existing or planned impact in the area. It therefore will not add to existing similar impacts.

	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent	Site and surroundings, (2)	Regional, **(3)**
Duration	Long term (4)	Long term, **(4)**
Magnitude	Small (0)	Moderate to high, **(7)**
Probability	Probable (3)	Highly probable **(4)**
Significance	**Low (18)**	**Medium (56)**
Status (positive or negative)	**Negative**	Negative
Reversibility	High	High
Loss of Resources?	No	No
Can impacts be mitigated?	Yes	NA
Confidence in findings:	High	

Mitigation:

Low level impacts associated with the heliostat field can be mitigated.

Planning:

- Plan levels to minimise earthworks to ensure that levels are not elevated.
- Plan to maintain the height of structures as low as possible.
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development.

Operations:

- Reinstate any areas of vegetation that have been disturbed during construction.
- Remove all temporary works.
- Monitor rehabilitated areas post-construction and implement remedial actions.
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site.
- Return all affected areas to appropriate land use.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Nature: The lower sections of the proposed project will intensify industrial character within an area that is already industrial in nature.

The tower will add a significant area that will be affected by development. However this impact will be of a different nature and scale than existing industrial development. Existing industrial development creates a relatively intense impact over a small area whereas the proposed tower will create a single element that will be visible over a very wide area. These two impacts are not comparable. The tower therefore will create a new

type of impact rather than create an extension to existing or planned impact in the area.		
	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent	Local **(1)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Small to minor **(1)**	Moderate to high **(7)**
Probability	Very improbable **(1)**	Highly probable **(4)**
Significance	**Low (6)**	Medium **(56)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Loss of Resources?	No	No
Can impacts be mitigated?	Yes	Yes
Confidence in findings:	High	

Mitigation:

Low level impacts associated with the heliostat field and development around the tower can be mitigated.

Planning:

- Plan levels to minimise earthworks to ensure that levels are not elevated.
- Plan to maintain the height of structures as low as possible.
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development.

Operations:

- Reinstate any areas of vegetation that have been disturbed during construction.
- Remove all temporary works.
- Monitor rehabilitated areas post-construction and implement remedial actions.
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site.
- Return all affected areas to appropriate land use.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Nature: The lower sections of the proposed project will intensify industrial character within an area that is already industrial in nature.

The water pipeline has the potential to expand the area of disturbance significantly. However if disturbance is minimised and rehabilitation undertaken the cumulative impact of this is likely to be negligible.

	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**

Magnitude	Minor **(2)**	Minor **(2)**
Probability	Probable **(3)**	Probable **(3)**
Significance	**Low (27)**	**Low (27)**
Status (positive or negative)	**Negative**	**Negative**
Reversibility	High	High
Loss of resources?	No irreplaceable loss	No irreplaceable loss
Can impacts be mitigated?	Yes	Yes
Confidence in findings:	High	

Mitigation:

Planning:

- Plan levels to minimise earthworks to ensure that levels are not elevated.
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development.

Operations:

- Reinstate any areas of vegetation that have been disturbed during construction.
- Remove all temporary works.
- Monitor rehabilitated areas post-construction and implement remedial actions.
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the site.
- Return all affected areas to appropriate land use.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Nature: The cumulative impact of the lighting associated with other solar energy projects in the area.

Currently lighting in the area is comprised of occasional low level lights associated with isolated homesteads. The project is therefore seen in a relatively dark area during night time hours.

There is potential for security lighting and operational lighting associated with solar energy projects to transform the night time landscape in the area.

The extent of lighting associated with solar projects in the area is not known. The assessment found that;

- If full security floodlighting of facilities is undertaken for existing facilities, then the proposed development could add slightly to impacts associated with these existing projects;
- If full security floodlighting is not required and only low level lighting of operational areas (buildings), then the proposed project will add negligible additional impact to the current CSP projects.

In the former case, the proposed extension will add slightly to cumulative impacts.

In the latter case, the proposed extension will not add to cumulative impacts.

	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent	Site and immediate surroundings **(2)**	Region **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Minor **(2)**	Low to moderate **(5)**
Probability	Probable **(3)**	Probable **(3)**
Significance	**Low (24)**	Medium **(36)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Confidence in findings:	High	
Mitigation: 1) Use of motion sensors to turn on security lights when needed. 2) Use of infrared security systems. 3) Preventing light spill through careful design.		

Nature: Construction impacts associated with the two existing CSP projects on the property appear to have been addressed. Therefore, this project will present a new area of impact rather than adding to existing impacts. The cumulative effect of impacts associated with construction is therefore expected to be minimal.		
	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent	Site and surroundings, **(1)**	Local, **(2)**
Duration	Very short duration, **(1)**	Very short duration, **(1)**
Magnitude	Small **(0)**	Minor, **(2)**
Probability	Very improbable, **(1)**	Probable, **(3)**
Significance	Low, **(2)**	Low, **(15)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Loss of resources?	There will be no irreplaceable loss.	There will be no irreplaceable loss.
Can impacts be mitigated?	Yes	Yes
Confidence in findings:	High	
Mitigation: • Minimise clearance of vegetation; • undertake dust prevention measures; and		

- Manage waste effectively and prevent waste blowing around and off site.

Nature: The cumulative impact of the project on glint and glare associated with solar projects in the area.

The assessment indicates that it is possible that there could be glint and glare impacts associated with the existing CSP projects on the property. However, if impacts should occur due to this project and appropriate mitigation is undertaken as indicated then there will be no cumulative impact.

	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent	Site and immediate surroundings**, (1)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Minor **(2)**	Minor **(2)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(14)**	**Low (16)**
Status (positive or negative)	Negative	Negligible
Reversibility	High	High
Loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Confidence in findings:	Medium	

Mitigation:
If impacts should occur the following measures can be used;
- Screening with opaque fencing / earth berms; and / or
- Careful siting and operation of solar collectors turning mirrors away from the sun during time periods when glare impacts are significantly adverse may substantially reduce or avoid visual impacts from offsite glare.

7.6.1. Implications for Project Implementation

Cumulative impacts on landscape character and sensitive visual receptors considering the proposed project and other similar projects in the area are expected to be of low – medium significance with the implementation of appropriate mitigation measures. There are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

7.7 Cumulative Heritage Impacts

Through Cultural Resource Management (CRM) studies for developments in the area, heritage sites are identified and protected from accidental damage. This can be regarded as a positive impact as it adds to the heritage database of the area.

In terms of the cumulative impact of the proposed Paulputs CSP Project and other developments in the area, the potential for impact on the heritage landscape is increased slightly. However, as no sites of heritage value have been identified within the development area, the project is not expected to have any impact with regards to heritage. The contribution to cumulative impacts is therefore expected to be negligible.

Nature of impact: Heritage impacts associated with the establishment of the proposed CSP Facility with other CSP Facilities in the area on the archaeology of the area		
	Without mitigation	**With mitigation (Preservation/ excavation of site)**
Extent	Local (1)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	High (8)
Probability	Improbable (2)	Probable (3)
Significance	**Low (28)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: » No-go areas have been recommended in this study in order to mitigate impacts on sensitive elements in the landscape that provided shelter and resources for people in Stone Age times.		

7.7.1. Implications for Project Implementation

The contribution of the project to cumulative impacts is expected to be negligible. As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

7.8 Cumulative Socio-Economic Impacts

Cumulative impacts from employment, skills and business opportunities

The proposed CSP facility and the establishment of other solar energy facilities has the potential to result in significant positive cumulative impacts; specifically with the creation of a number of socio-economic opportunities for the Province, which in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. Benefits to the local, regional and national economy through employment and procurement of services could be substantial should many renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore at municipal level, the cumulative impact could be positive and could incentivize operation and maintenance companies to centralise and expand their activities towards education and training more closely to the projects. Cumulative impacts on local entrepreneurs will be positive and assist in developing their businesses further. Also renewable energy projects under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) are obliged to make a real contribution to local economic development in the area. Awarded projects are required to spend a certain amount of their generated revenue on Socio-Economic Development (SED) and Enterprise Development (ED) and share ownership in the project company with local communities. The cumulative impacts are likely to have significant positive impact on the local economy.

Nature: An increase in employment opportunities, skills development, SED and business opportunities with the establishment of more than one solar energy facility		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local- Regional (3)	Local- regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (39)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Confidence in findings	High	
Enhancement The establishment of a number of solar energy facilities in the area has the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development, business opportunities and SED/ED. The positive benefits will be enhanced if local employment policies are adopted and local services providers are utilised by the developers to maximise the project opportunities available to the local community.		

The impact is assessed to be negative; local to regional in extent; long-term; moderate intensity and probable. The overall impact is likely to have a medium negative significance to the local area.

Cumulative impacts with large scale in-migration of people

The development of large-scale solar projects in the local area will likely draw a large number of labour, businesses and jobseekers to the area. If the local labour force cannot be sourced locally or the local labour pool is inadequate for the solar energy project, outside labour will likely move to the area to fill the gap. The area may experience an influx of new residents who may move to the area looking for job opportunities; which will have effects on the existing population during the construction periods that could entail problems of housing, sanitation, water usage and solid waste disposal. Employment for a solar energy facility peaks during construction and significantly declines during operation; since solar energy facilities need relatively few workers while in operation, solar facilities will not create long-term boomtowns. Though there may be an influx of workers during construction, these workers are largely temporary. Rapid population growth is a common experience in rural towns near new large development projects. Towns with larger populations (greater than 1 000 individuals) and with developed services will likely experience greater rates of population growth than areas without developed services. In relation to the area, the towns that are sensitive receptors will be Vryburg (population of 21 182 people) and the smaller settlements nearby. With the influx of new individuals, secondary industries in the town may also begin to grow, more individuals will move to the area to fill these secondary positions. The impact of this on services and resources is likely to impact the current communities and increase the pressure on local municipalities to meet the basic needs of these potential new communities. The poor communities are likely to be the most vulnerable to loss of service provision and suffer the negative impact of large scale in-migration. There is potential for the influx of migrants to significantly change the local receiving environment and this is likely to have a permanent impact in the region. If more than one solar energy facility is under construction at any one time, then the impacts from in-migration of people is likely to have more of a negative impact on the local area. However, this is unlikely to occur as all other facilities in the area are already operating, under development or soon to be developed. All the other facilities will already be developed by the time this proposed project is under construction. Therefore, the proposed project would not add significantly to the cumulative impact, it would mainly just extend the period over which the impact is experienced.

Construction & Operational Phase

Nature: Negative impacts and change to the local economy with an in-migration of labourers, businesses and jobseekers to the area.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (3)	Local (3)
Duration	Short term (2)	Long term (4)
Magnitude	Minor (2)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (14)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Confidence in findings	High	
Mitigation » Develop a recruitment policy/ process (to be implemented by contractors), which will source labour locally, where feasible. » Working together with government agencies to ensure service provision is in line with the development needs of the local area. » Forming joint ventures with community organisations, through Trusts, which can provide local communities with benefits, such as employment opportunities and services.		

The impact is assessed to be negative; local to regional in extent; long-term; low intensity and probable. The overall impact is likely to have a low negative significance to the local area.

Cumulative impact of nuisance impacts (noise, dust & traffic)

Impacts associated with the construction activities of other solar energy facilities being constructed in the area include noise, dust and increased traffic is a potential issue. The cumulative impact of other solar energy projects in the area could increase the nuisance impacts for the surrounding landowners and negatively impact farming activities. Experience from other Solar Energy Facilities projects indicate that site clearing does increase dust pollution and noise being generated, which in turn impacts the adjacent farming areas that are utilized for livestock farming and grape cultivation. The movement of heavy construction vehicles and construction activities have the potential to create noise and dust on local roads. The primary sources of noise during construction phases would be from the construction equipment and other sources of noise include vehicle traffic. Generation of dust would come from construction activities and movement of construction vehicles on gravel roads. Short-term increases in the use of local roads would occur during the construction periods. Increased traffic due to construction vehicles could cause disruptions to the local community and increase safety hazards. The use of local roads and transport systems may cause road deterioration and congestion. An increase of traffic from the rise in construction vehicles is a potential safety concern for road users and local communities in the area. The combined nuisance impacts with several other solar developments in the area in relation to noise, dust and traffic impacts could significantly affect sensitive social receptors in the local area. However, this is unlikely to occur as all other facilities in the area are already operating, under development or soon to be developed. All the other facilities will already be developed by the time this proposed project is under construction. Therefore, the proposed project would not add significantly to this cumulative impact, it would mainly just extend the period over which the impact is experienced.

Construction Phase		
Nature: Increase in traffic disruptions and increase in noise and dust with other solar energy facility developments		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Confidence in findings	High	
Mitigation » Dust suppression measures must be implemented on a regular basis. » Vehicles used to transport sand and building materials are fitted with tarpaulins or covers when travelling on roads. » Speed limits must be imposed on internal roads to limit dust generation » Ensure all vehicles are roadworthy, drivers are qualified and are made aware of the potential noise and dust issues. » Working hours to be appropriately arranged during the construction phase, and/or as any deviation that is approved by the surrounding landowners. » All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and made aware of the potential road safety issues. » Heavy vehicles should be inspected regularly to ensure their road safety worthiness. » Provision of adequate and strategically placed traffic warning signs and control measures along the N14 and R357 to warn road users of the construction activities taking place. Warning signs must be visible at all times. » Implement penalties for reckless driving for the drivers of heavy vehicles as a way to		

enforce compliance to traffic rules.

» The developer and engineering, procurement and construction (EPC) contractors must ensure that any damage / wear and tear to the roads caused by construction related traffic/ project activities is repaired.
» A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process. The EPC contractor should appoint a designated staff member to implement grievance procedures and address issues and complaints. A Public Complaints register must be maintained, by the Contractor and monitored by the ECO, to record all complaints and queries relating to the project and the action taken to resolve the issue.

The impact is assessed to be negative; local in extent; temporary in duration; low intensity and probable with mitigation measures. The impact is assessed to be of low significance to the decision making process.

Cumulative impacts on the sense of place and landscape

The immediate landscape of the area has already been altered by the existing CSP parabolic trough projects and the Paulputs substation which are located adjacent to the proposed development. The proposed project will intensify the industrial character within a limited impact area. The potential impact of solar facilities on the landscape is an issue that does need to be taken into consideration, specifically given the growing number of solar energy facility applications in the Northern Cape Province. The Environmental Authorities in the province should therefore be aware of the potential cumulative impacts when evaluating applications.

Operational Phase		
Nature: Visual impacts and change in the sense of place impacts associated with the establishment of more than one solar energy facility in the area		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (36)**	**Medium (48)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	No	
Confidence in findings	High	

Mitigation

» Implement mitigation measures and recommendations proposed by the visual specialist as part of the VIA.

The impact is assessed to be negative; local to regional in extent; long-term; moderate intensity and probable. The overall impact is likely to have a medium negative significance to the local area.

7.8.1. Implications for Project Implementation

As construction of the other facilities within the immediate vicinity of the project will be completed before that of the proposed project commences, cumulative impacts on the socio-economic environment are expected mainly during the operation phase. Cumulative impacts on the socio-economic environment as a result of the proposed project are expected to be both positive and negative. Impacts are expected to be of medium significance (both positive and negative) with the implementation of enhancement or mitigation measures. There are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

7.9 Contribution of the Project to Climate Change Mitigation

South Africa is a country with an economy dependent on coal for the majority of its electricity, an energy-intensive industrial sector and an energy sector responsible for 82% of total GHG emissions, making it the 12th highest world emitter of GHG[12].

It has been reported internationally that the move towards renewable energy for electricity generation needs has resulted in decreased greenhouse gas emissions. The International Energy Agency announced in March 2015 carbon dioxide emissions from the energy sector for the 2014 year levelled off for the first time in 40 years, without being linked to an economic downturn. This was attributed to the increase in the use of renewable energy sources by China and OECD countries[13]. As GHG emissions associated with the provision of energy services are a major cause of climate change, this move to renewable energy and subsequent reduction in CO_2 emissions is considered as a positive contribution towards climate change mitigation.

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[12] Greenhouse Gas Inventory for South Africa: 2000-2010

[13] http://ecowatch.com/2015/03/23/renewables-mitigate-climate-change/

The South African Government recognises the need to diversify the mix of energy generation technologies within the country and to reduce the country's reliance on fossil fuels which contribute towards climate change and are therefore not environmentally friendly. This is in accordance with the prescriptions of the United Nations Convention on Climate Change 1994 (UNFCCC) and its associated Kyoto protocol of 1997.

Consequently, the South African Government has recognised the need to move towards cleaner energy and has therefore set targets for cleaner energy technologies (including of 17GW renewable energy contribution to new power generation capacity) by 2030 (IRP, 2011). This is to be produced from wind, solar, biomass, gas and small-scale hydro facilities. Renewable energy plays a key role in mitigating global greenhouse gas emissions by radically lowering the emissions profile of the global energy system (International Renewable Energy Agency (IRENA), 2015). The proposed CSP facility will assist in reducing the country's CO_2 emissions associated with energy supply relative to fossil fuels (e.g. coal). Development of numerous such facilities will have a cumulative positive impact on CO_2 emissions as this will reduce reliance on power generation from fossil fuels. This will aid the country in meeting the commitments made under the COP 21 Agreement, to which the Government has committed to become a signatory.

This is considered to be a significant positive impact for the environment and society at an international level.

7.10 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The most significant of these will be the contribution towards a reduction in greenhouse gas emissions and consequent assistance with climate change mitigation. The current study assesses the cumulative impacts associated with the Paulputs CSP Project together with similar facilities within the region.

The alignment of renewable energy developments with the IRP and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The social and economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant. However, there is a lack of understanding of the cumulative impacts on other environmental and social receptors such as birds, visual amenity and landscape character of the affected areas largely due to limited information of impacts from existing facilities within the country. This assessment is therefore qualitative.

Table 7.2 provides a summary of the expected cumulative impacts associated with the proposed project on the identified site.

Table 7.2: Summary of cumulative impact significance for Paulputs CSP Project

Specialist assessment	Cumulative Impact Significance (Pre-Mitigation)	Cumulative Impact Significance (Post Mitigation)
Ecology	Medium	Low
Avifauna	Moderate	Low
Visual Impact	Medium	Low
Agriculture and soils	Medium	Low
Hydrology	Medium	Low
Heritage Impact	Medium	Low
Socio-Economic	Moderate (+ve) and Moderate (-ve)	Moderate (+ve) and Moderate (-ve)

Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Paulputs CSP Project will be acceptable and the majority are rated as being of low significance with the implementation of appropriate mitigation. On this basis, the following can be concluded considering Paulputs CSP Project:

» The construction of the project will not result in the unacceptable loss of threatened or protected plant species. The proposed development is acceptable from an ecological perspective.
» The construction and operation of the project will not result in an unacceptable risk to avifauna through loss of habitat, infringement on breeding areas, or risk to collision-prone species is expected.
» The construction of the project will not result in unacceptable loss of or impact to agricultural resources.
» The construction of the project will not result in unacceptable loss of or impact to hydrological resources.
» The construction of the project will not result in the complete or whole-scale change in sense of place and character of the area nor will the project result in unacceptable visual intrusion. Four preferred bidder projects are in the area, which creates an existing impact and alteration to the current sense of place.
» The construction of the project will not result in unacceptable loss of or impact to heritage resources.
» The project will not significantly increase the negative impact on the social environment. However, an increase in positive impacts, specifically as a result of job creation and socio-economic benefits, can be expected.

» The project will contribute towards a reduction in greenhouse gas emissions from energy generation and will aid the country in meeting the commitments made under the COP 21 Agreement, to which the Government has committed to become a signatory.

Based on a detailed evaluation, the cumulative impacts associated with the construction and operation of the proposed Paulputs CSP Project and other proposed renewable energy facilities in the region are considered to be acceptable. The low potential for cumulative impacts and risks makes this project desirable for further consideration provided that environmental impacts are mitigated to suitable standards as recommended within this EIA Report.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 8

Paulputs CSP RF (Pty) Ltd is proposing to develop a Concentrated Solar Power (CSP) Project and associated infrastructure on Portion 4 of the farm Scuitklip 92, in the Khai-Ma Local Municipality in the Northern Cape Province. A broader study area of approximately 3508 ha (Portion 4 of the farm Scuitklip 92) was considered through a feasibility level assessment in 2010, and the area was considered to be highly acceptable for the development of CSP facilities. This farm portion currently contains two CSP facilities owned by Abengoa Solar South Africa, known as KaXu Solar One (operational) and Xina Solar One (under construction). The development footprint for the Paulputs CSP Project (approximately 900 ha in extent) would be appropriately located within the remaining extent of the farm portion (approximately 1600ha in extent). The identified site is accessible via the R357 and MR73 existing access road, via the N14.

The project is being proposed in response to the requirement for additional electricity generation capacity at a national level and in response to identified objectives of the national, provincial, local and district municipalities to develop renewable energy facilities. From a regional perspective, the greater Pofadder area is considered favourable for the development of commercial solar electricity generating facilities by virtue of the prevailing climatic conditions (primarily as the economic viability of a solar energy facility is directly dependent on the annual solar irradiation values for a particular area), relief and aspect. The proposed project site is situated within the Northern Corridor defined in terms of Eskom's Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) conducted by the CSIR[14] and within an already established solar energy development area.

It is the developer's intention to bid the Paulputs CSP project under the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The power generated from the Paulputs CSP Project will be sold to Eskom and will feed into the national electricity grid. Ultimately, the project is intended to be a part of the renewable energy projects portfolio for South Africa, as contemplated in the Integrated Resource Plan 2030.

The proposed Paulputs CSP Project will have a contracted capacity of up to 200MW. Molten salt technology will be utilised to allow for at least 5 hours of storage to meet the requirements of the REIPPPP. The Paulputs CSP Project will

[14] Infrastructure Strategic Environmental Assessment (SEA) to be gazetted in mid-2016

consist of a field of heliostats and a central receiver, known as a power tower. The Paulputs CSP project will be constructed over an area of approximately 900 ha in extent, and include *inter alia* the following infrastructure:

» Molten salt tower up to 300m in height with surrounding heliostat field
» Power island including salt storage tanks, steam turbine generator, heat exchangers, and dry cooled condenser
» Cabling linking the power block to the on-site substation;
» Water supply abstraction point located at the Gariep River close to Onseepkans
» Filter and booster station at abstraction point
» Water supply pipeline along R357 Onseepkans Road to the site
» On-site lined ground water storage reservoir and various steel water tanks
» Lined evaporation ponds
» Packaged water treatment plant and associated chemical store
» Auxiliary wet cooled chiller plant
» Control room and office building
» Heliostat assembly building and workshop.
» Access roads
» On site substation and overhead power line

The regional site identification process undertaken in 2010 included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of the original CSP Projects (KaXu Solar One and Xina Solar One) , including the solar resource, land availability, accessibility and existing grid infrastructure. The remaining area of Portion 4 of the Farm Scuitklip was then earmarked by Paulputs (Pty) Ltd as being potentially suitable for this CSP Project. As a result, no feasible site alternatives have been identified for investigation for the proposed CSP Project, as the site has been screened as being potentially suitable for development of the project, is located in close proximity to an available grid connection point and is located in an already established solar energy development area (with 4 other projects in various stages of development). This area was therefore put forward for consideration within this EIA. . This area was put forward for consideration within this EIA.

A summary of the details and dimensions of the planned infrastructure associated with the Project is provided in Table 8.1.

Table 8.1: Details of the proposed Ilanga Tower 1 Facility

Component	Description/ Dimensions

Component	Description/ Dimensions
Location of the site	Portion 4 of the farm Scuitklip 92
Municipal Jurisdiction	Khai-Ma Local Municipality which falls within the jurisdiction of the Namakwa District Municipality
Ward number	1
SG Code	C03600000000009200004
Nearest Town	Pofadder
Site Co-ordinates	28°51'22.44"S 19°32'18.95"E 28°50'48.58"S 19°34'42.59"E 28°51'44.81"S 19°37'16.45"E 28°52'41.32"S 19°33'42.33"E
Contracted capacity of facility	200MW
Heliostat field	up to 800 ha up to 10m pedestal
Details of the Power Tower	~10ha Up to 300m (maximum height)
Power island and steam turbine and generator	6.5ha
Molten salt storage tanks	4 tanks each 40m diameter
Full extent of CSP facility	900ha
Extent of broader site	3507.6 ha
Internal access roads	8m wide, 1.5km in length
Site access	The site can be accessed via the existing tarred access road off the R357 Onseepkans Road via the N14. The internal access roads will need to be established. As far as possible, existing access roads to the site would be utilised, and upgraded where required.
Services required	» Refuse material disposal - all refuse material generated from the proposed development will be collected by a contractor and will be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required. » Sanitation – all sewage waste will be collected by a local contractor and will be disposed of at a licensed waste disposal site. This service will be arranged with the municipality when required during the construction and operation phases. » Water for the construction phase could

Component	Description/ Dimensions
	be sourced from the following options: o from the Gariep River through abstraction o Transporting water to site, using water tankers » During the operational phase water will be sourced from the Gariep River through abstraction.

The EIA process for the proposed Paulputs CSP Project has been undertaken in accordance with the EIA Regulations published in Government Notice GN38282 of December 2014, in terms of Section 24(5) of NEMA (Act No. 107 of 1998), and includes an assessment of the activities associated with the construction and operation of the Paulputs CSP Project.

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed development footprint as part of the project;
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed CSP facility;
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
» Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

8.1. Alternatives Considered for the Paulputs CSP Project

In accordance with the requirements outlined in Appendix 3 of the EIA Regulations 2014, the consideration of alternatives including site, activity, technology and site access alternatives, as well as the "do-nothing" alternative should be undertaken. If no alternative development locations for the activity were investigated, the motivation for not considering such must be included. The follow sections address this requirement.

8.1.1. Site Alternatives

The regional site identification process undertaken in 2010 included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of the original CSP Projects (KaXu Solar One and Xina Solar

One) , including the solar resource, land availability, accessibility and existing grid infrastructure. The remaining area of Portion 4 of the Farm Scuitklip was then earmarked by Paulputs (Pty) Ltd as being potentially suitable for this CSP Project. As a result, no feasible site alternatives have been identified for investigation for the proposed CSP Project, as the site has been screened as being potentially suitable for development of the project is located in close proximity to an available grid connection point (i.e. Paulputs Substation). This area was therefore put forward for consideration within this EIA. This area was put forward for consideration within this EIA.

The site is also located within an area which has become a node for renewable energy projects, with the following preferred bidder projects located directly adjacent to, or in close proximity to, the project development site: Konkoonsies Solar I (constructed and operational), Koonkoonsies II Solar Project (construction to commence in mid-2016), Xina Solar One (under construction) and KaXu Solar One (constructed and operational).
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Portion 4 of the Farm Scuitklip 92 was purchased by the developer for development. The development portion of the property has been rezoned for this intended use. Following the successful development and construction of the KaXu Solar One and Xina Solar One projects on the same farm, Abengoa Solar Power South Africa (Pty) Ltd is proposing the Paulputs CSP Project on the remainder of the farm portion.

Based on these considerations, Paulputs CSP RF (Pty) Ltd considers the proposed site as *highly preferred from a technical perspective* in terms of the development of CSP projects and able to draw on synergies with the projects currently under construction. No site alternatives are available for assessment

8.1.2. Layout and Design Alternatives

The consideration of the suitability of the site for the proposed project was in line with a typical mitigation hierarchy:

4. First Mitigation: avoidance of adverse impacts as far as possible by use of preventative measures (in this instance a sensitivity analysis assisted in the avoidance of identified ecological and avifaunal sensitive areas)
5. Second Mitigation: minimisation or reduction of adverse impacts to 'as low as practicable' (in this instance minimisation of impact on identified ecological and avifaunal sensitive areas through implementing mitigation)
6. Third Mitigation: remedy or compensation for adverse residual impacts, which are unavoidable and cannot be reduced further.

In determining the preferred layout for the proposed CSP Plant, a 'funnel-down approach' was used and commenced with the consideration of the larger 3507 ha farm portion.

Step 1: The full extent of the 3507.6 ha farm portion was considered in the EIA undertaken for the Pofadder Solar Thermal Facility, under which both the KaXu Solar One and Xina Solar One projects were authorised. In investigating the location of the proposed Paulputs CSP project the same approach was adopted where potentially sensitive areas identified through the environmental scoping study for Xina Solar One and KaXu Solar One were considered in order to define the areas which a) are to be avoided (i.e. no development considered acceptable), b) areas of some considered sensitivities which can be mitigated to acceptable environmental levels, and c) areas which are considered to be acceptable loss. The scoping phase sensitivity map (refer to Figure 2.3) provided detail from the ecological, avifaunal and noise surveys undertaken. Those potentially sensitive areas identified through the scoping study and the ecology and bird pre-construction monitoring across the full extent of the broader study area included:

» Areas to be avoided (i.e. no development considered acceptable):
    » Areas of high ecological function include the more inaccessible or unutilisable areas such as rocky outcrops should be regarded as no-go areas. These areas of high ecological function include Konkoonsiekop in the north western corner of the farm portion as well as Ysterberg located on the north eastern portion of the farm portion.
    » Konkoonsiekop as well as Ysterberg should be regarded as no-go areas due to avifaunal and ecological sensitivity.

» Areas of some considered sensitivities which could be mitigated to acceptable environmental levels
    » The natural areas remaining on the site are considered of moderate to high ecological sensitivity due to conservation importance as a result of the presence of Red Data species in these areas and should be avoided as far is reasonably possible. Such natural areas are located on the south western portion of the farm and in the eastern portion of the farm closer to Ysterberg.

» Areas which were considered to be acceptable loss:
    » Areas of moderate ecological function are considered of moderate sensitivity. Majority of the study area is of moderate sensitivity.
    » Areas that are already transformed due to slash and burn cropping techniques are considered of low sensitivity. Such transformed areas are located along the north-western border of the farm portion closer to Konkoonsieskop and towards the centre of the farm portion closer to

Ysterberg. These areas are of moderate ecological sensitivity, and therefore development within this area is considered acceptable loss

Step 2: The potentially sensitive areas already identified through the scoping study and the EIAs undertaken for the Xina and XaXu Solar Facilities, provided No-Go areas (i.e. avoidance of identified avifaunal and ecologically sensitive areas – First Mitigation in the proposed methodology). These areas were excluded from the developable area. The larger farm portion is approximately 3507.6 ha in extent, with 1600ha available for the Paulputs CSP Project which requires just 900ha. Based on the specialist findings and sensitivities identified during the scoping phase, the completed EIA for the Pofadder Solar Thermal Facility and avoidance of site sensitivities the development footprint of the Project comprises just only approximately 25% of the total extent of the farm The site can adequately accommodate the proposed 200MW Paulputs CSP Project. It is anticipated that the Project and its associated infrastructure can be appropriately positioned to avoid areas of environmental sensitivity and taking the location of the authorised facilities into consideration. The environmental sensitivities identified during the scoping phase have informed the layout of the proposed facility (refer to Figure 2.4). Therefore no layout alternatives were considered.

8.1.3. Technology Options

Details of the technology alternatives considered and the decision of technology for this project are explained below:

iii) CSP technology options

Abengoa Solar is the only solar company that commercially implements all CSP technological solutions in projects worldwide. As such, projects are designed to most optimally suit the techno-economic needs of the specific situation or customer. Paulputs CSP RF (Pty) Ltd considered two CSP technology types for implementation on the site in order to maximise the capacity and land available on the site, namely: heliostats and a power tower system (Solar Tower technology) and parabolic trough technology (Trough technology).

Both CSP technologies[15] are based on the operating principle that the power gained from the sun can be maximised if the radiant energy of the sun is gathered and concentrated on a single point. By concentrating the sun's rays, CSP technologies maximise the amount of sunlight that can be converted into electricity, thereby reducing wastage and increasing output. Technological similarities between power tower and parabolic trough plants include:

[15] CSP tower and CSP trough technologies are not considered to be alternative technology choices as they are fundamentally different solar thermal power technologies.

» Both technologies operate on a steam turbine system to generate electricity.
» The energy can be stored to enhance despatchability for both technologies.

The Renewable Energy Independent Power Producer Procurement (REIPPP) Programme selection process (details of which are not yet finalised for future bidding rounds), IRP from Government, and the economics of the concentrated solar power project are key factors in determining the final technology combination and the schedule of implementation for the Project. The preferred/optimal technology option (from a technical, financial and socio-economic perspective) for the Paulputs CSP project is considered by the Applicant to be a Solar Thermal Energy (STE) Molten Salt Tower (MST). The progress achieved by molten salt tower technology in recent years has resulted in Abengoa Solar considering this technology choice a preferred technology for application in South Africa to meet the specific requirements as outlined by the DoE (and the REIPPP Programme).

Molten salt towers have become the CSP technology of choice for implementation in markets requiring *significant energy storage* by Abengoa and other CSP developers due to significant technology advances occurring over the last couple of years. This is illustrated in projects that are currently being developed and constructed in markets such as Chile, North Africa and the Middle East.

The molten salt tower technology provides an optimal techno socio-economic solution when considering CSP alternatives, highlighted by the salient indicators of higher efficiency, associated reduced water consumption per MW generated and lower direct footprint alteration (the heliostat field does not require absolute levelling of the land as trough plants do with the associated terracing and cut-and-fill operations).

The recent international preference for molten salt towers, prompted the National Renewable Energy Laboratory in the USA (NREL) to conduct a comparative analysis of molten salt tower and parabolic trough with storage technology. The findings in the study titled “Estimating the performance and economic value of multiple CSP technologies in a production cost model” dated December 2013, found that parabolic trough CSP-TES plants may require a higher capacity, at a greater expense, than a similar rated molten salt power tower to achieve the same annual output, largely due to a larger seasonal variation in output, lower thermal efficiency, and greater storage losses, which support the findings as presented here.

Paulputs CSP RF (Pty) Ltd consider the CSP salt tower technology choice to meet the requirements of the DOE and deliver the greatest value to the country as a whole through maximising electricity production utilising the available solar resource while minimising associated infrastructure, O&M costs as well as social and environmental impacts. Therefore Solar Thermal Energy (STE) Molten Salt Tower (MST) is considered the preferred technology for the Paulputs CSP project.

iv) CSP cooling technology alternatives

CSP plants are designed to use water for cooling at the back-end of the thermal cycle. There are different types of cooling technologies available (discussed below for comparative purposes). Dry cooled technology is, however, the cooling technology that will be used for the Paulputs CSP Project.

Dry Cooling

Dry cooling by air cooled condensers (ACC) consists of large sections of finned air cooled heat exchangers (with mechanical draft), and the turbine exhaust steam passes through the heat exchangers forming condensate. This arrangement uses no cooling water, and therefore requires no makeup for evaporation losses. ACC cooling can reduce the total make-up water demand considerably, leaving only the process consumption and service water as major users, but is limited by its sensitivity to ambient temperature, negative effect on performance and capital expenditure. Water requirements would be approximately 400 000m^3 per annum utilising this technology.

Hybrid Cooling Tower

A hybrid cooling tower is an option that uses cooling coils with a regular cooling tower to condense a portion of the plume. This serves two purposes: a) to reduce the overall make up water by reclaiming evaporated water and b) plume abatement by reducing the humidity of the exiting air, preventing the formation of visible plume.

Air enters from the side, heats up as it passes across the coils, and then is mixed via baffles with the rest of the tower draft, lowering the draft to below saturation, thus eliminating the visible plume. This type of tower has the ability to reduce the evaporative losses by 20% to 30%. This type of tower reduces the water load with minor impact on performance, but cannot reduce the evaporation to meet the make-up demand requirement. A consideration for this type of tower is that at higher ambient temperatures the amount of cooling coils necessary to achieve the desired reduction can become cost prohibitive.

This, like all cooling towers, operates more efficiently at lower ambient temperatures, and as the ambient temperature rises, less condensation occurs across the coils. The hybrid tower is less expensive than the ACC, and has aesthetic and water reduction benefits, but is unable to meet the total make-up demand requirement.

Water requirements would be approximately 800 000m^3 per annum utilising this technology. This technology is not preferred based on efficiencies at high temperatures and water requirements.

Wet cooling system

A wet cooling tower is a conventional design and is the most common and economic alternative. This form of technology application and system design is based on the one hand by convective heat transfer, and on the other hand, evaporation of the water (increase in the air's humidity). As a result, the cooling water temperature that can be obtained from a wet cooling tower is not solely operative from the ambient temperature but also from the air humidity (air with 100% humidity). This type of technology results in severe water loss of which the primary reasons for loss of water in the cooling tower. Water requirements would be approximately 1 200 000m^3 per annum utilising this technology. This technology is not preferred based on water requirements and the need for cooling towers.

Dry cooled technology is the cooling technology that is preferred for the Paulputs CSP Project. This is also consistent with the Department of Water and Sanitation requirements. Therefore no alternative technology is considered.

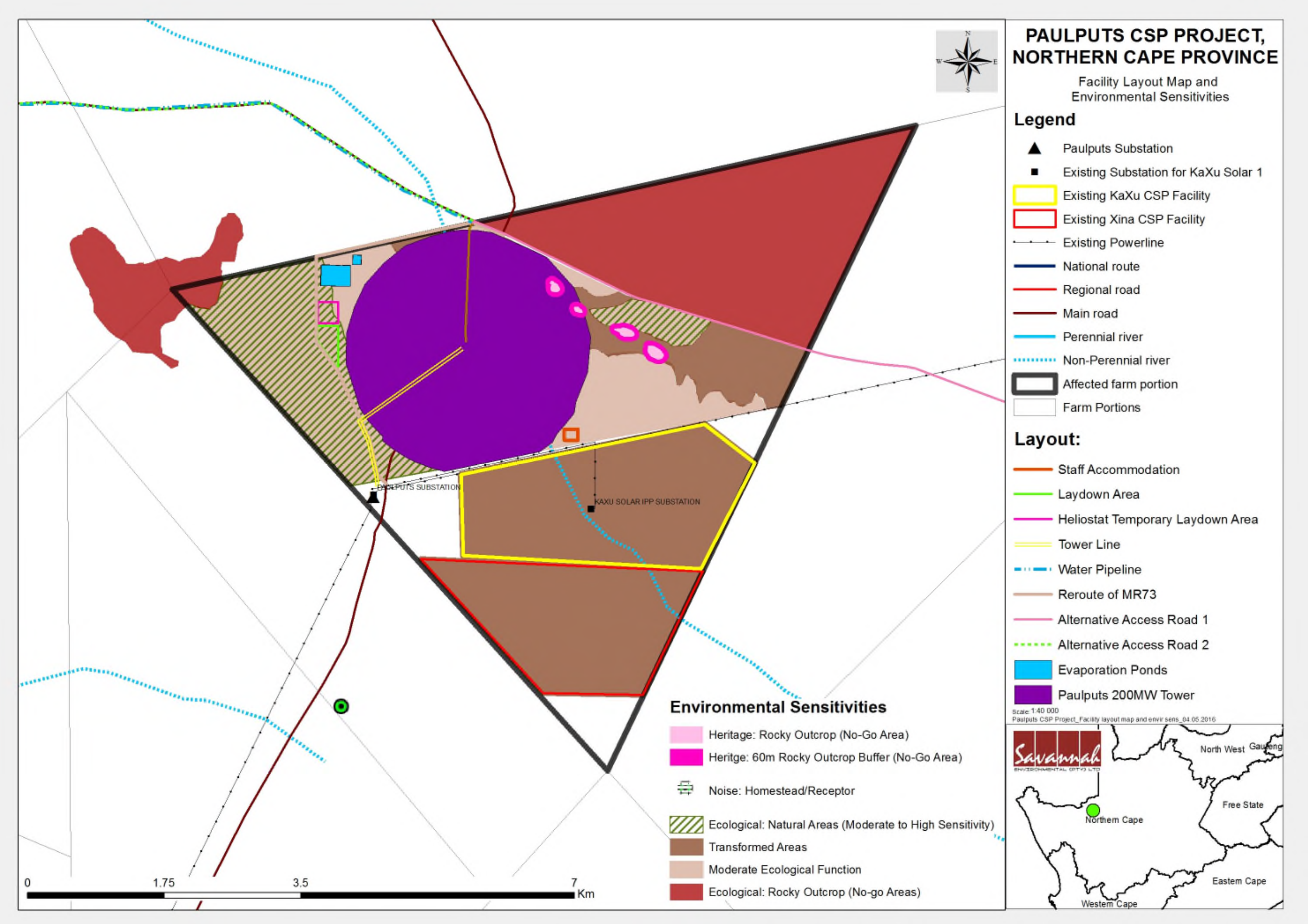

Figure 8.1: Combined Layout and Environmental Sensitivity Map for the Paulputs CSP Project (A3 map included in **Appendix N**).

8.1.4. Grid connection Alternatives

A number of grid connection alternatives have been considered though prefeasibility assessments. The grid connection for the project will be finalised based on input from Eskom and the environmental assessment. Due to the proximity of the Paulputs Transmission Substation (less than 3km away), only one viable option is considered at this point of the assessment process: i.e., a direct connection to the proposed plant substation (50m x 50m in extent) and a new 132kV overhead power line to Eskom's existing Paulputs Transmission Substation over a distance of approximately 3km.

The Paulputs Transmission Substation currently has the capacity to accommodate the power from the Paulputs CSP project. Therefore no connection alternative is required. An alternative point of connection for the project would be the Aggeneis Substation located 90km west of the site at Aggeneys. This grid connection alternative is not preferred or considered further based on the need for a new power line nothing less than 90km in length, and the availability restrictions at the Aggeneis Substation.

8.1.5. Access Road Alternatives

The following site access alternatives have been considered though prefeasibility assessments.

1. Access road 1: Access to site from the N14 national road via the existing R357 Onseepkans road used to access the farm, and the CSP facilities on this farm. This road is located to the east of the farm portion. The access point to the site off this road is 17km from the N14, with a formal entrance to the existing CSP facilities off of this public road. This section of the R357 is a tarred road.
2. Access road 2: Access to site from the N14 national road via the existing R358 and minor road MR73. This road is to the west of the farm portion. The access point to the site off this road is 30km from the N14. This is a gravel road.

These two alternative access routes to access the site are considered in this report A realignment of the MR37 road where it traverses the Scuitklip farm is proposed and discussions regarding the realignment are underway with the Northern Cape Department of Roads and Public Works (NC DR&PW).

8.1.6. Water Resource Alternatives

The CSP technologies function through the generation of steam to drive a conventional steam turbine and generator. Therefore, suitable and sufficient water resources will be required. During its operation the Paulputs CSP Project will require approximately 400 000m^3 of water per annum. During its 3 year construction phase 200 000m^3 to 300 000 m^3 per annum will be required.

For the proposed project, Paulputs CSP RF (Pty Ltd) investigated abstraction from a point on the Gariep River and conveyed via a water pipeline. The abstraction point would be located adjacent to the existing abstraction point which is utilised by commercial fruit farming activities. Potential water sources that were considered but proved to be unfeasible included:

» Abstraction from boreholes located within the study site or on adjacent farms. Previous Scoping and EIA studies for KaXu Solar One and Xina Solar One revealed that yield from boreholes would not meet the water requirements for the Paulputs CSP project.
» Purchase of water from the Khai Ma Municipality. Previous Scoping and EIA studies for KaXu Solar One and Xina Solar One revealed that purchase of water from the Municipality would not be a viable source

The Gariep River is considered to have sufficient availability of water to provide the annual water requirement for the Paulputs CSP project. An application has been submitted to the Department of Water and Sanitation in Upington however written confirmation from DWS is pending. No water source alternative is to be assessed.

8.2. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within **Appendices D - J** provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the Paulputs CSP Project and the associated infrastructure. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental team during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

The assessment of potential environmental impacts presented in this report is based on a preliminary layout of the tower, heliostats and associated infrastructure (for the 200MW facility) provided by Paulputs CSP RF (Pty Ltd (refer to Figure 8.1). It is anticipated that the Project and its associated infrastructure can be appropriately positioned to avoid areas of high environmental sensitivity while taking the location of the authorised facilities into consideration. The environmental sensitivities identified during the EIA phase have informed the layout of the proposed facility (Refer to Figure 8.1). All identified high sensitivities were excluded from the proposed development were feasible.

No environmental fatal flaws were identified to be associated with the proposed facility. However the following potentially significant environmental impacts have been identified through the EIA Phase.

- » Local site specific impacts resulting from the physical modification/disturbance of the site primarily during the construction phase.
- » Impacts on avifauna.
- » Impacts on water resources.
- » Visual impacts.
- » Impacts on the social environment.
- » Cumulative impacts.

8.2.1. Local site specific impacts resulting from the physical modification/disturbance of the site primarily during the construction phase.

The development of the proposed Paulputs CSP Facility is likely to result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat due to hard infrastructure such as roads, operations buildings, etc. The impact assessment determined that 8 main impacts are likely to occur due to the development, namely:

- » Vegetation Clearing and subsequent loss of species of concern;
- » Spillage of harmful or toxic substances;
- » Disturbance of biodiversity due to vibration and noise;
- » Habitat degradation and fauna impacts due to dust;
- » Effects on local migrations;
- » Increased prevalence of exotic invasive species;
- » Increased erosion; and
- » Impact of attracting insects and subsequently bats to the tower due to artificial light at night.

There are no features within the proposed development area considered to be very high sensitivity or which present a no go area, and the abundance of species of concern within the development area is also low.

- According to the Khai-Ma Land Use Decision Support tool, the study area falls within an Ecological Support Area (ESA). The development will affect less than 30% of the width of the migration route and should have very little effect on species using this route. It must also be noted that the migration route indicated is part of a large system of migration routes and that the percentage of these migration routes that will be impacted will be negligible..

Due to the fact that there are already three existing solar facilities in the area, as well as the fact there are more planned, the cumulative impacts of the impacts general to solar facilities are likely to be of a higher order of magnitude than the significance ratings given here. It must however be noted that none of the other solar facilities are tower facilities and impacts unique to tower facilities are therefore unlikely to have a higher cumulative impact.

With implementable mitigation measures and a functional monitoring – management – implementation – monitoring feedback loop in order to monitor and mitigate impacts, all probable ecological impacts can be managed to a low impact rating. Based on this and the fact that South Africa is experiencing a significant energy crisis, the risks and losses associated with this development can be seen as acceptable and defendable

8.2.2. Impacts on Avifauna

Potential impacts on avifauna as a result of the proposed project include disturbance during construction and operation, loss of habitat and potential for collision with the heliostats and the tower. A total of 29 species were recorded and a total of 1341 individual birds were recorded. Only one species of conservation importance was recorded during the study namely, the Maccoa Duck.

During the study the following factors which could provide biological requirements for local avifauna were identified. These potential factors should therefore be mitigated in order to reduce the number of birds likely to occupy the CSP facility (i.e. deter birds from using the area by making it as unsuitable for meeting avian biological requirements as possible, and therefore less attractive to birds):

- Openings at either end of the proposed horizontal rotating cylinder – may potentially provide nesting sites;
- Flat surfaces at the base of the proposed tower – may provide possible nesting and perching sites for a large number of species; and
- Colour of the proposed tower – may attract insects, which are a food source for insectivorous avifauna.

One of the main aspects of avifauna behaviour noted was that the majority of birds recorded during the study flew at a height below that of the heliostats (i.e. below a maximum height of 12m). in addition, it was noted that bird activity on the site was low between 11:00 and 16:00 every day, during this time most species were found to be active in the riparian or wash areas traversing the study area. As was expected, during the dry season survey, species activities were restricted to foraging and feeding or searching for food. No nesting or mating behaviour was observed. During the wet season survey no nesting was in progress, but recently used nests were abundant, especially in areas with larger trees and shrubs. These factors will most likely reduce the risk of mortality in avifauna species as a result of the proposed project.
During the study the following factors which could provide biological requirements for local avifauna were identified. These potential factors should therefore be mitigated in order to reduce the number of birds likely to occupy the CSP facility

(i.e. deter birds from using the area by making it as unsuitable for meeting avian biological requirements as possible, and therefore less attractive to birds):

- Openings at either end of the proposed horizontal rotating cylinder – may potentially provide nesting sites;
- Flat surfaces at the base of the proposed tower – may provide possible nesting and perching sites for a large number of species; and
- Colour of the proposed tower – may attract insects, which are a food source for insectivorous avifauna.

8.2.3. Impacts on Agricultural Potential and soils

Two major impacts were assessed. The first impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. However, this impact would in all probability be of limited significance due to the limited potential of the land in this regard, and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

The second impact would be the possibility of increased soil erosion due to the removal of vegetation in the construction process. This would probably be due to wind action on the relatively sandy topsoils.

Two CSP facilities, KaXu Solar One and Xina Solar One are located in the southern portion of the site. The major potential cumulative impact would be the possibility of wind erosion caused by construction activities at the Paulputs CSP site that would cause topsoil to be blown and deposited elsewhere, for example at any nearby facilities, where dust accumulation would be a problem.

Much of the area comprises either shallow to very shallow soils or surface rock outcrops, and only a very small portion of deep soils. The very low rainfall in the area means that the only means of cultivation would be by irrigation there are no signs of any agricultural infrastructure and certainly none of irrigation. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit. No areas were identified as degraded. In addition, no areas of cultivation were identified except for the strip of cultivated orchards and pivots along the Gariep River to the north.

There are no identified highly sensitive areas with regards to agricultural potential and soil and the Paulputs CSP Project will not have a significant impact on the agricultural potential of the area.

8.2.4 Impacts on aquatic resources

With the implementation of suitable mitigation and of the proposed layout, the development should have limited impact on the overall status of the site specific riparian systems. The assessment of the potential impacts of the proposed CSP project on the fish biota of Gariep River also did not reveal any significant impacts on the fish fauna and associated aquatic habitats, provided the appropriate mitigation measures are implemented. All impacts that were assessed can be reduced to medium or low significance with the implementation of appropriate mitigation, apart from the moderate impact of water abstraction from the Gariep River. However, in this case the precautionary principle was applied due the lack of data on the Ecological Water Requirements of the Gariep River for this locality.

Impacts on the Gariep River system due to water abstraction, and site-specific impacts on instream biota are difficult to quantify due to the number of unknowns and the highly regulated nature of the system.

In conclusion therefore, the facility is deemed to have a limited direct potential impact on the aquatic environment, considering the number of unknowns and the highly regulated nature of the Gariep River system. It is however assumed that any such changes would be detrimental to the various projects owners, i.e. reduce water availability for all projects. Therefore, based on this assessment the significance of the impacts assessed for the aquatic systems after mitigation would be Medium - Low. While all of the proposed alternatives would have a similar impact on the aquatic environment

8.2.5. Heritage Impacts

The destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. In the long term, the proximity of operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity.

With respect to the magnitude and extent of potential impacts, it has been noted that the erection of power lines would have a relatively small impact on Stone Age sites, in light of Sampson's (1985) observations during surveys beneath power lines in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon), whereas a road or a water supply pipeline would tend to be far more destructive (modification of the landscape surface would be within a continuous strip), albeit relatively limited in spatial extent, i.e. width (Sampson compares such destruction to the pulling out of a thread from an ancient tapestry). A water pipeline, if sourcing water at the river, could traverse more sensitive terrain, i.e. impacting a potentially greater density of archaeological sites.

The rocky outcrops that occur at the north eastern side of the proposed project footprint are regarded as no go areas and a 60 meter buffer has been considered around each outcrop. . These sites and others like them in the broader landscape provided shelter and variety of resources that attracted human activity through Stone Age times. Although two of these areas are shown to fall within the heliostat field in Figure 8.1, it has been confirmed by the developer that these areas will be avoided through the placement of the heliostats. This has been fully considered from a technical perspective and will result in the loss of approximately 93 heliostats within the northern portion of the heliostat field (refer to Figure 8.2).

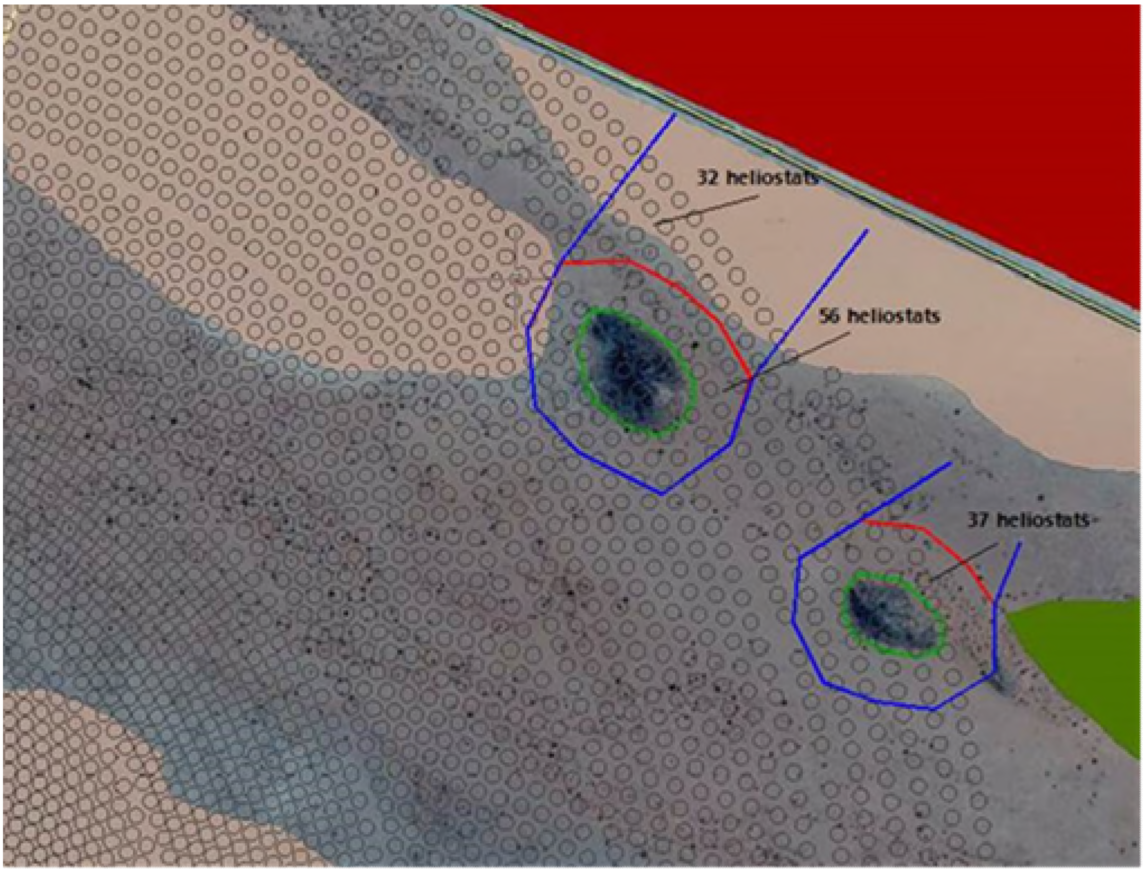

Figure 8.2: Image showing heritage no go areas and associated buffer and the number of heliostats to be lost through avoidance of these areas.

From a technical perspective, it is confirmed that this approach will not result in an impact on the feasibility of the project as these are further away from the receiver and are located within the northern heliostat field, which in the southern hemisphere are less efficient.

8.2.6 Visual impacts

The assessment indicates that the development is likely to have two main areas of visual impact;

3) It will intensify the current industrial character of the area immediately surrounding the proposed development area.
4) The proposed tower at 300m high will form a major new feature in the landscape. It is likely to be a dominant feature up to 15 to 20 km away. It is also likely to be obvious in the landscape up to 30km away.

The impact of the tower is mitigated to a degree by landform in that;

» It will largely be viewed against and within a rock formation that is taller and has substantially greater visual mass than the tower, it will therefore be in scale with its surroundings and seen against a landform backdrop from many viewpoints.
» The landform to the north will provide a large degree of screening from that direction.
» The compartmentalised nature of the landscape will mean that the impact will be limited.
» The steep slopes of the Orange River Valley will screen views of the tower from that area.
» Inselberge will help to further reduce the impact from key viewpoints such as the N14.

Identified cumulative impacts only relate to the low development components and associated infrastructure associated with the proposed power tower. The impacts associated with these elements will be similar to and will largely impact the same area as the two existing CSP parabolic trough projects and the Paulputs Substation which are located adjacent to the proposed development. The proposed project will therefore not extend but will intensify the industrial character within a limited impact area.

The proposed development will not affect protected areas and whilst the landscape in which it is set in is a dramatic and memorable landform it serves to compartmentalise views in a progressive way for travellers through the area. This compartmentalisation of the landscape serves to help limit impacts.

8.2.5. Impacts on the social environment

The proposed development site is located within a rural setting and is removed from settlements and homesteads. Impacts on the social environment are expected during both the construction phase and the operation phase of the CSP facility. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the CSP facility can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

Positive impacts associated with the project are largely due to job creation opportunities, business opportunities for local companies, skills development, and training. The proposed project could assist in alleviating poverty amongst some individuals in the study area through the provision of permanent employment opportunities.

The development of a renewable energy facility of this nature will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would fit in with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP).

Potential negative impacts which require mitigation relate to an influx of workers and jobseekers to an area (whether locals are employed or outsiders are employed) and an associated perceived risk of an increase in crime in the area, and traffic and intrusion influences during construction. As a limited number of workers are proposed to be housed on site, certain impacts could arise as a result of worker conduct at this site. Stringent mitigation is required to be implemented to reduce these impacts to acceptable levels.

Impacts on farming activities may occur as a result of the proposed development. However, due to the limited agricultural potential of the proposed development site, and the low rainfall in the area, the impact on agricultural potential as a result of the loss of land associated with the development is not expected to be significant. In fact, the proposed development may present opportunities for additional agriculture on the site and surrounds in that the water supply infrastructure could be utilised to transport water to irrigate crops within these areas. This would be a positive impact.

8.2.7. Assessment of Potential Cumulative Impacts

Based on the information available at the time of undertaking the EIA, there are at least 4 other facilities, 1 of which is a preferred bidder project within a 30 km radius of the site all at various stages of approval.

Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Paulputs CSP Project will be acceptable and the majority are rated as being of low significance with the implementation of appropriate mitigation. On this basis, the following can be concluded considering Paulputs CSP Project

- » The construction of the project will not result in the unacceptable loss of threatened or protected plant species. The proposed development is acceptable from an ecological perspective.
- » Low risk to avifauna through loss of habitat, infringement on breeding areas, or risk to collision-prone species is expected.
- » The construction of the project will not result in unacceptable loss of or impact to agricultural resources.
- » The construction of the project will not result in unacceptable loss of or impact to hydrological resources.
- » The construction of the project will not result in the complete or whole-scale change in sense of place and character of the area nor will the project result in unacceptable visual intrusion. One preferred bidder project is in the area, which creates an existing impact and alteration to the current sense of place.
- » The construction of the project will not result in unacceptable loss of or impact to heritage resources.
- » The project will not significantly increase the negative impact on the social environment. However, an increase in positive impacts, specifically as a result of job creation and socio-economic benefits, can be expected.
- » The project will contribute towards a reduction in greenhouse gas emissions from energy generation and will aid the country in meeting the commitments made under the COP 21 Agreement, to which the Government has committed to become a signatory.

Based on a detailed evaluation, the cumulative impacts associated with the construction and operation of the proposed Paulputs CSP Project and other proposed renewable energy facilities in the region are considered to be acceptable. The low potential for cumulative impacts and risks makes this project desirable for further consideration provided that environmental impacts are mitigated to suitable standards as recommended within this EIA Report. Cumulative impacts discussed above have been considered within **Chapter 7** and the detailed specialist studies (refer to **Appendices D - J**).

8.3. Consideration of Alternatives

Results of the specialist studies show that Access road 1 is the environmentally preferred access road alternative for implementation

8.4 Summary of All Impacts

Table 8.2 to 8.4 indicates the significance ratings for the potential impacts identified and assessed through the EIA process in terms of the preliminary layout.

As indicated in Chapter 4, the significance weightings for potential impact have been rated as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

Table 8.2: Summary of pre-mitigation and post mitigation impacts of the bio-physical and socio-economic environment during the **planning and construction phase** of the project

Environmental Aspect	Impact	Pre-mitigation Significance	Post Mitigation Significance
Ecology (Flora and Fauna)	Impacts on vegetation and protected plant species	Medium (55)	Low (28)
	Increased dust will occur in all areas where vegetation is cleared.	Medium (50)	Low (18)
	Local migrations of fauna in the area may be affected	High (65)	Low (20)
	Cleared areas colonised by exotic and/or invasive plant species.	High (65)	Low (20)
	Increased erosion	High (65)	Low (20)
Avifauna	Impact on local bird community due to habitat loss	Low (28)	Low (24)
	Impact on local bird community due to disturbance on site and in surrounding area	Low (15)	Low (12)
Agricultural Potential and soils	Loss of agricultural land because the land can no longer be utilised	Low (28)	Low (21)
	Loss of topsoil due to vegetation removal resulting in increased wind erosion potential	Low (24)	Low (18)
	Soil degradation	Low (24)	Low (18)
Aquatic	Impact on water quality in the region	High (55)	Medium (45)
	Impact on dry riverbeds and localised drainage systems	Medium (45)	Low (24)
	Impact on riparian systems through the possible increase in surface water runoff on riparian zone form and function as well as instream habitats	Medium (35)	Low (19)
Heritage	Destruction of archaeological material or objects	Low (28)	Low (6)
Visual	Visual impacts associated with construction	Low (15)	Low (4)

Social	Creation of employment opportunities and skills development opportunities	Medium (+36)	Medium (+44)
	impact from the economic multiplier effects from the use of local goods and services	Low (+27)	Medium (+33)
	Population changes adding pressure on resources, service delivery, infrastructure maintenance and social dynamics	Medium (30)	Low (24)
	Added pressure on economic and social infrastructure and increase in social conflicts	Low (24)	Low (18)
	Temporary increase in traffic disruptions and increase in noise and dust	Medium (30)	Low (24)
	Temporary increase in safety and security concerns	Low (16)	Low (12)
	Temporary negative impacts associated with on-site staff accommodation	Low (21)	Low (14)
	Intrusion impacts	Low (21)	Low (15)

Table 8.3: Summary of pre-mitigation and post mitigation impacts of the bio-physical and socio-economic environment during the **operation phase** of the project

Environmental Aspect	Impact	Pre-mitigation Significance	Post Mitigation Significance
Ecology (Flora and Fauna)	Attraction of large numbers of insects at night and subsequently bats	High (70)	Low (22)
	Local migrations of fauna in the area may be affected	High (65)	Low (20)
	Harmful or toxic substances that may affect the biota of the area if they were to enter the system	Medium (56)	Low (6)
Avifauna	Impact on local bird community due to disturbance on site and in	Low (15)	Low (12)

	surrounding area		
	Impact of the proposed facility infrastructure on avifauna	Low (16)	Low (8)
	Collisions with overhead power line	Moderate (52)	Low (18)
	Electrocution on overhead power line	Moderate (44)	Low (14)
Agricultural Potential and soils	Soil degradation	Low (24)	Low (18)
Aquatic	Impact on water quality in the region	High (55)	Medium (45)
	Abstraction of water from the Gariep River: timing and volume, i.e. impact on water quantity on the region	High (55)	Medium (45)
Heritage			
Visual	Industrialisation of a natural landscape as seen at night.	Medium (36)	Low (10)
	Possible impact of glint and glare.	Low (16)	Low (5)
	Potential visual intrusion on sense of place	Medium (56)	Medium (52)
	Potential effect on landscape features and scenic resources.	Medium (56)	Medium (52)
	: Potential effect on local inhabitants, visitors to the area and on tourism	Medium (33)	Medium to Low (30)
	Potential effect of related infrastructure	Medium (33)	Low (18)

Social	Creation of employment opportunities and skills development opportunities	Medium (+33)	Medium (+44)
	Benefits to the local area from SED/ ED programmes and community trust from REIPPPP social responsibilities	Low (+24)	Medium (+30)
	Development of clean, renewable energy infrastructure	Medium (+40)	Medium (+40)
	Visual impacts and sense of place	Medium (36)	Medium (36)

Table 8.4: Summary of pre-mitigation and post mitigation impacts of the bio-physical and socio-economic environment during the **decommissioning phase** of the project

Environmental Aspect	Impact	Pre-mitigation Significance	Post Mitigation Significance
Ecology (Flora and Fauna)	Disturbance or persecution of fauna	Low (21)	Low (15)
	Alien plants are likely to invade the site as a result of disturbance	Medium (30)	Low (21)
Avifauna			
Agricultural Potential and soils	Loss of topsoil due to disturbance	Low (24)	Low (18)
Visual			
Social	Retrenchment including loss of jobs and source of income	Medium (36)	Low (28)

8.4. Environmental Sensitivity Mapping

From the specialist investigations undertaken for the proposed CSP Facility, a number of sensitive areas were identified (refer to Figure 8.1 and the A3 map in **Appendix N**. The following sensitive areas/environmental features have been identified on the site:

» Ecology: On a local/site level, areas of high ecological function include the more inaccessible or unutilisable areas such as rocky outcrops should be regarded as no-go areas. These areas of high ecological function include Konkoonsiekop in the north western corner of the farm portion as well as Ysterberg located on the north eastern portion of the farm portion. The natural areas are considered to be of conservation importance due to the presence of Red Data species in these areas and should be avoided as far is reasonably possible. Such natural areas are located on the south western portion of the farm and to the eastern portion of the farm closer to Ysterberg (refer to Figure 8.1). The impacts for the construction and operational phase range from local to regional level. Overall, and with the suggested mitigation measures implemented, the impacts of the development are likely to be of moderate to low significance and no impacts of high significance are likely.
» Avifauna: Sensitive avifaunal habitats on the site are linked to landform and habitat. The areas of high ecological function including the rocky outcrops (Konkoonsiekop in the north western corner of the farm portion as well as Ysterberg located on the north eastern portion of the farm portion) should be regarded as no-go areas. Heritage: Areas of heritage sensitivity on the site include terrain close to hills or rocky features and the known road-side grave below Ysterberg. The rocky outcrops that occur at the north eastern side of the proposed project footprint are regarded as no go areas and a 60 m buffer around each outcrop has been considered. These sites and others like them in the broader landscape provided shelter and variety of resources that attracted human activity through Stone Age times. As indicated in Section 8.2.5, these areas have been considered within the design of the facility and would not be impacted. The open plains have been found to have sparsely scattered artefacts. The construction of the project could have a low impact on a local scale. Limited impact on palaeontological resources are envisaged due to the poor fossil assemblage in the local lithology.

As is evident in **Figure 8.1**, some areas of moderate and high sensitivity will be impacted by the proposed layout. These areas are however limited and impacts on these areas are not expected to result in impacts at a broader scale which could compromise habitat availability or species abundance. The layout as proposed is therefore considered to be acceptable.

8.5. Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise from the project proceeding. This could include:

» Direct loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the Paulputs CSP Project (which is limited to the development footprint of 900ha). The cost of loss of biodiversity is expected to be limited as a result of the wide distribution of the affected vegetation type and the limited presence of species of conservation concern within the development area.
» Visual impacts associated with the CSP Facility. The cost of loss of visual quality to the area is expected to be low as a result of the location of the facility in relation to sensitive visual receptors, as well as the nature of the topography of the area and the location of the site adjacent to similar infrastructure.
» Change in land-use and loss of land available for agriculture on the development footprint. The cost in this regard is expected to be limited due to the low agricultural potential of the property and the fact that there are two other CSP facilities on the property.

These costs are expected to occur at a local and site level and are considered acceptable provided the mitigation measures as outlined in this EIA and the EMPr are adhered to. No environmental fatal flaws associated with the proposed project have been identified.

The positive implications of establishing the Paulputs CSP Project on the demarcated site include:

» The project will result in important socio-economic benefits at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development (as detailed in Chapter 2 of this report). These will persist during the preconstruction, construction and operational phases of the project.
» The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective SDFs and IDPs.
» The project is located within an area that has become a node for solar energy projects and is located on a property where two CSP facilities are constructed. The location is therefore considered desirable
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix. As a result of the on-site storage associated with the project, it has the potential to provide extended periods of power to the grid. This will assist in stabilising the power supply during the periods of the day when this is required most.

The benefits of the project are expected to occur at a national, regional and local level. As the costs to the environment at a site specific level have been largely limited through the appropriate placement of infrastructure on the site within lower sensitivity areas, the expected benefits of the project are expected to partially offset the localised environmental costs of the project.

8.6. Overall Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8.4GW solar) within the period 2010 – 2030.

The need for the project at a national scale has therefore been determined. The location of the proposed project is further supported as it is situated within the Northern Corridor defined in terms of Eskom's Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) conducted by the CSIR

The viability of establishing the Paulputs CSP Project with a generating capacity of 200MW on Portion 4 of the Farm Scuitklip 92, located approximately 40 km north-east of Pofadder within the Khai-Ma Local Municipality in the Northern Cape has been established by Paulputs CSP RF (Pty) Ltd. The positive implications of establishing a CSP Plant on the identified site within the Northern Cape include:

» The potential to harness and utilise solar energy resources within the Northern Cape Province.
» The project will assist the South African government in reaching their set targets for renewable energy and consequent reduction in greenhouse gas emissions from energy generation.
» The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project will assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business.
» The National electricity grid in the Northern Cape Province will benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa.
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated from the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed CSP Plant and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures detailed within this EIA are implemented, and given due consideration during the process of finalising the facility layout.
» The proposed development on the site will create a localised reduction of indigenous trees and shrubs and other species of conservation concern, but not to a degree that the current conservation status of such species will be negatively affected.
» From an **ecological** perspective all probable ecological impacts can be managed to a low impact rating. While there are some protected species present, there are no species of high conservation concern present and no significant impacts can be expected on the local populations of the protected species present. Overall and with the implementation of the recommended mitigation measures, the impacts of the development are likely to be of moderate to low significance and no impacts of high significance are likely. As a result, there are no ecological fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved. According to the Khai-Ma Land Use Decision Support tool, the study area falls within an Ecological Support Area (ESA. The development will affect less than 30% of the width of the migration route and should have very little effect on species using this route. It must also be noted that the migration route indicated is part of a large system of migration routes and that the percentage of these migration routes that will be impacted will be negligible.
» The **avifauna** of the area may be affected by the infrastructure of the CSP plant. With implementable mitigation measures and a functional monitoring – management – implementation – monitoring feedback loop in order to monitor and mitigate impacts, all probable avifauna impacts can be managed to a low impact rating. Based on this and the fact that South Africa is experiencing a significant energy crisis, the risks and losses associated with this development can be seen as acceptable and defendable. The area to the south of the development consists of the Mattheus-Gat Conservation Area Important Bird Area (IBA) Of the IBA trigger species none were recorded during the extensive avifauna surveys that were conducted on site. It must also be noted that the vegetation to the south of the study area is far more accommodating to avifauna than the vegetation on site.
» From an **agricultural potential** perspective much of the area comprises either shallow to very shallow soils or surface rock outcrops. The very low rainfall in the area means that the only means of cultivation would be by irrigation there are no signs of any agricultural infrastructure and certainly none of irrigation. No areas were identified as degraded. In addition, no areas of cultivation were identified. There are no identified highly sensitive areas with regards to agricultural potential and soil and

the Paulputs CSP Project will not have a significant impact on the agricultural potential of the area.

- From a **hydrological** perspective the facility is deemed to have a limited direct potential impact on the aquatic environment, considering the number of unknowns and the highly regulated nature of the Gariep River system. The significance of the impacts assessed for the aquatic systems after mitigation would be medium - low. While all of the proposed alternatives would have a similar impact on the aquatic environment
- From a **heritage** perspective the rocky outcrops that occur at the north eastern side of the proposed project footprint are regarded as no go areas and a 60 m buffer is to be maintained around each outcrop. These sites and others like them in the broader landscape provided shelter and variety of resources that attracted human activity through Stone Age times. As the design of the facility has included the avoidance of these areas the impacts to heritage resources by the proposed development are not considered to be highly significant and the impact on archaeological sites is acceptable.
- From a **visual** perspective the proposed lower elements of the project are likely to be in keeping with their surroundings and are unlikely to significantly extend the influence of industrial development within the landscape. The proposed power tower however, will have significant visual influence that may extend beyond 30km. The proposed development will not affect protected areas and whilst the landscape in which it is set is dramatic and memorable landform serves to compartmentalise views in a progressive way for travellers through the area. This compartmentalisation of the landscape serves to help limit impacts.
- The development will have both positive and negative **social** impacts. It will create employment and business opportunities for locals during both the construction and operational phases and represent an investment in clean, renewable energy infrastructure. The potential for cumulative impacts also exists due to the proximity of the other CSP facility on the property, however, these impacts are not considered to represent a fatal flaw.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

8.7. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the Paulputs CSP Project can be managed and mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation. The layout plan as presented is considered acceptable.

The following conditions would be required to be included within an authorisation issued for the project:
for the project:

- All mitigation measures detailed within this report and the specialist reports contained within Appendices **D** to **J** are to be implemented.
- The draft Environmental Management Programme (EMPr) as contained within **Appendix K** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed for this project.
- The layout assessed within this EIA is considered to be acceptable. Any changes to this layout should consider and accommodate areas of high environmental sensitivity.
- Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
- An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMPr for the duration of the construction period.
- Areas disturbed during construction should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
- During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
- A comprehensive stormwater management plan should be compiled for the developmental footprint prior to construction.
- An ecological walk through survey for the CSP plant and associated infrastructure (such as pipeline, power line and access roads) must be undertaken prior to construction.
- A permit to be obtained for removal of protected trees and provincially protected flora that are affected.
- A detailed avifauna monitoring plan should be compiled prior to operation and implemented in order to constantly monitor the CSP facility and all associated infrastructure, including the power lines. Any and all avifauna mortalities should be investigated. This should be undertaken for a 1-year period after which the results should be reviewed in order to inform the requirement for further monitoring and/or mitigation.
- A Water Use License for relevant water uses is to be obtained from DWS prior to commencement of the water use.

» All other relevant and required permits must be obtained from the relevant regulating authorities..

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