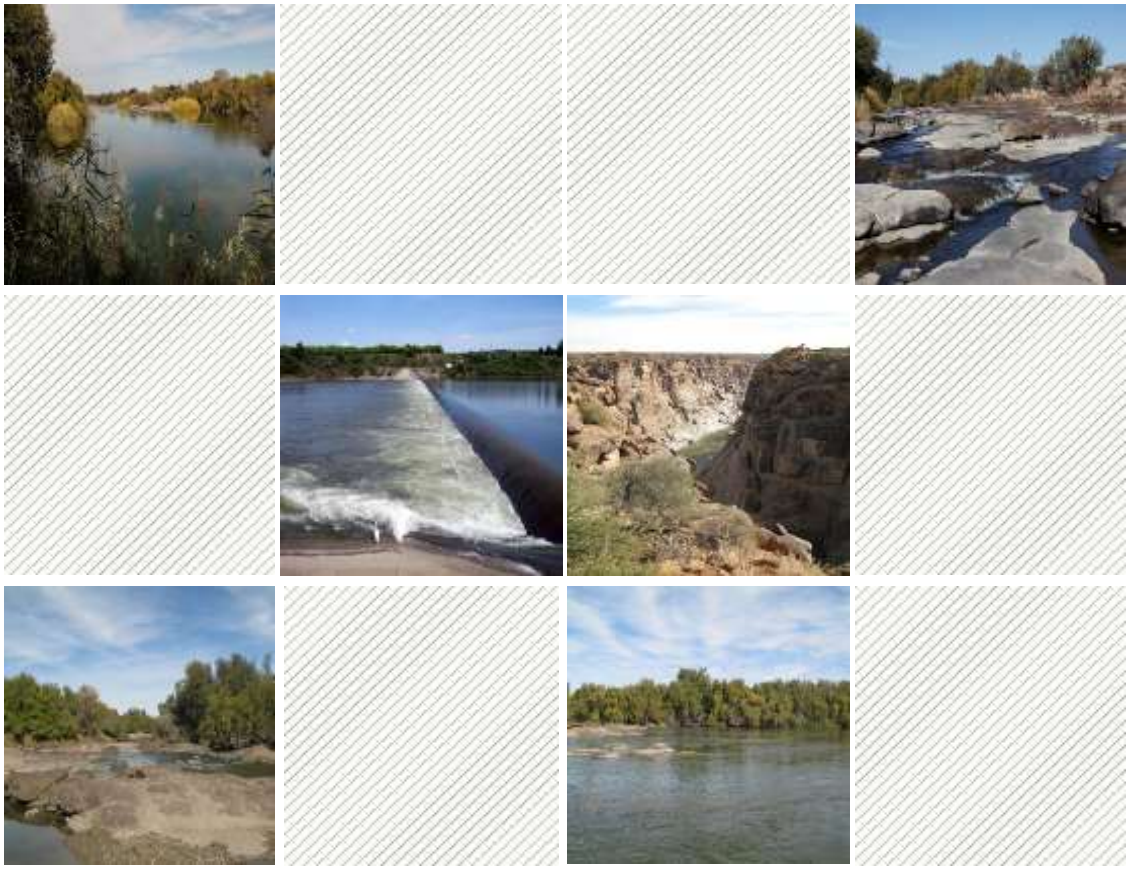

PROPOSED HYDROPOWER STATION ON THE FARM RIEMVASMAAK (REMAINDER OF FARM NO. 497 AND PORTION OF FARM NO. 498), ON THE ORANGE RIVER IN THE VICINITY OF AUGRABIES FALLS NATIONAL PARK, NORTHERN CAPE

FINAL SCOPING REPORT

September 2013

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Proposed Hydropower Station on the Farm Riemvasmaak (Remainder of Farm no. 497 and Portion of Farm no. 498), on the Orange River in the Vicinity of Augrabies Falls National Park, Northern Cape

Non-technical summary (English)

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Nie-tegniese opsomming (Afrikaans)

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NEMA requirements for Scoping Reports

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Regulation	Content as required by NEMA	Page/ Annexure
28(1)(a)	(i) Details of the EAP who prepared the report; and	Section 6.9, p. 96
	(ii) Details of the expertise of the EAP to carry out scoping procedures.	As per above. Also refer to Annexure C for CV's of the EAP's
28(1)(b)	A description of the proposed activity.	Section 3.1, p. 23
28(1)(c)	A description of any feasible and reasonable alternatives that have been identified.	Section 3.2, p. 34
28(1)(d)	A description of the property on which the activity is to be undertaken and the location of the activity on the property.	Section 5.2.1, p. 57
28(1)(e)	A description of the environment that may be affected by the activity and the manner in which the activity may be affected by the environment.	Chapter 5, p. 57
28(1)(f)	An identification of all legislation and guidelines that have been considered in the preparation of the scoping report.	Section 1.2, p. 6 Section 2.4, p. 20
28(1)(g)	A description of environmental issues and potential impacts, including cumulative impacts that have been identified.	Chapter 5, p. 57
28(1)(h)	Details of the public participation process conducted in terms of regulation 27(a), including –	Section 2.2, p. 16 Annexure B
	(i) The steps that were taken to notify potentially interested and affected parties of the application;	Section 2.2, p. 16 Annexure B
	(ii) Proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given;	Section 2.2, p. 16 Annexure B
	(iii) A list of all persons, organisations and organs of state that were registered in terms of regulation 55 as interested and affected parties in relation to the application; and	Annexure B
	(iv) A summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues.	Section 2.2.3, p. 18 Annexure C
28(1)(n)	A plan of study for environmental impact assessment which sets out the proposed approach to the environmental impact assessment of the application, which must include:	Chapter 6, p. 85
	(i) A description of the tasks that will be undertaken as part of the environmental impact assessment process, including any specialist reports or specialised processes, and the manner in	Section 6.3, p. 86 and Section 6.4, p. 89

	which such tasks will be undertaken;	
	(ii) An indication of the stages at which the competent authority will be consulted;	Section 6.8, p. 95
	(iii) A description of the proposed method of assessing the environmental issues and alternatives, including the option of not proceeding with the activity; and	Section 6.3.2, p. 86
	(iv) Particulars of the public participation process that will be conducted during the environmental impact assessment process.	Section 6.7, p. 94
28(1)(o)	Any specific information required by the competent authority.	-
28(1)(p)	Any other matters required in terms of sections 24(4)(a) and (b) of the Act.	-
28(2)	In addition, a scoping report must take into account any guidelines applicable to the kind of activity which is the subject of the application.	Section 2.4, p. 20
28(3)	The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) if the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation (1)(c), exist.	-

This Final Scoping Report is an update of the Draft Scoping Report of July 2013, including additional information on the current status of the public participation process and amendments made in light of some of the comments made. Substantive changes to the Draft Scoping Report are reflected in this Final Scoping Report as underlined text, while deletions are reflected with ~~strikethrough~~ text.

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Annexure D – Proof of Deproclamation of Riemvasmaak Land

Annexure E – Forward Planning of Energy in South Africa

Glossary of Terms

Environment	The surroundings (biophysical, social and economic) 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 wellbeing;
Environmental Impact Assessment (EIA)	A study of the environmental consequences of a proposed course of action.

Environmental Impact Report Assessment (EIR)	A report assessing the potential significant impacts as identified during the Scoping Phase.
Environmental impact	An environmental change caused by some human act.
Environmental Management Programme (EMP)	A document that provides procedures for mitigating and monitoring environmental impacts, during the construction, operation and decommissioning phases.
Public Participation Process	A process of involving the public in order to identify needs, address concerns, in order to contribute to more informed decision making relating to a proposed project, programme or development.
Scoping	A procedure for determining the extent of and approach to an EIA, used to focus the EIA to ensure that only the significant issues and reasonable alternatives are examined in detail
Scoping Report	A report describing the issues identified.

Abbreviations

BA	Basic Assessment
CARA	Conservation of Agricultural Resources Act (No. 43 of 1983)
CEMP	Construction Environmental Management Plan
CRR1	Comments and Response Report 1
CRR2	Comments and Response Report 2
DAFF	Department of Agriculture Forestry and Fisheries
DBAR	Draft Basic Assessment Report
DEA	Department of Environmental Affairs
DEANC	Northern Cape Department of Environmental Affairs and Nature Conservation
DEA: Waste	Department of Environmental Affairs: Waste
DMR	Department of Mineral Resources
DoA	Department of Agriculture
DoE	Department of Energy
EAPs	Environmental Assessment Practitioners
EFR	Environmental Flow Reserve

EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EP	Equator Principles
EPFIs	Equator Principles Financial Institutions
GG	Government Gazette
GN	Government Notice
HV	High Voltage
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IPPP	Independent Power Producer Process
IRP	Integrated Resource Plan
NCNCA	Northern Cape Nature Conservation Act (No. 9 of 2009)
NEA	National Energy Act (No. 34 of 2008)
NEMA	National Environmental Management Act (No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act (No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act (No. 57 of 2003)
NEM:WA	National Environmental Management: Waste Act (No. 59 0f 2008)
NFA	National Forest Act (No. 84 0f 1998) (as amended)
NHRA	National Heritage Resources Act (No. 25 of 1999)
NWA	National Water Act (No. 36 of 1998)
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SANParks	South African National Parks

WML	Waste Management Licence

1 INTRODUCTION AND BACKGROUND

The purpose of this Chapter is to introduce the project and describe the relevant legal framework within which the project takes place as well as the activities listed in terms of National Environmental Management Act (NEMA) that require authorisation. It further serves to contextualise the proposed project in terms of the initial process that was undertaken and the proposed location of the hydropower station and transmission line route near Augrabies in the Northern Cape. Supplementing this chapter is Annexure E, *Forward planning of Energy in South Africa,* which provides an overview of the policy and legislative context in which the development of renewable energy projects takes place in South Africa.

1.1 Introduction

RVM 1 Hydro Electric Power (Pty) Ltd (hereinafter referred to as RVM1) wishes to construct a 40 Megawatt (MW) hydropower station on the Orange River, on the farm Riemvasmaak (Remainder of Farm no. 497 and Portion 1 of Farm no. 498) (hereinafter referred to as Riemvasmaak), north of the Augrabies Falls within the Augrabies Falls National Park (AFNP), approximately 40 km north west of Kakamas in the Northern Cape Province of South Africa (refer to Figure 1). Aurecon South Africa (Pty) Ltd (Aurecon) has been appointed to undertake the requisite environmental process as required in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA), as amended, on behalf of RVM1.

A Basic Assessment (BA) process was initiated and a Draft Basic Assessment Report (DBAR) was made available for public comment from 4 January 2013 to 13 February 2013. However, based on comments received, the need for additional stakeholder engagement became apparent. Furthermore, a change in the restrictions ~~requirements~~ of the Department of Energy's Independent Power Producer Process meant that larger hydropower projects could be put forward. As such the decision was made to upgrade the process to a full Scoping and Environmental Impact Assessment (EIA) process and to increase the capacity of the proposed project to 40 MW. This report is the first step in the EIA process.

Riemvasmaak, owned by the Riemvasmaak Community Trust, is located within the borders of the AFNP. The farm was however excluded from AFNP in terms of Section 2(3) of the National Parks Act of 1976 (refer to Annexure D for a copy of the deproclamation) following the first successful land restitution in South Africa after the 1994 elections. The land was returned to the Riemvasmaak community following their forced removal in 1973/74 during Apartheid. Portions of the proposed project (e.g. the power house and tailrace) would be located on Riemvasmaak, however other portions (e.g. a weir and canal) would be located on land owned by the South African National Parks (SANParks).

The proposed hydropower station would consist of the following components:

- a weir across the Orange River (not greater than 2.5 m measured from the river base to the spill crest);

- an off-take structure;
- buried water conveyance infrastructure (pipeline);
- a head pond;
- two buried steel (or other suitable pipe material) penstocks;
- an underground power chamber to house the turbines and generation equipment;
- a switchroom and transformer yard; and
- access roads.

Energy generated by the proposed hydropower station would be evacuated from the site *via* a proposed 33 kV or 132 kV underground transmission line across Riemvasmaak land. The transmission line will surface outside of Riemvasmaak where it will link up with an overhead 132 kV transmission line and evacuate energy to a nearby Eskom substation (Figure 2). The transmission line will pass through the following farms/ erven:

- Portion 1, 3 and 4 of 492, remainder of 327, 353, 337, 341, 355, 370, 1566, 1215, 1292, 1288, 1726, and 2160.

In terms of the NEMA read with the NEMA 2010 EIA Regulations[1], the proposed project triggers a suite of listed activities which require environmental authorisation from the competent environmental authority. Since the project is for the generation of energy, which projects are dealt with by the national authority, the competent authority for this application is the national Department of Environmental Affairs (DEA). DEA's decision will be based on the outcome of this EIA process.

This report serves to document the Scoping Phase of the EIA process (the EIA process and sequence of documents produced as a result of the process are illustrated in Figure 3). The purpose of this Scoping Report[2] is to provide the background and outline the scope of work proposed to be undertaken in the EIA phase. Accordingly, the Scoping Report:

- Outlines the legal and policy framework;
- Describes the proposed project and its alternatives;
- Describes the Public Participation Process undertaken to date;
- Describes the biophysical and socio-economic context;
- Describes the range of alternatives that require further investigation in the EIA Phase;
- Identifies potential impacts, including cumulative impacts, that will be assessed in the EIA Phase, inclusive of specialist studies that will be undertaken; and
- Details the assessment methodology that will be adopted for the project.

[1] As contained in Government Notice (GN) No. R.543 of 18 June 2010, and the lists of activities identified in terms of S24 of NEMA, set out in GN R.544, 545 and 546.
[2] Section 28 of GN No. R.543 lists the content required in a Scoping Report.

Farms/ Erven comprising the sites	
Farm (hydropower station)	**Landowner**
Remainder of Farm 497	Riemvasmaak Community Trust
Portion 1 of Farm 498	Riemvasmaak Community Trust
Farm/ Erven (Transmission line corridor/ servitude)	**Landowner**
Portion 1, 3 and 4 of 492	Riemvasmaak Community Trust
Remainder of 327	RSA
353	Janetta Wilhelmina Antunes
337	Kai !Garib Local Municipality
341	Christie Jordaan Boerdery Trust
355	Willem Adriaan Theron
370	Jackwil Trust
1566	Johannes Rudolph Spangenberg
1215	W.P. Du Plessis Familie Trust
1292	Burger Du Plessis Familie Trust
1288	Burger Du Plessis Familie Trust
1726	Burger Du Plessis Familie Trust
2160	Not Registered

Table 1 **|** List of farms/ erven on which sites are located and the respective landowners

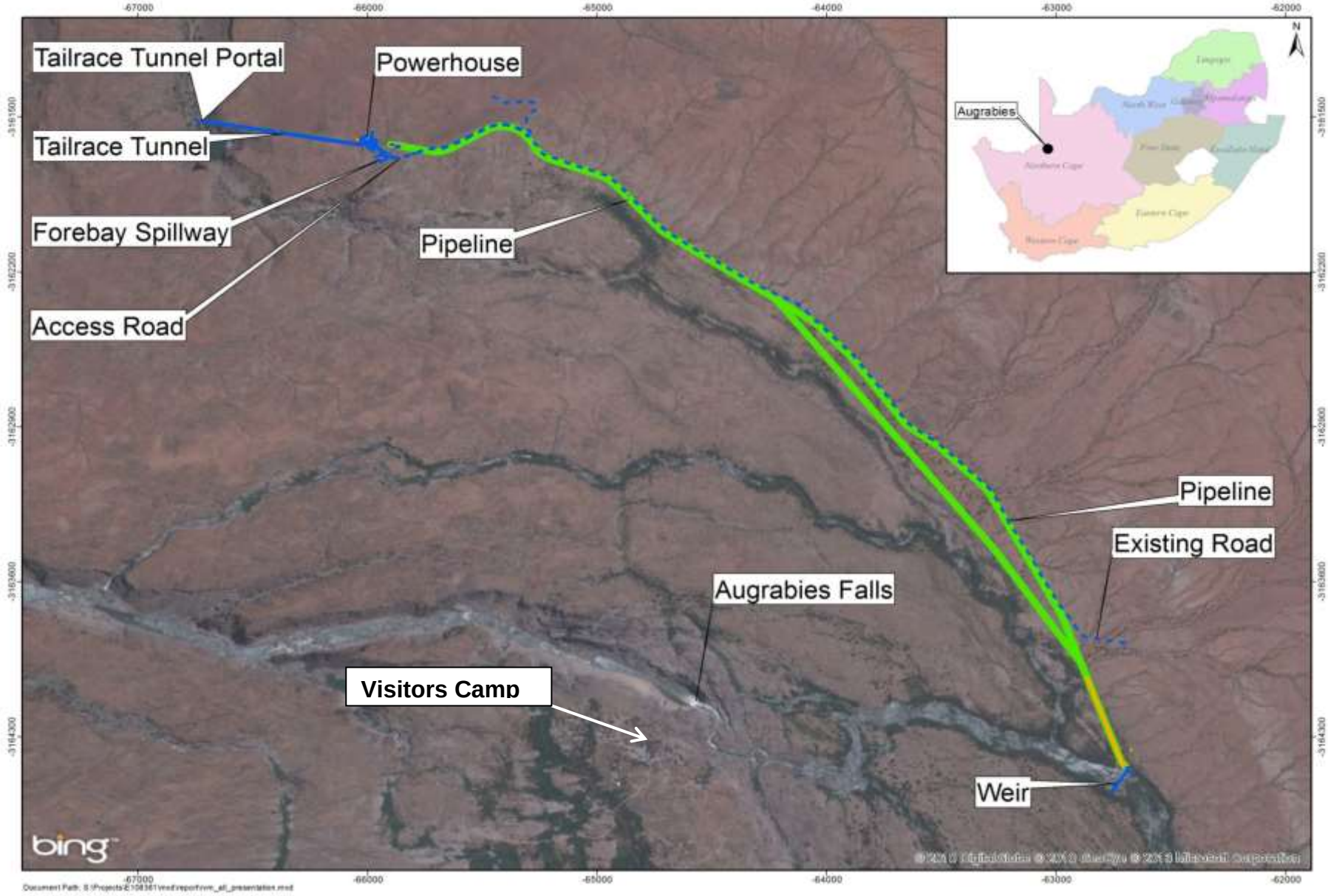

Figure 1 | Locality of the Proposed RVM Hydropower Project

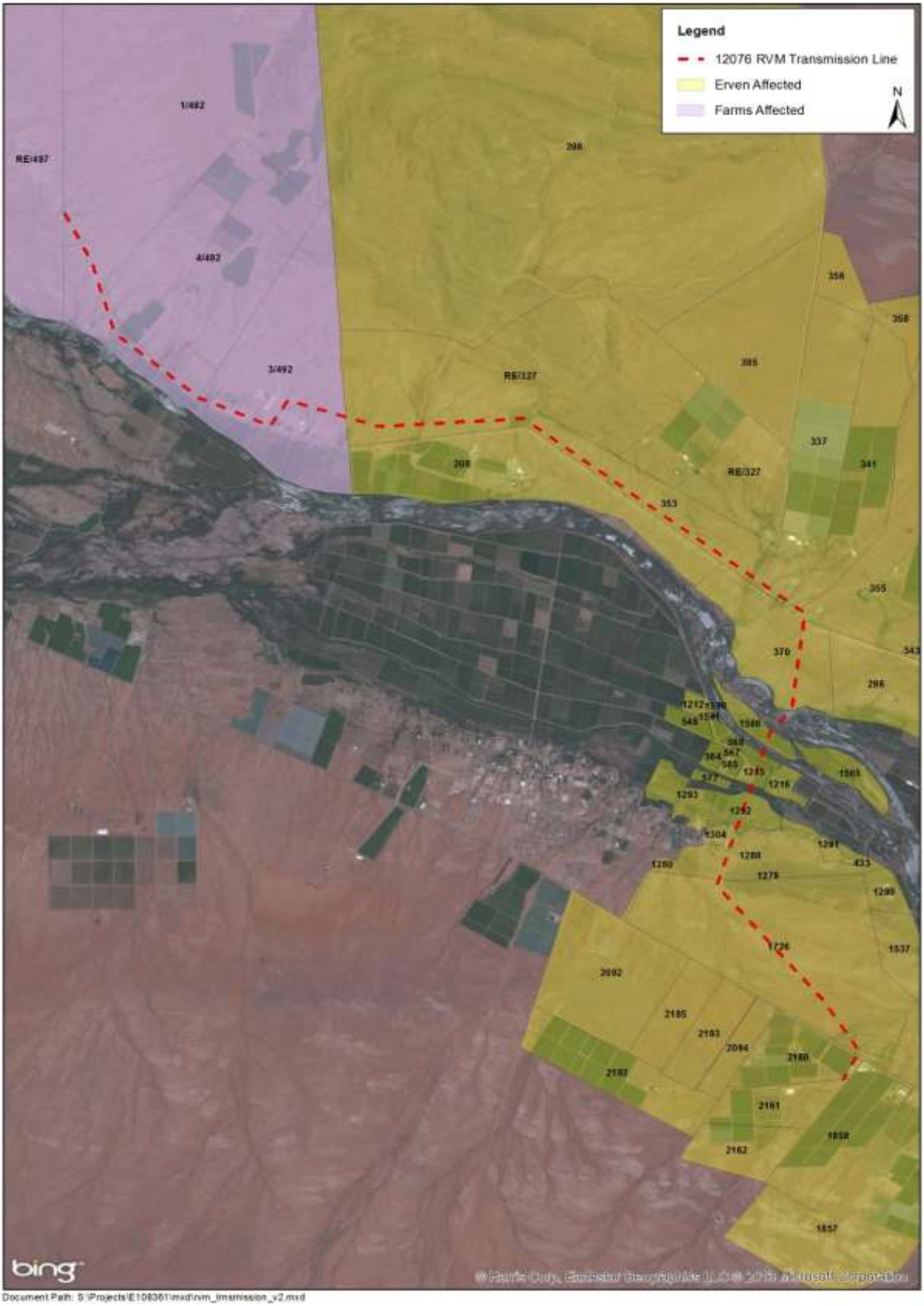

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Figure 2 | Map of transmission line route for the proposed RVM hydropower project, showing the erven that would be crossed.

1.2 Legal Requirements

There are a multitude of legal and policy documents and guidelines to consider when undertaking such a project. An overview of the legislation relevant to the proposed project is provided in Table 2.

Legal Requirements		
Title of legislation, policy or guideline	**Applicability to the project**	**Administrating Authority**
The Republic of South Africa Constitution Act ("the Constitution") (Act 108 of 1996)	The environmental right contained in section 24 of the Constitution provides that everyone is entitled to an environment that is not harmful to his or her well-being.	N/A
National Environmental Management Act, Act No. 107 of 1998 (NEMA)	Several listed activities in terms of NEMA GN No. 544, 545 and 546, 18 June 2010, have been triggered and need to be authorised for the proposed WEF (also see Table 3).	DEA
National Water Act, Act No. 36 of 1998 (NWA)	The proposed hydropower station would divert water from the Orange River for the generation of electricity. The location of the hydropower station falls within the D81A quaternary catchment and the Lower Orange Department of Water Affairs (DWA) water management area and requires authorisation from them for the following activities as listed in section 21 of the NWA: 21 (c) Impeding or diverting flow of water in a watercourse; and 21 (i) Altering the bed, banks, course or characteristics of a watercourse.	DWA
National Heritage Resources Act, Act No. 25 of 1999 (NHRA)	The development would change the character of a site exceeding 5 000 m^2 in extent and encompass the construction of an access road and transmission line exceeding 300 m in length. As such the act requires that a Heritage Impact Assessment is undertaken for the proposed project.	South African Heritage Resources Agency (SAHRA)
National Environmental Management: Biodiversity Act, Act No. 10 of 2004 (NEM:BA)	The hydropower station would be located in the AFNP which contains protected species listed in NEM: BA requiring permits for its removal should the project receive a positive Environmental Authorisation (EA).	Northern Cape Department of Environmental Affairs and Nature Conservation (DEANC)
National Forest Act, Act 84 of 1998 (as amended) (NFA)	Section 12(1)(d) read with s15(1) and s62(2)(c) list protected tree species that may not be cut, destroyed or disturbed without a licence. Should the project be granted a positive EA, the relevant	Department of Agriculture, Forestry and Fisheries (DAFF).

Legal Requirements		
Title of legislation, policy or guideline	**Applicability to the project**	**Administrating Authority**
	licences will be applied for if any endangered trees, as per those listed in the NFA, are to be cut, destroyed or disturbed.	
Northern Cape Nature Conservation Act Act No. 9 of 2009 (NCNCA)	Numerous sections (specifically sections 50-51) under NCNCA deal with indigenous and protected plants. A permit in terms of NCNCA will be required if species listed in the act are located on site and it would be necessary to remove or destroy them.	DEANC
The National Energy Act, Act No. 34 of 2008 (NEA)	In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) has been developed by the DoE and sets out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity must be met through the technologies and projects listed in the IRP and all Independent Power Producer (IPP) procurement programmes will be undertaken in accordance with the specified capacities and technologies listed in the IRP .	Department of Energy (DoE)
The National Environmental Management: Waste Act, Act 59 of 2008 (NEM: WA)	If no other alternatives are available and spoil is to be left on site, it might trigger the need for a Waste Management Licence (WML). DEA will be consulted in this regard to confirm if a WML will be required.	DEA: Waste
The International Finance Corporation (IFC) performance standards	A certain percentage of the funding for the proposed hydropower station would be sourced from the IFC. As such the IFC performance standards would be applicable to the proposed project.	N/A
Equator Principles (EP)	A certain percentage of the funding for the proposed hydropower station would be sourced from the Equator Principles Financial Institutions (EPFI's). As such the Equator Principles would be applicable to the proposed project.	N/A

Legal Requirements		
Title of legislation, policy or guideline	**Applicability to the project**	**Administrating Authority**
The National Environmental Management: Protected Areas Act, Act No. 57 of 2003 (NEM:PAA)	The proposed project would be situated in the AFNP which is a protected area and therefore falls under the requirements of NEM:PAA which serves to provide for the protection and conservation of protected areas in South Africa. The Act is also aimed at managing protected areas in accordance with national norms and standards. Specific sections that are applicable for the proposed project are, *inter alia*, section 41 (Management Plans) and 50 (Commercial and community activities in nature reserve and heritage sites)	DEA
Biodiversity Policy and Strategy for South Africa: Strategy on Buffer Zones for National Parks (GN 106 of 2012)	In terms of the approved SANParks management plan infrastructure for the proposed project would fall in an area which is zoned as a Priority Natural Area. The area has however not yet been declared as such by Government as per the requirements of the Strategy on Buffer Zones which states on p. 13 that: *"To establish buffer zones around each national park, Government will –* *(a) Identify buffer zones for all national parks in park management plans;* *(b)* ***Establish these buffer zones by publication in the Gazette;*** *(c) Integrate the buffer zones into municipal spatial development frameworks as special control/ natural area where appropriate; and* *(d) Where necessary or appropriate, declare the buffer zones or part thereof as protected environments in terms of the Act (i.e. NEM:PAA)."* Due consideration will be given to this Policy during the EIA Phase.	DEA

Table 2 **|** Legislation considered in preparation of the Scoping Report

1.3 Activities listed in terms of NEMA

This is the primary legislation tasked with management of environmental resources and accordingly, identifies activities that require authorisation prior to commencement. Such activities are detailed in Table 1 below.

NO.	LISTED ACTIVITIES	ASPECT OF PROJECT
GN No. R.544, 18 June 2010		
9	The **construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water**, sewage or storm water - **i. with an internal diameter of 0,36 metres or more; or** **ii. with a peak throughput of 120 litres per second or more,** excluding where: a. such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.	The proposed project requires water conveyance infrastructure which would comprise a pipeline to convey the water to the headpond. The pipeline length is about 4.6 km. The maximum discharge in the conveyance infrastructure will be 37m³/s. Twin pipelines with a with dimensions of approximately 4.0m high by 3.5m wide would be required to convey water in the required volume.
10	The construction 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; or** ii. inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.	A transmission line of 33 and 132 kV capacity and approximately 22 km long would be required to evacuate power from the proposed facility. The line would for the most part be outside urbanised areas although a portion would cross an urban area.
11	**The construction of:** **i. canals;** **ii. channels;** iii. bridges; iv. dams; **v. weirs;** vi. bulk storm water outlet structures; vii. marinas; viii. jetties exceeding 50 square metres in size; ix. slipways exceeding 50 square metres in size; x. buildings exceeding 50 square metres in size; or **xi. infrastructure or structures covering 50 square metres or more** where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	The footprint of the proposed hydropower plant, which would be constructed within and adjacent to the Orange River, would exceed 50 square meters. A small weir would also be constructed within the Orange River.
18	**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 from **i. a watercourse;** ii. the sea; iii. the seashore; iv. the littoral active zone, an estuary or a distance of 100	During construction of the proposed hydropower plant more than 5 cubic metres of material could be removed from the Orange River for the construction of certain project elements such as the weir and tailrace. Furthermore the construction of the proposed weir within the Orange River

NO.	LISTED ACTIVITIES	ASPECT OF PROJECT
	metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater- but excluding where such infilling, depositing, dredging, excavation, removal or moving i. is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or ii. occurs behind the development setback line.	would entail the depositing of more than 5 cubic metres of material into the river.
GN No. R.545, 18 June 2010		
1	The **construction of facilities or infrastructure for the generation of electricity** where the electricity output is **20 megawatts or more**.	The proposed project consists of a hydropower station capable of producing 40 MW.
10	The construction of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following: (i) water catchments, (ii) water treatment works; or (iii) impoundments, excluding treatment works where water is to be treated for drinking purposes.	DEA considers the headpond of the proposed project to be an impoundment into which water will be conveyed from the intake structure.
GN No. R.546, 18 June 2010		
4	The **construction of a road wider than 4 metres** with a reserve less than 13,5 metres. (a) In Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga and **Northern Cape provinces**: i. In an estuary; ii. **Outside urban areas, in:** (aa) **A protected area identified in terms of NEMPAA, excluding conservancies;** (bb) National Protected Area Expansion Strategy Focus 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; (dd) Sites or areas identified in terms of an International Convention; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; (gg) **Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve;** (hh) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined. iii. In urban areas: (aa) Areas zoned for use as public open space; (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent	Access roads to the proposed hydropower station would be approximately 6m in width and would be situated in the AFNP Management Plan area.

NO.	LISTED ACTIVITIES	ASPECT OF PROJECT
	authority or zoned for a conservation purpose; seawards of the development setback line or within urban protected areas.	
12	The **clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.** (a) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; (b) Within critical biodiversity areas identified in bioregional plans; (c) Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuary, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas.	The footprint of the proposed hydropower station would be greater than 300 square metres and would be located in an area of at least 75 % indigenous vegetation.
13	The **clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation**, except where such removal of vegetation is required for: (2) the undertaking of a linear activity falling below the thresholds mentioned in Listing Notice 1 in terms of GN No. 544 of 2010. **Northern Cape** and Western Cape: i. In an estuary; **ii. Outside urban areas, the following**: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus 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; (dd) Sites or areas identified in terms of an International Convention; (ee) Core areas in biosphere reserves; (ff) Areas within10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; (gg) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined.	The footprint of the proposed hydropower station would be greater than 1 ha and would be located in an area of at least 75 % indigenous vegetation.

NO.	LISTED ACTIVITIES	ASPECT OF PROJECT
14	The **clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation**, except where such removal of vegetation is required for: (a) purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or afforestation purposes; (b) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list; the undertaking of a linear activity falling below the thresholds in Notice 544 of 2010.	The footprint of the proposed hydropower station will be greater than 5 ha and would be located in an area of at least 75 % indigenous vegetation.
16	The **construction of**: i) jetties exceeding 10 square metres in size; ii) slipways exceeding 10 square metres in size; iii) buildings with a footprint exceeding 10 square metres in size; or **iv) infrastructure covering 10 square metres or more** where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	Infrastructure (i.e. weir, intake structure and tailrace) would be constructed within the Orange River and would exceed 10 square metres.

Table 3 **|** Activities listed in terms of NEMA GN No. R.544, 545 and 546, 18 June 2010, requiring authorisation for the proposed hydropower station

2 EIA METHODOLOGY

The purpose of this Chapter is to provide the reader with an overview of the proposed EIA methodology. It describes the proposed public participation process as engagement with the public and stakeholders forms an integral component of the EIA process. The commenting authorities and applicable guidelines are listed. Reference is made to current assumptions and limitations with regards to the proposed hydropower station.

2.1 Approach to the Project

Preceding the current EIA process was a BA process. The BA process was initially required for the project as it only triggered listed activities in terms of Listing Notice 1 (GN No. R.544) and Listing Notice 3 (GN No. R.546) of the NEMA EIA regulations. A BA is triggered by activities listed in Listing Notice 1 (GN No. R.544) and/or Listing Notice 3 (GN No. R.546) of the NEMA EIA regulations. If any listed activity is triggered in terms of Listing Notice 2 (GN No. R.545) of the NEMA EIA regulations, then the project requires a full Scoping and EIA process.

However, based on comments received, the need for additional stakeholder engagement became apparent. Furthermore, a change in the requirements of the DoE's Independent Power Producer Process (IPPP) meant that larger hydropower projects could be put forward. As such the decision was made to upgrade the process to a full Scoping and EIA process and to increase the capacity of the proposed project to 40 MW. The increase in the capacity of the project to above 20 MW means that Activity 1 of Listing Notice 2 is relevant and hence a full Scoping and EIA process is now necessary.

A meeting was held with DEA on 7 May 2013 to familiarise the competent authority with the proposed project and to discuss requirements they may have. DEA indicated that it is of the opinion that Activity 10 *("The **construction of facilities** or infrastructure **for the transfer of 50 000 cubic metres or more water per day**, from and to or between any combination of the following: (i) water catchments, (ii) water treatment works; or **(iii) impoundments**, excluding treatment works where water is to be treated for drinking purposes*) of Listing Notice 2 (GN No. R545) of the NEMA EIA regulations is applicable to the project. Although Aurecon is of the opinion that this activity is not applicable to the proposed project it will never-the-less be included in the application. DEA will be engaged to ensure that the correct activities are applied for prior to submission of the final EIA Report for decision-making. Initially RVM 1 applied for three separate projects based on the cap of ≤10 MW that the DoE had placed on all Renewable Energy Independent Power Producer (IPP) applications pertaining to hydropower projects. DoE, in consultation with the National Energy Regulator of South Africa, lifted the cap on 19 December 2012 and increased it to ≤40 MW.

Based on the above a request was put to DEA to upgrade the BA process to a Scoping and EIA process and to withdraw two of the initial three applications. The request was granted by DEA on 18 June 2013 (refer to Annexure A3 and A4). The reference number for the proposed project has not changed since the BA process as the two other applications were simply withdrawn, leaving the

original application and reference number in place. As changes generally occur to a project undergoing an EIA process an amended application form, containing the updated project description, is typically submitted with the Final EIR. Therefore it is proposed that a revised application form containing the most up to date project description will be submitted to the DEA during the EIA phase.

As outlined in Figure 3, there are three distinct phases in the EIA process namely the Initial Application Phase, the Scoping Phase and the EIA Phase. A description of the activities which have been, and will be, undertaken during each phase is provided in the following sections. Note that this report covers the second phase, namely the Scoping Report Phase.

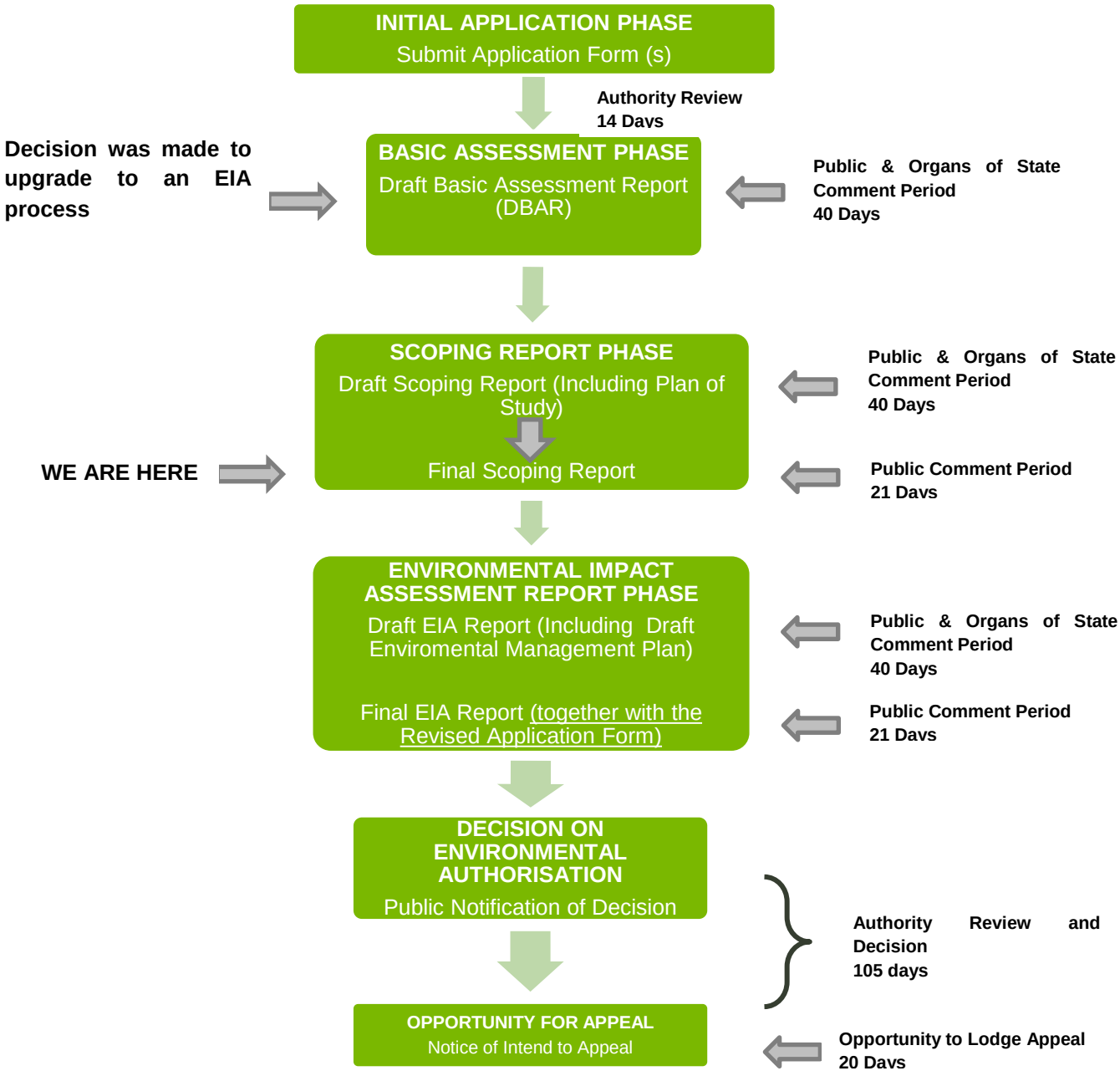

Figure 3 | **The EIA process in terms of NEMA**

2.1.1 Initial Application Phase

The Initial Application Phase entailed the submission of Application Forms, submitted on 17 August 2012 and 12 November 2012, to apply for the BA process. Acknowledgements of receipt of the EIA Application Forms were received from DEA on 3 September 2012 and 29 November 2012. The Application Forms and DEA's letters of acknowledgement are included in Annexure A1 and A2 respectively.

2.1.2 Basic Assessment Process

The BA process that preceded the EIA process included the following tasks:

- Landowners were notified of the proposed project by means of email (included in Annexure B1).
- Potential identified I&APs were sent a letter (Afrikaans and English) on 21 December 2012 informing them of the proposed project and inviting them to comment on the DBAR (refer to Annexure B1).
- A letter was sent to the relevant Authorities on 21 December 2012 inviting them to comment on the DBAR for the proposed project (included in Annexure B1).
- Site notices were erected at the entrance of the proposed site on 23 December 2013 (refer to Annexure B1 for photo proof).
- An advertisement (Afrikaans and English) was placed in *Die Volksblad* of 3 January 2013. The advertisement informed I&APs of the availability of the DBAR for comment as well as the date and venue of the public meeting that was to be held in Kakamas (refer to Annexure B1).
- The DBAR was lodged in the Kakamas Public Library on 21 December 2012.
- A public meeting was held in Kakamas at the Kalahari Gateway Hotel on 28 January 2013 to discuss the findings of the DBAR (refer to Annexure B1 for notes of the public meeting).
- All comments received on the DBAR were captured in Comments and Response Report 1 (CRR1) along with the consultant and proponent's responses thereto (refer to Annexure C).

2.1.3 The Scoping Phase

Scoping is defined as a procedure for determining the extent of, and approach to, the EIA phase and involves the following key tasks:

- Involvement of relevant authorities and I&APs;
- Identification and selection of feasible alternatives to be taken through to the EIA Phase;
- Identification of significant issues/impacts associated with each feasible alternative to be examined in the EIA Report; and
- Determination of methodology for assessment and specific Terms of Reference (ToR) for any specialist studies required in the EIA Report (Plan of Study for the EIA Report).

The Scoping Phase to date has involved a review of relevant literature, including the preceding BA process. These information sources included, *inter alia*, the following:

- The Draft Basic Assessment Report (DBAR);
- Specialist studies undertaken for the initial BA process including:
    - Botanical impact assessment;
    - Aquatic ecology assessment;
    - Visual assessment;

- Noise assessment;
- Socio-economic/ tourism assessment; and
- Heritage assessment.

- Siyanda District Municipality Integrated Development Plan (IDP), 2012/2013 – 2017;
- Siyanda District Municipality Environmental Management Framework, 2008; and
- AFNP Management Plan, 2008.

A site visit was undertaken on 4 July 2012. The main purpose of the site visit was to familiarise the Environmental Assessment Practitioners (EAPs) with the site and to allow for a rapid survey of the site to identify potential areas of concern. The information gathered during the site visit and throughout the initial BA process was used in refining the Plan of Study for the EIA process and ToR for the specialist studies that will be undertaken during the EIA Phase.

2.1.3.1 Decision making on the DSR

The Draft Scoping Report (DSR) was made available to the public for a 40 day comment period. All comments received during the comment period have been included in CRR2 and annexed to this report (refer to Annexure C), the Final Scoping Report (FSR). The FSR will be submitted to DEA for review.

The competent authority (DEA) must, within 30 days of acknowledging receipt of the FSR, or receipt of the required information, reports, or comments or an amended scoping report, consider it, and in writing –

(a) Accept the report and advise the EAP to proceed with the tasks contemplated in the Plan of Study for EIA;
(b) Request the EAP to make such amendments to the report as the component authority may require (request additional information), or
(c) Reject the Scoping Report if it
  i. Does not contain material information required in terms of these regulations, or
  ii. Has not taken into account guidelines applicable in respect of Scoping Reports and Plans of Study for EIA.

2.1.4 The EIA Phase

The Scoping Phase will be followed by the EIA Phase, during which the specialist investigations will occur, and will culminate in a comprehensive EIA Report (EIR) documenting the outcome of the impact assessments. Details of the EIR and the public participation process are provided in Section 5.6 and 5.7, respectively.

2.2 The Public Participation Process

Consultation with the public forms an integral component of this investigation and enables I&APs (e.g. directly affected landowners, national, provincial and local authorities, environmental groups, civic associations and communities), to identify their issues and concerns relating to the proposed activities, which they feel should be addressed in the EIA process. To create a transparent process and to ensure that I&APs are well informed about the project, as much information as is available has been included upfront to afford I&APs numerous opportunities to review and comment on the proposed project. Currently there are ~~99~~ 297 I&APs registered on the project database (see Annexure B2 for a list of I&APs). An outline of the proposed public participation process is given in Table 15 as part of the proposed EIA programme.

2.2.1 Identification of Stakeholders

The initial database of I&APs includes the landowners, the adjacent landowners, relevant district and local municipal officials, relevant national and provincial government officials, stakeholders (i.e. the Riemvasmaak Community Trust), I&APs who registered during the initial BA process, and organisations in the area. Key I&APs have been identified in Figure 4. This database will be augmented via chain referral during the EIA process, and will continually be updated as new I&APs are identified throughout the project lifecycle. The provisional list of I&APs is included in Annexure B2.

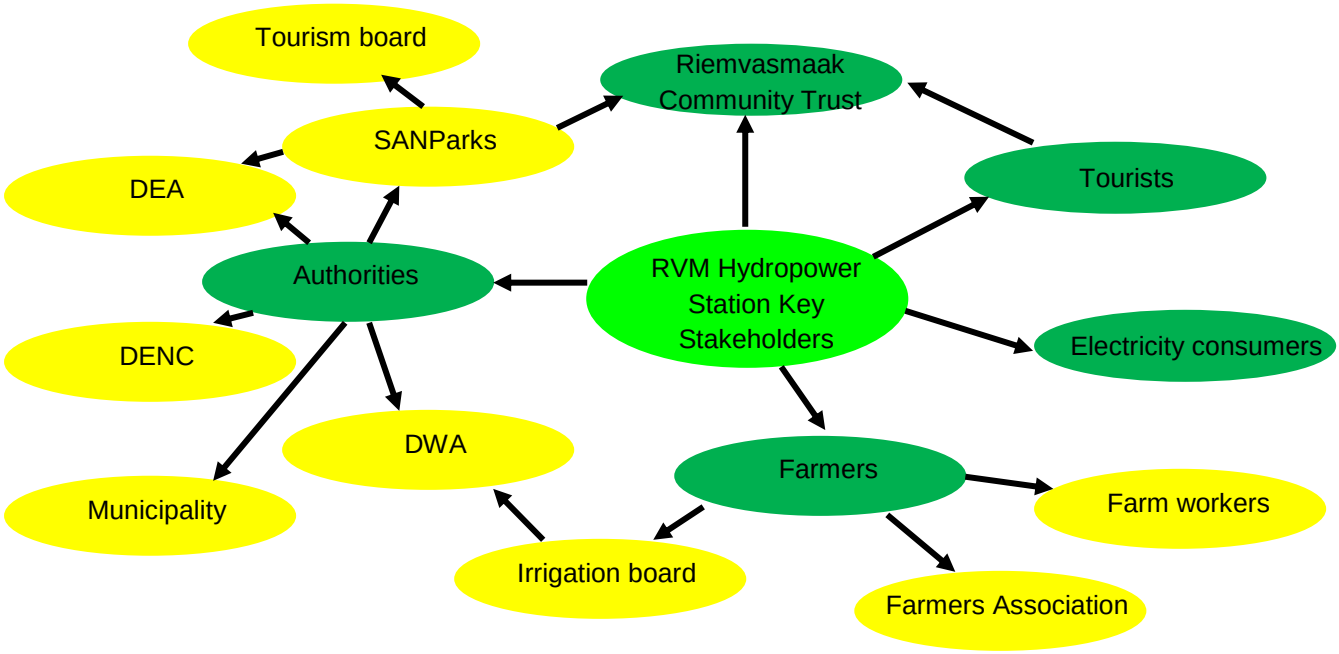

Figure 4 | Key I&APs identified for the proposed project

2.2.2 Notification of the Public Participation Process

Consultation with all potential I&APs commenced with the notification of the Public Participation Process (refer to section 2.1.2) as part of the initial BA process, as required in terms of the EIA Regulations. In addition to the BA process, the Scoping process entailed the following:

- Lodging the DSR at the Kakamas Public Library, the AFNP reception and on Aurecon's website (www.aurecongroup.com). I&APs were notified of the lodging of the reports by means of letters or email (refer to Appendix B) depending on what contact details were available. Two additional reports were also distributed through a community representative (Mr Lloyd Theunissen) to the Riemvasmaak Community.
- The letters included a non-technical Executive Summary, in English and / or Afrikaans. I&APs were provided with 40 days in which to comment on the report. During the comment period a public meeting was held with I&APs. The meeting was held on 5 August 2013 at the Kalahari Gateway Hotel in Kakamas. A total of 17 people, excluding the project team, attended the meeting (refer to Annexure B for a copy of the attendance register and meeting minutes In addition to the public meeting, the following meetings were held with the Community (refer to Annexure B for copies of the attendance registers and meeting minutes):
    - Meeting at the Riemvasmaak Community Hall (6 August 2013);

- Meeting at Vredesvallei (6 August 2013); and
- Meeting at Marchand Community Hall (22 August 2013).

A Focus Group Meeting was also held with SANParks in their head office in Pretoria on 25 July 2013 (refer to Annexure B for the attendance register and meeting minutes).

- Advertisements were placed in the following newspapers (Refer to Annexure B for copies of the advertisements):
  - *Die Gemsbok (26 July 2013)*;
  - *Die Volksblad (19 July 2013)*;
  - *Mail & Guardian (26 July 2013)*; and
  - *Die Rapport (21 July 2013)*.

- Requesting potential I&APs to recommend other potential I&APs to include on the database (chain referral process).

Thereafter, the remainder of the communications will be focused on registered I&APs.

2.2.3 Issues Raised

All issues raised during the initial BA process have been captured in CRR1 (refer to Annexure C) along with the responses from the client and consultant. The key issues raised are summarised in Table 4. All comments and/or concerns raised during the Scoping phase, along with the responses from the client and consultant, have been summarised into CRR2. CRR2 is annexed to the FSR (refer to Annexure C) and all parties that raised issues have been provided with a copy of CRR2.

Issues raised	
Impact Grouping	**Potential key impact/ issues identified**
Aquatic	• Potential impact of the weir on breeding habitats of fish such as yellow fish. • Potential impact on the Environmental Flow Reserve (EFR). • Potential impact on riparian vegetation. • Cumulative impact resulting from future upstream water use and the impact it will have on the viability of the proposed project. • Potential impact of climate change and upstream abstraction on water availability in future.
Visual	• Potential visual impact of proposed project infrastructure (i.e. weir, powerhouse and power lines). • Potential visual impact in areas zoned as “primitive” and “remote” in terms of the AFNP Management Plan. • Potential visual impact on visitors’ experience at the AFNP as a result of the diversion of a portion of the Orange River’s flow before the falls.
Social	• Potential number of jobs that will be created. • Economic viability of the proposed project.
Legal	• Discrepancy between the proposed project and SANPark’s mandate in terms of the NEM: BA. • Details of the WULA. • Conflict between the proposed project and future spatial development plans.

Issues raised	
Impact Grouping	**Potential key impact/ issues identified**
	• Conflict between the legal status of the AFNP and the proposed project. • Submission of revised EIA application.
Biodiversity	• Potential impact of animals not being able to reach water from the Orange River as a result of the proposed project infrastructure. • Potential impact on vegetation, including riparian vegetation, and associated habitats. • Potential impact on avifauna due to proposed transmission line. • Potential impact on reptiles and mammals. • Potential impact on tree species protected in terms of the NFA. • Potential impact on protected vegetation types. • Rehabilitation of the site. • Potential impact of the construction of the proposed weir on a breeding colony of water birds.
Tourism	• Potential impact of reduced flow volumes on tourists' experience of the Augrabies Falls. • Potential impact of bright lights from the proposed project on tourists' night time viewing experience of the Augrabies Falls.
General	• Initial notification of I&APs. • Potential impact of seismic activity in the area on the proposed project infrastructure. • Potential impact of tourists, especially on roads, should they be allowed to visit the proposed site. • First proposed hydropower station in a National Park ~~on the continent~~ in South Africa. • The manner in which the PPP process was undertaken. • The RVM community and their involvement. • The price at which electricity will be sold to Eskom. • AFNP as a Geopark. • Request for access to the AFNP to undertake geotechnical investigations. • Upgrading of the BA process to a full Scoping and EIA process. • Outbreak of malaria. • Discrepancies between information in BA documents and press releases. • Lack of sensitivity and respect for the AFNP sense of place. • Solar and wind as alternatives for the proposed project. • Impact of the proposed project on the on-going process of including additional land to the AFNP for conservation purposes. • Spoil management.
Heritage	• Potential impact on heritage and/or palaeontological resources.

Table 4 | Key issues raised by I&APs

2.3 Authority Involvement

Authority involvement commenced with the submission of the Application Forms to DEA (see section 2.1.1). A meeting was held with DEA on 7 May 2013 to familiarise them with the proposed project and to discuss any requirements they may have.

The following authorities were requested to comment on the DSR:

- DEA;
- Northern Cape Department of Environmental Affairs and Nature Conservation (DEANC);
- Kai !Garib Local Municipality;
- Siyanda District Municipality;
- DWA (National and Provincial);
- Department of Agriculture, Land Reform & Rural Development (Northern Cape);
- SAHRA;
- Northern Cape Provincial Heritage: *Boswa ya Kapa Bokone*;
- Department of Energy (Northern Cape);
- Eskom Holdings Ltd.;
- SANParks;
- Department of Agriculture, Forestry and Fisheries (Northern Cape) (DAFF); and
- Department of Tourism.

Where the need arises, focus group meetings will be arranged with representatives from the relevant national and provincial departments, local authorities and stakeholders. Focus Group Meetings have been proposed with SANParks at the Scoping and EIA Phases. The purpose of these Focus Group Meetings will be to ensure that the authorities and stakeholders have a thorough understanding of the proposed hydropower station project and that Aurecon has a clear understanding of the authority and stakeholder requirements. One such meeting has already been held with SANParks. However, SANParks will be engaged further during the EIA Phase. It is anticipated that beyond providing key inputs into the EIA, this authority Scoping process will ultimately expedite the process by ensuring that the final documentation satisfies the authority requirements and that the authorities are fully informed with respect to the nature and scope of the proposed hydropower station.

2.4 Guidelines

This EIA process is informed by the series of national Environmental Guidelines[3] where applicable and relevant:

- Integrated Environmental Information Management (IEIM), Information Series 5: Companion to the NEMA EIA Regulations of 2010 (DEA, 2010).
- Implementation Guidelines: Sector Guidelines for the EIA Regulations (draft) (DEA, 2010).
- IEIM, Information Series 2: Scoping (Department of Environmental Affairs and Tourism (DEAT), 2002).
- DEAT. 2002. IEIM, Information Series 3: Stakeholder Engagement (DEAT, 2002)
- IEIM, Information Series 4: Specialist Studies (DEAT, 2002).
- IEIM, Information Series 11: Criteria for determining Alternatives in EIA (DEAT, 2004)
- IEIM, Information Series 12: Environmental Management Plans (DEAT, 2004).
- Integrated Environmental Management Guideline Series, Guideline 4: Public Participation, in support of the EIA Regulations. Unpublished (DEAT, 2005).
- Integrated Environmental Management Guideline Series, Guideline 7: Detailed Guide to Implementation of the Environmental Impact Assessment Regulations. Unpublished (DEAT, 2007).

[3] Note that these Guidelines have not yet been subjected to the requisite public consultation process as required by Section 74 of R385 of NEMA.

- DEA. Guideline on Need and Desirability (GN 792 of 2012 in Government Gazette (GG) 35746)

The following guidelines from the Department of Environmental Affairs and Development Planning (Western Cape) (DEA&DP) were also taken into consideration:

- Brownlie. 2005. Guideline for involving biodiversity specialists in EIA process (June 2005).
- Winter & Baumann. 2005. Guideline for involving heritage specialists in the EIR process (June 2005).
- Oberholzer. 2005. Guideline for involving visual and aesthetic specialists in the EIR process (June 2005).
- Guideline for Environmental Management Plans (June 2005).
- Guideline for determining the scope of specialist involvement in EIA Processes (June 2005).
- Guideline for the review of specialist input into the EIA Process (June 2005).
- DEA&DP.2011. Guideline on Alternatives. EIA Guideline and Information Document Series. (DEA&DP, October 2011).
- DEA&DP.2011. Guideline on Need and Desirability. EIA Guideline and Information Document Series. (DEA&DP, October 2011).
- DEA&DP.2011. Guideline on Public Participation. EIA Guideline and Information Document Series. (DEA&DP, October 2011).

In addition to the abovementioned guidelines, the following international standards also apply:

- IFC performance standards; and
- Equator Principles.

2.5 Assumptions and Limitations

2.5.1 Assumptions

In undertaking this investigation and compiling the Scoping Report, the following has been assumed:

- The strategic level investigations undertaken by DoE regarding South Africa's proposed energy mix prior to the commencement of the EIA process are ~~technologically~~ technically acceptable and robust;
- The information provided by the client is accurate and unbiased;
- The scope of this investigation is limited to assessing the environmental impacts associated with the proposed hydropower station and connections to the grid. The EIA does not include any infrastructure upgrades which may be required by Eskom to allow capacity in the local grid for the proposed project; and
- The AFNP Management Plan could be revised to allow for the proposed project, should the potential impacts assessed in this EIA be considered to be acceptable to DEA.

2.5.2 Gaps in Knowledge

This Scoping Report has identified the potential environmental impacts associated with the proposed activities. However, the scope of impacts presented in this report could change, should new information become available during the EIA Phase. The purpose of this section is therefore to highlight gaps in knowledge when the Scoping Phase of the project was undertaken.

The planning for the proposed project is at a feasibility level and therefore some of the specific details are not available at this stage of the EIA process. This EIA process forms a part of the suite of feasibility studies, and as these studies progress, more information will become available to inform the EIA process. For instance the exact volume of spoil material or the design of the weir would only become available at the detailed design stage after the recommendations for mitigation and other considerations have been incorporated. This will require the various authorities, and especially DEA, to issue their comments and ultimately their environmental decision to allow for the type of refinements that typically occur during these feasibility studies and detailed design phase of the project. Undertaking the EIA process in parallel with the feasibility study does however have a number of benefits, such as integrating environmental aspects into the layout and design and therefore ultimately encouraging a more environmentally sensitive and sustainable project.

2.6 Independence

Aurecon and its sub-consultants are not subsidiaries of RVM1, nor is RVM1 a subsidiary of Aurecon. Furthermore, Aurecon and its sub-consultants do not have any interests in secondary or downstream developments that may arise out of the authorisation of the proposed project.

The Project Director, Mr van der Merwe, is a certified Professional Engineer (PrEng) and the Project Manager, Miss Corbett, is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNSP). Miss Corbett is the designated EAP for the proposed project. The Project Staff, Mr Nelis Bezuidenhout, is an appropriately qualified member of the team with an MPhil in Environmental Management. Aurecon is bound by the codes of conduct for SACNSP. The CV summaries of the key Aurecon staff are included in the Plan of Study for EIA contained in Chapter 6 with full CV's available on request.

3 THE PROPOSED ACTIVITY

The purpose of this Chapter is to describe the proposed activity with specific reference to the construction, operation and decommissioning of the proposed hydropower station and to describe the alternatives that are being considered. Alternatives being considered are discussed in terms of location, activity, site layout and technology.

3.1 Description of the Proposed Activities

The proposed RVM hydropower station would be located on the farm Riemvasmaak (Remainder of Farm no. 497 and Portion 1 of Farm no. 498) located approximately 40 km north west of Kakamas in the Northern Cape. The location of the proposed hydropower station is within the management area of the AFNP, but the area on which the main infrastructure for the hydropower station would be located (i.e. Portion 1 of Farm no. 498) belongs to the Riemvasmaak Community Trust ~~is private land~~. This land was returned to the Riemvasmaak Community Trust as part of the first successful land claim in South Africa[4]. While previously within the AFNP, Riemvasmaak was de-proclaimed on 19 February 2004 (see Annexure D) and has continued to be managed by the park.

Cabinet did however recommend "that there should be co-management by the community and the Department of Environmental Affairs and Tourism of the Community Tourist Park that has been established on the land." (see Annexure D)[5]. According to the AFNP approved Management Plan, p. 1 – 2, (2013) there is currently a draft co-management agreement between SANParks and the Riemvasmaak Community Trust. The management plan notes that the draft co-management agreement is still in the process of negotiation. The management plan (2013) notes that the draft agreement recognises the Riemvasmaak Community as the owners of the land and agrees that the land will only be used in ways that are compatible with nature conservation. According to the agreement the Riemvasmaak Community has access to graves and other sites of historical value.

The facility would be a run-of-river hydropower scheme capable of producing a maximum of 40 MW of electricity. The facility would extract water approximately 1.5 km upstream from the Augrabies Falls and return this water to a branch of the Orange River 7.5 km north west (downstream) of the Augrabies Falls. Run-of-river schemes use the natural flow and drop in elevation of a river to produce electricity. A portion of the river's flow is channelled through the hydropower station and through turbines. The spinning of the turbines generates electricity (a coal-fired power station creates steam to turn turbines, wind turbines are turned by wind and water turns turbines in hydropower stations).

A run-of-river hydropower station, like the proposed, consists of the following main components (refer to Figure 5 and Figure 6 below):

[4] http://www.greenkalahari.co.za/index.php/riemvasmaak (Accessed: 21 June 2013)
[5] It should be noted that the Community Tourist Park is no longer operational and no tourists are allowed to visit the site currently.

- Intake infrastructure (i.e. weir and off-take structure);
- Water conveyance infrastructure (i.e. canal or pipeline);
- Head pond/ forebay;
- Power station intake structure/ penstock;
- Powerhouse; and
- Outlet works/ tailrace.

Ancillary infrastructure includes access roads for use during construction and for maintenance purposes during operation, a transmission line for evacuating the energy produced by the hydropower station, a switchroom and transformer yard.

Infrastructure that would be constructed on Riemvasmaak Trust land includes:

- The powerhouse and electrical infrastructure;
- The headpond (forebay);
- A section of the pipeline;
- A section of the underground transmission line; and
- The tailrace.

The following ancillary infrastructure would be constructed on land owned by SANParks:

- Access road;
- A section of the underground transmission line; and
- A section of the pipeline.

As the weir would be constructed in the Orange River, it would be on land belonging to DWA.

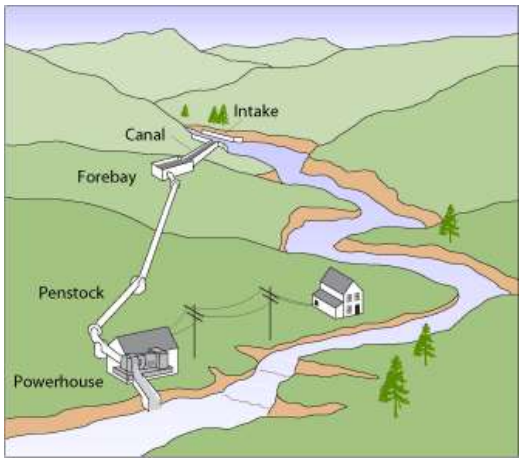

Figure 5 | Illustration of a run-of-river hydropower station

[source: http://turbineel.net/run-of-river-turbines (Accessed: 21 June 2013)]

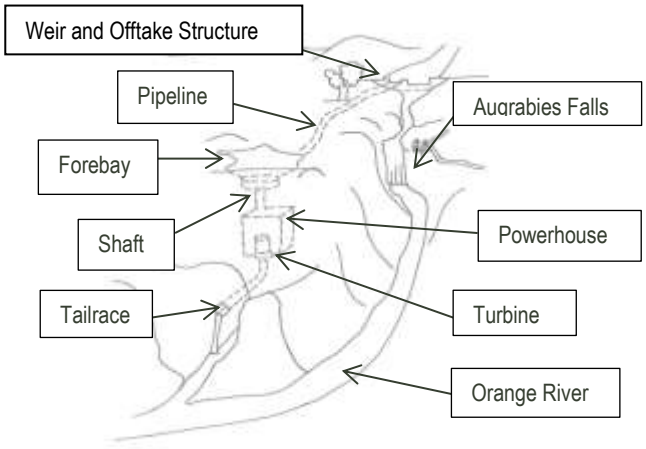

Figure 6 | Illustration of the proposed layout of the RVM Hydro Electric Project.

3.1.1 Components of the Hydropower Station

This section describes each component of the proposed hydropower station in more detail.

Weir and Off-take Structure

The weir would be constructed approximately 1.5 km upstream of the Augrabies Falls. The function of the weir (refer to Figure 7) is to divert the required amount of water into the off-take structure. The project would be operated in such a way as to always (permitting that sufficient water is available in the Orange River) allow agreed flow volumes of 30 m^3/s to pass the weir and remain within the Orange River, continuing to Augrabies Falls, and only take a portion of the water surplus to the EFR for the purpose of power generation. The weir would be 2.5 m tall (measured from the river bed). This height was determined in order to avoid raising the water level to such a point that it bypasses the main channel by flowing down existing secondary river channels. The closest of these channels is located about 1.4 km upstream of the proposed weir site so the weir pool created by the proposed weir would not extend past this point. An island situated some 7 km upstream of the weir is an area of intense agriculture and has complex irrigation and drainage systems. The design of the weir would also be such as to not impact on the outfall from irrigation or drainage pipes on the island. Should the detailed design indicate that additional flooding of upstream farm land could take place during flood events due to the weir, then the weir would be gated to prevent this from occurring. The weir would have two "slots", a "low slot" and a "hydro slot" (refer to Figure 9). The "low slot" would allow water to pass the weir before water can flow over the "hydro slot" and be diverted for the hydroelectric project. The level of the "hydro slot" would coincide with the level at which water will pass through the "low slot" at the agreed minimum flow rate. It is proposed that up to a maximum of 37 m^3/s of water would be diverted after the EFR has been met and when sufficient river flow is available. More detail on the variable proposed abstraction volumes will be provided in the EIR. The detailed weir design would consider the following environmental and technical requirements:

- Release of 30 m^3/s or the EFR, whichever is greater at all times;
- The weir should not raise the water level to the point where flow is bypassed through upstream secondary channels at minimum flows as this would reduce the water available to the hydro scheme;
- The weir should not impact on the irrigation and drainage pipes on the island upstream of the weir;
- The weir must not affect backwater levels at the upstream mid-stream farms and vineyards during all operations, including major floods. These properties currently experience poor drainage and the hydro scheme must not affect the water levels in this area;
- Sediment must be controlled near the intake to prevent excessive transport of material to the head pond; and
- A fishway is potentially required for upstream fish passage, depending on the weir design and alternative fish passage through secondary channels.

The main criteria for the selection of the proposed weir site were its sufficient elevation to allow transport of water to the proposed power station, while maintaining a low profile in the river itself.

The off-take structure (refer to Figure 8) would consist of a predominantly concrete structure built into the right (north) side of the weir. In addition to the concrete weir, the off-take structure would comprise a trash rack and an operable gate. The off-take structure would form part of the weir as one

homogenous structure. The trash rack prevents the intake of debris such as branches or trees. Debris caught in the trash racks will be removed from site for disposal.

Figure 7 | Example of a weir.

[source: http://wikimapia.org/504763/Weir (Accessed: 21 June 2013)]

Figure 8 | Example of an intake structure.

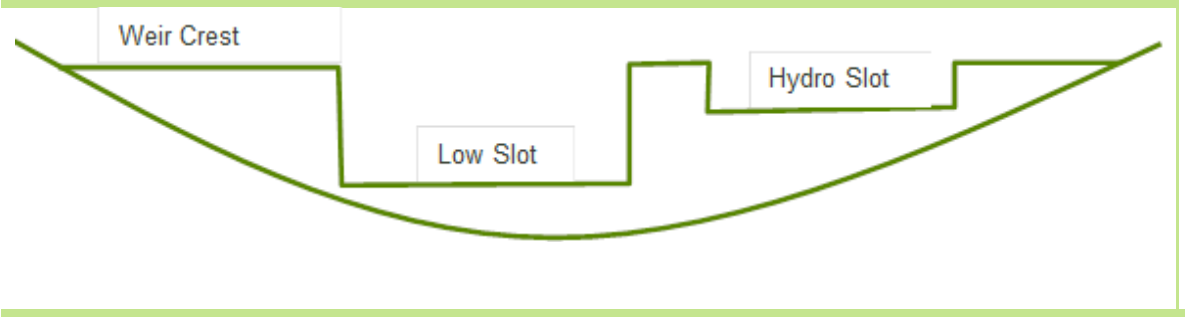

Figure 9 | Illustration of the proposed weir design.

The operable gate regulates the volume of water which enters the off-take structure. The regulation of the volume of water entering the off-take structure would be necessary to, amongst other things:

- Limit the flow of water to the station during low flow periods so as to ensure the obligations to maintain the agreed environmental flows in the Orange River are met; and
- Ensure that only the volume of water required for electricity generation is transferred to the water conveyance infrastructure during peak flows and flooding of the Orange River.

Low flow periods, according to feasibility studies, typically occur for three months of the year during June, July and August (i.e. during winter as the catchment area receives summer rainfall). Flows during this time can get as low as 20 m^3/s for erratic periods. Although the power station would not be able to operate during flows of less than 30 m^3/s (excluding the EFR), it would only be for limited periods and would not affect the economic viability of the proposed project as sufficient flow is available for at least 90% of the year. Feasibility studies have provided in-depth consideration of available flow for the proposed project to ensure that it would be economically viable. This will be expanded on in the EIA reports.

Water Conveyance Infrastructure

The water conveyance infrastructure conveys the water from the weir and off-take structure to the powerhouse. It would comprise a combination of a pipeline and the head pond. The pipeline would be buried for its entire length.

Pipeline - Two alternative routes have been identified for the pipeline ~~route~~, both with common alignments for the initial 500 m and the final 2 000 m, and a divergence for the central 2 100 m. Option 1 follows the existing access road with an offset of 10 m, passing to the east of the majority of heritage sites identified during the BA process. Option 2 is located to the river side and is a straighter alignment that passes to the west of the majority of the initially identified heritage sites.

The area between the two routes contains the majority of heritage sites and will be avoided by both alignments. The option 2 route may need a temporary access road for construction purposes, but this would ensure the existing track remains open for general access and also downstream construction access.

The depth of the trench in which the pipeline would be constructed would vary depending upon, amongst other things, the topography of the terrain through which it is passing. Preliminary analysis has estimated that a typical cross-section for the trench conduit would be a maximum of 10 m deep and 9 m wide at the floor of the conduit. The width of the trench would be up to ~~12~~ 13 m at the surface. The trench would be constructed by using an excavator where the geology is not too hard. Where the geology is too hard, controlled blasting would be required to loosen the rock which would then be removed by an excavator and either carted off-site or stockpiled on-site for later use as refilling material. This trench would be completely backfilled once the pipeline has been constructed. The pipeline length would be approximately 4.6 km.

The pipeline would be constructed using precast or cast in *situ* box culvert sections from reinforced concrete. Preliminary analysis has estimated that twin pipelines would be installed having width and a depth of 3.6 and 3.0 m, respectively.

Head pond – The headpond would be located at the lowest position on the alignment required for the RVM Hydro Electric Project. This provides sufficient fall for the conduit/ pipeline to pass the required flow, and will result in a low profile levee to reduce visibility. The maximum height of the headpond levee will be 3 m.

The power-station would operate by maintaining a constant level in the headpond. This is independent of the level in the river weir, which is controlled by the river intake control gate to pass the maximum available flow. On station trip, such as failure of the transmission system, the headrace conduit will continue to flow for a period, even if the river intake receives a signal to close. Therefore, the headpond includes a spillway capable of passing the maximum conduit flow. This spillway will direct water down a natural flow path to be returned to the Orange River.

The headpond is approximately 90m wide x 130m long, and will generally be 1m deep between the inlet and outlet. The surface area at the normal operating level is 8 100m². The headpond would be kept as natural as possible (i.e. it would only have an earth embankment of 3 m).

~~Consideration needs to be given to fencing the headpond.~~ The headpond would have a gradually sloped bank (much like a river's edge), which would take its form from the natural environment. It should not pose a danger to humans and/or animals as they would be able to walk out. A log boom may be sufficient to protect people and animals from approaching the power intake.

Figure 10 | Photo of a headpond.

Power Station Intake Structure (Penstocks)

The power intake would divert water from the headpond into the penstock for delivery to the turbines. The intake would be a low profile structure with a top level located at the same level as the headpond levee crest. Due to the shallow pond, the intake structure will be constructed in a deep excavation to provide sufficient hydraulic cover to the penstock offtake. The intake would contain a roller gate to shut off flow to the turbines, and a stoplog gate for maintenance closure. A trashrack would be provided to the power intake to prevent entry of foreign material.

The penstock would be buried between the power intake and the powerstation access shafts. Water would then descend vertically within the penstock shaft ~~118m~~ about 120m down to the power chamber. A distributor would divide the flow for delivery to each turbine. The penstock would be mild steel, epoxy coated pipes (or similar material) with a diameter of 3.4 m. An anti-vacuum valve would be required on the penstock at the location where it enters the power chamber access shaft.

Power chamber

The power chamber would be located underground, at a short distance from the headpond power intake, on land belonging to the Riemvasmaak Community Trust. This location has been selected to avoid excessive excavation for the penstocks as it is in a low point on the headworks alignment. This would also reduce its visibility and any scarring across sensitive areas from construction work.

The power chamber will be connected to the surface by 3 x 6 m diameter shafts – one for the penstock, emergency access ladder and electrical cabling; one for access stairs, a personnel lift and ventilation ducting; and one for major equipment access.

The chamber will be about 45 m wide x 16 m long, and will contain the penstock distributor, ~~four~~ main inlet valves, turbines, generating equipment and switchgear. The chamber will also contain an overhead crane suitable for lifting the heaviest item (generator) and moving it to the service area for potential removal to the surface by mobile crane through the access shaft.

Figure 11 | Example of an Underground powerhouse.

Outlet Works/ Tailrace

The tailrace tunnel would be 675 m long from the power chamber to the portal. The portal would be located in a near vertical rock cliff. The tunnel would be sized to keep the flow velocity to 2 m/s. This would allow the tunnel to remain unlined, except for the invert. Lining may be required at the downstream portal, and also in the immediately downstream of the draft tubes area. The tunnel excavated size would be 5.5 m wide x 5.2 m high, and invert lining would be 200-300 mm thick.

Switchgear and transformers

Switchgear would be located in the power chamber and power would be evacuated to the surface by 11 kV busbars/cables. A transformer bay housing the machine transformers (4 x 11/33 kV (or 132kV) @ 12 MVA each) would be located in an excavated adit[6]/surface cut so that they are not visible from surrounding areas.

High Voltage (HV) Transmission Infrastructure

The 33 kV or 132 kV HV transmission infrastructure to be located on SANParks or Riemvasmaak land would be buried. Beyond the boundary of SANParks land the transmission line would be located above ground and would connect into Eskom's 132 kV transmission system. Preliminary discussions with Eskom indicate that:

i. the preferred Eskom solution is likely to be the evacuation of power via a 33 kV line across Riemvasmaak and SANParks land and construction of a new substation with a maximum area of 50 x 50 m on private land, adjacent to the boundary with SANParks land, to step the voltage up from 33 kV to 132 kV to connect to Renosterkop substation.; and
ii. an alternate solution, although less favourable, is the evacuation of power by 132 kV across Riemvasmaak and SANParks land all the way to Renosterkop substation. If

[6] An adit is an entrance to an underground chamber (http://en.wikipedia.org).

this alternative is preferred, no substation is required, rather a riser pole in a small (5m x 5m) fenced yard would transfer to the overhead 132kV line.

The approximate length for the proposed power line is ~~6~~ 7.5 km across Riemvasmaak and AFNP to a new substation on private land adjacent to the AFNP boundary. From the new substation, the line would traverse 16 km to the Renosterkop substation.

3.1.2 Construction of the Proposed Hydropower Station

The construction of the proposed hydropower station would take approximately 36 months. During the construction period several major tasks would need to be completed.

Site Access

Access to the site during the construction period would be *via* roads of no more than ~~5~~ 4 m in width. Where possible these construction access roads would be constructed to a standard suitable for permanent site access for the construction and operational phases of the project. As far as possible existing road alignments would be modified to be a maximum of 6m wide to accommodate construction vehicles during the construction period. The access roads would require passing bays every 400 m to allow construction vehicles to pass each other. The passing bay would be 50 m in length and would be limited to more disturbed or less sensitive areas.

Weir and Coffer Dams

Weir construction would involve clearing an area of 500m^2 at the weir site to facilitate access and for construction of foundations. Coffer dams (refer to Figure 12) would be built upstream and downstream of the weir site and would block half of the Orange River to enable the weir to be constructed in two halves (i.e. half of the Orange River would be blocked while half of the weir is constructed. Once the one half of the weir is finished, the other half would then be constructed in the same way as the first section). Controlled blasting would be used to provide a suitable foundation for the weir before concrete is placed. Any mechanical equipment would be installed after the majority of the civil construction works were completed.

Water Conveyance Route

Construction of the water conveyance structures would involve the clearing of vegetation along the alignment as required. The alignment would be cleared for a width of ~~12~~ 13 m. A temporary construction corridor of 5 m width would be required adjacent to the alignment in order for the construction machinery to manoeuvre. In total the disturbance corridor for the pipeline would be 18 m wide. Once cleared, any soft or intermediate material would be excavated by mechanical means (i.e. excavator). Hard rock would be loosened by means of controlled blasting before it would be excavated. Pipe sections would then either be laid or cast in-situ depending on the construction methodology adopted. Pipes would be backfilled using select material, which would include excavated material, after which it will be re-vegetated.

Figure 12 | Illustration showing the staging of coffer dam placement

Headpond

Similar to the conduit site, the headpond site would be cleared and excavated. An area of 8100 m^2 would be cleared. Depending on the geology of the site, controlled blasting might again be required to loosen up hard rock that cannot be excavated mechanically. Any required concrete lining of the headpond would be cast in-situ.

Penstock

The penstock would be steel or other suitable material.

Powerhouse

The powerhouse shaft could be constructed by means of either the raise bore method from below or by a drill and blast method from above. The raise bore method makes use of a special raise boring machine that drills a pilot hole upwards to a higher level (refer to Figure 13). The pilot drill is retrieved once the desired length is achieved. A reamer[7] is then attached and pushed upwards into the pilot hole to widen it. The cuttings will fall down by gravity into a special chute which is attached to the top of the raise bore (http://www.raisebore.com.au). This method could be used if construction of the powerhouse is initiated from within the power chamber. The tailrace (discussed in the section below) would first be tunnelled up to the point of the power chamber. From there the raise bore would be

[7] A reamer is a type of rotary cutting tool.

used to drill to the top. The chamber would then be hollowed to the required size. Spoil from the tailrace and chamber would either be taken to the surface and carted away, or it would be permanently disposed in a nearby plunge pool (refer to the section under "Spoil material" below). For the drill and blast method a predetermined pattern of holes are bored to a selected depth in the rock face. The holes are then filled with explosives and the charges are detonated. This causes the rock to crack and break into smaller pieces. The loosened debris is then dislodged and hauled away (http://www.ritchiewiki.com). ~~This method could be used if construction of the powerhouse is from the surface.~~

Figure 13 | Illustration of the raise bore method.

[source: http://www.herrenknecht.com/en/products/core-products/mining/boxhole-boring-machine-bbm.html (accessed: 23 June 2013)]

Tailrace

The tailrace is a tunnel that conveys water from the power station to the river. The tunnel would have a diameter of about 6m. ~~for the underground powerhouse~~. It would be constructed by a drill and blast method.

Transmission Line

For the transmission line, the below ground sections would be placed in the same trench as the conduit or in a trench under the access roads. The above ground transmission line would be constructed from timber or steel poles and wires would be strung between these poles.

Site Infrastructure

A site office would be located near the site of the construction works. It would house the administrative personnel for the construction works and would have its own services and amenities. It is expected that two site camps would be required, one site camp near the powerhouse and one along the conduit route. The size of the camps would be approximately 50 x 75 m each. The peak construction workforce is estimated to be 150 to 200 people. Accommodation for the workforce would be in Kakamas.

Spoil Material

An approximate total of ~~160~~ 200 000 m^3 spoil material would be excavated from the weir, conduit, powerhouse, and tailrace. The largest amount of spoil would be generated by the construction of the pipeline. Several options will be assessed for the removal and disposal and/or re-use of spoil material. Removal options include:

- Construct road access and allow truck removal of the tailrace tunnel and powerhouse spoil;
- Construct a tunnel to the powerhouse to allow truck removal of spoil through the tunnel. This would then remain as a permanent powerhouse access;
- Use of a conveyor;
- Haulageway/ cableway.

Options for disposal and/ or re-use include:

- Identifying possible sites for disposal or stockpiling for future use as infill material near the construction site – one possible site for disposal is a plunge pool area located immediately to the south of the powerhouse (this option might require the need for a crusher on site);
- Hauling of the spoil material off-site to private land where it can be stockpiled for future use as road building material by the Department of Transport in the Northern Cape, the local Municipality and/or farmers in the area; and
- Hauling of the spoil off-site for use as rehabilitation material in existing quarries and/or borrow pits.

A combination of the above options may be required to ensure the proper management of spoil during the construction phase. These options will be assessed in more detail during the EIA phase.

3.1.3 Operation of the Proposed Hydropower Station

During the operation phase of the project, staff would be on site on a routine basis to undertake maintenance tasks although operation of the facility would be done remotely. It is estimated that the operational phase will result in between five to ten job opportunities of which one position would not be local. Vehicles would use the permanent access roads to travel to the powerhouse for work. On occasion, maintenance activities would be required on other areas of the project, which may require heavier construction equipment. This equipment would be restricted to the access roads and the work site to minimise its impact on the environment.

3.1.4 Decommissioning of the Proposed Hydropower Station

The proposed hydropower station would have a lifespan of between 50 - 100 years, although the contract with Eskom would only be for 20 years, it is anticipated that there would be an option to renew the contract. As the entire infrastructure, such as roads, transmission, and powerhouse, etc would already be established, and the energy source (water) is a renewable one, the proposed project could potentially continue to be operated beyond this. As such the facility would most likely be upgraded with the latest applicable technology and/or existing infrastructure would be maintained for further use after the lifespan of the facility.

However, should the facility be decommissioned, which is unlikely, all components would have to be disassembled, removed and recycled as far as possible. Depending on the best available option at the time, any above ground structures must be demolished unless an alternative use is found for

them. Decommissioning would have to be undertaken as per the environmental legislation relevant at that time.

The rehabilitation of the disturbed areas would form part of any decommissioning phase. The aim would be to restore the land to its original substratum characteristics (or as near as possible). The prescribed restoration activities will be described in the Environmental Management Plan (EMP) which will be included in the EIR.

3.2 Consideration of Alternatives

3.2.1 Introduction

The NEMA requires that alternatives are considered during the EIA process. An important function of the Scoping Phase is to screen alternatives to derive a list of feasible alternatives that need to be assessed in further detail in the EIA Phase. An alternative can be defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004).

"Alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—

a. the property on which or location where it is proposed to undertake the activity;
b. the type of activity to be undertaken;
c. the design or layout of the activity;
d. the technology to be used in the activity;
e. the operational aspects of the activity; and
f. the option of not implementing the activity.

In addition to the list above, the 2013 DEA&DP Guidelines on Alternatives also considers the following as alternatives:

a. **Demand alternative:** Arises when a demand for a certain product or service can be met by some alternative means (e.g. the demand for electricity could be met by supplying more energy or using energy more efficiently by managing demand).
b. **Input alternative:** Input alternatives are applicable to applications that may use different raw materials or energy sources in their process (e.g. Industry may consider using either high sulphur coal or natural gas as a fuel source).
c. **Routing alternative:** Consideration of alternative routes generally applies to linear developments such as power line servitudes, transportation and pipeline routes.
d. **Scheduling and timing alternative:** Where a number of measures might play a part in an overall programme, but the order in which they are scheduled will contribute to the overall effectiveness of the end result.
e. **Scale and Magnitude alternative:** Activities that can be broken down into smaller units and can be undertaken on different scales (e.g. for a housing development there could be the option 10, 15 or 20 housing units. Each of these alternatives may have different impacts).

The alternatives most pertinent to the proposed project include the following:

- Location alternatives - alternative locations for the entire project proposal or for components of the project proposal.

- Activity (type) alternatives - also referred to as project alternatives. Requires a change in the nature of the proposed activity. This category of alternatives is most appropriate at a strategic decision-making level.
- Layout alternatives - site layout alternatives permit consideration of different spatial configurations of an activity on a particular site.
- Technology alternatives – technology alternatives permit consideration of different types of technology used in the project.
- Routing alternative - routing alternatives permit consideration of different routes for the project.

The above categories of alternatives are the ones most pertinent to this EIA process, and will be explored in detail below. The purpose of this section of the report is to identify (scope) and describe all potential alternatives and determine which alternatives should be carried through to the EIA Phase of the project for further assessment.

3.2.2 Location Alternatives

South Africa is on the verge of increasing the percentage contribution made by renewable energy power generation to the existing energy mix. In response to this opportunity for large scale renewable energy production, RVM1 has identified potential sites across the country and is currently pursuing the best suited locations for hydropower production.

A number of options were considered for the location of the site. The applicant investigated some 12 sites along the Lower Orange River, from Onseepkans to Vioolsdrift. All of these opportunities would involve extensive tunnelling (approximately 8 – 10 km each), with an 8 – 12 m drop in elevation. For these projects to be feasible, a flow rate of some 100 m^3/s would be required for 80 % of the time (which is unlikely to occur on the Lower Orange River). Furthermore, they would all require extensive infrastructure to be built and connections to the existing grid were generally 50 km or more away. As such, these sites were not considered to be feasible. A few sites were however considered to be feasible. A site at Neus weir near Kakamas has been approved for a proposed hydropower station with a maximum capacity of 12 MW. This proposed hydropower station at Neus was selected in the second bid round and is currently under construction. The applicant has also initiated an EIA for a new site at Boegoeberg weir near Groblershoop for 10 MW (DEA Ref. No. 14/12/16/3/3/1/951).

Furthermore, the applicant also investigated five sites on the Thukela River. These sites would require tunnel lengths ranging from 1 to 2.5 km, with elevation drops ranging from 13 to 32 m. Two of these sites with tunnel lengths of 1 to 1.3 km are currently undergoing feasibility studies (including an EIA process). Of the three remaining sites, two are still being investigated for future development.

This site was selected for the following reasons:

- Good hydrology: most rivers in South Africa do not provide the hydrology required for the feasible development of small hydro opportunities. In this regard only the Orange and Thukela rivers present themselves as viable options for smaller hydropower schemes;
- Good difference in elevation (also called head), which resultantly requires only a small diversion of water to make the project feasible; and
- The potential for socio-economic development in the Kai !Garib Local Municipality and particularly for the Riemvasmaak Community Trust.

A number of location alternatives were considered in the vicinity of the Augrabies, at the initiation of the project, including options along the northern and southern banks of the river. Due to various reasons such as ownership of land, technical complexity and length of routes these options were discarded in favour of the currently proposed alternative. The proposed project balances the need for a significant difference in elevation in the river with the length of the proposed aqueduct.

Considering that the chosen location is situated on land owned by the Riemvasmaak Community Trust, a good opportunity exists for economic development of the Riemvasmaak community. The community would receive a constant income from the proposed project which could aid in sustained upliftment of their community.

The proposed project could however also result in disadvantages for the chosen site. These include, *inter alia*, decreased flow of water over the Augrabies Falls, which in turn could detract from tourists' experience of the Falls, impact on the aquatic environment due to reduced flows, potential visual impacts during construction and impact on botany due to loss of vegetation. These are discussed in more detail in Chapter 5 of this report. Specialists would provide input into the assessment of a number of the identified impacts for the construction, operation and potential decommissioning of the hydropower station. The findings would be recorded and discussed in the EIA report.

3.2.3 Activity Alternatives

The need for additional energy generation in South Africa is well documented, as summarised in **Annexure E** (Forward planning of Energy in South Africa) which covers the following policies and legislation:

- Policies regarding greenhouse gas and carbon emissions;
- White Paper on the Energy Policy of the Republic of South Africa (1998);
- White Paper on Renewable Energy (2003);
- National Energy Act (No. 34 of 2008) and Electricity Regulation Act (ERA) (No. 4 of 2006);
- Integrated Energy Plan for the Republic of South Africa (2003);
- Integrated Resource Plan (2010); and
- Regional Methodology for Wind Energy Site Selection (Department of Environmental Affairs and Development Planning (DEA&DP), 2006 Guideline document).

Furthermore, numerous policies and legislation have been promulgated indicating the mixture of renewable and non-renewable energy which South Africa wishes to pursue. These strategic documents provide the road map for the activity alternatives available to South Africa. RVM1 has identified a number of projects for hydropower generation across South Africa, aimed at meeting these stated goals through hydropower generation ~~in particular~~.

The site, situated on the banks of the Orange River near Augrabies Falls, is suitable for a small hydro given the reasons provided in Section 3.2.2. RVM1 as a company also specialises in hydropower generation. As such only hydropower generation will be considered for the proposed Riemvasmaak site.

3.2.4 Site Layout Alternatives

Five layout alternatives were considered for the proposed project during the BA process. After specialist input Alternative 2a was considered to be the best environmental option, acceptable to all specialists (Aurecon, 2012).

Option 1a, 1b and option 3 were considered unacceptable, after mitigation, due to their very high (-) and high (-) impacts on botany (construction phase) and aquatic ecology (operation phase). The potential impact on heritage (graves) for all options was considered to be medium to high (-) after mitigation (construction phase), but was considered to be acceptable. The remaining impacts, after mitigation, were all of medium (-) significance or lower (refer to Figure 14). Options 1a and 1b were considered to be fatally flawed from a botanical perspective due to their potential impact on the general ecology of the area. Option 1a was also considered to be fatally flawed from an aquatic ecology perspective. As such this EIA will only look at the preferred alternative, previously referred to as 2a.

IMPACT			Option 1A		Option 1B		Option 2 (A and B)		Option 3	
			No Mit	With Mit	No Mit	With Mit	No Mit	With Mit	No Mit	With Mit
CONSTRUCTION PHASE IMPACTS										
1	Impact on botany		VH	VH	VH	VH	H	M	H	H
2	Impact on fauna		L	L	L	L	L	L	L	L
3	Impact on aquatic ecology		L-M	L-M	L-M	L-M	L-M	L-M	L-M	L-M
4.1	Impact on heritage resources:	Archaeology	M	L	M	L	M	L	M	L
4.2		Graves	H	M-H	H	M-H	H	M-H	H	M-H
5	Impact on visual aesthetics		H	M	H	M	H	M	H	M
6	Impact on agriculture		N	N	N	N	N	N	N	N
7	Impact of noise		L	L	L	L	L	L	L	L
8	Socio-economic impacts		M+	M+	M+	M+	M+	M+	M+	M+
9	Impact on transport		L	L	L	L	L	L	L	L
OPERATIONAL PHASE IMPACTS										
10	Impacts on fauna (including avifauna)		M	L	M	L	M	L	M	L
11	Impacts on aquatic ecology		H	H	H	H	M	L	M	L
12	Impact on heritage resources		M	L	M	L	M	L	M	L
13	Impact on visual aesthetics		H	L	M	L	M	L	M	L
14	Impact on agriculture		N	N	N	N	N	N	N	N
15	Impact of noise		N	N	N	N	N	N	N	N
16	Socio-economic impacts		M-H+	M-H+	M-H+	M-H+	M-H+	M-H+	M-H+	M-H+
17	Impact on tourism		L+	L+	L+	L+	L+	L+	L+	L+
18	Economic impacts (energy generation)		L+	L+	L+	L+	L+	L+	L+	L+
19	Impact on climate change		L+	L+	L+	L+	L+	L+	L+	L+
DECOMMISSIONING PHASE IMPACTS										
20	N/A									

KEY		
	H	High Significance
	M-H	Medium to High Significance
	M	Medium Significance
	L-M	Low to Medium Significance
	VL-M	Very Low to Medium Significance
	L	Low Significance
	VL-L	Very Low to Low Significance
	VL	Very Low Significance
	N	Neutral Significance
	H+	High positive significance
	M+	Medium positive significance
	L+	Low positive significance

Figure 14 | Summary of impact ratings as assessed during the BA process

3.2.5 Technology Alternatives

During construction different excavation technologies would be considered. These include excavation of the conduit and tailrace by mechanical means vs. drilling and blasting. Another technology alternative includes the raise bore method *vs* drilling and blasting for the construction of the powerhouse. These will depend on the geology of the site as well as the technology alternative chosen for powerhouse. A combination of the aforementioned could be required.

For the powerhouse two technology alternatives are considered for the switchroom, that being underground vs. aboveground. The underground option would involve the removal of more spoil than that of an aboveground powerhouse. Due to the head and flow characteristics of the site, only Francis turbines have been considered (refer to Figure 15) as these are well adapted to these characteristics.

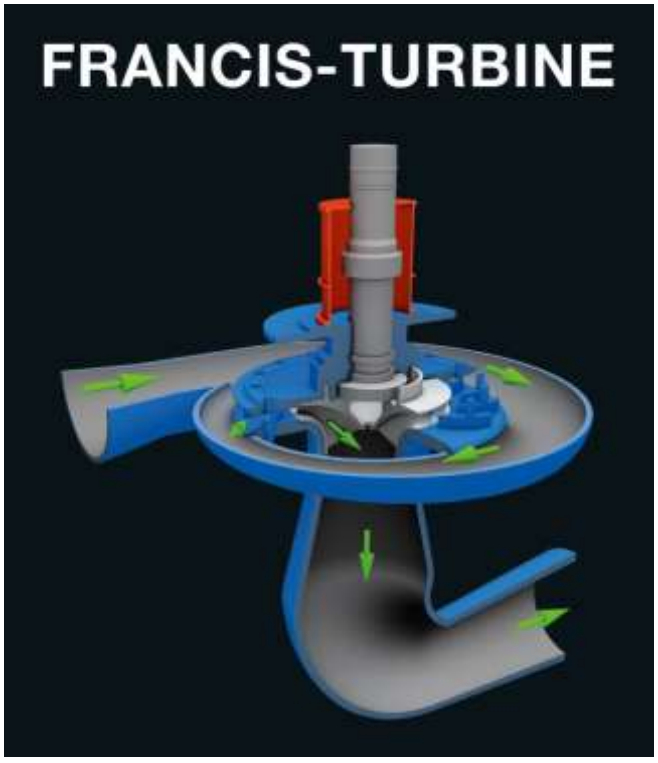

Figure 15 | Francis Turbine.

[source: http://www.kwm.ch/francis-turbine.html (accessed: 24 June 2013)]

3.2.6 Routing Alternatives

Layout alternatives for the access road are limited as it is proposed to use existing roads, as far as possible and the conduit alignment. Layout alternatives for the roads are therefore limited to existing alignments as well as the conduit alignment (refer to Figure 2).

The layout for the transmission line would also follow the projects alignment as far as possible. Where the transmission line extends beyond the project's alignment it would follow the shortest available

route towards the existing Eskom line to the south. This route may be adapted should specialist studies indicate that this is required to avoid any sensitive areas.

3.2.7 No-Go alternative

The assessment of alternatives must at all times include the “no-go” option. The “no-go” alternative will be the baseline against which all other alternatives are measured.

3.2.8 Summary of Alternatives

To summarise, the feasible alternatives which will be assessed in the EIR include the following:

- Location alternatives
  - Only the current location (site) of the proposed hydropower station will be considered.
- Activity alternatives
  - Only energy generation by means of a hydropower station will be considered.
- Site layout alternatives
  - Only one site layout alternative, which includes the two options for the routing of the midsection of the pipeline, will be considered; and
  - Two routing alternatives for the transmission line.
- Technology alternatives
  - Blasting and drilling vs. raise bore method for the powerhouse construction.
  - Underground vs. aboveground switchroom.
- The “no-go” alternative

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4 NEED AND DESIRABILITY

The purpose of this Chapter is to describe the need and desirability of the proposed hydropower station as it relates to the local context. It answers questions posed DEA&DPs need and desirability guidelines (2011). The chapter also gives a brief description on the proposed sustainability assessment which will form part of the EIA Report.

4.1 The need for the proposed activity

As noted previously the need for renewable energy is well documented. Hydropower generation is desirable as it:

- Creates a more sustainable economy by promoting South Africa's energy policy towards energy diversification.
- Hydropower provides baseload[8] power, which other renewable energy technologies typically do not as they are dependent on the vagaries of wind and sunlight. As such hydropower can replace for instance coal-fired power stations, which other renewable technologies cannot do without storage capacity.
- Reduces the demand on scarce resources such as water and air quality by promoting energy generating facilities which are less resource intensive[9].
- Assists in meeting nationally appropriate emission targets in line with global climate change commitments by reducing reliance on coal as an energy source.
- Reduces and where possible eliminates pollution by using cleaner energy generating mechanisms and reducing the demand on carbon based fuels.
- Assists in alleviating energy poverty by providing energy in rural areas to stimulate the local economy.
- Promotes local economic development by creating jobs and promoting skills development. The proposed project will also provide a sustainable income to the Riemvasmaak Community Trust.
- Enhances energy security by diversifying generation to reduce reliance on coal as a primary energy source and promoting renewable energy generation.

Furthermore, the IRP (see Annexure E) allows for an additional 20 409 MW of renewable energy in the electricity blend in South Africa by 2030. Of the aforementioned a 110 MW is reserved for small hydro. While there are a number of renewable energy options (including, *inter alia*, wind and solar)

[8] Baseload is the amount of power required to meet minimum demands based on reasonable expectations of customer requirements. Baseload power stations are devoted to the production of baseload supply and produce energy at a constant rate. Examples of baseload plants using nonrenewable fuels include nuclear and coal-fired plants. Among the renewable energy sources, hydroelectric, geothermal, biogas, biomass, solar thermal with storage and ocean thermal energy conversion can provide baseload power (https://en.wikipedia.org/wiki/Base_load_power_plant, accessed 26/06/2013)

[9] A hydropower station only uses water for turning the turbines that generate electricity. Water is not consumed during energy production.

being pursued in South Africa, many more renewable energy projects are required to meet the targets set by the IRP. Consequently, based on this requirement for renewable energy, RVM1 is pursuing a number of hydropower projects of which this project is one.

Need and Desirability	
Need (Timing)	
Question	Response
1. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP?	There is currently no SDF available for the area (p. 14 of the Siyanda District IDP). Although no SDF exists, the IDP (2012 – 2017) identifies two primary development objectives (p.26 of the Siyanda District IDP): • Promoting the growth, diversification and transformation of the provincial economy. • Poverty reduction through social development. The IDP (2012 – 2017) then lists the following macro-level conditions for growth (p.26 of the Siyanda District IDP), including: • Enhancing infrastructure for economic growth and social development. To give effect to the above, one of the high-level development targets set in the Northern Cape is (p.26 of the Siyanda District IDP): • To provide adequate infrastructure for economic growth and development by 2014. The proposed project, which would generate sustainable electricity, would therefore help to promote development and economic growth.
2. Should development, or if applicable, expansion of the town/ area concerned in terms of this land use (associated with the activity being applied for) occur at this point in time?	Yes. As per the response to question 1 above, the proposed project would contribute to the provision of adequate infrastructure for economic growth and social development, by 2014, as per the high-level targets set in the Siyanda District IDP (p.26 of the Siyanda District IDP). Furthermore, South Africa is actively pursuing renewable energy projects.
3. Does the community/ area need the activity and the associated land use concerned (is it a societal	Yes. The Siyanda District IDP lists projects aimed at delivering the

Need and Desirability	
priority)?	targets set by the IDP. Projects for the Kai !Garib Municipality is listed from p. 282 – 298. On p. 283 of the Siyanda District Municipality it lists the development of 400 erven at Augrabies. In addition to this, another 2 300 erven are planned within the Siyanda district. The proposed project would therefore assist in providing electricity to sustain these developments. The IDP, p. 291 – 292, also refers to the provision of area and street lighting for a number of areas including Kakamas. Again the proposed project will help to generate electricity to help sustain these proposed developments. The proposed hydropower station would not only create job opportunities for the local community as the construction and operation of the facilities require a wide range of skill levels which the District can, to a degree, supply, but would also be a source of income to the landowners. Secondary economic impacts may include an increase in service amenities through an increase in contractors and associated demand for accommodation.
4. Are there necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	Yes. The proposed project would feed into the national Eskom grid through at the Renosterkop substation. The connection to the substation would be constructed as part of the proposed project. According to the IDP (p. 292) it is planned to upgrade the entire Kai !Garib Municipality electricity network. The target dates set for this was 2009/15.
5. Is this development provided for in the infrastructure planning of the municipality, and if not, what will the implication be on the infrastructure planning of the municipality (priority and placements of services)?	*Yes.* As mentioned earlier in question one above, one of the high-level development targets set in the Northern Cape is (p.26 of the Siyanda District IDP): • To provide adequate infrastructure for economic growth and development by 2014. The proposed project, which would generate sustainable electricity, would therefore help to promote development and economic growth.
6. Is this project part of a national programme to address an issue of national concern or importance?	Yes. The establishment of the proposed facilities would strengthen the existing electricity grid for the area. Moreover, the project would contribute towards meeting the national energy target as set by the DoE, of a 30% share of all new power generation being derived from IPPs. The Industrial Policy Action Plan (IPAP2, 2010) recommends a sector focussed approach identifying key sectors with

Need and Desirability	
	potential to be developed. The sectors identified in the IPAP2 document renewable energies. The proposed Hydropower project although not specifically mention will further facilitate the realisation of this development objective. The Integrated Resource Plan (IRP 2010) developed by the DoE for the 2010 to 2030 period aims to achieve a "balance between an affordable electricity price to support a globally competitive economy, a more sustainable and efficient economy, the creation of local jobs, the demand on scarce resources such as water and the need to meet nationally appropriate emission targets in line with global commitments". The final IRP provides for an additional 20 409 MW of renewable energy in the electricity mix in South Africa by 2030.
Desirability (Placing)	
Question	Response
1. Is the development the best practicable environmental option (BPEO) for this land/ site?	*Yes.* Although the project will be situated in a National Park, the high positive social impact that the project could have, especially for the landowners (Riemvasmaak Community), as well as the contribution it would make to the energy grid in South Africa makes this option a feasible option for the area. Technically the area is one of a few areas in South Africa that is suitable for a Hydropower station. Of all the renewable energy resources hydro is the only technology that is regarded as baseload which other renewable energy technologies typically do not as they are dependent on the vagaries of wind and sunlight. Considering that South Africa is committed to renewable energy, the proposed project is a practicable environmental option for the site.
2. Would the approval of this application compromise the integrity of the existing approved Municipal IDP and SDF as agreed to by the relevant authorities?	*No.* The project is in line with the Siyanda District Municipality IDP (2012-2017) which recognizes the need for economic development to strengthen and improve the local economy to create a sustainable economy which creates employment opportunities for local people.
3. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in Environmental Management Frameworks (EMFs)), and if so, can it be justified from in	The proposed project would be located in the management area of the AFNP, but partly on land belonging to the Riemvasmaak Trust. Aspects of the proposed project would be within the areas zoned as "Primitive" and "Remote" as per the AFNP Management Plan. Should the proposed project receive environmental approval it would be necessary to amend the park management plan to allow for a hydropower

Need and Desirability	
terms of sustainability considerations?	station within these zones. ~~Although the proposed project is not strictly in accordance with the National Strategy on Buffer Zones Around National Parks the visual impacts can be mitigated to acceptable measures and if necessary the Management Plan could be revised to allow for the proposed development.~~ The National Strategy on Buffer Zones notes that "The viability of protected areas is dependent upon the extent to which such areas are socially, economically, and ecologically integrated into the surrounding region. These issues are especially pertinent to protected areas in South Africa, several of which fall within some of the most populous and poverty-stricken parts of the country. As protected areas are often centres of economic activity, social and economic conditions within and outside of these areas contrast starkly. These discrepancies are aggravated by the fact that in the past some protected areas were established at severe cost to communities. In the creation of protected areas, many communities were forcibly removed without adequate compensation." The proposed Riemvasmaak hydropower station is a fairly unique development in that it is proposed to build a large part of the infrastructure on private land owned by a community trust (but within the management area of the Park) - a site where the project can make an enormous difference to people who are living in marginal circumstances. As such the proposed project is in line with the spirit of the National Strategy on Buffer Zones around National Parks. It should be noted that the transmission lines would be within the buffer zone of the National Park. Most of the project infrastructure, including the powerhouse, transmission line and pipeline, would be buried to mitigate the visual aspect of the proposed project. The visual impact will be assessed further during the EIA process. As part of the EIA process a sustainability assessment will also be carried out (refer to Section 4.2, p. 46).
4. Do location factors favour this land use (associated with the activity applied for) at this place?	*Yes.* This site was selected for the following reasons: • Good hydrology: most rivers in South Africa do not provide the hydrology required for the feasible development of small hydro opportunities. In this regard only the Orange river presents viable options for smaller hydropower schemes;

Need and Desirability	
	• Good difference in elevation (also called head), which resultantly requires only a small diversion of water to make the project feasible; and • The potential for socio-economic development in the Kai !Garib Local Municipality and particularly for the Riemvasmaak Community Trust.
5. How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/ natural environment)?	Potential impacts associated with the proposed upgrade will be discussed and assessed during the EIA Phase. Refer to the Plan of Study for EIA in Chapter 6.
6. How will the development impact on people's health and wellbeing (e.g. in terms of noise, odours, visual character and sense of place, etc.)?	Potential impacts associated with the proposed upgrade will be discussed and assessed during the EIA Phase. Refer to the Plan of Study for EIA in Chapter 6.
7. Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	Potential impacts associated with the proposed upgrade will be discussed and assessed during the EIA Phase. Refer to the Plan of Study for EIA in Chapter 6.
8. Will the proposed land use result in unacceptable cumulative impacts?	Potential impacts associated with the proposed upgrade will be discussed and assessed during the EIA Phase. Refer to the Plan of Study for EIA in Chapter 6.

Table 5 **|** Discussion related to specific questions in the DEA draft Needs and Desirability Guideline (DEA ~~DEA&DP~~, 2012)

4.2 Sustainability of the proposed activity

The Constitution of South Africa and many other laws recognise that it is vital to promote economic and social development in South Africa. However, it is stipulated that such development must be on an ecologically sustainable basis. It is also understood that economic, social and ecological systems are interdependent and that they continuously interact and influence each other. EIAs are often undertaken to ensure compliance with the minimum legislated procedural steps. The outcome is usually the identification of mitigation measures to reduce negative impacts of a project and in certain cases, improve baseline conditions. Despite this there is a decrease in environmental quality in many areas.

It is therefore vital to move beyond merely incorporating elements of sustainability and impact mitigation into EIAs. EIAs should also measure development proposals against identified sustainability objectives and outcomes.

A framework has been developed in accordance with recent discussion documents from members of DEA&DP[10]. The framework will take cognisance of the strategic context of the area, such as the Environmental Management Framework and the Environmental Management Plan for the Augrabies Falls National Park. It will also consider generally accepted indicators, such as those identified by the Global Reporting Initiative for Sustainability Reporting, as well as any others identified for the South African context. This will allow for assessment of how well the project performs in relation to the sustainability context identified for the proposed activity within the AFNP in particular and South Africa at a broader level.

This approach will allow for identification of measures by the project team to ensure that the sustainability goals are met. It can ensure that issues are identified early in the planning process that could potentially cause delays, have negative publicity and increase project costs further down the line. The project is more acceptable as the sustainability of the project is clearly assessed. This approach indicates a transparent commitment to sustainable development goals.

The proposed framework against which the proposed project will be assessed in the EIAR is indicated below:

[10] Hardcastle P. and Gerber G. 2011. Sustainability criteria for EIA practice in South Africa – towards the development of a guideline on sustainability criteria to improve EIA practice, EIA decision-making and EIA outcomes in South Africa. Unpublished Paper, originally presented at the IAIA National Conference 2010.

ECOLOGICAL INTEGRITY			DISCUSSION	LEVEL OF CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS
				High / medium / low
1	How will this development (and its separate elements/aspects) impact on the ecological integrity of the area:			
	1.1	What are the ecological integrity objectives for the area?		
	1.2	How will this development positively or negatively impact on these objectives?		
2	Has the mitigation hierarchy been applied to firstly ensure avoidance altogether, and then only, if avoidance is not possible, was mitigation and management considered? Was remediation or offsets considered as a last resort?			
	2.1	Were appropriate efforts made to avoid negative impacts?		
	2.2	If negative impacts on the ecosystem are unavoidable, what mitigation, management and control measures have been applied to minimise impacts to acceptable levels?		
	2.3	Was the identification of offsets introduced as the last resort?		
3	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?			
4	Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without			

ECOLOGICAL INTEGRITY			DISCUSSION	LEVEL OF CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS
	compromising their quest to improve their quality of life).			
5	5.1	Does the proposed use of natural resources constitute the best use thereof? (Is the use justifiable?) (Intra- and intergenerational Equity)		
	5.2	Do the proposed location, type and scale of development promote a reduced dependency on resources? (Intra- and intergenerational equity)		
6	Have the positive impacts on the biophysical environment (especially ecosystem functions) been enhanced?			
7	Have the positive and negative cumulative ecological/biophysical impacts been adequately addressed in the report bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?			
8	Considering the need to secure ecological integrity and a healthy bio-physical environment, do the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), allow the best practicable environmental option to be selected?			
9	Have the linkages between human wellbeing, livelihoods and ecosystem services been made clear and will these dependencies be affected by the proposed development?			
Equity and social justice				
10	How will this development (and its separate elements/aspects) impact			

ECOLOGICAL INTEGRITY			DISCUSSION	LEVEL OF CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS
	on the social objectives of the area:			
	10.1	What are the social objectives in the area?		
	10.2	How will this development contribute to or negatively impact on these social objectives?		
11	Will there be an equitable distribution of positive and negative social consequences?			
12	Will the development absorb available local labour and result in skills development:			
	12.1	Will the development absorb the labour available in the area (i.e. do the required skills match the skills available in the area)?		
	12.2	Will skills and human development be specifically addressed along with basic needs?		
	12.3	Is there a disparity between the location of jobs opportunities and the location of impacts (i.e. equitable distribution of costs and benefits)?		
13	Will the development address the spatial reconstruction priorities			
	13.1	Is the development consistent with the spatial priorities (areas) identified for socio-economic integration?		
	13.2	Will the development result in urban sprawl or lead to densification of existing urban areas?		
	13.3	Will the development result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the		

ECOLOGICAL INTEGRITY			DISCUSSION	LEVEL OF CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS
		development result in densification and the achievement of thresholds in terms public transport)?		
	13.4	Will the development have unacceptable opportunity costs in terms of bulk infrastructure expansions in non-priority areas (i.e. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement)?		
	13.5	Will the development allow for opportunities for all the segments of the community (i.e. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?		
	13.6	Will the development impact on community access to public resources (e.g. a gated residential development that cuts off historic access routes to the coast), or will it improve access to public amenities (e.g. through reduced walking distances to such facilities)? Have alternatives been considered to avoid these impacts, and if unavoidable, have alternatives been identified to mitigate negative and enhance positive impacts in terms of access?		
	13.7	Will the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?		
14	What will the health impacts be? Has the health baseline in the community been determined? Have the potential impacts on heath (e.g. TB, malaria, HIV/AIDS, STDs, lung disease, cancer, bilharzias, stress, etc.) and safety (road safety, crime, man-made hazards, etc.) been			

ECOLOGICAL INTEGRITY		DISCUSSION	LEVEL OF CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS
	identified and adequately addressed?		
15	Has the mitigation hierarchy been applied to firstly ensure avoidance altogether, and then only, if avoidance is not possible, was mitigation and management of negative impacts considered, while alternatives are to be considered to enhance positive impacts?		
16	Have the sense of history, sense of place and heritage of the area been considered and will the development be appropriate considering the socio-cultural and cultural-historic characteristics and sensitivities of the area?		
17	Have the positive and negative cumulative social impacts been adequately addressed bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?		
18	Considering the need for social equity and justice, do the alternatives identified, allow the best practicable environmental option to be selected, or is there a need for other alternatives to be considered? (Who are the beneficiaries and is the development located appropriately?)		
19	Will the social impacts be justified when considered together with the need to secure ecological integrity and economic efficiency (e.g. the development will result in significant and extensive negative social impacts, while only resulting in a small economic benefit for only a few)?		
Economic Efficiency			
20	Will the development contribute to the achievement of the economic		

ECOLOGICAL INTEGRITY			DISCUSSION	LEVEL OF CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS
	objectives for the area:			
	20.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?		
21	Within its regional context, is the settlement in which the resources are to be invested an area that will generate the highest socio-economic returns (i.e. an area with high economic potential)?			
22	Within its local context, does the proposed development provide equitable access to opportunities for all sectors of the community with a focus on the highest socio-economic needs?			
23	Will the development address the spatial reconstruction priorities?			
	23.1	Will the development result in a more compact settlement?		
	23.2	Will the development contribute to densification, or will it exacerbate urban sprawl?		
	23.3	For urban related development, is there not perhaps vacant or underutilised land available with the urban edge that can be used?		
	23.4	Will the development minimise the need to travel?		
	23.5	Will the development enable the use of public and non-motorised transport?		
	23.6	If housing development, will the development be located close to		

ECOLOGICAL INTEGRITY			DISCUSSION	LEVEL OF CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS
		economic opportunity and social amenities?		
	23.7	If housing, does the proposed development reflect the priority income group?		
24	Will the development promote de-materialised growth?			
25	Has the use of resources been optimised through the consideration of demand management, the implementation of appropriate technology, the optimisation of existing infrastructure and resources?			
26	What are the full socio-economic and ecological costs and benefits in instances where impacts on the environment cannot be avoided (i.e. full cost accounting)?			
27	What will the positive and negative cumulative economic impacts be?			
28	Considering the need for economic efficiency, is the alternative being proposed the best practicable environmental option?			
29	Will the economic impacts be justified when considered together with the need to secure ecological integrity and social equity and justice?			
General criteria:				
30	Does the nature and scale of the proposed development (and its impacts) dictate that alternatives should be considered at a local, regional or national level, and were such alternatives adequately considered?			
31	In terms of collectively considering ecological, social and economic impacts it is important to remember that while there might be some			

ECOLOGICAL INTEGRITY		DISCUSSION	LEVEL OF CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS
	trade-offs between the considerations, in South Africa all development must be ecologically sustainable, and economic and social development must be justifiable. There are therefore trade-off rules that apply. Environmental integrity may never be compromised and the social and economic development must take a certain form and meet certain specific objectives in order for it to be considered justifiable. The ecological/social/economic changes might also not be justifiable when considered against their impacts. In this regard opportunity costs and alternatives must be considered.		

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5 DESCRIPTION OF THE AFFECTED ENVIRONMENT AND POTENTIAL IMPACTS

The purpose of this Chapter is to provide a brief description of the affected environment and the potential impacts that could result from the proposed project. Potential impacts on the biophysical and the socio-economic environment during the construction, operation and decommissioning phases are discussed and take consideration of the previous specialist assessments that were undertaken as part of the BA process. Where additional information is required for detailed assessment in the EIR, recommendations are made as to appointing specialists.

5.1 Introduction

The description of the affected environment provided below draws on existing knowledge from published data, previous studies, site visits to the area and discussions with various role-players. The identification of potential impacts which may occur as a result of the proposed activities described in Chapter 3 of this report is broad, to cover the lifecycle of the proposed project. Impacts of lesser importance are also screened out, with reasons provided, to ensure that the EIR is focused on the potentially significant impacts.

5.2 Broad Description of the Affected Biophysical and Socio-Economic Environment

5.2.1 Description of the Site

The proposed site is situated in the Kai !Garib Local Municipality in the Northern Cape. The town of Kakamas is located approximately 31 km south-east of the proposed site. The nearest town to the proposed site is Augrabies, located approximately 11 km south east of the site. The proposed site itself is located inside the management area ~~borders~~ of the AFNP on land owned by the Riemvasmaak Community Trust where most of the proposed infrastructure (i.e. powerhouse, headpond, tailrace, portion of the pipeline and a portion of the underground transmission line) would be constructed. Some of the infrastructure (i.e. access road, portion of the pipeline, and a portion of the underground transmission line) would be constructed on land owned by ~~as well as~~ SANParks.

The Augrabies Falls is a well-known tourist attraction in the Northern Cape with a 56 m high waterfall where the Orange River cascades down. Its name was derived from the Khoi people who named it “Aukoerebis” which means “place of great noise”. The Augrabies Falls is especially popular during flood periods when the falls are particularly spectacular. Apart from the falls, the Park is set in a picturesque rocky landscape and provides a sanctuary to a diversity of species ranging from the small succulents, birds and reptiles to Hartmann’s mountain zebra, springbok, gemsbok and giraffe (www.sanparks.co.za).

Figure 16 | Location of site within the Kai !Garib Municipality (Source: Wikipedia).

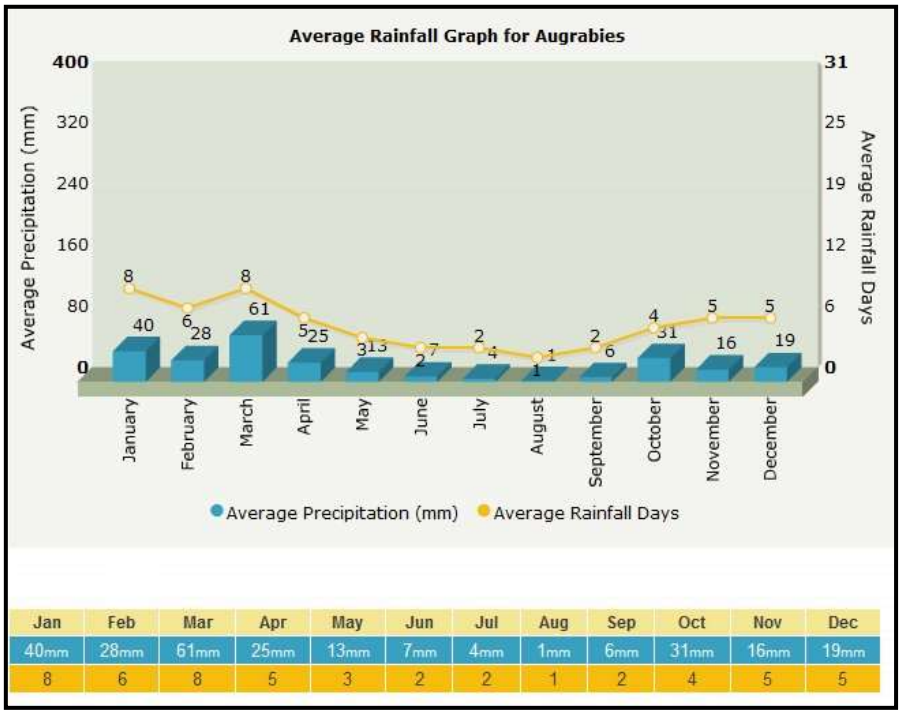
Figure 17 | General surroundings of the site

Figure 18 | Rocky landscape characterising the proposed power house site.

Figure 19 | Photo of the Orange River at the weir site.

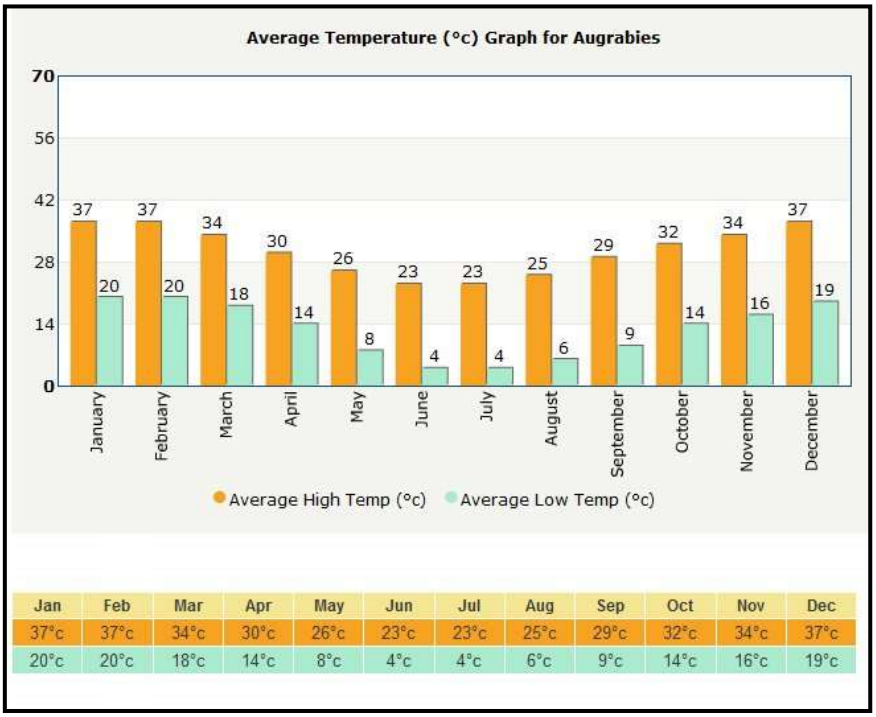
5.2.2 Climate

The study area falls within the Nama Karoo Biome which is one of the most arid regions in South Africa. According to long term records, rainfall is greatest between February and April with a distinct peak in March (autumn) (McDonald, 2012). As mentioned previously Augrabies is the closest town to the proposed development. According to McDonald (2012) Augrabies has a mean annual rainfall of 251 mm (refer to Figure 20), mean summer daytime temperature (October to March) of 35^{o}C and mean winter night temperature (April to September) of 5^{o}C (refer to Figure 21).



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40mm	28mm	61mm	25mm	13mm	7mm	4mm	1mm	6mm	31mm	16mm	19mm
8	6	8	5	3	2	2	1	2	4	5	5

Figure 20 | Average rainfall at Augrabies (source: McDonald, D. 2012).



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
37°c	37°c	34°c	30°c	26°c	23°c	23°c	25°c	29°c	32°c	34°c	37°c
20°c	20°c	18°c	14°c	8°c	4°c	4°c	6°c	9°c	14°c	16°c	19°c

Figure 21 | Average temperatures for Augrabies (source: McDonald, D. 2012).

5.2.3 Topography, Geology, Soils and Seismicity

The geology of the site is complex consisting of a main rock type known as granite-gneiss of the Kakamas Terrane of the Namaqua-Natal Province, with small outcrops of ultrametamorphic rocks in places (McDonald, 2012) (refer to **Error! Reference source not found.**).

McDonald (2012) describes the landscape in the study area as complex, but that three main land-types are recognised within the study area (refer to Figure 23). The first type, Ia1, is equivalent to the riparian zone with alluvial sediments (Tertiary to Recent) over intrusive rock (mainly granite) of the Namaqualand Metamorphic Complex. Ic3 is the second land-type. It consists of broken, deeply incised terrain consisting of igneous granitic-amphobilitic rocks of the Toeslaan Formation (Korannaland Sequence) and is found in the "canyon zone" below the Augrabies Falls. The third land-type, Ag2 ("upland zone") characterises the southern and northern sides of the Orange River. The underlying geology of this land-type consists of migmatite, gneiss and granite with the land surface dissected by sub-dentritic drainage channels.

The Augrabies area experiences earthquake swarms[11] from time to time. According to the Council for Geoscience[12] the first recorded earthquake swarm in the Augrabies area occurred during February 2010. However, people only came aware of seismic activity on 26 July 2010 when an earthquake measuring 3.7 magnitudes occurred in the area. Since then at least another five earthquakes exceeding magnitude 4 have occurred near Augrabies. The most recent recorded ~~was~~ earthquakes were of magnitude 4.2 and 4.9 ~~that occurred on 12 and 25 January 2013 respectively~~.

5.2.4 Flora

The study area falls in the Nama Karoo Biome, Bushmanland and West Griqualand Bioregion (Rutherford & Westfall, 1994; Mucina *et al.*, 2006). These can be divided into three vegetation types:

- Lower Gariep Alluvial Vegetation;
- Lower Gariep Broken Veld; and
- Bushmanland Arid Grasslands.

According to McDonald (2012) neither the Lower Gariep Broken Veld nor the Bushmanland Arid Grasslands are listed in the National List of Threatened Ecosystems. However, the Lower Gariep Alluvial Vegetation is listed as **Endangered A1**[13].

[11] An earthquake swarm is an event where a local area experiences sequences of many earthquakes in a relatively short period of time. A swarm may last in the order of days, weeks, or months, but rarely more than two years. They are differentiated from earthquakes succeeded by a series of aftershocks, by the observation that no single earthquake in the sequence is obviously the main shock (ref: http://www.geoscience.org.za) [date accessed: 30 September 2013]

[12] http://www.geoscience.org.za/index.php/downloads?id=1455:seismicity-in-the-augrabies-area&catid=1:latest-news [date accessed: 30 September 2013]

[13] The A1 criterion means there is irretrievable loss of natural habitat with the remaining natural habitat of this type less than its biodiversity target of greater than15%.

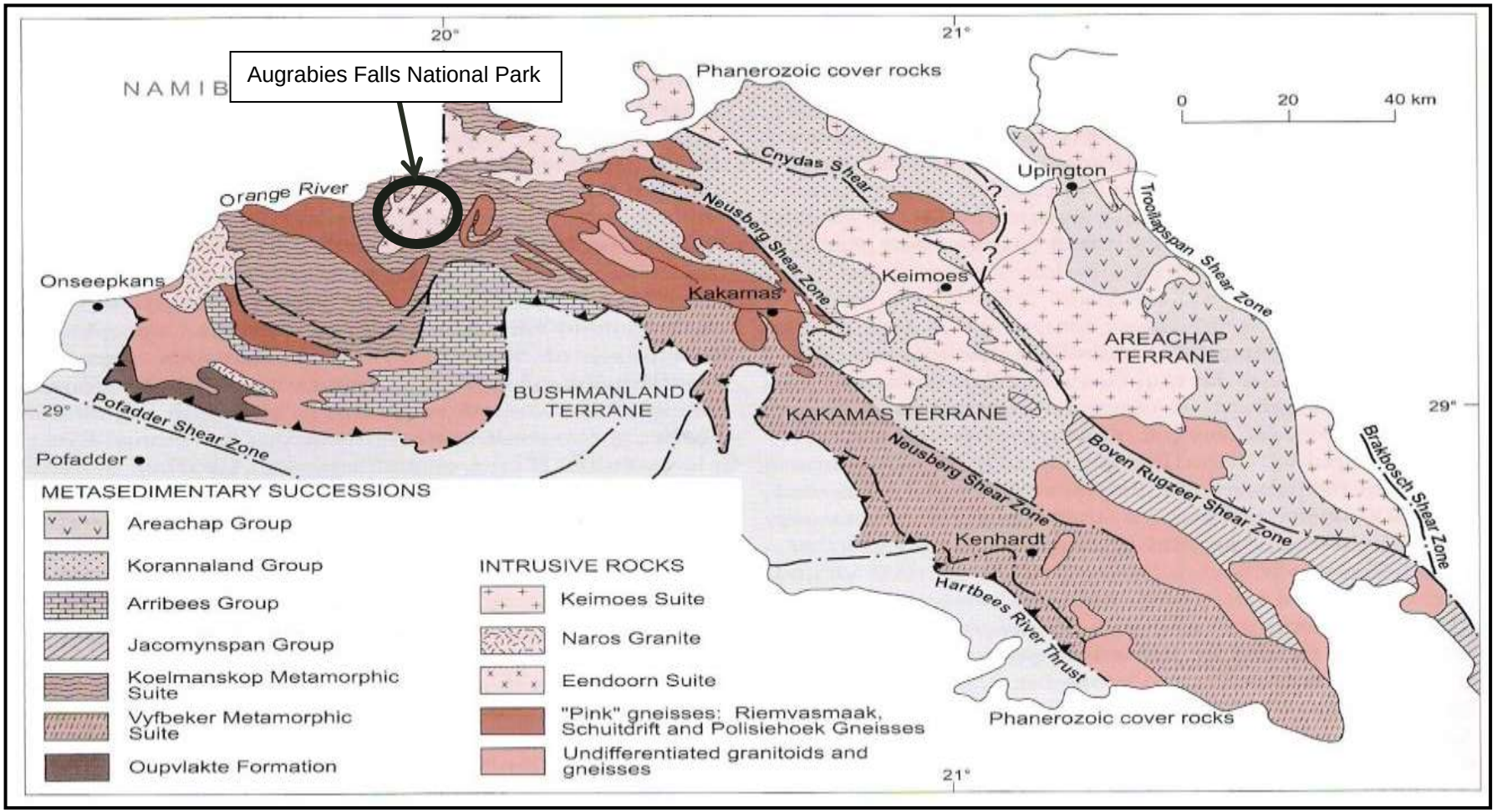


Figure 22 | Generalised geological map of part of the Northern Cape Province. The study area lies north-west of Kakamas in the approximate area of the circle.

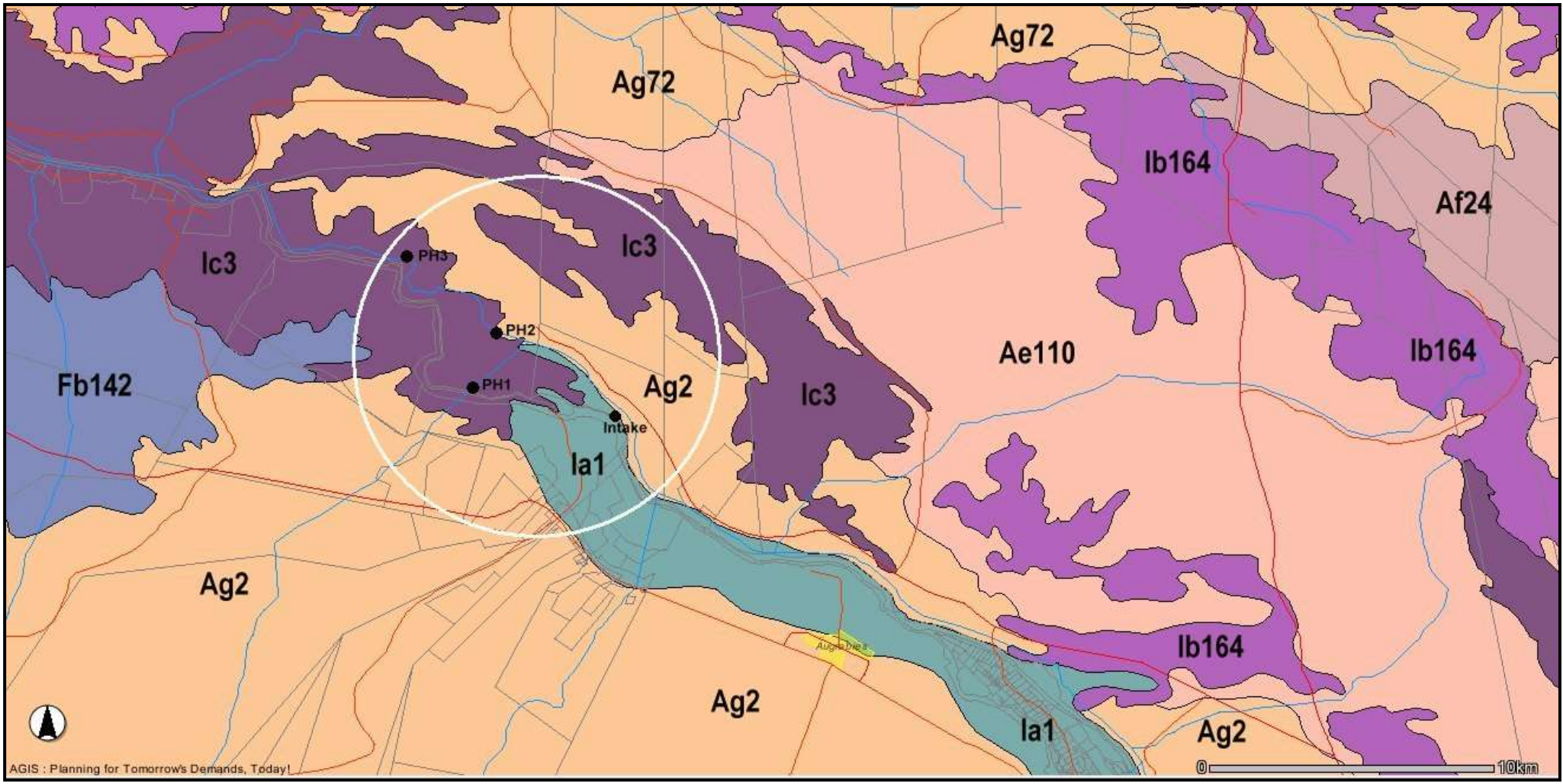


Figure 23 | Land-types found in the Riemvasmaak are of the Northern Cape Province.

Three land types are found in the study area (within the white circle): Ic3, Ag2 and Ia1. All three power-house sites (PH1, PH2 and PH3) are located in the Ic3 land type. The 'intake ' site is in the Ia1 land-type and the canal / pipe is mainly within the Ag2 land-type (Source: McDonald, D. 2012).

Lower Gariep Alluvial Vegetation

According to McDonald (2012) the vegetation type is found on the recently deposited alluvial sediment along the Orange (Gariep) River. It forms dense thickets of thorn trees (*Acacia Karoo* and to a lesser extent *Acacia erioloba*) on the upper banks. Other species include *Searsia pendulina, Ziziphus mucronata, Maerua gilgii and Lycium bosciifolium*. Other prominent trees include *Euclea pseudebenus* and *Tamarix usneoides*. Exotic mesquite (*Prosopis glandulosa* var. *glandulosa*) often invades the riverine thickets forming dense, impenetrable, thorny masses.

McDonald notes that extensive reed-beds are formed by *Phragmites australis* in the main river channels and occasionally where water persists in the mainly dry side channels.

As mentioned earlier the Lower Gariep Alluvial vegetation is threatened. This is as a result of the intense agriculture (mainly table grapes and citrus) on the alluvial soils in the Groblershoop area and mainly west of Upington as far as Augrabies (McDonald, 2012).

McDonald (2012) recorded Lower Gariep Alluvial Vegetation at the proposed intake as well as lining the river banks along the upper reaches of the Orange River and its side channels above the Augrabies Falls and along the subsidiary river channels north of the falls.

Lower Gariep Broken Veld

McDonald (2012) notes that vegetation of the Lower Gariep Broken Veld is found on the rugged ultrametamorphic[14] koppies and inselbergs (the Hardeveld) interspersed with low plains, along the Orange (Gariep) River stretching from Onseepkans, including a large area of Riemvasmaak, in the west to Prieska in the east and from Karos in the north to Marydale in the south. Lower Gariep Broken Veld is sparse, dominated by shrubs and dwarf shrubs with perennial grasses. The annual species are more prominent during the spring time. Mucina *et al.* (2006) notes that vegetation from the Lower Gariep Broken Veld at Augrabies is found along the gorge and below the falls.

Bushmanland Arid Grassland

Between the three vegetation types occurring in the study area, Bushmanland Arid Grassland is the most widespread of the three. It stretches across a vast area in the Northern Cape from the Bushmanland Basin in the south to the vicinity of the Orange River in the north and from Prieska in the east to Aggenys in the west (McDonald, 2012). It mixes with Lower Gariep Broken veld at Augrabies and has numerous plant species in common with the latter type. McDonald (2012) notes that the two can easily be distinguished by the relatively greater abundance of “white grasses” (*Aristida* and *Stipagrostis species*) in Bushmanland Arid Grassland.

[14]The metamorphism of rock during which the temperature of the rock exceeds its melting point resulting in complex geological features (source: http://dictionary.reference.com.)

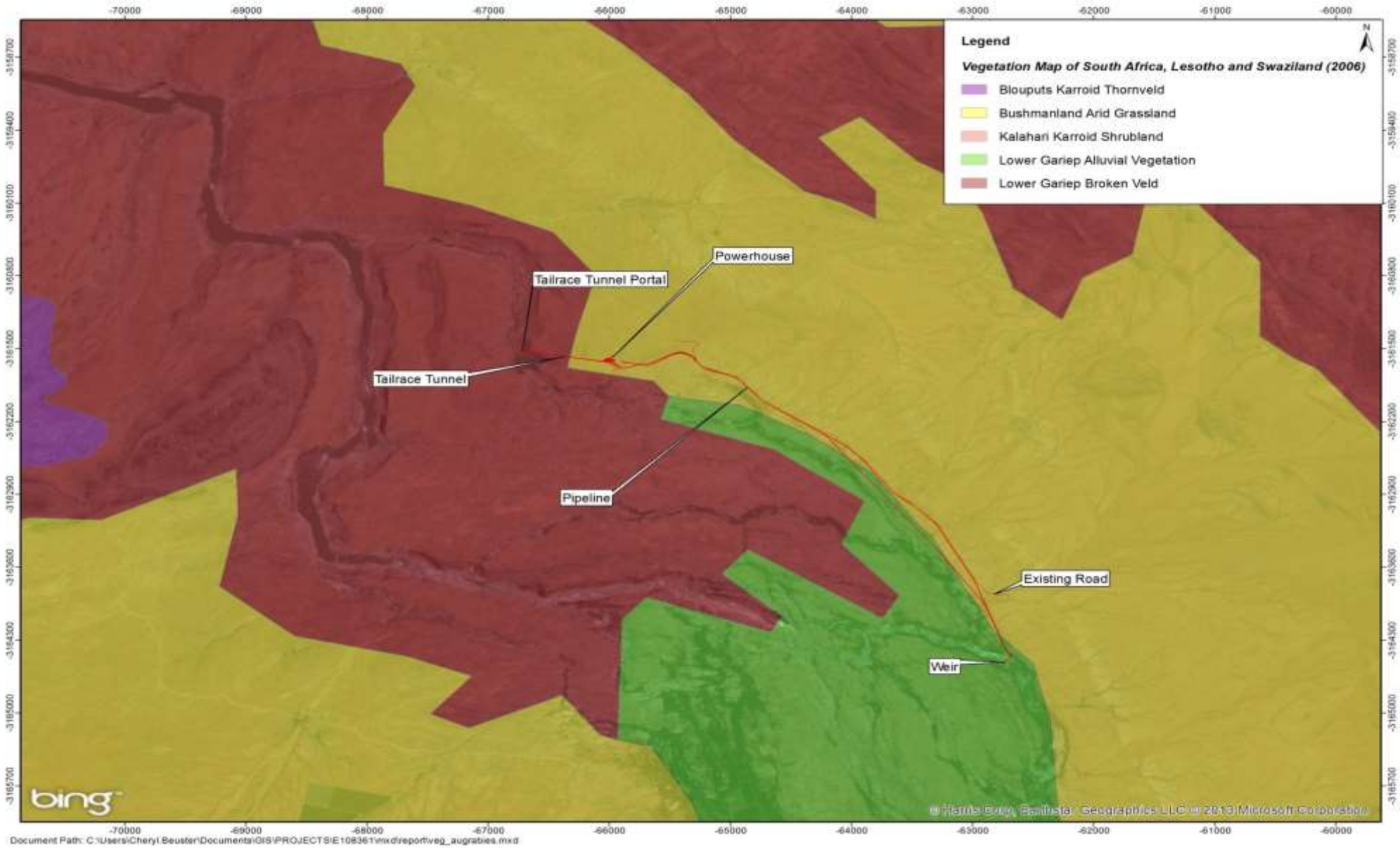


Figure 24 | **RVM Vegetation Map**

5.2.5 Fauna

The AFNP consists of a range of wildlife which includes various mammals, reptiles and insects.

Mammals

SANParks notes that animals like the slender mongoose, the yellow mongoose, rock dassies, clawless otter and giraffe are found in the park (source: http://www.sanparks.co.za/parks/augrabies).

Most animals come out at night to avoid the high day-time temperatures during summer. Night hunters like the bat-eared fox, aardwolf, African wild cat and small spotted genet are found in the park. Leopard is also found in the park, although rarely seen. Hartmann's Mountain Zebra, listed as an endangered species, is also found in the park (source: http://www.sanparks.co.za/parks/augrabies).

Reptiles

The park is home to 41 reptile species. Of these species it is said that the most famous reptile is Broadley's flat lizard, known locally as the Augrabies flat lizard. Its fame is derived from the fact that the lizard is only found in a 100 km radius of the falls. Snakes found in the park include the infamous black spitting cobra, the cape cobra, horned adder, dessert mountain adder, and Karoo sand snake amongst others (source: http://www.sanparks.co.za/parks/augrabies).

Figure 25 | Broadley's flat lizard

[source: http://whitinglab.com/?attachment_id=2333 (accessed: 28 June 2013)]

Insects

The Lepidopterists[15] Society of Africa conducted a quick survey (i.e. a morning) of the AFNP. In the short amount of time they observed 14 species, but noted that this was not nearly the total species count. They only found one really interesting butterfly known as the *Alenia sandaster* (Coetzer & Coetzer, 2008). The *Alenia sandaster* is a butterfly of the Hesperiidae family that is known to occur from the arid Nama Karoo of the eastern part of the Western Cape the central Northern Cape. The

[15] A lepidopterist or aurelian is a person who specialises in the study of Lepidoptera, members of an order encompassing moths and the three superfamilies of butterflies, skipper butterflies, and moth-butterflies.

wingspan of males and females vary with males having a wingspan of between 22 – 27 mm and females grow a wingspan of between 26 – 28 mm. They have a life expectancy of one year (source: http://en.wikipedia.org/wiki/Alenia_sandaster).

Avifauna

The Verreaux Eagle (*Aquila verreauxii*), or more commonly known as the Black Eagle, breeds in the park. Other bird species include amongst others the following (source: http://www.sanparks.co.za/parks/augrabies):

- Pygmy Falcon;
- Pale Chanting Goshawk;
- Rosy-faced Lovebird;
- Namaqua Warbler;
- Fairy Flycatcher; and
- Rock Kestrel.

Trees used for breeding by a colony of water birds, which include Darters, White-breasted cormorant and Reed cormorant, are located along the banks of the river just upstream of the proposed weir site (refer to figures below).

Figure 26 | Water birds breeding colony near the proposed weir site.

(Image courtesy of Nardus du Plessis: 2013)

Figure 27 | White-breasted Cormorants near the proposed weir site.

(Image courtesy of Nardus du Plessis: 2013)

Figure 28 | Images of Darters /near the proposed weir

Figure 29 | White-breasted Cormorant in nest near the

site.

(Image courtesy of Nardus du Plessis: 2013)

proposed weir site.

(Image courtesy of Nardus du Plessis: 2013)

5.2.6 Freshwater Ecology

According to McKenzie (2012) the steep gradient within the study area provides a wide range of hydraulic and substrate conditions, including cobbles, boulders and bedrock in slow to very fast current, backwaters, deep pools, secondary channels and abundant to sparse marginal vegetation, with abundance. The high diversity of instream habitats is reflected by a higher diversity of aquatic invertebrates than in areas where the gradient is flatter. The following aquatic invertebrate species within the study area were considered to be of particular conservation significance (McKenzie, 2012):

- Simulium gariepense, a large-river species that is endemic to the middle and lower Orange River. This species is specialised for feeding in turbid environments, and has largely disappeared because of reduced turbidity, but appeared in the lower Orange River (Blouputs and Vioolsdrift) following floods in March 2010.
- Acanthiops varius, a tropical mayfly species recorded once at Neusberg, in October 1992, but not recorded during monthly monitoring near Upington over five years, or anywhere in the Orange River. The rare occurrence of this species at Neusberg suggests that the ecological conditions at Neusberg, and presumably other areas with steeper gradients, differ from areas with flatter gradients.

According to McKenzie (2012) most of the fish species in the study area are classified as Least Concern in terms of conservation status. Two species of high conservation status are however present. The Largemouth yellowfish (Labeobarbus kimberleyensis) which is Near Threatened according to IUCN (2007) and Vulnerable according to NEMBA (2004). The Namaqua barb (Barbus hospes) is endemic to the Orange River System (below Augrabies Falls).

Based on the results of a comprehensive reserve determination study conducted in 2010, the Orange River reach that includes the proposed study area falls into a Present Ecological Status (PES) of Category C (Slightly to Moderately modified) for fish, invertebrates and overall instream component. It is estimated that the specific section of the river in the study area most probably also falls into a category C (due to the upstream impacts), but due to the protected status provided by the AFNPin the direct vicinity of the study area, this reach would fall at least within the higher (improved) scale of the C category, bordering or even reaching the lower category B (largely natural) (McKenzie, 2012).

5.2.7 Heritage, Archaeology and Palaeontology

The heritage context of the area can be divided into four main groups for the purpose of sketching a broad context. These are palaeontology, pre-colonial archaeology, graves and human remains and the colonial period.

Palaeontology

The igneous rocks that comprise the landscape means that palaeontological material would not occur in the hard geology of the area. The Namaqua-Natal Metamorphic rocks have no palaeontological significance, since no fossils have yet been recorded in them (Orton & Webley, 2012). Isolated fossils

might be present, trapped in the silt deposits on the Orange River floodplains, but these are most likely limited to tiny plants and animal remains.

Archaeology

With a few exceptions, the archaeology along the Orange River has only been well studied in two areas namely the Richtersveld and the Middle Orange River area. The bulk of archaeological research conducted in the vicinity of Augrabies Falls was done during the 1970s and 1980s and demonstrates that there are important heritage sites located in the region (Orton, 2012).

Although no Early Stone Age (ESA) sites were found during the survey undertaken as part of the initial BA process, the earlier survey of the National Park revealed several isolated ESA artefacts and at least one scatter of such artefacts. None occur within the study area.

Middle Stone Age (MSA) artefacts and scatters were found to be far more common on site and a large number of such sites were recorded (see a number of the MSA finds in Figure 30). The vast majority are relatively light scatters, often associated with naturally occurring pebbles of banded ironstone, although some are denser.

A number of Later Stone Age (LSA) sites were encountered by Orton (2012), mostly close to or beneath trees on the silty plains along the river margins (see a number of the MSA finds in Figure 31). According to Orton (2012) many of these sites are very likely to be those of pastoralist people (the Khoekhoen) who were known to camp along the river. It was frequently the case that ashy patches were found associated with the artefacts. This raises the significance of the sites since it greatly elevates the chances of obtaining reliable radiocarbon dates.

Few rock shelters were found to be present in the study area by Orton (2012), but when a reasonable one was found it usually has artefacts around it. One such rock shelter with artefacts around it is located in the study area (see Figure 32). The artefact scatter is considered by Orton (2012) to be a mix of MSA and LSA artefacts. There are also a number of light to extensive scatters in the vicinity of the rock shelter. The vast majority of these artefacts are quartz, but banded ironstone and fine-grained black rock is also present along with some Ostrich Egg Shell (OES) fragments.

Figure 30 | Artefacts from a MSA scatter.

(source: Orton, 2012)

Figure 31 | LSA artefacts including flaked stone, beads and pottery.

(source: Orton, 2012)

Figure 32 | View into a rock shelter which is too low for general human occupation.

(source: Orton, 2012)

Historical archaeology and local history

According to Orton (2012) the study area has numerous historical sites which relate to the ancestors of the Riemvasmaak Community. These sites therefore represent the community's history. It should be noted that the community, through a letter from the Riemvasmaak Trust's lawyer, has indicated their support for the development even though it passes through the area once occupied by them and their predecessors. They did, however, stipulate that all graves should be protected. An historic settlement, Wabrand, occurs to the northwest of the study area. Blousyfer occurs in the northernmost part of the study area and Hartbeesvlak and Melkbosrand in the centre refer to Figure 33).

5.2.8 Socio-Economic Aspects

The socio-economic aspects of the general area are provided below in Table 6 in comparison to the broader South African statistics. The population of the Northern Cape is estimated at approximately 1.1 million people. The Kai !Garib Local Municipality had around 65 867 people with an average population growth rate of approximately 2.1%. The average household size is 3.9 persons (Urban-Econ, 2012).

Population & Household Totals				
2011	**SA**	**NC**	**Siyanda DM**	**Kai !Garib LM**
Population Total	51,769,798	1,145,710	236,754	65,867
Average Population Growth Rate	1.4%	2.1%	2.1%	2.1%
Household Total	14,449,831	301,367	61,086	16,700
Average Household Size	3.6	3.8	3.9	3.9

Table 6 **|** Population & Household Aspects

(Source: Urban-Econ, 2012)

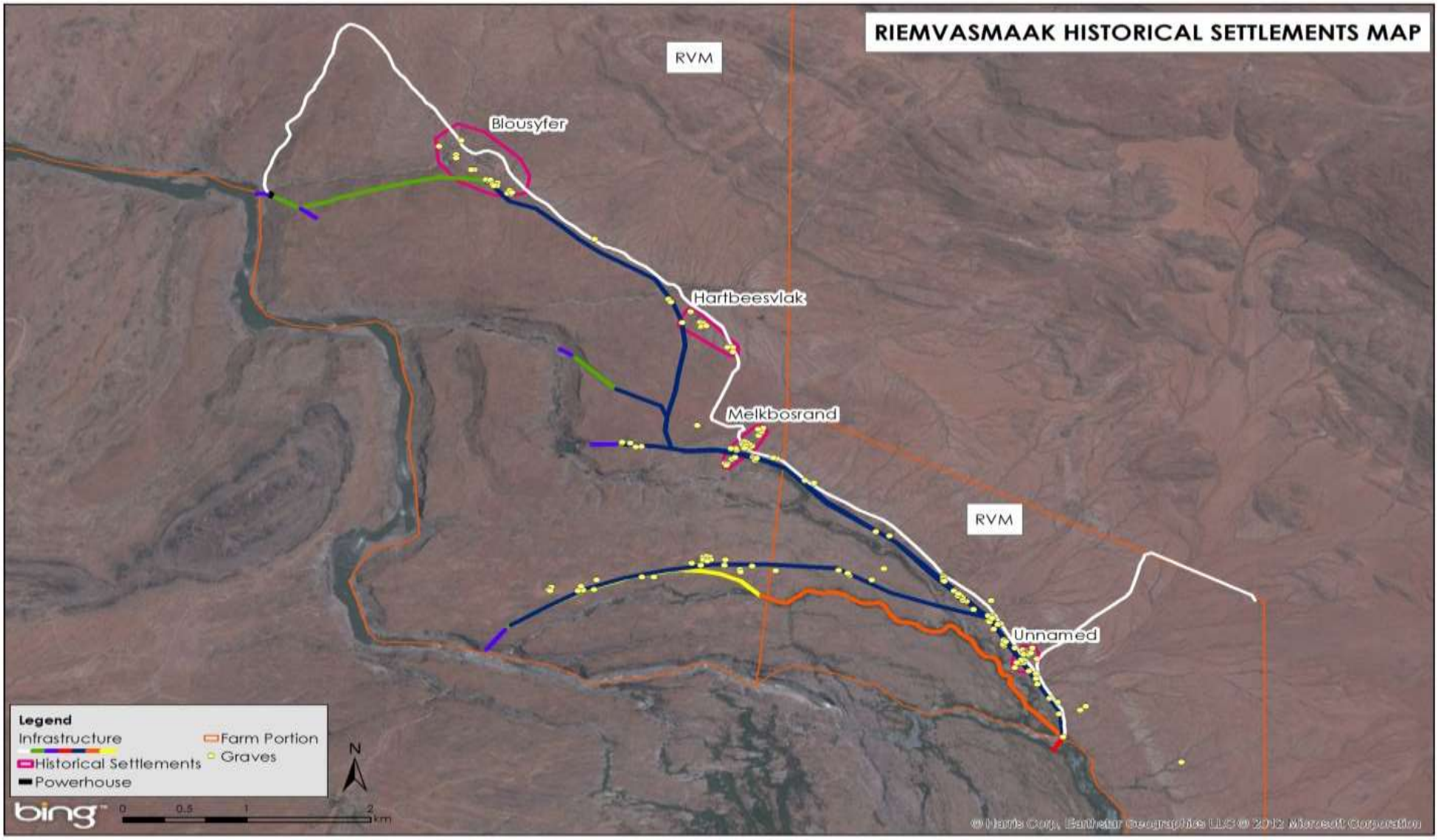


Figure 33 | Aerial view of the study area showing the locations of four historical settlements, as well as identified graves.

(Source: Orton, 2012)

Age Profile				
2011	**SA**	**NC**	**Siyanda DM**	**Kai !Garib LM**
Ages 0-14	29.2%	30.1%	28.4%	24.4%
Ages 15-24	20.0%	18.5%	19.6%	22.3%
Ages 25-64	45.4%	45.7%	46.9%	48.2%
Age 65+	5.3%	5.6%	5.1%	5.1%

Table 7 **|** Age Profiles
(Source: Urban-Econ, 2012)

The potentially Economically Active (PEA) population of the The Kai !Garib Local Municipality represents approximately 70.5% of the total population. In the The Kai !Garib Local Municipality 29.5% of the population is dependent on the PEA (70.5%) (Urban-Econ, 2012). Males represent 48.6% of the Kai !Garib Local Municipality population whilst females represent 51.4%.

Table **8** shows that 87.8% of the population the local study area use electricity for lighting while 10.1% uses candles. The study area therefore has a high electricity demand.

Electricity Usage				
2011	**SA**	**NC**	**Siyanda DM**	**Kai !Garib LM**
Electricity	85.0%	85.6%	86.9%	87.8%
Gas	0.2%	0.2%	0.2%	0.1%
Paraffin	3.0%	1.7%	0.9%	0.7%
Candles	11.4%	11.3%	10.5%	10.1%
Solar	0.4%	1.1%	1.5%	1.2%
Other	0.0%	0.0%	0.0%	0.0%

Table 8 **|** Electricity Usage in the study area
(Source: Urban-Econ, 2012)

The majority (67.2%) of the residents within the Kai !Garib Local Municipality is employed in the Agricultural sector. This is due to the presence of the Orange River which provides a good source of water for irrigation purposes as well as the climate which is favourable for the production of table grapes.

5.2.9 Surrounding Land Uses

As noted above, the predominant land use for the area is agriculture. The agricultural sector contributed 47% to the The Kai !Garib Local Municipality economy. As one moves further away from the Orange River, livestock grazing becomes the main activity.

According to Urban-Econ (2012) the agricultural sector in the Northern Cape contributes to the tourism sector in the form of game farms/ reserves and wine farms that offer tours and tastings. It is also noted by Urban-Econ (2012) that tourism is one of the most important economic sectors in the Northern

Cape as well as within the Kai !Garib Local Municipality. The AFNP contributes to the attraction of tourists to the area.

The ~~site itself is~~ most significant infrastructure of the proposed project would be constructed on land belonging to the Riemvasmaak Community, but which falls within the management area of the AFNP and hence is used for conservation. As mentioned earlier, certain infrastructure would also be constructed on land belonging to SANParks.

5.2.10 Visual Landscape

Figure 34 | View of the landscape on the way to the AFNP.

(Source: Du Plessis, 2012)

Figure 35 | View of the landscape in the AFNP.

(Source: Du Plessis, 2012)

Considering that the study area falls within the AFNP ~~a National Park~~, the area has a tranquil sense of place. It is a well-known tourist attraction in the Northern Cape. The area is sparsely covered with vegetation, and topographical features/ relief and geological features play a major role in the visual character of the environment. The Augrabies landscape is mostly made up of granite features shaped by interesting weathering patterns (Du Plessis, 2012). The main falls and the gorge in the AFNP are a big tourist attraction.

5.3 Construction Phase Impacts on the Biophysical and Socio-Economic Environment

The construction phase is likely to result in a number of potential impacts on the biophysical and the socio-economic environment. These could potentially include:

- Disturbance of flora and fauna (including avifauna);
- Impact on heritage resources (including palaeontology);
- Sedimentation and erosion of water ways;
- Impact on local economy (employment) and social conditions;
- Visual impact;
- Impact on traffic;
- Storage of hazardous substances on site;
- Noise pollution; and
- Dust impact.

The significance of construction phase impacts is likely to be limited by their relatively short duration, since the construction phase would last approximately 36 months for the proposed hydropower station. Many of the construction phase impacts could be mitigated through the implementation of an appropriate EMP. During the EIA Phase, the construction phase impacts on the biophysical and socio-economic environment will be assessed in terms of the methodology outlined in the Plan of Study for EIA (refer to Chapter 6). Furthermore, an EMP will be compiled as part of the EIA process, and submitted as part of the EIR, to provide mitigation and ascribe responsibilities for many of the construction phase impacts.

The potential construction phase impacts are described in more detail below.

5.3.1 Disturbance of Flora and Fauna

This impact considers impacts beyond the permanent footprint impacts of the proposed hydropower station. Alien plant seeds could be introduced with construction material such as sand or other materials, with any disturbed areas being particularly vulnerable.

During the construction phase the vegetation within the footprint of the activity would be cleared. This might result in a loss of habitat and / or habitat fragmentation. Any affected fauna or avifauna would generally be mobile and would relocate during the construction phase but are likely to recolonise the area, once the construction phase has been completed and the disturbed areas rehabilitated. A rehabilitation plan would be drafted by the Botanist to address the aforementioned.

Vegetation clearance and topsoil preservation will be addressed in the EMP and in accordance to the specialist botanical recommendations (to be included in the EIA phase).

Bats could potentially be impacted on by the construction phase as they could use the rocky outcrops as roosting sites.

The EMP would require that the area is inspected for fauna before construction activities commence. Considering that fauna are mobile, they would usually evacuate the area themselves, but where fauna are found on the alignment of the proposed project, they would be relocated by a suitably qualified person. The impact on fauna would be for the 36 months during construction, after which they would be able to return to the area. As it is proposed to bury most of the infrastructure, fauna would be able to populate the area again once construction is completed. As mentioned earlier a breeding colony of water birds, including Darters, White-breasted cormorant and Reed cormorant, is located near to the proposed weir. The impact of the construction of the weir on these birds will be assessed by the appointed Ecologist during the EIA phase.

5.3.2 Impact on Heritage and Palaeontological Resources

Heritage resources include archaeological material (e.g. rock paintings, stone tools), paleontological material (e.g. fossilised materials) and cultural heritage material (e.g. old graveyards, fences or ruins of buildings). Since some potential heritage material is buried, it is often only found during the construction phase of a project.

A large scale development such as the proposed project could have a negative impact on the archaeology (e.g. rock paintings, stone tools), cultural heritage resources (e.g. old graveyards, fences or ruins of buildings) and paleontological resources (e.g. fossilised materials) by damaging or destroying such material or by requiring the material to be removed and stored off site. It is therefore

necessary to assess the potential impacts of the proposed project at an early stage in order to best determine the course of action for the resources on site. A HIA, including input on archaeological and heritage considerations as well as a study on the palaeontology was undertaken during the previous BA process. The area between the two pipeline routes was found to contain the majority of heritage sites and will be avoided by both alignments. However, it is possible that more heritage resources might be discovered on one or both of the alignments by the heritage specialist during the assessment that would be undertaken for the EIA process. The excavation of the power chamber could potentially uncover palaeontological remains. However, the initial heritage assessment noted that the igneous rock in the area would render palaeontological remains very unlikely due to its hard nature (Orton: 2012). This study will be updated based on the revised project description.

5.3.3 Sedimentation and Erosion

The proposed project would result in construction activities in and adjacent to the Orange River. This could therefore result in the increase of sediment loads in the Orange River. This would be exacerbated during the wet season and during any intense rainfall events. This will be addressed in the EMP and in the updated aquatic ecology study.

If adequate care is not taken, the construction of coffer dams could result in sedimentation in the river which would impact on aquatic life. Construction could also result in dangerous chemicals such as oil and petrol leaking into the river. These would however be addressed in the Construction Environmental Management Plan (CEMP).

5.3.4 Impact on Local Economy (employment) and Social Conditions

The proposed project would create temporary jobs~~, mostly~~ during the construction phase which would last approximately 36 months. If local suppliers would be used, a number of indirect jobs would also be created. A Socio-Economic Impact Assessment would be undertaken to determine the social impact on the local economy.

5.3.5 Visual Impact

The location of the proposed activity in a National Park requires special attention in terms of visual impacts as it is a tourism destination. During the construction phase a number of construction vehicles would be required onsite. These include bakkies, excavators, trucks and other earth moving equipment. If not managed this could result in dust impacts and an overall visual impact. The construction phase is however of limited extend (i.e. 36 months).

The construction of new roads would result in a visual impact due to the clearance of vegetation. The construction of roads would also result in the loss of vegetation. The aforementioned impacts would also apply for the expansion of roads, although to a lesser extent due to the fact that the existing road already creates a visual scar. These will also be assessed in more detail during the EIA phase. The construction and expansion of roads could also have a positive socio-economic impact as it would result in better access to the area, should it be decided to use the area for tourism in future.

The construction would therefore result in a visual impact. This will be assessed in more detail by the visual specialist during the EIA phase. A rehabilitation plan would be implemented once construction is completed to re-establish the area to as near natural as possible. A nursery could be established prior to rehabilitation.

The construction of the weir would not stop the flow to the Augrabies Falls as it would be constructed in two halves to ensure that the Orange River continues flowing. It is therefore not anticipated that the construction of the weir would detract from visitors' experience of the falls. The visual impact for the construction phase would be investigated further during the EIA phase by the visual specialist who undertook the original visual impact assessment for the BA.

5.3.6 Impact on Traffic

A number of construction vehicles would be required onsite, including bakkies, excavators, trucks and other earth moving equipment. Construction vehicles are likely to make use of the existing roads, including the R359, to transport equipment, people and material to and from the construction site. The necessary clearances from the respective Roads Authorities (specifically Department of Roads and Public Works, Northern Cape) would need to be in place if any "abnormal loads" are to be transported, prior to the transporting of these loads. The management of traffic would be achieved through the implementation of an EMP, which would specify measures to avoid accidents and hazards.

5.3.7 Storage of Hazardous Substances on Site

It is common practice at construction sites to use and temporarily store various hazardous substances on site. These substances may include, amongst other things, diesel, curing compounds, shutter oil and cement.

Use of hazardous substances at a construction site is controlled by various pieces of legislation. The management and protection of the environment would however be achieved through the implementation of an EMP, which would *inter alia* specify the storage details of hazardous compounds and the emergency procedures to follow in the event of a spillage.

5.3.8 Noise Pollution

An increase in noise pollution would be expected from the operation of heavy machinery during the construction period, as well as due to the increased traffic. The proposed activity is however a good distance away from noise sensitive receptors. Noise impacts during the construction phase would be managed through the implementation of the EMP.

5.3.9 Dust Impacts

As mentioned earlier, construction vehicles would use existing access roads (i.e. dirt roads) to transport equipment and material to the construction site. Earthworks would also be undertaken. These activities would exacerbate dust especially in the dry winter months. The dust impact would be managed through the EMP, which would include procedures for dealing with dust pollution events including watering of roads.

5.4 Operational Phase Impacts on the Biophysical and Socio-Economic Environment

This section of the report considers the operational phase impacts on the biophysical and socio-economic environment that may be associated with the proposed activities, including the following:

- Botanical impact;
- Impact on aquatic resources
- Visual impact;

- Impact of noise;
- Impact on local economy (employment), tourism and social aspects;
- Impact on agricultural land
- Impact on fauna (including avifauna); and
- Planning.

During the previous BA process, specialist studies were conducted for all of the above, except for impacts on fauna and agriculture. The following sections are based on the previous studies, except the section regarding fauna and impact on agriculture. It must be noted that all the above studies would be updated for the EIA phase based on the revised project description. In addition it is proposed to conduct a faunal study.

5.4.1 Botanical Impact

As noted in Section 5.2.4 there are three main vegetation types applicable to the study area. One of these, the Lower Gariep Alluvial Vegetation is listed as **Endangered A1.** The Melkbosrand area, on which most of the infrastructure is proposed, was occupied by the Riemvasmaak Community before their removal. Thereafter the area was used by the South African National Defence Force (SANDF). In 1982 a piece of the land (4 270 ha) was incorporated into the AFNP which was then de-proclaimed in 2004 (AFNP Management Plan: 2013). Remnants of the Riemvasmaak Community can still be seen in the area (refer to Figure 36) however the vegetation, being in the management area of a National Park, is still of very good quality and mostly undisturbed as access to the area is not open to Park visitors and has not been for some time,

Figure 36 | Remnants on Melkbosrand.
(Source: Du Plessis, 2012)

The site is located within critical biodiversity areas (CBA) for environmental support area/migration corridor; canyons and Lower Gariep Alluvial Vegetation.

Management of the study area is currently under the control of SANParks with the objectives being conservation of the ecosystem and its biodiversity. This is a highly desirable situation from an environmental perspective since the area is stocked with wild ungulates and is not grazed by domestic livestock. It is actively managed for optimal carrying capacity and is therefore not over-utilized. Access to the area is also restricted, resulting in a distinct sense of wilderness and aesthetic appeal which would have long-term benefits if the area was to once again be opened to limited 'wilderness experience' tourism.

Most of the impacts on botanical resources would occur during the construction phase of the proposed project when clearing of vegetation will occur. The operational phase would mostly relate to the rehabilitation of disturbed areas and management of these areas for which a rehabilitation plan would be drafted. A nursery would also be considered to aid rehabilitation.

The Botanical Impact Assessment undertaken as part of the initial BA process will be updated, based on the revised project description, to determine the significance of impacts on botany during the operational and construction phase of the proposed project as well as to look at cumulative impacts and to propose mitigation measures that can be included in the EMP. The Terms of Reference (ToR) for this study are included in Table 14.

5.4.2 Impact on Aquatic Resources

It is believed that invertebrate species are mostly homogenous through the entire length of the river. The river plays host to freshwater shrimp and freshwater mussels. 12 to 15 indigenous freshwater fish species are found downstream of Augrabies Falls LORMP, Draft October 2008. In the study area, fish species classified as Near Threatened and Vulnerable are found (refer to Section 5.2.6).

The Ecological Importance and Sensitivity of the site during the aquatic study conducted as part of the initial BA process was considered to be high. Based on this finding the aquatic study will be reviewed for the EIA phase. The ToR for this study is included in Table 14.

Impacts on aquatic ecology could potentially be affected by reduced flow and the impact of the weir as a potential migration barrier. The weir pool could also impact on the aquatic ecology in that area. Spoil may also be disposed in a plunge pool. These would all be considered in more detail by the aquatic ecologist who would revisit the site during the EIA phase.

5.4.3 Visual Impact

The location of the proposed project in the management area of the AFNP ~~a National Park~~ results in the area falling in a Priority Natural Area and Viewshed Protection Areas as per the Parks management plan. CBA form part of the inherent landscape character of the affected environment. Conservation planning and potential park expansion are not only important biophysical elements, but also potential scenic natural resources that may be affected (Du Plessis, 2012).

The proposed project could impact on the visual resources and hence the Visual Impact Assessment (VIA) undertaken as part of the initial BA process will be updated, based on the revised project description. The assessment will determine the significance of visual impacts during the operational and construction phase of the proposed project as well as to look at cumulative impacts and to

propose mitigation measures that can be included in the EMP. The ToR for this study is included in Table 14. As a mitigation measure most infrastructure will be buried or constructed underground. Figure 39 shows what infrastructure will be visible on the surface.

The proposed project would at all times ensure that a minimum of 30 m^3/s of water would pass the weir permitting that sufficient water is available in the river. The potential exists that the reduced flow could impact on the visual experience of tourists coming to visit the AFNP which could have a negative impact on tourism (discussed further under section 5.4.5.1 below). Below are photographs showing the falls at different flows.

Figure 37 | Augrabies Falls at a flow of 34m^3/s.

(Source: **http://www.dwaf.gov.za/Hydrology/Daily/Default.aspx** (accessed: 11 September 2013)

Figure 38 | Augrabies Falls at a flow of 41 m^3/s.

(Source: **http://www.dwaf.gov.za/Hydrology/Daily/Default.aspx** (accessed: 11 September 2013)

5.4.4 Impact of Noise on Sensitive Receptors

The initial Noise study, which formed part of the previous BA process, determined that there would be a low potential for a noise impact during the operational phase due to the large distance between receptors and the project footprint. The turbines would generate machinery noise levels at approximately 95 dBA at a distance of 3 m from the machine. Since the proposed hydropower stations' equipment would be situated underground, no difference in significance would result during the operational phase. As such it is anticipated that very little to no noise would be heard within 500 m of the power houses and therefore no impact would result. As such noise impacts will be managed through the EMP. Due to the low noise impact rating of the proposed project as assessed during the BA process, the potential noise impact would be discussed in the EIA reporting, but would not be re-assessed by the noise specialist.

5.4.5 Impact on the Socio-Economic Environment

5.4.5.1 Impact on Tourism

The Augrabies Falls is a significant tourist draw card in the region. According to Urban-Econ (2012) the Augrabies Falls recorded 84 630 and 83 970 visitors in 2010 and 2011 respectively. Note however

that during 2010 and 2011 floods was experienced which resulted in a spike of people wanting to experience the flood conditions in the Park. According to the AFNP Draft Management Plan (2012) the AFNP attracts 50 000 to 100 000 visitors annually. This wide variation in numbers depends largely upon the fluctuating Namaqua wild flower displays and the high levels of the Orange River.

The main attraction within the reserve is the Augrabies Falls itself, a 56 m high waterfall with various viewing decks and the park reception in near vicinity. The river then continues its path through an 18 kilometre gorge. Two hiking trails exist with the longer, 3 day trail being closed during October to May due to the heat. Mountain biking and game driving also takes place within the park. Several panoramic viewpoints can be visited inside the park, all of which give wide open vistas of the park, the gorge and the Orange River. These viewpoints are Moon Rock (offering one of the best views of the park and surrounds), Swart Rante, Oranjekom and Ararat (offering the best opportunity to observe the massive gorge area) and Echo Corner (Urban-Econ, 2012).

The visual impact of the proposed project could result in an impact on how the park is valued by tourists and hence its ability to attract. The potential impact on tourism would be as a result of reduced flows over the Augrabies Falls. Permitting that sufficient water is available in the Orange River, 30 m^3/s of water would always be allowed to pass the weir (refer to Figure 37 which depicts the Falls at a flow of 34 m^3/s). A maximum of 37 m^3/s would be used by the proposed project once 30 m^3/s or the EFR, whichever is greater, have been let through. That means that if 100 m^3/s is available in the Orange River, 37 m^3/s would be used by the proposed hydropower station and the remaining 63 m^3/s would be let through to the Falls. The power station needs a minimum of approximately 3.5 m^3/s to operate. The findings of the initial socio-economic/ tourism report will be updated based on the revised project description. A meeting with SANParks also highlighted the need to determine the effect the flow over the Augrabies Falls has on visitors' experience in order to determine an "acceptable" flow rate for tourists coming to visit the AFNP. This requirement will be incorporated into the Socio-Economic Study.

5.4.5.2 Impact on the Community

The town of Riemvasmaak (10-16 km north of the site) received approximately 1 530 visitors from January 2012 till November 2012. Riemvasmaak offers some tourism facilities including accommodation, 4x4 routes and hot springs. Although the area is not heavily utilised at present the opportunity exists to increase the numbers of visitors to this town (Urban-Econ, 2012).

The Riemvasmaak community could benefit from the project in a number of ways. Firstly, they would receive a sustained annual income as the project would be located on their property. This income could be used to help uplift the community through development projects. Furthermore, the community could benefit from the job opportunities that the project would generate directly and/ or indirectly.

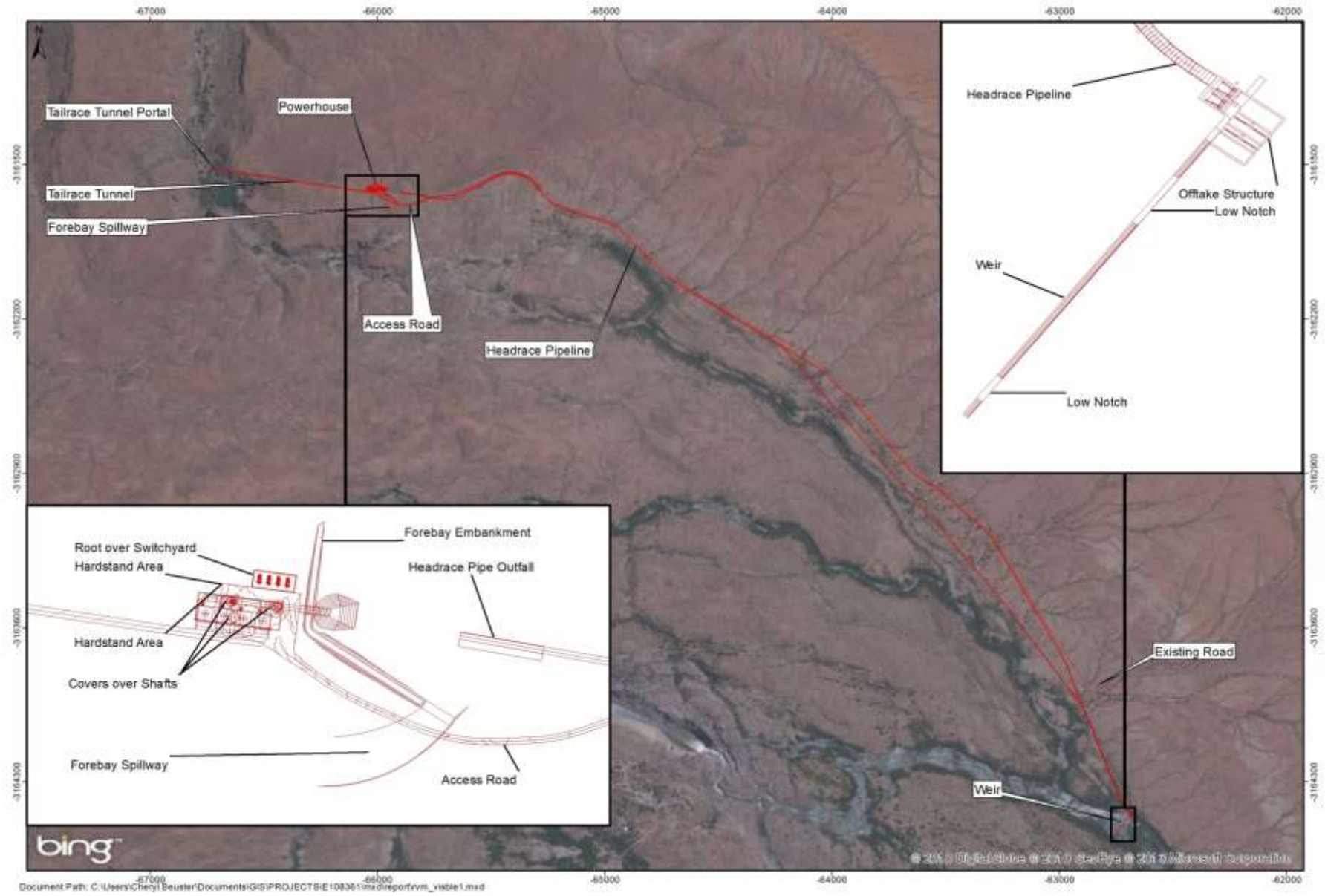


Figure 39 | **Infrastructure of the Proposed RVM Hydropower Station that will be visible on the surface.**

Indirect opportunities exist to promote the Riemvasmaak community and associated tourism potential through the proposed project and development projects it may bring to the area.

Further to the above, a study carried out by Frost & Sullivan (2013) found that the local content value for both window one and two of the Renewable Energy Independent Power Producer Programme (REIPPP) will be up to R23 205 million. The study also claims that up to 21 214 operational and construction jobs will be created during the first two windows. Overall the REIPPP is expected to attract investment of around R100 billion between 2012 and 2016 (Frost & Sullivan, 2013). Frost & Sullivan (2013) notes that there has been a significant level of investment from government-backed and multilateral financial organisations, including the Development Bank of Southern Africa (DBSA) and the Industrial Development Corporation (IDC).

The EIA phase will consider the Riemvasmaak community and the broader community and assess the impacts from the proposed project. Measures to improve positive impacts will be put forward. This will form part of the Socio-Economic study and the ToR for this study are included in Table 14.

5.4.5.3 Impact on the Energy Production

The draft IRP was published on 8 October 2010 by the National Energy Regulator of South Africa, Department of Energy and the System Operator within Eskom. The IRP sets out a 20 year electricity plan for South Africa and allows for an additional 123 000 MW of renewable energy in the electricity mix in South Africa by 2030. It also notes that there will be a shortfall of supply in the immediate future (2011 – 2017).

There are a number of renewable energy options (including, *inter alia*, wind, solar and hydropower) which are being pursued in South Africa, however many more renewable energy projects are required to meet the targets set by the draft IRP. The benefits of renewable energy, such as is proposed, are the carbon savings of a decreased requirement for energy from non-renewable sources such as coal-fired power stations. Furthermore, the proposed project would contribute towards South Africa's energy requirements. The potential impact on energy production will be assessed by Aurecon in the EIR.

5.4.6 Impact on Agriculture

Though agriculture is the main economic contributor in the local area, no impact to the sector as a result of the proposed project is expected. This is because the area is not zoned for agriculture. The nearest agricultural farm lands are 4 km upstream of the proposed weir on the Orange River. Water would only be diverted and later released into the Orange River again. Therefore no water would be lost and it would not impact irrigation farmers downstream. Local farmers have raised concern that the weir may flood drainage pipes on the island on the south side of the weir. This would be considered by the engineers in the design of the weir and discussed in more detail during the EIA phase. Another potential impact could be that of traffic during the construction phase (approximately 9 trucks accessing the site per day are anticipated) and the possible impact it may have on the collection and delivery of agricultural produce in the area. This would however only be for a short period of time and will be addressed by the EMP. As such no further assessment of the potential impact on agriculture will be undertaken.

5.4.7 Impact on Fauna (including Avifauna)

Impact on fauna would mostly be limited to the construction phase of the project considering that clearing of vegetation would happen during the construction phase (refer to 5.3.1 Disturbance of Flora and Fauna, p.73). The transmission line would however impact on birds during the operational phase ~~if it is not~~ for the section where it would surface (i.e. not be buried) on private land once it had crossed Riemvasmaak and SANParks' properties.

The impact on fauna, including avifauna, will be assessed in a Faunal Study during the EIA phase. The ToR for this study is included in Table 14.

5.4.8 Planning

Though planning is not an impact as such, it does need to be considered given the unique situation of the proposed project's location in the management area of the AFNP ~~a National Park~~. The proposed project's infrastructure would be located within an area which is currently zoned as either Primitive or Remote, as demarcated in the AFNP Management Plan (March 2008) and falls in the 'special management area' category of visual protection. The approved Management Plan could be revised to accommodate the proposed infrastructure if environmental authorisation is received. Amendments to the Management Plan and Zoning must be done according to a legislated process and in terms of the National Protected Areas Act. Should the project receive environmental authorisation application would be made to amend the AFNP Management Plan.

5.5 Decommissioning Phase Impacts on the Biophysical and Socio-Economic Environments

This section of the report summarises the biophysical and socio-economic environment and considers the decommissioning phase impacts on the biophysical and socio-economic environment that may be associated with the proposed activities, including the following:

- Sedimentation and erosion of water ways;
- Hazardous substances on site;
- Dust impact;
- Impact on local economy (employment) and social conditions;
- Impact on traffic;
- Impact on flora;
- Impact on fauna (including avifauna ~~and bats~~);
- Impact on surface water;
- Impact on heritage resources (including palaeontology);
- Impact on visual aesthetics;
- Impact on local economy (employment) and social conditions; and
- Impact of noise.

Depending on the economic feasibility RVM1 might consider replacing only certain components of the project and extending the life of the facility. In order to assess the possible impacts of decommissioning the proposed hydropower station it is assumed that the facility would be completely decommissioned at the end of the official agreement (i.e. 20 years), unless a new PPA (Power Purchaser's Agreement) is signed ~~(expected lifespan 30 years from the date of commissioning)~~. The decommissioning is expected to take between 12 to 18 months. Impacts associated with the

decommissioning phase are expected to be in close correlation with impacts identified in for construction phase.

After disconnecting the hydropower station infrastructure from the electricity network, all above ground components would have to be disassembled, removed and recycled as far as possible. Underground components would most likely be left *in situ.*

Rehabilitation of the disturbed areas would form part of the decommissioning phase. The aim would be to restore the land to its original substratum characteristics (or as near as possible). A number of jobs during the decommissioning phase of the proposed project would be created. The necessary activities will be assessed by Aurecon in the EIR and measures to manage impacts included in the EMP.

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6 PLAN OF STUDY FOR THE EIA

The purpose of this Chapter is to detail the Plan of Study for the EIA Phase to ensure that the impacts are adequately addressed in the EIA Phase. This section furthermore describes the assessment methodology that will be utilised in determining the significance of the impacts associated with the proposed project on the socio-economic and biophysical environment. Where additional information is required for detailed assessment in the EIR, the ToR for specialist studies are given.

6.1 Purpose of the Plan of Study for the EIA

The Scoping process has been documented in this Scoping Report, which has identified various potential environmental impacts and project alternatives that require detailed investigation. This Plan of Study is the culmination of the Scoping Phase and its purpose is to ensure that the EIA Phase of this EIA process satisfies the requirements of NEMA. Accordingly, this Plan of Study for EIA outlines the anticipated process and products for the EIA Phase.

This Plan of Study for EIA has been compiled in terms of GN No. R.33306 of 18 June 2010 of NEMA and will be submitted to DEA for their consideration.

6.2 Description of the Proposed Activity

The nature of the activity is described in detail in Chapter 3, but in brief includes the following:

The proposed hydropower facility would be a run-of-river hydropower scheme able of producing a maximum of 40 MW of electricity. A portion of the river's flow is channelled through the hydropower station and through turbines to generate electricity.

The proposed hydropower station would consist of the following main components:

- Intake infrastructure (i.e. weir and off-take structure);
- Water conveyance infrastructure (i.e. canal or pipeline);
- Head pond/ forebay;
- Power station intake structure/ penstock;
- Powerhouse; and
- Outlet works/ tailrace.

Ancillary infrastructure includes access roads for use during construction and for maintenance purposes during operation, transmission line for evacuating the energy produced by the hydropower station, switchgear and transformers.

6.3 Description of Tasks to be Performed

6.3.1 Potential Environmental Impacts identified during Scoping

Chapter 5 has identified the range of potential environmental impacts associated with the proposed project. During this scoping exercise a shortlist of potentially significant environmental impacts was identified for further, more detailed investigation during the EIA Phase. Specifically the following potential environmental impacts have been identified:

- Construction phase impacts on the biophysical and socio-economic environments:
    - Disturbance of flora and fauna (including bats);
    - Impact on heritage
    - Sedimentation and erosion of water ways;
    - Impact on local economy (jobs) and social conditions;
    - Visual impact
    - Impact on traffic;
    - Storage of hazardous substances on site;
    - Noise impacts and
    - Dust impacts;
- Operational phase impacts on the biophysical environment and socio-economic environments:
    - Botanical Impacts;
    - Impact on aquatic resources;
    - Visual impacts;
    - Impact of noise;
    - Impact on the socio-economic environment (including community, tourism, and energy impacts)
    - Impact on agriculture;
    - Impact on fauna (including Avifauna); and
    - Planning
- Decommissioning phase impacts on the biophysical and socio-economic environments
    - Sedimentation and erosion of water ways;
    - Hazardous substances on site;
    - Dust impact.
    - Impact on local economy (employment) and social conditions;
    - Impact on traffic;
    - Impact on flora;
    - Impact on fauna (including avifauna ~~and bats~~);
    - Impact on surface water.
    - Impact on heritage resources (including palaeontology);
    - Impact on visual aesthetics;
    - Impact on local economy (employment) and social conditions; and
    - Impact of noise.

6.3.2 Method of Assessing the Significance of Potential Environmental Impacts

This section outlines the proposed method for assessing the significance of the potential environmental impacts outlined above. As indicated, these include construction, operational and decommissioning phase impacts.

For each impact, the EXTENT (spatial scale), MAGNITUDE and DURATION (time scale) would be described. These criteria would be used to ascertain the SIGNIFICANCE of the impact, firstly in the

case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the EIR would represent the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented. A letter will be obtained from RVM1 indicating which measures will be implemented and this letter will be included in the Final EIR.

The tables on the following pages show the scale used to assess these variables, and defines each of the rating categories.

Assessment criteria		
Criteria	**Category**	**Description**
Extent or spatial influence of impact	**Regional**	Beyond a 10 km radius of the candidate site.
	Local	Within a 10 km radius of the candidate site.
	Site specific	On site or within 100 m of the candidate site.
Magnitude of impact (at the indicated spatial scale)	**High**	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact	**Construction period**	Up to 2 years
	Short Term	Up to 5 years after construction
	Medium Term	5-15 years after construction
	Long Term	More than 15 years after construction

Table 9 | Assessment criteria for the evaluation of impacts.

The SIGNIFICANCE of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in Table 10.

Significance ratings	
Significance ratings	**Level of criteria required**
High	• High magnitude with a regional extent and long term duration • High magnitude with either a regional extent and medium term duration or a local extent and long term duration • Medium magnitude with a regional extent and long term duration
Medium	• High magnitude with a local extent and medium term duration • High magnitude with a regional extent and construction period or a site specific extent and long term duration • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration

Significance ratings	
Significance ratings	**Level of criteria required**
	• Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long term duration
Low	• High magnitude with a site specific extent and construction period duration • Medium magnitude with a site specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long term duration
Very low	• Low magnitude with a site specific extent and construction period duration • Very low magnitude with any combination of extent and duration except regional and long term
Neutral	• Zero magnitude with any combination of extent and duration

Table 10 | Definition of significance ratings.

Once the significance of an impact has been determined, the PROBABILITY of this impact occurring as well as the CONFIDENCE in the assessment of the impact, would be determined using the rating systems outlined in Table 11 and Table 12. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring. Lastly, the REVERSIBILITY of the impact is estimated using the rating system outlined in Table 13.

Probability ratings	
Probability ratings	**Criteria**
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 11 | Definition of probability ratings.

Confidence Ratings	
Confidence ratings	**Criteria**
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 12 | Definition of confidence ratings.

Reversibility Ratings	
Probability ratings	**Criteria**
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 10 years after the cause or stress is removed.

Table 13 | Definition of reversibility ratings.

6.4 Need for Additional Information: Specialist Studies

In reviewing the potential environmental impacts, a number of specialist studies were identified to provide input into the EIR so that the potential impacts can be adequately assessed. Accordingly, we propose to undertake the specialist studies listed in Table 14, in order to address a suite of potential environmental impacts. The ToR for investigations as well as the identified specialists are outlined. A short summary of the various specialist consultants is given (CVs are available upon request).

Proposed Specialist Investigations			
Study	**Consultant**	**Specialist Summary**	**The proposed ToR for this specialist study are as follows**
Botanical Impact Assessment	**Dr Dave McDonald**	Dr Dave MacDonald of Bergwind Botanical Surveys' and Tours cc will undertake the requisite assessment. Dr MacDonald is a botanical ecologist with 20 years of experience in the field of vegetation science. Dr MacDonald is registered as a Professional Natural Scientist with the SACNASP.	• Provide a broad description of the botanical characteristics of the site and surrounds; • Identify and describe biodiversity patterns at community and ecosystem level (main vegetation type, plant communities in the vicinity and threatened/ vulnerable ecosystems species), at species level (Red Data Book species, presence of alien species) and in terms of significant landscape features; • Assess the potential direct and indirect and cumulative impacts resulting from the proposed development (including the canal / pipelines, power-house , transmission lines and associated infrastructure e.g. access roads), both on the footprint and the immediate surrounding area, during construction, operation and decommissioning; • Comment on whether or not biodiversity processes would be affected by the proposed project, and if so, how these would be affected; • Provide a detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts and improve positive impacts for each phase of the project; • Include a detailed vegetation rehabilitation plan to show how impacts will be mitigated; • Consider any relevant guidelines and take cognisance of the Department of Environmental Affairs and Development Planning guideline: "Guideline for involving biodiversity specialists in EIA processes" (Brownlie, 2005) as well as the requirements of the Botanical Society of South Africa (BotSoc) and CapeNature in developing an approach to the botanical investigation; and • Assist in the assessment of the sustainability of the project, based on criteria contained in the DSR.

Proposed Specialist Investigations			
Study	**Consultant**	**Specialist Summary**	**The proposed ToR for this specialist study are as follows**
Aquatic Impact Assessment	~~**James MacKenzie**~~ **Mathew RossRob Palmer**[16]	~~James MacKenzie~~ Mathew Ross from ~~MacKenzie Ecological & Development Services CC~~ EnviRoss CC will be undertaking the Aquatic Study for the proposed project. Mr Ross is a registered Natural Scientist. ~~Mr MacKenzie has done work in the Orange River for other hydropower projects upstream of the proposed scheme.~~	• Undertake an initial desktop study of reputable sources to provide background information for the aquatic ecological assessment; • Collect primary data from the Orange Rivers and side channels on site to provide information regarding riparian and instream sensitivity and importance; • Undertake the requisite field work and compile a report that considers the following aspects: o Broad description of the aquatic ecology of the candidate sites and surrounding wetlands/riparian zones and streams including aquatic assessment and habitat classification; o Delineation of riparian zones or wetlands; o Assessment of the consequences of the various release options on the ecological state of the river; o Assessment of the ecological state, importance and sensitivity of aquatic ecosystems on the site, together with an assessment of the ecological services provided by these ecosystems, using standard methods (such as the EcoClassification method); o General comment on whether ecosystem processes would be affected (including comment on how these would be affected); o Identification of potential impacts, including cumulative impacts, and recommendations to prevent or mitigate these; o Take cognisance of any guidelines which may be relevant including the Department of Environmental Affairs and Development Planning guideline: "Guideline for involving biodiversity specialists in EIA processes" (Brownlie, 2005). • Assist in the assessment of the sustainability of the project, based on criteria contained in the DSR.

[16] Due to capacity constraints a new Aquatic Ecologist has been appointed.

Proposed Specialist Investigations			
Study	**Consultant**	**Specialist Summary**	**The proposed ToR for this specialist study are as follows**
Visual Impact Assessment	**Lourens du Plessis**	The visual impact assessment will be undertaken by Lourens du Plessis from MetroGIS (Pty) Ltd in his capacity as a visual assessment specialist and Professional Geo-information Sciences (PrGISc) Practitioner. Lourens has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.	• Identify issues relating to visual, aesthetic and scenic resources through a desktop study of existing literature and a site visit; • Describe the receiving environment and the proposed projects in terms of landscape character and land use; • Create a detailed digital terrain model (DTM) of the potentially affected environment; • Source relevant spatial data, including cadastral features, vegetation types, land use activities, topographical features, site placement, etc; • Create viewshed analyses of the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses should take into account the dimensions of the proposed structures; • Establish the view catchment area, view corridors, viewpoints and receptors; • Include photomontages for the construction and operational phases of the proposed project as would be seen from various perspectives within AFNP or other sensitive areas; • Undertake an assessment of the visual impacts at the site in terms of the scale of impact (local, regional, national), magnitude of impact (low, medium or high) and the duration of the impact (construction, up to 10 years after construction, more than 10 years after construction). The assessments must take into account the expected community response as well as any applicable South African standards and should also indicate the potential cumulative impacts; • Describe potential mitigation measures to reduce or eliminate the potential visual impacts identified; • Cognisance must be taken of the Department of Environmental Affairs and Development Planning guideline: “Guideline for involving visual and aesthetic specialists in EIA processes”; and • Assist in the assessment of the sustainability of the project, based on criteria contained in the DSR.

Proposed Specialist Investigations			
Study	**Consultant**	**Specialist Summary**	**The proposed ToR for this specialist study are as follows**

Heritage Impact Assessment	**Dr Jayson Orton**	Dr Jayson Orton from ACO Associates has been appointed to undertake the requisite Heritage Impact Assessment for the proposed project. Dr Orton has extensive experience in conducting heritage assessments for various projects all over South Africa.	• Conduct a detailed desktop level investigation to identify known archaeological, cultural and historic sites in the proposed development area;
			• Undertake field work to verify the results of the desktop investigation;
			  ○ Document (GPS coordinates and map) all sites, objects and structures identified;
			  ○ Compile a report which would include:
			  ▪ Identify archaeological, cultural and historic sites within the proposed development area;
			  ▪ Assess the sensitivity and significance of all heritage remains on the site;
			  ▪ Evaluate the potential impacts, including cumulative impacts, of construction, operation and maintenance of the proposed development on heritage resources, in terms of the scale of impact (local, regional, national), magnitude of impact (low, medium or high) and the duration of the impact (construction, up to 10 years after construction (medium term), more than 10 years after construction (long term));
			  ▪ Recommend mitigation measures to ameliorate any negative impacts on areas of heritage importance;
			  ▪ Consider any relevant guidelines and take cognisance must be taken of the Department of Environmental Affairs and Development Planning guideline: "Guideline for involving heritage specialists in EIA processes" (Winter & Baumann 2005).
			• Assist in the assessment of the sustainability of the project, based on criteria contained in the DSR.

Socio-Economic Impact Assessment (including Tourism)	**Dr R.D. Heinsohn**	Dr Dieter Heinsohn has 21 years' experience in EIA's, Social Impact Assessments, Monitoring and Evaluation, Management of Public Participation Programmes, Resettlement Planning and Implementation and Project Management.	• Provide a baseline socio-economic analysis to provide an understanding of the current socio-economic environment; • Describe and evaluate the potential impacts, including cumulative impacts, of construction, operation and maintenance of the proposed development on the socio-economic environment, in terms of the scale of impact (local, regional, national), magnitude of impact (low, medium or high) and the duration of the impact (construction, up to 10 years after construction (medium term), more than 10 years after construction (long term)); • Recommend mitigation measures to ameliorate any negative impacts and to enhance positive impacts. • Provide comment on the impact on tourism, using the existing Tourism Study for the proposed project as a basis; • Assess the impact of the reduced flow over the Falls on tourism; • Assist in the assessment of the sustainability of the project, based on criteria contained in the DSR.

Proposed Specialist Investigations			
Study	**Consultant**	**Specialist Summary**	**The proposed ToR for this specialist study are as follows**

Faunal Impact Assessment	**Warren McCleland**	Mr McCleland has 14 years of experience in conducting baseline surveys, data analysis and report writing in various biomes in Southern Africa.	• Undertake a desktop review of relevant faunal literature and undertake a site visit.
			• Compile a report including:
			• The findings of the existing ecology-related studies (aquatic ecology and botany) as relevant.
			• Information on vertebrate fauna, including avifauna, likely to be present on the site and surrounds.
			  ○ Identify and describe biodiversity patterns at community and ecosystem level (animal species in the vicinity and threatened/ vulnerable ecosystems species) and at species level (Red Data Book species);
			  ○ Provide an assessment of the potential direct and indirect and cumulative impacts resulting from the proposed development (including the canal / pipelines, power-house, transmission lines and associated infrastructure e.g. access roads), both on the footprint and the immediate surrounding area, during construction, operation and decommissioning;
			  ○ Map any sensitive areas identified;
			  ○ Comment on whether or not ecological processes would be affected by the proposed project, and if so, how these would be affected;
			  ○ Provide a detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts and improve positive impacts for the project;
			  ○ Consider any relevant guidelines and take cognisance of the Department of Environmental Affairs and Development Planning guideline: "Guideline for involving biodiversity specialists in EIA processes" (Brownlie, 2005); and
			• Assist in the assessment of the sustainability of the project, based on criteria contained in the DSR.

Table 14 | Proposed Specialist Investigations.

6.5 Reasonable Project Alternatives Identified during Scoping

Chapter 3 reviewed a range of project alternatives associated with the proposed activities. Pursuant to this Scoping exercise, which was based on input from the authorities, I&APs and various specialists, a shortlist of reasonable project alternatives has been identified for further, more detail investigation during the EIA Phase, namely:

- Location alternatives
  - Only the current location (site) of the proposed hydropower station will be considered.
- Activity alternatives
  - Only energy generation by means of a hydropower station will be considered.
- Site layout alternatives
  - Only one site layout alternative, which includes the two options for the routing of the midsection of the pipeline, will be considered; and
  - Two routing alternatives for the transmission line.

- Technology alternatives
    - Blasting and drilling vs. raise bore method for the powerhouse construction.
    - Underground vs. aboveground switchroom.
- The “no-go” alternative

6.6 The Environmental Impact Assessment Report

The purpose of the EIR would be to undertake a comparative assessment of the relative significance of the potential environmental impacts for the proposed hydropower station and its alternatives. The EIR would thus include the following:

- A brief overview of the potential environmental impacts and reasonable alternatives identified during the Scoping investigation.
- A summary of the key findings of the various specialist studies as they pertain to the affected environment.
- An overview of the public participation process conducted during the compilation of the EIR.
- A detailed assessment of the significance of the potential environmental impacts for the various project alternatives. This assessment, which would use the methodology outlined in Section 6.3.2, would be informed by the findings of the specialist studies, and professional judgement.
- An overview of the full range of mitigation measures including an indication of how these would influence the significance of any potential environmental impacts, together with a lifecycle EMP. The mitigation measures would be informed by the specialist studies, professional experience and comment received from I&APs.
- A set of recommendations regarding the way forward would be provided, should any of the proposed alternatives be authorised in terms of NEMA.

6.7 Public Participation Process

The purpose of the public participation process would be to provide I&APs with adequate opportunity to have input into the environmental process. The public participation process would include the following:

6.7.1 Public Comment on the Draft EIR

Following the completion of the Draft EIR (refer to Section 6.6 above), it will be lodged at the Kakamas Public Library, the AFNP reception and on Aurecon’s website (www.aurecongroup.com). In addition to the aforementioned, three reports would also be distributed amongst the Riemvasmaak Community. I&APs will be notified of the lodging of the reports by means of letters, email or sms depending on what contact details are available. The Riemvasmaak Community would be notified through their community representatives as this has been found to be the most effective method, due to a large portion of the community being situated in a remote area and without contact details.

The letters will include a non-technical Executive Summary, in English and / or Afrikaans. I&APs will be provided with 40 days in which to comment on the report. During the comment period a public meeting will be held with I&APs. Details of the meeting will be communicated to I&APs by any of the above means. A Focus Group Meeting will be held with SANParks.

The public comments would be consolidated into a CRR, which would summarise the issues raised and provide the project team's responses thereto. The comments and the CRR would form an annexure of the EIR. The draft report would also be revised in light of feedback from the public, where necessary.

6.7.2 Public Comment on the Final EIR

Once the EIR has been finalised and submitted to DEA for decision-making, it will be made available for a 21 day comment period. The report will be made available in the same locations in which the Draft EIR was made available, and I&APs will be notified of the availability of the Final EIR in writing. Any comments received will not be included in a CRR but will instead be collated and forwarded directly to DEA.

6.7.3 Opportunity for Appeal

All registered I&APs would be notified in writing of the release of the Environmental Authorisation. They would be reminded of their right to appeal against DEA's decision to the Minister of Environmental Affairs in terms of NEMA.

6.8 Proposed Programme

A summary of the proposed programme is given in Table 15 below.

Proposed EIA Programme	
Activity	**Proposed Date**
2nd round of public engagement: • Letter to I&APs • Lodge DSR in public venues and with Authorities • Focus group and Public meetings • Public comment period on DSR ends • Comment period on FSR	 July 2013 (completed) July 2013 (completed) August 2013 (completed) August 2013 (completed) September/ October 2013
Submit FSR (incl. Plan of Study for EIA) to environmental authority	September 2013
3rd round of public engagement: • Letter to I&APs • Lodge DEIR in public venues • Focus group and Public meetings, if necessary • Public comment period on DEIR ends • Comment period on FEIR	 ~~January 2014~~ November 2013 ~~January 2014~~ November 2013 ~~January 2014~~ December 2013/ January 2014 ~~February~~ January 2014 March~~/ April~~ 2014
Submit final EIAR to environmental authority	February 2014

Table 15 | Proposed EIA Programme.

6.9 Personnel

Aurecon have selected a team of highly experienced specialists and multi-disciplinary practitioners in order to execute this project as professionally as possible.

The Project Director, Mr Andries van der Merwe is a certified Environmental Engineer registered with the Engineering Council of South Africa (PrEng) and holds a B Eng (Civil) degree. Mr van der Merwe has over 13 years' experience in the field of impact assessment.

Miss Louise Corbett, the Project Manager and designated EAP, will manage the EIA process. Nelis Bezuidenhout will be responsible for undertaking the requisite PPP process and the reporting. A short summary of these consultants is provided below.

Miss Corbett, the Project Manager, is an Associate and Senior Environmental Practitioner in Aurecon's Cape Town office. She has seven years' experience in the environmental field and has compiled and managed numerous environmental investigations, including EIAs, EMPs and Environmental Management Programmes. Louise has a particular interest in the energy sector and has undertaken numerous large environmental projects in this field, in particular renewable energy projects. Miss Corbett is a registered Professional Natural Scientist with SACNSP.

Mr Bezuidenhout has a BA Degree in Development and Environment, as well as a Masters in Philosophy, specialising in Environmental Management, from the University of Stellenbosch. Mr Bezuidenhout has been exposed to a number of EIA projects that range from cement plants through to bulk water pipelines and wind farms. He has specific interest in renewable energy. Nelis also has some Environmental Control Officer experience.

Aurecon and the above EAPs are bound by the codes of conduct for ~~EAPSA and~~ SACNSP. The Curriculum Vitae's of the Aurecon staff are available upon request.

7 CONCLUSIONS AND WAY FORWARD

The purpose of this Chapter is to briefly summarise and conclude the Draft Scoping Report and describe the way forward.

7.1 Conclusions

As per the requirements of NEMA, this Scoping investigation has reviewed a range of project alternatives and contemplated the array of potential environmental impacts associated with the following proposed activities on the Riemvasmaak site. The Scoping investigation is largely based on the information and studies gathered, as well as input from I&APs, during the initial BA process that was underway for the proposed project. The following feasible alternatives have been identified for further consideration in the EIR:

- Location alternatives
  - Only the current location (site) of the proposed hydropower station will be considered.
- Activity alternatives
  - Only energy generation by means of a hydropower station will be considered.
- Site layout alternatives
  - Only one site layout alternative, which includes the two options for the routing of the midsection of the pipeline, will be considered; and
  - Two routing alternatives for the transmission line.
- Technology alternatives
  - Blasting and drilling vs. raise bore method for the powerhouse construction.
  - Underground vs. aboveground switchroom.
- The “no-go” alternative

Specifically the following potential environmental impacts have been identified for further consideration in the EIR:

- Construction phase impacts on the biophysical and socio-economic environments:
  - Disturbance of flora and fauna (including bats);
  - Impact on heritage
  - Sedimentation and erosion of water ways;
  - Impact on local economy (jobs) and social conditions;
  - Visual impact
  - Impact on traffic;
  - Storage of hazardous substances on site;
  - Noise impacts; and
  - Dust impacts;
- Operational phase impacts on the biophysical environment and socio-economic environments:
  - Botanical Impacts;
  - Impact on aquatic resources;
  - Visual impacts;
  - Impact of noise;

- Impact on the socio-economic environment (including community, tourism and energy impacts)
- Impact on agriculture;
- Impact on fauna (including Avifauna); and
- Planning

- Decommissioning phase impacts on the biophysical and socio-economic environments
  - Sedimentation and erosion of water ways;
  - Hazardous substances on site;
  - Dust impact.
  - Impact on local economy (employment) and social conditions;
  - Impact on traffic;
  - Impact on flora;
  - Impact on fauna (including avifauna ~~and bats~~);
  - Impact on surface water.
  - Impact on heritage resources (including palaeontology);
  - Impact on visual aesthetics;
  - Impact on local economy (employment) and social conditions; and
  - Impact of noise.

7.2 The Way Forward

This DSR has been lodged on Aurecon's website (www.aurecongroup.com, change "Current Location" to "South Africa" and follow the "Public Participation" link), the Kakamas Public Library and at the AFNP reception area. Two additional reports were also distributed through a community representative to the Riemvasmaak Community.

I&APs had 40 days, until 28 August 2013, to submit their written comments on the DSR. Cognisance was taken of all comments in compiling the final report and the comments, together with the project team and client responses thereto, are included in this report as Annexure C.

I&APs were invited to attend a public meeting that was held on 5 August 2013 at the Kalahari Gateway Hotel in Kakamas. An open-house meeting was also held from 16h00 till 17h00 on the same day as the public meeting. The open-house meeting was an informal meeting where I&APs could engage with the project team and view posters. A formal presentation was presented from 17h00 till 19h00. It included a facilitated question and answers session.

The FSR has been submitted to DEA and the Northern Cape DEANC for their review and comment, respectively. DEA will either reject the application or instruct the client to proceed to the EIA Phase, either as proposed in the Plan of Study for EIR, or direct that amendments are made before continuing.

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National Environmental Management: Biodiversity Act, Act No. 10 of 2004

The National Environmental Management: Protected Areas Act, Act No. 57 of 2003

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National Heritage Resources Act, Act No. 25 of 1999

National Water Act, Act No. 36 of 1998

Northern Cape Nature Conservation Act, Act No. 9 of 2009

Siyanda District IDP, 2012 - 2017

The Integrated Resource Plan, 2010

The National Energy Act, Act No. 34 of 2008

The National Environmental Management: Waste Act, Act 59 of 2008

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9 REPORT TRANSMITTAL NOTE

No of Hard-copies	No of E-copies	DISTRIBUTION RECORD (hard copy)			
		To (Name)	Organisation	Rev	Date sent
2	2	Mpho Monyai	Department of Environmental Affairs	Final	13 September 2013
0	1	Natalie Uys	Northern Cape Department of Environmental Affairs and Nature Conservation (DEANC)	Final	16 September 2013
0	1	The Mayor	Kai! Garib Local Municipality	Final	16 September 2013
0	1	The Mayor	Siyanda District Municipality	Final	16 September 2013
1	0	Fabie Basson	Kakamas Public library	Final	16 September 2013
1	1	Leane Smith	SANParks Reception	Final	16 September 2013
0	1	A.B. Abrahams	Department of Water Affairs (DWA)	Final	16 September 2013
0	1	Leon Terreblanche	Department of Agriculture, Land Reform & Rural Development, Northern Cape	Final	16 September 2013
0	1	Katie Smuts	South African Heritage Resources Agency (SAHRA) (Uploaded to SAHRA website)	Final	16 September 2013
0	1	Timothy Ratha	Northern Cape Provincial Heritage: Boswa ya Kapa Bokone;	Final	16 September 2013
0	1	SP Mokuele (Director)	Department of Energy (Northern Cape): Regional Energy Director	Final	16 September 2013
0	1	John Geeringh	Eskom Holdings Limited	Final	16 September 2013
0	1	Dr Howard Hendricks	SANParks	Final	16 September 2013
0	1	Jacoline Mans	Northern Cape Department of Agriculture, Forestry and Fisheries (DAFF)	Final	16 September 2013
0	1	Mr Andile Hawes	Department of Agriculture, Forestry and Fisheries (National)	Final	16 September 2013
0	1	Mr Trevor Bloem	Department of Tourism (National)	Final	16 September 2013

0	1	Mr Johann van Schalkwyk	Northern Cape Department of Economic Development and Tourism	Final	16 September 2013
0	1	Mr Walther van der Westhuizen	National Department of Water Affairs	Final	16 September 2013

Distributed by : **Nelis Bezuidenhout**

(Full name) (Signature)

Unit/Office : Cape Town Delivery Centre **Date :** 13 September 2013