

**Public Review Document**

**Draft Scoping Report for the Proposed Construction of the North Hydroelectric Power Site, Orange River, Siyancuma Local Municipality, Northern Cape**

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View of the Orange River downstream to the proposed North Hydroelectric Power Site

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## EXECUTIVE SUMMARY

Sidala Energy Solutions (Pty) Ltd. (hereafter referred to as Sidala) is a South African based development company operating in the emergent renewable energy industry. An Independent Power Producer, the company has identified two sites along the Orange River between Hopetown and Douglas that have the potential of generating just under 40MW of power. Referred to as the *North* and *South* Sites, these would utilise the flows released from the Vanderkloof Dam to move through the hydroelectric power facility and mechanise the turbine for generation of electricity. This assessment investigates and describes the **North Site** only.

The facility will comprise of a weir in the river; a short canal with headrace, powerhouse and tailrace and an access road. The facility is proposed to have a design flow rate of 100m<sup>3</sup>/s, with an average turbine-generator efficiency of approximately 85% and capacity output of 22MW. The identification of the proposed site location was determined through investigation regarding geology, hydrology (flow duration only), physical properties such as river cross sections, tailwater and area inundation, site access and hydro potential. A twenty year operational period would ensue following construction with feed-in of electricity into Eskom's national grid.

This Draft Scoping Report (DSR) focuses on identifying the environmental impacts associated with the **North Site**, situated on the Orange River between the Remainder of Farm Tullochgorum No. 158 and the Remainder of Farm Kameelsdrift No. 285. The DSR forms part of a greater Scoping and Full Environmental Impact Assessment (EIA) process, which is subject to the conditions of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Environmental Impact Assessment (EIA) Regulations of 18 June 2010 and supporting guidelines.

Enviroworks (an Independent Environmental Consultancy) was appointed as the project Environmental Assessment Practitioners (EAP) to carry out this EIA process, so as to address the impact of the proposed activity; a practice which entails amongst others site surveys, impact identification, public participation, as well as impact rating and review.

The following outcomes are intended to be achieved through this DSR:

- Detail the nature and extent of the activity;
- Identify and describe feasible alternatives;
- Identify and describe potential issues linked to the proposed activity; and
- Quantify the level of investigation to be undertaken during the forthcoming EIA process.

Several factors assisted towards addressing these aims, through the involvement of role-players such as the project applicant, the engineering consultant, interested and affected parties (I&APs), stakeholders and specialist consultants.

Coupled to the publishing of this report, a 40 day comment period will run concurrently during which time stakeholders and I&APs have the opportunity to review all documentation and provide comment for further discussion, examination and integration into the EIA process.

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## **ABBREVIATIONS AND ACRONYMS**

CO <sub>2</sub> e	Carbon Dioxide Equivalent
CRR	Comments and Response Report
DEA	Department of Environmental Affairs
DEANC	Department of Environmental Affairs and Nature Conservation
DM	District Municipality
DMR	Department of Mineral Resources
DoE	Department of Energy
DSR	Draft Scoping Report
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FSR	Final Scoping Report
Ha	Hectares
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IPP	Independent Power Producer
kV	Kilovolt
LM	Local Municipality
MW	Megawatt
NEMA	National Environmental Management Act
NERSA	National Energy Regulator of South Africa
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment
WULA	Water Use Licence Application

## INTRODUCTION

Sidala Energy Solutions (Pty) Ltd. (hereafter referred to as Sidala) is a South African based development company operating in the emergent renewable energy industry. The company has identified two sites along the Orange River between Hopetown and Douglas that have the potential of generating just under 40MW of power. Referred to as the *North* and *South* Sites, these would utilise the flows released from the Vanderkloof Dam. This assessment investigates the **North Site** only.

Globally, hydropower (both small and large) as a “renewable resource”, represents 19% of the world’s electricity production (*Paish 2002: 537*). Small-scale hydro is in most cases operated by means of in-stream flow, with no dam or water storage, making it a highly cost-effective, low impact technology for deployment in rural areas of developing countries. Once a hydroelectric power facility is constructed, the project produces no direct waste, and has a considerably lower output level of the greenhouse gases than fossil fuel powered energy plants.

Sidala intends to develop a hydroelectric power facility to harness the high level of renewable energy potential of the flows released from the Vanderkloof Dam. To capacitate the South African Government’s commitment to reduce the countries’ greenhouse gas emissions and transition to a low-carbon economy, the Department of Energy introduced the Renewable Energy Independent Power Producer Procurement Programme. The programme was designed to enable the contribution of renewable energy by independent companies towards a national target of 3 725 megawatts by 2030 (*Department of Energy 2012*).

Several aspects are important in determining the feasibility of the proposed development activity and are detailed in this report. The Orange River is South Africa’s longest river and a significant collection source for a substantial portion of the country’s water. A variety of uses centre around the river as an important enabler, including it being a source of irrigation for agriculture, water for mining and industry, as well as providing small businesses and the public with opportunities for recreational, sporting and adventure type activities.

### 1.1. Background to the project

The North Site small-scale hydroelectric power facility is proposed to be constructed on a portion of the Orange River, which falls between the Remainder of Farm Tullochgorum No. 158 and Remainder of Farm Kameelsdrift No. 285. The development shall comprise a weir and associated infrastructure, as well as a 132kV power line. The site is situated approximately 25km south-west of Douglas, and falls within the jurisdiction of the Siyancuma Local Municipality, situated within the greater Pixley ka Seme District Municipality. Near to the provincial road, the R385 runs to the East of the site and a gravel road to the West. Both these roads link Douglas in the North with Hopetown in the South.

The proposed facility will comprise a weir with powerhouse, switchyard, headrace and tailrace, as well as a dam wall.

### 1.2. Applicant

Sidala Energy Solutions (Pty) Ltd. is the project proponent and would be the owner of the proposed small-scale hydroelectric power facility. The property adjacent the Orange River on which the

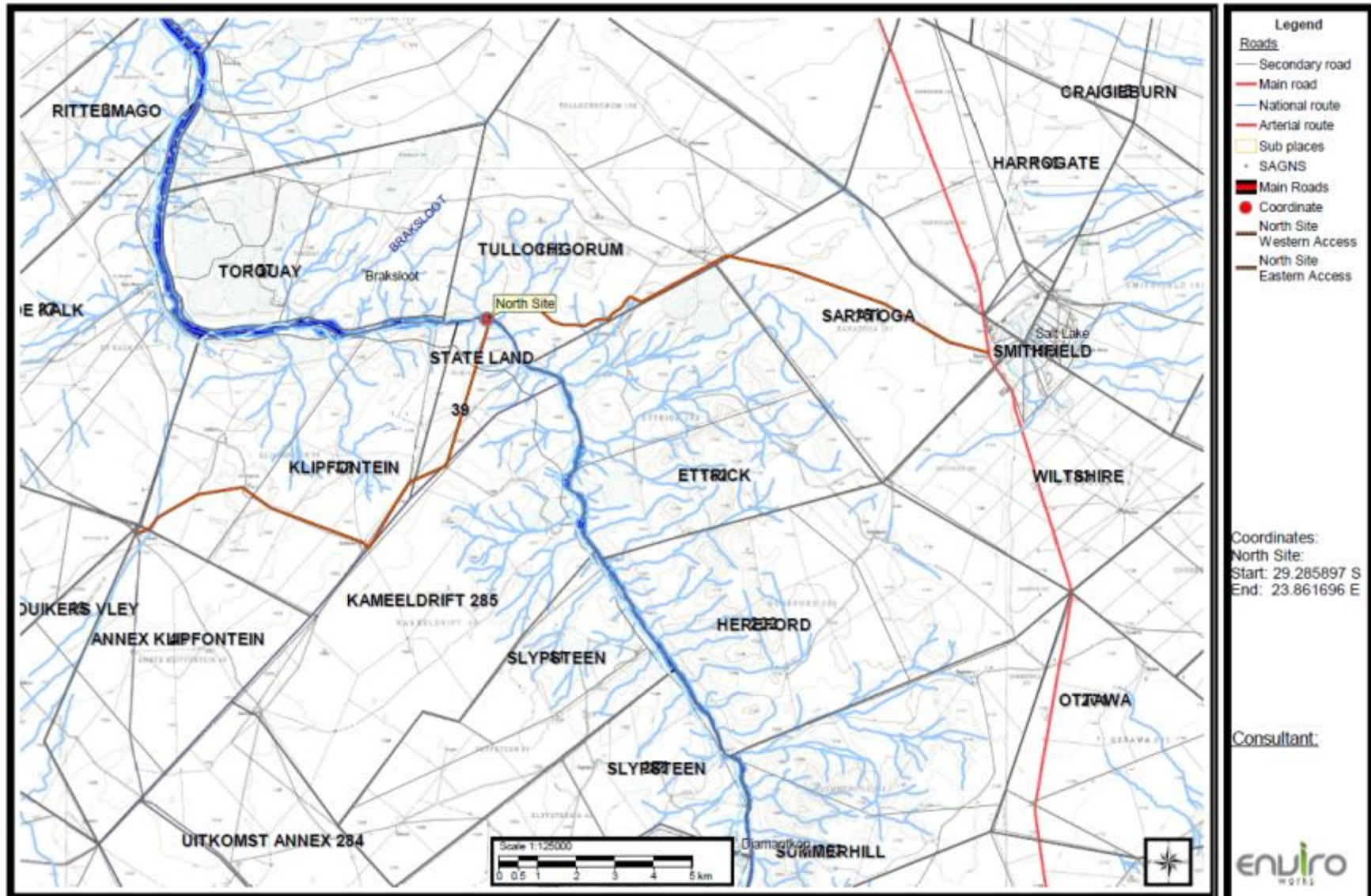
proposed facility falls is privately owned, whilst the Department of Water Affairs maintains authority over water use for the Orange River and activities, which would impact on this river system.

### **1.3. Locality**

The proposed small-scale hydroelectric power facility will be situated on the Orange River at coordinates -29.285897°; 23.861696° between the Remainder of Farm Tullochgorum No. 158 and Remainder of Farm Kameelsdrift No. 285. The site is accessible by use of existing gravel tracks traversing neighbouring farms to the site. A gravel road, currently being upgraded to tar runs parallel to the Orange River between Hopetown and Douglas on the western side. This road will provide access to the Farm Kameelsdrift No. 285. A well maintained gravel road links access to Farm Tullochgorum No. 158 via neighbouring farm portions with the regional road, the R385 that runs parallel to the Orange River on the eastern flank. One of these two roads is proposed to be upgraded, to allow for access of machinery and vehicles during construction and maintenance activities during operation of the proposed small-scale hydroelectric power facility.

**Figure 1** below illustrates the locality of the proposed facility in relation to access routes, adjacent farm portions and nearby towns.





Locality Map for the proposed North Site Small-scale Hydropower Facility on the Orange River, adjacent the Remainder of Farm Tullochgorum 158 and Remainder of Farm Kameeldrift 285, Siyancuma Local Municipality, Northern Cape Province.

Figure 1: Locality Map

#### **1.4. Alternatives considered**

Three alternatives are considered and discussed in this report, two site alternatives and a “no-go” option. A brief description of each is provided below:

##### **1.4.1 Site Alternative 1 (Preferred Alternative)**

This site falls between the Remainder of Farm Tullochgorum No. 158 and Remainder of Farm Kameelsdrift No. 285, on the Orange River at a latitude of -29.285897° and longitude of 23.861696°.

As the preferred alternative, this site constitutes the most suitable placement of a small-scale hydroelectric power facility based on topographical features, physical appropriateness and hydrological flow data. Although cost and income represent important indicators, these fall subordinate to the former features, and would not vary significantly. Environmental and social impacts are however features that will be articulated further in this report and those forthcoming.

##### **1.4.2 Site Alternative 2**

This site is located between Portion 2 of Farm Torquay No. 157 and the Remainder of Farm Klipfontein No. 38, on the Orange River at a latitude of -29.287419° and a longitude of 23.835288°.

The site was formerly identified as the preferred alternative, however a direct proximity to unalienated state land together with a less favourable topography that would result in a greater cross-sectional area and associated costs, deem this option as less favourable.

##### **1.4.3 No-Go Option**

This alternative would entail that the proposed development not be built and the site remain unchanged as it currently exists. More significantly, the secondary effect of inundation would be negated. This would prevent any anticipated environmental, socio-economic and cultural impacts from occurring; however, benefits towards social, economic and political commitments would not be realised.

#### **1.5. Need and desirability of the proposed project**

Several key factors can be cited as motivation, detailing for the need and desirability of such a facility. In summary these are:

- Alignment with National commitments to address Climate Change;
- Alignment with National commitments to renewable energy generation;
- Ensuring reliable and locally-supplied energy;
- Harnessing energy from a renewable source/resource;
- Economic stimulus to the local economy, and subsequent social benefits to local communities.

In order to contribute towards realising these goals, Sidala proposes the construction of the North Site 22MW Hydroelectric power facility on the Orange River, between the Remainder of Farm

Tullochgorum No. 158 and Remainder of Farm Kameelsdrift No. 285, Siyancuma Local Municipality, Northern Cape.

### **1.6. NEMA EIA Regulations**

The National Environmental Management Act, 1998 (Act No. 107 of 1998) is the principle legislation governing Environmental Impact Assessment, under the authority of the National Department of Environmental Affairs.

NEMA makes provisions for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by Organs of the State and to provide for matters connected therewith. Section 2 of the Act establishes a set of principles, which apply to the activities of all Organs of State that may significantly affect the environment. These include the following:

- Development must be sustainable;
- Pollution must be avoided or minimised and remedied;
- Waste must be avoided or minimised, reused or recycled;
- Negative impacts must be minimised and positive impacts enhanced; and
- Responsibility for the environmental health and safety consequences of a policy, project, product or service exists throughout its entire life cycle.

These principles are taken into consideration when a Government department exercises its powers, for example, during the granting of permits and the enforcement of existing legislation or conditions of approval.

In terms of the Environmental Impact Assessment Regulations of 2010 (Government Notices R544, R545 and R546 in Government Gazette No. 33306 of 18 June 2010), also referred to as Listing Notices 1, 2 and 3, respectively, several activities were identified to be triggered by the proposed development. Considering the nature and scale of these activities, it was identified that a full Scoping and Environmental Impact Assessment Process was necessary.

The concluding aspect of this process would be the issuing of an Environmental Authorisation by the competent authority, the National Department of Environmental Affairs (DEA). Only with this authorisation and supporting permits may the applicant lawfully commence with the intended activity, thus rendering this process critical in the feasibility and planning stage of the development.

The following listed activities are triggered by the proposed development:

<b>Table 1: Listed activities triggered by the proposed development.</b>		
<b>Regulation</b>	<b>Activity</b>	<b>Description of Trigger</b>
No. R. 544, 18 June 2010	1. (i)	Construction of a facility generating less than 20MW of electricity.
No. R. 544, 18 June 2010	10(i)	Construction of a 132kV power line for transmission of electricity.
No. R. 544, 18 June 2010	11. (v) (xi)	Construction of a weir and hydroelectric power facility in the watercourse.
No. R. 544, 18 June 2010	18 (i)	Construction and establishment of a hydroelectric power facility on the banks of the Orange River.
No. R. 544, 18 June 2010	23 (ii)	Construction of a hydroelectric power facility along the Orange River on undeveloped land.
No. R. 545, 18 June 2010	10 (i)	Construction of a hydropower facility and weir within the one in ten year flood line of the Orange River.
No. R. 546, 18 June 2010	4	Construction of a road to provide access to the site.
No. R. 546, 18 June 2010	13	Site preparation and levelling to construct and install the facility in and adjacent to the river.

### **1.7. Other Legislation, Policy, Plans and Guidelines**

Aside from the NEMA, several other key legislation, policy, plans and guidelines will be triggered, whilst others shall provide strategic goals and priorities for different resources and sectors. These are stratified into levels of National, Provincial and Local jurisdiction.

#### **1.7.1. National level**

##### **The Constitution of the Republic of South Africa**

The Constitution of the Republic of South Africa (Act No. 108 of 1996) in Section 24, states that everyone has the right to an environment that is not harmful to their health or wellbeing and to have the environment protected, for benefit of present and future generations, through reasonable legislation and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while prompting justifiable economic and social development. These principles should therefore be integrated into the project wherein such rights may be affected.

### **National Water Act, 1998 (Act No. 36 of 1998)**

The **National Water Act, 1998** aims to ensure sustainable use of water through the protection of the quality of water resources for the benefit of all water users. Its principal focus is the equitable allocation and use of the scarce and disproportionately distributed water resources of South Africa. The Department of Water Affairs oversees implementation hereof and is the responsible authority for the issuing of permits for water use.

Section 21 of this Act defines types of water use, of which the following types are triggered by this proposed development:

- (c) Impeding or diverting the flow of water in a watercourse;
- (d) Engaging in a stream flow reduction activity;
- (e) Engaging in a controlled activity identified in Section 37(1)(c) a power generation activity which alters the flow regime of a water resource; and
- (i) Altering the bed, banks, course or characteristics of a water course.

In light of the triggering of these water uses, Enviroworks is actively engaging the Department of Water Affairs to ensure that a decision can be reached regarding such proposed activities on the Orange River.

A Water Use Licence Application (WULA) process is being implemented to address triggers of the National Water Act.

### **Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)**

This Act aims to govern acquisition, use and disposal of mineral rights by delegating the state with power and control over mineral and petroleum resources of South Africa. The Department of Mineral Resources are the custodians of this Act and maintain an information database of all registered mining activities within the borders of South Africa.

Enviroworks has conducted Access to Information with the Department of Mineral Resources to determine what mineral rights are assigned to affected properties and the extent of such operations. Landowners have also been engaged to obtain further detail on such related activities.

### **National Heritage Resource Act, 1999 (Act No. 25 of 1999)**

To assess the archaeological and paleontological sensitivity of the proposed development, specialist surveys are being conducted, in line with requirements of the National Heritage Resources Act, 1999 (Act 25 of 1999). This is triggered by the site being greater than 0.5 hectares in extent.

In terms of the National Heritage Resources Act, 1999, the South African Heritage Resources Agency (SAHRA) has a mandate to enforce the conditions of the Act, and hence oversees the management of heritage resources together with provincial heritage agencies.

Several Sections of Section 38 are triggered by the proposed activity. In addition, the region in which the proposed development falls, maintains a rich cultural landscape with multiple heritage landmarks and designated protected sites throughout. As a result, heritage specialist investigation is being undertaken to assess the implications of such a development on any such resources.

### **White Paper on Renewable Energy Policy in South Africa (2003)**

The white paper is responsible for promoting and implementing renewable energy in South Africa. It sets a framework and vision for government's intent to meet renewable energy, policy principles, strategic goals and objectives. With a wealth of renewable resources, largely solar and wind, South Africa intends to promote the agenda of this policy. Critical outputs include meeting economic, technical and other developmental constraints, as well as fighting the effects of climate change through renewable energy activities.

In addition, through the support of renewable energy generation as supported in this policy, South Africa will make progress towards meeting their set target of 10 000 GWh of renewable energy contribution to final energy consumption by 2013 through biomass, wind, solar and small-scale hydro forms. Through this target, roughly 4% of the national energy demand shall be met (*DME 2003*).

### **Integrated Resource Plan for Electricity, 2010-2013**

In accordance with the Energy Act of 2008, the Minister of Energy must develop and publish an integrated resource plan. To meet this requirement, the Department of Energy (DoE) and National Energy Regulator of South Africa (NERSA) assembled the Integrated Resource Plan (IRP) for the period 2010 to 2030. The critical objective hereof is to develop a sustainable electricity investment strategy for generation capacity and transmission infrastructure. Amongst other goals, the IRP is intended to improve the long term reliability of electricity supply by keeping pace with economic growth and development, as well as determining South Africa's capacity investment needs.

Objectives of the IRP include the evaluating of security of supply, and determining the least cost supply option and provide information on the opportunities for new investment. The plans outcomes found that South Africa will still be dependent on coal-fired options over the next 20 years and the construction of additional base load plants will be required from 2010. Committed generation is planned for 9.6 GW of nuclear, 6.3 GW of coal, 17.8 GW of renewable (including 8.4 GW solar) and 8.9 of other generation sources.

### **Electricity Regulation Act 2006 (Act No. 4 of 2006)**

NERSA, under the mandate of the National Energy Regulator Act of 2004 (No. 40 of 2004) and subordinate legislation, such as the Electricity Regulation Act (No. 4 of 2006), has the authority to determine prices at and condition under which electricity may be supplied by licence to Independent Power Producers (IPPs). Presently, NERSA is undertaking requests for qualification and proposals for new generation capacity under the IPP procurement program, as well as updating and expanding the process in awarding electricity generation licences.

## **1.7.2. Provincial Level**

### **Northern Cape Provincial Spatial Development Framework**

The Northern Cape Provincial Spatial Development Framework (NCPSDF) was formulated in 2011 to meet the requirements of the Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998) and the Municipal Systems Act, 2000 (Act No. 32 of 2000). Prepared in accordance with a bioregional planning approach adapted to suit the site-specific requirements of the Northern Cape, the NCPSDF recognises that no region or area should be planned and managed as an 'island' in

isolation from its surroundings. Together, unit areas form part of the broader environment and the mutual relationships and linkages between adjacent units must be understood and applied.

The framework aims to act as a policy and strategy providing direction and guidance for:

- future land use,
- spatial context for provincial sectoral strategies,
- promoting a developmental state,
- alignment of environmental management priorities, and
- mobilising the overarching objective of the Northern Cape Provincial Growth and Development Strategy (PGDS) to build prosperous, sustainable and growing provincial economy to eradicate poverty and improve social development.

A focus for achieving sustainable development as discussed in the framework, requires four areas of capital, being environmental, human, infrastructure and monetary. The plan further stresses the need for integrated participation, positive interventions and innovative finance.

With relevance to the NCPSTDF, the proposed development aligns with the goals for intelligent land use, development of local government infrastructure and implementation of environmental management policy and planning processes to ensure sound development is achieved.

### **Northern Cape Provincial Growth and Development Strategy (NCPGDS)**

The Northern Cape Provincial Growth and Development Strategy (NCPGDS) (2004 – 2014) highlights the most significant growth and development challenge as the reduction of poverty, and that only through long-term sustainable economic growth and development shall this be achieved. Important areas where growth can be achieved include agriculture and agro-processing, transport and tourism. In support of such growth areas the creation of opportunities for life-long learning, improvement of labour force skills to enhance productivity and expanding access to education and knowledge shall lead to the further realisation of such growth.

The inclusion of macro-level objectives shall mobilize these primary growth areas. Such objectives include the developing of human and social capital, improving the efficiency and effectiveness of governance and associated institutions and enhancing infrastructure for economic growth and development. The North site would contribute towards meeting this strategic objective.

### **1.7.3. District and Local Level**

#### **Pixley Ka Seme District Municipality Integrated Development Plan from 2011-2016**

The Pixley ka Seme District Municipality presides over eight constituent local municipalities. The Municipality envisions that the Integrated Development Plan (IDP) will enable the council to work with citizens, groups and communities of the region to identify sustainable ways of meeting their social, economic and material needs, as well as to improve the quality of their lives.

The document identifies the development priorities for the district over a five year period, with a mandate to promote a developmental municipality and promote sustainable development in the

region through effective and efficient service delivery. This with the aim to improve the health and living conditions of the poor, generate local economic development and job creation.

### **Siyancuma Local Municipality Integrated Development Plan 2012-2013**

The Siyancuma Local Municipality IDP maintains key themes around increasing economic growth, improving community self-reliance, achieving service excellence and sustainability led by strengthened leadership and good governance, and a mutual approach between stakeholders (*Siyancuma Integrated Development Plan 2012-2013: 10*). The plan recognises the IDP as providing institutions with the opportunity to plan ahead amidst a framework of recognised and accessible resources (*Siyancuma Integrated Development Plan 2012-2013: 12*). The proposed development would align with objectives of the IDP to generate jobs and activities for local employment procurement of labour could be motivated for. The Community Work Programme of the local municipality could be supported in this regard.

The development may further reduce scope 3 greenhouse gas emissions (Other Indirect Emissions) for the local municipality through the consumption of locally generated electricity supplementing the power supply grid, which would align with a National Sub-output objective of the IDP.

### **Siyancuma Local Municipality Local Economic Development Plan 2012**

This document provides an approach to sustainable economic development that encourages residents of local communities to work together to stimulate local economic activity for improved quality of life. The vision of the document is to deliver sustainable development, economic growth and development, local employment creation and a high quality of life for all, diversified local economy and education and skills development. This proposed development can be considered to address four of these five provisions. The document aligns in many respects with components of the IDP.

#### **1.8. Environmental Assessment Practitioner**

Enviroworks was appointed by Sidala Energy Solutions (Pty) Ltd. as the independent Environmental Assessment Practitioner (EAP) to conduct a Scoping and Full EIA process for the proposed project.

Enviroworks, a Small, Medium and Micro-sized Enterprise (SMME) company was established in November 2002. Although the formal establishment of this company took place then, it is backed by 25 years of professional service and experience in the environmental field. The qualifications and expertise of our professional team forms the backbone of the company's continued success.

The vision of Enviroworks is to provide excellent, cutting edge Environmental Management Solutions and Services, underpinned by a team of professional consultants together with our associated network of specialist partners and project managers. Through an integration of skills and expertise, it is believed that Enviroworks will deliver exceptional, competitive services for task execution and to meet deliverables.

Enviroworks through our years of experience and industry presence, assures the seamless execution and roll out of tasks to achieve projected results on time. The company continuously engages existing and emerging legislation, guidelines and practices, to ensure the execution of qualitative



and appropriate studies. Our past experience on renewable energy projects further benefits our understanding of technology-related processes and the impacts thereof.

- *The project EAP is Mark Day, Senior Environmental Specialist at Enviroworks.*

Mark Day has been employed as an environmental consultant at Enviroworks since March 2010. With expertise in environmental management and associated legal processes, Mark has rapidly gained insight into the field through the engagement and conducting of numerous projects across South Africa. His principal knowledge relates to environmental impact assessments, public participation, compliance monitoring and research-related discourses. A strong background in community engagement and facilitation, together with excellent project management skills, ensures that Mark delivers streamlined and integrated deliverables to his clients. Strong report writing and investigative skills enable Mark to contribute significantly towards ensuring an integrated assessment process. A copy of the Curriculum Vitae of this consultant can be viewed in **Addendum A**.

- *The internal reviewer is Pieter de Villiers, General Manager and Senior Environmental Consultant at Enviroworks*

Pieter de Villiers maintains nearly 10 years of experience in the environmental management arena. The skills gained during this time provide him with the ability to coordinate projects and manage teams effectively. Pieter serves as general manager providing leadership to staff and overseeing all company projects and services areas. He also functions as a Senior Environmental Consultant and maintains projects of his own.

## **2. SCOPING PROCEDURE**

DEAT (2002) describes scoping as an important tool for involving the public in the environmental assessment process, and for structuring assessment studies. It is through scoping, that priorities of the environmental assessment are set. The conditions and terms of reference for the subsequent Environmental Impact Assessment phase is based on issues and concerns that are raised during scoping.

The DEA further encourages the contribution of all stakeholders and I&APs to take part in scoping activities, so as to ensure optimal and rigorous investigation preceding the EIA phase.

### **2.1. Purpose of the Scoping Phase**

The main purpose of the scoping process is to identify issues surrounding the proposed project. Furthermore, it is by this process that issues of I&APs are documented and provided for decision-makers to assess, issues which are important for decision-making are prioritized, early engagement of stakeholders and I&APs, feasible alternatives are identified and legal, policy and planning measures pertinent to the project are identified. Issues are identified through (DEAT 2002).

In respect to the proposed development, measures enabling the scoping process include:

- Site investigations,
- Professional judgement,
- Review of available literature,
- A comprehensive public participation process.

### **2.2. Steps of the Scoping Phase**

DEAT (2002) identifies three primary procedural steps which are followed when scoping:

- Planning the scoping procedure;
- Stakeholder engagement to identify key issues; and
- Reporting on terms of reference for the next phase of the assessment.

Each step can be described as follows:

#### **2.2.1. Planning the scoping procedure**

The objectives of such a step are to identify authorities and I&APs to be involved; define the roles and responsibilities of authorities and I&APs; find agreement on the process to be followed; generate background information to spur on the involvement of authorities and I&APs; and identify the most suitable strategies for communicating with I&APs.

Such planning for this process was achieved through the generation of a preliminary list of stakeholders and I&APs that would need to be made aware of such a proposed development. The provision of a Background Information Document was made, providing preliminary details on the nature of the project, location, steps to the assessment process, how I&APs can participate and contact information of the EAP.

### 2.2.2. Stakeholder engagement to identify the key issues

The objectives of engaging stakeholders include ensuring agreement on the scoping process to ensue; providing access to project information; guaranteeing that I&APs understand what is being proposed and why; determining principal issues for consideration in the assessment; scheduling issues by level of importance; and developing a strategy for resolving key issues.

These objectives were mobilised through active engagement of authorities and stakeholders identified as key national, regional and local role-players and documentation of issues in a comment and response table.

### 2.2.3. Reporting on the terms of reference for the next phase of the assessment

The objectives of this final stage are to provide closure on all issues to be investigated in the environmental impact assessment and by specialist studies to be undertaken; as well as provision of responses as to how concerns raised have been integrated into the EIA process.

Such objectives are met through this report, which shall provide baseline information on all spheres of the development, details on issues which have materialised and draft terms of reference for specialist studies.

## 2.3. Public Participation

A comprehensive public participation process has been conducted and remains ongoing to ensure that I&APs remain informed of the proposed development and to ensure that all I&APs and stakeholders have the opportunity to raise their concerns and/or comments. Proof of consultation of all parties to date can be found in **Appendix C: Public Participation Document**.

### 2.3.1. Notification and Registration Process

The following measures were implemented to date:

- Placement of an advertisement in Die Noordkaap Newspaper on the 26<sup>th</sup> June 2013;
- Placement of A2 size Site Notices on the 23<sup>rd</sup> July 2013 on surrounding farms, as well as two notices in Douglas and Hopetown each;
- Engagement of affected landowners via telephone and email notification on the 23<sup>rd</sup> July 2013;
- The following surrounding landowners were informed of the project by means of a Background Information Document via email notification, and afforded the opportunity to comment of the project by means of an Interested and Affected Parties Comment Form:

○

Lot 271, Rem Kameeldrift 285, P. 8 Disselfontein 77  
P. 1 Ettrick 82, Rem. Ettrick 82, Rem. Hereford 202  
P. 2 Torquay 157  
P. 1 Summerhill 203, Rem. Summerhill 203  
P. 3 Slypsteen 41  
Rem. Klipfontein 38  
Rem. Sypsteen 41  
Rem. Sypsteen 42, Rem. Farm 270

Mr Leon Ferreira  
Mr Louis Nel  
Mr Frans Wiid  
Mr Bobby Bertrand  
Mr Hendrik Le Roux  
Mr Frans Wiid  
Mr Gerald Daniels  
Mr Pieter Van Wyk

- Authorities and stakeholders were informed via telephone and email notification on and after the 23<sup>rd</sup> July 2013. These were:
  - Siyancuma Local Municipality Mr. W Stadhouer
  - Ward Councillor Mr. Johannes Mosele
  - Pixley Ka Seme District Municipality Mrs. Viv Jones
  - Department of Environment & Nature Conservation Ms. Anga Yaphi
  - Department of Water Affairs Ms. R Nobela
  - Eskom Mr. B Williams
  - National Energy Regulator of South Africa Mr. G van Schalkwyk
  - South African Heritage Resources Agency Mr. Martin Untiedt
  - Ms. Kathryn Smuts

The following persons and organisations responded to notification and registered on the project:

- Surrounding landowners
  - Remainder of Farm No. 39 Mr. Leon Ferreira
- Stakeholders
  - Department of Water Affairs Mr. Dries Visser
  - Mr. Vernon Blair
  - Ms. Jackie van Bosch
  - Ms. Thembe Olebogang
  - Mr. Carlo Schrader
  - South African Heritage Resources Agency Ms. Kathryn Smuts
  - Vanderkloof Water Use Association Mr. Johan van Graan
- Interested and Affected Parties
  - The Fly Guides Mr. Chris Van Der Post
  - Aurecon (Pty) Ltd Ms. Louise Corbett

Registered I&APs will be communicated with further on the application, whilst unresponsive stakeholders and I&APs shall be engaged for comment during the upcoming Draft Scoping phase.

### 2.3.2. Issues and Responses

The following table provides a summary of key issues and responses given to date:

Table 2: Issues and Response Table	
Issue	Response
<b>Commenting Party: Leon Ferreira (28 July 2013)</b>	<b>Enviroworks Response: Mark Day (5 Aug 2013)</b>
Requested the height, which the water level shall rise to.	The water level shall rise to between 1010m-1015m (North Hydroelectric Power site) and between 1030m – 1035m (South Hydroelectric Power site).
Commented on the presence of river pumps, rafting camp, hunting camp, diamond gravels and archaeological sites.	The party was requested to provide a list of assets and locations thereof to capture sites, which may be impacted on.
Comment on the negative impact to tourism	A lease agreement between the proponent and

potential to affected properties and market value.	the party may offset any market value loss.
<b>Commenting Party: Leon Ferreira (4 Sept 2013)</b>	<b>Enviroworks Response: Mark Day (4 Sept 2013)</b>
<p>The party identified two properties under his ownership, which would be affected, namely Farm Kameelsdrift 285 and Farm Disselfontein 77.</p> <p><i>Comments pertaining to Farm Kameelsdrift 285:</i></p> <p>Diamond mining activity is underway on the farm, which carry large financial outlays;</p> <p>Two central pivots, which shall be reinstalled following rehabilitation, the mining area is proposed for other land use. The sites where these shall be installed will be inundated by the facility;</p> <p>Rafting activity on the farm will be impacted on.</p> <p><i>Comments pertaining to Farm Disselfontein 77:</i></p> <p>The farm contains a rafting camp with bushman paintings, both which will be inundated. Furthermore the hells gate and hubly bubbly rapids will disappear.</p> <p>Water pumps and associated pipeline to transfer between 3.2 and 3.6 million litres/hour for irrigation, will be flooded. This may result in immense losses to agricultural activities.</p>	<p><i>Response to comments on Farm Kameelsdrift 285:</i></p> <p>Enviroworks has submitted an application to the Department of Mineral Resources for Access to Information on all mining activity on farms to be affected by inundation, so as to identify mining right holders.</p> <p>For all described land uses and features, Enviroworks requested that the party provide GPS coordinates for further investigation.</p>
<b>Commenting Party: SAHRA (20 Aug 2013)</b>	<b>Enviroworks Response: Mark Day (20 Aug 2013)</b>
The party provided interim response to the information uploaded to the SAHRIS online portal. The detailed that an archaeological Phase 1 Assessment and Paleontological investigation be conducted.	Enviroworks acknowledged the comment and indicated that such studies shall be conducted.
<b>Commenting Party: Louise Corbett (27 Aug 2013)</b>	<b>Enviroworks Response: Mark Day (27 Aug 2013)</b>
The party requested to be registered as an I&AP to the project and requested the Megawatt size for each facility and flow volume.	Enviroworks acknowledged registration and indicated that the proposed North Hydroelectric Power site would have a Megawatt capacity of 22MW and 150 m <sup>3</sup> /s flow rate, whilst the proposed South Hydroelectric Power site would have a Megawatt capacity of 18MW and a 150 m <sup>3</sup> /s flow rate.
<b>Commenting Party: The Fly Guides – Chris Van Der Post (1 Sept 2013)</b>	<b>Enviroworks Response: Mark Day (1 Sept 2013)</b>
Fly-fishing business operations for Smallmouth Yellowfish shall cease due to the flooding of rapids; The section of the Orange River between Douglas and Hopetown remains un-splotted;	Enviroworks acknowledged registration and requested GPS coordinates for the sections of the river, where operations are conducted.

Agreements for use with Farm Disselfontein 77 and Kameelsdrift 285 shall be affected;  
 Concerns over fish migration paths for Smallmouth and Largemouth Yellowfish and the 'blockages' thereto;  
 Navigation of the river will be seriously impact on, whilst cataraft structures which rely on fast-flowing water shall become un-useable as a result of slowed in-stream water movement.  
 Financial investments due to marketing conducted to date shall be lost.

**Commenting Party: Department of Water Affairs – Numerous (Sept 2013)**      **Enviroworks Response: Mark Day (5 Sept 2013)**

Various officials from the Department of Water Affairs have registered as stakeholders on the project. These are Dries Visser, Vernon Blair, Jackie van Bosch and Thembe Olebogeng. These officials represent directorates of both the Northern Cape and Free State regional offices

Enviroworks acknowledged registration with all parties and confirmed with Mr Dries Visser and Vernon Blair that Water Use Licence Applications are to be submitted to the Department. Enviroworks requested that a pre-consultation meeting be scheduled. This is yet to be confirmed.

**Commenting Party: Vanderkloof Water Use Association – Johan van Graan (9 Sept 2013)**      **Enviroworks Response: Mark Day (9 Sept 2013)**

The party requested to be registered.

Enviroworks acknowledged receipt and registered the party

## 3. OVERVIEW OF THE PROPOSED PROJECT

### 3.1. Project Alternatives

Only site alternatives have been investigated for the proposed development. The technology being proposed has been identified based on several site variables as the most suitable and site appropriate. No layout or design alternatives have been proposed to date.

#### 3.1.1. Site Alternative 1 (Preferred Alternative)

This alternative comprises the construction of a weir for 20m above the river bed level. This site falls between the Remainder of Farm Tullochgorum No. 158 and Remainder of Farm Kameelsdrift No. 285, on the Orange River at a latitude of  $-29.285897^{\circ}$  and longitude of  $23.861696^{\circ}$ .

As the preferred alternative, this site constitutes the most suitable placement of a small-scale hydropower facility based on topographical features, physical appropriateness and hydrological flow data. Although cost and income represent important indicators, these fall subordinate to the former features, and would not vary significantly. Environmental and social impacts are however features that will be articulated further in this report and those forthcoming.

#### Layout of the weir site

High flood peaks of the structure necessitate the need for the spillway to be as lengthy as possible, resulting in a concrete gravity structure for the entire weir. The layout shall comprise:

- An ogee-type **spillway** with a stilling basin;
- A **river outlet system** constructed near the river bed to minimise the excavation and if required a bridge structure will be constructed for provide access to this
- The system will comprise an intake structure, dam wall and outlet component;
- A **power house** with intake area, powerhouse facility and outlet.

#### Site Elevation

The river cross-section and stage-capacity curve of a site have a major influence on the economic viability of hydroelectric power facilities. According to BKS (2012: 14), the stage-capacity curve indicates which site will have the lowest height for the highest storage volume and the river cross section should indicate which site has the least cost for a certain height.

In addition to cost effectiveness of a weir, the foundation compatibility to the concrete structure is important and therefore acceptable bearing pressures in the foundation for a concrete gravity structure and excavation depth are critical. As mentioned above, the cross-section of the river remains an important consideration, due to its dependency on the weir height. For example, at the proposed site a weir height of 20m has a cross-section of 320m, but if this was increased to a height of 40m the cross-section would increase to 410m.

Site alternative 1 was identified as having an efficient river cross section through comparison of the top length and the volume of concrete required to construct a 20m high weir at each site and position. For this site the length of the crest was 320m whilst the concrete volumes was recorded at

approximately 76 000m<sup>3</sup>, lower than that of the site alternative. Figure 2 on the page to follow provides a 3D model view of the proposed facility.

### **Engineering Geology**

BKS (2012: 20) conducted a preliminary review of the foundation conditions at the site, which were based on the published 1:250 000 Geological Map 2922 Prieska; geological information on the Torquay Dam site contained in a report on the Orange River Development Project and Replanning Study prepared for DWAF by BKS and Ninham Shand in May 1998; as well as Google Earth images of July 2005.

The reviewed materials found that site is underlain by andesitic lava of the Ventersdorp Group. Foundation conditions described the river channel as irregular strong rock requiring an average of 2m excavation, whilst the river banks consist of alluvial sand and boulders on irregular strong rock surface which would require average excavation of 6m. Flanks to a height of 20m above the river bed level were described as weathered rock requiring an average excavation of 6m, while curtain grouting to an average depth of 20m would be needed.



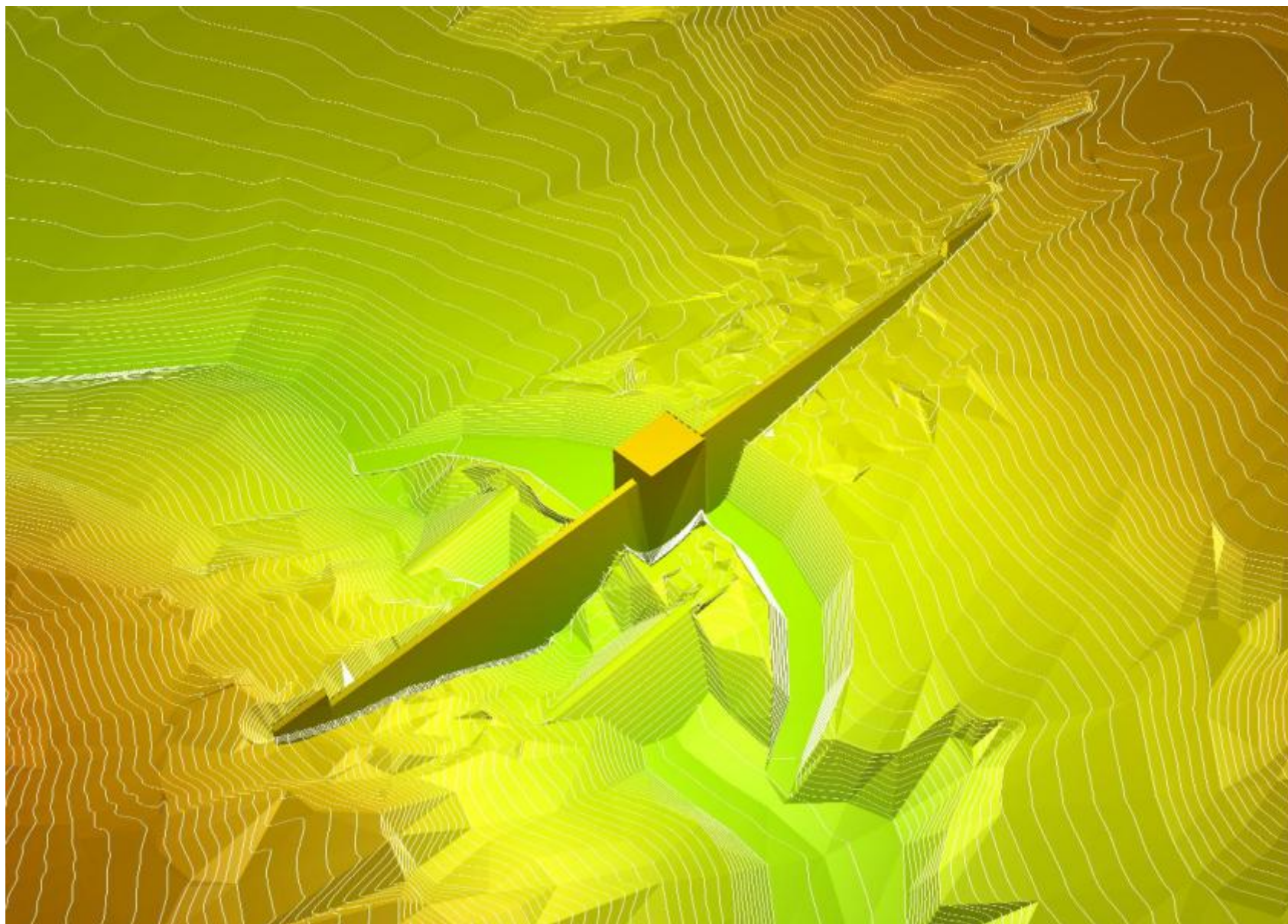


Figure 2: A 3D Model view of the proposed North Site Hydroelectric Power facility (Source: BKS 2013).

## Hydro Power Units

The selection of a turbine unit was based on a first order determination and to determine if any fatal flaws could be identified with the river topography and high flood peaks. The specific speed at which water will cause the turbine to rotate is based on a certain head (m), flow ( $\text{m}^3/\text{s}$ ) and speed (revolutions per minute (rpm)). Where flows above  $40 \text{ m}^3/\text{s}$ , heights of up to 20m and speed above 200 rpm, BKS (2012: 16) recommend an axial flow vertical Kaplan turbine. An illustration of the power generation facility and associated turbine is provided in figure 3 below.

## Power Transmission Elements

An overhead transmission line of 132kV is necessary, based on the rated current and volt-drop indices. The proximity of the site location to the nearest substation is 24km.

## Access Roads

Two access routes are proposed, one from the east (access from the R357 road) and the other from the western orientation (access from the R385 road). BKS (2012: 18) identifies the latter as being more preferable, due to the status of the R357 as a gravel road at the time of this investigation, however this road is currently being upgrade to tar. The access road connecting the site to one of these regional roads, would be built over existing gravel routes lessening the impact to surroundings.

## Reservoir Footprint Issues

BKS (2012: 19) described that the reservoir footprint would not pose an impact on social and environmental aspects of the region since the larger the footprint, the greater the acquisition, environmental mitigating and re-establishment cost would be. It would however be pertinent to identify sensitive environmental and social features and model the footprint around such significances as far as possible, so as to retain intrinsic site value instead of simply only planning for reinstatement expenses per se.

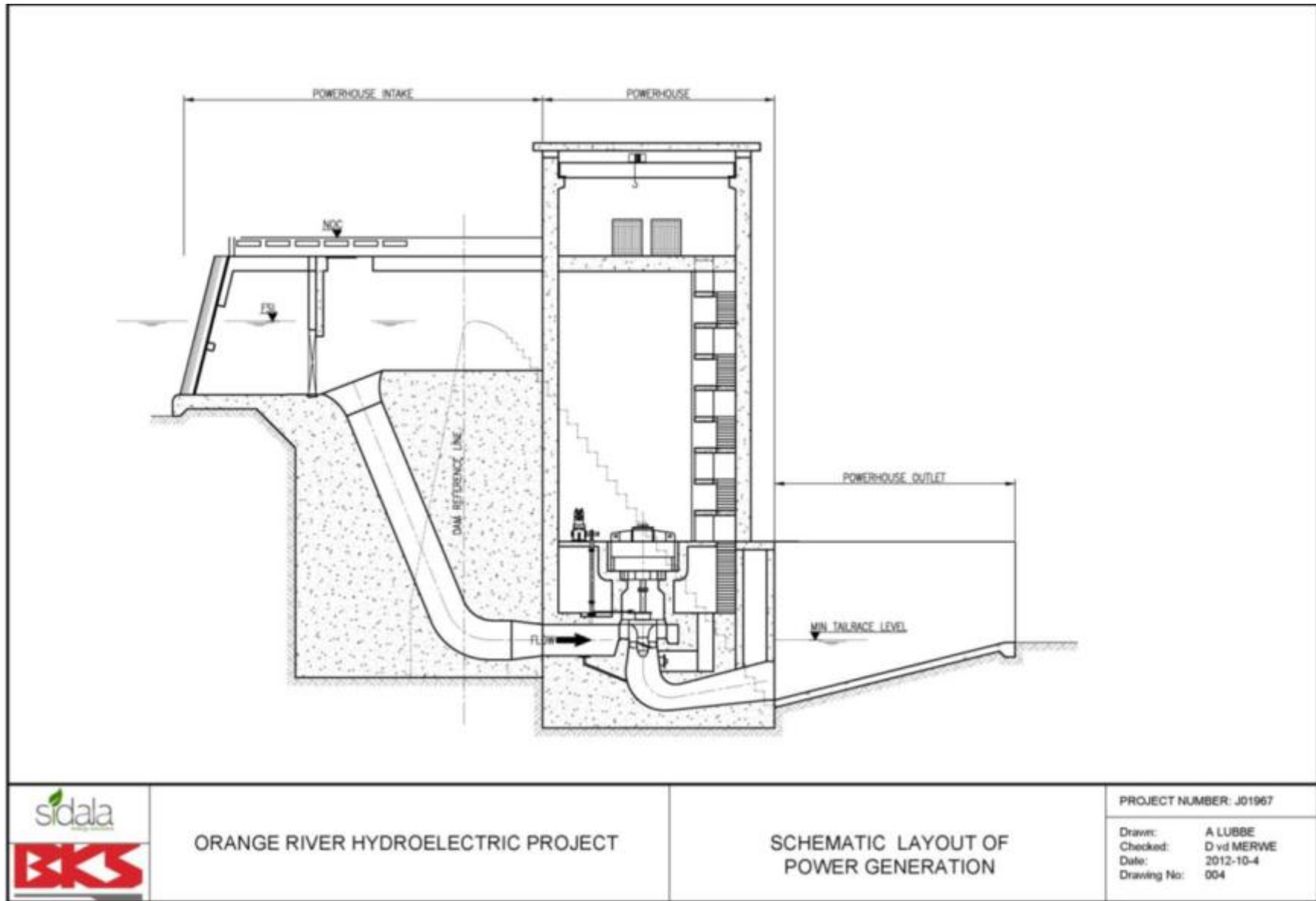


Figure 3: Illustration of the axial flow vertical Kaplan turbine proposed for use.

### 3.1.2. Site alternative 2

This option maintains similar features to the preferred site alternative hence only factors reducing its favourability will be mentioned. The site is located at -29.287419°; 23.835288°, approximately 2.5km east of the preferred site alternative.

Principal factors rendering it less favourable to site alternative 1 are:

- **Un-alienated state land**

The site falls adjacent to un-alienated state land, which would require engagement of the state to negotiate lease of the affected land. This could prove to be a lengthy process, while avoidance of delays based on process timeframes would be minimised through engagement with private landowners, which would be the case for the preferred site alternative.

- **Topography**

The suitability of the topography at this site is lower than that of the preferred site alternative, since the site would have a greater cross-sectional area resulting in a greater development footprint and higher cost.

Based on these two anomalies, this alternative was deemed to be less favourable.

### 3.1.4. The No-Go or 'Do-Nothing' Alternatives

This alternative would entail that the proposed development not be constructed and the site remains unchanged as it currently exists. More significantly, the secondary effect of inundation would be negated. This would prevent any anticipated environmental, social economic and cultural impacts from occurring.

## 3.2. A Background on Hydroelectric Power

Paish (2002: 538) describes hydropower as being in use for some 2, 000 years, but primarily for the milling of grain. In the 19<sup>th</sup> century, waterwheels were experimented with as a potential means for generating electricity and towards the end of the century, wheels were being replaced with turbines as investigations into the technology grew. The first half of the 20<sup>th</sup> century saw exceptional growth in the use of hydropower and today it stands as the most significant of 'renewables' for electrical power production globally (Paish 2002: 539). This is substantiated by the International Journal of Hydropower and Dams which in 2000 reported that the global technically feasible hydro potential is estimated at 14 370 TWh/year of which 8080 TWh/year is deemed economically feasible. At the time, hydropower provided 19% of the world's electricity, compared to 2% for all other renewable forms combined (Paish 2002: 539).

The fundamental process involves the conversion of water pressure by hydro-turbines into mechanical shaft power that subsequently drives an electricity generator or other machinery. Herein, the available power is proportional to the product of pressure and volume flow rate, demonstrated by the following formula:

$$P = \eta \rho g Q H$$

In **Figure 2**,  $P$  is the mechanical power produced at the turbine shaft (Watts),  $\eta$  is the hydraulic efficiency of the turbine,  $\rho$  represents the density of water ( $kg/m^3$ ),  $g$  is the acceleration as a result of gravity ( $m/s^2$ ),  $Q$  correspond to the volume flow rate moving through the turbine ( $m^3/s$ ) and  $H$  is the pressure head of water over the turbine ( $m$ ) (Paish 2002: 540).

Energy is therefore derived to make power by the force of water moving from a higher elevation to a lower elevation. Water then turns the turbine at enormous speeds. The turbine rotates, via a connected shaft to an electrical generator, and this generator creates electricity. It is the turbine and generator working in combination that converts "mechanical energy" into "electric energy".

Once a hydroelectric complex is constructed, the project produces no direct waste, and has a considerably lower output level of the greenhouse gas carbon dioxide (CO<sub>2</sub>) than fossil fuel powered energy plants. Hydroelectric plants also tend to have longer economic lives than fuel-fired generation, with some plants now in service which were built 50 to 100 years ago. Operating labour cost is also usually low, as plants are automated and have few personnel on site during normal operation (Fouche 2011).

According to energy experts South Africa has moderate hydroelectric potential, and the establishment of small hydroelectric projects around the country could help provide a sustainable future energy supply (Fouche 2011). Because of the shortage of energy supply faced in South Africa, the government is in the process of authorising independent power producer licences. This process is also aimed to diversify the countries energy mix by bringing in renewable energy technologies. Small hydro power plants (<10MW) is one of the qualifying criteria for the refit and will contribute to the country's target of 10 000 GWh by 2013. The proposed North Hydroelectric Power Site may sell Carbon Credits through the Clean Development Mechanism (CDM) as recognised by the UNFCCC.

The Orange River is major river confluence in South Africa supporting a myriad of land use along its banks, such as agriculture, mining and recreation. The river further supports a functioning aquatic ecosystem and provides an important perennial source of water for surrounding terrestrial ecosystems. Factors of predictable water supply together with the availability of comprehensive information on current and future flows, make the potential for the operation of a hydropower facility possible. Key feature of such supply are that the system maintains a constant flow through interventions by various water management schemes upstream to the site of the proposed development; and that this flow is timed and predictable.

## **4. BROAD DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT**

### **4.1. Climate**

The region experiences summer and autumn rainfall with very dry winters (*Mucina & Rutherford 2006: 517*). A Mean Annual Precipitation (MAP) of between 250mm – 450mm occurs, whilst frost is of reoccurrence in winter. The mean monthly maximum and minimum temperatures for the nearby town of Douglas are 39.7°C and -4.6°C for January and July respectively.

### **4.2. Topography**

The sites is characterised by undulating terrain with rocky dolerite sills prevalent, whilst the river is flanked by relatively steep slopes.

### **4.3. Geology and Soils**

Mucina and Rutherford (2006: 517) described this as a highly fragmented on Ecca and Dwyka Group sediments and Karoo dolerites as well as on Ventersdorp Supergroup lavas. The area is characterized by dolerite sills forming ridges and plateaus and slopes of koppies and small escarpments with erosion terraces prevalent. Alternating layers of mudstone and sandstone are overlain by dolerite sills. Prominent soil forms are Mispah and gravel-rich Glenrosa forms of origin from Jurassic dolerite, whilst calcrete-rich soils occupy the lowlands (*Mucina & Rutherford 2006: 517*).

A geotechnical investigation is proposed to be conducted during the Environmental Impact Assessment phase of the Environmental Impact Assessment process. This shall entail the drilling of a series of pilot holes in and adjacent the watercourse to determine the suitability of bedrock to support such a proposed structure. A Basic Assessment Process is being conducted due to the triggering of Activity 18 of Listing Notice 1 (Government Notice R.544) of the NEMA EIA Regulations of 18 June 2010. Outcomes generated from the Basic Assessment study shall be incorporated into forthcoming reports of the EIA Phase of this application.

### **4.4. Ecological Status**

The ecological specialist study was not available at the date of publishing of this document so specific details of the site and any ecological sensitivities are not known. At present, the site is not known to contain any ecological systems receiving protection under South African legislation, such as National Protected Area Expansion Strategy Focus areas, or sensitive areas as identified in an environmental management framework in terms of Chapter 5 of NEMA.

#### **4.4.1. Terrestrial Ecological Survey**

Ecologist, Mathew Ross of Enviross CC is currently preparing a report on findings from a site inspection conducted in August 2013. Particulars of the outcome of these investigations shall be made available on publication and will be incorporated into the Draft Environmental Impact Report (DEIR).



**Figure 4: The view of the proposed site facing upstream**

#### **4.4.1.1. Habitat**

To be addressed in the Final Scoping Report (FSR).

#### **4.4.1.2. Flora**

Munica and Rutherford (2006: 517) describe vegetation in immediate proximity to the Orange River in this region as SVk 5 Vaalbos Rocky Shrubland. This vegetation form occupies slopes as well as elevated hills and ridges within plains of SVk 4 Kimberley Thornveld. Plant communities of common occurrence constitute an arid species mix of evergreen shrubs.

A discussion on identified plant species and any noteworthy observations shall be discussed in the .

#### **4.4.1.3. Fauna**

A species list and discussion shall be provided for in the FSR following specialist investigation.

#### **4.4.2. Aquatic Ecological Survey**

Ecologist, Mathew Ross of Enviross CC is currently preparing a report on findings from a site inspection conducted in August 2013. Particulars of the outcome of these investigations shall be made available on publication and will be incorporated into the FSR.

Specific focal areas of this study will include:

- In-stream Habitat Integrity;
- Macro-invertebrate Integrity ;
- Riparian Zone Habitat and Riparian Vegetation Integrity; and
- Water Quality Assessment.

#### **4.5. Heritage Status**

Archaeologist, Karen van Ryneveld of Archaeomaps CC is currently preparing a report on findings from a site inspection conducted in August 2013. Particulars of the outcome of these investigations shall be made available on publication and will be incorporate into the FSR.

Several Stone Age sites are known to occur in the vicinity of the Orange River in this area, including the presence of bushman paintings on a nearby farm, Disselfontein No. 77. The South African Heritage Resources Agency is being engaged on the development to ensure that any heritage resources be protected and impact of the development on such sites or structure, offset.

Aspects to be considered in further detail include:

- Archaeological; and
- Paleontological Aspects.

#### **4.6. Visual and Aesthetic Status**

The proposed development would be located in the Orange River watercourse, which is surrounded by steep slopes. The nature of the surrounding topography as undulating would shield the presence of such a facility unless when in immediate proximity to the structure. Furthermore, the undulating state of the river would lessen the conspicuousness of the facility to upstream or downstream uses.

#### **4.7. Land Use**

The precise land uses underway on properties adjacent to the site are not currently verified, whilst those underway on properties nearby include:

- Livestock farming;
- Conservation;
- Hunting;
- Safaris and tourism;
- Mining;
- Agriculture;
- Cultural; and
- Water abstraction.

It is anticipated that through further engagement with surrounding landowners and stakeholders, land use information will be refined. Therefore, a detailed description of such features will be described in forthcoming stages of this assessment process.



## **4.8. Socio-Economic Structure of the Area**

### **4.8.1. Economic Issues**

The Siyancuma Local Municipality places one of the themes in the Integrated Development Plan of 2012-2013 as increasing economic growth. The IDP recognises budget spending for Douglas (the closest town to the proposed development site) as being centred around providing basic infrastructure within poor areas to address service backlogs. This plan also recognises an in-migration of unskilled people from farms as an ongoing phenomenon. Furthermore, the agriculture sector, community, social and personal service sectors are primary job-providing economic entities.

Land use within the local municipal boundaries of the Siyancuma Local Municipality comprises towns and settlements (<5%), farms and agricultural land (>90%) and other forms like mining and resorts (<5%). Within the local municipal boundaries, employment levels decreased between 2001 and 2007 to the region of 7000 persons, whilst unemployment increased from approximately 3000 persons in 2001 to 3500 persons in 2007 respectively. Not economically active persons (including scholars, housewives, pensioners and disabled) were recorded at approximately 10 000 individuals in 2007 (*Siyancuma Local Municipality Integrated Development Plan 2012: 24*).

The level of education in Douglas maintains the highest percentage at secondary school (35%) whilst the lowest for tertiary education (2%). At a municipal level the majority of household income in 2001 was recorded at between R4 801 – R9 600 for approximately 2100 households, whilst no income was reported for approximately 1400 households (*Siyancuma Local Municipality Integrated Development Plan 2012: 25*).

### **4.8.2. Social Context**

The population of Siyancuma Local Municipality was recorded as 35 790 people in 2007. The density ratios of 2011 determined that the largest age component within the residing community was of the 20 – 65 year old age bracket. A housing survey found that 6970 dwellings within the municipality were formal structures constructed of brick on a separate stand or yard, whilst second to this 1232 dwellings comprised informal structures in a squatter settlement. The Siyancuma Local Municipality Local Economic Development Strategy recognised a population growth trend which peaked in 2003 at approximately 41 100 individuals and declined to approximately 38500 individuals in 2010. Of the same year, the Siyancuma Local Municipality recognised an HIV/AIDS Prevalence Rates of 6.8% in the population, which is below the national average of 12.6% of that year.

## 5. IDENTIFICATION, DESCRIPTION AND METHODOLOGY OF THE ENVIRONMENTAL IMPACTS

The following section describes the identification, description and methodology to be used in the assessment of environmental impacts, to be undertaken in the Environmental Impact Assessment Phase, following approval of the Plan of Study (PoS) by DEA.

### 5.1. Identification of Environmental Impacts

Several factors have been used to compile this section in determination of environmental impacts to date. These include the conducting of an initial site visit on the 23<sup>rd</sup> July 2013, the use of available information provided in the Draft Inception Report from engineering investigations (BKS 2012), detail gathered on the impacts of such facilities from former projects conducted by Enviroworks (*Fouche 2011*) and a degree of technical and site information from Sidala Energy Solutions (Pty) Ltd.

#### 5.1.1. Methodology for Assessment of Potential Impacts

The impacts will be evaluated by applying the methodology as described below. The impact is defined and the significance is rated from Low to High as indicated in the table below, with an explanation of the impact magnitude and a guide that reflects the extent of the proposed mitigation measures deemed necessary.

<b>Table 3: Methodology for Assessment of Potential Impacts</b>					
<b>Significance</b>	<b>Low</b>	<b>Low-Medium</b>	<b>Medium</b>	<b>Medium-High</b>	<b>High</b>
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect.  Acceptable.	Impact is of low order and therefore likely to have little real effect.  Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the environment.	Impact is real and substantial in relation to other impacts. Pose a risk to the environment.  Unacceptable.	Impact is of the highest order possible.  Unacceptable.  Fatal flaw.

Action Required	Maintain current management measures.  Where possible improve.	Maintain current management measures.  Implement monitoring and evaluate potential increase in risk.  Where possible improve.	Implement monitoring. Investigate mitigation measures and improve management measures, to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.
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The following is a short description of the assessment criteria as mentioned above:

The **Nature of impact** is a broad indication of what is being affected and how it is being affected.

**Severity** relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects or impacts on the biophysical and socio-economic environment may be.

Table 4 : Nature of Impact Assessment Criteria					
Type of criteria	1 - Low	2 Low-Medium	3 Medium	4 Medium-High	5 High
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant/ Harmful	Great/ Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/	Low cost to mitigate	Substantial cost to	High cost to mitigate	Prohibitive cost to

	High potential to mitigate impacts to level of insignificance/ Easily reversible		mitigate/ Potential to mitigate impacts/ Potential to reverse impact		mitigate/ Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

**Extent** refer to the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders).

Table 5: Extent of Impact Assessment Criteria	
Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within the affected property boundary
4: Medium-High	Beyond the affected property boundary
5: High	Regional, National, International

**Frequency** refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Table 6: Frequency of Impact Assessment Criteria	
Rating	Description
1: Low	Once a year or once/more during operation
2: Low-Medium	Once/more in 6 Months
3: Medium	Once/more a Month
4: Medium-High	Once/more a Week
5: High	Daily

**Probability** considers the likelihood of an impact/incident occurring over time.

Table 7: Probability of Impact Assessment Criteria	
Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

**Duration:** Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.

Table 8: Duration of Impact Assessment Criteria	
Rating	Description
1: Low	Almost never / almost impossible
2: Low-	Very seldom / highly unlikely

Medium	
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

## 5.1.2. Environmental Impacts identified to date

### 5.1.2.1. Ambient Air Quality

Construction activities as well as vehicle movement normally associated with construction will result in an increase in the dust level. The quantity of dust generated would be dependent on, in which season the construction takes place and the prevailing wind directions. Appropriate measures to minimise the generation of nuisance dust from the works, operations and activities shall be taken. Such measures shall include regular and effective treatment of access roads and working areas, etc.

During operational phase, the potential emissions will be from of a few project vehicles and is not considered to be of any significance. The proposed project will also have a positive impact on the ambient air quality during the operational phase as the hydro-power generation will help save greenhouse gas emissions of approximately 23 000 tons of equivalent of carbon dioxide per annum.

Anticipated impacts include:

- Windblown dust due to construction activities;
- Reduction of carbon dioxide emissions (Positive Impact)

### 5.1.2.2. Geology and Soils

Based on similar projects (*Fouche 2011*), soil erosion potential of the proposed development on the project site has been a consideration. Concern relating to stream erosion pertains to the river area downstream of the tail-race canal outlets. Hydraulic models are a way of enabling analysis of the conditions of such sites, of which a 'Pre-Development' scenario assumes that with no development the geometry and flow regime of the site would remain unaffected; whilst a 'Post-Development' scenario assumes that if the hydropower scheme is developed, all flow would be directed from the river into the headrace canal, via the powerhouse, down the tailrace and exit back into the river. The latter assumes that zero flow passes down the river between the inlet to the headrace canal and the outlet and tailrace canal.

From analysis of the Pre-Development and Post-Development Scenario models it is likely that the proposed development will have no effect on bedshear stresses downstream of the tailrace outlet. Scrutiny of the model outputs indicates that this is due to the fact that flow in the river channel at the outlet is sub-critical. On a broad scale then, flow characteristics are controlled from downstream, rather than from upstream, and hence upstream changes in geometry do not affect flow characteristics in the river at the tailrace outlet (*Fouche 2011*).

Based on the layout of the proposed development, the river can be divided into the following reaches and areas:

- **The river upstream of the head-race canal inlet**
  - There are no effects on shear stresses and hence erosive potential expected upstream of the head-race canal inlets as a result of the proposed developments
- **The river in the immediate vicinity of the head-race canal inlet**
  - It is expected that the design of the head-race canal inlet will result in localized changes in flow-lines which could result in increased erosion of the banks. It is therefore suggested that the river banks surrounding the inlet can be protected with riprap. All riprap needs to be obtained from a licensed supplier and may not be sourced from natural areas.
- **The river between the head-race canal inlet and the tail-race canal outlet**
  - The flow in the river between the head-race canal inlet and the tail-race canal outlet is proposed to be greatly reduced, with a consequent reduction in erosive power and shear stresses between the water and the river bed and banks.
  - At the North Hydropower facility, the design requires the construction of a new weir across the river. Turbulence associated with a hydraulic jump immediately downstream of the weir could have the potential to erode the river banks in this area. It is therefore recommended that the river banks immediately downstream of the weir be provided with significant protection, in the form of either concrete training walls or heavy riprap.
- **The head-race canal**
  - The head-race canals are designed to be lined with concrete, and no erosion problem is anticipated.
- **The tail-race canal**
  - The flow velocities in the tail-race outlets are anticipated to be low. Appropriately designed riprap protection of the canal invert and walls, or a concrete-lined canal, would prevent erosion occurring in this reach.
- **The river in the immediate vicinity of the tail-race canal outlet**
  - It is expected that the design of the tail-race canal outlet, which discharges flow at an angle of between 20° and 90° to the Pre-Development direction of flow in the river, will result in localized changes in flow-lines which could result in increased erosion of the banks. It is therefore recommended that the river banks surrounding the outlet be protected with riprap, except where erosion-resistant bedrock is exposed.
- **The river downstream of the tail-race canal outlet**
  - The hydraulic model analysis undertaken in the investigation has indicated that there is no increase in erosive potential expected downstream of the tail-race canal outlet.

Further investigations into the impact of the South Hydroelectric Power facility on erosion of the Orange River would evaluate:

- The likelihood of impact of the facility on erosion;
- Recommendations to negate any local hydraulic effects that may have resulted in erosion.

Anticipated impacts include:

- Loss of topsoil during the construction period;
- Erosion due to the unmanaged increase of activity along the river during the construction phase;
- Scouring of river beds and loss of riverbanks due to the erroneous release of water back in the river.

### **5.1.2.3. River Characteristics**

The proposed hydroelectric power facility, due to the proposed extent of the facility, may cause a high level of impact on the river system, affecting the levels of the river both upstream and downstream. No water will however be taken out of the system on a permanent basis and neither will it be stored in any way. Flooding of upstream areas will occur due to the permanent inundation of land adjacent to the watercourse, which could affect the ecology of the river, riparian area and banks.

Anticipated impacts include:

- The flooding of upstream areas due to inundation of land adjacent to the river;
- The contamination of ground or surface water during the construction and operational phases of the proposed development;
- The increase in water temperature as a result of the proposed project;
- The increase of sedimentation levels of the water;
- Impeding the flow of the river;
- Negative impact on the hydroelectric power generation infrastructure due to rubble in the river;
- Impact of changed oxygen levels of the water released back into the river;
- Obstruction of migratory paths of fish.

### **5.1.2.4. Fauna and Flora**

The potential impact on fauna and flora are presently being assessed by the ecologist, Mathew Ross and shall be discussed in the FSR.

Anticipated impacts include:

- Disturbance of fauna during the construction phase;
- Safety risk posed to fauna by the hydroelectric power generation plant infrastructure;
- Obstruction to movement of fauna caused by the dam wall (both in-stream and on the banks of the river);



- Impact on the aquatic ecosystem due to damming and barricading of the river;
- Obstruction of migratory paths of fish;
- Loss of flora during the construction phase;
- Impact of the proposed infrastructure on riparian and in-stream vegetation.

#### **5.1.2.5. Aesthetics**

Engineering design ensures compatibility with the natural area in terms of style, layout and colour. As this area is situated in a scenic environment in the vicinity of an important tourist attraction the importance of a development that blends into the surrounding area will not be underestimated. Due to the extent of the proposed structure as illustrated in figure 2, the visual impact will be a important impact area for further assessment. A visual impact assessment is to be conducted to investigate this impact area, therefore this impact area has not been considered at this stage.

Anticipated impacts include:

- Potential visual impact that stems from the height hydroelectric power generation facility and associated infrastructure to surrounding land users and recreational activities associated with the river;
- Visual impact of proposed power line.

#### **5.1.2.6. Land Use**

##### **5.1.2.6.1. Increase in traffic volumes**

Construction vehicles would have to make use of the exiting farm access roads, which could impact negatively on the traffic flow and safety of the area. The traffic volumes on the road will increase by  $\pm 10$  trucks per day for the duration of the construction phase. Impacts on traffic flow during construction could be mitigated by ensuring that all regulations relating to traffic management are followed. Adequate and appropriate traffic warning signs with appropriate speed limits for construction vehicles should be present and adhered to.

During the operation phase of the hydroelectric power generation plant the traffic volumes will be considerably less, as the plant is automated and will have few personnel on site during normal operation. Maintenance vehicles will only visit the site when necessary.

Anticipated impacts include:

- Impact on the traffic volume of the area;
- Deterioration of access roads during the construction phase.

##### **5.1.2.6.2. Impacts of inundation on increased flood levels**

Due to the construction of the hydropower facility in the river the flood level will rise, causing permanent inundation. The increased flood line will have potentially high levels of impact on the various land uses adjacent to or on the banks of the Orange River. The precise land use to be affected will be verified through consultation with affected landowners, in discussions with stakeholders and through engagement of authorities. Known land uses with the potential of being

affected include mining, recreational use, irrigation infrastructure and cultural. These will be described in the FSR

Anticipated impacts include:

- Impacts to infrastructure in and/or adjacent to the river;
- Impacts to agricultural and grazing land use directly adjacent to the river;
- Impacts to agricultural activity which sources water from infrastructure in the and/or adjacent to the river;
- Impacts to recreational users of the river

#### **5.1.2.7. Waste Handling**

Solid waste produced during the construction phase of the activity may require frequent removal from the site to nearby waste dump facility in Douglas. The municipality will be contacted in this regard and approval will be obtained from the municipality prior to any dumping of waste at the dumping site.

All hazardous substances e.g. diesel, oil etc. required by the contractors shall be stored in dedicated areas, outside the flood line of the river, developed to minimize spills and to protect the environment. Any spillage of hazardous substances will be cleaned according to the guidelines in the EMP and the area will be rehabilitated. No hazardous substances will be dumped at the local waste dump site, but will be transported to a hazardous waste disposal facility. Portable toilet facilities would need to be regularly cleaned in accordance with the number of personnel operating on site during the construction period.

Anticipated impacts include:

- Litter or waste pollution of the area;
- Spills of hazardous materials from machinery and vehicles operating on site during construction.

#### **5.1.2.8. Socio-economic structure of the area**

The proposed development is anticipated to have some positive impacts on the local socio-economic sectors. Indirect impacts caused by the hydroelectric power facility and inundation must be adequately investigated as these remain an important implication of the facility to surrounding land uses.

Anticipated impacts include:

- Potential economic implications of permanent inundation on upstream users adjacent to the river;
- Potential economic implications of permanent inundation to agricultural activities which source water from infrastructure in the river;
- Potential economic implications of permanent inundation to recreational users and businesses operating tourism-related activities in and adjacent to the river;

- Potential economic implications of barricading of the river to recreational users and businesses operating tourism-related activities in and adjacent to the river;
- Increase in the security risk of the area due to the construction activities;
- Potential impact of the development in generating jobs during the construction phase and skilled positions during the operational phase.

#### **5.1.2.9. Existing Infrastructure**

Various forms of infrastructure exist in support of land uses being undertaken in or adjacent to the Orange River, which may be affected by inundation of upstream areas. An inventory of infrastructure including location, type and other information shall be prepared once all infrastructures are made known during forthcoming assessment periods.

Anticipated impacts include:

- Impact of permanent inundation to known infrastructure include mining-related infrastructure and structures, central irrigation pivot pumps, weirs, access roads and camping facilities;
- Impact of permanent inundation to planned infrastructure.

## 6. PLAN OF STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT

The following Plan of Study for EIA sets out the proposed approach to the Environmental Impact Assessment phase of the EIA process.

### 6.1. Description of the tasks to be undertaken during the Environmental Impact Assessment

- The potential environmental impacts will be inspected and discussed further through the methodology described in this Scoping Report.
- Mitigation and management measures for incorporation during the construction- and operational phases will be proposed.
- Parallel with the above mentioned activities, the following public participation process will be followed:
  - Continued discussions with the client and engineer;
  - Consultation will be done with:
    - Surrounding Landowners;
    - Department of Environmental Affairs;
    - Department of Water Affairs;
    - Department of Agriculture;
    - Department of Mineral Resources;
    - South African heritage Resources Agency;
    - South African National Biodiversity Institute;
    - Northern Cape Department of Roads and Public Works;
    - Northern Cape Department of Environment and Nature Conservation;
    - Pixley Ka Seme District Municipality;
    - Siyancuma Local Municipality;
    - Eskom;
    - National Energy Regulator of South Africa;
    - Ward Councillors;
    - The Fly Guides.
- The Draft Scoping Report will be made available for comment to all Interested and Affected Parties and Stakeholders for a 40 calendar day period. Comments from the Draft Scoping Report will be incorporated into the Final Scoping Report, in the form of a Comments and Responses Report.

### 6.2. Assessing method to be used

The impacts will be evaluated by applying the methodology as described in the Scoping Report. The impact is defined and the **significance** is rated from Low to High with an explanation of the impact magnitude and a guide that reflects the extent of the proposed mitigation measures deemed necessary.

- The **Nature** of impact is a broad indication of what is being affected and how.

- **Severity** relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment.
- **Extent** refer to the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders);
- **Frequency** refers to how often the specific activity, related to the event, aspect or impact, is undertaken.
- **Probability** considers the likelihood of an impact/incident occurring over time
- **Duration** refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.

#### **6.4. Specialist Investigations**

In order to adequately assess the probable impacts on areas that may be caused by the proposed development, the appointment of qualified and experienced specialists is to be undertaken. To fulfil this commitment, the following specialist investigations are to be conducted:

- Phase 1 Archaeological Impact Assessment;
- Palaeontological Desktop and Phase 1/Exemption Study;
- Terrestrial Ecological Impact Assessment;
- Aquatic Ecological and Fishways Studies; and
- Visual Impact Assessment.

Where additional studies are identified to be beneficial towards assessment of impacts, these shall be identified and include in the FSR.

#### **6.4. Particulars of the Public Participation Process to be followed**

The following public participation process will be followed:

- Continued discussions will be done with the Client and the Planner;
- A copy of the Draft Scoping Report will be available to I&APs/ Stakeholders for comment;
- The preparation of a resource inventory will be done in collaboration with landowners, stakeholder, authorities, land users and interested parties.
- A copy of the archaeological and cultural heritage investigation will be send to the South African Heritage Resources Agency for comments.

The comments received on the Draft Scoping Report will be incorporated into the Final Scoping Report and Draft Impact Assessment Report.

## 7. WAY FORWARD

The abovementioned Plan of Study for EIA sets out the proposed approach to the Impact Assessment phase of the EIA process.

Key dates associated with the remaining scoping phase milestones are as follows:

<b>September 2013</b>	Publication of DSR + accompanying 40 day comment period
<b>October 2013</b>	Publication of FSR + 21 day comment period
<b>November 2013</b>	DEA reviews the FSR and PoS for EIA
<b>December 2013/ January 2014</b>	DEA reviews FSR and PoS

Following the completion of the Draft Scoping Report 40 day commenting period, Enviroworks CC shall submit this Plan of Study for Environmental Impact Assessment for the proposed development of a hydroelectric power generation scheme (North Hydropower facility) to the Department of Environmental Affairs for review and decision as to whether approval of the Plan of Study shall be granted, and to continue with the EIA phase of the project.

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## APPENDICES

Appendix A: CVs

Appendix B: DEA Acknowledgement Letter

Appendix C: Public Participation Document

Appendix D: Locality Map

Appendix E: Site Layout Plan

Appendix F: Inundation Contours