MAISTREAM RENEWABLE POWER SOUTH AFRICA (PTY) LTD

PROPOSED CONSTRUCTION OF THREE WIND FACILITIES AND ONE SOLAR ENERGY FACILITY NEAR AGGENEYS IN THE NORTHERN CAPE, SOUTH AFRICA

(30985.00-REP-003 REV 1)

PRELIMINARY STORM-WATER MANAGEMENT REPORT

NOVEMBER 2014

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ISSUE & REVISION RECORD

QUALITY APPROVAL

	Capacity	Name	Signature	Date
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Approved by Design Centre Leader	Project Director	André Greyling		13/11/2014

This report has been prepared in accordance with BVi Consulting Engineers Quality Management System. BVi Consulting Engineers is ISO 9001: 2008 registered and certified by NQA Africa.

REVISION RECORD

Revision Number	Objective	Change	Date
0	Issue to Client for comments and work approval	None	14/11/2014
1	Issue to Client for approval	As proposed by Client	18/11/2014

CLIENT APPROVAL RECORD

	Capacity	Name	Signature	Date
Mainstream Renewable Power				

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1 INTRODUCTION

1.1 TERMS OF REFERENCE

Mainstream Renewable Power South Africa (Pty) Ltd has identified the need for Civil and Electrical Engineering inputs during the feasibility stages of a proposed renewable energy project. BVi Consulting Engineers (Pty) Ltd was appointed to prepare a *Preliminary Engineering Services Report* that will aim to address this need. Submission of a *Preliminary Storm-water Management Report* forms part of the scope, and is the subject of this report.

1.2 APPOINTMENT

Mainstream appointed BVi Consulting Engineers to do a desktop study of the potential for environmental damage due to increased runoff as a result of construction of the proposed renewable energy project, including review of relevant legislation and regulations pertaining to storm-water management.

1.3 OBJECTIVES AND STRATEGIES

1.3.1 Strategy Followed

The proposed development was assessed to determine the specific *storm-water* needs during the different phases of implementation, specifically construction and installation, operation and decommissioning.

A desktop study was performed using the information made available by Mainstream and relevant authorities, utilising engineering judgement and by studying the relevant guidelines that are available.

1.3.2 Purpose of the project

The purpose of the project is to investigate possible locations for the generation of wind and solar energy.

1.3.3 Purpose of the report

The purpose of the report is to conduct a preliminary storm-water management investigation for the wind and solar farm site and related local transportation routes.

The following objectives will be outlined in this preliminary study:

- Storm-water considerations
- Storm-water drainage features
- Storm-water management plan

1.4 AVAILABLE INFORMATION

The following sources of reference were studied:

- The 1:50 000 scale topographical maps 2919AC Namies and 2919AD Samoep, both published in 2003.

2 DESCRIPTION OF THE PROJECT

Mainstream Renewable Power is proposing the development of three wind farms and a solar energy facility near Aggeneys in the Northern Cape Province.

The proposed facilities are located on portions of the following farms:

- Portions 1 and Remaining Extent of Farm 209 (Poortje); and
- Portion 1 and 2 of Farm 212 (Namies Suid)

The extent of the site identified for this development includes an area of approximately 17 500 hectares with a perimeter of 55km, and is subject to refinement based on detailed design investigations.

The proposed location falls within the Department of Water Affairs defined quaternary catchment D81G and the site is bounded by National Route 14 to the north and Regional Road 358 to the south. Access to the site will be off National Route 14 via a proposed new formal intersection, located at an existing at-grade intersection leading to an unsurfaced road.

2.1 SITE LOCATION

The extent of the investigation is based on the provisional distribution of wind turbines and solar panels as indicated on the 20140930-EM-Khai, 20140930-EM-Korana and 20140930-EM-Poortjies kmz files provided by Mainstream. This area is based on boundaries determined by Mainstream and based on project requirements.

The area of investigation is located approximately 30km south of Pofadder in the Northern Cape Province, as indicated on the attached Annexure 1: Locality Plan.

2.2 STORM-WATER CONSIDERATIONS

2.2.1 Construction of the Internal Roads

The construction of the internal roads will involve earthworks where undisturbed soils would be exposed which may lead to erosion. These exposed areas tend to form channels and will collect rain water. It is therefore important that all storm-water runoff be directed to the lower side of the gravel roads. At this point it should then be collected in side drains and disposed of in designated places by means of suitable outlet structures and berms. All roads should therefore be carefully designed and constructed to make the handling of storm-water possible.

2.2.2 Existing Drainage Features

A topographical map and *Google Earth* was used to identify existing drainage features on Namies Suid and Poortjies. A list of the existing drainage features is shown below:

- Non-perennial rivers
- Jeep tracks and Secondary roads

As a rule all rivers and drainage channels should be kept untouched so that the existing hydrology is not disturbed. No rivers will be diverted due to the construction of the internal roads. The natural drainage channels that collect water from the existing jeep tracks and secondary roads will be upgraded and should be used as drainage channels as far as possible. It is proposed that the drainage channels for the new internal roads should follow natural drainage lines. These drainage channels should then ultimately link up with the existing drainage routes on site.

2.2.3 Construction of the Wind Turbine Foundations

The wind turbine foundations will be constructed on dense pedocretes or on in-situ bedrock (refer *Preliminary Geotechnical Report*), and therefore deep excavations will be required. *Figure 2-1* below shows a typical layout of the construction envisaged for the turbine foundations on the renewable energy site.

Figure 2-1: Typical Layout for the Construction of the Wind Turbine Foundations

The deep excavations necessitate that cut-off drains be constructed on the high side of the excavations. The cut-off drains prevent surface water run-off from entering the excavation. The fresh excavations have a high risk of erosion and all water channels need to be kept away from the construction of the foundations. Emergency pumps should be in place to remove any water at the bottom of the foundations in case of need.

2.2.4 Construction of the Solar Panel Foundations

Solar panel arrays are required to be installed on level ground, which will necessitate mass earthworks to be undertaken before installation of the foundations. Ground conditions may determine that the solar panel foundations be founded on the very dense pedocretes, located beneath the overlying soils, or on the existing bedrock, as per the *Preliminary Geotechnical Report.* The mass earthworks will however facilitate storm-water drainage, specifically overland flow, which will be catered for in the design. An unlined side-drain will be utilised to collect run-off from the solar panel array site for discharge in a natural watercourse. The design and location of the drainage system for the solar portion of the facility will form part of the Detailed Design Report, before construction commences.

2.2.5 Construction Camp

The laydown area, operation and maintenance building, site compound and concrete batch plant will be founded on levelled, compacted and sloped natural gravel. Cut-off drains must be constructed around the construction camp which must then be channelled to existing drainage channels.

2.3 STORM-WATER DRAINAGE STRUCTURES

2.3.1 Drainage Channels

Drainage channels should be constructed adjacent to the internal roads under construction. The drainage channels should follow the natural flow of the ground with a constant depth to ditch invert. The objective is to allow storm-water from the roads to be discharged into natural drainage structures and then discharge it into the veld at suitable drainage locations.

Figure 2-2 below shows the drainage trench envisaged during the construction of the internal roads.

Figure 2-2: Typical Construction of a Drainage Channel adjacent to the Internal Roads

Figure 2-2 shows the drainage channel adjacent to the internal road under construction. The depth and type of trench can be established at the design stage. The drainage channel can be left in place as permanent installations on completion of the works or in filled and reinstated to the existing areas natural vegetation.

2.3.2 Intermediate Cross-Drains

If required, intermediate cross-drains should be built under the internal roads to make water crossings possible. A long gradient profile of a road has the risk of surface water accumulating at the lowest point.

The risk for large volumes of flow on the internal roads can lead to scouring of the road surface, causing erosion to form. *Figure 2-3* below shows the envisaged intermediate cross drain to be constructed under the internal roads.

Figure 2-3: Cross drains under the Internal Roads

2.4 STORMWATER MANAGEMENT PLAN

Based on the storm-water considerations for the renewable energy site located on Namies Suid and Poortjies, the following points should be considered for the development of a detailed storm-water management plan.

- Natural drainage paths should be maintained and utilised as far as possible.
- In-situ soils are highly permeable with relatively low run-offs generated.
- Natural flora should be disturbed as little as possible.
- No large amounts of water should be allowed to dam on site.
- A maintenance plan should be developed for any installed storm-water systems.
- Pollution prevention and environmental protection legislation should be adhered to.

3 PRELIMINARY 1:100 FLOOD LINE OPINIONS AND RISK ASSESSMENTS

3.1 INTRODUCTION

Due to the location of the proposed development it can be expected that a 1:100 year flood for the wind energy facility will not be a limiting factor. For accurate flood line calculations a detailed topographical survey of the area is required prior to construction commencing. To determine where existing watercourses are crossed by either new or existing roads a 1:50 000 topographical map of the site was used to overlay the positions of the turbines, roads, substations and associated infrastructure. Recommendations have been made such that no infrastructure will be located in

possible flood areas, low points or close to watercourses. If it is not possible to relocate infrastructure then the design thereof must be amended to

3.2 IDENTIFICATION OF EXISTING RIVERS WITHIN NAMIES SUID AND POORTJIES

Various watercourse have been identified using 1:50 000 topographical maps of the proposed site as shown in *Figure 2-2 below*. The proposed road network which will be utilised during construction and operations and maintenance will cross various watercourses as identified on the 1:50 000 topographical map of the area.

The chosen access route to the site is indicated in *Figure 2.1* below. The access route traverses approximately 7 minor watercourses, which do not pose a major risk to the project. As there is only one existing road within the site, a new network of internal roads will have to be constructed. These roads will be required to be designed in such a manner that watercourse crossings are minimised as far as possible. Storm-water management of the new road network will take cognisance of the topography, soil conditions and proposed road network and infrastructure layout. It is not recommended that watercourses be diverted and therefore infrastructure should not be located in close proximity to the major watercourses, as indicated in *Figure 3-1* below.

The internal road network will be designed as part of the *Preliminary Engineering Services Report* taking the above considerations into account.

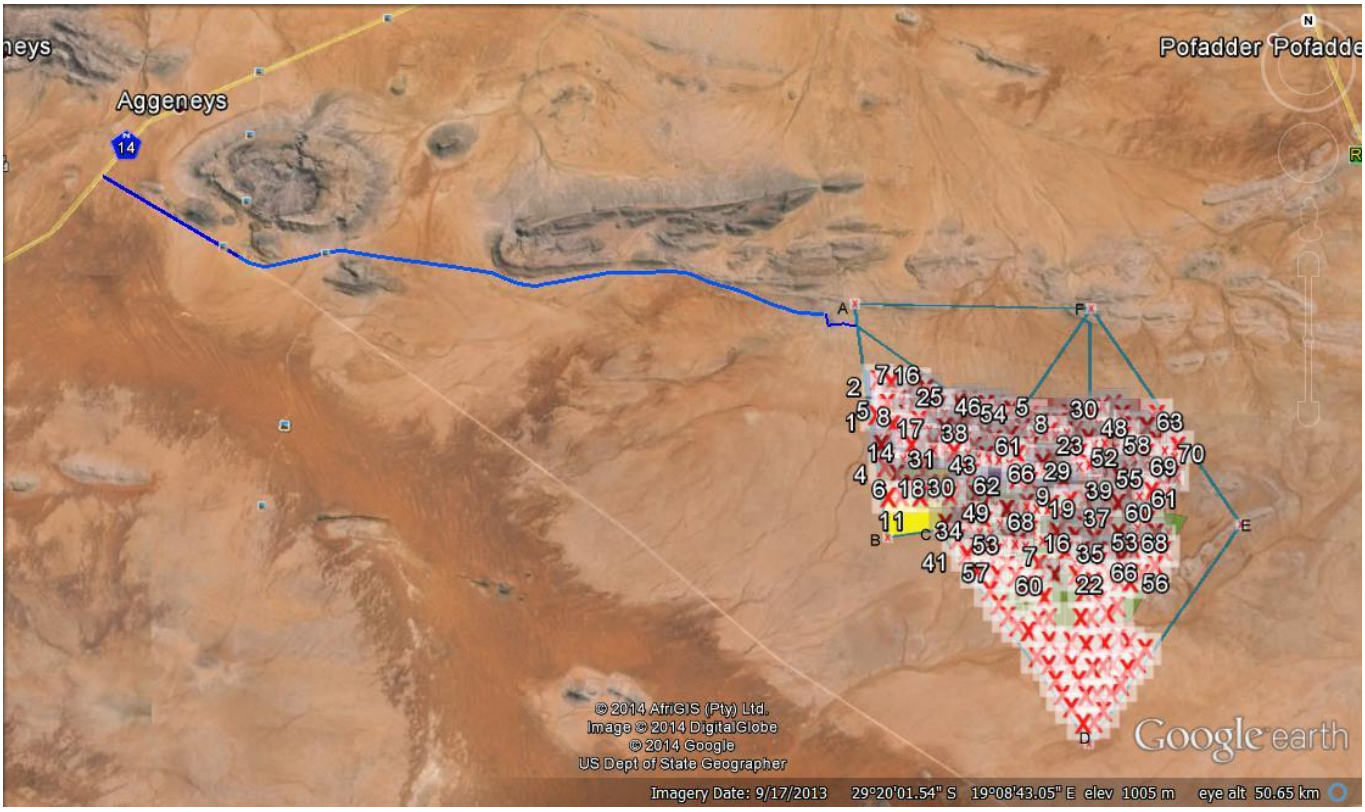

Figure 3-1: Wind and solar site access road

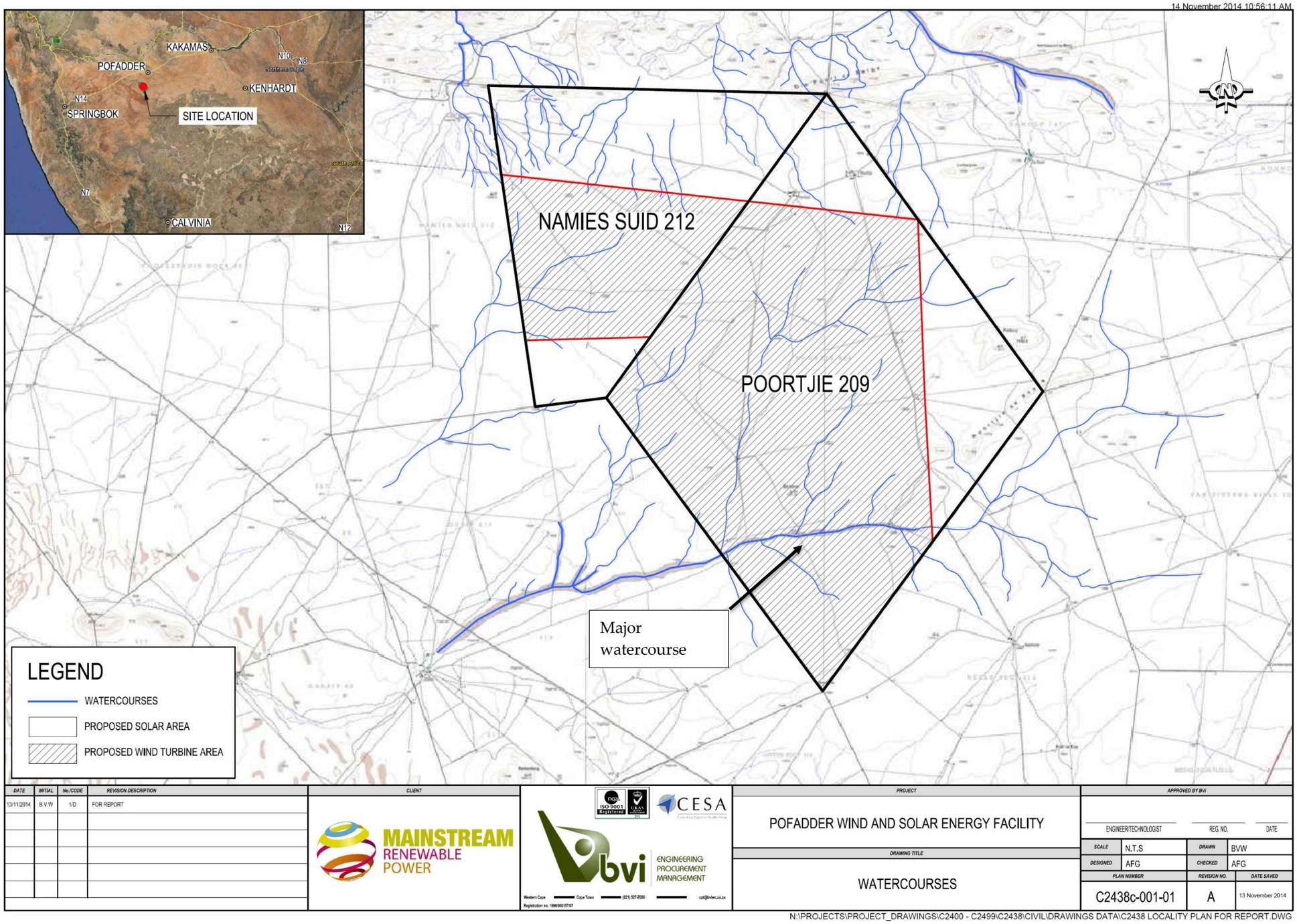

Figure 3-2: Namies Suid/ Poortjies watercourses

3.2.1 Conclusion and Recommendation

It is recommended that a detailed storm-water management plan be completed once the project details are finalised and before construction commences. Development and design of an internal road network will take place as part of the *Preliminary Engineering Services Report*, taking into account the recommendation that the path of natural watercourses not be adjusted. Infrastructure constructed as part of the renewable energy project should be designed to accommodate the natural watercourses.

4 REFERENCES

The 1:50 000 scale topographical maps 2919AC Namies and 2919AD Samoep, both published in 2003.

ANNEXURE 1 – Locality Plan

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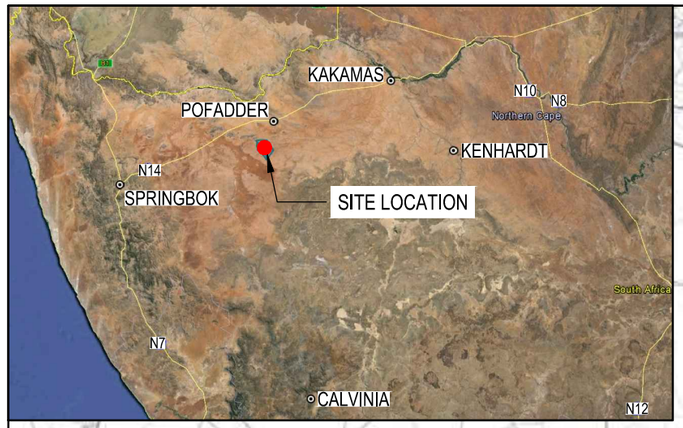

NAMIES SUID 212

POORTJIE 209

LEGEND

- WATERCOURSES
- PROPOSED SOLAR AREA
- PROPOSED WIND TURBINE AREA

DATE	INITIAL	No./CODE	REVISION DESCRIPTION
13/11/2014	B.V.W	1/D	FOR REPORT

CLIENT: MAINSTREAM RENEWABLE POWER

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PROJECT: POFADDER WIND AND SOLAR ENERGY FACILITY

DRAWING TITLE: LOCALITY PLAN

APPROVED BY BVi

ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	N.T.S	DRAWN	BVW
DESIGNED	AFG	CHECKED	AFG

PLAN NUMBER	REVISION NO.	DATE SAVED
C2438c-001-01	A	13 November 2014

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