Project design document form for small-scale CDM project activities

(Version 08.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for small-scale CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Bethlehem Hydroelectric project
Version number of the PDD	12
Completion date of the PDD	05/08/2016
Project participant(s)	Bethlehem Hydro (Pty) Ltd. Statkraft Markets BV
Host Party	South Africa
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	Methodology: AMS-1.D "Grid connected renewable electricity generation" (Version 18.0) Standardised baseline: ASB0001 "Standardized baseline: Grid emission factor for the Southern African power pool" (Version 01.0)
Sectoral scope(s) linked to the applied methodology(ies)	Sectoral scope: 01, Energy industries (renewable-/non-renewable sources)
Estimated amount of annual average GHG emission reductions	32,288 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The Bethlehem Hydroelectric Project was registered on 08 October 2009. The project was implemented and the first crediting period starting from 08 October 2009 elapses on 07 October 2016. The PDD has been updated in order to facilitate the request for renewal of the crediting period. The project participants are Bethlehem Hydro (Pty) Ltd who was owned by NuPlanet from South Africa and Statkraft Markets BV from the Netherlands. Subsequently NuPlanet has rebranded the business as Renewable Energy Holdings (REH).

The purpose of the project activity is to generate hydroelectricity, which will be distributed into the currently coal intensive South African grid. The hydro power generated from the project site will be replacing electricity from the national grid, consequently avoiding CO_2 emissions from fossil fuelled power plants connected to the grid. Prior to the implementation of the project activity, there was no hydro-power generated at the project sites. The baseline scenario has been updated to make use of the “Standardized baseline: Grid emission factor for the Southern African power pool”, which represents a more accurate.

The project involves the development and operation of 5.8[1]MW of hydro generation capacity within the boundaries of the Dihlabeng Local Municipality (Free State Province, South Africa). The project will generate 37 GWH per annum and is comprised of two generation facilities i.e.

- A run of river site located on the As River, midway between Bethlehem and Clarens; and,
- Facility to be located at the existing concrete wall of the Sol Plaatje Dam, in the town of Bethlehem. The Sol Plaatje Dam supplies water to the town and is not used for hydropower generation so far.

The project involved the construction of these facilities as well as a 5km transmission line at 11KV on wood poles to deliver to the Panorama substation to link the project to the national grid. A step-up transformer will be required at the power station in order to deliver power at 11kVA. Existing access roads to the site will also be upgraded.

The water resource in the As River is artificially fed from the Lesotho Highlands Water Project (LHWP). Water from the project is currently transferred from the Katse Dam in Lesotho to South Africa via the transfer tunnel and the delivery tunnel. During the transfer it is used to generate electricity for Lesotho in the Muela hydropower plant situated between the two tunnels. After driving the turbines the water flows to South Africa via the delivery tunnel, the outfall of which is located in the upper reaches of the As River (a tributary of the Liebenbergsvlei River). The flow rate in the river is therefore not seasonally dependent and remains almost constant throughout the year and over time.

The project will contribute to sustainable development in South Africa through supporting the development of renewable energy in the country and assisting South Africa in the achievement of its renewable energy target of 10000 GWH renewable energy contribution to final energy consumption by 2013 (White Paper on Renewable Energy, Republic of South Africa, November 2003).

[1] Correction to the generation capacity of the plant was made in this PDD revision, to align accurately with the equipment specifications. There were not equipment or operational changes on site.

At a local level the project has led to increased economic activity in the area. In terms of job creation the project created 40 skilled and 100 to 160 unskilled job opportunities during the construction phase, which lasted approximately 12 months. Three full-time permanent jobs were created after implementation.

An estimation of the annual average GHG emissions reductions are 32,288 metric tonnes CO_2 equivalent. An estimation of the total GHG emission reductions for this crediting period is 226,016 metric tonnes CO_2 equivalent.

This project is not part of a programme of activities, it is a standalone project.

A.2. Location of project activity

A.2.1. Host Party

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South Africa

A.2.2. Region/State/Province etc.

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Free State

A.2.3. City/Town/Community etc.

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Bethlehem (Dihlabeng Municipality)

A.2.4. Physical/Geographical location

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The Sol Plaatje facility will be located at the Sol Plaatje dam which is 5km from the centre of Bethlehem. The actual location is at the existing concrete dam wall adjacent to a pumping station, which supplies the town of Bethlehem with water.

The Merino site is located on farmland on the As River on the farms 'Merino' and 'De Burg Susan', some 15 km outside Bethlehem in the direction of the town of Clarens.

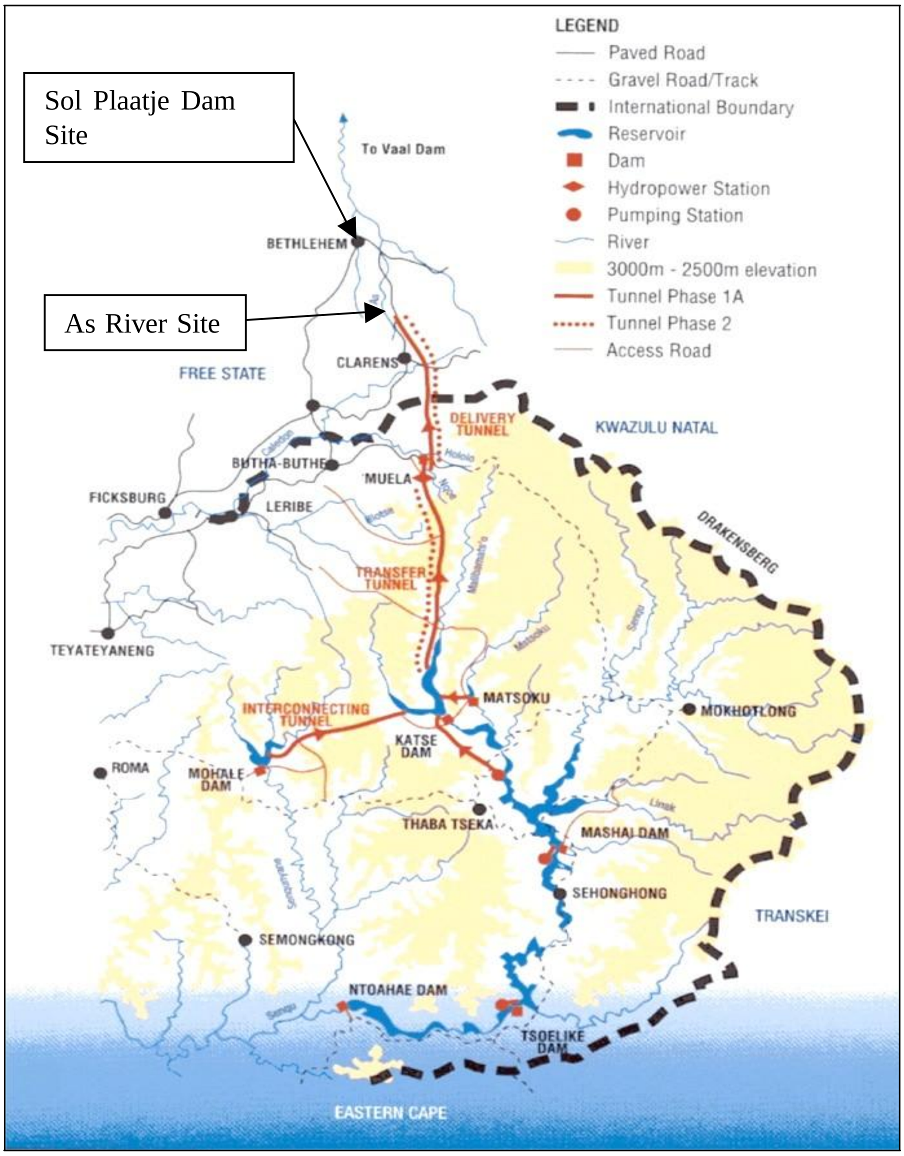
The co-ordinates for the two sites are:

Merino:
28º 22' 09" S, 028º 21' 42" E

Sol Plaatje:
28º 12' 59" S, 028º 21' 50" E

Bethlehem Hydro (Pty) Ltd is located at, Claremont Central, Corner of Main road and Vineyard road, Claremont, Cape Town, 7735, South Africa

Map showing project location



A.3. Technologies and/or measures

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The project activity contributes to technology transfer to the host country South Africa, since it utilises hydro power technology developed outside South Africa, imported from India.

The project is using small hydro technology at both of the following facilities:

1. Sol Plaatje unit – located at the Sol Plaatje dam will be a dam-installation, but operates as a run-of-river power station and doesn't affect the water volumes of the dam. The facility uses a single 2.1m diameter, double-regulated horizontal axis Kaplan small hydro turbine with a 2.5 MW rating. The equipment was installed in 2009 and has been in operations for approximately 8 years. The lifespan of the equipment is in excess of 20 years. The overall efficiency at net operating head and maximum flow through the turbine is approximately 85.17%. The site has a generating head of approximately 11 meters.

2. Merino unit – located on the As River, is a run-of-river small hydro power plant that uses a single double-regulated horizontal axis Kaplan small hydro turbine with a 3.6 MW rating. The equipment was installed in 2010 and has been in operation for approximately 7 years. The lifetime of the equipment is in excess of 20 years. The overall efficiency at net operating head and maximum flow through the 3.6 MW Kaplan turbine installed at the Merino site is approximately 86.37%. The site has a generating head of approximately 13 meters.

There is no mass transfer in such a system due to the nature of hydropower projects. The maximum turbine flow for both of the installations is around 29.2 m^3/s. The water entering the system is exactly the same as the water flowing downstream of the system. The energy balance of a hydropower facility is linked to the flow of the water through the turbine and the amount of head. There are no significant transmission or distribution losses in the project due to close proximity of the equipment to the grid. The energy produced is the amount of energy delivered to the grid.

Prior to the implementation of this project activity "the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid." The South African grid is predominantly coal-fired grid.

The arrangement of the 2 facilities in the project activity are as follows (Figure 1):

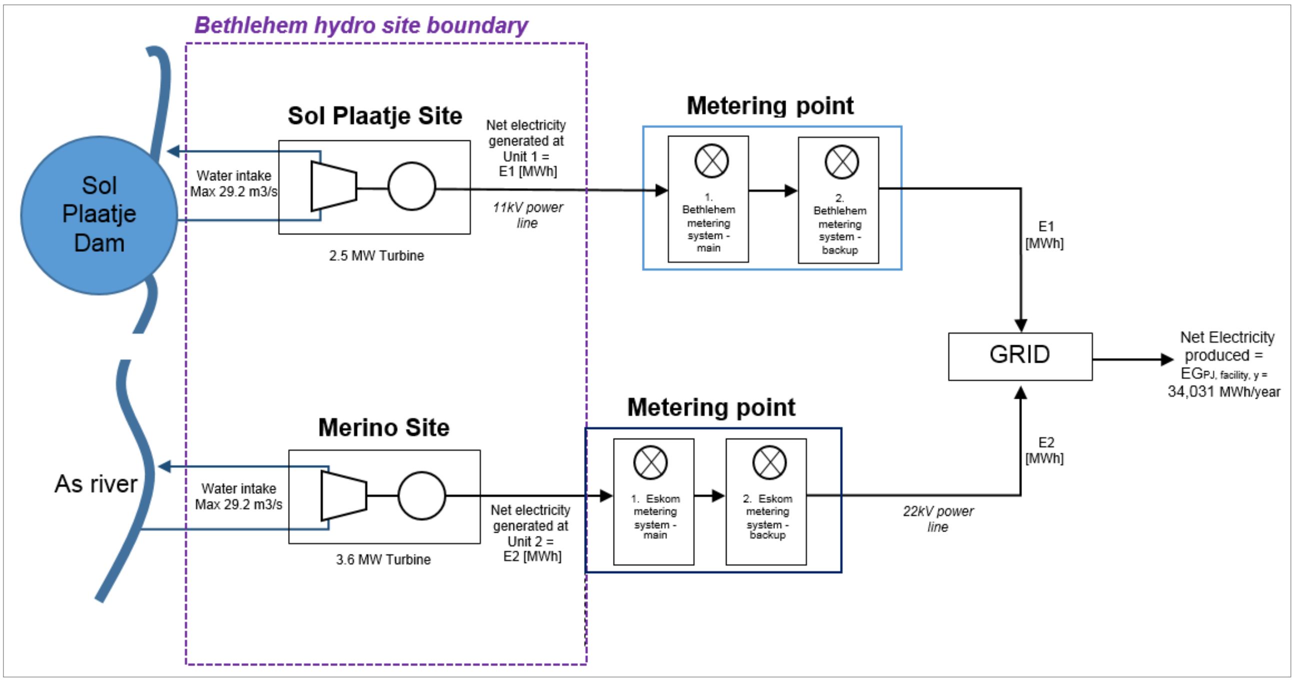

Figure 1: Project activity equipment arrangement

A description of the monitoring equipment, electricity meters, is given in Appendix 5 of this PDD.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
South Africa (host)	Bethlehem Hydro (Pty) Ltd	No
The Netherlands	Statkraft Markets BV	No

A.5. Public funding of project activity

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The Government of Netherlands provided resources for early project identification and development related activities with regard to this project from their AIJ programme. As such

the funding did not result in a diversion of official development assistance. The Government of the Netherlands is not claiming any emission reductions as a result of their early support to the project.

No public funding from ODA has been used to acquire CERs from this project.

A.6. Debundling for project activity

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According to the Methodological tool: Assessment of Debundling for small-scale project activities (Version 04.0) - a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity, if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point

The project owner confirms that they have not registered any small scale CDM project activity or are applying for registration of another small scale CDM project activity within 1 km of the project boundary of the proposed small-scale activity, in the same project category and technology/measure. In addition, there is no other registered small-scale CDM project activity with the same project participants in South Africa (in the past two years or previous).

So the proposed project is not a debundled component of any large scale CDM activity and hence it qualifies as a small scale project activity.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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Methodology:

- AMS-I.D.: “Grid connected renewable electricity generation” (Version 18.0)
  https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

Tools:

- “Methodological tool: Tool to determine the remaining lifetime of equipment” (Version 01)
  https://cdm.unfccc.int/EB/050/eb50_repan15.pdf

- “Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (Version 03.0.1)
  https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

Water reservoir calculations use:

- ACM0002: “Grid-connected electricity generation from renewable sources” (Version 17.0)
  https://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

Standardised baseline:

- ASB0001 “Standardized baseline: Grid emission factor for the Southern African power pool” (Version 01.0)
  https://cdm.unfccc.int/methodologies/standard_base/EB73_repan03_ASB-0001.pdf

B.2. Project activity eligibility

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The following table summarises the applicability criteria for projects using AMS-I.D (version 18). This project activity meets all of the criteria as reflected in the table below.

No.	Applicability Criteria – AMS-I.D Version 18	Project Activity
1.	*This methodology is applicable to project activities that:* *(a) Install a Greenfield plant;* *(b) Involve a capacity addition in (an) existing plant(s);* *(c) Involve a retrofit of (an) existing plant(s);* *(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or* *(e) Involve a replacement of (an) existing plant(s).*	Meets the applicability criterion. This project activity involves the installation of a new grid-connected hydropower plant at a site where no renewable power plant was operated prior to implementation of the project activity therefore criterion (a) is applicable.
2.	*Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:* *(a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir;* *(b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;* *(c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m^2.*	Not applicable. Although this project activity is located at the existing concrete wall of the Sol Plaatje Dam, the existing reservoir is not used as a storage facility for dispatch production of electricity. Instead, the facility only utilises the water as and when the water flows out the dam, thus the facility does not affect the water volumes of the dam. The project activity is located at an existing reservoir, and there is no change in the volume of the reservoir.
3.	*If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.*	Not applicable. This project activity has only one component, which is a hydropower plant with a generation capacity of 5.8MW.
4.	*Combined heat and power (co-generation) systems are not eligible under this category*	Not applicable. This project activity does not involve a combined heat and power system.
5.	*In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.*	Not applicable. This project activity is a Greenfield project, and does not include a capacity addition.
6.	*In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW.*	Not applicable. This project activity is a Greenfield project, and does not include a retrofit, rehabilitation or replacement.

No.	Applicability Criteria – AMS-I.D Version 18	Project Activity
7.	*In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.*	Not applicable. This project activity is a hydro power projects.
8.	*In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply*	Not applicable. The project activity is not a biomass related project.

The following table summarises the applicability criteria for projects using the ASB0001 "Standardized baseline: Grid emission factor for the Southern African power pool" (version 01.0). This project activity meets all of the criteria as reflected in the table below.

No.	Applicability Criteria – ASB0001 Version 01.0	Project Activity
1.	*This standardized baseline is applicable to the CDM projects in the following countries, which are the SAPP member countries:* *(a) The Republic of Botswana;* *(b) The Democratic Republic of the Congo (DRC);* *(c) The Kingdom of Lesotho;* *(d) The Republic of Mozambique;* *(e) The Republic of Namibia;* *(f) The Republic of South Africa;* *(g) The Kingdom of Swaziland;* *(h) The Republic of Zambia;* *(i) Zimbabwe.*	Meets the applicability criterion. The project activity is implemented in the Republic of South Africa, and thus it complies with criteria (f).
2.	*The CDM project activities can apply this standardized baseline under the following conditions:* *(a) The project activity is connected to the project electricity system;* *(b) The CDM approved methodology that is applied to the project activities, requires to determine CO2 emission factor(s) for the project electricity system through the application of the tool, for the determination of baseline emissions, project emissions and leakage emissions; and* *(c) When applying the values of this standardized baseline to CDM projects, the requirements below are to be followed:* • *In the case that the project activity uses the ex ante option of data vintage, as per the tool, the latest approved values of this standardized baseline shall be used for calculation of emission reduction for the entire first, or entire second or entire third crediting period;* • *In the case that the project activity uses the ex post option of data vintage as per the tool, the*	Meets the applicability criterion. The project activity is connected to the electricity system of South Africa, and delivers electricity into the predominantly coal-fired grid and thus it complies with criteria (a). The approved and applicable AMS-I.D methodology requires that the project activity determine the CO_2 emission factor of the project electricity system to determine baseline emissions and thus the project activity complies with criteria (b). The project activity uses the ex-ante approach, and thus the standardised baseline will apply

No.	Applicability Criteria – ASB0001 Version 01.0	Project Activity
	latest approved values of this standardized baseline valid at the end of the monitoring period shall be used for calculation of emission reduction for that monitoring period.	for the entire second crediting period. Thus the project activity complies with criteria (c).

This project activity only contains one component, which is the generation of renewable energy. The maximum generation capacity of the project is 5.8MW, which thus is under the limit of 15MW and classifies the project as a Type I small scale project activity.

B.3. Project boundary

As defined in the methodology AMS-I.D the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to. According to the "Tool to calculate the emission factor for an electricity system" a grid/project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

The project boundary encompasses the physical geographical location of the two generating units. The units may from time to time import electricity from the grid.

The diagram below delineates the project boundary (Figure 2):

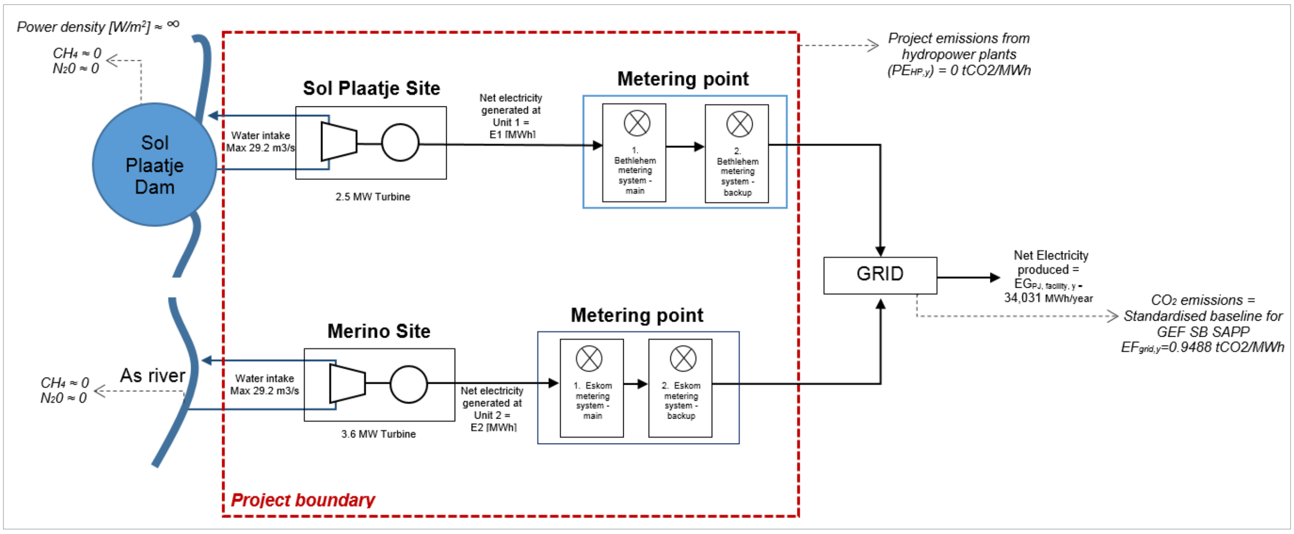

Figure 2: Delineation of project boundary

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the table below. The main greenhouse gas that is prevented from being emitted into atmosphere is carbon dioxide which would have otherwise been emitted from the fossil fuel fired power plants that are connected to the grid.

Source	**Gas**	**Included?**	**Justification/Explanation**
Grid electricity generation	CO_2	Yes	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.
	CH_4	No	Minor emission source

Source	Gas	Included?	Justification/Explanation
	N_2O	No	Minor emission source

B.4. Establishment and description of baseline scenario

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In accordance with the methodology AMS-I.D, “the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.” Baseline emissions include only CO_2 emissions from electricity generation in power plants that are displaced due to the project activity.

Assessment of the validity of the original/current baseline:

The tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (Version 03.0.1) is used to assess the validity of the initial baseline for the second crediting period by applying the following steps:

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The current baseline complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation and are applicable at the time of requesting renewal of the crediting period.

Step 1.2: Assess the impact of the circumstances

The architecture of the project remained the same for the new crediting period. In 2009 a baseline was validated for this project. In 2013 a Grid Emission Factor Standardised Baseline was approved for usage in projects within the Southern Africa Power Pool. As the electricity mix on the grid has evolved since 2009, this project will continue to make use of the Standardised Baseline as it represents an update of the current electricity mix on the grid. The Standardised Baseline will be reassessed prior to the expiry of the validity period and the Regional Centre in Kampala is assisting in updating this multi-country baseline.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

According to the 2015 State of de Renewable Energy in South Africa published by the Department of Energy (http://www.gov.za/sites/www.gov.za/files/State%20of%20Renewable%20Energy%20in%20South%20Africa_s.pdf) renewable energies, of which hydropower forms part, are still very new in the South African market, making up 4% of the national electricity mix. This is a notable improvement in just four years from an almost negligible presence. However it is not significant and the baseline is not affected by the penetration of new technologies, which remains dominated by coal generation technologies. Likewise, as per methodological tool “*Tool to determine the remaining lifetime of equipment*”- option (c), the default values for generation facilities, which make for the bulk of the generation in South Africa, is 25 years. This will suffice to cover the second crediting period.

Step 1.4: Assessment of the validity of the data and parameters

The baseline determined at the start of this project activity has been updated to make use of the Southern African Power Pool Grid Emission Factor Standardised Baseline to calculate baseline emission for this crediting period.

Step 2.1 and 2.2: Update the current baseline and the data and parameters

The baseline for the project activity has been updated to use the Southern African Power Pool Grid Emission Factor Standardised Baseline.

In order to calculate the baseline emissions for the project activity, the combined margin (CM) grid emission factor needs to be determined, consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'. The standardized baseline grid emission factor for the Southern African power pool, version 01.0 has been used in the quantification of baseline emissions.

Thus, as per the paragraph 22 of the methodology, the baseline emissions are the product of quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity multiplied by the Southern African standardized baseline grid emission factor.

$$BE_y = EG_{PJ,y} * EF_{grid,y}$$

BE_y	=	Baseline emissions in year y (t CO_2)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{grid,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

Key assumptions and rationale used to determine the baseline and baseline emissions:

No.	Parameter/Variable	Value	Source
1.	$EG_{PJ,y}$: net electricity exported to grid (MWh/annum)	34,031.111	Measured by electricity meters installed at the sites. This is the sum of the net electricity exported to the grid from both power generation units.
2.	$EF_{grid,y}$: combined margin emission factor for the project electricity system in year y (tCO_2/MWh)	0.9488	ASB0001 "Standardized baseline: Grid emission factor for the Southern African power pool", Version 01.0

B.5. Demonstration of additionality

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Additionality was proven using attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, which showed that the project is additional in terms of the following barriers:

Barrier due to prevailing practice: the entry of Independent Power Producers in the South African power market is a recent phenomenon, with ESKOM still playing the dominant role in terms of generation capacity. Only some 5% of South Africa's generation capacity comes from non-Eskom sources. These are all either municipally owned plants or generators imbedded in large industrial operations supplying primarily for own internal use. There are therefore almost no privately owned power plants in South Africa apart from co-generation plants owned by large industry. In fact private ownership within the power generation sector of South Africa was only mandated by the SA cabinet in 2003.

The National Energy Regulator of South Africa (NERSA) has licensed a total of 5 private power plants. These private plants have a combined installed capacity of 1387MW of which 1279 MW is coal fired plants run by large industrial companies for their own supply and 105MW is baggage plants run by the sugar mills for their own internal power consumption. A single 3MW hydro plant is licensed. (Source: Energy Supply Statistics 2004, http://www.nersa.org.za/UploadedFiles/Publication/ESS2004.pdf)

The South African Department of Mineral and Energy (DME) provide the following information on the South African power generation sector:

> *Almost 90 percent of South Africa's electricity is generated in coal-fired power stations. Koeberg, a large nuclear station near Cape Town, provides about 5 percent of capacity. A further 5 percent is provided by hydroelectric and pumped storage schemes. In South Africa there are few, if any, new economic hydro sites that could be developed to deliver significant amounts of power. Generation is dominated by Eskom, the national wholly state-owned utility, which also owns and operates the national electricity grid. Eskom supplies about 95 percent of South Africa's electricity.* (Source: http://www.dme.gov.za/energy/electricity.stm)

This figure is supported by the electricity generation statistics published by the National Energy Regulator of South Africa (NERSA). Of the total electricity produced in 2004 in South Africa of 230 004GWh, Eskom produced 221 382GWh. In 2004 therefore Eskom produced 96% of the electricity in South Africa. (Source: Energy Supply Statistics 2004 p 13 http://www.nersa.org.za/UploadedFiles/Publication/ESS2004.pdf)

Bethlehem Hydro will be the one of the first new (not refurbished) Independent Power Plant to be constructed in South Africa for the sole purpose of selling power commercially and not for internal use. The ability of new generators to break into this market is difficult as a result of a number of factors including the ability to negotiate access to the grid, the need for an Independent Power Producers license from the national regulator and the price paid for electricity. To date no other new IPP could compete with the low cost of power produced by Eskom. All of these requirements require resource levels that are generally beyond the capacity of producers. Therefore the grid contribution of small and independent hydro producers is currently extremely limited. In the case of Bethlehem this manifested itself in terms of the long lead time required to develop such a project (in the order of four years) as well as the time required to discuss and get agreement on the possibility of a power purchase agreement with the municipality.

Other barriers (financial resources): the ability of small and independent hydro power plants to be financially viable is constrained by their ability to compete with the prices of ESKOM electricity. ESKOM is one of the lowest cost producers in the world as a result of the historically subsidised investment in generation capacity which is most coal based but includes a small (less than 10%) large hydro and nuclear. The effect of this is that income stream from electricity sales for independent power projects is strongly influenced by the wholesale prices ESKOM charges to its customers, rather than being directly related to the cost of production of power. The low electricity prices make small and independent hydropower in general, financially unattractive as investments as measured by their returns for investors. There have therefore been no new and independent small hydro power plants in South Africa since the early 1980's. The general price available to facilities is usually in the range 12 – 14 South African cents (approximately 2 US cents based on an exchange rate of R7 to the dollar) depending of course what the buyer (local municipality) is paying to Eskom. The national Electricity Regulator of South Africa (NERSA) requires distributors of electricity (municipalities) to purchase the cheapest electricity (Eskom or an own embedded generator) available for on sale to their customers.

Without the income from the carbon revenue, the project would not generate sufficient cash flow to meet the minimum debt service coverage ratio requirements of the Development Bank of Southern Africa (DBSA). The carbon revenue is an essential component of the project's income in order to meet its debt payment requirements. The DBSA has therefore included a signed sales agreement for the emission reductions as a suspensive condition for its loan disbursement. This barrier applies specifically to the proposed project activity; it is not necessary for thermal power plants to meet this requirement.

The timeline below shows the mayor milestones during the project’s development.

Milestone	**Date**
Feasibility study completed	May 2003
Environmental Impact Assessment approval	5 July 2004
Water use license awarded	26 May 2005
Loan Agreement Signed	6 June 2005
International Stakeholder Consultation	20 September 2005 to 19 October 2005
Power generation license awarded	7 November 2005
Power Purchase Agreement signed	21 November 2006
Emission Reduction Purchase Agreement	28 November 2006
Project Start date (Commencement of Civil Works notice)	28 November 2006
International Stakeholder Consultation (No Comments)	15 June 2007 to 14 July 2007
International Stakeholder Consultation (ISHC with updated Methodology)	12 March 2008 to 10 April 2008
Start of Crediting Period	08/10/2009
Start of second Crediting Period	The anticipated starting date is 08/10/2016

When this project was registered there was no option for automatic additionality.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Emission Reduction Calculation:

As per paragraph 43 of AMS-I.D. (version 18.0), emission reductions are calculated according to equation (9) of the methodology as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ERy = Emission reductions in year y (t CO_2)

BEy = Baseline Emissions in year y (t CO_2)

PEy = Project emissions in year y (t CO_2)

LEy = Leakage emissions in year y (t CO_2)

Baseline Emissions:

According to the methodology AMS-I.D, version 18.0, the baseline emissions are calculated as the product of quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity multiplied by the grid emission factor (equation (1) of the methodology).

$$BE_y = EG_{PJ,y} * EF_{grid,y}$$

BE_y	=	Baseline emissions in year y (t CO_2)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{grid,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (t CO_2/MWh)

The grid emission factor for the Southern African power pool standardized baseline, version 01.0 has been calculated and is applicable to CDM projects implemented in the SAPP member countries, including South Africa. For the purpose of estimation of emission reductions from the project activity, the standardized baseline combined margin emission factor has been used as is stipulated for “project activities other than wind and solar for the second of third crediting period”. The value of 0.9488 tCO_2/MWh is applied for $EF_{grid,y}$. The standardized baseline combined margin emission factor was derived from the version 2.2.1 of the “Tool to calculate the emission factor for an electricity system” which entered into force on 31/05/2013.

The calculation of $EG_{PJ,y}$ for greenfield power plants are calculated according to equation (2) of the methodology as:

$$EG_{PJ,y} = EG_{PJ,facility,y}$$

Where:

$EG_{PJ,facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

Project Emissions:

According to the AMS-I.D. methodology (version 18.0) project emissions (PE_y) for most renewable energy project activities are equal to zero.

However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of “ACM0002: Grid-connected electricity generation from renewable sources” (Version 16.0):

a. Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption);
b. Emissions from water reservoirs of hydro power plants.

Point a) does not apply to this project activity as it is not a geothermal power plant. Point b) does apply to this project activity as there is an existing water reservoir, the Sol Plaatje Dam, at the one turbine. However the existing reservoir is not used as a storage facility for dispatch production of energy. Instead, the facility only utilises the water as and when the water flows out the dam, and thus the facility does not affect the water volumes of the dam.

According to ACM0002, version 16.0 the emissions from water reservoirs of hydro power plants ($PE_{HP,y}$) are calculated depending on the value of the power density (PD) of the project activity, which is calculated according to equation (3) of the methodology as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD	=	Power density of the project activity (W/m^2)
Cap_{PJ}	=	Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL}	=	Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
A_{PJ}	=	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
A_{BL}	=	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

In this project activity the difference between $A_{PJ} - A_{BL}$ is zero as the project activity has not changed the water volume of the dam. The volume of water in the dam is not affected by the project activity but only by the water requirements of the town where the water is being delivered. As mentioned, only as and when the water is transported to the town for consumption is the project activity able to produce power. The facility does not use the reservoir as a storage facility for dispatch energy production.

With power density (PD) equation being divide by zero it results in a PD = ∞, infinity. According to paragraph 45 of the large scale methodology ACM0002, version 16.0, if PD > 10 W/m^2 then $PE_{HP,y}$ = 0, equation (6) of the methodology.

In addition, according to methodology AMS-I.D version 18.0, CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”. However the project activity does not consume any diesel on site. The project activity used to have a backup diesel generator on site. However this has now been removed and there are thus no project emissions related to fossil fuel consumption.

As such project emission for this project activity are equal to zero, PE_y = 0.

Leakage Emissions:

According to methodology AMS-I.D, version 18.0, leakage emissions only apply to biomass project activities. Thus leakage emissions are zero for this project activity.

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$EF_{grid,y}$
Unit	tCO_2/MWh
Description	Southern African standardised baseline grid emissions factor, ASB0001, applicable to all project activities other than wind and solar for the second or third crediting period
Source of data	ASB0001 “Standardized baseline: Grid emission factor for the Southern African power pool”, (Version 01.0)
Value(s) applied	0.9488

Choice of data or Measurement methods and procedures	No direct measurements will be taken. The combined margin emission factor "applicable to all project activities other than wind and solar for the second or third crediting period" from the ASB0001 "Standardized baseline: Grid emission factor for the Southern African power pool" (Version 01.0) has been used. This standardised baseline value will be used until its subsequent revision is made available.
Purpose of data	Used in the calculation of the baseline emissions.
Additional comment	This project activity meets the applicability criteria of the ASB0001 standardised baseline, in that it is situated in South Africa and is connected to the project electricity system. The grid emission factor is calculated ex-ante.

B.6.3. Ex ante calculation of emission reductions

>>

Following equation (9) methodology AMS-I.D, (Version 18.0), annual emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

With PE_y and LE_y = 0 as explained in section B.6.1 of this PDD, equation (9) simplifies to:

$$ER_y = BE_y$$

And with BE_y calculated following equation (1) of the methodology AMS-I.D, version 18.0:

$$BE_y = EG_{PJ,y} * EF_{grid,y}$$

According to the methodology ASM-I.D, (Version 18.0) the equation simplifies to:

$$ER_y = EG_{PJ,facility,y} * EF_{grid,y}$$

Where:

$EG_{PJ,facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

$EF_{grid,y}$ = 0.9488 tCO_2/MWh

as per the ex-ante standardised baseline ASB0001 grid emission factor for Southern Africa

Thus:

$ER_y = (EG_{PJ,facility,y} * EF_{grid,y}) – PE_y - LE_y$

Where:

ER_y = annual emission reductions in tons CO_2
$EG_{PJ,facility,y}$ = annual net electricity generation supplied to the grid
$EF_{grid,y}$ = Emission Factor
PE_y = Project Emission
LE_y = Leakage Emissions

$EG_{PJ,facility,y}$ = 34,031.111 MWh/annum
$EF_{grid,y}$ = 0.9488 tCO_2/MWh
PE_y = 0
LE_y = 0

ER_y = ((34,031.111) * 0.9488) – 0 - 0
= 32,288.718 tCO2e/annum

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 2016	7,519	0	0	7,519
Year 2017	32,288	0	0	32,288
Year 2018	32,288	0	0	32,288
Year 2019	32,288	0	0	32,288
Year 2020	32,288	0	0	32,288
Year 2021	32,288	0	0	32,288
Year 2022	32,288	0	0	32,288
Year 2023	24,769	0	0	24,769
Total	226,016	0	0	226,016
Total number of crediting years	7 (seven)			
Annual average over the crediting period	32,288	0	0	32,288

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{PJ,facility,y}$
Unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)
Source of data	Electricity meters installed at both the generating unit's connection point (Sol Plaatje and Merino sites).
Value(s) applied	34,031

Measurement methods and procedures	Remote monitored meter will be used which records each Wh produced. The data will be monitored continuously and aggregated monthly. The operational Manager is responsible for the measurements. There is a bidirectional meter recording imports and exports of energy for each of the two facilities, as well as a check meter in each facility. The total net electricity generation is obtained from the sum of the net electricity generation from both main meters (Sol Plaatje and Merino). The meters' accuracy is as described below: • Sol Plaatje Main: accuracy class of 0.2s • Sol Plaatje Check: accuracy class of 0.5 • Merino Eskom meter Main: accuracy class of 0.5s • Merino Eskom meter Check: accuracy class of 0.5s
Monitoring frequency	Continuous real time monitoring, with a daily download of data and monthly recording thereof.
QA/QC procedures	According to the National Standard for Metering (NRS-057), the meters need to be at least of Class 1. Meters' calibration to be checked by accredited calibration authority every 3 (three) years.
Purpose of data	Used in the calculation of the project emission reductions
Additional comment	Refer to Appendix 5 for additional information.

B.7.2. Sampling plan

>>

Not applicable to this project activity as sampling will not be utilised.

B.7.3. Other elements of monitoring plan

>>

The approved monitoring methodology for category Type I.D, renewable electricity generation for a grid is described as follows in appendix B of the simplified M&P for CDM small-scale project activities:

"Monitoring shall consist of metering the electricity generated by the renewable technology."

This methodology will be applied to the two hydropower generating facilities that constitute the project. Separate remote monitored electricity meters will be installed at each generation unit. Data will be transmitted daily via a GPRS (phone) connection and recorded electronically.

The total electricity generated by the project will be the sum of the generation at each power unit, which will be calculated as:

Total net project generation

$EG_{PJ,facility,y} = E1 + E2$

Where,

E1	=	annual net electricity generated at Unit 1 (Sol Plaatje) in MWh
E2	=	annual net electricity generated at Unit 2 (Merino) in MWh

Further information on operational and management structures for this project activity are discussed in Appendix 5 of this PDD

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
Date of completion of application of the selected methodology ASM-I.D Small-scale Methodology “Grid connected renewable electricity generation”, Version 18.0: 28/11/2014.

Date of completion of application of the selected standardized baseline ASB0001 “Standardized baseline: Grid emission factor for the Southern African power pool”, Version 01.0: 31/05/2013.

Consultant (not to be considered as a project participant):
Promethium Carbon
Ballyoaks Office Park
35 Ballyclare Drive
Bryanston
South Africa

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
The start date of the project activity was 28/11/2006, the date of commencement of Civil Works.

C.1.2. Expected operational lifetime of project activity

>>
In excess of 20 years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Renewable crediting period. This is the second crediting period.

C.2.2. Start date of crediting period

>>
08/10/2016

C.2.3. Length of crediting period

>>
7 years 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
In terms of South Africa's Environmental Impact Assessment (EIA) Regulations an EIA Scoping study was completed by independent consultants. The environmental impacts assessed during the scoping study covered both the construction and the operational phases of the project. An Environmental Control Officer (ECO) has been appointed and mandated by the Free State Provincial Authority to monitor environmental impacts on their behalf. The conclusions and recommendations of the scoping study as approved by the Free State Provincial Authorities were:

Conclusions
This Report has assessed the potential impacts associated with the proposed hydropower scheme construction. This investigation has not identified any potential impacts on the environment, which are so severe as to suggest that the proposed infrastructure should not be constructed. However, an environmental cost associated with the development of the 4MW mini hydro power station at the As River Site, is the flooding of a wetland identified in a natural basin.

The proposed development is aimed at enhancing/ augmenting the electricity supply to nearby Bethlehem. The expected long term effects on the environment is mostly positive, while the short term negative effects of construction activities of has limited impact on the environment, and with the implementation of the recommendations contained in this report, could be managed and minimised.

Considering the present environmental conditions, the assessment of the environmental issues, and the recommendations contained in this report, it is believed that the Environmental Assessment could be completed at this Scoping Stage, and that no further assessment is required.

Recommendations
The following recommendations are considered professional opinions and are based on experience in the field, knowledge of the local environment, and are informed by comments received during the course of the Scoping process. The recommendations can be separated into the following groups:

- Construction recommendations; and
- Operational and maintenance recommendations

<u>Construction recommendations</u>

- It is recommended that the mitigation measures detailed in the report be implemented in order to reduce the significance of the impacts associated with the construction of the proposed hydropower scheme.
- In order to manage construction and limit the significance of impacts mentioned in Section 4, an EMP should be developed and implemented. An appropriately qualified environmental consultant, taking cognisance of the mitigation measures outlined in this report should draft this EMP. It is crucial that the implementation of the EMP is enforced by an Environmental Control Officer during construction, and that the environmental conditions, costs and penalties are written onto the contract documentation
- In particular, it is recommended that disturbed areas should be rehabilitated and re-vegetated with suitable vegetation.
- The initial design of the Merino site would have flooded a small wetland. The flooding of the wetland was approved under the Record of Decision. However, a change from a head pond to a canal design at Merino managed to avoid any impact on the wetland

<u>Operational and maintenance recommendations</u>

- Develop and implement an operational Environmental Management Programme (EMP), with appropriate guidelines for the optimal operation of the plant and a contingency plan to deal with upset operating conditions and emergency situations (*e.g.* flooding, mechanical failure) should they arise. The EMP should incorporate appropriate monitoring protocols and make adequate provision for appropriate action in the event of potentially significant thresholds being reached or trends indicating potentially significant adverse impacts be noted.
- Related to the aforementioned EMP, ensure the continued implementation of a monitoring programme.
- Ensure that the plant operators have been properly trained in the operation of the works.

In accordance with the Record of Decision requirements an EMP has been developed. The EMP clearly identifies the environmental indicators to be monitored during construction and operation as well as the monitoring procedures. The enforcement of compliance with the EMP lies with the ECO who conducts regular site visits and reports to the relevant ministry

The Construction indicators monitored for compliance by the ECO are (EMP table 4.1 p 20):

- Compliance with relevant legislation
- Site established and access roads constructed to minimise environmental impact
- Injuries to construction workers and residents
- Water supply
- Proper signage
- Visual Impact
- Dust pollution
- Noise levels
- Litter and waste production
- Disposal sites
- Terrestrial and aquatic fauna and flora
- Sensitive sites
- Soil and Surface water
- Security
- Traffic
- Fires
- Flooding

The Operational Indicators monitored for compliance by the ECO are (EMP table 4.1p 21):

- Visual
- Terrestrial fauna and flora
- Sensitive sites
- Erosion
- Infrastructure
- Recreational use of river

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

The main form of stakeholder consultation was through the environmental impact assessment (EIA) process. Local stakeholders were invited to comment on the scoping report, produced for the EIA process through the following mechanisms:

- Scoping advertisements were released in the local press in May 2003.
- In May 2003, poster notices of the EIA process were erected.

- Letters including a background information document and response form were distributed to the identified stakeholders in May 2003. Moreover various authorities were consulted during the process.
- In June 2003, the public meeting was held in Bethlehem to provide the local stakeholders with an opportunity to meet with the consultants, project proponent and authorities and to comment on the proposed development and raise any issues and concerns.
- Following the completion of the draft scoping report in July 2003, the report was sent to the stakeholders and also lodged in the library in Bethlehem. The public was notified to the lodging of the draft report by means of letters to identified stakeholders and given a three week period in which to comment on the report. At the end of the comment period, all relevant issues and concerns raised by the public have been noted and incorporated into the final scoping report.

In addition the project draft PDD was posted on the South African DNA website for comments for the period 24 October 2005 to 23 November 2005. Any interested party could post comments on the project to the DNA. As indicated in the DNA's letter of "Host Country Approval", the DNA approved the project without requiring any changes.

E.2. Summary of comments received

>>
The only comments that can be summarised are those associated with the EIA process. These included;

- The requirements that the project would be subject to in terms of the licensing requirements of the Department of Water Affairs and Forestry;
- The actual benefits that would accrue to the community from such a project;
- What employment opportunities would actually be created by the project;
- The nature of the diversions to be created as part of the project;
- A request for an archaeological impact assessment report; and,
- Discussions with regard to the alternatives associated with the project.

E.3. Report on consideration of comments received

>>
The comments received were incorporated into the final scoping report that was submitted to the Provincial Environmental Authorities, and was used by the authorities to give the record of decision. As a result of the comments received an archaeological impact assessment report was commissioned and used in the EIA process.

SECTION F. Approval and authorization

>>
The letter of approval was issued on 30/04/2014 by the Department of Energy being the Designated National Authority for the Clean Development Mechanism in South Africa, the Host Country.

The letter of approval by the Netherlands Ministry of Housing, Spatial Planning and Environment (VROM) was issued on 06/12/2007. VROM is the Designated National Authority for the Clean Development Mechanism in the Netherlands.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Statkraft Markets BV
Street/P.O. Box	Gustav Mahlerplein 100
Building	ITO Building
City	Amsterdam
State/Region	
Postcode	1082 MA
Country	The Netherlands
Telephone	+31 (20) 795 78 00
Fax	+31 (20) 795 78 99
E-mail	stef.peters@statkraft.com
Website	Stef Peters
Contact person	Managing Director
Title	Mr
Salutation	Peters
Last name	
Middle name	Stef
First name	
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Bethlehem Hydro (Pty) Ltd
Street/P.O. Box	P O Box 23589
Building	Claremont Central
City	Cape Town
State/Region	Western Cape
Postcode	7735
Country	
Telephone	+27 21 671 1457
Fax	+27 86 233 8523
E-mail	al@rehgroup.co.za
Website	http://www.rehgroup.co.za/
Contact person	Anton-Louis Olivier
Title	Mr
Salutation	Managing Director
Last name	Olivier
Middle name	
First name	Anton-Louis
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Promethium Carbon (Pty) Ltd
Street/P.O. Box	35 Ballyclare Drive
Building	Lacey Oak House, Ballyoaks office park
City	Johannesburg
State/Region	Gauteng
Postcode	2021
Country	South Africa
Telephone	+27 11 706 8185
Fax	+27 86 589 3466
E-mail	harmke@promethium.co.za
Website	www.promethium.co.za
Contact person	Harmke Immink
Title	Director
Salutation	Mrs
Last name	Immink
Middle name	
First name	Harmke
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2. Affirmation regarding public funding

The Government of Netherlands provided resources for early project identification and development related activities with regard to this project from their AIJ programme. As such the funding did not result in a diversion of official development assistance. The Government of the Netherlands is not claiming any emission reductions as a result of their early support to the project.

Appendix 3. Applicability of methodology and standardized baseline

Not applicable

Appendix 4. Further background information on ex ante calculation of emission reductions

Refer to the attached Excel spread sheet: "Bethlehem Hydro ER calcs"

Appendix 5. Further background information on monitoring plan

1. **Overall project management**

Bethlehem Hydro has a clear and well defined management structure Consisting of Managing Director, a Operational Manager and an Administrative Clerk Overall responsibility at the plant lies with the Managing Director who also has final responsibility for the CDM project. The management structure is flat with the Managing Director and the Operational Manager having direct day to day responsibilities in the running of the plant.

2. **Management of project registration, monitoring, measurement and reporting**

The Operational Manager will have final responsibility for all aspects relating to data measurements, monitoring of data recording and will sign off all reports on monitoring.

Data will be collected digitally and consolidated by the Bethlehem Hydro Administrative Clerk, who will also draw up the monthly and annual emission reduction monitoring reports.

Monitoring itself will be integrated as far as possible into existing plant operating procedures. The data required for the monitoring of the emission reductions will come from data already collected as part of the plant's operations, i.e the metering of electricity sales

Data will be recorded at in real time with remote monitored electricity meters that records each Watt hour (Wh) generated intervals according to the table attached to the monitoring plan. The actual measured data will be entered into the "Bethlehem Hydro ER calcs" spreadsheet attached to the PDD to calculate the emission reductions for the period.

3. **Training of monitoring personnel**

Due to the nature of the project and its monitoring needs there is no need for specific or specialized training of personnel for monitoring. The data which will be collected is also collected for general plant operational and financial administration.

4. Emergency preparedness procedures

The following emergency events can be foreseen which could have an impact on the project's emission reductions or the data collection procedures:

4.1. Loss of power at plant

In the case of loss of power at a plant no data will be lost. When power is lost the meter retains an internal record of the electricity metered since the last transmission of data. Once power is restored the meter will continue to record electricity production.

5. Monitoring Equipment

5.1. Calibration of monitoring equipment

The only relevant monitoring equipment for this project relates to the electricity meters. An electricity meter will be installed at each generation unit's "point of supply" to the off taker. The metering equipment (meters and GPRS data transmission systems) is provided with factory calibration certificates.

Each meter will be submitted for calibration verification tests at least once every 3 years to a duly qualified and accredited entity, which provides such calibration services.

5.2. Accuracy class of monitoring equipment

The meters are of accuracy class:

- Sol Plaatje Main: accuracy class of 0.2s
- Sol Plaatje Check: accuracy class of 0.5

- Merino Eskom meter Main: accuracy class of 0.5s
- Merino Eskom meter Check: accuracy class of 0.5s

5.3. Installation of Monitoring Equipment

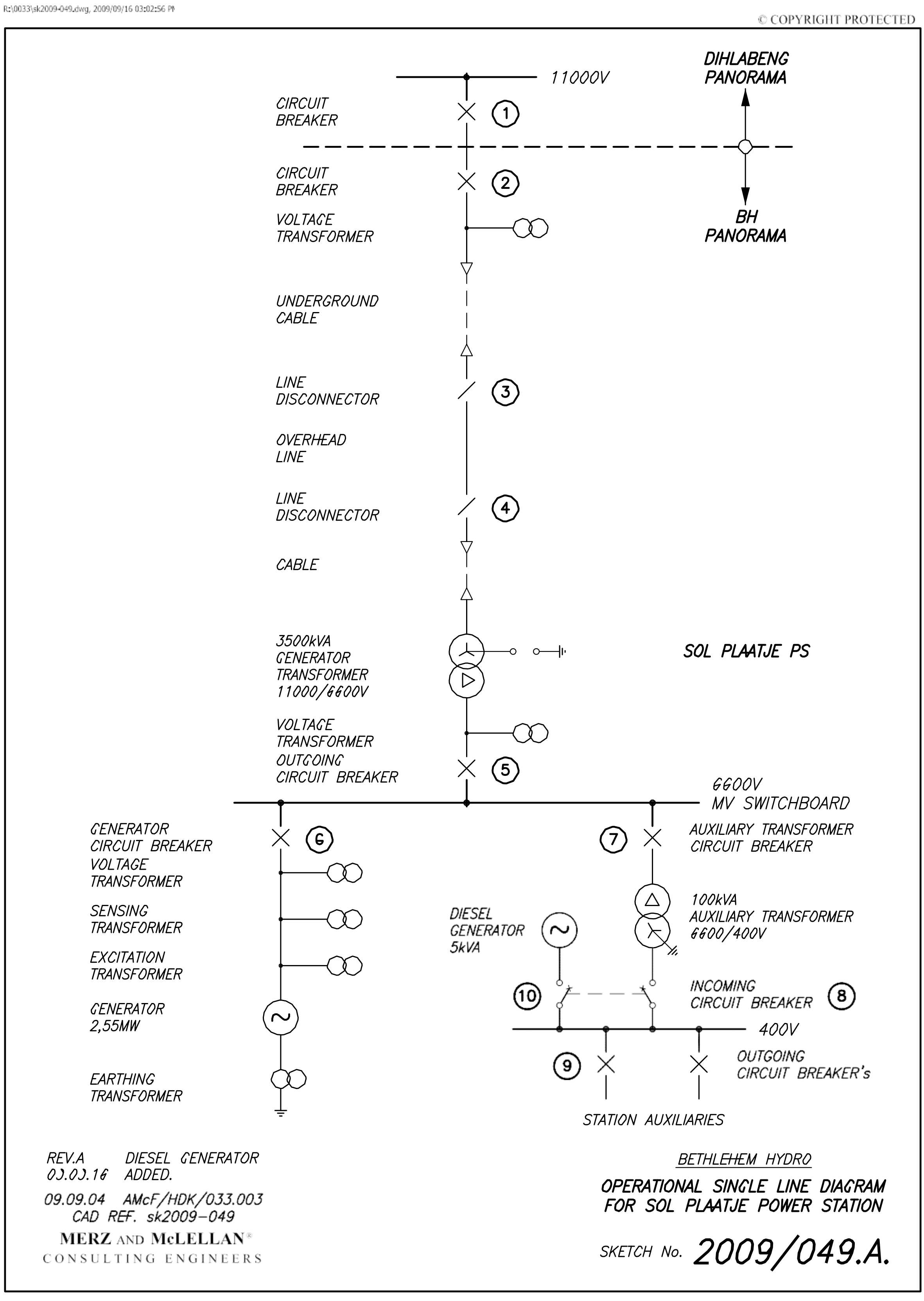
5.3.1. Sol Plaatje electricity meters

The electricity production of the Sol Plaatje unit will be measured by an electricity meter (main meter), installed at the Panorama substation. The meter will be located in a small closed building constructed specifically to house the Bethlehem Hydroelectric project switchgear and meter located at the point of supply (POS) into the grid. The meter is "bidirectional" meaning that it measures and records both the power produced by the power plant as well as power consumed by the power plant. The plant is a net consumer of electricity in periods when the plant is not producing power, e.g. for lighting, pumping and machine tools during maintenance periods when the plant is shut down. In the same location there is also a check meter for the power produced by the Sol Plaatje unit.

Power produced by the Sol Plaatje unit will be transmitted to the Panorama substation by a dedicated 11kV power line. This line which consists of a combination of overhead conductors (3km length) and buried cable (2km length) is used exclusively for the supply of power by the Sol Plaatje unit to the grid.

Access to the substation is restricted to authorized employees of the Dihlabeng Municipality's electricity department. Access to the Bethlehem Hydroelectric project switchgear is restricted to Bethlehem Hydro and NuPlanet operational personnel.

The Sol Plaatje Unit Single Line Diagram is shown on the next page. Dihlabeng Panorama, shown in the top left hand corner of the diagram.



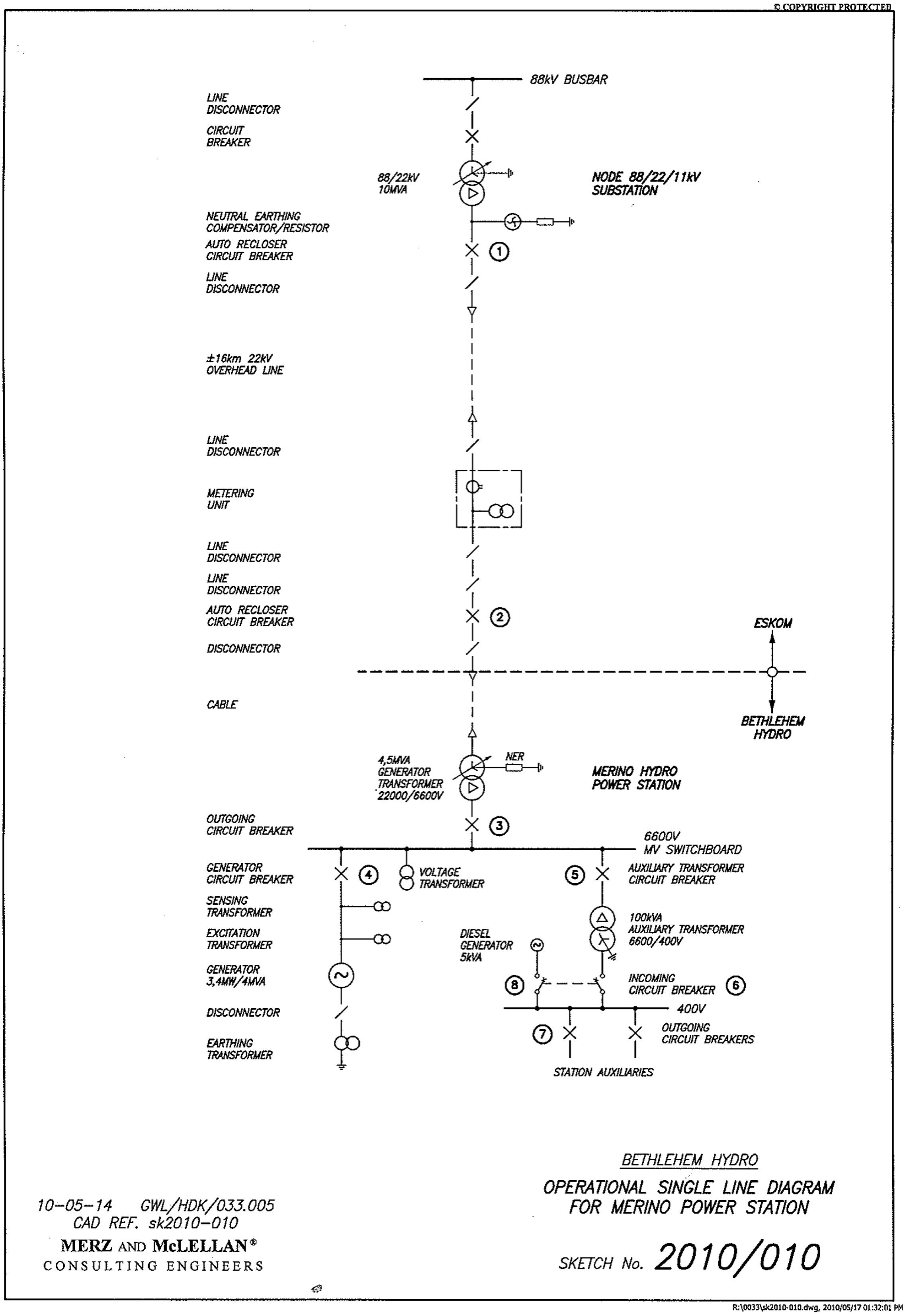
5.3.2. Merino electricity meters

Identical to the Sol Plaatje unit, there is a main and a check electricity meters that will measure the electricity production of the Merino unit. For this unit, Eskom installed a dedicated 22kV line, which runs to the boundary of the power station. As a result, the power generated at the Merino unit interconnects directly into the Eskom line, without being routed through a substation. The electricity meters are located in an enclosed box at the metering point of the Eskom line. Both meters are “bi-directional” meters. They measure and record both the power produced by the power plant as well as power consumed by the power plant. The plant is a net consumer of electricity in periods when the plant is not producing power, for example when the plant is shut down, but lighting is required in the plant.

Power produced by the Merino unit will be transmitted away from the power station by a dedicated 22kV power line. This line is used exclusively for the supply of power by the Merino unit to the electricity grid.

Access to the Bethlehem Hydroelectric project switchgear and point of supply is restricted to Bethlehem Hydro and NuPlanet operational personnel.

The Merino Unit Single Line Diagram is shown on the next page.



6. Maintenance of monitoring equipment and installations

The digital electricity meters will be subjected to calibration tests at least once every three years by an accredited entity.

7. Day-to-day records handling procedures

Day to day record keeping is done according to a fixed programme indicating what measurements are taken, who is responsible and how the data is processed as outlined in the table below.

Variable	Monitoring interval	Monitoring methodology	Responsible person	Quality control	Data storage procedure
Net electricity generated at Merino site	Per Watt hour (Wh) generated	Automatic reading by electricity meters	Operational Manager Back up: Managing Director	Compare to Dihlabeng Meters	Data transmitted daily and digitally stored
Net electricity generated at Sol Plaatje site	Per Watt hour (Wh) generated	Automatic reading by electricity meters	Operational Manager Back up: Managing Director	Compare to Dihlabeng Meters	Data transmitted daily and digitally stored

8. Monitoring data adjustment procedures

Data will be collected on a daily and monthly basis and consolidated on a monthly basis where the data will be cross checked against records for sold/purchased electricity (example invoices) for quality control purposes on a regular basis. The meter will be checked on regular basis and will be calibrated, serviced and maintained according to the manufacturers' instructions but at least every 3 years as per Guidelines for Assessing Compliance with the Calibration Frequency Requirements (version 01; EB 52, Annex 60). Corrective measures will be applied in case any discrepancy is observed. To ensure that the data is reliable and transparent, Quality Assurance and Quality Control (QA&QC) measures are established and form part of the grid code to effectively control and manage data reading, recording, auditing as well as archiving data and all relevant documents.

9. Data and reports review procedures

Data will be reviewed by the Operational Manager and signed off by the Managing Director on a monthly basis again predicted and historical values. Should there be discrepancies in the data the procedure indicated in Point 7 above will be followed to adjust the data.

10. Internal GHG audit procedures

There are no requirements for internal audits of GHG project compliance with the plants operational requirements

11. Project performance review before verification

Data and project performance will be reviewed by the Managing Director and the Operational Manager on a monthly basis against predicted and historical values. The consolidated annual project emission reduction reports will be reviewed by Bethlehem Hydro's auditors for compliance before being submitted for verification.

12. Procedures for improving quality of project monitoring

The main procedure for improving the accuracy of the monitoring is the quality control procedures described above in the Monitoring Plan. The data collection and reporting formats are checked on a monthly basis for accuracy and the monitoring procedures will be adjusted as required for

improved integration with plant operations and to minimise faulty measurement or meter reading errors.

Appendix 6. Summary of post registration changes

Removed all information on diesel consumption and diesel monitoring at the project activity, as the backup generator has been removed from site.

Inclusion and use of the Standardized baseline: Grid emission factor for the Southern African power pool.