

GREEN DOOR environmental

DRAFT SCOPING REPORT AND APPLICATION

Proposed Establishment of a Bioenergy Facility and related infrastructure at Harmony Gold Mine in Welkom, Matjhabeng Local Municipality, Free State Province

EIA Ref. No. TO BE PROVIDED

Prepared For Harmony Gold Mining Company Limited

28th February 2013



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The Curriculum Vitae (CV) of the Environmental Assessment Practitioner (EAP) is included in Appendix A.

EXECUTIVE SUMMARY

Green Door Environmental has been appointed by Harmony Gold Mining Company Limited to apply for an Environmental Authorisation and Waste Management Licence, for the proposed establishment of a Bioenergy facility and associated infrastructure at its Welkom mining operations in the Free State Province. This application is in terms of the National Environmental Management: Waste Act No.59 of 2008 (NEM:WA) and the Environmental Impact Assessment (EIA) Regulations made under Section 24(5) of the National Environment Management Act 2008 (NEMA) No. 107 of 1998.

Harmony proposes to establish a Bioenergy facility comprising of:

- Intensive energy crop cultivation on 520 hectares of non-arable land consisting of a tailings footprint (Free State North 5 – FSN5), and less mine impacted land on the northern section of the FSN5 tailings footprint;
- the installation of an Anaerobic Treatment Plant for the production of biogas from the harvested energy crop;
- the installation of a Biogas Treatment Plant for the production of Bio-CNG (Compressed Natural Gas), including a 450 m³ Bio-CNG storage facility;
- the installation of Microturbines for the generation of renewable electricity (less than 200 Kilowatts);
- the installation of algae raceways on a 17 ha footprint, including an algae-ethanol Distillation plant for concentrated ethanol production;
- the installation of a Bio-CNG fuelling station for vehicles; and
- the installation of a Biomass-fired combustion equipment for the generation of heat energy from recovered wood chips and alien vegetation.

The Competent Authority for this project is the Free State Department of Economic Development, Tourism and Environmental Affairs (DEDTEA). Other Authorities applicable to this project include:

- Department of Mineral Resources (DMR);
- Department of Energy (DoE);
- Department of Water Affairs (DWA);
- Department of Agriculture, Forestry and Fisheries (DAFF);
- Department of Environmental Affairs (DEA);
- Department of Transport;
- Lejweleputswa District Municipality; and

- Matjhabeng Local Municipality.

The Scoping Phase of the EIA process identifies potential issues associated with the proposed project, and defines the extent of the studies required to be conducted as part of the EIA Phase. This Draft Scoping Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final Scoping Report will incorporate all comments and responses prior to submission to the DEDTEA.

To date, the main environmental issues that have been raised through the Scoping Phase are:

- Current or existing toxicity levels of the soils on the tailings footprint;
- Toxicity levels of the harvested energy crop and its hazard rating;
- Effects of the energy crop on human health if consumed by trespassers from the surrounding community;
- Human exposure to potentially radioactive soils or dust during the cultivation or planting of the energy crop on the tailings footprint;
- Irrigation water run-off and the subsequent pollution of downstream water resources;
- Increased soil erosion on cultivated land and resultant sedimentation of downstream water courses;
- Over-abstraction of irrigation water from the Toronto pan and subsequent salination;
- Potential irrigation water pipeline leakages;
- Explosion Risks associated with the storage and road transportation of Bio-CNG;
- Traffic increases during the operational phase;
- Potential invasion of blue-green algae to nearby surface water bodies;
- Point source air pollution from the proposed biomass fired equipment;
- Potential surface and ground water contamination due to improper disposal of the digestate residue;
- Infestation of invasive alien plants;
- Potential tailings structural instability; and
- Potential visual impact.

The Scoping phase has not identified any 'fatal-flaws' with the proposed development, however, as part of the EIA phase, a number of Specialist Studies will be conducted. These include:

- Contaminated Land Assessment / Crop Toxicity;

- Geotechnical Assessment;
- Run-off Plan and Irrigation Specifications;
- Geohydrological Risk Assessment;
- Socio-economic Assessment;
- Agricultural potential / Soil Analysis;
- Biodiversity Risk Assessment for alien species (for the algae raceways);
- Heritage Impact Assessment; and
- Major Hazardous Installations (MHI) Risk Assessment.

TABLE OF CONTENTS

CONTACT DETAILS	i
EXECUTIVE SUMMARY	ii
LIST OF FIGURES	viii
LIST OF TABLES	viii
ABBREVIATIONS	ix
1 INTRODUCTION.....	1
1.1 Intensive Energy Crop Cultivation	4
1.1.1 Processing of the Energy Crop	4
1.1.2 Anaerobic Digestion of the energy crop mixture	4
1.2 Elution Plant Biogas Combustion	5
1.3 Gas Treatment/Processing Plant	5
1.4 Renewable Electricity Generation	5
1.5 Algae Raceways	5
1.6 Algae-Ethanol Distillation	5
1.7 Biomass-fired Combustion Equipment	6
2 BACKGROUND INFORMATION	7
2.1 Location, Access and Land Description	7
2.1.1 The Free State North 5 tailings footprint.....	7
2.1.2 The less mine impacted land	7
2.1.3 The Bio-energy plant and associated equipment	8
2.1.4 Irrigation Water Pipeline Route & Servitudes	8
3 SERVICES	11
4 LEGAL AND POLICY FRAMEWORK.....	12
4.1 Environmental Impact Assessment National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998)	12
4.2 National Environmental Management: Waste Act (NEMWA) 2008 (No. 59 of 2008)14	
4.2.1 Environmental Authorisation and Waste Licence Application	15
4.3 National Water Act (NWA), 1998 (Act no. 36 of 1998).....	16
4.4 Environmental Management Air Quality Act (NEM:AQA), 2004 (No. 39 of 2004) ..	17
4.5 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)18	
4.5.1 Agricultural Permits.....	19
4.6 Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act No.28 of 2002) 19	
4.7 Mine Health and Safety Act (MHSA), 1996 (Act No.29 of 1996).....	20
4.8 Occupational Health and Safety Act (OHSA), 1993 (Act No.85 of 1993)	21

4.9	National Energy Act (NEA), 2008 (Act No.34 of 2008)	21
4.9.1	Renewable Energy Policies and Programmes	22
4.9.2	NERSA Registrations and Licensing	23
4.10	South African Biofuels Industrial Strategy (SABIS) 2007	23
4.11	National Climate Change Response White Paper	24
4.12	South African Heritage Resources Act (SAHRA), 1999 (Act No. 25 of 1999)	25
5	ASSISTING GUIDELINE DOCUMENTS	26
5.1	The Department of Environmental Affairs Assisting Guideline Document Series ..	26
6	METHODOLOGY	27
6.1	Application	27
6.2	Baseline Environmental Description.....	27
6.3	Consultation with Interested & Affected Parties (I&APs)	27
6.4	Description of the Proposed Development	27
6.5	Assessment of Potential Environmental Impacts.....	27
7	ALTERNATIVES	29
7.1	Site Alternatives	29
7.1.1	Alternative cropland sites	29
7.1.2	Bioenergy Plant Location Alternatives.....	29
7.1.3	Irrigation water pipeline route alternatives	32
7.1.4	Alternative irrigation water sources	32
7.2	Type of Energy Crop.....	33
7.3	Alternative Farming Methods	34
7.4	Alternative irrigation technology	35
7.5	Bioenergy Technology Alternatives	35
7.5.1	Alternative Anaerobic Biogas Digesters	35
7.5.2	Alternative Biogas Treatment Plant.....	35
7.5.3	Alternative Algae-Ethanol Technology	36
7.6	No-Go Alternative	36
8	PUBLIC PARTICIPATION PROCESS	37
8.1	Notification of the Proposed Development	37
8.2	Public Information Session.....	40
9	POTENTIAL IMPACTS ON THE BIOPHYSICAL ENVIRONMENT.....	44
9.1	Topography.....	44
9.2	Climate	44
9.3	Air Quality and Surface Wind	46
9.4	Geology and Soils.....	46

9.5	Ground and Surface Water	48
9.6	Flora and Fauna	49
9.7	Fire Management.....	51
10	POTENTIAL IMPACTS ON THE SOCIAL AND ECONOMIC ENVIRONMENT	52
10.1	Surrounding Land-use	52
10.2	Employment and Local Economy.....	54
10.3	Planning Initiatives	55
10.3.1	Matjhabeng Local Municipality-Integrated Development Plan (MLM-IDP)	55
10.3.2	The MLM Spatial Development Framework (MLM-SDF).....	55
10.4	Cultural, Historical and Archaeological Resources.....	56
10.5	Traffic, Roads and Access	56
10.6	Noise	57
10.7	Security.....	58
10.8	Health and Safety	59
11	PLAN OF STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT.....	60
11.1	Introduction	60
11.2	Public Participation	60
11.3	Specialist Studies	60
11.3.1	Contaminated Land Assessment / Crop Toxicity	60
11.3.2	Geotechnical Assessment.....	61
11.3.3	Run-off Plan and Irrigation Specifications	61
11.3.4	Geohydrological Risk Assessment.....	62
11.3.5	Socio-economic Impact Assessment	62
11.3.6	Agricultural Potential Assessment.....	62
11.3.7	Biodiversity Risk Assessment for Alien Species.....	62
11.3.8	Heritage Impact Assessment / Archaeological / Paleontological Report.....	63
11.3.9	Major Hazardous Installations (MHI) Risk Assessment	63
11.4	Environmental Management Programme	63
11.5	Environmental Impact Assessment Report	63
11.5.1	Information to be included in the EIA Report.....	64
11.5.2	Assessment of Environmental Issues	64
12	SUMMARY OF IDENTIFIED IMPACTS	66
13	REFERENCES.....	68
14	APPENDICES	70

APPENDICES

Appendix A:	EAP's CV
Appendix B:	Water Use License documentation
Appendix C:	EIA and Waste Licence Applications
Appendix D:	Newspaper adverts in the Volksblad
Appendix E:	Site Posters
Appendix F:	Background Information Document
Appendix G:	List of Interested & Affected Parties
Appendix H:	Comments received from Interested & Affected Parties on the circulation of the BID, Site Posters, Adverts, and Draft Scoping Report
Appendix I:	Public Information Session – Posters, Photographs, Attendance Register

LIST OF FIGURES

Figure 1: A simplified process flow diagram of the proposed Bioenergy Facility	3
Figure 2: A Topographical Map showing the location of the proposed energy crop, irrigation water pipeline route, and Bioenergy facility	9
Figure 3: Google Earth Map showing the location of the proposed energy crop and Bioenergy facility, and associated infrastructure at Harmony Gold Mine in Welkom.....	10
Figure 4: A map showing the location of the alternative cropland sites.....	30
Figure 5: A Google Earth Map showing the proposed Bioenergy plant alternative sites	31
Figure 6: A map indicating the alternative irrigation water pipeline routes	32
Figure 7: A map showing the alternative irrigation water sources	33
Figure 8: Map showing location of the placement of posters	39
Figure 9: Monthly average temperature and rainfall for Welkom between 1964 and 2010 (Climate Information Portal)	45
Figure 10: A map showing the FSN6 Tailings Dam proposed for the disposal of contaminated residues	53

LIST OF TABLES

Table 1: Required services for the proposed development.....	11
Table 2: Summary of Public Participation Process	37
Table 3: Comments received in response to circulation of the BID and the placement of adverts and site posters	41
Table 4: Summary of comments received and responses given at the first Public Information Session	42
Table 5: Unemployment rate of the MLM	54
Table 6: Summary of aspects used for assessing environmental impacts	64

ABBREVIATIONS

ATP	Anaerobic Treatment Plant
BID	Background Information Document
CNG	Compressed Natural Gas
DEA	Department of Environmental Affairs
DEDTEA	Free State Department of Economic Development, Tourism and Environmental Affairs
DSR	Draft Scoping Report
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FSN	Free State North
I&APs	Interested and Affected Parties
LDM	Lejweleputswa District Municipality
MLM	Matjhabeng Local Municipality
WWTW	Waste Water Treatment Works

1 INTRODUCTION

Harmony Gold Mining Company Limited (referred to as Harmony from here on) proposes to establish a Bioenergy facility which primarily involves the growing of an energy crop on an existing disused tailings footprint and less mine impacted land at its gold mining operations in the Welkom area, Free State Province. The proposed Bioenergy Facility is part of Harmony's initiative to reduce its carbon footprint, energy costs, and future carbon tax liability costs. One of its long-term business strategies (post 2015) is focused on optimising long-life assets and developing Greenfields operations. Therefore, Harmony has made a strategic decision to secure a constant reliable lower-carbon energy supply, which minimises the impact of increased energy costs and potential exposure to carbon tax. This will be largely driven by its strategic target to reduce its Carbon Dioxide emissions by 15 % by 2013.

The proposed Bioenergy facility comprising of:

- Intensive energy crop cultivation on 520 hectares of non-arable land consisting of a tailings footprint (Free State North 5), and less mine impacted land located to the north of the FSN5 tailings footprint;
- the installation of an Anaerobic Treatment Plant for the production of biogas from the harvested energy crop;
- the installation of a Biogas Treatment Plant for the production of Bio-CNG, including a 450 m³ Bio-CNG storage facility;
- the installation of Microturbines for the generation of renewable electricity (less than 200 Kilowatts);
- the installation of algae raceways on a 17 ha footprint, including an algae-ethanol Distillation plant for concentrated ethanol production;
- the installation of a Bio-CNG fuelling station for vehicles; and
- the installation of a Biomass-fired combustion equipment for the generation of heat energy from recovered wood chips and alien vegetation.

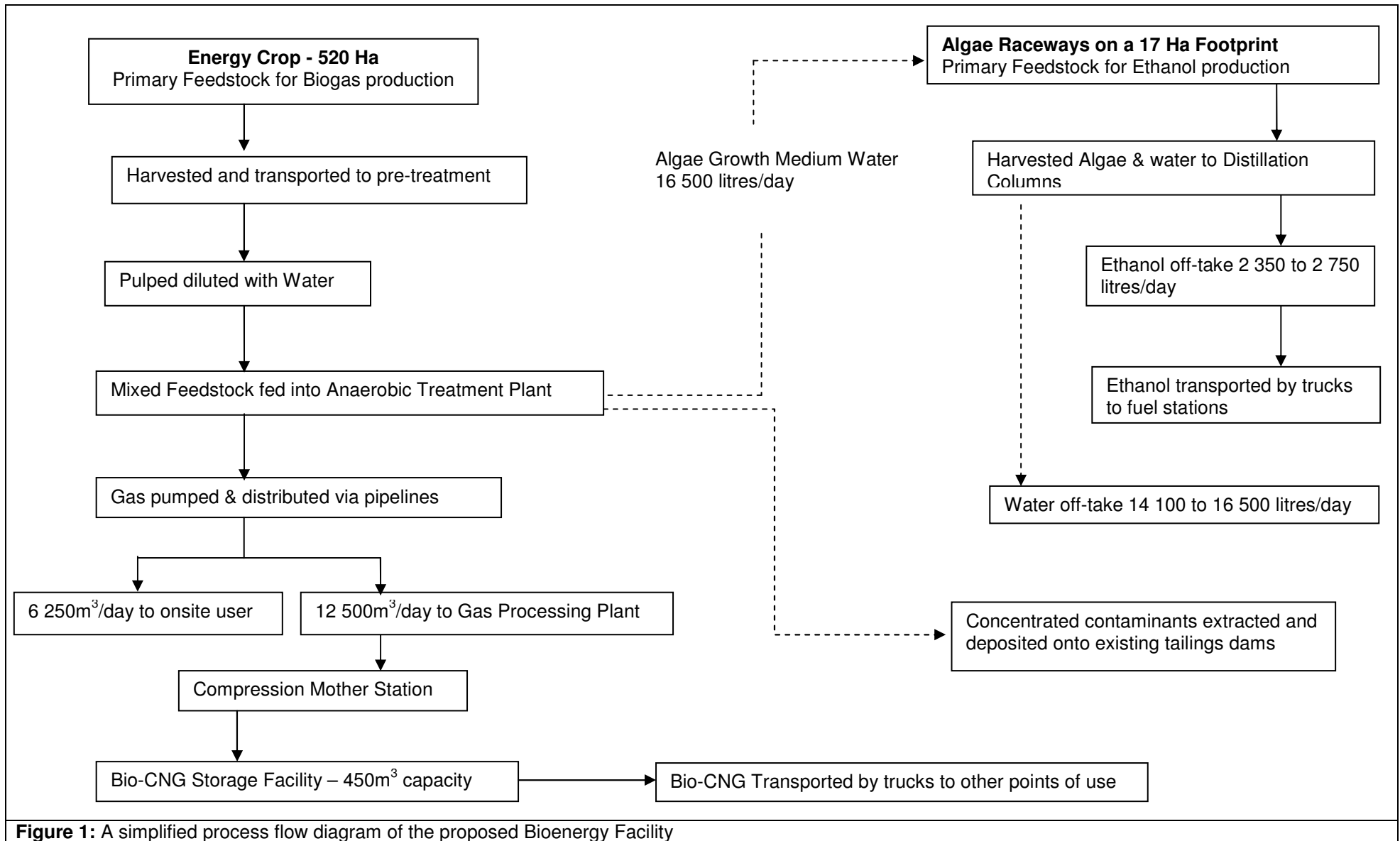
Refer to Figure 1 for a simplified process flow diagram of the proposed Bioenergy Facility.

This project supports Harmony's environmental management efforts in the Free State Province through the rehabilitation of decommissioned sites. The proposed project will reduce Harmony's environmental liability and release large tracts of land for alternate use. One of the material issues identified in terms of improving environmental performance is to ensure concurrent rehabilitation that returns available land to a state that supports value creation. In addition, this project will be part of Harmony's Social & Labour Plan (SLP) which focuses on providing alternative skills to employees (both current and retrenched employees). This gives

employees access to employment opportunities in other sectors of the economy outside mining, and promotes sustainable livelihoods through self employment. The proposed construction and operation of the Bioenergy plant will create employment opportunities and skills development, not only to the mine workers, but also to the surrounding community.

A Bioenergy consulting company, Selectra CC., was appointed by Harmony, under the auspices of its Central Projects Team, to conduct a prefeasibility study for the proposed Bioenergy project. The final results of this study were communicated in a report dated 19 March 2012, and according to the report there are numerous benefits associated with the implementation of the proposed Bioenergy project, as briefly presented above.

Selectra is currently conducting energy crop nursery trials on a sections of the FSN5 tailings footprint and less mine impacted land, in order to determine which energy crops can be grown successfully, and to assess the financial implications associated with each crop. Successful trials have so far been conducted on Sugar beet and Sorghum. These results will be made available in the EIA Report.



1.1 Intensive Energy Crop Cultivation

The primary feedstock of the proposed Bioenergy Plant will come from the intensive cultivation and irrigation of a 260 ha energy crop to be planted on a tailings footprint, and an additional 260 ha to be planted on the surrounding, less mine impacted land. It is proposed that the energy crops will be grown on a two year rotational cycle, with a suitable secondary crop planted every season to restore soil fertility.

It is proposed that the cropland will be irrigated using a fully automated centre pivot system. Irrigation water will be pumped from the Toronto Pan (approximately 5 to 8 Mega Litres per day) to the cropland through a 4 km long uPVC pipeline. The irrigation water pipeline route is planned to run in parallel with the existing Flamingo pipeline. Refer to Section 7.1.3 for the proposed pipeline route.

Planting of the energy crop will be conducted by contractors to minimise the capital expenditure required, and also to provide employment and entrepreneurial opportunities to the local communities. Harvesting is planned to be partially mechanised. It is thus currently anticipated that 200 direct employment opportunities and a number of indirect jobs will be created as a result of the energy crop production cycle. However this will be further investigated during the EIA Phase.

1.1.1 Processing of the Energy Crop

The harvested energy crops will be loaded in trucks and transported to the Bioenergy Plant, where it will be hammer-milled and diluted before the mixture is fed into an Anaerobic Treatment Plant for bio-methane production.

1.1.2 Anaerobic Digestion of the energy crop mixture

The diluted energy crop mixture will be fed into a 4000 m³ Anaerobic Treatment Plant, in which it will be anaerobically digested under controlled conditions to produce methane rich biogas. The preferred proposed Anaerobic Treatment Plant is a New-Gen Bioenergy System with a footprint size of $\pm 5\,000\text{ m}^2$ and divided into two sections; the Hydrolysis, and Bio-Filter section.

The digestate released after the required Hydraulic Retention Time (HRT) will be a liquid slurry mixture of decomposed and contaminated crop residues. This contaminated residue will be extracted through a Screw Press Drier, dried and transported in a dump truck for disposal onto the adjacent FSN6 tailings dam as indicated in Figure 2. Whilst the nutrient rich waste water will be pumped back into the Anaerobic Treatment Plant or channelled into algae raceways.

The raw methane rich biogas trapped underneath the geomembrane cover will be pumped and distributed to the various points of use.

1.2 Elution Plant Biogas Combustion

Approximately a third of the total biogas, $\pm 6\,250\text{m}^3$, will be used as a replacement fuel for the existing Elution Plant Polyfuel. No processing of the raw biogas will be required prior to use at this point.

1.3 Gas Treatment/Processing Plant

The remainder of the biogas ($\pm 12\,500\text{m}^3/\text{day}$), will either be channelled into a Gas Treatment Plant to produce compressed natural gas (Bio-CNG), or into a Microturbine to generate renewable electricity. The proposed Gas Treatment Plant removes all the unwanted impurities and gases, such as carbon dioxide. The clean, processed gas ($\pm 8\,750\text{m}^3/\text{day}$) from the Gas Treatment Plant will then be compressed to Bio-CNG ($35\text{m}^3/\text{day}$). This Bio-CNG will then be stored on site in a 450m^3 storage facility, before it is transported by trucks to various end users. The technology of choice for the Gas Treatment Plant has not yet been finalised, and alternative technologies will be evaluated in the EIA Report.

1.4 Renewable Electricity Generation

Excess methane rich biogas that cannot be effectively utilised by the Gas Treatment Plant will be diverted and combusted in a gas to electricity Microturbine. Depending on the amount of biogas available, the installed electricity generation capacity of the Microturbines is expected to be $\pm 200\text{ Kw}$. The electricity generated will solely be for the Mine's own usage.

1.5 Algae Raceways

The proposed Bioenergy facility also includes the establishment of Algae Raceways covering a 17 hectare footprint, located adjacent to the Bioenergy Plant. It is proposed that the algae will be cultured or grown in effluent wastewater recovered from the Anaerobic Treatment Plant ($\pm 16\,500\text{ litres/day}$), and on Carbon dioxide ($\pm 3\,750\text{m}^3/\text{day}$) recovered from the Gas Treatment Plant. Further details on the proposed algae-ethanol technology and alternatives evaluated, will be presented in the EIA Report.

1.6 Algae-Ethanol Distillation

An Algae-Ethanol Distillation plant is also planned to process and concentrate the harvested algae-ethanol solution into fuel grade (94% ethanol). The algae-ethanol solution is distilled to produce between 2 350 to 2 750 litres/day of e-Ethanol. The entire distillation process is expected to result in a water off-take of between 14 100 to 16 500 litres/day. This water will be

recycled back into the algae raceways or distillation columns.

The e-Ethanol produced will be blended with an ignition improver to produce a hydrous ethanol fuel, E95, to be used in vehicles. More details will be provided in the EIA Report.

1.7 Biomass-fired Combustion Equipment

Biomass fired combustion equipment is also being considered as part of the Biogas Plant installation. This equipment is to be fired using wood chips recovered during the extraction of ore from underground operations. Another potential fuel source considered during the pre-feasibility study was the combustion of invasive plants removed during land preparation or site clearance. The heat produced by the combustion installation will be used to generate electricity or provide heat where required. Further details on the type of technology proposed and its associated emissions will be provided in the EIA Report.

2 BACKGROUND INFORMATION

2.1 Location, Access and Land Description

The proposed energy crop will be grown on both the FSN5 tailings footprint and surrounding less mine impacted land, with a combined aerial extent of 520 hectares. Although the land is mine impacted and belongs to Harmony, both areas are zoned as rural and agriculture. Figure 2 shows the location of the preferred energy crop area, preferred water source for irrigation and pipeline route, and Bioenergy Plant.

2.1.1 The Free State North 5 tailings footprint

The FSN5 tailings footprint energy crop is proposed to be 260 Hectares in extent, and is on the Farm Friedesheim, No. 51, Welkom, and the Farm Erdfeel No.18, Welkom, located along the R30 road to Odendaalsrus. (Geographical Coordinates 27°57'9.04" S, 26°41'55.26" E).

The FSN5 tailings footprint is located near the Welkom 7 Shaft, approximately 4km North West of Welkom (refer to Figures 2 and 3), and is surrounded by:

- Industrial mining companies, and residential hostels for mine workers to the south;
- A formal residential area to the north east (Rheederpark);
- A small scale farming community to the north (Jabulani Village);
- A tailings dam (FSN6) to the south west, across the R30; and
- A cemetery to the south west, north of the FSN6.

The tailings footprint is degraded and disused. Although public access to the site is prohibited, the surrounding community is using it for dumping domestic waste and as an access route. The site has also been invaded by illegal gold miners, leaving a trail of open trenches and damaged water pipeline infrastructure.

2.1.2 The less mine impacted land

The remaining 260 Ha energy crop will be grown on the adjacent less mine impacted land located on the Remainder of the Farm Wesselia, No.101, Welkom, along the R30 road to Odendaalsrus, north of the Free State North 5 tailings footprint (shaded in grey in Figure 2). (Geographical Coordinates 27°56'9.06"S, 26°41'46.53"E).

The proposed area for cultivation stretches north to the Eland Shaft and FSN3B tailings (see Figure 2). This area has been impacted by previous mining activities and is surrounded by:

- Jabulani village and Rheederpark to the south;

- Mining and industrial companies across the R30, and to the north east; and
- Friedesheim railway station to the north east.

2.1.3 The Bio-energy plant and associated equipment

The proposed Bio-energy plant and associated equipment is proposed to be located on the Remainder of the Farm Welkom, No. 80, Welkom, and Marmageli, No.20, Welkom, south east of the town of Welkom, at Brand 1 Shaft next to the Witpan (shaded in purple in Figure 2). (Geographical Coordinates 28° 0'32.62"S, 26°44'49.01"E).

Access to the site from Welkom can be gained from Badenhorst Street or President Brand Street.

The land has been degraded by past mining activities and is surrounded by:

- Harmony gold mine processing plant to the south;
- Harmony's President Brand 1 shaft operations to the north;
- Derelict land and buildings further north;
- Witpan Waste Water Treatment Works, across Witpan to the north west;
- Railway line, parallel to Badenhorst Street; and
- An Eskom sub-station to the south west, across Badenhorst street.

2.1.4 Irrigation Water Pipeline Route & Servitudes

It is currently proposed that water for irrigation will be pumped via a pipeline from the Toronto Pan to the cropland on the FSN5 tailings footprint and less mine impacted land.

The preferred irrigation water pipeline route traverses the following properties:

- Rem of the Farm Meriba, No. 16, Welkom;
- The Farm Jacobastrust, No. 118, Welkom;
- Rem of the Farm Toronto, No. 115, Welkom;
- Portions 2,8, and 7 of the Farm Theronsrust, No. 69, Welkom; and
- Portion 1 of the Farm Theronia, No. 71, Welkom.

The preferred routing of the irrigation water pipeline is indicated by a red dotted line in Figure 2, which stretches from the Toronto Pan and runs in parallel with the edge of the FSN6 towards the FSN5. The preferred irrigation water pipeline runs parallel to an existing pipeline.

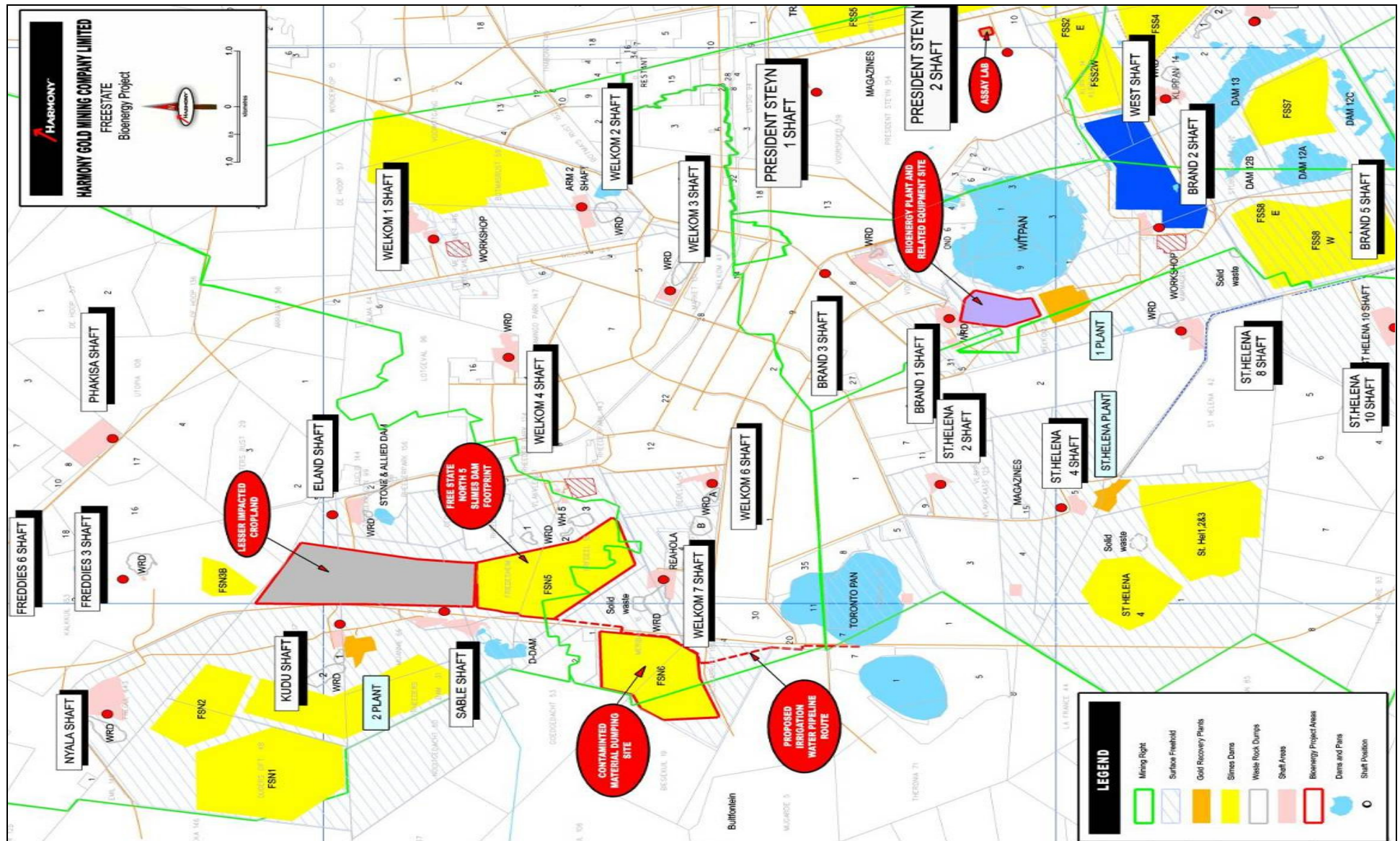


Figure 2: A Topographical Map showing the location of the proposed energy crop, irrigation water pipeline route, and Bioenergy facility



Figure 3: Google Earth Map showing the location of the proposed energy crop and Bioenergy facility, and associated infrastructure at Harmony Gold Mine in Welkom

3 SERVICES

This Section provides details on the required services for the proposed development. These services are summarised in Table 1.

Table 1: Required services for the proposed development

Service	Status
Power / Electricity	The proposed Bioenergy Plant will operate on its own generated electricity. The proposed electricity generation plant is expected to have an installed capacity of 200 Kw. However, it is anticipated that 70 Kw or less will be obtained from the local grid to power the irrigation system and other installations far from the Bioenergy Plant.
Waste disposal	Approximately 150 m ³ of contaminated energy crop residues from the Anaerobic Treatment Plant will be extracted and deposited into the existing FSN6 Tailings dam, located adjacent to the FSN5. The remaining wastewater (200 m ³) will either be pumped back into the Anaerobic Treatment Plant or channelled into alga-ethanol raceways.
Water	A number of nearby water sources are being investigated for possible irrigation abstraction. These include: the Witpan, Flamingo and Toronto Pans. Based on preliminary investigations carried out as part of the pre-feasibility study conducted by Selectra, the Toronto Pan emerged as the most feasible source for irrigation water abstraction. This is because of its capacity and proximity to the cropland area. It is anticipated that approximately 8 to 9 Mega Litres (ML) per day will be pumped from the Pan for irrigating the energy cropland. Refer to Appendix B for Harmony's Water Use License documentation.
Access Roads or Routes	The harvested energy crop will be transported in heavy duty trucks from the cropland area to the Bioenergy Plant for processing and anaerobic digestion. The routes are still being determined and will be made available in the EIA Report. However, no new roads or widening of existing roads are expected to be required. Both areas have good access roads. A Virtual Pipeline Network of trucks is proposed for the transportation of Bio-CNG from the Bioenergy Plant to the end users. These Bio-CNG trucks will comply with all the legislative requirements, including the Hazchem regulations on the transportation of hazardous substances. The expected total number and size of trucks is currently being determined and will be provided in the EIA Report.
Stormwater Management	The Stormwater Management Plans (SWMPs) for run-off emanating from the Tailings Footprint, cropland area, and Bioenergy Plant will be designed by an appointed specialist. The SWMP specialist will also provide measures for the separation of contaminated run-off. In order to ensure that run-off from the Tailings Footprint does not come into contact with clean run-off and downstream water resources.

4 LEGAL AND POLICY FRAMEWORK

4.1 Environmental Impact Assessment National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998)

Environmental Impact Assessment Regulations are meant to regulate procedures and criteria, as contemplated in Chapter 5 of NEMA, for the submission, processing, consideration and decision of applications for environmental authorisations of activities and for matters pertaining thereto. This Act establishes the concepts of participatory, cooperative and developmental governance in environmental management. It also establishes principles for environmental management and provides structures to facilitate these.

The Environmental Impact Assessment process in terms of the NEMA –

- Requires a developer / applicant to commission a Basic Assessment or Scoping and EIA process, depending on the nature of the activity;
- Provides the public with a meaningful opportunity to understand and comment on the proposed activity;
- Provides the government decision-making bodies with important information to assist them in deciding whether to approve or deny the application for environmental authorisation to proceed with the activity; and
- Gives Interested and Affected Parties (I&APs) the legal right to participate in the EIA process.

The main stakeholders/parties involved in the EIA process are:

- The Applicant / Developer (the party requesting the authorisation);
- The Environmental Assessment Practitioner (EAP - the party managing the process on behalf of the Applicant);
- The Competent Authority (based on the outcome of the EIA process will either grant or refuse the requested Environmental Authorisation); and
- The Interested & Affected Parties (neighbours, business people, communities etc).

The EIA process is detailed in the Environmental Impact Assessment Regulations 2010, under Section 24(5) of the National Environmental Management Act (No 107 of 1998), published in Government Notice Regulation (GNR) 543 of 2010. In terms of the

Regulations, certain activities are identified in Listing Notices 1 and 2 published in GNR 544 and 546 of 2010 respectively for which a Basic Assessment is required. Whilst, Listing Notice 3 published in GNR 545 of 2010 lists activities for which a Scoping and Environmental Impact Assessment is required.

The proposed Bioenergy project does not trigger any of the Listed Activities in terms of Listing Notices 1 or 3 of 2010 published in GNR 544 and 546 respectively, which are promulgated in terms of Section 24(5) of the NEMA. However the proposed Bioenergy project does triggers the following Listed Activities in terms of Listing Notice 2 of 2010 published in GNR 545, promulgated in terms of Section 24(5) of the NEMA:

Part 3: *The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres;*

Although the proposed development involves the construction of a Bio-CNG storage facility with a capacity of 450 m³, which is below the 500 m³ metre capacity, this is a conservative estimate, and does not consider the additional storage capacity of the Bio-CNG fuelling stations.

Part 4: *The construction of facilities or infrastructure for the refining, extraction or processing of gas, oil or petroleum products with an installed capacity of 50 cubic metres or more, excluding facilities for the refining, extraction or processing of gas from landfill sites; and*

The proposed Bioenergy plant includes the installation of a Gas Treatment Plant capable of processing more than 50 m³ of raw methane rich biogas.

Part 12: *The construction of facilities, infrastructure or structures for aquaculture of – (iii) aquatic plants where the facility, infrastructure or structures will have a production output of 200 000 or more kg per annum (live round weight).*

The proposed Bioenergy plant includes the construction and installation of algae raceways which are likely to produce more than 200 000 kg per annum of microalgae.

Thus a full Scoping and EIA is required for this project in terms of the National Environmental Management Act, 1998 and the Environmental Impact Regulations, 2010.

The Competent Authority for this project's Environmental Authorisation is the Free State Department of Economic Development, Tourism and Environmental Affairs (DEDTEA).

4.2 National Environmental Management: Waste Act (NEMWA) 2008 (No. 59 of 2008)

The National Environmental Management: Waste Act (NEM:WA) provides Regulations and measures for the sustainable management of waste to prevent environmental pollution and ecological degradation. Section 19(1) of the Act, makes provision for the Minister to publish a list of waste management activities which have, or are likely to have a detrimental effect on the environment. This list was published in GNR 718 of 2009, and lists the activities into two categories; Category A and B. Category A is for Listed Activities that are subject to a Basic Assessment Process and Category B for Listed Activities which are subject to a Scoping and EIA Process.

The proposed Bioenergy project triggers the following **Category A Listed Activities**:

Part 12: The remediation of contaminated land.

The proposed cultivation of the energy crop on the tailings footprint and surrounding less mine impacted land is also a phytoremediation measure for the potentially toxic soils.

Part 10: The processing of waste at biogas installations with a capacity to process in excess of five tons per day of bio-degradable waste.

The processing of the harvested energy crop as feedstock for the Anaerobic Treatment Plant (Biogas Digester) triggers this Listed Activity.

The proposed Bioenergy project triggers the following **Category B Listed Activities**:

Part 4: The biological, physical or physico-chemical treatment of hazardous waste at a facility that has the capacity to receive in excess of 500 kg of hazardous waste per day.

The proposed Anaerobic Treatment Plant is a waste management activity which involves the biological treatment of a potentially hazardous feedstock, thus the above Listed Activity is applicable.

Part 5: The treatment of hazardous waste using any form of treatment regardless of the size or capacity of such a facility to treat such waste.

As stated above, the energy crop harvested from the tailings footprint as feedstock for the proposed Anaerobic Treatment Plant is likely to be contaminated and classified as hazardous. Although the energy crop cannot be effectively classified as waste, the fact that it will be grown on a tailings footprint to extract toxic metals from the soil makes it hazardous and unfit for human consumption. Hence it is unwanted, and if it cannot be utilised as feedstock for the Anaerobic Treatment Plant it will be managed as hazardous waste. Therefore, the proposed Anaerobic Treatment Plant is also likely to be classified as a “hazardous waste treatment facility”.

Part 8: The incineration of waste regardless of the capacity of such a facility.

The proposed Biomass combustion equipment is going to be fired using residue wood recovered from the mineral ore separation process.

Part 9: The disposal of any quantity of hazardous waste to land.

The contaminated residue that remains after the anaerobic treatment process will be disposed at one of the nearby tailings dam, and is therefore a Listed Activity.

Part 11: The construction of facilities for activities listed in Category B of this Schedule ...

The construction of facilities for all the above Listed Activities triggers activity 11.

As explained in the above Listed Activity, the proposed Bioenergy Plant is required to apply for a Waste Management Licence in terms of the NEM:WA, 2008 and the EIA Regulations, 2010. Therefore a Scoping and EIA process is required as part of the Waste Management Licence Application.

In terms of Section 43(1)(a) of the NEM:WA, the Minister is the licensing authority for all Waste Management Activities which involve the storage, treatment or disposal of Hazardous Waste. Therefore the Waste Licensing Authority for this application is the National Department of Environmental Affairs (DEA).

4.2.1 Environmental Authorisation and Waste Licence Application

An Application for Environmental Authorisation has already been submitted to the DEDTEA (refer to Section 6.1 and Appendix C). A separate Waste Management Licence Application will be submitted together with this Draft Scoping Report to the DEA in terms of

the published Waste Licensing Application Process for Hazardous Waste Management Activities (refer to Appendix C for the Waste Licence Application).

4.3 National Water Act (NWA), 1998 (Act no. 36 of 1998)

The National Water Act (NWA), 1998 (Act no. 36 of 1998), aims to manage national water resources in order to achieve sustainable use of water for the benefit of all water users. This requires that the qualities of water resources are protected, and that integrated management of water resources takes place.

The purpose of the Act is to ensure that the Nation's water resources are protected, used, developed, conserved, managed and controlled, in order to:

- (a) Meet the basic human needs of present and future generations;
- (b) Promote equitable access to water;
- (c) Redress the results of past racial and gender discrimination;
- (d) Promote the efficient, sustainable and beneficial use of water in the public interest;
- (e) Facilitate social and economic development;
- (f) Provide for growing demand for water use;
- (g) Protect aquatic and associated ecosystems and their biological diversity;
- (h) Reduce and prevent pollution and degradation of water resources;
- (i) Meet international obligations;
- (j) Promote dam safety; and
- (k) Manage floods and droughts.

Section 21 of the Act sets out general principles for regulating water use, and water use is defined broadly as including:

- *the taking and storage of water;*
- *activities which reduce stream flow;*
- *waste discharges and disposal;*
- *controlled activities (activities which impact detrimentally on a water resource);*
- *altering a watercourse; and*
- *removing water found underground for certain purposes; and recreation.*

A Water Use Licence is required for any of the above defined water uses, including those stipulated under Section 21(a) to (k).

The proposed Bioenergy project primarily involves the intensive cultivation of an energy crop through irrigation. The proposed source of water for irrigation has not yet been finalised, but pre-feasibility studies indicate Toronto Pan as the preferred source. Abstraction of water from this Pan is a Water Use requiring a licence in terms Section 21(a) of the NWA.

Harmony possesses the required Water Use authorisation to abstract water from the Toronto Pan (Refer to Appendix B).

The proposed Anaerobic Treatment Plant involves processes that will result in the disposal of contaminated waste or waste water which may detrimentally impact on a water resource. This is a regulated activity requiring a Water Use license in terms of Section 21(g). However, the proposed Anaerobic Treatment Plant is not required to have a Water Use Licence in terms of Section 21(g) due to its low storage capacity which is less than the 5 000 cubic meter minimum threshold stipulated under Schedule 4 of the General Authorisation. Therefore the Anaerobic Treatment Plant need only be registered as a Water User in terms of Section 21(g).

A Section 21(g) Water Use Licence is required for the algae raceways, as they are proposed to use wastewater which is likely to be above the combined 5 000 m³ storage capacity.

4.4 Environmental Management Air Quality Act (NEM:AQA), 2004 (No. 39 of 2004)

The National Environmental Management Air Quality Act (NEM:AQA), 2004 (No. 39 of 2004) provides for the protection of the environment by providing reasonable measures for the:

- Protection and enhancement of the quality of air in the Republic;
- Prevention of air pollution and ecological degradation; and
- Securing of ecologically sustainable development whilst promoting justifiable

economic and social development.

On 31 March 2010 the DEA published a list of activities as contemplated in Section 21(1) (a) of the NEM:AQA. The published list is gazetted in GNR 248, and is a list of activities which result in atmospheric emissions which may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage. This GNR also includes the minimum emission standards for the Listed Activities as contemplated in Section 21(3) (c) of NEM:AQA.

Point source gaseous emissions for the proposed Bioenergy Plant are likely to emanate from biogas combustion installations, that is, the Elution Plant and the gas to electricity Microturbines. The emissions standards for gas combustion installations are listed under subcategory 1.4 of GNR 248 and applies to all installations with a design capacity equal to or greater than 50 MW heat input per unit, based on the lower calorific value of the fuel used. The proposed gas to electricity Microturbine installation has a design capacity far lower than the 50 MW heat input per unit, and thus no atmospheric emissions licence is required.

It is proposed that the polyfuel currently being used for heating the Elution Plant boilers will be substituted by biogas. This will reduce the type and amount of emissions released during the heating of the boilers. Biogas is a cleaner, renewable energy source with low carbon emissions. The design capacity of the new biogas burners has not yet been finalised and will be made available in the Draft EIA Report.

The replacement of polyfuel with biogas will not only improve the surrounding air quality, but will also reduce carbon emissions and greenhouse gases into the atmosphere, thereby helping to combat the effects of global warming and climate change.

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

The growing of alien or invasive aquatic weeds is regulated in terms of Sections 65 and 71 of the NEM:BA. In terms of the Alien and Invasive Species Regulations of the NEM:BA, any species listed under Section 70 cannot be propagated, grown, brought or sold by any industry without a permit. Further details on the taxonomy of the proposed blue-green-algae (*Cyanobacteria*) will be required in order to determine if it is a listed alien or invasive

aquatic weed. This will be confirmed during the EIA Phase. Should it be found that it is listed, then a permit application will be required in terms of NEM:BA.

Alien species

Section 65 (1): A person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7.

Section 65(2): A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

Invasive Species

Section 71(1) A person may not carry out a restricted activity involving a specimen of a listed invasive species without a permit issued in terms of Chapter 7.

Section 71(2): A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

4.5.1 Agricultural Permits

In terms of the Conservation of Agricultural Resources Act (CARA), 1983 (Act No.43 of 1983), the Applicant may be required to apply for a planting permit through the Department of Agriculture, Forestry and Fisheries (DAFF). In addition, an agricultural permit in terms of the Plant Improvement Act, 1973 (Act No. 53 of 1973) may be required for the proposed energy crop and Cyanobacteria. This will be determined during the EIA Phase.

4.6 Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act No.28 of 2002)

The aim of the MPRDA is to improve environmental management, promote equitable access to the Nation's mineral and petroleum resources, expand opportunities for historically disadvantaged individuals and create employment and economic welfare.

In terms of Section 38 of the MPRDA, the applicant is required to manage all environmental impacts in accordance to an approved Environmental Management Programme (EMPr) and must as far as reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or

predetermined state or to a land use which conforms to the generally accepted principle of sustainable development. Section 42 further makes provision that residue stockpiles and residue deposits be managed in the prescribed manner or any site demarcated for that purpose in the EMPr. Refer to Section 11.4 for details on the EMPr for the proposed Bioenergy Facility.

According to the MPRDA, before mine residue deposits can be rehabilitated they must be characterised in terms of their physical, chemical and environmental characteristics. This can be done by conducting a Contaminated Land Assessment (refer to Section 11.3.1).

4.7 Mine Health and Safety Act (MHSA), 1996 (Act No.29 of 1996)

Gold mining residues often contain significant concentrations of uranium and radionuclides which may have a potential environmental or human health risk. The major environmental pathway for human exposure is by inhalation of airborne radon and windblown dust. This poses a serious risk to the health and safety of the workers on mine residues.

The MHSA ensures owner responsibility for health and safety through creation of codes of practice, training, identifying potentially hazardous factors, investigating said factors, employing hygienists for the industry, and founding methods of medical attention and recording for the site.

The MHSA, therefore, makes it mandatory for the responsible owner to identify hazards and eliminate, control and minimise the risks relating to health and safety at mines. Furthermore, in terms of the Act, the employer must identify the relevant hazards and assess the related risks to which persons who are not employees may be exposed. Liability is placed on the mine:

“The employer of a mine that is not being worked, but in respect of which a closure certificate in terms of the Minerals and Petroleum Resources and Development Act has not been issued, must take reasonable steps to continuously prevent injuries, ill-health, loss of life or damage of any kind from occurring at or because of the mine”.

The responsible owner is also required to establish an environmental health and safety policy:

“Every employer must prepare a document that-

- *describes the organisation of work;*
- *establishes a policy concerning the protection of employees' health and safety at work;*
- *establishes a policy concerning the protection of persons who are not employees but who may be directly affected by the activities at the mine; and*
- *outlines the arrangements for carrying out and reviewing policies."*

4.8 Occupational Health and Safety Act (OHSA), 1993 (Act No.85 of 1993)

Although the proposed Bioenergy facility is in a mining area, some aspects of the project, such as construction activities and Biogas Plant installations, are regulated under the OHSA.

The aim of the OHSA is to provide for the safety and health of persons at work and in connection with their use of plant and machinery. It further provides for the protection of people other than people at work from hazards arising out of or in connection with the activities of people at work.

The main objective of the Act is to prevent and avoid work related injuries and illness. It regulates and controls health and safety in all organisations, from a normal office environment to more hazardous environments like industrial plants and construction sites.

The OHSA also outlines a series of construction regulations to protect the safety of workers. Construction activities for the proposed Bioenergy facility must comply with the Construction Regulations, 2003, promulgated in terms of Section 43 of the OHSA.

The proposed storage of gas on site and the establishment of a 17 ha Algae Raceway facility are likely to be classified as Major Hazardous Installations which may have a potential risk to human health and safety. Therefore, the Applicant is required to comply with the Major Hazard Installation Regulations of 2001, promulgated in terms of Section 43 of the OHSA. This will be confirmed during the EIA Phase.

4.9 National Energy Act (NEA), 2008 (Act No.34 of 2008)

The major objectives of the National Energy Act (NEA), 2008 (Act No.34 of 2008) are to:

- ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and

- poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors;
- provide for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feed stocks and carriers, obtaining adequate investment, appropriate upkeep and access to energy infrastructure;
- provide measures for the furnishing of certain data and information regarding energy demand, supply and generation; and
- establish an institution to be responsible for promotion of efficient generation and consumption of energy and energy research (South African National Energy Research Institute - SANERI).

The Act defines Renewable Energy as “*energy generated from natural non-depleting resources including solar energy, wind energy, **biomass energy**, **biological waste energy**, hydro energy, geothermal energy and ocean and tidal energy*”. The proposed Bioenergy facility involves the production of biomethane, biofuel (ethanol), and heat energy from biomass and biological waste as the primary feedstocks.

4.9.1 Renewable Energy Policies and Programmes

The proposed project activity, as a renewable energy project, seeks to contribute to all the South African Government's Renewable Energy targets made in the White Paper on Renewable Energy and the Integrated Resource Plan (IRP) for Electricity 2010-2030.

The White Paper on Renewable Energy sets a target of 10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small scale hydro. Under the newly revised March 2011 Policy-Adjusted IRP, the South African Government has set a target of 17.8 GW of renewable energy sources by 2030.

The IRP, amongst other objectives, seeks to provide for a diversified energy mix in terms of new generation capacity that includes:

- Reducing carbon emissions;
- Reducing new technology uncertainties, such as costs, operability and lead time to build;

- Promoting localisation, green economy, and job creation; and
- Increasing security of supply.

If approved the proposed Bioenergy facility will be registered as a Renewable Energy Project under the National Energy Regulator of South Africa (NERSA), which is the statutory body mandated to regulate all energy related projects under the Electricity Regulation Act No.4 of 2006 (Chapter 2 of Section 3(1)).

4.9.2 NERSA Registrations and Licensing

One of the major objectives of NERSA is to facilitate the fair treatment of and non-discrimination between Independent Power Producers (IPPs) and Eskom.

The proposed project activity is exempted from holding a licence under Schedule 1, Section 15(2) and (3) of the National Energy Regulation Act No.4 of 2006:

- (1) Any generation plant constructed and operated for own use; and*
- (2) Non-grid connected supply of electricity except for commercial use.*

The electricity generated is for the Mine's own use and will be essentially non-grid connected.

The proposed Biogas Plant, Virtual Bio-CNG Distribution Network and related Combustion Installations will be licensed as gas activities in terms of Section 15 of the Gas Act, 2001 (Act No.48 of 2001).

4.10 South African Biofuels Industrial Strategy (SABIS) 2007

The South African Biofuels Industrial Strategy of 2007 (SABIS) outlines key incentives for promoting the development of a sustainable biofuels industry in South Africa. The strategy aims to achieve a 2% penetration level of biofuels in the national liquid fuel supply by 2013. According to the strategy; the 2% level can be achieved without jeopardising food security.

Furthermore, due to food security concerns, the strategy supports the growing of non-food crops, such as sugar cane and sugar beet, for bio ethanol production. As such, the

proposed Bioenergy facility is considering the growing of non-food crops, such as sugar beet. The use of maize for ethanol production has been excluded in the strategy.

The impact of energy crops on water resources is also highlighted in the strategy as a major concern, considering irrigation agriculture uses 60% of the total available resource. According to DWA, irrigated cropping for biofuels will have to find its water from existing allocations.

The proposed development will use non-arable, mine impacted land for the growing of the energy crop in order to prevent food security concerns.

The strategy also seeks to stimulate rural development and reduce poverty by creating sustainable income-earning opportunities especially to small scale farmers. The proposed Bioenergy project will engage surrounding small scale farmers in the growing of the energy crop. More information on this will be provided in the EIA Report.

4.11 National Climate Change Response White Paper

The White Paper outlines the South African Government's vision *"for an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society"*. This vision is guided by principles set out in the Constitution, the Bill of Rights, the National Environmental Management Act, the Millennium Declaration and the United Nations Framework Convention on Climate Change (UNFCCC). The overall strategic approach to achieving this vision is through adaptation and mitigation. The mitigation approach, addressed in Section 6 of the response policy seeks to;

"Balance the country's contribution as a responsible global citizen to the international effort to curb global emissions with the economic and social opportunities presented by the transition to a lower-carbon economy as well as the requirement that the country successfully tackles the development challenges facing it".

Some of the key elements in the overall mitigation approach are be:

- Using a national Green House Gas Emissions Trajectory Range, against which the collective outcome of all mitigation actions will be measured;
- Requiring companies and economic sectors or sub-sectors for which desired emission reduction outcomes have been established to prepare and submit

mitigation plans that set out how they intend to achieve the desired emission reduction outcomes.

In terms of its legal obligations under the UNFCCC and Kyoto Protocol, the South African Government has made a commitment to contributing its share to global Green House Gas mitigation efforts by keeping the temperature increase well below 2 ° C. *“South Africa’s contribution to reducing Green House Gas emissions will be met by the desired Peak Plateau and Decline (PDD) green house gas emissions trajectory”*. Under this PDD Trajectory, the South African Government *“will undertake a range of voluntary nationally appropriate mitigation actions to ensure that the country’s emissions deviate below the ‘Business as Usual’ baseline by around 34% by 2020 and by 42% by 2025”*.

The proposed Bioenergy project will contribute towards reducing Harmony’s carbon emissions from the ‘Business as Usual’ baseline, indicating the company’s commitment to reducing Green House Gas emissions in support of government policy on mitigating climate change.

4.12 South African Heritage Resources Act (SAHRA), 1999 (Act No. 25 of 1999)

Under Section 38 of the South African Heritage Resources Act (Act No. 25 of 1999), an assessment of the impact of specified types of development on heritage resources may be required. The purpose of the National Heritage Resources Act is to prevent the destruction or unsympathetic alteration of heritage resources that have either Formal or General Protection. Transgression of the stipulations of the Act may result in severe penalties in terms of fines and /or prison sentences.

A specialist Archaeological / Paleontological Report will be made available in the EIA Report.

5 ASSISTING GUIDELINE DOCUMENTS

5.1 The Department of Environmental Affairs Assisting Guideline Document Series

In order to assist potential applicants, Environmental Assessment Practitioners (EAPs) and Interested & Affected Parties (I&APs) to understand what is required of them in terms of the EIA Regulations, what their rights are and / or what their role may be, the Department of Environmental Affairs (DEA) has recently updated its 2005 Integrated Environmental Management Guideline Series by publishing the following new Guidelines:

ITEM Guideline 5: Companion Guideline on the Implementation of the Environmental Impact Assessments Regulations, 2010

ITEM Guideline 7: Public Participation Guideline

ITEM Guideline 6: Environmental Management Framework Guideline

ITEM Guideline 5 provides a broad introduction to the EIA Regulations, 2010 by explaining the roles and responsibilities of the people involved in environmental authorisation applications, the processes that are involved in applying for environmental authorisation, an interpretation of the Listed EIA Activities, and answering a set of key questions which may arise (DEA, 2010a).

ITEM Guideline 7 provides information and guidance for applicants, authorities and I&APs on the public participation requirements of the Regulations as described in Chapter 6 of the EIA Regulations, 2010. It provides guidance on the benefits of public participation, the minimum legal requirements for public participation processes, the generic steps of a public participation process, guidelines for planning a public participation process, and a description of the roles and responsibilities of the various role-players (DEA, 2010b).

ITEM Guideline 6 provides guidance on the compilation of environmental management frameworks (EMFs) in terms of the EMF Regulations published in GNR 547 of 2010 (DEA, 2010c).

6 METHODOLOGY

The methodology was formulated and undertaken in accordance with Regulations 26-29 and 54-57 of the Environmental Impact Assessment Regulations 2010, under Section 24(5) of NEMA (Act No. 107 of 1998) and published in GNR 543 of 2010. These Regulations refer to the process of environmental assessment of which the Scoping Report is the first phase.

6.1 Application

This report details the Scoping Phase in terms of Chapter 3, under Part 3 of GNR 543 of 2010, of which an Application for Environmental Authorisation for the proposed activity was submitted to the DEDTEA on 21 February 2013 (Appendix C). The Waste Licence Application will be submitted to the DEA Waste Licensing Directorate together with four copies of this DSR (Appendix C).

6.2 Baseline Environmental Description

Baseline information has been collected in order to identify any restrictions that the environment may have on the proposed project, and to establish the sensitivity of the environment. Preliminary biophysical, social and economic information has been assimilated during a desktop study. This information has been obtained from existing literature, aerial photography, a 1:500 000 Geohydrological Map for the area (Kroonstad 2726) and a 1:50 000 topographical map of the area. These findings were verified by site visits to the properties.

6.3 Consultation with Interested & Affected Parties (I&APs)

Notification of the proposed development has been provided to the public and authorities through adverts in local newspapers (Appendix D), site posters (Appendix E) and the circulation of Background Information Documents (BIDs – Appendix F). Meetings have been held with the Applicant and the EAP, and a Public Information Session was held for all I&APs to attend. Further details of the Public Participation Process are provided in Section 8.

6.4 Description of the Proposed Development

A detailed description of the proposed development has already been provided in Section 1 and the alternatives to be evaluated during the EIA Phase are listed in Section 7. Both sections provide details on the proposed development and its associated alternatives.

6.5 Assessment of Potential Environmental Impacts

This Scoping Report documents issues that will be relevant for consideration for the application to the Competent Authority. Using the information gathered from on-site

assessments, past documentation and from public and authority feedback, project activities and associated potential impacts have been identified. Where appropriate, alternatives have been described.

7 ALTERNATIVES

The EIA Regulations require an identification and investigation of alternatives. These could include alternative layouts, activities, locations, infrastructure, land-uses as well as the “do-nothing” alternative. For this project, the following different types of alternatives will be investigated during the EIA Phase:

7.1 Site Alternatives

7.1.1 Alternative cropland sites

The following cropland sites were identified and evaluated during the pre-feasibility Study:

- Site 1 (Nooigedacht TSF);
- Site 2 (FSN5 & Surroundings); and
- Site 3 (Saints 1,2,3,4 & surroundings).

Refer to Figure 4 for a map of the three alternative cropland sites.

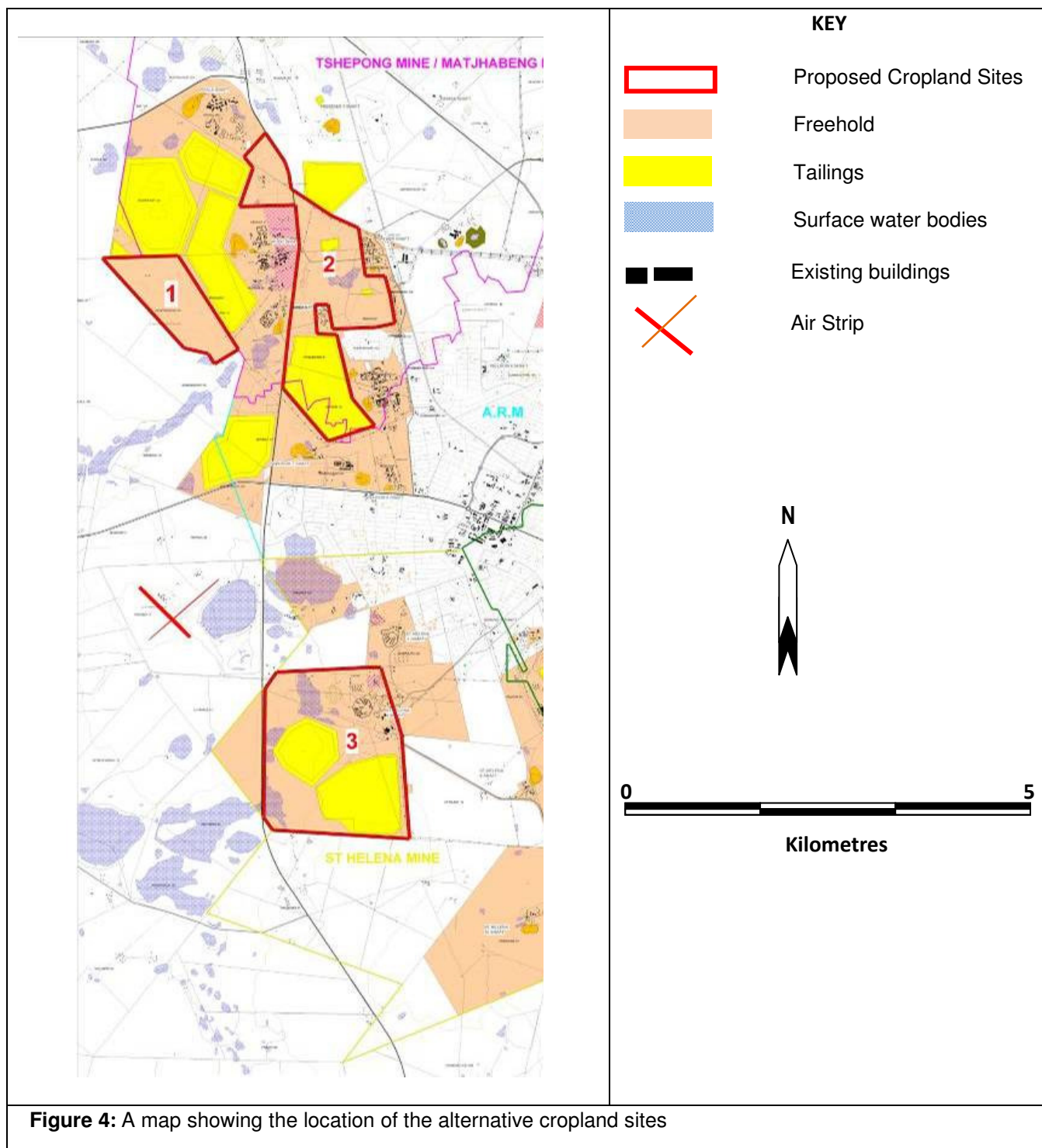
During the pre-feasibility study Site 2 (FSN5 & Surroundings) emerged as the preferred site for the cultivation of the energy crop. However during the EIA Phase all three sites listed above will be investigated from an environmental perspective, in order to confirm that Site 2 is the most appropriate site.

7.1.2 Bioenergy Plant Location Alternatives

Two alternative development sites were identified for the Bioenergy Plant.

- Site 1: located near to the Brand Shaft 1 (28° 0'32.62"S, 26°44'49.01"E)
- Site 2: located near to the Harmony 1 Plant (28° 1'19.87"S, 26°45'5.96"E)

Refer to Figure 5 for a map of the two alternative Bioenergy Plant Locations. As part of the EIA Phase, the suitability of the above two sites will be investigated.



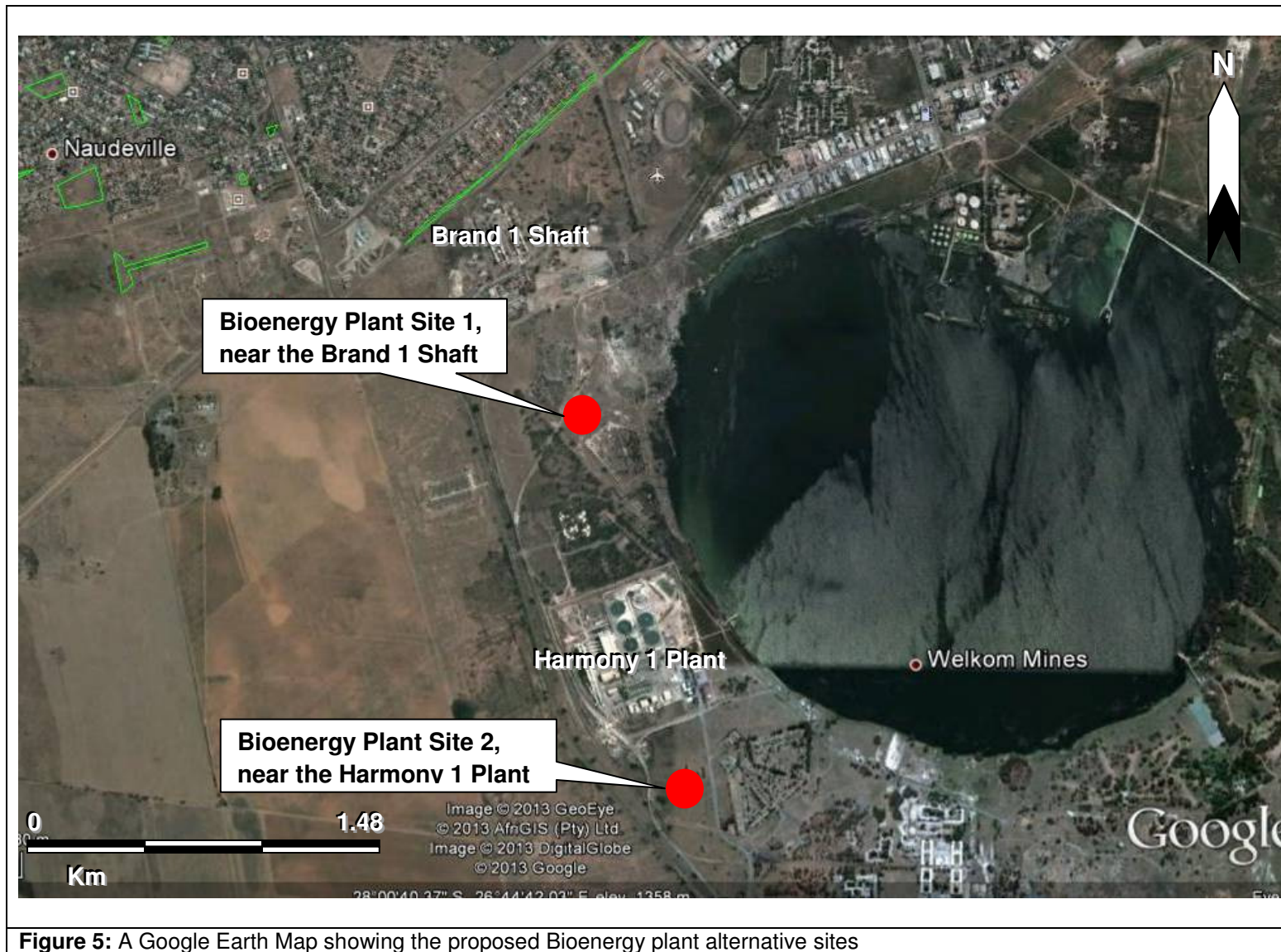


Figure 5: A Google Earth Map showing the proposed Bioenergy plant alternative sites

7.1.3 Irrigation water pipeline route alternatives

Two alternative pipeline routes have been identified. Refer to Figure 6 for a map of the two alternative pipeline routes.

- Route 1: and
- Route 2.

As part of the EIA Phase, the suitability of the above two routes will be investigated.

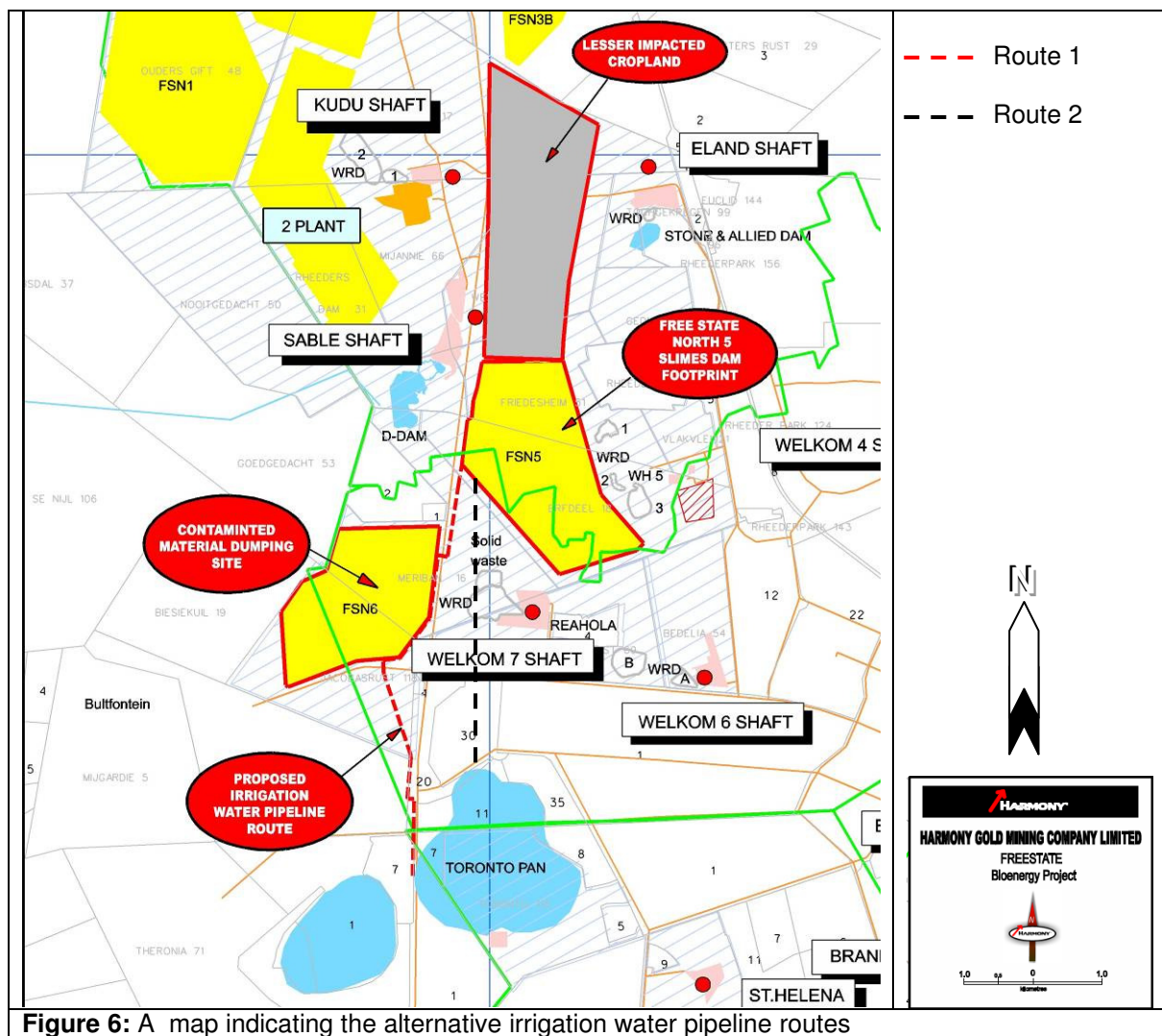


Figure 6: A map indicating the alternative irrigation water pipeline routes

7.1.4 Alternative irrigation water sources

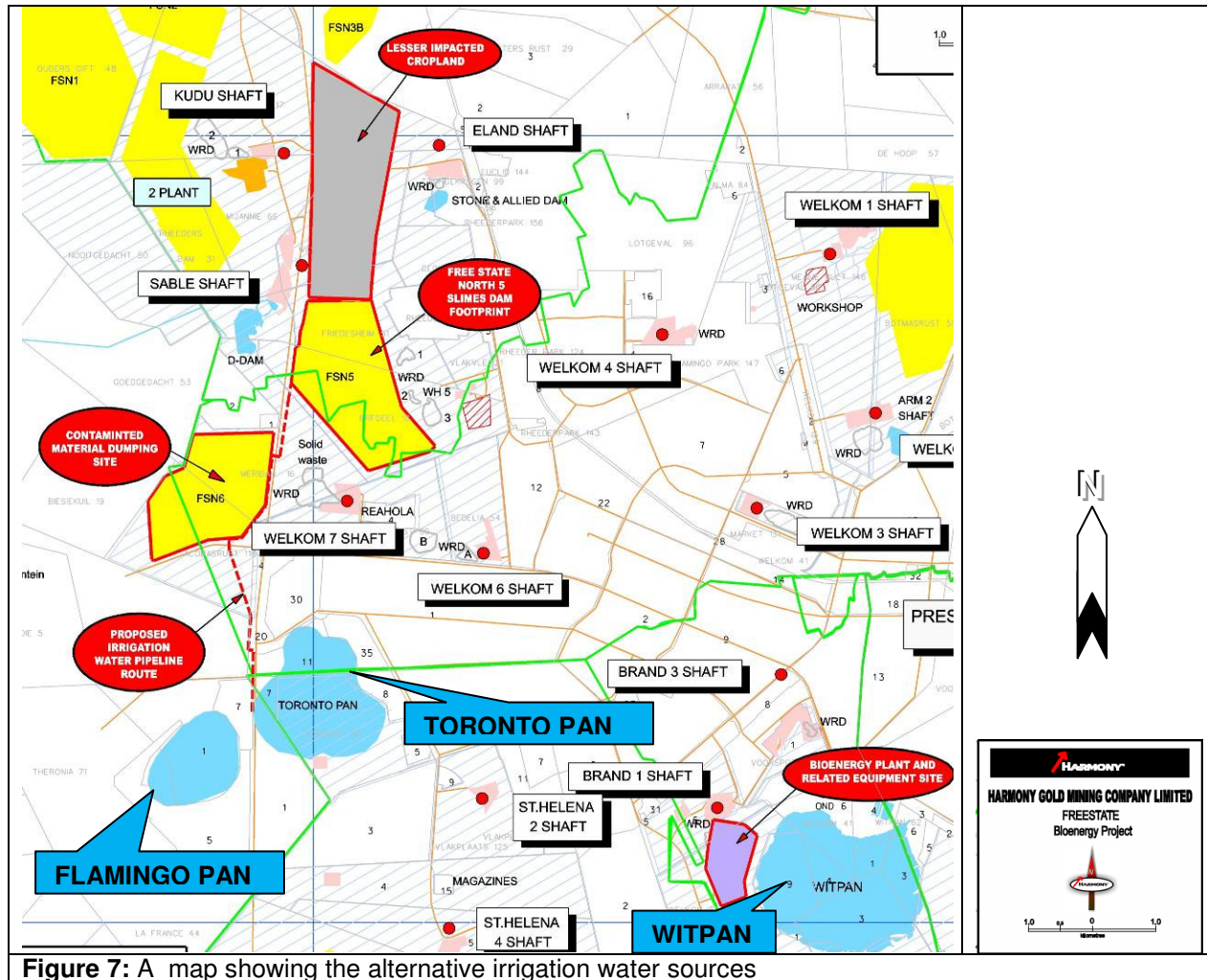
The following water sources were identified and evaluated during the pre-feasibility Study:

- Toronto Pan;
- Flamingo Pan; and

- Witpan.

Refer to Figure 7 for a map of these four alternative water sources.

During the pre-feasibility study the Toronto Pan emerged as the preferred water source for the proposed development. However during the EIA Phase all three water sources listed above will be investigated from an environmental perspective, in order to confirm whether or not the Toronto Pan is the most appropriate source.



7.2 Type of Energy Crop

In terms of the South African Biofuels Industrial Strategy of 2007, the growing of energy crops in areas traditionally used for food production is not encouraged or supported in South Africa. The types of the energy crops recommended in the strategy include sugar cane, sugar beet, soyabeans, sunflower and canola. Maize and Jatropha are not permitted crops from which biofuels can be manufactured. Other energy crops may be considered provided there is a strong motivation.

The proposed energy crop will be grown on non-arable, mine impacted land, which cannot be used for food production due to potential human health risks. The use of non-arable land for the cultivation and growing of energy crops also minimises the impact on food security and prices.

First generation crops (sugars or starches) as opposed to lignocellulosic biomass (second generation crops) are considered as the most suitable feedstock for biomethane production, as lignin reduces the digestibility of the crop, unless it is pre-treated with an enzyme. Generally, sugars and starches digest readily, therefore requiring shorter Hydraulic Retention Time in the biogas digester.

In selecting the type of energy crop, biogas yield is an important factor and is determined by the chemical composition and digestibility of the crop. High yielding crops mean less land is required for the same fuel production. Compared to making liquid biofuels, biogas has the advantage that the entire crop can be utilised and not merely the starch, sugar or oil rich parts.

The choice of energy crop is also determined by environmental elements, such as land, water, soil and climatic conditions.

The following energy crops were identified and evaluated during the pre-feasibility Study:

- Sugar beet;
- maize;
- Hybrid Sorghum; and
- Hybrid Rye

During the pre-feasibility study Sugar Beet emerged as the preferred feedstock for biomethane production, and Hybrid Sorghum and Rye as the preferred secondary, rotational crops for biomethane production. However during the EIA Phase all energy crops will be investigated from an environmental perspective, in order to confirm the findings of the pre-feasibility Study.

7.3 Alternative Farming Methods

The following alternative farming methods have been identified during the Scoping Phase:

- Dryland verses irrigation; and
- Monoculture verses crop rotation,

The above farming methods will be investigated in detail during the EIA Phase.

7.4 Alternative irrigation technology

The impact of energy crop production on water resources has been raised as an important concern; considering South Africa is water stressed, and irrigated agriculture already uses about 60% of the total available resource. It is important that a water efficient irrigation system is implemented to conserve water resources. The drip and centre pivot irrigation systems are widely used and well known for their water efficiency in South Africa.

As part of the EIA Phase, both the Drip Irrigation method and the Centre Pivot Irrigation method will be investigated.

7.5 Bioenergy Technology Alternatives

Three alternative Bioenergy technologies have been identified during the Scoping Phase:

- Anaerobic Biogas Digester Technology;
- Biogas Treatment Technology; and
- Algae-Ethanol Technology.

The Microturbine is the preferred gas to electricity generator, due to its low emission levels and high operational efficiency. In addition, the Microturbine is carbon neutral. Although there other alternative gas to electricity technologies available, the proposed Capstone DM65 Microturbine is environmentally friendly and has low maintenance costs. As such, no other alternative gas to electricity technologies will be investigated as part of the EIA Phase.

7.5.1 Alternative Anaerobic Biogas Digesters

The following two types of Anaerobic Digesters will be investigated as part of the EIA Phase:

- Covered Anaerobic Lagoon Digester - using the New-Gen High Rate Continuous Flow Lagoon Digester; and
- Complete Mix Anaerobic Digester – using Dry Continuous Anaerobic Digestion.

7.5.2 Alternative Biogas Treatment Plant

It is proposed that approximately a third of the uptake biogas from the digester will be channelled into a Gas Treatment Plant to remove impurities, such as Carbon Dioxide, Hydrogen Sulphides, and water vapour. The purified gas will then be further processed to Compressed Natural Gas (Bio-CNG), to be stored on-site as a replacement fuel for petrol or diesel vehicles. The use of Bio-CNG as a viable, alternative fuel source for vehicles will

reduce the use of fossil-fuel based petroleum products, which are responsible for the emission of harmful gases into the atmosphere.

There are various gas treatment technologies the world over, but the two most common and widely used technologies are the Water Scrubber and the Membrane Separator. These two technologies are also well suited to local South African climate conditions. The removal of impurities from the gas stream results in the emission of pollutants which are potentially toxic and may contaminate the environment. Thus, during the EIA Phase, both the Water Scrubber and Membrane Separator technologies will be investigated.

7.5.3 Alternative Algae-Ethanol Technology

The proposed Bioenergy project includes the production of biofuel from microalgae, grown in raceways containing wastewater discharged from the NewGen digester. Microalgae are photosynthetic organisms that grow using solar energy and are broadly categorised into eukaryotic and Cyanobacteria (blue-green algae). The latter is a large and morphologically diverse group, which can thrive in all kinds of waters with some species thriving in freshwater while others thrive in brackish water or the marine environment.

The important factor in the production of algal biomass is the selection of the strain that is best suited to the environmental and cultivation conditions. The Cyanobacteria strain for the proposed ethanol production has yet to be selected, however it will be provided in the Draft EIA Report.

The following two types of algae-ethanol technology will be investigated as part of the EIA Phase:

- Microalgae Cultivation Technology; and
- Ethanol Purification Technology.

7.6 No-Go Alternative

The No-go Alternative will also be investigated as part of the EIA Phase.

8 PUBLIC PARTICIPATION PROCESS

8.1 Notification of the Proposed Development

Table 2 provides details of the Public Participation Process to date.

Table 2: Summary of Public Participation Process

Date	Activity	Description / details
From 9 th November 2012	Background Information Documents (BIDs)	Background Information Documents (BIDs) were distributed to all identified I&APs for their review and comment. BIDs were also sent to those who responded to other advertising methods. A copy of the BID is included in Appendix F.
19 th November 2012	Newspaper adverts	Public notices, in both English and Afrikaans, were placed on the Volksblad (Appendix D).
29th November 2012	Site posters	Site Posters, in both English and Afrikaans, were displayed along all major roads leading to both development sites (Appendix E). Refer to Figure 8 for map. Poster 1 27 56 40.50S 026 41 33.57E Poster 2 27 58 19.78S 026 41 19.74E Poster 3 27 58 26.51S 026 42 01.87E Poster 4 27 55 48.55S 026 41 40.89E Poster 5 27 58 31.97S 026 43 11.31E
4th February 2013	First notification of Public Information Session	All I&APs were personally invited by fax, e-mail, phone or post to the first Public Information Session, held at the Oppenheimer Park Golf Club in Welkom between 3:30 - 6:30 pm.
18th February 2013	Second notification of the Public Information Session	All key I&APs (a total of 50) were phoned and reminded on the Public Information Session. 25 I&APs confirmed their attendance.
19th February 2013	Public Information Session	The first Scoping Phase Public Information Session was held in order to provide information and to give I&APs an opportunity to comment and raise their concerns. Refer to Appendix I for pictures of the displays, copies of the slides and attendance register. Minutes of the Public Information Session were tabulated (refer to Table 4). Refer to Section 8.2 for further information.
27 February 2013	Circulation of minutes of the Public Information Session	The minutes of the meeting were tabulated and circulated to all I&APs for comment.
28 February 2013	Notification of the Draft Scoping Report.	All I&APs were personally notified by fax, e-mail, phone or post of the availability of the Draft Scoping Report.

March 2013	Radio announcements.	The proposed project is being advertised in Sesotho and Xhosa on the following radio stations: Radio Lesedi and Radio Lefika.
20 March 2013 (to be confirmed)	Focus Group meeting.	A focus group meeting is being organised to present the Draft Scoping Report to Key Government Departments.
20 March 2013 (to be confirmed)	Focus Group meeting.	A focus group meeting is being organised to present the Draft Scoping Report to the Mayor and the ten 10 Members of the Mayoral Committee.
20 March 2013 (to be confirmed).	Focus Group meeting.	A focus group meeting is being organised to present the Draft Scoping Report to Speaker of the house, and relevant councillors for the area.
March 2013	Newspaper adverts.	Public notices, in Sesotho are being placed in the Vista and Free State Sun to advertise the availability of the Draft Scoping Report.

A list of I&APs has been compiled (Appendix G). Those identified as I&APs included Authorities, neighbouring landowners and community groups. Persons responding to the adverts and site posters were added to the list of I&APs.

Comments received following the circulation of the BID, placement of adverts and site posters are summarised and responded to in Table 3.



Figure 8: Map showing location of the placement of posters

8.2 Public Information Session

At the Public Information Session, project information was verbally and pictorially presented by the EAP. The presentation addressed the following topics:

- Overview of the EIA project;
- Description of project activity and location;
- Technology operation;
- Types of energy crops to be grown;
- Description of the Algae-Ethanol process;
- Benefits associated with the proposed project;
- Specific project information regarding the Bioenergy Plant; and
- Details of the proposed specialist studies to be undertaken during the EIA.

In addition, members of the project team were in attendance to answer any questions.

Table 3: Comments received in response to circulation of the BID and the placement of adverts and site posters

Source	Comment	Response
Shelton Tsanga Enviroworks 19 November 2012	<ul style="list-style-type: none"> • Please kindly register me as an Interested and Affected Party for the Proposed Bio-Energy facility. Comments will be made upon review of the Draft Scoping Report (DSR)- an indication date on its availability is highly appreciated. 	<ul style="list-style-type: none"> • The I&AP has been registered and informed that the DSR will be made available during March 2013.
Nombulelo Leeuw 13 December 2012	<ul style="list-style-type: none"> • Our names are, Nombulelo Leeuw and Liziwe Mhlontlo, and we have an interest in meeting with you regarding matters you would know very well of, the Mining Sector and their Corporate Social Investment/ Responsibility programs. • Basically, Liziwe and I, are 'environmentalists', we have questions regarding the management of waste within the Harmony Gold. • Why such an interest, we are doing research on how our business, working together with Harmony, can increase employment levels within the communities where Harmony is operational. • As someone already operating as a Professional in the mining sector, working with Community and Enterprise affairs, your input, direction and your valued time with us will be highly appreciated. • Could you kindly assist in this regard as two young black woman venturing in the eco environment business. • Hope to hear from you, in due time and looking forward to meeting you soon. 	<ul style="list-style-type: none"> • Noted. • Noted. • Noted. • Noted. • Noted. The EAP requested that both ladies attend the Public Information Session. • See above response.
Rebone Senyane 7 January 2013	<ul style="list-style-type: none"> • I would like to know how far is the process of establishing a Bioenergy facility at Harmony Gold Mine, Welkom, Matjhabeng Local Municipality, Free State Province. I am keen in taking part in the process. 	<ul style="list-style-type: none"> • The I&AP was informed that the project was currently in its Scoping Phase, and that a Public Information Session was scheduled for February 2013.
Rebone Senyane 11 January 2013	<ul style="list-style-type: none"> • Following our telephonic conversation that we just had, i would like to have clarity on the following: • What business opportunities are available? • Who are eligible for such business opportunities? 	<ul style="list-style-type: none"> • Noted. • This will be addressed in the EIA Report. • This will be addressed in the EIA Report.

	<ul style="list-style-type: none"> • And what are the critical requirements that should be met for taking part in any business opportunity that might exist? • I am raising the aforementioned questions being concern about Local Economic development, wherein the local people should be the main beneficiaries of the process, hence my questions so that one can position himself correctly for any business opportunities. • Other than that I know of the company that specialises in radiation protection, safety assessment, radioactive waste management, radiological environmental control and solid waste management. The owners of the company have operational and regulatory experience in nuclear, environment, mining and occupational safety .They have executed the following projects for Harmony: <ul style="list-style-type: none"> ○ Monitoring and control of radiation hazards in underground mine, ○ Technical audits, ○ Radiation protection specialist and risk assessment services. 	<ul style="list-style-type: none"> • This will be addressed in the EIA Report. • This will be addressed in the EIA Report. • Noted.
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Table 4: Summary of comments received and responses given at the first Public Information Session

Comment	Response
Is the waste produced by the proposed Anaerobic Treatment Plant organic?	The by-product is inorganic and, depending on the constituents it may or may not be suitable for use as a fertilizer (Ignus).
To what degree has the proposed cropland area been impacted by mining activities?	Two types of mine impacted land are proposed for cultivation; the tailings footprint, and the less mine impacted land (Ignus). As part of the EIA the toxicity of the tailings footprint is going to be tested and analysed (Ignus).
How far have you gone in identifying the end users of the gas?	Harmony is the end user of the gas. The gas will be used to operate different aspects within the company – from Office to plant (Ignus).
Is the mine impacted land going to be rehabilitated by the proposed growing of the energy crop?	A focus of the project is to plant energy crops which will extract toxins from the mine impacted land. However we have not yet established the phyto-remediation potential of the project at this stage (Ignus).
Are you only considering Sugar beet as the only potential energy crop?	There are a range of different types of energy crops being tested. These include rye grass and sorghum (Ignus).
What is Harmony's investment in this?	We are unable to provide information on this, as the project is still in the feasibility phase (Rob).
Harmony has a rehabilitation commitment in this.	Noted.
What is the investment value of this project?	As stated previously, we are unable to provide information on this as the project is

	still in the feasibility phase (Rob).
What have you learned so far about this project?	We have learnt a great deal from the existing pilot project which has been established on both the tailings footprint and mine impacted land. The findings to date are promising (Ignus).
Are there any residential areas likely to be impacted by this project?	The proposed areas to be cultivated border some residential areas. Impacts on surrounding land-users will be investigated during the EIA Phase (Rebecca).
What is the lifespan of the project, and is there a possibility of terminating it after its lifespan?	The project life-span is in-line with the projected lifespan of the mine. However we do not anticipate closing the project upon mine closure at this stage (Rob).
Where are you going to source your EIA Specialists?	The EAP will be sourcing suitably qualified specialists to compile the necessary studies (Rebecca).
Are you going to look at decommissioning the Biogas Plant?	Decommissioning procedures and responsibilities for the Biogas Plant will be addressed in the Environmental Management Programme, which will be made available for comment during the process (Rebecca).
Harmony has a sustainability commitment. How are dust emissions from the energy crop tailings footprint going to be suppressed from spreading to surrounding communities?	The issue of dust has been investigated as part of the pre-feasibility Assessment, however further investigation will be made during the EIA (Rebecca).
It seems like your adverts and public meeting invites were in English and Afrikaans only, yet we have so many Sesotho speaking people in the area who are likely to be affected by the proposed project.	We have made contact with the applicable Ward Councilors and community groups who confirmed yesterday that they would be attending this meeting. We established posters at the entrance to the residential areas. We shall be investigating the establishment of additional posters within the relevant residential areas, and placing an advert in a Sesotho Publication to notify them of the availability of the Draft Scoping Report, and a Community Meeting, if this is supported. We want as many people as possible to be involved in this project, and appeal to you all to provide us with contact details of any community groups or key people whom you feel should be notified. We are also considering radio adverts about this Project in Sesotho, to be aired in any one of the local community radio stations (Rebecca).
There are people who can directly benefit from this project, particularly the unemployed youth who form a major proportion of the urban population in Welkom.	Noted (Rebecca).
What will happen to the cropland area after harvesting?	This is currently being investigated. We are looking at the planting of a secondary, rotational energy crop (Ignus).
The Chamber supports the development and we are keen to help with anything if we can.	Noted (Rebecca).
The proposed abstraction of irrigation water from the surrounding existing Pans is going to affect water supply in our townships. Is this going to affect the water table?	Water for the proposed development is a major aspect of this project, and we shall be thoroughly investing this as part of the Process. We intend to commission a Geohydrological Assessment to address this during the EIA (Rebecca).
Who is going to undertake the farming enterprise, is it Harmony?	Various options are currently being investigated (Rebecca).
Irrigation water must be abstracted from Witpan?	As mentioned previously, the water source for this project is going to be fully investigated in the assessment (Rebecca).

9 POTENTIAL IMPACTS ON THE BIOPHYSICAL ENVIRONMENT

9.1 Topography

Description:

The regional topography of the northern Free State Tailings can be described as relatively flat, with rolling plains and low hills extending into the Welkom area. The rolling plain elevations range from 1 260 meters above mean sea level (amsl) to 1 460 metres amsl, while the elevations for the FSN5 tailings footprint and surrounding less mine impacted land ranges from 1 340 metres amsl to 1 360 metres amsl.

The topography slopes from east to west and the northern section of the plain slopes towards the north and the Vaal River. The general slope of the terrain ranges from 1:250 to 1:100.

Implications:

- Agricultural activities on the tailings footprint and less mine impacted land will be visible.
- Agricultural activities will alter stormwater run-off. If not managed correctly, stormwater could accelerate erosion and sedimentation of local water resources.

9.2 Climate

Description:

The Welkom area is in a typical highveld climate with moderately wet, warm summers and cold dry winters.

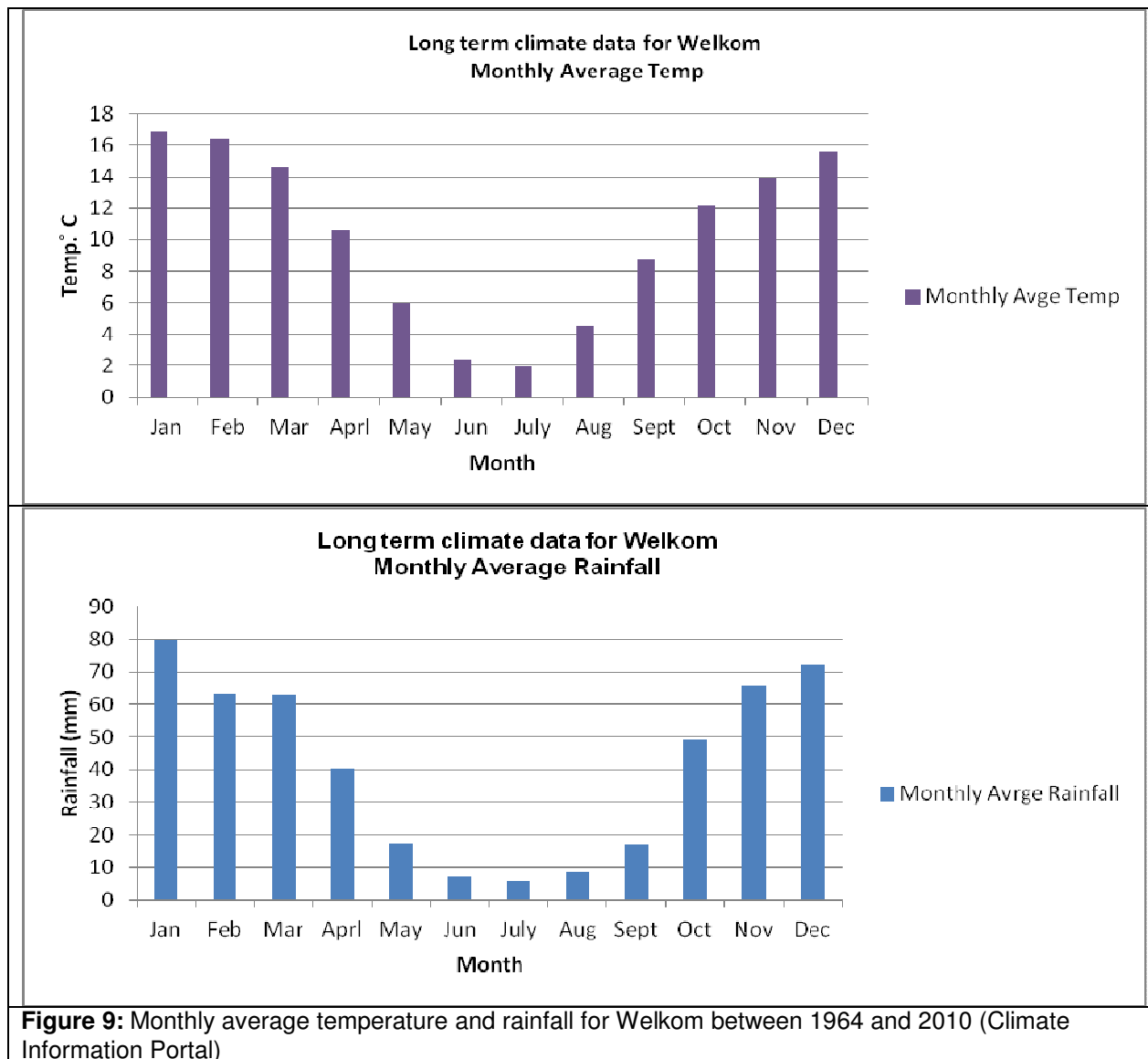
Based on collated climate data from the Climate Information Portal (CIP), the average monthly temperature for Welkom is 17 °C in summer and 5 °C in winter, as graphically indicated in Figure 8. The average annual rainfall is 490 mm as indicated in Figure 9. The coldest month is July when temperatures drop to 0 °C. Frost conditions are most common in winter from middle May to the first week of September.

South African Weather data for wind speed and direction recorded for Kroonstad between 2000 to 2003, averages a north, northeast and east with an approximate 12, 8 and 15% frequency of occurrence of each for the total period. Wind speeds average between 1m/s to 8m/s with calm periods (<1m/s) occurring for 3.4% of the time.

Implications

- Extremely low temperatures, especially during winter may affect crop growth.

- Severe weather conditions, such as hailstorms and high speed wind, may reduce crop yields.
- Heavy storms may increase soil erosion through surface-runoff.
- Land preparation for cultivation has the potential to create wind-blown dust which may affect the easterly residents of Flamingo Park and Rheederpark.
- Potential risk of fire or explosion and damage of infrastructure if lightning conducting equipment from the Bioenergy plant is not properly earthed.



9.3 Air Quality and Surface Wind

Description:

The regional air quality is generally expected to be poor, due to air pollution from the surrounding mine activities in the area.

Implications

- Due to the predominantly easterly wind direction, agricultural activities on the tailings footprint may cause dust emissions to the easterly located residential townships of Flamingo Park and Rheederpark.
- Potential exists for additional traffic and the cultivation of crops to generate dust.
- Wastewater from the anaerobic treatment plant and algae raceways has the potential to emit offensive odours if not managed correctly.

9.4 Geology and Soils

Description:

The development site is in the Free State Goldfield area which lies in the Highveld region of the African plantation surface. The regional surface geology consists of three geological units: Witwatersrand Supergroup, Ventersdorp Supergroup; and Karoo Supergroup. The Witwatersrand Supergroup comprises of Randian age sedimentary rocks with several thousand meters of thickness (Braan, 2006). These sedimentary rocks consist of shale, quartzite and conglomerate. The Ventersdorp Supergroup consists of an assemblage of sedimentary and volcanic rocks of the Randian age, which are subdivide into the Klipriviersberg Group and Platberg Group. The rocks occur under thick karoo cover in the Free State Goldfields where they overly the Witwatersrand Supergroup. The Platberg Group, formed by debris flow sediments, lies at the top, and the Klipriviersberg Group with heavy basaltic to andesitic lavas is at the bottom (Golder Associates Africa, 2009).

Based on an interpretation of a 1:500 000 Hydrogeological Map series for the Kroonstad area (DWA, 2000), the lithology of the development site consists of argillaceous rocks; shale, mudstone, and subordinate siltstone of the Adelaide Subgroup. Most of these rocks have been intruded by dolerite sills and dykes with favourable water-bearing characteristics.

The natural soil in the area predominantly consists of duplex soils; which can be divided into red, yellow, brown, dark, and gleyed soils based on subsurface colour. According to Tekle (2004), duplex soils have relatively permeable topsoil overlying a very slowly permeable

diagnostic horizon which is not a hardpan. The A horizon is normally coarse textured, and the B horizon is fine textured. The coarse textured A horizon has a low water holding capacity and the structure is usually weak (Tekle, 2004).

The slopes are typically covered by well weathered unstructured red or yellow soils, while the valleys have clay deposits washed down from the slopes.

The FSN5 Tailings Footprint is predominantly covered by a thick layer of white silty sand with an underlying layer of rock debris from mining activities. Both layers are considered potentially toxic due to elevated levels of trace metals and radionuclides from the mining process.

According to the results of a tailings footprint Soil Analysis conducted by Promethium in 2011, as part of the pre-feasibility study, crops can be difficult to grow on the tailings footprint due to the toxic nature of the soils. The report also notes that physical, chemical and biological amendments can be made to the soils in order to create a root zone favourable for sustainable plant growth. However, the current energy crop trial plantations (sugar beet) which have been planted on a small portion of the FSN5 tailing footprint have proven that sugar beet can be successfully planted with relatively low cost soil conditioners.

Implications

- In terms of geotechnical strength, the soils on the tailings footprint may not be stable enough for intensive energy crop cultivation and irrigation.
- The soils on the tailings footprint potentially contain radioactive material which might have adverse effects on human health if exposed to workers and the surrounding community.
- Wind dispersion of radioactive dust may affect a wider geographical area.
- Potential soil erosion and sedimentation of downstream surface water bodies due to overflow and run-off during irrigation.
- The energy crop will help stabilise and phytoremediate soil on the tailings footprint.
- Phytoremediation of the tailings footprint will restore the productive capacity of the land.

9.5 Ground and Surface Water

Description:

The less mine impacted land and the FSN5 tailings footprint both fall in the Mahemspuit sub-catchment. The Mahemspuit is in quaternary C43B and is a tributary of the Sand River. The Sand River and its tributaries form the central watershed system of the Welkom area. The River flows to the south of Welkom then west through Virginia, before joining the Vet River which flows into the Vaal River at Bloemhof Dam.

According to the Golder Associates Hydrology Report (2009), the watercourses in the area do not have the typical well defined central channel system with associated flood plains, but are a single broad flat well vegetated channel system. The water courses break into pans which collect runoff during the summer rainfall period and dry-up over the dry winter period. As a result salt builds up in the pans resulting in increasing salt concentrations.

Water for irrigation will be abstracted from one of these pans (Toronto Pan), which is located downstream of the FSN5 tailings footprint and adjacent to the Toronto Waste Water Treatment Works (TWWTW). According to the pre-feasibility study, the water in the pan is expected to be of poor quality due to contamination by sewage waste flowing from the TWWTW. The water is therefore not suitable for human or recreational use. There are no other competing water uses associated with the pan. Pre-feasibility water requirements for irrigation indicate that approximately 5 to 8 Mega Litres per day will be pumped from the pan via a uPVC pipeline to the energy crop fields.

Groundwater potential in the region is associated with the Karoo aquifer system which can be subdivided into the following units: a shallow, weathered aquifer; a deeper, fractured, hard rock aquifer; and an alluvial aquifer of limited extent. The groundwater for the shallow weathered aquifer is often perched on impermeable clay or shale horizons and may be artesian in places. The shale layers often restrict the downward infiltration of rainwater into the aquifer. The borehole yields in this aquifer are generally low due to the low permeability of the clayey weathered aquifer material (Baran & Dziembowski, 2003). The ground water quality is good especially in undisturbed areas due to the rainfall recharge.

The deeper Karoo aquifer is associated with fracturing along dolerite dykes and sills which create conduits for groundwater movement (Baran & Dziembowski, 2003). Occasional high-yielding boreholes can be intersected, but most of them are unable to sustain large-scale

pumping and irrigation. The groundwater quality is generally poor due to the concentration of salts and slower rate of recharge.

Implications

- High water usage may affect the availability of surface and groundwater resources in the area.
- Over-abstraction of irrigation water, especially during the dry season, may deplete the pan. However, abstraction of irrigation water from the Toronto Pan could help reduce overflow incidences which normally occur during the rainfall season.
- Over-application of synthetic fertilisers, pesticides and herbicides may result in downstream pollution of surface water bodies.
- Over-irrigation can potentially erode the topsoil or wash down chemicals through run-off.
- Increased groundwater abstraction may lower the water table, thereby increasing the hydraulic gradient and subsequent acceleration of pollutant transport times.
- Irrigation with contaminated water may pollute the soil and groundwater resources.
- Waste leakages from the Gas Treatment Plant, algae-ethanol raceways, and the fermentation plant may pollute underlying groundwater resources.
- If the proposed NewGen anaerobic digester is not properly lined underneath, leachate might pollute soil and groundwater resources.
- If stormwater is not correctly channelled off the site, increased erosion may occur.

9.6 Flora and Fauna

Description:

The natural vegetation in the study area is dominated by two types of grasslands; the Vaal-Vet Sandy Grassland and the Highveld Alluvial Grassland.

The Vaal-Vet Grassland vegetation occurs throughout the area, whereas the Highveld Alluvial Vegetation occurs along rivers and drainage lines in the area. Much of these grasslands have been degraded throughout the region. Only 0.3% of the Vaal-Vet Sandy Grassland is statutorily conserved in the Bloemhof Dam, Schoonspruit, Sandveld, Faan Meintjies, Wolvespruit and Soetdoring Nature Reserves. More than 63% of it has been transformed for cultivation (ploughed for commercial crops) and the rest under strong grazing pressure from cattle and sheep. The grassland is listed as endangered (Target 24%).

More than a quarter of the Highveld Alluvial Grassland vegetation has been transformed for cultivation and by the building of dams. The grassland is least threatened (Target 31%). Nearly 10% is statutorily conserved in the Barberspan (a Ramsar site), Bloemhof Dam, Christiana, Faan Meintjies, Sandveld, Schoonspruit, Setdoring and Wowelspruit Nature Reserves. The Highveld alluvia are prone to invasion by a number of weeds due to the high nutrient status of the soils, and ample water supply. The undergrowth of the alluvial riparian thickets and the accompanying grasslands suffer from heavy overgrazing in many places.

The majority of the study area is considered to be of low or moderate Conservation Importance, as it has been disturbed by chemical or mechanical means, and there is a high occurrence of exotic species in the area.

A number of invader species have been observed in the area and these include *Argemone* spp, *Cestrum laevigatum*, *Datura* spp, *Nicotiana glauca*, *Eucalyptus camaldulensis*, *Pinus* spp, *Prosopis glandulosa*, *Melia azedarach*, *Tamarix* spp, and *Asparagus* spp.

The proposed less mine impacted land for energy crop cultivation is covered by degraded grasslands and invader species. There are no signs of natural vegetation or wetlands.

The proposed FSN5 tailings footprint for energy crop cultivation is dominated by patches of alien vegetation with *Eucalyptus camaldilensis* and *Pinus* spp bordering the entire footprint. There are no signs of natural vegetation or wetlands.

The proposed Bioenergy Plant development site is covered by degraded grasslands. A large number of exotics colonise this area, further reducing the ecological integrity of the area. The development site is located near to Witpan dam; which is heavily polluted and infested by alien species.

Implications:

- The cultivation of hybrid crops may promote the growth of alien and invasive weeds in the area.
- The growing of imported plant species may bring in new forms of pesticides and weeds which are difficult to control.
- Vegetation cover on the tailings footprint through crop production will help stabilise the soil and reduce erosion and dust dispersion.

- The growth of the energy crop on the tailings footprint will help phytoextract toxic metals and substances from the soil. Laboratory results on current trials being conducted on the tailings footprint will be made available during the EIA.
- Vegetation clearance on the Bioenergy plant construction site may increase soil erosion.
- The proposed production of enhanced Cyanobacteria in raceways may accidentally spread or invade into nearby surface water bodies.
- If approved, the development could result in increased alien vegetation as a result of soil movement during planting.

9.7 Fire Management

Description:

The Grasslands are largely dependent on fire for propagation and continuity within the Savannah Biome. Thus the vegetation is highly vulnerable in terms of its propensity to catch fire. The fuel structure of grasslands comprises erect grass swards with continuous distribution providing fine fuel to support fires. Fire frequencies average between two and four years nationally and with fuel loads of around 600g/m² and fire intensities of 1000 – 3000 kw/m. Fires occur as surface fires, mainly in the dry winter periods and fuel consumption is efficient with 70-80% of biomass being consumed (Willis et al. 2001).

In order to prevent grassland fires from spreading to the Bioenergy Plant or cropland area, an integrated fire management system in line with international standards and in accordance with the National Veld and Forest Fire Act (Act 101 of 1998) is required. Part of this system includes fire breaks and a lightning protection system to prevent any dangers associated with lightning conductivity.

The perimeter of the Bioenergy Plant will be fenced and the necessary danger warning signs established. The signs will warn of the dangers associated with naked flames near the site.

Implications:

- There is potential for vegetation, crops, structures, Bioenergy plant equipment and methane rich biogas to ignite from lightning, sparks, negligence or arson. A fire could have serious environmental and financial implications to Harmony, as well as for surrounding land owners.

10 POTENTIAL IMPACTS ON THE SOCIAL AND ECONOMIC ENVIRONMENT

10.1 Surrounding Land-use

Description:

The proposed Bioenergy Facility is located in Welkom in the Free State Province. The province has an estimated population of 2.7 million people, concentrated in Bloemfontein, Welkom and Kroonstad. The main economic activities include agriculture, mining and industrial activities.

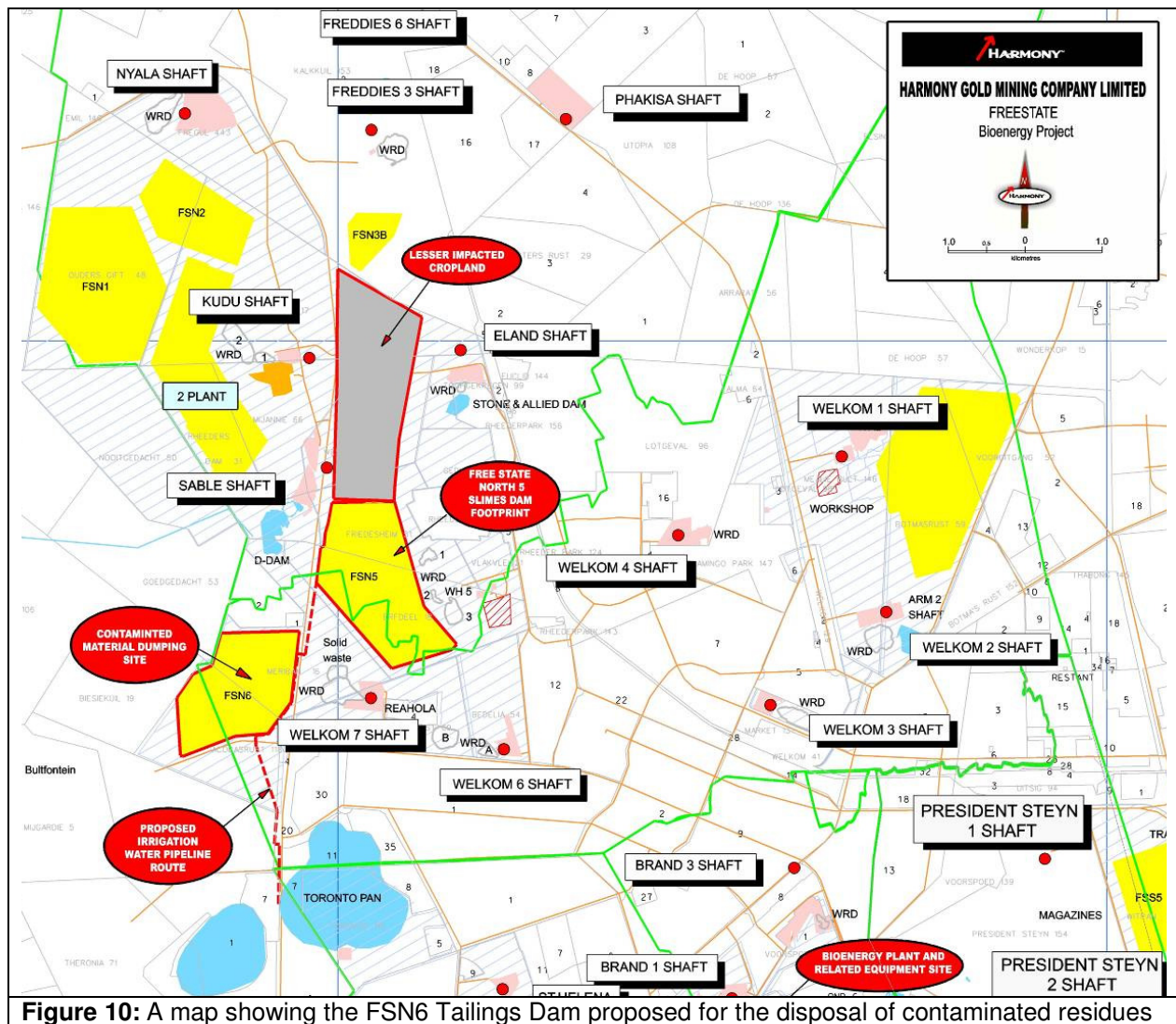
Lejweleputswa District Municipality (LDM) is one of the five District Municipalities in the Province. The largest settlements in this District Municipality are Welkom, Odendaalsrus, Theunissen, Winburg and Hennenman. The LDM is made up of 20 Local Municipalities of which Matjhabeng Local Municipality is one of them, and its area of jurisdiction includes Welkom, Odendaalsrus, Virginia, Hennenman, Allanridge and Ventersburg.

The proposed FSN5 tailings footprint and less mine impacted land for energy crop cultivation are both located north west of Welkom along the R30 highway to Odendaalsrus. The FSN5 tailings footprint lies on the northern side of the Welkom 7 shaft, while the less mine impacted land stretches from the northern end of the FSN5 tailings footprint at Sable Shaft to Eland Shaft, near the FSN3B.

Both areas are surrounded by tailings dams with the FSN1, 2 and 3 located north west near the Kudu Shaft. The FSN6 tailings dam proposed for the disposal of contaminated residue from the Anaerobic Treatment Plant is located south west adjacent to the FSN5 across the R30 (refer to Figure 10).

Other surrounding landuses include:

- Residential townships of Rheederpark and Falmingo Park on the eastern side of both proposed cropland areas, and Jabulani Village (largely small scale farmers) located on the outer northern side of the FSN5 tailings footprint;
- Welkom airport – south west of the FSN5 tailings footprint, across the R710;
- A graveyard – across the R30, just after the northern entrance of the FSN5 tailings footprint; and
- Toronto Waste Water Treatment Plant – to the far south of the FSN5 tailings footprint along the R30 and after the R73.



The Bioenergy Plant development site is located south east of Welkom, at the Brand 1 Shaft near the Witpan dam. The area is surrounded by Harmony's mining related infrastructure, with the nearest residential areas of Naudeville and Jan Cilliers Park located approximately 1km north west of the development site. Other nearby surrounding landuses include:

- Witpan Waste Water Treatment Works – located approximately 2km north east across Witpan;
- Voorspoed industrial site - located approximately 800m north east; and
- A primary school at Welkom Mines – located approximately 1.8km south.

Implications:

- The proposed energy crop cultivation will improve the productive capacity of the mine impacted land through phytoremediation. It will also improve the visual and aesthetic value of the degraded landscape.

- Land preparation and cultivation activities will create dust emissions which can potentially spread to surrounding residential areas.
- Odour emissions from the anaerobic digestion process and algae raceways may spread to surrounding residential areas if not properly maintained.
- The on-site generation of renewable electricity will reduce demand on the local Eskom grid, thereby allowing uninterrupted supply to local residents and businesses.

10.2 Employment and Local Economy

Description:

The major economic activities in the Lejweleputsa District Municipality (LDM) include mining and agriculture, and Matjhabeng Local Municipality (MLM) is dominated by mining activities in Allanridge, Odendaalsrus, Welkom and Virginia, with more than half of the population employed in the mining sector.

Approximately 72% of the District's economic output is generated in MLM (LDM IDP 2010/2011). More than 98% of the mining in the LDM takes place in the MLM and Masilonyana Municipality. However, the contribution of the mining industry is on the decline in both MLM and Masilonyana, impeding economic growth in both Municipalities.

The local economy in the town of Welkom is based on mining and trade. The GGP contributions by sector for the MLM are as follows: Mining (58%), Trade (12%), Finance (7%), Manufacturing (7%), Government (6%), Transport (3%), Construction (3%), Community services (1%), Electricity (1%), and other (1%) (MLM Draft IDP Review 2010/2011).

According to the recent 2011 census results from Statistics South Africa, MLM has recorded a 9.5 % decline in unemployment from 46.5 % in 2001 to 37.0 % in 2011 (Table 5). The youth unemployment rate has also declined by 10.6 %. The Mining sector is the largest employer, with 30 144 people working for the sector in 2007. While Agriculture was the sixth largest employer, with 4 943 people working for the sector in 2007. Both the mining and agricultural sector continue to register decline in terms of employment numbers.

Table 5: Unemployment rate of the MLM

SA Statistics Census	Unemployment Rate	Youth Unemployment Rate
2001	46.5	60.3
2011	37.0	49.7

Source: Statistics SA, 2011 Census

Implications:

- The proposed project will create 200 direct employment opportunities and a number of indirect jobs.
- The construction and operational phases will result in skills transfer and development for green jobs.
- The proposed development will contribute to the local economy through the use of local contractors, suppliers and service providers.
- The inclusion and support of surrounding local farmers in the growing of the energy crop will help alleviate poverty and improve the local agricultural economy.
- The proposed development will also contribute to Harmony's SLP programme as part of community development.

10.3 Planning Initiatives

10.3.1 Matjhabeng Local Municipality-Integrated Development Plan (MLM-IDP)

Development strategies of the MLM IDP 2010/2011 which apply to the proposed development include:

- **Stimulate economic development** – the proposed development is an investment to the local green economy as it will result in job creation, technology and skills transfer, and rehabilitation of mine impacted land.
- **Develop and enhance infrastructure for economic growth and social development** – the proposed development is an investment in renewable energy infrastructure or technology with direct and indirect socio-economic benefits to the local community.
- **Ensure a safe and secure environment for all people** – the proposed development also aims to rehabilitate mine impacted land through phytoremediation in order to restore the land for the safety and benefit of the surrounding community.

10.3.2 The MLM Spatial Development Framework (MLM-SDF)

The MLM-SDF is still in progress and will be compiled in 3 Phases. The first phase has been completed, resulting in a base map of the area.

The MLM-SDF has in the mean time adopted the Free State Goldfields Structure Plan, which aims to direct development under the following objectives; efficiency, sustainability and accessibility. Spatial development trends likely to constrain development in the MLM include:

- The fragmented nature of the urban structure;

- Mining areas, as a physical constraint for spatial development and urban integration;
- Uneven distribution of economic development and job opportunities; and
- Environmental constraints including polluted areas.

Localised spatial development principles likely to enhance development in the study area include:

- The optimal utilisation of natural and infrastructural resources, and integrated planning principles to drive all development; and
- The compact integration of core areas of the Goldfields including Welkom/Thabong, Odendaalsrus/Kutlwanong, and Virginia/Meloding into a sub-region.

In terms of Open Space Management, the SDF suggests the integration of existing drainage areas, lake areas, exotic and indigenous plantations as well as thorn veldt areas as part of the open space network. *“Retention facilities should be planned in advance in these areas to prevent storm water hazards”* (MLM IDP 2010/2011, pg 75).

Implications:

- The development sites are on mine impacted land which is hazardous for human habitation and is therefore designated for rehabilitation as part of spatial planning.

10.4 Cultural, Historical and Archaeological Resources

Description:

A Heritage Impact Assessment (HIA) for the proposed development will be conducted in order to identify any paleontological or archaeological artefacts. The findings of this study will be included in the Draft EIA.

Implications:

- Cultural, paleontological, archaeological and historical resources may be discovered during the construction phase.

10.5 Traffic, Roads and Access

Description:

Access to the proposed cropland areas is from the R30. The FSN5 Tailings Footprint can be accessed from the north along the R30 turn-off to Jabulani village, and also to the south from the R73 turn-off. Both access roads are well tarred and in good condition. No additional access roads will be required for the transportation of the harvested energy crop.

The proposed Bioenergy Plant development site can be accessed from Badenhorst Street which passes through the residential suburbs of Naudeville and Jan Cilliers Park from the R73.

The harvested energy crop will be transported in 20 ton trucks to the hammer mill located next to the Bioenergy Plant. Contaminated residues extracted from the Anaerobic Treatment Plant will be transported in dump trucks to the FSN6 Tailings Dam.

The Bio-CNG will be supplied to various end users via a “Virtual Pipeline” (road transport system). The Bio-CNG will be transported in specialised modules which can be easily loaded and off-loaded from trucks. The transportation and access routes have yet been finalised and will be provided in the EIA Report.

Ethanol will be transported in tanker trucks to various end users.

All trucks transporting hazardous or inflammable by-products will be Hazchem compliant.

More information on the number and sizes of the proposed trucks, and their proposed transport routes will be provided in the EIA Report.

Implications:

- The movement of heavy trucks may accelerate the deterioration of existing roads in and / or create hazards for local pedestrians and motorists.
- Trucks transporting dangerous or inflammable by-products may have environmental health and safety risks if accidentally released in transit.
- The anticipated increase in traffic volume might create congestion and hazards on the existing roads.
- High number of vehicles entering and exiting the Bioenergy Facility may cause traffic disruptions.

10.6 Noise

Description:

The proposed development is anticipated to generate noise during land preparation, cultivation and Bioenergy Plant construction phase, due to the operation of machinery and / or

equipment. During the operational phase, another potential source of noise is likely to emanate from the movement of trucks transporting feedstock to the Bioenergy plant and Bio-CNG distribution trucks.

Noise associated with the proposed agricultural activities is unlikely to be problematic for nearby residents, as these activities will take place during usual working hours, and are not commonly associated with creating nuisance noise.

Noise associated with the different aspects of the proposed development will be investigated as part of the EIA process, however as no residents are located in close proximity to the proposed operations (other than the agricultural components); nuisance noise is unlikely to be created by the proposed project.

Implications:

- Noise from the movement of trucks during the operational phase, could be potentially disrupted for residents located near or along the proposed transport routes, however this is unlikely.

10.7 Security

Description:

The cropland area will be fenced with a galvanised diamond mesh wire, to prevent unauthorised entry by members of the public and illegal gold miners. Signage prohibiting illegal entry will be displayed at selected points, along the perimeter of the fence. Security measures will be communicated to all workers and strictly adhered to. In order to ensure the safety of the surrounding neighbours and community, any unlawful activities conducted during the construction phase will be legally dealt with.

Implications:

- Illegal gold miners are likely to continue trespassing on the FSN5 tailings footprint if effective security measures are not put in place.
- The surrounding community is also likely to continue using the area as an access route, if not properly managed.
- Crime in the area could increase as a result of criminals posing as workers, or people seeking employment on the site.

10.8 Health and Safety

Description:

As the proposed development is likely to emit high levels of dust during land preparation and cultivation of the energy crop, workers will be at risk from exposure to potentially hazardous dust from the tailings footprint.

If mine health and safety standards are not met, there is concern for the safety of those employed, contracted, and visiting the site, as well as those in the surrounding area.

The proposed Biomass combustion equipment will largely produce particulate emissions in the form of wood smoke. The amount of particulate emissions produced will depend on the type of technology and combustion efficiency. The burner is also likely to produce fly ash which is potentially toxic, especially if it contains trace metals. However, wood waste fired boilers are generally known to have low emissions which are non toxic. The toxicity of the emissions depends on the type of biomass feedstock, mix and moisture content.

Implications:

- Negligence or non compliance with site specific mine health and safety, and occupational health and safety regulations can be a potential hazard for the employees.
- Potential point source particulate emissions from the incomplete combustion of wood chips in the burner.

11 PLAN OF STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT

11.1 Introduction

As required in terms of Section 28(n) of GNR 543, this Section provides details of the methodology for the full EIA phase of this application.

11.2 Public Participation

The register of I&APs from the scoping phase will be carried over and expanded during the EIA phase. Registered I&APs will receive notification at the start of the EIA phase comprising a brief description of the process and their possible involvement. I&APs will again be given the opportunity to submit written comments on the proposed development.

Focus-group meetings and site visits will be held with Government Authorities, Municipal departments, community leaders and conservation bodies, if and when required. After the completion of the specialist studies and the compilation of the Environmental Management Programme (EMPr) and EIA Report, a second Public Information Session will be held with registered I&APs. The purpose of this meeting will be to present the EIA Report, its findings and recommendations. Following this session, the EIA Report and EMPr will be made available to all I&APs for review and comment (for 40 days).

Comments on the Draft EIA Report will be sought and incorporated and responded to in a final version of the EIA Report, which will be forwarded to Competent Authority for a decision.

11.3 Specialist Studies

Details of the specialist studies which will be undertaken as part of the full EIA are provided below.

11.3.1 Contaminated Land Assessment / Crop Toxicity

Gold mine residues have a potential environmental of health risk due to specific minerals and their weathering processes by means of oxidation and also dust problems associated with it. Oxidation processes cerate acidification (low pH) in the pedosphere and hydrosphere systems.

The objective of this study is to assess soil samples within the tailings footprint proposed for energy crop cultivation in order to determine if there are any ecological or human health risks,

and to establish a baseline for future monitoring. This Assessment will also determine the hazard rating of the crop.

The Contaminated Land Assessment will include:

- Hazard identification, characterisation and classification of the tailings footprint based soil analysis results;
- Identification of exposure pathways and associated human health risks;
- An evaluation on existing pollution problems and how these can be addressed; and
- Assessment of radiation levels and how these will impact workers.

11.3.2 Geotechnical Assessment

A geotechnical assessment of the mine impacted land is required in order to

- Assess any potential geotechnical instability associated with the cultivation and irrigation of mine impacted land;
- Assess foundation conditions for the proposed Bioenergy infrastructure;
- Evaluate any potential Bioenergy Plant construction constraints; and
- Provide recommendations and mitigation measures.

11.3.3 Run-off Plan and Irrigation Specifications

There are two forms of runoff to be considered during crop production; storm water and irrigation water. Stormwater runoff largely occurs during the rainfall season, while irrigation water runoff depends on soil conditions in terms of saturation. If runoff is not managed properly it may contaminate downstream water resources.

Irrigation and storm water runoff from the cropland may contain organic and inorganic compounds from fertilisers, pesticides, herbicides, and fungicides used during crop production. Runoff from the tailings footprint may contain toxic metals and other substances washed from the soil.

Therefore a runoff plan is required to properly manage storm water and irrigation water. This requires the design of a drainage system that minimises water loss and prevents storm or irrigation water pollution.

An irrigation plan is also required to prevent over-irrigation and subsequent saturation of the soil which creates conditions for overflow and runoff.

11.3.4 Geohydrological Risk Assessment

The geo-hydrological assessment will comprise the following:

- A brief geo-hydrological description of the site;
- Assessment and analysis of the existing groundwater sources;
- Potential over-abstraction of irrigation water and subsequent lowering of the water table;
- Potential groundwater pollution associated with the irrigation of the tailings footprint
- Water quality results and assessment thereof; and
- A Groundwater Pollution Risk Assessment.

11.3.5 Socio-economic Impact Assessment

This Assessment will document the extent to which the proposed development will contribute to the social and economic environment. A desktop analysis will provide a baseline on demographics, local economy, unemployment, poverty levels, and infrastructural development. All these socio-economic conditions will then be assessed based on the proposed development's contribution. Special attention will be given on how the proposed development can contribute in terms of alleviating high unemployment levels amongst the youth in the Municipality.

11.3.6 Agricultural Potential Assessment

Agricultural potential is defined as an area's suitability and capacity to sustainably accommodate an agricultural land use, and this potential is based on crop production.

An Agricultural Potential Assessment is required in order to determine whether the soil conditions are suitable for the growing of the selected energy crops, and to identify potential risks associated with crop production on the proposed land.

This Assessment can be conducted as a desktop study and includes a description on the climate, soils, terrain, aspect, land capability, geology and current agricultural practices in the area. It also includes the undertaking of an agricultural constraint analysis to indicate potential fatal flaws.

11.3.7 Biodiversity Risk Assessment for Alien Species

This Assessment will be conducted when the type of algae for the raceways has been determined. This assessment will assess the likely impact of the proposed algae on the receiving ecological environment.

11.3.8 Heritage Impact Assessment / Archaeological / Paleontological Report

A Heritage Impact Assessment, or Archaeological Report, is an assessment study on historical artefact material that may occur on the proposed development site, on the surface or underneath the ground.

11.3.9 Major Hazardous Installations (MHI) Risk Assessment

This might be required if requested by the Competent Authority in order to prove that the proposed facilities do not pose any danger / risk to the ecological and human environments.

11.4 Environmental Management Programme

Residue stockpiles and residue deposits are managed in terms of Section 42 of the MPRDA. It is understood that there is an existing Environmental Management Programme (EMPr) for Site 5 which addresses this management. It is further understood that this EMPr is currently being amended and updated to comply with current standards by an independent consultant.

Therefore the EMPr will be amended accordingly and will contain guidelines to ensure that all activities associated with the proposed development are carried out in an environmentally responsible and acceptable manner. Specific management objectives and mitigation measures will be specified for the entire duration of the proposed development, including:

- Planning and design;
- Pre-construction and construction activities;
- Operation or undertaking of the activity;
- Rehabilitation of the environment; and
- Closure, (where relevant).

The EMPr will be based on the principles of the NEMA and the MPRDA, as well as the recommendations made in the Scoping Report and EIA Report, and will identify roles and responsibilities of management personnel on site. The EMPr will be used as a framework for environmental compliance monitoring and reporting.

11.5 Environmental Impact Assessment Report

The EIA Report will contain a summary of the findings of the specialist studies and their recommendations for mitigation and management. It will also detail the Public Participation Process undertaken as part of the EIA Phase and will include records of notices, comments and meetings with I&APs.

11.5.1 Information to be included in the EIA Report

The following information will be provided in the EIA Report:

- Finalised process description, design drawings and layouts;
- Finalised energy crop types, irrigation water sources and cultivation methods;
- Finalised Cyanobacteria species to be cultured in algae raceways for ethanol production;
- Finalised quality and quantity of energy crop feedstock for biomethane production;
- Finalised details of the Bioenergy Plant;
- Comments from all relevant Departments and Organisations. This will include the following:
 - Department of Mineral Resources (DMR);
 - Department of Energy (DoE);
 - Department of Agriculture, Forestry and Fisheries (DAFF);
 - Department of Transport;
 - Lejweleputswa District Municipality;
 - Matjhabeng Local Municipality; and
 - WESSA.

11.5.2 Assessment of Environmental Issues

In order to assess potential environmental issues associated with the proposed development, each aspect addressed in Section 9 and 10 will be given a qualitative rating in relation to its environmental impact. Each aspect has been divided into a number of different classes, each of which has been assigned various criteria (See Table 6).

Table 6: Summary of aspects used for assessing environmental impacts

Aspect	Class	Criteria
NATURE OF IMPACT	Positive	The impact on the environment will be positive.
	Negative	The impact on the environment will be negative.
	Direct	The impact is caused directly by the activity and generally occurs at the same time and at the place of activity.
	Indirect	The impact induces changes that may occur as a result of the activity.
	Cumulative	The impact is a result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
OCCURRENCE OF IMPACT	Construction	The impact will happen during construction.
	Operation	The impact will happen during operation.
	Decommissioning	The impact will happen during decommissioning
	Immediate	The impact will happen immediately.
	Delayed	There will be a delay in the impact occurring.

PROBABILITY OF IMPACT OCCURRING (WITH MITIGATION)	Definitely	The impact will definitely occur even with mitigation (100%).
	Likely	It is likely that the impact will occur (60-90%).
	Fairly	There is a fair chance that the impact will occur (30-59%).
	Unlikely	It is unlikely that the impact will occur (0-29%).
REVERSIBILITY (WITH MITIGATION)	Possible	It is possible to reverse the impact.
	Partly	It is partly possible to reverse the impact.
	Not possible	It is not possible to reverse the impact.
EXTENT OF IMPACT (WITH MITIGATION)	Site	The impact will be limited to the site.
	Local	The impact will affect the local area (within a radius of 40km).
	Provincial	The impact will affect areas beyond the site but within the boundaries of Free State province.
	National	The impact will affect areas beyond the province but within the boundaries of South Africa.
DURATION (WITH MITIGATION)	Short-Term	0-5 years (construction phase)
	Medium-Term	5-40 years (construction and operation).
	Long-Term	(>40 years).
	Permanent	Permanent damage to the environment.
SIGNIFICANCE OF IMPACT WITHOUT MITIGATION	Low	Small impact / disturbance.
	Medium	Moderate impact / disturbance expected.
	High	Significant impact / disturbance expected.
SIGNIFICANCE OF IMPACT POST-MITIGATION	Low	Small impact / disturbance.
	Medium	Moderate impact / disturbance expected.
	High	Significant impact / disturbance expected.

12 SUMMARY OF IDENTIFIED IMPACTS

The proposed Bioenergy project provides Harmony with the opportunity to off-set its carbon emissions whilst at the same time meeting its carbon reduction targets, and socio-economic commitments under its Social and Labour Plan (SLP).

The following ecological and socio-economic benefits have been identified during the Scoping Phase:

Ecological

- Rehabilitation and restoration of mine impacted land. Growing of the energy crop on mine impacted land will help remediate the toxic soils through phytoextraction, thereby restoring the productive capacity of the land. This will be confirmed in the EIA Report.
- Productive reutilisation and restoration of the mine impacted land will prevent land degradation by illegal gold miners. It will also prevent the illegal dumping of domestic waste by the surrounding community.
- Reduced carbon and Green House Gas emissions through the use of alternative, renewable energy – will contribute towards meeting government's commitment of reducing Green House Gas emissions to 34% by 2020 and to 42% by 2025.
- Generation of electricity from a renewable energy source will result in reduced demand for fossil fuel-based, non-renewable energy source from the national grid, as well as a reduction in the upstream impacts associated with fossil fuelled power generation.

Socio-economic

If approved, the Bioenergy Project will:

- Contribute to South Africa's transition to a low-carbon, green economy;
- Help facilitate the development of a local biofuels industry in South Africa;
- Facilitate the transfer, diffusion, and upscale of green technologies in the biofuels industry of South Africa;
- Contribute to green jobs and government's Green Economy Accord target of 300 000 jobs by 2020; and
- Result in skills transfer and development for green jobs.

The project is also an important investment for Harmony as it will directly result in:

- Reduced production costs due to reduction in energy costs;
- Reduced future Carbon tax liabilities. The South African government is set to introduce carbon tax as an emissions reduction instrument for all industrial air polluters. Implementation of the project will reduce Scope 1 emissions and hence reduce carbon tax liabilities;
- Reduced Mine Closure Liabilities, as a result of the restoration of the tailings footprint through Phytoremediation (growing of the energy crop); and
- Benefits for Harmony's Social & Labour Plan (SLP) which focuses on providing alternative skills to employees (both current and retrenched employees)

The proposed energy crop production will not have any impact on food security, land issues and water resources as:

- Energy crop cultivation will be on mine impacted, non-productive, and non-arable land;
- No major food crops, such as maize, will be grown; and
- The pre-feasibility assessment identified that the major source of water for irrigation is contaminated and has no competing uses. However this information will be confirmed during the EIA Phase.

Thus, it can be concluded that no fatal flaws have been identified during the Scoping Phase. However the identified environmental impacts will be investigated and assessed during the EIA Phase in order to determine if the proposed development should receive environmental authorisation.

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14 APPENDICES

Appendix A: EAP's CV

Appendix B: Water Use License documentation

Appendix C: EIA and Waste Licence Applications

Appendix D: Newspaper adverts in the Volksblad

Appendix E: Site Posters

Appendix F: Background Information Document

Appendix G: List of Interested & Affected Parties

Appendix H: Comments received from Interested & Affected Parties on the circulation of the BID, Site Posters, Adverts, and Draft Scoping Report

Appendix I: Public Information Session – Posters, Photographs, Attendance Register