APPENDIX Q: ENVIRONMENTAL MANAGEMENT PLAN

LANGER HEINRICH URANIUM (PTY) LTD
A Member of the Paladin Energy Ltd Group of Companies

ENVIRONMENTAL MANAGEMENT PLAN – AUGUST 2009

DATE: 25-08-2009

Draft

TABLE OF CONTENTS

Page

TABLE OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

DEFINITIONS AND ABBREVIATIONS

DEFINITIONS

Biological biodiversity: The variability among living organisms from all sources including amongst others terrestrial ecosystems and aquatic ecosystems and the ecological complexes of which they are part and this includes diversity within species, between species and of ecosystems (Environmental Management Act, No 7 of 2007).

Environment: The complex of natural and anthropogenic factors and elements that are mutually interrelated and affect the ecological equilibrium and the quality of life. The environment includes (a) the natural environment being land, water and air, all organic and inorganic material and all living organisms; and (b) the human environment being the landscape and natural, cultural, historical, aesthetic, economic and social heritage and values (Environmental Management Act, No 7 of 2007).

Environmental Aspect comprises all elements of an organisation's activities, products or services which can interact with the environment (ISO 14001).

Environmental Impact means any change to the environment, whether adverse or beneficial, wholly or partly resulting from an organisation's activities, products and services (ISO 14001).

Environmental Management Plan (EMP) The EMP is a legal requirement and form part of the Pro forma environmental contract. It is a document which stipulates environmental objectives and targets to avoid or mitigate environmental aspects. It further should establish the responsibilities and time frame to achieve the set objectives. An EMP should be regularly reviewed and if necessary be amended to meet any changes of the company's activities.

Environmental Objective is an achievable goal set by management to manage significant environmental aspects. The objectives are set at the beginning of the life of mine and reviewed at least once a year.

Environmental Policy is a statement by an organisation of its intentions and principles in relation to its overall environmental performance which provides a framework for action and for the setting of its environmental objectives and targets (ISO 14001).

Environmental Targets are the specifications which show that the environmental objective set out in the environmental Management Plan has been achieved.

Hazardous Substances means any substance or mixture of substances declared hazardous in terms of section 3(1) of the Hazardous Substances Ordinance 14 of 1974 or in terms of any other legislation which may be enacted to provide for the control of hazardous substances (Environmental Management Bill, 2002).

Hazardous Waste means a hazardous substance that is no longer of use to the organisation and which needs or be disposed of in the appropriate manner.

Pollution means the direct or indirect introduction, as a result of human activity, of substances, vibrations, heat, radiation or noise into the air, water or land which may be harmful to human health or well-being or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment (Environmental Management Bill, 2002).

Management program: A written document developed to outline what management and monitoring measures are necessary to meet a set of defined objectives and targets.

Waste means any substance or thing that the holder discards or disposes of, or intends or is required to discard or dispose of, irrespective of its value to any person, and any substance or thing deemed by regulations to be waste (Environmental Management Bill, 2002).

ABBREVIATIONS

CCD	Counter Current Decanter
DWA	Department of Water Affairs
EAR	Environmental Assessment Report
ELR	Environmental Legislation Register
EMP	Environmental Management Plan
EMS	Environmental Management System
IX	Ion exchange
LOM	Life of Mine
LHU	Langer Heinrich Uranium Pty (Ltd)
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment and Tourism
ML	Mine Lease
MME	Ministry of Mines and energy
MOHSS	Ministry of Health and Social Services
Mtpa	Million tonnes per annum
Mlbs	Million pounds
NNNP	Namib Naukluft National Park
RMP	Radiation Management Plan
ROM	Run of Mine
SLT	Strategic Leadership Team
STP	Sewage treatment plant
TSF	Tailings storage facility
WRD	Waste rock dump

LANGER HEINRICH URANIUM ENVIRONMENTAL MANAGEMENT PLAN

SECTION A

INTRODUCTION AND ENVIRONMENTAL MANAGEMENT FRAMEWORK

A.1 INTRODUCTION

In 2005 Langer Heinrich Uranium (LHU) was granted a mining license, ML 140, to mine and process uranium oxide (U_3O_8) at its site located in the Namib Naukluft Park (Figure A. 1).

As part of the mining license application process (2005), an Environmental Impact Assessment (EIA) Report (Softchem, 2005) and Environmental Management Plan (EMP) (Speiser, 2005) were submitted and approved by the relevant authorities. The EMP was then revised and approved by the Ministry of Environment and Tourism (MET) in 2008 (LHU, 2008) to cater for infrastructure and activities that included both existing facilities and those being constructed as part of the Stage II expansion programme.

This EMP, the second amendment to the mine's EMP, has been amended to cater for Stage III expansion project and the 2009 EIA. It should therefore be read in the context of the 2009 EIA. In this regard, a summary table highlighting the issues identified in the EIA and the corresponding management and mitigation plans (MMPs) is included in Table A. 1 below.

The EMP documents a series of management and mitigation plans (MMPs) designed to meet legal requirements and minimise the impacts associated with uranium mining in a national park. The MMPs have been compiled based on a review of the management commitments in the 2008 EMP as well as the findings and recommendations of the 2009 EIA.

Table A. 1: Summary of issues identified in the 2009 EIA and corresponding management programmes

Environmental component (reference to Section 7 of the EIA report)	Issue (reference to Section 7 of the EIA report)	Relevant MMP (reference to relevant MMP in the EMP)
Topography (7.1)	Hazardous excavations and infrastructure (7.1.1)	MMP B1.1 – Stakeholder consultation MMP B.1.2 – Safety & Security
Soil and land capability (7.2)	Loss of soil resources from pollution (7.2.1)	MMP B.1.9 Soil MMP B.1.11 – Waste Management
	Loss of soil resources from physical disturbance (7.2.2)	MMP B.1.9 – Soil
Biodiversity – Natural vegetation and animal life (7.3)	Physical destruction of biodiversity (7.3.1)	MMP B.1.3 – Biodiversity
	Reduction of water resources as an ecological driver (7.3.2)	MMP B.1.3 – Biodiversity MMP B.1.5 – Surface Water MMP B.1.6 – Groundwater MMP B.1.7 – Resources
	General disturbance of biodiversity (7.3.3)	MMP B.1.3 – Biodiversity MMP B.1.9 – Soil MMP B.1.11 – Waste management
Surface water (7.5)	Altering drainage patterns (7.5.1) – discussed in Section 7.3.2	MMP B.1.5 – Surface Water
	Pollution of surface water (7.5.2)	MMP B.1.5 – Surface Water MMP B.1.11 – Waste Management
Groundwater (7.6)	Dewatering (7.6.1)	MMP B.1.6 – Groundwater

Environmental component (reference to Section 7 of the EIA report)	Issue (reference to Section 7 of the EIA report)	Relevant MMP (reference to relevant MMP in the EMP)
	Contamination of groundwater (7.6.2)	MMP B.1.6 – Groundwater MMP B.1.11 – Waste management
Air quality (7.7)	Air pollution (7.7.1)	MMP B.1.8 – Air quality
Noise (7.8)	Noise pollution (7.8.1)	MMP B.1.12 – Noise
Archaeology (7.9)	Damage to archaeological resources and landscapes (7.9.1)	MMP B.1.15 – Archaeology
Visual (7.10)	Visual impact (7.10.1)	MMP B.1.10 – Visual
Socio-economic (7.11)	Economic impact (7.11.1)	MMP B.1.13 – Socio-Economic MMP B1.1 – Stakeholder consultation
	Road use and traffic impacts (7.11.2)	
	Inward migration (7.11.3)	
	Social wellbeing impacts (7.11.4)	
Radiological (7.4)	Direct exposure to radiation from on-site sources (7.4.1)	MMP B1.14 – Radiological MMP B.1.2 – Safety & Security
	Aquatic and atmospheric pathways (7.4.2)	
	Secondary pathways (7.4.3)	

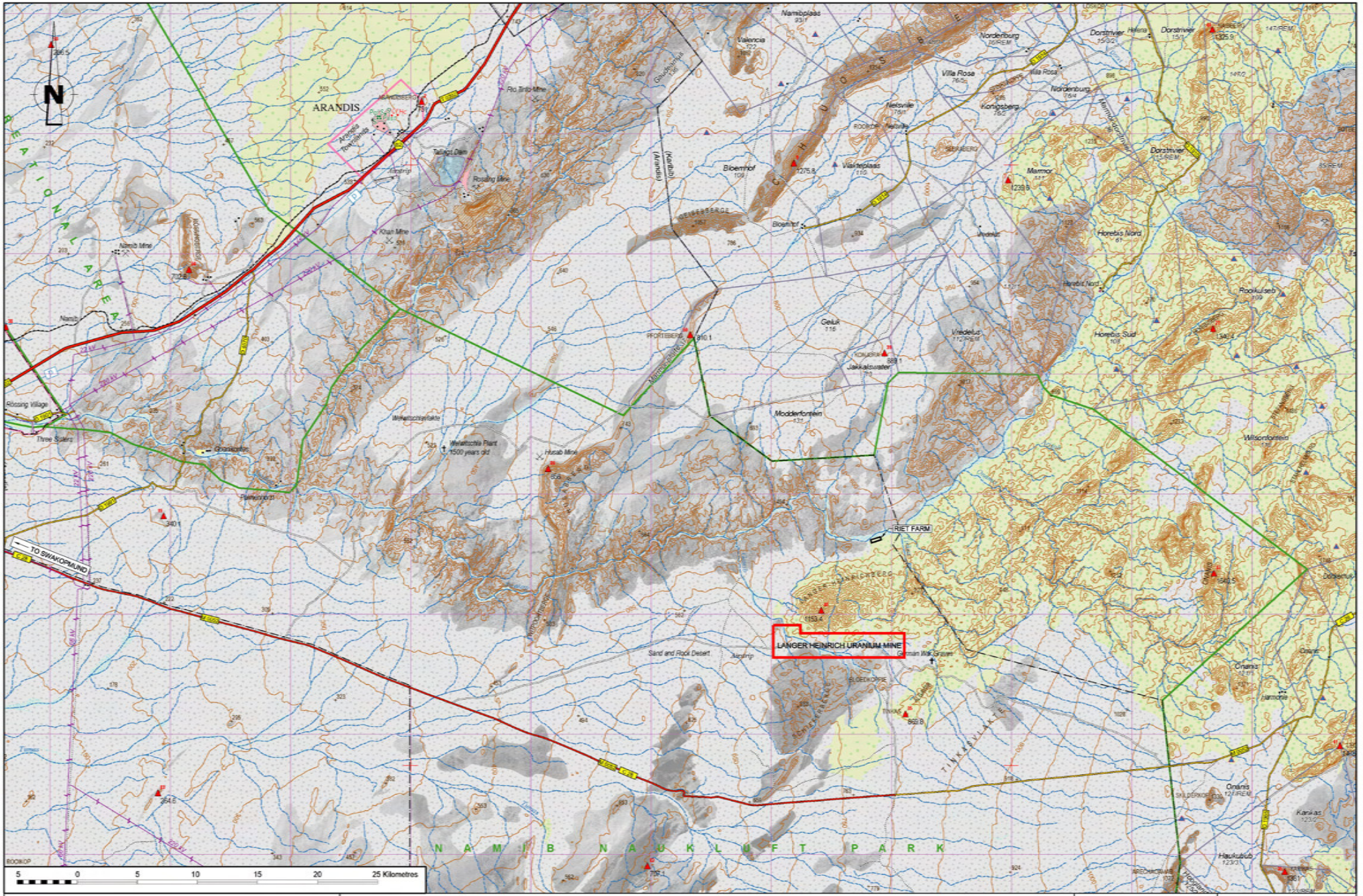
The EMP structure has also been updated since the second revision (2008 EMP) to allow for improved implementation and to streamline the transition of the EMP requirements into the LHU Environmental Management System (EMS). On request of the Ministry of Environment and Tourism (MET): Directorate of Environmental Affairs (DEA), the draft EIA regulations (April 2009) have been used as a guideline for this EMP.

The required components of the EMP are included in Table A. 2:

Table A. 2: Requirements for the content of the EMP

Draft EIA Regulation requirement	Reference in the EMP
Details of the persons who prepared the EMP and the expertise of those persons to prepare an environmental management plan.	Section A.1.2
Information on any proposed management or mitigation measures to address the environmental impacts that have been identified in a report contemplated by these regulations, including environmental impacts or objectives in respect of – i. Planning and design ii. Pre-construction and construction activities iii. Operation or undertaking of the activity iv. Rehabilitation of the environment v. Closure, where relevant	Section B – MMP B.1.1 to MMP B.1.15
A detailed description of the aspects of the activity that are covered by the EMP.	Section A.2 Section A.5

Draft EIA Regulation requirement	Reference in the EMP
An identification of the persons to be responsible for the implementation of the mitigation measures.	Section B.2
Where appropriate, time frames within which the measures contemplated in the EMP must be implemented.	Section B.2.4
Proposed mechanisms for monitoring compliance with the EMP and reporting on it.	Section B.1 (relevant MMPs) Section B.2.1.3 Section C



Metago Environmental Engineers (Pty) Ltd
Consulting Engineers & Scientists

LANGER HEINRICH URANIUM MINE
MAP SHOWING LOCATION OF ML 140

Date : 07/2009	Scale : AS SHOWN
Project No : L016-01	FIGURE A.1

A.1.1 Background regarding permits and approvals

A.1.1.1 Documentation submitted during the approval process

The relevant documents submitted to the Government notifying and seeking approval to date:

- An Environmental Assessment Report (EAR) (Softchem, 2005), submitted to the Ministry of Environment and Tourism (MET);
- EMPs for both the construction and operational phases (Speiser, 2005), submitted to MET and Ministry of Mines and Energy (MME);
- A Bankable Feasibility Study (BFS) (GRDMinproc, 2005), submitted to MME;
- An Accessory works plan (2006), submitted to MME;
- A mine contract plan (GRDMinproc, April 2006), submitted to MME.
- The EMP was amended (LHU, 2008) to cater for expansion activities and approved in 2008 by MET; and
- The EIA Report (Metago, 2009) for the 2009 EIA (current and future expansion activities) was submitted for approval in 2009. (This EMP is appended to the EIA Report).

A.1.1.2 Permits obtained once approval was granted

LHU has been issued with the following permits and approvals.

- A Mining License (ML140) was awarded in August 2005;
- An Environmental clearance certificate was granted for ML140 in August 2005;
- The EMPs were approved and a proforma contract was signed in April 2006;
- An environmental clearance certificate was awarded to LHU in July 2006 for Protea Chemicals to supply chemicals to LHU;
- Permission to abstract water from the Swakop River was granted in January 2006 and the permit was extended in April and again in September 2006;
- A license to purchase water from Namwater was issued in April 2006;
- An explosives Magazine license was issued in September 2006;
- Permission to upgrade the access road from a track was issued in December 2005 and permission to upgrade it further (same standard as C28) was granted in September 2007;
- The Ministry of Health and Social Services accepted the Radiation Management Plans in March 2006;
- The Ministry of Agriculture, Water and Forestry (MAWF) issued an Effluent Discharge permit for the construction phase in November 2005. LHU has applied for a new discharge permit to cover operations and has received a temporary permit from the Ministry of Agriculture, Water and Forestry (MAWF) valid until September 2008. MAWF has indicated that LHU should apply for an extension of the current temporary permit to allow time to complete the modifications to the sewerage treatment plant. It has been indicated that this temporary permit will be granted, after which a five year discharge permit will be issued if the conditions in the application are being met.

In addition, LHU conducted an environmental overview and EMP for the exploration of EPL 3500 and submitted this application to MME and MET for approval in November 2006. An

environmental clearance certificate to explore for Uranium on EPL3500 was issued in February 2007. EPL 3500 has its own EMP and is therefore excluded from the scope of this EMP.

A.1.2 Keeping EMPs current

In the introduction to the first EMP for operations (ASEC, 2005), it indicated that:

''this should be seen as a 'living document' which will be amended during the operation, as activities might change or new ones be introduced.''

This is in keeping with Section 50 (g) of the Minerals (mining and Prospecting) Act, 33 of 1992, which states that the holder of a mining license shall undertake the periodic review of the EMP(s) should circumstances change.

Despite only being operational for less than three years, LHU has seen a number of changes in its operations. The 2009 EIA considered all impacts in a cumulative manner such that the impacts of the current activities and those potentially associated with the project were discussed and assessed together, allowing for improved management and mitigation measure to be develop.

A.1.3 Details of the persons who prepared this (second amended) EMP

Metago Environmental Engineers (Pty) Ltd (Metago), the independent firm of consultants undertook the 2009 EIA and compiled the EIA Report (Metago, 2009) that (together with the 2008 EMP) forms the basis of this EMP.

Werner Petrick (LHU, Environmental Specialist), with the assistance of Brandon Stobart (Metago) and Alex Pheiffer (Metago) prepared this second amended LHU EMP.

Werner Petrick has over twelve years of relevant experience in Environmental Management including management and implementation of EIAs and the development of Environmental Management Plans.

Brandon Stobart has over ten years of relevant experience and is certified with the Certification Board for Environmental Assessment Practitioners of South Africa (EAPSA) as an Environmental Assessment Practitioner (EAP). Alex Pheiffer has seven years of relevant experience and is registered with the South African Council for Natural Scientific Professions (SACNSP) as a professional natural scientist (*PrSciNat*) (Environmental Management).

A.2 SCOPE OF THE EMP

A.2.1 Scope of work

The EMP provides a description of the activities and associated environmental impacts relating to the current LHU activities and surface infrastructure and the activities and infrastructure associated with the (phase 3) expansion project.

A.2.1 Description of infrastructure

The current LHU surface infrastructure are described in Table A. 3 and Table A. 4 and Figure A. 2 and Figure A. 3.

Table A. 3: Summary of current/approved LHU infrastructure

Infrastructure	Description
Access Road	• The access road to the mine joins the regional C28 road. All employees, contractors, input materials, waste materials and product that are transported to or from site, are transported on the access road and C28. From the C28 the traffic flows are split between the roads to Walvis Bay, Swakopmund and Windhoek.
Airstrip	• A 1.3km gravel runway is located on the gravel plains on the western side of the ML, about 300m north of the access road.
Barren stockpiles	• There are two barren stockpiles (rejected from the processing plant). One east of the process plant and the other south of the one waste rock dump.
Exploration (drillers) camp Site	• An exploration drilling contractor camp is located in the south east of the ML approximately 5km from the processing plant. Approximately 30 people stay there for 4 days a week.
Contractor lay-down area	• This is a site that is used to accommodate any short term contractors. It consists of a yard with storage and ablution facilities. These ablution facilities discharge into a French drain system. It is located within the ML to the west of the process plant and was part of the original construction camp
Conveyors	• Conveyors are used to transport material in the front end of the process plant between the crushers, scrubbers and some of the stockpiles.
Exploration drill rigs and network of boreholes	• Exploration drilling is continuous. It is used to upgrade the mineral resource on a yearly basis as well as to assist with detailed mine planning.
Explosives	• The explosives compound is located on the eastern side of the current temporary tailings storage facility (TSF) and is accessed by a single controlled-access road. It houses heavy energy fuel (HEF) storage tanks and an unloading bay. There are two fenced in explosives magazines. Management of the explosives compound and of all blasting activities is currently subcontracted to Bulk Mining Explosives (BME).
Fuel storage facilities	• There are a number of above ground diesel and petrol fuel tanks located in covered and/or bunded areas.
Internal haul roads	• There are a number of internal dirt haul roads within the ML. Trucks are used to haul run of mine (ROM), mine residue waste and other equipment and material.
Laboratory	• Samples of solids, liquids, pulp and resin from the processing plant are analyzed at the assay laboratory. • Analyses includes: ▪ XRF (Uranium & Vanadium mainly) ▪ Ore Moisture ▪ Titrations ▪ Total suspended solids • The laboratory is also equipped for analysis of environmental (dust and water) samples. The results from the analyses are used for process control, metal accounting purposes and water quality monitoring. Any excess sample volumes are returned to the process before the sample containers are cleaned out for re-use.

Infrastructure	Description
Low grade stockpiles	• Currently low grade ore material (discard from the open pits) is stockpiled to the east of the processing plant. Provision has been made for additional stockpiles in the ML, as required.
Offices, stores and Workshop	• The main office complex (offices and ablution facilities) is located within the security fence directly north of the processing plant. • An engineering office block is located between the process water dam (process dam) and the Engineering workshops. Activities associated with the workshops include painting, grinding, welding, repairs and general maintenance. • The front end process control room is located inside the laboratory building, which is situated near the counter current decantation (CCD) tanks in the plant area. The back end central process control room is located in the recovery building. • Karibib mining contractors has its own office and workshop, with a fuel storage facility and tyre workshop, directly east of the main office complex. • In relatively close proximity to the engineering workshop, there is an engineering storage yard for new large equipment and salvageable equipment. • The following items are kept at the store: reagents - Sodium Carbonate; Sodium bicarbonate; Sodium chloride; Flocculent; Hydrogen peroxide; Sodium hydroxide; Sulphuric Acid; and Ferrous sulphate, personal protective equipment, paint, and general maintenance equipment.
Open pit mine	• Mining is performed using conventional open pit mining methods. • In accordance with current approvals, the dimensions of the total mined area will be in the order of an 11.5km (east-west) long pit, plus a number of smaller pits over an additional 4.0km. The average width (north-south) will be 400m, and the average depth will be 30m, although the deepest point will be 80m below the ground surface. • Current mining areas include Pit A, Pit B and Pit D. These are situated north-east and west of the processing plant.
Open pit dewatering facilities	• Water seeping into the pits is pumped via pipelines to dedicated water storage areas to be used for dust suppression or for use as process water in the plant.
Ore stockpiles (ROM)	• The mined out ore grade material is stockpiled directly east of processing plant on the ROM pad and south of Pit A.
Pipelines	• A number of internal pipelines are used for the transportation of water, gas, diesel, air, reagents, process plant solution, sewage and tailings. • The main external pipeline is for water supply from NamWater. This pipeline is from the Omdel aquifer. It has a number of pump stations along route. LHU has authorisation to purchase 1.5 million m^3 per year from this source but currently only uses 1 million m^3 per year. LHU intends maximising consumption in 2010. • A shorter pipeline supplies water from the boreholes in the Swakop River. LHU has authorisation to receive 0.5 million m^3 per year from this source but currently only uses 50 to 70 000m^3 per year. LHU intends maximising consumption in 2010.
Powerlines, substation and diesel	• Electricity is supplied from the NamPower Kuiseb substation close to Walvis Bay. This power line is approximately 50 km in length and supplies approximately 16.6 MVA.

Infrastructure	Description
generator	• A diesel generator facility, with an approved capacity of 30 MVA, is used to augment NamPower. • There is an on-site substation and internal power lines.
Processing Plant	• The processing plant is located towards the middle of the ML. Key process components are described in Table A. 4.
Sewage Plant	• Two bio-treatment sewerage plants (trickling filter plant) are located directly west of the main office buildings. This combined facility has a capacity of 50m^3/day.
Tailings Storage Facility (TSF)	• The current temporary TSF is strategically located above part of the ore body to the east of the office buildings and processing plant. Once this facility is replaced with the approved permanent facility to the west of the processing plant it will be re-mined and processed. The permanent TSF will primarily be placed in mined out pits as backfill material, but a portion of the tailings will remain above ground. • Supernatant water is pumped back to the processing pond via a pipeline, to be recycled back into the process plant.
Topsoil stockpiles	• There are four topsoil stockpiles. These are located on the western and eastern sides of the processing plant.
Waste rock dumps (WRDs)	• There are two WRDs located to the north and east of mining Pit A and additional provision has been made adjacent to the permanent TSF. Over the mine life the number of WRDs within the ML will increase as required.
Waste - Radioactive waste disposal facility	• Disposal sites for radioactive contaminated material/waste have been established within the various waste rock dumps. This radioactive contaminated waste includes inter alia: old personal protective equipment, drums, pipes, etc.
Waste - General and non-radioactive hazardous waste handling facilities	• Hazardous waste (non radioactive) includes inter alia: fuels, chemicals, lubricating oils, hydraulic and brake fluid, paints, solvents, acids, detergents, resins, brine, solids from sewerage and sludge. • General waste includes industrial and domestic non-hazardous waste. • Facilities are provided for sorting and temporary storage prior to removal and disposal • Final disposal of these waste types is by contractors at licensed facilities in Walvis Bay and Swakopmund
Water storage facilities	• The lined raw water “turkey” dams store water that is pumped from the Swakop River borehole and from the NamWater pipeline. • NamWater is stored in three reservoirs to feed the process, in an emergency tank and in a number of potable water tanks • The process dam is a lined dam and receives water from the TSF return circuit, the open pits, the treated sewage water circuit, laboratory, wash bays, plant run-off and the process plant circuit. • As mining advances, one or more of the mined out pits will be used to contain storm water.
Water treatment	• A modular reverse osmosis plant is used to remove excess salts and other parameters from the incoming potable NamWater and potable Swakop River water. This is done to prevent blockages in the more sensitive processing plant components even though the incoming water is potable. The brine water from the reverse osmosis plant is used in other parts of the water circuit.

Table A. 4: Main components of the existing process flow

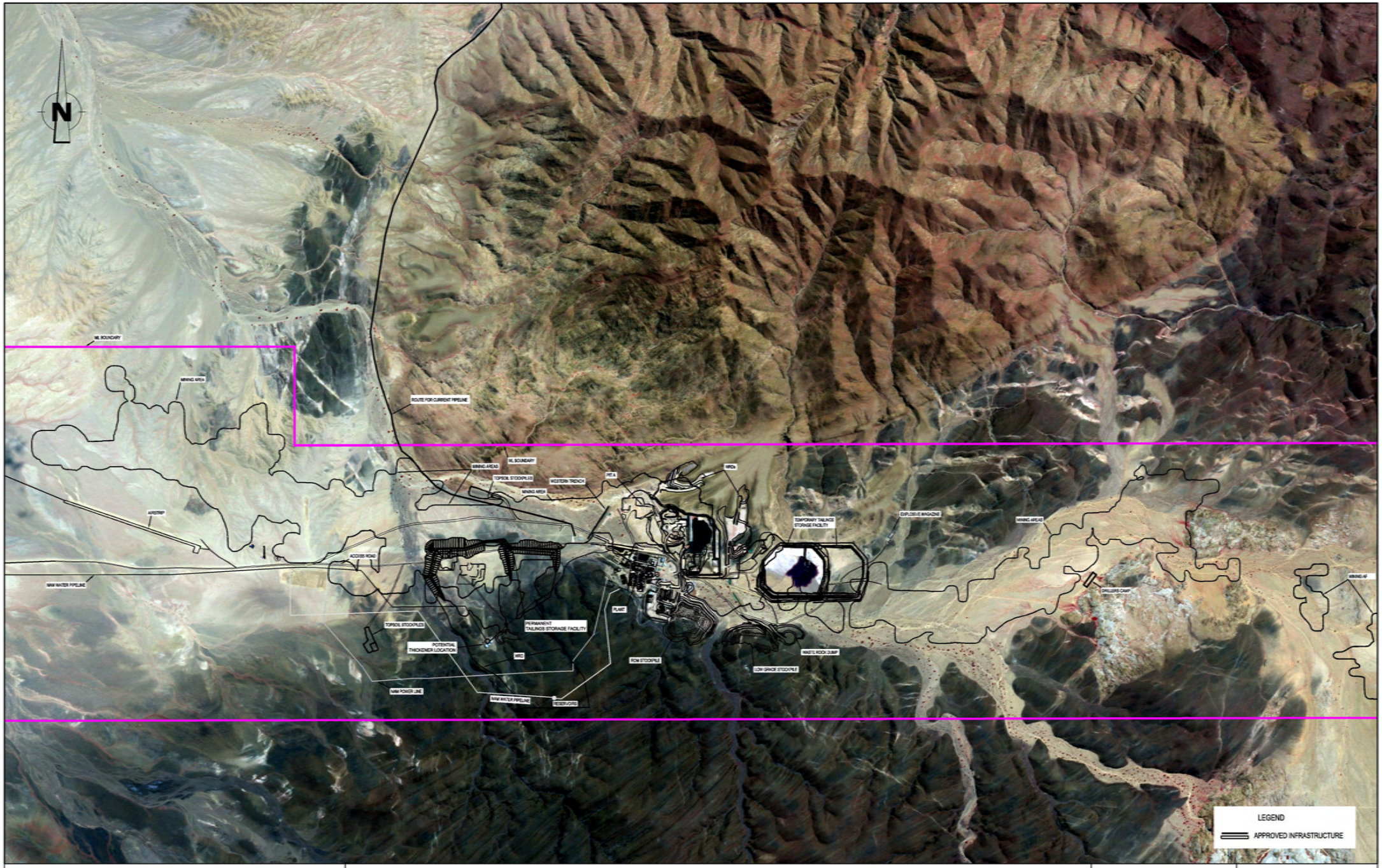
Stage	Description
Open pit mining	• Areas to be mined are stripped of topsoil and stockpiled and vegetation where possible re-located and re-planted. • Drilling and blasting is required to fragment the rock sufficiently so that excavation of the waste rock can be removed and the ore material stockpiled for processing. • Ore grade material is stockpiled on the run of mine (ROM) pad by haul trucks.
Crushing and scrubbing	• Ore grade material on the ROM is fed through a vibrating grizzly feeder and crushed in a crusher. • Crushed material is conveyed to the two scrubbers which serve two purposes. Firstly, the scrubber moisture breaks down the calcrete that holds the agglomerates together and secondly, the scrubbers remove the uranium bearing coating from the quartz pebbles.
Cyclones and screening	• Screened undersize from the scrubbers is pumped to the cyclones. Screened oversize is discharged to additional crushing circuits. • Cyclones are used to further separate the material. Cyclone overflows go to the pre-leach thickener after screening at 300-500 microns whilst cyclone underflow undergoes a three stage screening process to recover all 300-500 micron material that also goes to the pre-leach thickener. All material bigger than 500 microns is discharged via conveyor onto the low grade (barren) stockpiles.
Pre leach thickeners	• The 300-500 micron slurry material is pumped to two pre-leach thickeners where it is thickened to an underflow density up to 40% solids by mass with the assistance of flocculent. Thickener overflow is recycled back to the scrubbing process.
Leaching	• The thickener underflows are pumped to separate conditioning tanks where sodium carbonate and sodium bicarbonate are added. The slurry is then pumped through a first set of spiral heat exchangers where it is pre-heated by hot slurry leaving the leach circuit. It is then further heated through a second set of heat exchangers by hot water that elevates the temperature of the slurry to more than 75°C. The slurry is then discharged into either the original leach circuit comprising cascading concrete leach tanks or to the new circuit comprising two larger concrete tanks. All leach tanks are fitted with agitators to ensure optimal slurry mixing. The pH is continuously monitored and sodium carbonate and sodium bicarbonate are added as required to maintain the target of +/-pH 10. After 32 hours the leachate exits the leach tanks and is pumped through the heat exchangers to pre-heat the fresh leach feed slurry.
Counter current decantation	• The counter current decantation (CCD) circuit comprises three high density thickeners and six high rate thickeners (fed as two parallel rows of three) operating in series to make up a single Counter Current Wash circuit. Flocculent is dosed to each thickener to assist with the settling of solids. • In the final CCD stage, underflow is transferred to the tailings sump before being pumped to the TSF. Each CCD unit allows for extensive internal dilution to take place as solids contents of 3% and less are required to achieve acceptable settling rates and compaction. • Clarifier overflows are collected in pregnant solution transfer sumps and pumped to the existing pregnant solution holding tank.
Ion exchange	• The continuous fixed bed ion exchange system recovers uranium from the CCD pregnant solution. Twenty four extraction columns are used to adsorb the uranium from solution onto a weak base resin. Once the resin is fully

Stage	Description
	loaded, it is eluted with sodium bi-carbonate to strip the resin of uranium into a high grade pregnant solution. Thereafter the columns are put back into an adsorption stage and the process repeats itself.
Precipitation, thickening and centrifuging	• The pregnant solution from the ion exchange/elution circuit (eluate) flows to a uranium precipitation holding tank where the pH of the solution is increased to +/-12.0 through the addition of sodium hydroxide (NaOH). This precipitates the uranium as sodium diuranate (SDU) which is collected in a thickener to increase the underflow density. • It is then pumped to a continuous wash tank to remove high levels of NaOH and then pumped to a batch precipitation tank where it is re-dissolved in sulphuric acid (H2SO4) at a pH of 3.6. Once all SDU is dissolved, hydrogen peroxide (H2O2) is added at a controlled rate, together with NaOH (to maintain the correct pH) which causes the uranium to precipitate as UO4. The residence time for this stage is approximately 10-30 minutes. • The batch tank underflow (UO_4) is pumped firstly to a product thickener and then to a dewatering centrifuge, with dewatered uranium solids discharging into the uranium dryer feed hopper. Centrate from the centrifuge is recycled to the product thickener to recover any misplaced solids.
Product drying and drumming	• From the drier feed hopper the solids are fed to one or two oil heated dryers using an enclosed screw feeder. Drying takes place at 180°C for 1 hour to drive off free and crystalline water. The dry powder (final Uranium Oxide product) is then packaged in drums, weighed and sealed in preparation for transportation.

The infrastructure associated with the expansion project include the following: (Refer to Figure A.4)

- Upgrade to the processing plant
- Increased rate of mining
- Satellite mine workshop
- Satellite crushing plant
- Heap leach pad
- Tailings thickener
- Provision of additional pumps, and power (either generators or a power line) to the Swakop river for abstracting the full allotment of groundwater
- Temporary contractors camp

Refer to Section 6 of the EIA Report (Metago 2009) for a detailed description of the proposed expansion.



Metago Environmental Engineers (Pty) Ltd
Consulting Engineers & Scientists

LANGER HEINRICH URANIUM
CURRENT INFRASTRUCTURE LAYOUT

Date : 07/2009	Scale : NTS
Project No : L016-01	FIGURE A.2

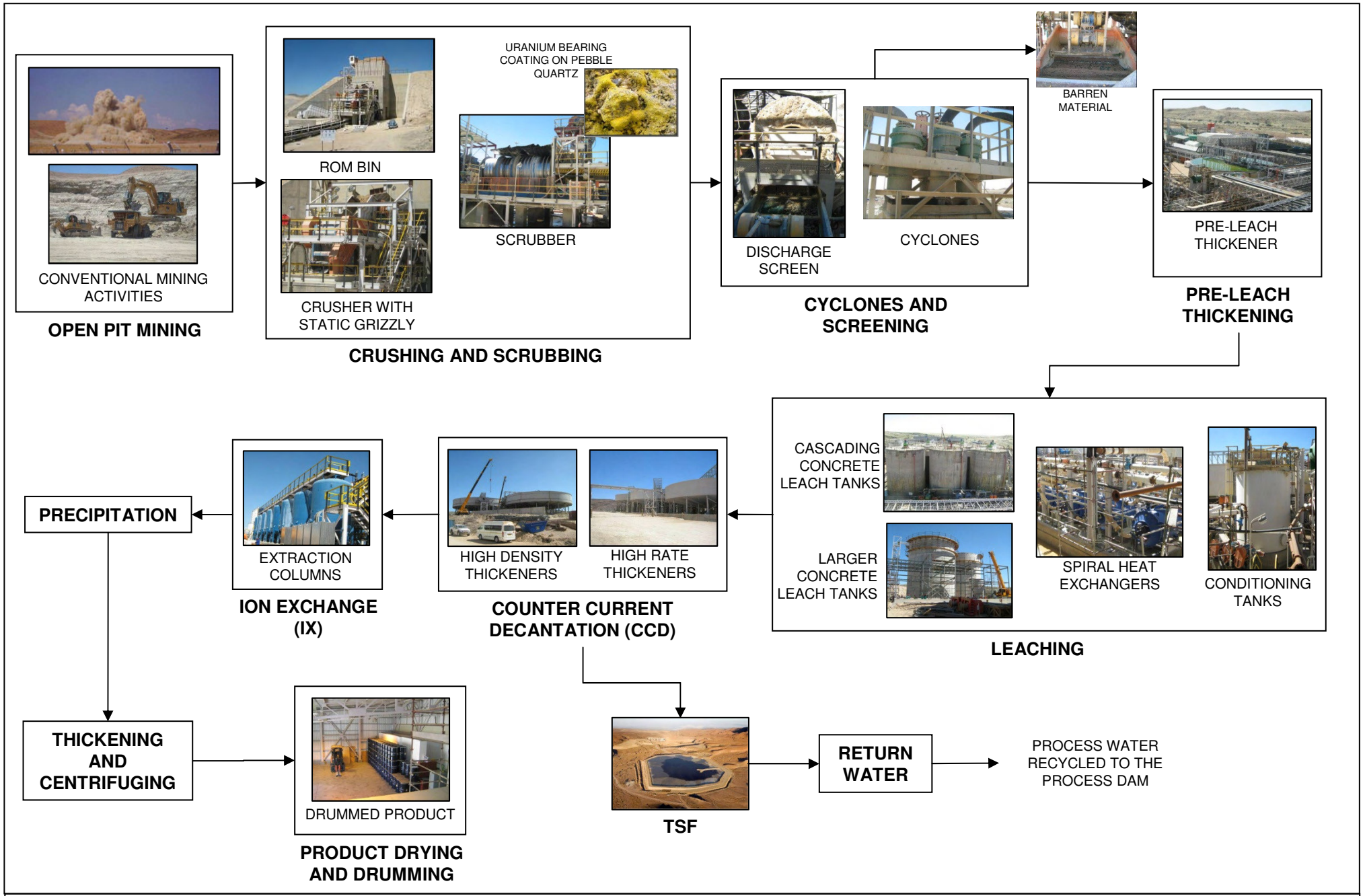
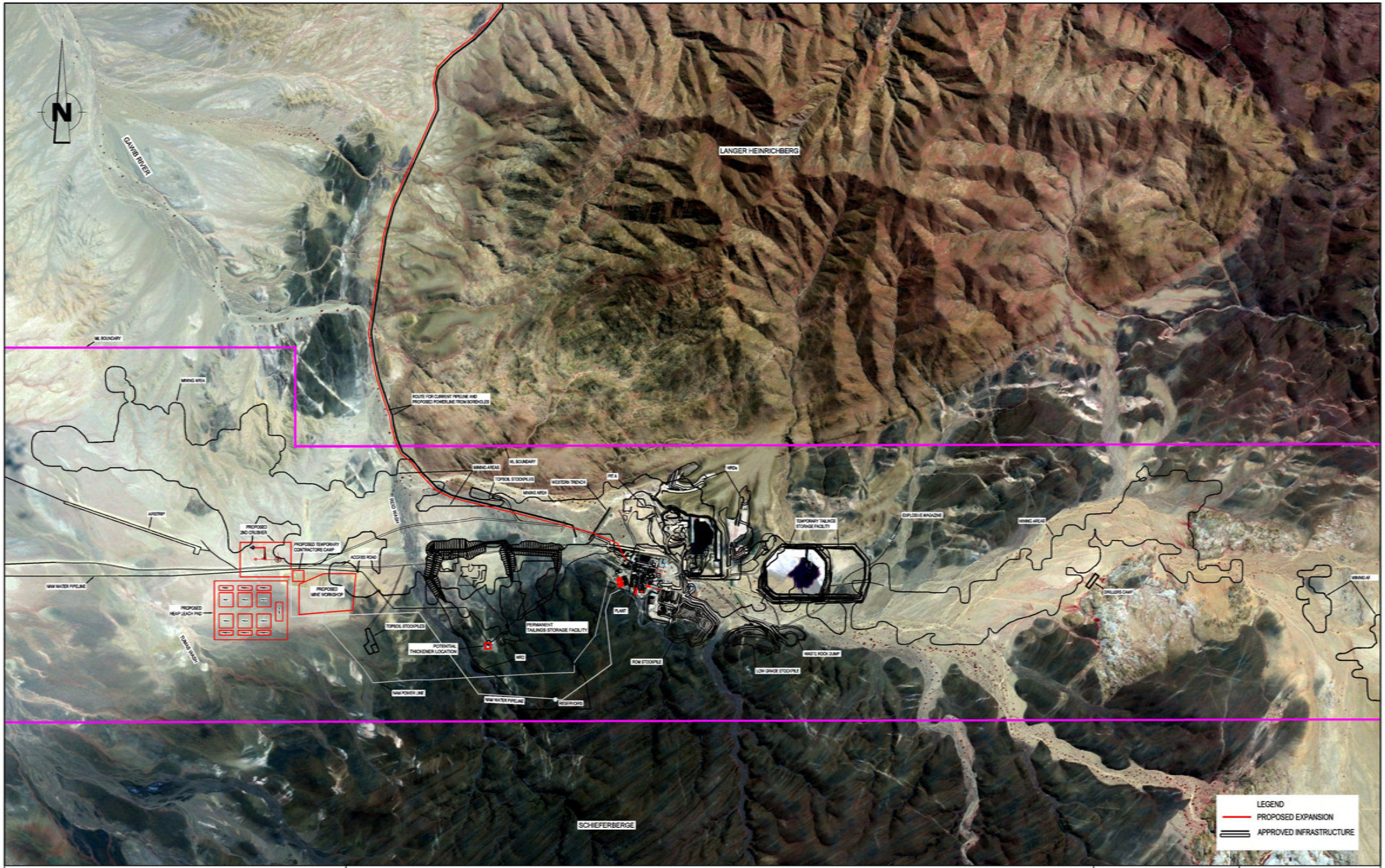


FIGURE A.3: PROCESS FLOW DIAGRAM SHOWING MAIN PROCESS COMPONENTS



Metago Environmental Engineers (Pty) Ltd
Consulting Engineers & Scientists

LANGER HEINRICH URANIUM
INFRASTRUCTURE LAYOUT SHOWING CURRENT AND FUTURE (PART OF EXPANSION) INFRASTRUCTURE

Date :	07/2009	Scale :	NTS
Project No :	L016-01		FIGURE A.4

A.3 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

LHU has implemented an environmental management system that complies with the requirements of the ISO14001 (International Organisation for Standardisation, 2004). The associated certification was received from Lloyds Register Quality Assurance (LRQA) in April 2009. The use of this system ensures that the environmental management requirements on LHU's activities are not only properly planned for, but a robust mechanism for implementation is also ensured and, most importantly that the environmental management function is always reviewed in a spirit of continual improvement.

The original EMP (Speiser, 2005) and the revised EMP (LHU, 2008) were used as the basis for the EMS. This updated EMP will in future be the basis of the EMS and all the associate programmes, procedures, work instructions, etc. will be updated and improved where relevant.

A.4 ENVIRONMENTAL LEGISLATION APPLICABLE TO URANIUM MINING IN NAMIBIA

LHU complies with all Namibian legislation, and where legislation is lacking, will comply with internationally recognized standards of best practice to ensure that a high level of environmental compliance is realized.

During 2007 LHU developed an Environmental Legislation Register (ELR). The register identifies what legislation is applicable to environmental management at a Namibian uranium mine and makes reference to the relevant sections in these various pieces of legislation. Hard and electronic copies of legislation are available at the mine site. The ELR is kept on the share drive so all employees with computer access have access to the register. A summary of the legislation covered in the ELR is provided in Table A.5.

A.4.1 Permits

The list of certificates and permits that have been granted to LHU are listed in the introduction (Section A.1). The originals and copies of these documents are kept on site.

Table A. 5: Environmental Legislation Register – Summary of relevant legislation.

LHU MINE LEGISLATION INDEX												01 July 2008				
YEAR	NAME	Natural Resource Use (energy & water)	Resource Use (manufactured materials)	Emissions to air (fumes, dust & odours)	Emissions to land (non hazardous & hazardous	Emissions to water (industrial & domestic)	Radiation (environ-mental only)	Noise (remote only)	Visual	Vibrations	Impact on Land use	Impact on biodiversity	Impact on Archeology	Emergency situations	Socio-economic	Safety & Health (no legal commentary)
CURRENT NAMIBIAN LEGISLATION																
1990	The Constitution of the Republic of Namibia of 1990	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
1992	The Labour Act 6 of 1992			☺	☺	☺					☺					☺
1997	Regulations relating to the Health & Safety of Employees at Work (promulgated in terms of Section 101 of the Labour Act No 6 of 1992 (GN156, GG 1617 of 1 August 1997)				☺									☺		
1997	Namibian Water Corporation Act, 12 of 1997	☺													☺	
1998	The Health Act 21 of 1988			☺	☺	☺										☺
1992	The Minerals (Prospecting and Mining) Act 13 of 1990	☺		☺	☺	☺						☺				
1990	Petroleum Products and Energy Act 13 of 1990, as amended	☺			☺	☺								☺		☺
1999	Road Traffic and Transport Act 22 of 1999			☺	☺											
2000	Petroleum Products regulations	☺			☺	☺								☺		☺
2000	Electricity Act 2 of 2000	☺														
	Explosives Act	☺		☺						☺						
2001	The Forestry Act 12 of 2001	☺									☺	☺				
2004	Water Resources Management Act, 2004	☺				☺									☺	
2004	National Heritage Act 27 of 2004												☺			☺
2005	Atomic Energy and Radiation Protection Act 5 of 2005	☺		☺												
2007	Environmental Management, Act 7 of 2007	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺		☺
FORMER SOUTH AFRICAN AND SWA LEGISLATION STILL APPLICABLE IN NAMIBIA																
1919	Public Health Act 36 of 1919			☺	☺	☺										☺
1956	Water Act 54 of 1956	☺				☺										
1956	Explosives Act 26 of 1956															
	Regulations promulgated un terms of the Explosives Act 26 of 1956															
1968	Regulations made under the provisions of the Mines, Works and Minerals ordinance, 1968 (Ordinance 20 of 1968)	☺			☺						☺					☺
1969	Soil Conservation Act 76 of 1969	☺				☺						☺				
1974	Hazardous Substances Ordinance 14 of 1974	☺	☺	☺	☺	☺								☺		☺
1975	Nature Conservation Ordinance 14 of 1975	☺				☺						☺	☺			
1976	Atmospheric Pollution Prevention Ordinance 11 of 1976			☺												
NAMIBIAN POLICY																
1994	Policy for the Conservation of Biotic Diversity and Habitat Protection	☺									☺	☺				☺

LHU MINE LEGISLATION INDEX												01 July 2008					
YEAR	NAME	Natural Resource Use (energy & water)	Resource Use (manufactured materials)	Emissions to air (fumes, dust & odours)	Emissions to land (non hazardous & hazardous	Emissions to water (industrial & domestic)	Radiation (environ-mental only)	Noise (remote only)	Visual	Vibrations	Impact on Land use	Impact on biodiversity	Impact on Archeology	Emergency situations	Socio-economic	Safety & Health (no legal commentary)
1995	Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺		☺
1998	Draft White Paper on the Energy Policy of Namibia	☺		☺												
1999	Policy for Prospecting and Mining in Protected Areas and National Monuments	☺									☺	☺	☺			☺
2000	National Water Policy White Paper	☺				☺						☺				☺
2002	Minerals Policy for Namibia	☺		☺	☺	☺			☺		☺	☺				☺
PENDING NAMIBIAN LEGISLATION																
1999	Draft Pollution Control and Waste Management Bill	☺		☺	☺	☺		☺		☺		☺		☺		
1999	Draft Mine Health and Safety Regulations (10th draft)			☺	☺	☺		☺		☺				☺		☺
1999	Draft National Heritage Bill for Namibia										☺		☺			☺
2000	Draft Road Traffic and transport Regulations		☺	☺	☺											
2002	Draft Water Resource Management Bill 2002	☺				☺										
2002	Draft Parks and Wildlife Management Bill	☺				☺					☺	☺	☺			☺
INTERNATIONAL LAW																
1985	Vienna Convention for the Protection of the Ozone Layer		☺	☺												
1987	Montreal Protocol on substances that deplete the Ozone Layer	☺	☺	☺												
1989	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal				☺	☺									☺	
1989	The Rotterdam convention on the Prior Informed Consent Procedure for Certain Hazardous chemicals and Pesticides in International Trade		☺	☺	☺	☺						☺				
1992	The Rio de Janiero Convention on Biological Diversity	☺										☺				☺
1992	United Nations Framework Convention on Climate Change	☺		☺		☺										
REGIONAL AGREEMENTS																
1997	Southern African Development Community (SADEC): Protocol on Mining	☺									☺					☺
OTHER / BEST PRACTICE																
	Namib Naukluft Park Rules	☺			☺			☺	☺		☺					

A.5 ENVIRONMENTAL ASPECTS AND IMPACTS OF THE ENVIRONMENT IMPACTED BY LHU'S ACTIVITIES

As part of the original EIA (Softchem, 2005 and Speiser, 2005), LHU has identified the environmental aspects and potential environmental impacts. Subsequently LHU has developed an aspects-impacts register as part of their process to produce the revised EMP (LHU, 2008) and to develop and implement their ISO 14001 EMS.

The 2009 EIA (Metago, 2009) assessed the current activities and facilities associated with LHU's operations as well as those associated with the proposed expansion project. Therefore the aspects-impacts register was updated.

The full suite of LHU's facilities and activities, associated with the construction, operation, decommissioning, and closure phases are summarised in Table A. 6 below. The associated environmental aspects and potential impacts are summarised in Table A. 7. The activity/facility-aspects-impacts registers appear in Appendix A.

Table A. 6: Summary of the LHU activities and facilities in the various phases

LHU activities/facilities			
Construction phase	**Operations phase**	**Decommission phase**	**Closure phase**
Borehole abstraction	Backfill of mine voids and the possibility of settlement	Backfill of mine voids and the possibility of subsidence	Aftercare and maintenance activities
Borrow pits	Borehole abstraction	Borehole abstraction	catchment dams and TSF
Building roads	Buildings and equipment	Clearing and grubbing	Erosion of final land forms
Clearing and grubbing	Construction of water containment and/or diversion infrastructure – berms, channels, dams.	Construction of water containment and/or diversion infrastructure – berms, channels, dams.	Final voids (if any)
Compacting bases	Conveyors	Cranes	Mineralised and radioactive contaminated non-mineralised waste
Construction of surface water containment and/or diversion infrastructure – berms, channels, dams.	Crushing and screening	Diesel generators	Other waste
Cranes	Diesel Generators	Dirty water management and related facilities	Permanent stockpiles
Diesel generators	Dirty water management and related facilities	Decommissioning activities	Permanent TSF
Dust fallout	Drilling and blasting	Dust fallout	Permanent water dams

LHU activities/facilities			
Construction phase	**Operations phase**	**Decommission phase**	**Closure phase**
Earth moving equipment	Dust fallout	Earth moving equipment	Placement of final land forms with associated water containment and/or diversion infrastructure – berms, channels, dams
Equipment servicing	Earth moving equipment	Equipment servicing	Remaining infrastructure – surface water management system, TSFs, other mineralised stockpiles and other wastes
Erecting power line	Existing and proposed operational activities	General building activities	Seepage from remaining stockpiles, catchment dams and TSF
Foundations	Exploration	Generators	Seepage, runoff and dust fallout from remaining mineralised stockpiles,
General building activities	General materials handling	Management of dirty water	Settlement in backfilled areas
Generators	General operational activities	Material handling	Surface subsidence
Infrastructure establishment	Generators	Material movement	Vegetation establishment and maintenance
Management of dirty water	Management of dirty process water/effluent	Material tipping	
Managing contractors (construction camp and drillers camp site)	Management of dirty water	Mineralised waste	
New construction activities	Material handling	Non mineralised waste	
Opening borrow pits and trenches	material tipping	Open pits	
Pipelines	Mine development	Ore	
Power lines	Mineralised waste	Piles of scrap	
Preparation of the foundations	Non-mineralised waste product	Piles of rubble	
Roads	Open pits	Pipelines	

LHU activities/facilities			
Construction phase	**Operations phase**	**Decommission phase**	**Closure phase**
Sanitation	Ore	Pit dewatering	
Scaffolding	Ore processing	Power lines	
Security lights	Overburden removal	Removal of infrastructure	
Servicing equipment	Pipelines	Sanitation	
Slope stabilization	Pit dewatering	Scaffolding	
Soil stripping	Placement of stockpiles	Security lights	
Stockpiles	Power lines	Servicing equipment	
Storage and handling of new and used materials and chemicals	product	Slope stabilization	
Trenches	Sanitation	Soil management activities	
Use of vehicles and equipment that may leak lubricants and fuel	Security lights	Soil stripping	
Vehicle movement	Servicing equipment	Stockpiles	
Vehicle movement and exhaust fumes	Soil management activities	Stockpiles and waste facilities	
Vehicle movement on access roads, internal roads and off road	Soil stripping	Storage and handling of new and used materials and chemicals	
Waste management (non-mineralised)	Stockpile development	Stripping of buildings and equipment	
	Stockpiles	Surface Subsidence	
	Storage and handling of new and used materials and chemicals	Trenches	
	Surface subsidence	TSFs	
	Trenches	Use of vehicles and equipment that may leak lubricants and fuel	
	TSF development	Vehicle movement	
	TSFs	Vehicle movement and exhaust fumes	
	Use of vehicles and equipment that may leak lubricants and fuel	Vehicle movement on access roads, internal roads and off road	
	Vehicle movement	Voids	

LHU activities/facilities			
Construction phase	**Operations phase**	**Decommission phase**	**Closure phase**
	Vehicle movement and exhaust fumes	Waste management (mineralised and non mineralised)	
	Vehicle movement on access roads, internal roads and off road	Waste management (non-mineralised)	
	Voids	Waste management (mineralised)	
	Waste management (mineralised and non-mineralised)	Water dams	
	Water dams		

Table A. 7: Summary of the LHU environmental aspects

Aspects associated with consumption of resources	Aspects Associated with waste/pollution generation	Aspects associated with noise and visual pollution	Aspects relating to archaeology	Aspects associated with ecosystems	Social issues and aspects associated with third party and animal safety
Energy use	Soil pollution	Noise pollution	Physical disturbance of archaeological resources	Physical disturbance of soil	Dewatering of rivers
Water Resource	Emissions to surface water	Visual disturbance		Physical disturbance of land	Communication with stakeholders
Use of Manufactured materials	Emissions to groundwater			Physical disturbance of biodiversity	Hazardous excavations and infrastructure
Fuel consumption	Emissions to land			Physical disturbance of water courses or groundwater	Radiological issues
	Emissions to air				Job creation
					Local economies
					Inward migration

The potential impacts on the environment can be summarised as follows:

- Human (3rd party) and animal health & safety impacts.
- Disturbance/destruction of vertebrates, invertebrates and/or vegetation.

- Loss of soil resources & functionality.
- Loss of ecosystem functionality.
- Surface water pollution.
- Groundwater pollution.
- Air pollution.
- Nuisance impacts.
- Loss of natural resources - Impacts on 3rd parties.
- Impacts on tourists (tourism)/ visitors to the Naukluft National Park.
- Disturbance/destruction of archaeology, resources & landscapes.
- Impacts on Erongo regional economy and Namibian economy.
- General social impacts.
- Social well-being impacts.

To manage the above mentioned aspects and potential impacts, LHU, with the assistance of Metago, developed a range of Management and Mitigation Plans (MMPs) which are presented in Section B of this EMP.