

REPORT NO.: P 02/B810/00/0608/02 Annexure K

GROOT LETABA RIVER DEVELOPMENT PROJECT (GLeWaP)

ENVIRONMENTAL IMPACT ASSESSMENT

(DEAT Ref 12/12/20/978)

ANNEXURE K: HEALTH IMPACT ASSESSMENT

MARCH 2010



Margot Saner & Associates (Pty) Ltd

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DECLARATION OF INDEPENDENCE

EIA Regulation 385 states, inter alia, that an independent consultant must be appointed to act on behalf of the client and to ensure that the public participation process is managed properly. In this regard, Margot Saner & Associates (Pty) Ltd, as part of the Environmental Impact Assessment team, submits that it has:

- The necessary required expertise to conduct health impact assessments, including the required knowledge and understanding of any guidelines or policies that are relevant to the proposed activity;
- Undertaken all the work and associated studies in an objective manner, even if the findings of these studies are not favourable to the project proponent;
- No vested financial interest in the proposed project or the outcome thereof, apart from remuneration for the work undertaken under the auspices of the above-mentioned regulations;
- No vested interest, including any conflicts of interest, in either the proposed project or the studies conducted in respect of the proposed project, other than complying with the required regulations.

REPORT DETAILS PAGE

Project name:	Groot Letaba River Water Development Project	
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Dr Martin van Veelen Project Director

Health Impact Assessment

FINAL 2009/03/03

EXECUTIVE SUMMARY

As part of the Groot Letaba River Water Development Project, the Department of Water Affairs and Forestry (DWAF) is planning to construct a dam at the Nwamitwa site in the Limpopo Province, North-east of Tzaneen, in the Groot Letaba catchment area which falls within the Luvubu-Letaba Water Management Area. This dam is scheduled to be in operation by 2012, with full yield by 2013. Consideration is also being given to raising the dam wall of the Tzaneen Dam to increase water for irrigation to the area upstream from the proposed dam.

The above components, as well as the necessary road re-alignments, water treatment works and bulk water supply infrastructure will be considered within the Environmental Impact Assessment (EIA) studies as components of the Groot Letaba Water Development Project (GLeWaP).

Margot Saner & Associates (Pty) Ltd was appointed by ILISO Consulting (Pty) Ltd to conduct a specialist Health Impact Assessment (HIA) for the GLeWaP EIA. The broad aims of the investigation were to assess the potential health impacts (positive and negative) of the project and to improve public policy decision making through recommendations to enhance predicted positive health impacts whilst minimising negative ones.

The HIA was conducted in accordance with the prescribed methodology for specialist studies as per Regulation 33(2) of GN 385. Reference was made to international methodologies for HIA and to other specialist study reports:

- European Policy Health Impact Assessment a Guide
- The Merseyside Guidelines for Health Impact Assessment
- Social Impact Assessment MasterQ Research
- Noise Impact Assessment Jongens Keet Associates
- Air Quality Impact Assessment Airshed Planning Professionals

The HIA comprised a baseline description and an impact assessment.

Baseline description

This required the consideration of the number of construction workers involved in the project and their general state of health, as well as the number of persons in surrounding

communities and their state of health.. The potential health risks to which construction workers engaged on the various sites may be exposed were identified along with the potential health risks which construction activities would pose to surrounding communities. Consideration was also given to determining the possible health impacts on construction workers and the surrounding communities as a consequence of water related diseases following construction of the proposed dam.

Health impact assessment – this included consideration of the following issues:

* **Construction Phase** - Health risks associated with transmittable diseases, impacts of construction activities on construction workers and impacts of construction activities on surrounding communities.

* **Operational Phase** - Potential health risks to surrounding communities associated with changing water levels and the change from a free-flowing river to a large body of water, potential impacts on community health following the provision of an improved water supply system.

Assumptions and Limitations

- The identified potential health impacts and health effects were qualitatively assessed only i.e. no quantitative verification of impacts/effects was undertaken.
- Any inaccuracies and/or uncertainties contained in the referenced specialist reports may have inadvertently been incorporated into the HIA.
- The time-frame allocated to this specialist study precluded extensive on-site investigations and the HIA must therefore be viewed as a desk-based study which will require on-site verification once construction activities have been initiated.

CONCLUSIONS

Baseline description

Number of construction workers and their state of health

Approximately 50 workers will be engaged in the raising of the Tzaneen dam, whilst approximately 300 workers will be engaged at the proposed dam site at Nwamitwa. Fifty of these will be professional workers and will be accommodated with their families in Letsitele. Another fifty of the workers will be skilled specifically in dam construction and will be sourced from outside of the region. These workers will be housed in the Letsitele single quarters. The

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remainder of the workforce (~200 workers) will be accommodated in purpose-built construction camps. Approximately 50 of the 300 workers will be female.

Within the South African context, some concern is expressed about the potential state of health of construction workers, particularly with respect to the incidence of HIV and TB infection.

* Human Immunodeficiency Virus (HIV)

As migratory workers, it can be expected that unskilled and semi-skilled construction workers sourced from outside of the region will exhibit an elevated incidence of STI, including HIV. Latest DoH data reveals that ~24.7% of antenatal women in the Mopani District Municipality (MDM) tested HIV positive in 2006. Local labour is therefore also likely to have a high prevalence of HIV.

* Tuberculosis (TB)

The incidence of TB amongst construction workers is also likely to be elevated, irrespective of whether they are sourced locally or from outside of the region. South Africa has the seventh highest incidence of TB in the world (720 cases per 100,000 population in 2006) and the incidence of the disease has increased significantly in the last ten years. The incidence of TB in South Africa is further complicated by the high rate of HIV infection.

Number of persons in the surrounding communities and their state of health

The proposed construction site at the Tzaneen Dam and the proposed site at Nwamitwa fall within the Greater Tzaneen Local Municipality (GTLM) and the Greater Letaba Local Municipality (GLLM) respectively. These municipalities form part of the Mopani District Municipality (MDP) of the Limpopo Province.

The GTLM covers an area of \sim 3242km² and has a population of \sim 375,000 people. The population density is \sim 116 persons/km². There are \sim 97,400 households in the area and the average number of persons per household is \sim 43.94. Approximately 98% of the population is designated Black African, whilst Females comprise \sim 54% of the population. Almost half of the populace (48.7%) is under the age of 19 years.

The GLLM covers an area of ~1891km² and has a population of ~220,000 people. The population density is ~116 persons/km². There are ~53,700 households in the area and the average number of persons per household is ~4.1. Approximately 99% of the population is

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designated Black African, whilst Females comprise ~55% of the population. More than half of the populace (53.9%) is under the age of 19 years.

Education levels throughout both the GTLM and the GLLM are generally low, with between 35-45% of the adult population having no formal education at all (Social Impact Study, MDM IDP).

With regard to the state of health of the populations within close proximity to the proposed construction sites, the following is relevant:

* Human Immunodeficiency Virus (HIV)

The incidence of HIV infection is high throughout the Limpopo Province, with a recorded 20.6% HIV incidence in antenatal women in 2006 whilst the Mopani District Municipality (MDM) recorded a prevalence of HIV in antenatal women of 24.7% (2006).

* Tuberculosis (TB)

The incidence of Tuberculosis (TB) amongst the local populace is likely to be fairly elevated as South Africa has the seventh highest incidence of TB in the world (720 cases per 100,000 population in 2006). Limpopo Province has a lower infection rate than the rest of SA (apart from the Northern Cape) but the local incidence of TB is further complicated by the high rate of HIV infection within the local populace.

* Malaria

The Mopani District Municipality (MDM) is not considered to be an endemic malaria region. There remains some risk however as ~20% of the annual recorded cases of malaria for the Limpopo Province are recorded in the MDM. Local climate in the MDM can accommodate the insect vectors (Anopheles sp. mosquitoes) necessary for the spread of the malaria parasite (P.falciparum).

* Schistosomiasis (bilharzia)

The incidence of Schistosomiasis is difficult to estimate as it is not a notifiable disease. It is however recognised that schistosomiasis is second only to malaria in contributing to the disease burden in the developing world. The climate and rainfall characteristics of the MDM make it likely that both S.haemotobium and S.mansoni are endemic to the area, provided that suitable intermediate hosts (pulmonate snails sp.) are present. Residents of the villages

in the area of the proposed GLeWaP bulk water distribution area are at risk of infection as they currently rely heavily on communal taps, borehole and/or river water.

* Diarrhoeal diseases

The lack of water-borne sewage systems in the proposed GLeWaP bulk water distribution area increases the risk of spread of diarrhoeal diseases as untreated sewage may enter rivers, streams and underground water resources.

* Healthcare infrastructure/resources

Latest available information shows that the status of healthcare services within the GTLM and GLLM is inadequate to effectively respond to the community health needs.

* Poverty

The majority of communities within the GTLM and TLLM are impoverished with generally poor levels of nutrition, especially amongst children. Poor nutritional standards impact adversely on the health status of populations and significantly increase the risk of disease.

Potential health risks to which construction workers will be exposed

Construction workers engaged on all of the sites can be expected to be exposed to the following health risks as a result of construction activities:

• chemical stressors

- inhalation exposure to airborne hazardous chemical substances (total inhalable particulates, respirable particulates, cement dusts, bitumen fume, volatile organic compounds, welding fumes, gas-cutting fumes, diesel exhaust emissions)
- *dermal exposure to volatile organic compounds, cement dusts, bitumen products*

• physical stressors

- excessive noise rating levels (plant machinery, pneumatic tools, impact tools, hammering, grinding, compressors, blasting)
- excessive heat stress conditions (work requiring moderate to high metabolic work rates under hot/humid environmental conditions)
- excessive cold stress conditions (work performed at night and early winter mornings planned 24 hour work schedules)
- vibration (whole body vibration during operation of plant machinery and vehicles; hand-arm vibration when operating power tools, compactors)

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• *ultraviolet radiation (prolonged and/or repeated exposures to sunlight)*

• ergonomic stressors

- work requiring manual lifting and carrying of heavy materials
- work requiring heavy manual labour (digging, drilling etc)
- repetitive work
- prolonged standing
- prolonged sitting (machine operators)
- pushing / pulling activities

• hazardous biological agents

- sexually transmitted diseases (HIV, syphilis)
- infectious diseases (TB, diarrhoeal diseases)
- vector borne diseases (malaria, schistosomiasis)

Potential health risks to communities during construction

Communities in close proximity to the construction sites can be expected to be exposed to the following health risks as a result of construction activities:

- chemical stressors
 - inhalation exposure to airborne pollutants (total inhalable particulates, respirable particulates, cement dusts, bitumen fumes)
 - ingestion exposure to pollutants released into existing water courses (oils, volatile organic compounds, pesticides, herbicides, sewage, garbage)

• physical stressors

Excessive noise rating levels (plant machinery, pneumatic tools, impact tools, hammering, grinding, compressors, blasting, operation of pump stations) – planned 24 hour work schedules

• hazardous biological agents

- sexually transmitted diseases (HIV, syphilis)
- *infectious diseases (TB, diarrhoeal diseases)*
- vector borne diseases (malaria, schistosomiasis)

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The outcome of the Health Impact Assessment revealed the following:

Construction workers will be potentially exposed to the following health risks with subsequent negative health impacts:

- HIV, STI, TB medium significance following mitigation
- Excessive noise rating levels medium significance following mitigation
- Inhalation exposure to airborne Hazardous Chemical Substances (HCS) low significance following mitigation
- Dermal exposure to HCS low significance following mitigation
- Excessive heat stress conditions low significance following mitigation
- Excessive cold stress conditions low significance following mitigation
- Excessive vibration stress low significance following mitigation
- Excessive heat stress conditions low significance following mitigation
- Excessive ultraviolet radiation low significance following mitigation
- Excessive ergonomic stress medium significance following mitigation
- Malaria low significance following mitigation
- Schistosomiasis low significance following mitigation
- Diarrhoeal diseases low significance following mitigation

Priority potential health risks for construction workers therefore include:

- HIV, STI and TB transmission
- Exposure to excessive noise rating levels
- Exposure to excessive ergonomic stress

Even following the implementation of the recommended mitigation measures, it is likely that these risks would still present a medium significance in terms of their impact on the health of construction workers. Effective management of these priority health risks would be required if the impacts on the health of construction workers are to be effectively controlled.

Construction activities could potentially expose the surrounding communities to the following health risks with consequent negative heath impacts:

- HIV, STI, TB medium significance following mitigation
- Inhalation exposure to airborne Hazardous Chemical Substances (HCS) low significance following mitigation
- Ingestion exposure to HCS low significance following mitigation

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• Excessive ambient noise rating levels – low significance following mitigation

Priority potential negative health impacts for surrounding communities therefore include:

• HIV, STI and TB transmission

Even following the implementation of the recommended mitigation measures, it is likely that these risks would still present a medium significance in terms of their health impact on surrounding communities. Effective management of these priority health risks would be required if the impacts on the health of community members are to be effectively controlled.

The completion of the project could however impact <u>positively</u> on the following health risks to surrounding communities:

- Malaria low significance following mitigation
- Schistosomiasis medium significance following mitigation
- Diarrhoeal diseases medium significance following mitigation

Whilst the incidence of these diseases is unlikely to change during the construction phase, it is very likely that it will decrease following completion of the installation of bulk water infrastructure. The incidence of schistosomiasis and diarrhoeal diseases within the local populace is likely to decrease significantly following provision of clean water to households.

In conclusion, the raising of the Tzaneen dam is unlikely to have any significant impact on the health of either the construction workers or the surrounding community provided the recommended mitigation measures are effectively implemented. The construction of a dam at the Nwamitwa site and the installation of bulk water infrastructure throughout the surrounding areas, is however, likely to have several potential health impacts on both construction workers and the affected communities.

- The nett health impact of construction activities on construction workers is likely to be negative. The majority of impacts could however be effectively mitigated.
- The nett health impact on surrounding communities is likely to be positive, with the benefits of improved access to clean water supplies outweighing the temporary negative impacts associated with construction activities – all of which could be readily and effectively mitigated.

Recommended Mitigation Measures for Priority Health Impacts

Transmittable diseases:

All construction workers should be subject to baseline medical examinations which should include appropriate testing for:

- Tuberculosis
- *HIV* (voluntary consent but strongly encouraged)
- Syphilis / other STI

Infected workers must be afforded appropriate treatment and/or counselling whilst all workers should be subject to education and training in the health risks associated with high risk sexual activities. Workers must be made familiar with the routes of exposure to STI and TB as well as ways to reduce the risks and/or prevent infection. Workers should be made to be familiar with the signs and symptoms of STI and should be encouraged to seek prompt treatment in the event of them developing these signs and symptoms. Consideration should be given to distributing free condoms to workers and encouraging their use through education.

Members of the surrounding communities should be encouraged to undergo voluntary examination/testing for:

- Tuberculosis
- HIV
- Syphilis / other STI

Infected individuals should be encouraged to undergo appropriate treatment and/or counselling and communities should be made familiar with the routes of exposure to HIV/STI and TB as well as ways to reduce the risks and/or prevent infection. Communities should also be made to be familiar with the signs and symptoms of infection and should be encouraged to seek prompt treatment in the event of them developing these signs and symptoms. Local healthcare resources are already struggling to cope with current HIV/AIDS and TB related infections and disease. Prior to initiation of construction activities it is recommended that community leaders be informed of the possible health risks associated with transmission of disease from/to workers and the communities. Community leaders should then be encouraged to distribute this knowledge and information to their community members.

Noise rating levels

In terms of the Construction Regulations promulgated under the Occupational Health and Safety Act (Act 85 of 1993), it is required of all contractors to conduct a baseline risk assessment prior to performing any construction activities. This risk assessment must identify and evaluate all of the risks to the health and safety of persons engaging in construction activities. Given that construction activities will expose workers to excessive noise rating levels it is recommended that a baseline noise survey also be conducted as soon as possible following commencement of site activities – in accordance with the requirements of the Noise Induced Hearing Loss Regulations (OHSAct 85 of 1993) and SANS 10083:2004. This noise survey will quantify worker exposures to noise during typical activities and allow for informed comment on the relative risks to hearing presented by various activities – i.e. identify sources of excessive noise and allow for demarcation of noise zones. Recommendations with regard to appropriate control measures (engineering controls and/or personal protective equipment) can then follow. A formal noise survey will also permit structuring of an appropriate audiometric examination protocol for construction workers – as required by the Noise Induced Hearing Loss Regulations – OHSAct 85 of 1993.

Ergonomic stress

Within the context of construction activities, ergonomic stresses present one of the highest risks to worker health. The Construction Regulations (OHSAct 85 of 1993) require that all contractors conduct an initial health risk assessment of their workers activities prior to initiating any work on site. Ergonomic stress must be included as a priority issue in any baseline risk assessment. Whilst the formal risk assessment would allow for identification of specific ergonomic issues, appropriate mitigation measures are likely to include:

- Ensuring that all workers are certified medically fit to perform their duties by a qualified OMP
- Ensuring that mechanical assistance for lifting and transporting of heavy material is readily available and appropriate to the task
- Ensuring that workers are adequately trained in lifting techniques and actively practice these techniques
- Ensuring that workers know when to ask for assistance and do so

With regard to expected health impacts of lower priority, recommended mitigation measures included:

Hazardous Chemical Substances

It is strongly recommended that an initial HCS Risk Assessment be performed for each of the construction sites. The outcomes of these assessments will permit specific and relevant comment on the suitability of existing engineering control measures, Personal Protective Equipment, policies and work procedures in preventing/controlling worker exposure to HCS. Comment on the need for personal air monitoring programmes and/or medical surveillance programmes will also be assessed by these baseline studies. Pending these assessments:

- generation of dust should be minimised by implementing formal wetting down procedures for sites
- diesel powered equipment/ vehicles must be suitably serviced, maintained and repaired in order to minimise the emission of diesel particulate matter
- particulate emissions from construction activities should be minimised by:
 - ensuring that all roads, access ways and other unpaved areas are subject to appropriate dust control measures.
 - setting appropriate speed limits for all surfaces and roads
 - ensuring that the carry over of mud or dirt onto paved roads is prevented as far as possible
 - traffic movement is minimised as far as possible
 - o all spillages onto road surfaces are promptly cleaned up
 - o all exposed areas are promptly re-vegetated/stabilised
 - the extent of the excavations is minimised
 - the heights of stockpiles are minimised and stockpiles are located as far away from sensitive receptors as possible
 - windbreaks are erected around stockpiles where possible

Thermal Stress

- Heat Stress
 - Ensuring that all workers are medically fit to conduct their activities
 - Ensuring that all workers are suitably informed and trained in the signs and symptoms of heat stress
 - Ensuring that all workers are trained in appropriate measures to prevent heat stress related injuries or illnesses. Informing workers of the need to drink regular quantities of water should be prioritised. Ready access to drinking water must be provided at all work locations.
 - Drafting of formal work procedures for working in hot environments

- Cold Stress
 - Issuing of appropriate protective wear (jackets, hats and gloves)
 - Use of hand-held powered machinery and/or tools should be subject to special precautions under cold climatic conditions (low risk in this instance).

Vibration Stress

Appropriate mitigation measures would include:

- Ensuring that all equipment, tools and vehicles are properly maintained according to design specifications so as to minimise the risk of worker exposure to excessive vibration stress
- Ensuring that all defective and broken equipment, tools and vehicles are promptly removed from duty and properly repaired
- Ensuring that workers are trained to understand the hazards associated with vibration i.e. sources of vibration, health effects.
- Ensuring that workers are adequately trained to recognise problematic vibration which could cause vibration related injuries
- Issuing of appropriate personal protective equipment

Ultraviolet Radiation

Appropriate mitigation measures to address worker exposure to direct sunlight would include:

- Issuing appropriate personal protective equipment (brimmed hats, caps)
- Educating the workforce about the damaging effects of prolonged and/or repeated exposure to solar radiation
- Encouraging the diligent use of sunscreens by especially vulnerable persons

Malaria

 Drafting of a formal malaria control plan for the construction sites is recommended. Although compulsory issue of prophylactic drugs to workers is not deemed necessary, some consideration could be given to initiating an appropriate chemical control programme at worker accommodation sites. Spraying of effective insecticides to control mosquito populations is an effective way of reducing the risk of malaria. Advice on residual spray methods should be obtained from a relevant authority prior to initiation.

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- Educating workers in ways and means of preventing malaria is also recommended. Priority should be given to ensuring that workers are aware of the benefits of:
 - Limiting time out of doors after dark
 - Wearing long sleeved shirts and long trousers after dark
 - Making use of insect repellents
 - o Closing windows and doors of sleeping quarters at night
- Consideration should be given to providing all worker sleeping quarters with mosquito repellents (chemical impregnated mats or coils) and/or mosquito nets above beds
- Ensuring that workers are able to readily identify the common signs and symptoms of malaria so that diagnosis is promptly confirmed and appropriate treatment initiated.
- Continuation of existing malaria control measures as implemented by the Provincial and Local health authorities
- Improve public awareness of risk
- Improve public knowledge about ways of reducing risks

Schistosomiasis

* The incidence of Schistosomiasis should be confirmed in the study area by appropriate specialists, preferably before construction begins. A formal assessment should then be made of the risks of contamination following completion of the dam construction at the proposed Nwamitwa site. In the interim, mitigation measures should include:

- Education and training of workers in ways and means of reducing their risks of infection – i.e:
 - Avoid swimming or bathing in uncontrolled water sources
 - Avoiding drinking water from uncontrolled or unknown sources
 - Avoid urinating in water sources / courses
- Education of workers in signs and symptoms of infection so that medical assistance can be sought and appropriate treatment initiated
- Ready access to healthcare services for workers in the event of treatment being required.

Diarrhoeal Diseases

* Mitigation measures should include:

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- Education and training of workers in ways and means of reducing their risks of infection i.e:
 - Avoid swimming or bathing in uncontrolled water sources
 - Avoiding drinking water from uncontrolled or unknown sources
 - Avoid urinating in water sources / courses
 - Follow good personal hygiene practices (washing hands etc)
 - Avoid eating food from unknown or suspect sources
 - Avoid unwashed, raw or undercooked foods
- Education of workers in signs and symptoms of infection so that medical assistance can be sought and appropriate treatment initiated
- Ready access to healthcare services for workers in the event of treatment being required.
- Education of the local population in ways and means of reducing their risks of infection – i.e:
 - Avoid swimming or bathing in uncontrolled water sources
 - Avoiding drinking water from uncontrolled or unknown sources
 - Avoid urinating in water sources / courses
 - Thoroughly wash hands following ablutions and prior to eating, drinking or smoking
 - Thoroughly wash vegetables and fruit prior to eating
 - Thoroughly cook foods

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ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome	
DoH	Department of Health	
DWAF	Department of Water Affairs and Forestry	
GLeWaP	Groot Letaba River Water Development Project	
GLLM	Greater Letaba Local Municipality	
GTLM	Greater Tzaneen Local Municipality	
HCS	Hazardous Chemical Substances	
HIA	Health Impact Assessment	
HIV	Human Immunodeficiency Virus	
IDP	Integrated Development Plan	
ILISO	ILISO Consulting	
LP	Limpopo Province	
MDM	Mopani District Municipality	
OMP	Occupational Medical Practitioner	
RDP	Reconstruction and Development Programme	
SA	Republic of South Africa	
STI	Sexually Transmitted Infections	
ТВ	Tuberculosis	

1. STUDY INTRODUCTION

1.1 BACKGROUND TO PROJECT

The Department of Water Affairs and Forestry (DWAF) is currently undertaking an Environmental Impact Assessment (EIA) to investigate the environmental feasibility of raising the Tzaneen Dam, the construction of a storage dam in the Groot Letaba River and associated bulk water infrastructure (water treatment, pipelines, pump stations, off-takes and reservoirs) in the Limpopo province. The EIA is being undertaken by ILISO Consulting with Zitholele Consulting providing the public participation support. The EIA is being undertaken according to the EIA Regulations under Section 24 (5) of the National Environmental Management Act (NEMA), (Act No 107 of 1998) as amended in Government Notice R385, 386, 387 – Government Gazette No. 28753 of 21 April 2006.

ILISO Consulting has appointed Margot Saner & Associates (Pty) Ltd to undertake the Health Impact Assessment (HIA) as part of the EIA.

1.2 STRUCTURE OF THIS REPORT

This specialist study will be undertaken in compliance with regulation 33(2) of GN 385. **Table 1.1** indicates how Regulation 33 of GN385 has been fulfilled in this report.

Figure	1.1: Indication	of compliance	with Regulation	33 in this report

Regulatory Requirements	Section of Report
(a) The persons who prepared the report; and the expertise of these persons to carry	Chapter 2
out the specialist study or specialised process.	
(b) a declaration that the person/s is/are independent	Page i
(c) an indication of the scope of, and the purpose for which, the report was prepared	Chapter 3
(d) a description of the methodology adopted in preparing the report or carrying out	Chapter 4
the specialised process	
(e) a description of any assumptions made and any uncertainties or gaps in	Chapter 5
knowledge	
(f) a description of the findings and potential implications of such findings on the	Chapter 6
impact of the proposed activity, including identified alternatives, on the environment	
(g) recommendations in respect of any mitigation measures that should be considered	Chapter 7
by the applicant and the competent authority	
(h) a description of any consultation process that was undertaken during the course of	Chapter 8
carrying out the study	
(i) a summary and copies of any comments that were received during any	Chapter 9
consultation process	
(j) any other information requested by the competent authority.	Chapter 10

2. PROJECT TEAM

This report was jointly compiled by Andrew Dickson and Margot Saner of Margot Saner & Associates (Pty) Ltd. Additional input was provided by Dr Lorraine Hodge of OAITC (Occupational and Industrial Training College) cc.

Margot Saner & Associates (Pty) Ltd is a Department of Labour Approved Inspection Authority (CI036OH) and has offered professional services in the fields of Occupational and Environmental Hygiene since 1993.

Margot Saner has been a Certified Occupational Hygienist (COH) with the Southern African Institute for Occupational Hygiene (SAIOH) for 24 years. Margot also holds the following qualifications: National Higher Diploma in Medical Technology and Animal Science, a BSc degree in Geology and Chemistry and a National Diploma in Safety Management. Margot has developed the Air Pathway Analysis System (APAS) for Landfill sites in South Africa which incorporates an exhaustive methodology for the assessment of health risks to both workers and communities. The APAS has been successfully implemented on 17 sites in South Africa. Margot is currently engaged in post graduate research in Waste Resource Management.

Andrew Dickson attained a BSc degree in Natural Science (Zoology, Physiology) from the University of the Witwatersrand in 1991. After joining Margot Saner & Associates in 1995, Andrew obtained a Diploma of Professional Competence in Occupational Hygiene from the British Institute of Occupational Hygiene (1995-1999). In 1999 he was registered as a Certified Occupational Hygienist (COH) by the Southern African Institute for Occupational Hygiene (SAIOH). Andrew has acquired some 12 years of experience in the field of Occupational Hygiene, specialising in Health Risk Assessments.

Dr Lorraine Hodge attained her National Higher Diploma in Medical Technology in 1976. She went on to attain a BTech, MTech and PhD in Applied Community Science, focusing on Environmental Health and Safety issues.

3. PURPOSE OF REPORT AND SCOPE OF WORK

The aim of this investigation is to conduct a presumptive Health Impact Assessment for the proposed Groot Letaba River Water Development Project. Health Impact Assessments (HIA) may be defined as "the estimation of the effects of a specified action on the health of a defined population" (Scott-Samuel 1999). The broad aims of a HIA are:

- to assess the potential health impacts (positive and negative) of projects.
- to improve public policy decision making through recommendations to enhance predicted positive health impacts whilst minimising negative ones.

The scope of work covered in this Health Impact Assessment is described in detail below:

3.1 BASELINE DESCRIPTION

This will include:

- The determination of the approximate number and general state of health of the construction workers involved in the project.
- The determination of the approximate number and state of health of the surrounding community.
- The identification of potential health risks to which construction workers engaged on the various sites will be exposed.
- The identification of potential health risks to which the surrounding communities will be exposed as a consequence of construction activities.
- The determination of the possible health impacts on construction workers and the surrounding communities as a consequence of water related diseases following construction of the proposed dam.

3.2 HEALTH IMPACT ASSESSMENT

This will include consideration of the following issues:

3.1.1 Construction Phase

- Health risks associated with transmittable diseases i.e. from construction workers to the surrounding communities.
- Health risks associated with transmittable diseases i.e. from surrounding communities to construction workers.
- Impacts of construction activities on construction workers.
- Impacts of construction activities on surrounding communities.

3.1.2 Operational Phase

- Potential health risks to surrounding communities associated with changing water levels.
- Potential health risks to surrounding communities associated with the change from a free-flowing river to a large body of water.
- Potential impacts on community health following the provision of an improved water supply system

4. METHODOLOGY

The key issues identified during the Scoping Phase informed the terms of reference of this Health Impact Assessment specialist study. Each of the identified issues consists of components that, on their own, or in combination with each other, give rise to potential impacts, either positive or negative and from the project onto the environment or from the environment onto the project. In the EIA, the significance of the potential impacts will be considered before and after identified mitigation has been implemented.

A description of the nature of the impact, any specific legal requirements and the stage (construction/decommissioning or operation) is provided. Impacts are considered to be the same during construction and decommissioning.

The following criteria are used to evaluate significance:

Nature

The nature of the impact will be classified as positive or negative, and direct or indirect.

Extent and location

Magnitude of the impact and is classified as:

- Local: the impacted area is only at the site the actual extent of the activity
- **Regional**: the impacted area extends to the surrounding, the immediate and the neighbouring properties.
- **National**: the impact can be considered to be of national importance.

Duration

This measures the lifetime of the impact, and is classified as:

Short term: the impact will be for 0 – 3 years, or only last for the period of construction.

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- Medium term: three to ten years.
- Long term: longer than 10 years or the impact will continue for the entire operational lifetime of the project.
- **Permanent**: this applies to the impact that will remain after the operational lifetime of the project.

Intensity

This is the degree to which the project affects or changes the environment, and is classified as:

- **Low**: the change is slight and often not noticeable, and the natural functioning of the environment is not affected.
- **Medium**: The environment is remarkably altered, but still functions in a modified way.
- **High**: Functioning of the affected environment is disturbed and can cease.

Probability

This is the likelihood or the chances that the impact will occur, and is classified as:

- Low: during the normal operation of the project, no impacts are expected.
- **Medium**: the impact is likely to occur if extra care is not taken to mitigate them.
- **High**: the environment will be affected irrespectively; in some cases such impact can be reduced.

Confidence

This is the level knowledge/information, the environmental impact practitioner or a specialist had in his/her judgement, and is rated as:

- Low: the judgement is based on intuition and not on knowledge or information.
- Medium: common sense and general knowledge informs the decision.

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• **High**: Scientific and or proven information has been used to give such a judgement.

Significance

Based on the above criteria the significance of the identified issues are determined. This is the importance of the impact in terms of physical extent and time scale, and is rated as:

- Low: the impacts are less important, but may require some mitigation action.
- **Medium**: the impacts are important and require attention; mitigation is required to reduce the negative impacts
- High: the impacts are of great importance. Mitigation is therefore crucial.

Cumulative Impacts

The possible cumulative impacts are also considered.

Mitigation

Mitigation for significant issues will be incorporated into the EMP for construction.

The methodology followed by this Health Impact Assessment was broadly based on that detailed in the following guidelines:

- European Policy Health Impact Assessment a Guide.
- The Merseyside Guidelines for Health Impact Assessment.

Reference was also made to the following specialist reports:

- Social Impact Assessment MasterQ Research (Vol 2, Annexure C).
- Noise Impact Assessment Jongens Keet Associates (Vol 2, Annexure I).
- Air Quality Impact Assessment Airshed Planning Professionals (Vol 2, Annexure F).

These reports are fully referenced in Chapter 12.

5. ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

- The identified potential health impacts and health effects have been qualitatively assessed only – i.e. no quantitative verification of impacts/effects has yet been undertaken. Recommendations in this regard are detailed in Chapter 7 of this report.
- For the purposes of this Health Impact Assessment, reference has been made to the following Specialist Studies:
 - Social Impact Assessment.
 - Noise Impact Assessment.
 - Air Quality Impact Assessment.

Any inaccuracies and/or uncertainties contained in these reports may have inadvertently been incorporated into the Health Impact Assessment. Each of these specialist reports details the relevant limitations and assumptions and gaps in knowledge.

- This Health Impact Assessment must be viewed as a prospective / predictive study as there has as yet been no initiation of any construction activities on any of the proposed sites. Additional commentary in this regard is provided in **Chapter 7**: Recommendations.
- •
- The time-frame allocated to this specialist study negated extensive on-site investigations. As such this Health Impact Assessment should be viewed as a desk-based study which will require on-site verification once construction activities have been initiated. Recommendations for future risk assessments and quantitative studies are detailed in Chapter 7.

6. FINDINGS

6.1 BASELINE DESCRIPTION

6.1.1 Number of construction workers and their state of health

The raising of the Tzaneen Dam wall will lead to the creation of approximately 50 jobs during the construction phase. The per annum direct temporary employment opportunity during the construction phase will be ¬250 jobs.

Most of the indirect and induced jobs will be created in the manufacturing, finance and business sector, mining, trade and accommodation sectors and transport sectors. During the construction phase, temporary employment will be created. The increased employment in the area during the construction phase will also result in increased expenditure, which will mean that more than just the proposed direct jobs required for the construction will be created due to economic spin-offs that will result. During the construction phase, local contractors and service providers will be utilised as far as practically possible.

There will be approximately 300 workers engaged at the proposed dam site at Nwamitwa. Fifty of these will be professional workers and will be accommodated with their families in Letsitele. Another fifty of the workers will be professional specifically in dam construction and will be sourced from outside of the region. These workers will be housed in the Letsitele single quarters. The remainder of the workforce (~200 workers) will be recruited locally and will be accommodated in their own homes. Approximately 50 of the 300 workers will be female.

Within the South African context, some concern is expressed about the potential state of health of construction workers, particularly with respect to the incidence of HIV and TB infection.

* Human Immunodeficiency Virus (HIV)

It can be expected that semi-skilled and unskilled construction workers sourced from outside of the region will, as migratory workers, exhibit an elevated incidence of Sexually Transmitted Infections (STI), including HIV. Based on the latest available (2006) Department of Health data (DoH Report on National HIV and Syphylis

Prevalence, 2006), locally sourced unskilled workers are also likely to have an elevated incidence of HIV infection (~24.7% of antenatal women in the Mopani District Municipality (MDM) were recorded as being HIV positive in 2006).

* **Tuberculosis (TB)**The incidence of Tuberculosis (TB) amongst construction workers is also likely to be elevated, irrespective of whether they are sourced locally or from outside of the region. South Africa has the seventh highest incidence of TB in the world (720 cases per 100,000 population in 2006) and the incidence of the disease has increased significantly in the last ten years. A total of 341,165 cases of TB were reported in 2006 (DoH Strategic Plan for TB: 2007-2011). The incidence of TB in South Africa is further complicated by the high rate of HIV infection, the proportion of co-infection with HIV/TB is ~55%. Treatment of TB has improved and cure rates have steadily increased, however an increasing number of patients receiving treatment fail to complete the course, resulting in ever-increasing cases of drug-resistant TB strains.

6.1.2 Number and state of health of surrounding communities

With respect to the number of persons living in the study area and the general state of their health, the following was established (data from the Integrated Development Plan for the Mopani District Municipality):

The proposed construction site at the Tzaneen Dam and the proposed site at Nwamitwa fall within the Greater Tzaneen Local Municipality (GTLM) and the Greater Letaba Local Municipality (GLLM) respectively. These municipalities form part of the **Mopani District Municipality** (MDP) of the Limpopo Province.

The **Greater Tzaneen Local Municipality** (GTLM) covers an area of \sim 3242km² and has a population of \sim 375,000 people. The population density is \sim 116 persons/km². There are \sim 97,400 households in the area and the average number of persons per household is \sim 3.9. Approximately 98% of the population is designated Black African, whilst Females comprise \sim 54% of the population. Almost half of the populace (48.7%) is under the age of 19 years.

The **Greater Letaba Local Municipality** (GLLM) covers an area of \sim 1891km² and has a population of \sim 220,000 people. The population density is \sim 116 persons/km². There are \sim 53,700 households in the area and the average number of persons per

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household is ~4.1. Approximately 99% of the population is designated Black African, whilst females comprise ~55% of the population. More than half of the populace (53.9%) is under the age of 19 years.

The town of Tzaneen lies in close proximity to the planned construction site for the raising of the Tzaneen Dam wall. The raising of the wall will not require acquisition of additional land as the flood level will remain within the area purchased for the original dam.

Villages located within the area of the proposed GLeWaP bulk water distribution area include: ka-Matubana, Nwanedzi, ka-Mandehakazi, ka-Mavele, Runnymede, Serolorolo, ga-Mookgo, Morapalala, Kadzumeri, Makhwivirini, Ooghoek, Hlohlokwe, Kampakeni, Merekome, Babanana and Kharangwani. The settlements closest to the proposed areas of primary construction activity include: Nkamboko (dam site at Nwamitwa), Serolololo (water reservoir), Miragoma (borrow pit) and Gamokgwathi (borrow pit).

Education levels throughout both the GTLM and the GLLM are generally low, with between 35-45% of the adult population having no formal education at all (Social Impact Study, MDM IDP).

With regard to the state of health of the populations within close proximity to the proposed construction sites, the following is relevant:

* Human Immunodeficiency Virus (HIV)

The incidence of Human Immunodeficiency Virus (HIV) infection is high throughout the Limpopo province, with a recorded 20.6% HIV incidence in antenatal women in 2006 (DoH Report on National HIV and Syphylis Prevalence, 2006). The Mopani District Municipality (MDM) had a recorded prevalence of HIV in antenatal women of 24.7% in 2006 (DoH Report on National HIV and Syphylis Prevalence, 2006). It is therefore not unreasonable to expect that the populations of the villages listed above will exhibit similar infection rates.

* Tuberculosis (TB)

The incidence of Tuberculosis (TB) amongst the local populace is likely to be fairly elevated. As noted, South Africa has the seventh highest incidence of TB in the world

(720 cases per 100,000 population in 2006). Limpopo Province has a lower infection rate than the rest of SA (apart from the Northern Cape) but the local incidence of TB is further complicated by the high rate of HIV infection within the local populace.

* Malaria

The Mopani District Municipality (MDM) is not considered to be an endemic malaria region. The Hans Merensky Nature Reserve located ~15km Northeast of the proposed site of the Nwamitwa dam is malaria free and visitors are not obliged to take malaria prophylactics. There remains some risk however as illustrated by the fact that ~20% of the annual recorded cases of malaria for the Limpopo Province (6369 cases in 2006) are recorded in the Mopani District Municipality (DoH Annual Malaria Statistics, 2006).

Local climate in the MDM can accommodate the insect vectors (Anopheles sp. mosquitoes) necessary for the spread of the malaria parasite (*P.falciparum*).

* Schistosomiasis (bilharzia)

The incidence of Schistosomiasis is difficult to estimate as it is not a notifiable disease. It is however recognised that schistosomiasis is second only to malaria in contributing to the disease burden in the developing world. The climate and rainfall characteristics of the Mopani District Municipality (MDM) make it likely that both *S.haemotobium* and *S.mansoni* are endemic to the area, provided that suitable intermediate hosts (pulmonate snails sp.) are present. The occupants of villages in close proximity to the Tzaneen township have better access to piped drinking/bathing/washing water and are therefore at lower risk of exposure to the disease. The population of the villages in the area of the proposed GLeWaP bulk water distribution area are more at risk of infection as they currently rely heavily on communal taps, borehole and/or river water.

* Diarrhoeal diseases

The lack of water-borne sewage systems in the proposed GLeWaP bulk water distribution area increases the risk of spread of diarrhoeal diseases as untreated sewage may enter rivers, streams and underground water resources. The risk of exposure to diarrhoeal disease is significantly lower in the Tzaneen townships which are supplied with water-borne sewage systems and/or Ventilation Improved Pit (VIP) latrines in accordance with RDP standards.

* Healthcare infrastructure/resources

Latest available information (Limpopo Department of Health and Welfare, 2003) shows that the status of healthcare services within the GTLM and GLLM is inadequate to effectively respond to the community health needs:

ISSUE	GLLM	GTLM
Fixed clinics	20	33
Prof nurse	77	187
Prof nurse:population ratio	1:2612	1:2588
Ave no of patients/nurse/month	1:974	1:572
Mobile clinics	4	10
Visiting points	141	457
Frequency	Monthly	Monthly
Prof nurses	4	10
District hospitals	2	2
Number of beds	262	250
Regional hospital	-	1
Private hospital	-	1
Special care hospital	-	-
Prof houses	58	55
Medical doctors	14	24
NGOs/CBOs dealing with HIV/AIDS	4	39

Figure 6.1: Health infrastructure and resources: Limpopo Province 2003

* Poverty

The majority of communities within the GTLM and TLLM are impoverished with generally poor standards of nutrition, especially amongst children. Poor nutritional standards impact adversely on the health status of populations and significantly increase the risk of disease.

In summary therefore, the health of the populations currently living in the settlements located within the proposed GLeWaP bulk water distribution area is compromised by several factors at present, including low income levels, poor nutritional standards, lack of access to health care facilities, high incidence of HIV and TB infections, largely unknown incidence of schistosomiasis and diarrhoeal disease. Malaria may

also present a threat and additional health concerns such as diabetes, hypertension and pneumonia may further complicate matters.

6.1.3 Potential health risks to which construction workers will be exposed

Construction workers engaged on all of the sites (Tzaneen Dam, dam site at Nwamitwa, borrow pits and sites of the bulk water distribution infrastructure) can be expected to be exposed to the following health risks:

• chemical stressors

- inhalation exposure to airborne hazardous chemical substances (total inhalable particulates, respirable particulates, cement dusts, bitumen fume, volatile organic compounds, welding fumes, gas-cutting fumes, diesel exhaust emissions).
- dermal exposure to volatile organic compounds, cement dusts, bitumen products.

• physical stressors

- excessive noise rating levels (plant machinery, pneumatic tools, impact tools, hammering, grinding, compressors, blasting).
- excessive heat stress conditions (work requiring moderate to high metabolic work rates under hot/humid environmental conditions).
- excessive cold stress conditions (night-time and early winter mornings).
- vibration (whole body vibration during operation of plant machinery and vehicles; hand-arm vibration when operating power tools, compactors).
- ultraviolet radiation (prolonged and/or repeated exposures to sunlight).

• ergonomic stressors

- work requiring manual lifting and carrying of heavy materials.
- work requiring heavy manual labour (digging, drilling etc).
- repetitive work.
- prolonged standing.
- prolonged sitting (machine operators).
- pushing / pulling activities.

• hazardous biological agents

• sexually transmitted diseases (HIV, syphilis).
- infectious diseases (TB, diarrhoeal diseases).
- vector borne diseases (malaria, schistosomiasis).

6.1.4 Potential health risks to communities during construction

Communities in close proximity to the construction sites (Tzaneen Dam, dam site at Nwamitwa, borrow pits and sites of the bulk water distribution infrastructure) can be expected to be exposed to the following health risks as a result of construction activities:

• chemical stressors

- inhalation exposure to airborne pollutants (total inhalable particulates, respirable particulates, cement dusts, bitumen fumes)
- ingestion exposure to pollutants released into existing water courses (oils, volatile organic compounds, pesticides, herbicides, sewage, garbage)

• physical stressors

Excessive noise rating levels (plant machinery, pneumatic tools, impact tools, hammering, grinding, compressors, blasting, operation of pump stations) – planned 24 hour work schedules

hazardous biological agents

- sexually transmitted diseases (HIV, syphilis)
- infectious diseases (TB, diarrhoeal diseases)
- vector borne diseases (malaria, schistosomiasis)

6.2 HEALTH IMPACT ASSESSMENT

Table 6.1: Health impacts associated with transmittable disease – from construction/maintenance workers to the surrounding communities

Description of potential impact	Transmission of HIV, syphilis, TB	
Legal requirements	TB is notifiable disease	
01		0 "
Stage	Construction and decommissioning	Operation

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Extent of impact	Regional	Regional
Duration of impact	Short term	Long term
Intensity	Medium	Low
Probability of occurrence	Medium	Medium
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Low
Mitigation measures (EMP requirements)	Testing, Treatment, Education	Testing, Treatment, Education
Level of significance after mitigation	Medium	Low
Cumulative Impacts	Simultaneous infections with HIV and other diseases may exacerbate condition	Simultaneous infections with HIV and other diseases may exacerbate condition
Comments or Discussion: As noted, the incidence of HIV and STI in migrant workers such as construction workers is likely to be elevated and may even exceed the already high prevalence rate amongst the local population (24.7% in antenatal women – 2006). Construction workers are more likely to engage in risky sexual practices and the risk of transmission of HIV		

/ STI from these workers to members of the local communities is deemed moderate-high.

Table 6.2: Health impacts associated with transmittable disease – from surrounding communities to construction/maintenance workers

Description of potential impact	Transmission of HIV, syphilis, TB	
Legal requirements	TB is notifiable disease	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Regional	Regional
Duration of impact	Short term	Long term
Intensity	Medium	Low
Probability of occurrence	Medium	Medium
Confidence of assessment	Medium	Medium
Level of significance before	Medium	Low

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mitigation		
miligation		
Mitigation measures (EMP	Testing Treatment Education	Testing Treatment Education
requirements)	resung, rreatment, Education	resung, rreament, Eucation
Level of significance after mitigation	Medium	Low
	Simultaneous infections with HIV and	Simultaneous infections with HIV and
Cumulative Impacts	other diseases may exacerbate	other diseases may exacerbate
	condition	condition
Comments or Discussion: ~24.7% of antenatal women in the Mopani District Municipality tested HIV positive in 2006. It		
can be assumed therefore that the incidence of HIV infection in the local community is high and that there is a strong		
possibility that there will be some transmission of HIV infection from locals to construction workers following high risk sexual		
interactions.		

Table 6.3: Health impacts on construction workers associated with
construction activities – noise rating levels

Description of potential impact	Exposure to excessive noise rating levels (LAr,8h > 85dBA)	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Noise Induced Hearing Loss Regulations, SANS 10083:2004	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Medium-High	Medium
Probability of occurrence	High	Medium
Confidence of assessment	Medium	Medium
Level of significance before mitigation	High	Medium
Mitigation measures (EMP requirements)	Noise survey, Noise zoning, issue of PPE (hearing protective devices), Audiometry, Training	Noise survey, Noise zoning, issue of PPE (hearing protective devices), Audiometry, Training
Level of significance after mitigation	Medium	Low
Cumulative Impacts		

Comments or Discussion: Construction activities are known to generate excessive noise rating levels to which workers are very likely to be directly exposed. There is a high probability that some workers (machine/tool operators, blasting teams) will be exposed to 8 hour average noise rating levels in excess of the Statutory limit (85dBA). As a consequence there is a real risk of construction workers suffering from some form of noise induced hearing loss.

Table 6.4: Health impacts on construction workers associated with
construction activities – inhalation exposure to Hazardous
Chemical Substances

Description of potential impact	Inhalation Exposure to Hazardous Chemical Substances (total inhalable, respirable particulates, cement dusts, bitumen fume, welding fume, VOC, diesel exhaust emissions)	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Regulations for Hazardous Chemical Substances, Construction Regulations; National Environment Management Air Quality Act (Act 39 of 2004)	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Medium	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Low
Mitigation measures (EMP requirements)	Baseline HCS Risk Assessment, Personal and ambient air sampling surveys, PPE (respiratory protective equipment), Medical surveillance, Training	Baseline HCS Risk Assessment, Personal and ambient air sampling surveys, PPE (respiratory protective equipment), Medical surveillance, Training
Level of significance after mitigation	Low	Low
Cumulative Impacts	Exposure to elevated airborne concentrations of HCS could complicate any existing medical conditions	Exposure to elevated airborne concentrations of HCS could complicate any existing medical conditions

Comments or Discussion: Construction activities will result in the emission of several airborne pollutant compounds, primarily airborne particulate matter (total inhalable and PM10 / respirable dusts). Road tarring activities are likely to expose workers to airborne concentrations of bitumen fumes and coal tar pitch volatiles (carcinogenic). Concrete fabrication will expose workers to airborne concentrations of cement dusts (irritant and corrosive). Operation of diesel powered vehicles will expose workers to airborne diesel exhaust fume (including carcinogenic diesel particulate matter).

Table 6.5: Health impacts on construction workers associated with
construction activities – dermal exposure to Hazardous
Chemical Substances

Description of potential impact	Dermal Exposure to Hazardous Chemical Substances (cement dusts, bitumen, VOC, misc oils and greases)	
Lagal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Regulations for Hazardous	
Legarrequirements	Chemical Substances, Construction Regulations	
Stage	Construction and decommissioning Operation	
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Short term
Intensity	Low	Low
Probability of occurrence	Medium	Medium
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Medium
	Baseline HCS Risk Assessment,	Baseline HCS Risk Assessment,
Mitigation measures (EMP	Personal and ambient air sampling	Personal and ambient air sampling
requirements)	surveys, PPE (respiratory protective	surveys, PPE (respiratory protective
	equipment), Medical surveillance,	equipment), Medical surveillance,
	l raining	Iraining
Level of significance after mitigation	Low	Low
	Dermal exposure to solvents and oils	Dermal exposure to solvents and oils
Cumulative Impacts	could increase the risk of secondary	could increase the risk of secondary
	skin infections	skin infections
Comments or Discussion: Construction workers are likely to experience direct skin contact with a variety of chemical		
Comments or Discussion: Construction	workers are likely to experience direct skin	contact with a variety of chemical

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ranging from localised irritation of exposed skin to absorption of the chemicals through intact skin and into the body where they may cause systemic health effects.

Table 6.6: Health impacts on construction workers associated with construction activities – Heat Stress

Description of potential impact	Exposure to Heat Stress Conditions	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Environmental Regulations, Construction Regulations	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Medium	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Low
Mitigation measures (EMP requirements)	Baseline Heat Stress Risk Assessment, PPE, Acclimatisation, Medical surveillance, Training	Baseline Heat Stress Risk Assessment, PPE, Acclimatisation, Medical surveillance, Training
Level of significance after mitigation	Low	Low
Cumulative Impacts	Exposure to excessive heat stress could exacerbate other, existing medical conditions	Exposure to excessive heat stress could exacerbate other, existing medical conditions

Comments or Discussion: Local climate may periodically cause workers to be exposed to high air temperatures as well as elevated humidity levels (>50%), especially in Summer. Whilst the risk of outdoor worker exposure to Wet Bulb Globe Temperatures (WBGT) in excess of the Statutory limit (30 for 1 hour) is likely to be low, workers performing tasks which require moderate to high metabolic work rates (digging, carrying, lifting), or which are performed indoors, may be at some risk of developing heat stress related symptoms (heat syncope, heat exhaustion, heatstroke).

Table 6.7: Health impacts on construction workers associated with construction activities – Cold Stress

Description of potential impact	Exposure to Cold Stress Conditions	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Environmental Regulations, Construction Regulations	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Medium	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Low
Mitigation measures (EMP requirements)	Baseline Cold Stress Risk Assessment, PPE, Medical surveillance, Training	Baseline Cold Stress Risk Assessment, PPE, Medical surveillance, Training
Level of significance after mitigation	Low	Low
Cumulative Impacts	Exposure to excessive cold stress could increase the risk of exacerbating other medical conditions	Exposure to excessive cold stress could increase the risk of exacerbating other medical conditions
Comments or Discussion: Local climate	ensures that worker exposure to air temperature of workers being exposed to concern	eratures <6°C is unlikely to occur except

Comments or Discussion: Local climate ensures that worker exposure to air temperatures <6°C is unlikely to occur except on occasional winter nights or mornings. The risk of workers being exposed to <6°C for more than the Statutory limit of 4 hours is low as air temperatures rise rapidly following sunrise. Construction activities are however planned for 24 hours and there may be some risk of worker exposure to uncomfortably cold conditions during winter nights and early mornings.

Table 6.8: Health impacts on construction workers associated with construction activities – Vibration Stress

Description of potential impact	Exposure to Vibration Stress	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Construction Regulations	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Medium	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Low
	Baseline Ergonomics Risk	Baseline Ergonomics Risk
Mitigation measures (EMP	Assessment, Vehicle, Tool, Plant	Assessment, Vehicle, Tool, Plant
requirements)	Maintenance, PPE, Medical	Maintenance, PPE, Medical
	surveillance, Training	surveillance, Training
Level of significance after mitigation	Low	Low
Cumulative Impacts	Exposure to vibration stress could exacerbate other medical conditions	Exposure to vibration stress could exacerbate other medical conditions
Comments or Discussion: Vehicle operators may be at some risk of exposure to Whole Body Vibration (WBV) whilst		

Comments or Discussion: Vehicle operators may be at some risk of exposure to Whole Body Vibration (WBV) whilst operators of compactors, drilling machines and similar tool/machinery may be at risk of exposure to Hand-Arm Vibration (HAV). Plant equipment, pumps, compressors may also be sources of vibration. Actual assessment of these risks would only be possible once it is known what equipment is to be used at the sites and what state of repair it is in. The impact of the operation of pump stations would require similar assessment following completion and commissioning.

Table 6.9: Health impacts on construction workers associated with construction activities – UV Radiation

Description of potential impact	Exposure to Ultraviolet Radiation (sunlight)	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Construction Regulations	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Short term
Intensity	Medium	Medium
Probability of occurrence	High	Medium
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Medium
Mitigation measures (EMP	PPE, Medical surveillance, Education,	PPE, Medical surveillance, Education,
requirements)	Training	Training
Level of significance after mitigation	Low	Low
Cumulative Impacts	n/a	n/a
Comments or Discussion: Construction workers will spend the majority of their time outdoors and directly exposed to		

Comments or Discussion: Construction workers will spend the majority of their time outdoors and directly exposed to sunlight. South Africa has a very high incidence of solar UVA and UVB and there is a high risk of suffering skin damage following prolonged or repeated exposures to sunlight. Although fair skinned people are most at risk in this regard, darker skinned persons can also develop serious and life threatening conditions (cancers) if exposed to excessive amounts of sunlight.

Table 6.10: Health impacts on construction workers associated with construction activities – Ergonomic Stress

Description of potential impact	Exposure to Ergonomic Stress	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Construction Regulations	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Short term
Intensity	Medium	Low
Probability of occurrence	Medium	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Low
Mitigation measures (EMP	Mechanical assistance, Medical	Mechanical assistance, Medical
requirements)	surveillance, Education, Training	surveillance, Education, Training
Level of significance after mitigation	Medium	Low
Cumulative Impacts	n/a	n/a
Comments or Discussion: Many of the c	onstruction workers will engage in manual	labour activities which require physical
strength to perform and may consequently	expose them to musculo-skeletal stresses	and strains. Although mechanical

assistance may be available for digging and transport purposes there remains significant risk of injury to workers. Correct training is vital if injuries are to be prevented.

Table 6.11: Health impacts on construction workers associated with construction activities - Malaria

Description of potential impact	Exposure to Hazardous Biological Agents - Malaria	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Regulations for Hazardous Biological Agents	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Medium	Medium
Probability of occurrence	Low	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Medium
Level of significance before mitigation	Medium Prophylaxis, Chemical control	Medium Prophylaxis, Chemical control
Level of significance before mitigation Mitigation measures (EMP	Medium Prophylaxis, Chemical control (Spraying of Accommodations with	Medium Prophylaxis, Chemical control (Spraying of Accommodations with
Level of significance before mitigation Mitigation measures (EMP requirements)	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance,	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance,
Level of significance before mitigation Mitigation measures (EMP requirements)	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training
Level of significance before mitigation Mitigation measures (EMP requirements) Level of significance after mitigation	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low
Level of significance before mitigation Mitigation measures (EMP requirements) Level of significance after mitigation	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low Malaria infection is very likely to	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low Malaria infection is very likely to
Level of significance before mitigation Mitigation measures (EMP requirements) Level of significance after mitigation Cumulative Impacts	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low Malaria infection is very likely to impact adversely on any pre-existing	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low Malaria infection is very likely to impact adversely on any pre-existing
Level of significance before mitigation Mitigation measures (EMP requirements) Level of significance after mitigation Cumulative Impacts	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low Malaria infection is very likely to impact adversely on any pre-existing medical condition	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low Malaria infection is very likely to impact adversely on any pre-existing medical condition
Level of significance before mitigation Mitigation measures (EMP requirements) Level of significance after mitigation Cumulative Impacts Comments or Discussion: Although the	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low Malaria infection is very likely to impact adversely on any pre-existing medical condition Mopani District Municipality (MDM) is not a	Medium Prophylaxis, Chemical control (Spraying of Accommodations with DDT), Medical surveillance, Education, Training Low Malaria infection is very likely to impact adversely on any pre-existing medical condition an endemic malaria region, incidences of

Comments or Discussion: Although the Mopani District Municipality (MDM) is not an endemic malaria region, incidences of malaria are regularly recorded. During 2006, ~20% of the 6369 cases of malaria recorded in Limpopo Province where from the MDM. Whilst no hard evidence exists to confirm the presence of either the malarial parasite (*P.falciparum*) or the insect vector (Anopheles mosquitoes) in the area, construction workers may be at some risk of contracting malaria from already infected persons (via a mosquito vector). Development of a comprehensive malaria control programme for the construction sites would however adequately address these risks. The incidence of malaria is very seasonal, with the vast majority of cases being recorded in the summer wet season. Precautionary measures and controls should be prioritised during the peak infection season.

Table 6.12: Health impacts on construction workers associated with construction activities - Schistosomiasis

Description of potential impact	Exposure to Hazardous Biological Agents - Schistosomiasis	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Regulations for Hazardous Biological Agents	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Low	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Low	Low
Mitigation measures (EMP	Clean water supply, Medical	Clean water supply, Medical
requirements)	surveillance, Education, Training	surveillance, Education, Training
Level of significance after mitigation	Low	Low
Cumulative Impacts	Schistosomiasis is very likely to impact adversely on any pre-existing medical condition	Schistosomiasis is very likely to impact adversely on any pre-existing medical condition

Comments or Discussion: Because schistosomiasis is not a notifiable disease its incidence in the Mopani District Municipality (MDM) is largely unknown. There is some evidence to suggest that between 10-50% of children under 14 years of age may be (or have been) infected. Construction workers are likely to be at minimal risk of contracting the disease provided they observe basic precautions such as not drinking from unknown water sources, not bathing, washing in untreated water. As the construction sites will have ready access to clean potable water the risks of exposure should be lower than for the local populace. Construction workers are also likely to have better access to health services which will ensure better diagnosis and treatment.

Table 6.13 :Health impacts on construction workers associated with construction activities – Diarrhoeal Diseases

Description of potential impact	Exposure to Hazardous Biological Agents - Infectious Diarrhoeal Diseases	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Regulations for Hazardous Biological Agents	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Low	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Low	Low
Mitigation measures (EMP requirements)	Clean water supply, Formal ablution facilities, Good food hygiene and personal hygiene practices, Medical surveillance, Education, Training	Clean water supply, Formal ablution facilities, Good food hygiene and personal hygiene practices, Medical surveillance, Education, Training
Level of significance after mitigation	Low	Low
Cumulative Impacts	Diarrhoeal diseases are very likely to impact adversely on any pre-existing medical condition	Diarrhoeal diseases are very likely to impact adversely on any pre-existing medical condition
Comments or Discussion: Construction they observe basic precautions such as no and making use of controlled ablution facili water, formal controlled ablution facilities a pathogenic micro-organisms will be signifi	workers are likely to be at minimal risk of c ot drinking from unknown water sources, no ities. Provided that the construction sites h and well run kitchen and canteen facilities, cantly lower than for the local populace. C	ontracting diarrhoeal disease provided ot bathing or washing in untreated water ave ready access to clean potable the risks of worker exposure to onstruction workers are also likely to

have better access to health services which will ensure better diagnosis and treatment should any disease be contracted.

Table 6.14: Health impacts on communities associated with construction activities – Hazardous Chemical Substances (Tzaneen site)

	Inhalation Exposure to ambient concentrations of Hazardous Chemical Substances (total inhalable, respirable particulates, cement dusts, diesel	
Description of potential impact		
	exhaust emissions) – Tzaneen site	
	Occupational Health & Safety Act (Act 8	5 0f 1993) – Regulations for Hazardous
Legal requirements	Chemical Substances, National Environr	nent Management Air Quality Act (Act
	39 of 2004)	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	High	Low
Confidence of assessment	High	High
Level of significance before	Low	l ow
mitigation		
Mitigation measures (FMP	Baseline Air Quality Impact	Management of effective dust control
requirements)	Assessment, effective dust control	nrogrammes
i oquii omontoj	programmes	programmoo
Level of significance after mitigation	Low	Low
	Exposure to elevated airborne	Exposure to elevated airborne
Cumulativa Impacta	concentrations of HCS could	concentrations of HCS could
Cumulative impacts	complicate any existing medical	complicate any existing medical
	conditions	conditions
Comments or Discussion: Construction	activities at the Tzaneen site will result in t	he emission of airborne pollutant
compounds, particularly airborne particulate matter (total inhalable and PM10 / respirable dusts). Concrete fabrication will		
generate airborne concentrations of ceme	nt dusts (irritant and corrosive) whilst the o	peration of diesel powered machinery
will generate airborne concentrations of diesel exhaust emissions including carcinogenic diesel particulate matter. Based on		
the outcome of the Air Quality Impact Ass	essment, particulate emissions generated a	at the construction site are unlikely to

will generate airborne concentrations of diesel exhaust emissions including carcinogenic diesel particulate matter. Based o the outcome of the Air Quality Impact Assessment, particulate emissions generated at the construction site are unlikely to impact significantly on nearby sensitive receptors. The associated health risk to residents is therefore minimal and can be effectively reduced even further by implementation of appropriate mitigation measures.

Table 6.15: Health impacts on communities associated with construction activities - Hazardous Chemical Substances (Nwamitwa site)

Description of potential impact	Inhalation Exposure to ambient concentrations of Hazardous Chemical Substances (total inhalable, respirable particulates, cement dusts, bitumen fume, diesel exhaust emissions) – Nwamitwa site	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Regulations for Hazardous Chemical Substances, National Environment Management Air Quality Act (Act 39 of 2004)	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Medium	Low
Probability of occurrence	High	Low
Confidence of assessment	High	High
Level of significance before mitigation	Medium (Nkamboko)	Low
Mitigation measures (EMP requirements)	Baseline Air Quality Impact Assessment, effective dust control programmes	Management of effective dust control programmes
Level of significance after mitigation	Low	Low
Cumulative Impacts	Exposure to elevated airborne concentrations of HCS could complicate any existing medical conditions	Exposure to elevated airborne concentrations of HCS could complicate any existing medical conditions
Comments or Discussion: Construction	n activities at the Nwamitwa site will result matter (total inhalable and PM10 / respire	It in the emission of airborne pollutant able dusts) bitumen fumes and coal tar

Comments or Discussion: Construction activities at the Nwamitwa site will result in the emission of airborne pollutant compounds, including airborne particulate matter (total inhalable and PM10 / respirable dusts), bitumen fumes and coal tar pitch volatiles (carcinogenic), cement dusts (irritant and corrosive) and diesel exhaust emissions including carcinogenic diesel particulate matter. Based on the completed Air Quality Impact Assessment, emissions of particulate matter from dam wall construction activities are only likely to impact significantly on the nearby Nkamboko settlement. In the absence of any effective mitigation measures, the residents of Nkamboko may be at risk of exposure elevated airborne concentrations of PM10 respirable dusts which may in turn impact adversely on their health. Following completion of construction activities, routine operation of the infrastructure is unlikely to impact significantly on ambient air quality / public health.

Table 6.16: Health impacts on communities associated with constructionactivities - Hazardous Chemical Substances (Bulk infrastructuresites)

Description of potential impact	Inhalation Exposure to ambient concentrations of Hazardous Chemical Substances (total inhalable, respirable particulates, cement dusts, bitumen fume, diesel exhaust emissions) – Bulk infrastructure sites (reservoirs, pumpstations, water treatment plant)	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Regulations for Hazardous Chemical Substances, National Environment Management Air Quality Act (Act 39 of 2004)	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Medium	Low
Probability of occurrence	High	Low
Confidence of assessment	High	High
Level of significance before mitigation	Medium (Serolololo)	Low
Mitigation measures (EMP requirements)	Baseline Air Quality Impact Assessment, effective dust control programmes	Management of effective dust control programmes
Level of significance after mitigation	Low	Low
Cumulative Impacts	Exposure to elevated airborne concentrations of HCS could complicate any existing medical conditions	Exposure to elevated airborne concentrations of HCS could complicate any existing medical conditions
Comments or Discussion: Construction activities at the reservoir and pump station sites will result in the emission of airborne pollutant compounds, including airborne particulate matter (total inhalable and PM10 / respirable dusts), cement dusts (irritant and corrosive) and diesel exhaust emissions (carcinogenic). Based on the completed Air Quality Impact		

dusts (irritant and corrosive) and diesel exhaust emissions (carcinogenic). Based on the completed Air Quality Impact Assessment, emissions of particulate matter from these sites are only likely to impact significantly on the Serolololo settlement. In the absence of effective mitigation measures, residents of Serolololo may be at risk of exposure elevated airborne concentrations of PM10 dusts – may impact adversely on their health. Following completion of the construction

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activities, routine operation of the bulk infrastructure is unlikely to impact significantly on ambient air quality / public health.

Table 6.17: Health impacts on communities associated with construction

activities - Hazardous Chemical Substances (Borrow Pits)		
Description of potential impact	Inhalation Exposure to ambient concentrations of Hazardous Chemical Substances (total inhalable, respirable particulates, cement dusts, bitumen fume, diesel exhaust emissions) – Borrow Pits	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Regulations for Hazardous Chemical Substances, National Environment Management Air Quality Act (Act 39 of 2004)	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	n/a
Extent of impact	Local	n/a
Duration of impact	Short term	n/a
Intensity	Low	n/a
Probability of occurrence	High	n/a
Confidence of assessment	High	n/a
Level of significance before mitigation	Low	n/a
Mitigation measures (EMP requirements)	Baseline Air Quality Impact Assessment, effective dust control programmes	n/a
Level of significance after mitigation	Low	n/a
Cumulative Impacts	Exposure to elevated airborne concentrations of HCS could complicate any existing medical conditions	n/a
Comments or Discussion: Borrow pit activities will result in the emission of airborne pollutant compounds. including		

Comments or Discussion: Borrow pit activities will result in the emission of airborne pollutant compounds, including airborne particulate matter (total inhalable and PM10 / respirable dusts) and diesel exhaust emissions (including carcinogenic diesel particulate matter). Based on the completed Air Quality Impact Assessment, emissions of particulate matter from borrow pit activities are unlikely to impact significantly on any of the residential settlements – i.e. minimal public health risk.

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Table 6.18:Health impacts on communities associated with construction
activities - Hazardous Chemical Substances (Transport of
Material)

Description of potential impact	Inhalation Exposure to ambient concentrations of Hazardous Chemical Substances (total inhalable, respirable particulates, cement dusts, bitumen fume, diesel exhaust emissions) – Transportation of material	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Regulations for Hazardous Chemical Substances, National Environment Management Air Quality Act (Act 39 of 2004)	
Stage	Construction and decommissioning Operation	
Nature of Impact	Negative	n/a
Extent of impact	Local	n/a
Duration of impact	Short term	n/a
Intensity	Low	n/a
Probability of occurrence	High	n/a
Confidence of assessment	High	n/a
Level of significance before mitigation	Low	n/a
Mitigation measures (EMP requirements)	Baseline Air Quality Impact Assessment, effective dust control programmes	n/a
Level of significance after mitigation	Low	n/a
Cumulative Impacts	Exposure to elevated airborne concentrations of HCS could complicate any existing medical conditions	n/a

Comments or Discussion: Transport of materials along roadways will result in the entrainment of airborne particulate matter (total inhalable and PM10 / respirable dusts) and diesel exhaust emissions (including carcinogenic diesel particulate matter). Based on the completed Air Quality Impact Assessment, emissions of particulate matter from transport activities are unlikely to impact significantly on any of the residential settlements – i.e. minimal public health risk.

Table 6.19: Health impacts on communities associated with construction activities – Ingestion of pollutants

Description of potential impact	Ingestion exposure to pollutants released into existing water courses	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Regulations for Hazardous Chemical Substances, National Environment Management Air Quality Act (Act 39 of 2004)	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Medium	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Low
Mitigation measures (EMP requirements)	Effective pollution control programmes	Effective pollution control programmes
Level of significance after mitigation	Low	Low
Cumulative Impacts	Exposure to elevated levels of pollutant compounds in drinking water will complicate any existing medical conditions	Exposure to elevated levels of pollutant compounds in drinking water will complicate any existing medical conditions
Comments or Discussion: Construction courses if control measures are not effective bulk water distribution area obtains at lease	activities may generate chemical pollutants vely implemented. The majority of the loca	s which could enter the existing water I populace within the proposed GLeWaP

comments or Discussion: Construction activities may generate chemical pollutants which could enter the existing water courses if control measures are not effectively implemented. The majority of the local populace within the proposed GLeWaP bulk water distribution area obtains at least some of their water from uncontrolled sources (rivers, boreholes) which may be readily polluted following spillage (deliberate or accidental) of chemicals as a result of construction activities. Following completion of construction activities, routine operation of the infrastructure is unlikely to pose any significant risk of additional water pollution.

Table 6.20: Health impacts on communities associated with construction activities – Noise Rating Levels

Description of potential impact	Exposure to excessive ambient noise rating levels	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993) – Noise Induced Hearing Loss Regulations, SANS 10083:2004, SANS 10103:2003, SANS 10328:2003	
Stage	Construction and decommissioning	Operation
Nature of Impact	Negative	Negative
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Medium	Low
Probability of occurrence	Medium	Low
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Low
Mitigation measures (EMP requirements)	Baseline ambient noise survey, Engineering control measures, Noise control program	Baseline ambient noise survey, Engineering control measures, Noise control program
Level of significance after mitigation	Low	Low
Cumulative Impacts		
Comments or Discussion: Construction activities will generate elevated noise rating levels which are likely to have some		

Comments or Discussion: Construction activities will generate elevated noise rating levels which are likely to have some impact on ambient noise rating levels in the surrounding communities. These impacts are however expected it be restricted to annoyance and irritation rather than having significant health impacts. The planned 24 hour operation of some construction sites is likely to cause some annoyance to affected parties during night-time.

Table 6.21: Health impacts on communities associated with construction activities - Malaria

Description of potential impact	Exposure to Hazardous Biological Agents - Malaria	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Regulations for Hazardous Biological Agents	
Stage	Construction and decommissioning	Operation
Nature of Impact	Positive	Positive
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Medium	Medium
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Low	Low
Mitigation measures (EMP requirements)	Prophylaxis, Chemical control (Spraying of dwellings with DDT), Medical surveillance, Education, Training	Prophylaxis, Chemical control (Spraying of dwellings with DDT), Medical surveillance, Education, Training
Level of significance after mitigation	Low	Low
Cumulative Impacts	Malaria infection is very likely to impact adversely on any pre-existing medical condition	Malaria infection is very likely to impact adversely on any pre-existing medical condition
Comments or Discussion: As noted, despite the Mopani District Municipality (MDM) not being an endemic malaria region, incidences of malaria are regularly recorded. During 2006, ~20% of the 6369 cases of malaria recorded in Limpopo Province		

incidences of malaria are regularly recorded. During 2006, ~20% of the 6369 cases of malaria recorded in Limpopo Province where from the MDM region. Whilst no hard evidence exists to confirm the presence of either the malarial parasite (*P.falciparum*) or the insect vector (Anopheles mosquitoes) in the area, construction activities may in fact lower the risk of community members contracting malaria due to improved vector control through effective spraying campaigns. The development of a comprehensive malaria control programme for the construction sites could also effectively address malaria risks in surrounding communities. It is unlikely that, following construction activities, the new dam at Nwamitwa will increase the risk of malaria in the MDM region – the dam may in fact reduce the risks due to infiltration/inundation of previous potential mosquito habitats.

Table 6.22: Health impacts on communities associated with construction activities - Schistosomiasis

Description of potential impact	Exposure to Hazardous Biological Agents - Schistosomiasis	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Regulations for Hazardous Biological Agents	
Stage	Construction and decommissioning	Operation
Nature of Impact	Positive	Positive
Extent of impact	Local	Local
Duration of impact	Short term	Long term
Intensity	Low	Low
Probability of occurrence	Medium	Medium
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Medium
Mitigation measures (EMP	Clean water supply, Medical	Clean water supply, Medical
requirements)	surveillance, Education, Training	surveillance, Education, Training
Level of significance after mitigation	Medium	Medium
Cumulative Impacts	Schistosomiasis is very likely to impact adversely on any pre-existing medical condition	Schistosomiasis is very likely to impact adversely on any pre-existing medical condition

Comments or Discussion: Although the incidence of schistosomiasis in the Mopani District Municipality (MDM) is largely unknown, there is some evidence to suggest that between 10-50% of children under 14 years of age may be (or have been) infected. The construction of the dam at the Nwamitwa site and the provision of bulk water supply infrastructure to the broader community will undoubtedly reduce the risk of locals contracting schistosomiasis. Provision of clean potable water to households will prevent occupants from having to collect water from uncontrolled sources and thereby reduce their risk of exposure to schistosoma pathogens and vectors. Education will further improve matters.

Table 6.23: Health impacts on communities associated with construction activities – Diarrhoeal Diseases

Description of potential impact	Exposure to Hazardous Biological Agents - Infectious Diarrhoeal Diseases	
Legal requirements	Occupational Health & Safety Act (Act 85 0f 1993), Regulations for Hazardous Biological Agents	
Stage	Construction and decommissioning	Operation
Nature of Impact	Positive	Positive
Extent of impact	Local	Local
Duration of impact	Short term	Short term
Intensity	Low	Low
Probability of occurrence	Medium	High
Confidence of assessment	Medium	Medium
Level of significance before mitigation	Medium	Medium-High
Mitigation measures (EMP requirements)	Clean water supply, improved ablution facilities, improved food hygiene and personal hygiene, Education	Clean water supply, improved ablution facilities, improved food hygiene and personal hygiene, Education
Level of significance after mitigation	Medium	Medium-High
Cumulative Impacts	Diarrhoeal diseases are very likely to impact adversely on any pre-existing medical condition	Diarrhoeal diseases are very likely to impact adversely on any pre-existing medical condition

Comments or Discussion: The construction of the dam at the Nwamitwa site and the provision of bulk water supply infrastructure to the broader community will reduce the risk of locals contracting diarrhoeal diseases. Provision of clean potable water to households will prevent occupants from having to collect water from uncontrolled sources and thereby reduce their risk of exposure to pathogenic micro-organisms associated with causing diarrhoeal disease. Education will further improve matters. Similarly, the provision of water borne sewage systems or RDP approved latrine facilities will significantly lower the risk of infection. Education will further improve matters

7. RECOMMENDED MITIGATION MEASURES

7.1 MITIGATION MEASURES: TRANSMITTABLE DISEASES

Construction workers

- All construction workers should be subject to baseline (pre-employment) medical examinations. The structure of these examinations should be at the discretion of a registered Occupational Medical Practitioner but should include appropriate testing for:
 - o Tuberculosis.
 - HIV (voluntary consent but strongly encouraged).
 - o Syphilis.
 - Other STI.
- Infected workers must be afforded appropriate treatment and/or counselling whilst all workers should be subject to education and training in the health risks associated with high risk sexual activities.
- Workers must be made familiar with the routes of exposure to STI and TB as well as ways to reduce the risks and/or prevent infection.
- Workers should be made to be familiar with the signs and symptoms of STI and should be encouraged to seek prompt treatment in the event of them developing these signs and symptoms.
- Consideration should be given to distributing free condoms to workers and encouraging their use through education.

Surrounding community

- Members of the communities should be encouraged to undergo voluntary examination/testing for:
 - o Tuberculosis.
 - o HIV.
 - o Syphilis.
 - Other STI.
- Infected individuals should be encouraged to undergo appropriate treatment and/or counselling.
- Communities should be made familiar with the routes of exposure to HIV/STI and TB as well as ways to reduce the risks and/or prevent infection.

- Communities should also be made to be familiar with the signs and symptoms of infection and should be encouraged to seek prompt treatment in the event of them developing these signs and symptoms.
- Local healthcare resources are already struggling to cope with current HIV/AIDS and TB related infections and disease. Prior to initiation of construction activities it is recommended that community leaders be informed of the possible health risks associated with transmission of disease from/to workers and the communities. Community leaders should then be encouraged to distribute this knowledge and information to their community members.

7.2 MITIGATION MEASURES: NOISE RATING LEVELS

Construction workers

- In terms of the Construction Regulations promulgated under the Occupational Health and Safety Act (Act 85 of 1993), it is required of all contractors to conduct a baseline risk assessment prior to performing any construction activities. This risk assessment must identify and evaluate all of the risks to the health and safety of persons engaging in construction activities.
- Given that construction activities will expose workers to excessive noise rating levels it is recommended that a baseline noise survey also be conducted as soon as possible following commencement of site activities in accordance with the requirements of the Noise Induced Hearing Loss Regulations (OHSAct 85 of 1993) and SANS 10083:2004. This noise survey will quantify worker exposures to noise during typical activities and allow for informed comment on the relative risks to hearing presented by various activities i.e. identify sources of excessive noise and allow for demarcation of noise zones. Recommendations with regard to appropriate control measures (engineering controls and/or personal protective equipment) can then follow. A formal noise survey will also permit structuring of an appropriate audiometric examination protocol for construction workers as required by the Noise Induced Hearing Loss Regulations OHSAct 85 of 1993.

Surrounding communities

The health risks to surrounding communities presented by ambient noise rating levels generated by activities conducted on the various construction sites are likely to be low based on the findings of the Noise Impact Assessment. Noise generated by construction activities are however likely to present some annoyance to affected

residents, with night-time and after-hours activities being of particular concern. Mitigation measures to limit such annoyance noise are detailed in the Noise Impact Assessment.

7.3 MITIGATION MEASURES: HAZARDOUS CHEMICAL SUBSTANCES

Construction workers

- Workers engaged on the various construction sites are likely to be at some risk of inhalation and/or dermal exposure to a large variety of HCS. In order to formally assess the health risks associated with such exposures it is a requirement of law (Construction Regulations and the Regulations for Hazardous Chemical Substances – OHSAct 85 of 1993) that an initial HCS Risk Assessment be performed. It is strongly recommended that an initial HCS Risk Assessment be performed for each of the construction sites. The outcomes of these assessments will permit specific and relevant comment on the suitability of existing engineering control measures, Personal Protective Equipment, policies and work procedures in preventing/controlling worker exposure to HCS. Comment on the need for personal air monitoring programmes and/or medical surveillance programmes will also be assessed by these baseline studies.
- In order to minimise the generation of dust by construction activities it is recommended that a formal wetting down procedures for sites be drafted and implemented. Additional dust control measures are detailed under the discussion for surrounding communities (overleaf).
- All diesel powered equipment and vehicles used in construction activities must be suitably serviced, maintained and repaired in order to minimise the emission of diesel particulate matter and reduce subsequent worker exposure to this carcinogenic substance.

Surrounding communities

- Construction activities will also cause surrounding communities to be potentially exposed to a range of airborne pollutants. The outcome of the Air Quality Impact Assessment revealed that the only community likely to be significantly affected by ambient particulate emissions from construction activities is the Nkamboko settlement (proposed dam wall site at Nwamitwa).
- In order to minimise the generation of particulate emissions from construction activities it is recommended that:

- All roads, accessways and other unpaved areas on which vehicular traffic will be required to operate should be subject to appropriate dust control measures. Application of chemical suppressant materials to road surfaces is an effective means of reducing dust generation. Simple wetting down with water may also prove effective, especially on surfaces which are in temporary or intermittent use.
- Speed limits be set and enforced on all surfaces and roads. Paved surfaces/roads should be subject to a speed limit of 35km/h whilst on unpaved surfaces/roads the speed limit should be 15-20km/h.
- The carry over of mud or dirt onto paved roads should be prevented as far as possible in order to limit subsequent dust generation following drying out of these materials.
- Traffic movement should be minimised as far as possible.
- Spillages onto road surfaces must be promptly cleaned up.
- All areas exposed during excavation activities should be re-vegetated and stabilised as soon as possible.
- Minimise the extent of the excavations as far as reasonably practicable.
- All excavated areas and related accessways must be subject to an appropriate wetting down procedure – especially under dry and windy weather conditions.
- The heights of stockpiles should be minimised as far as possible to reduce wind entrainment and stockpiles should be located as far away from sensitive receptors as possible.
- Windbreaks should be erected around stockpiles where possible in order to reduce wind entrainment of dust emissions.

7.4 MITIGATION MEASURES: THERMAL STRESS

Construction workers

As previously noted it is required in terms of the Construction Regulations (OHSAct 85 of 1993) that all contractors conduct an initial health risk assessment of their workers activities prior to initiating any work on site. One of the stressors to which construction workers may be exposed in the course of their work on the GLeWaP project may be thermal stress (heat stress and cold stress). Whilst the initial health risk assessment would allow for more specific comment on the health risks

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associated with worker exposure to thermal stress, appropriate mitigation measures would include:

- Heat Stress
 - Ensuring that all workers are medically fit to conduct their activities, with priority being given to those workers required to engage in manual physical labour activities pre-employment medical examinations are recommended
 - Ensuring that all workers are suitably informed and trained in the signs and symptoms of heat stress
 - Ensuring that all workers are trained in appropriate measures to prevent heat stress related injuries or illnesses. Informing workers of the need to drink regular quantities of water should be prioritised. Ready access to drinking water must be provided at all work locations.
 - Drafting of formal work procedures for working in hot environments

Cold Stress

- Issuing of appropriate protective wear (jackets, hats and gloves) should suffice in preventing workers from developing any adverse health effects following exposure to cold working conditions.
- Use of hand-held powered machinery and/or tools should be subject to special precautions under cold climatic conditions (low risk in this instance).

7.5 MITIGATION MEASURES: VIBRATION STRESS

Construction workers

In terms of the Construction Regulations (OHSAct 85 of 1993), all contractors must conduct an initial health risk assessment of their workers activities prior to initiating any work on site. Another of the potential stressors to which construction workers may be exposed in the course of their work is vibration stress. Whilst the initial health risk assessment would allow for more specific comment on the health risks associated with worker exposure to vibration stress, appropriate mitigation measures would include:

- Ensuring that all equipment, tools and vehicles are properly maintained according to design specifications so as to minimise the risk of worker exposure to excessive vibration stress
- Ensuring that all defective and broken equipment, tools and vehicles are promptly removed from duty and properly repaired.

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- Ensuring that workers are trained to understand the hazards associated with vibration i.e. sources of vibration, health effects.
- Ensuring that workers are adequately trained to recognise problematic vibration which could cause vibration related injuries.
- Issuing of appropriate personal protective equipment to limit/prevent worker exposure to excessive vibration stress (kidney belts for machine operators etc).

7.6 MITIGATION MEASURES: ULTRAVIOLET RADIATION

Construction workers

Appropriate mitigation measures to address worker exposure to direct sunlight would include:

- Issuing appropriate personal protective equipment (brimmed hats or peaked caps) and enforcing the use of such PPE.
- Educating the workforce about the damaging effects of prolonged and/or repeated exposure to solar radiation.
- Encouraging the diligent use of sunscreens by especially vulnerable persons (fair-haired and light-skinned).

7.7 MITIGATION MEASURES: ERGONOMIC STRESS

Construction workers

Within the context of construction activities, ergonomic stresses present one of the highest risks to worker health. The Construction Regulations (OHSAct 85 of 1993) require that all contractors conduct an initial health risk assessment of their workers activities prior to initiating any work on site. Ergonomic stress must be included as a priority issue in any baseline risk assessment. Whilst the formal risk assessment would allow for identification of specific ergonomic issues, appropriate mitigation measures are likely to include:

- Ensuring that all workers are certified medically fit to perform their duties by a qualified Occupational Medical Practitioner. Priority should be given to high risk work categories such as those engaging in manual physical labour.
- Ensuring that mechanical assistance for lifting and transporting of heavy material is readily available and appropriate to the task.
- Ensuring that workers are adequately trained in lifting techniques and actively practice these techniques.

• Ensuring that workers know when to ask for assistance and do so.

7.8 MITIGATION MEASURES: MALARIA

Construction workers

- Drafting of a formal malaria control plan for the construction sites is recommended. Although compulsory issue of prophylactic drugs to workers is not deemed necessary, consideration could be given to initiating an appropriate chemical control programme at worker accommodation sites. Spraying of effective insecticides to control mosquito populations is an effective way of reducing the risk of malaria and advice on residual spray methods should be obtained from the relevant authority.
- Educating workers in ways and means of preventing malaria is also recommended. Priority should be given to ensuring that workers are aware of the benefits of:
 - Limiting time out of doors after dark.
 - \circ $\,$ Wearing long sleeved shirts and long trousers after dark.
 - Making use of insect repellents.
 - Closing windows and doors of sleeping quarters at night.
- Consideration should be given to providing all worker sleeping quarters with mosquito repellents (chemical impregnated mats or coils) and/or mosquito nets above beds.
- Ensuring that workers are able to readily identify the common signs and symptoms of malaria so that diagnosis is promptly confirmed and appropriate treatment initiated.

Surrounding communities

- Continuation of existing malaria control measures as implemented by the Provincial and Local health authorities.
- Improve public awareness of risk.
- Improve public knowledge about ways of reducing risks.

7.9 MITIGATION MEASURES: SCHISTOSOMIASIS

Construction workers

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* The incidence of Schistosomiasis should be confirmed in the study area by appropriate specialists, preferably before construction begins. A formal assessment should then be made of the risks of contamination following completion of the dam construction at the proposed Nwamitwa site. In the interim, mitigation measures should include:

- Education and training of workers in ways and means of reducing their risks of infection – i.e:
 - \circ Avoid swimming or bathing in uncontrolled water sources.
 - Avoiding drinking water from uncontrolled or unknown sources.
 - Avoid urinating in water sources / courses.
- Education of workers in signs and symptoms of infection so that medical assistance can be sought and appropriate treatment initiated.
- Ready access to healthcare services for workers in the event of treatment being required.

Surrounding communities

* During the construction phase it is unlikely that communities surrounding the construction sites will be at any increased risk of infection with Schistosomiasis. Following completion of the project the risks of infection will, on balance, be reduced as a consequence of the provision of clean drinking water to communities which were previously reliant on uncontrolled water sources. The following mitigation measures remain relevant:

- Education of the local population in ways and means of reducing their risks of infection – i.e:
 - Avoid swimming or bathing in uncontrolled water sources.
 - \circ Avoiding drinking water from uncontrolled or unknown sources.
 - Avoid urinating in water sources / courses.

7.10 MITIGATION MEASURES: DIARRHOEAL DISEASES

Construction workers

* Mitigation measures should include:

- Education and training of workers in ways and means of reducing their risks of infection – i.e:
 - \circ Avoid swimming or bathing in uncontrolled water sources.
 - Avoiding drinking water from uncontrolled or unknown sources.

- Avoid urinating in water sources / courses.
- Follow good personal hygiene practices (washing hands etc).
- Avoid eating food from unknown or suspect sources.
- \circ $\;$ Avoid raw or undercooked foods.
- Education of workers in signs and symptoms of infection so that medical assistance can be sought and appropriate treatment initiated.
 - Ready access to healthcare services for workers in the event of treatment being required.
 - Surrounding communities.
 - * During the construction phase it is unlikely that communities surrounding the construction sites will be at any significant increased risk of infection with diarrhoeal diseases. Following completion of the project, the risks of infection will, on balance, be reduced as a consequence of the provision of clean drinking water and improved toilet facilities to communities which were previously reliant on uncontrolled water sources and pit latrines. The following mitigation measures remain relevant.
- Education of the local population in ways and means of reducing their risks of infection – i.e:
 - Avoid swimming or bathing in uncontrolled water sources.
 - \circ Avoiding drinking water from uncontrolled or unknown sources.
 - Avoid urinating in water sources / courses.
 - Thoroughly wash hands following ablutions and prior to eating, drinking or smoking.
 - \circ $\;$ Thoroughly wash vegetables and fruit prior to eating.
 - Thoroughly cook foods.

8. CONSULTATION PROCESS

THE PUBLIC PARTICIPATION PROCESS

Engagement with Interested and Affected Parties (I&APs) forms an integral component of the EIA process. I&APs have an opportunity at various stages throughout the EIA process to gain more knowledge about the proposed project, to provide input into the process and to verify that their issues and concerns have been addressed.

The proposed project was announced in July 2007 to elicit comment from and register I&APs from as broad a spectrum of the public as possible. The announcement was done by the following means:

- the distribution of Background Information Documents (BIDs) in four languages,
- placement of site notices in the project area,
- publishing of advertisements in regional and local newspapers,
- publishing of information on the DWAF web site,
- announcement on local and regional radio stations; and
- the hosting of five focus group meetings in the project area.

Comments received from stakeholders were captured in the Issues and Response Report (IRR) which formed part of the Draft Scoping Report (DSR). The DRS was made available for public comment in October 2007. A summary of the DSR (translated into four languages) was distributed to all stakeholders and copies of the full report at public places. Two stakeholder meetings were held in October to present and discuss the DSR. The Final Scoping Report was made available to stakeholders in December 2007.

The Draft Environmental Impact Assessment Report, its summary (translated in four languages), the various specialist studies, the Environmental Management Plans and Programmes were made available for a period of thirty (30 days) for stakeholders to comment. Stakeholder comments were taken into consideration with the preparation of the final documents. The availability of the final documents will be announced prior to submission to the decision-making authority

9. COMMENTS RECEIVED

The sole comment received with respect to the terms of reference for the Health Impact Assessment was:

- That the EIA specialist studies should consider the possibility of increased water borne diseases such as malaria.

This has been addressed as part of the Health Impact Assessment – refer Table 6.11

10. OTHER INFORMATION REQUESTED BY THE AUTHORITY

No other information was requested by the authority.

11. CONCLUSION

The outcome of this Health Impact Assessment revealed the following:

Construction workers will be potentially exposed to the following health risks with subsequent negative health impacts:

- HIV, STI, TB medium significance following mitigation
- Excessive noise rating levels medium significance following mitigation.
- Inhalation exposure to airborne Hazardous Chemical Substances (HCS) low significance following mitigation.
- Dermal exposure to HCS low significance following mitigation.
- Excessive heat stress conditions low significance following mitigation.
- Excessive cold stress conditions low significance following mitigation.
- Excessive vibration stress low significance following mitigation.
- Excessive heat stress conditions low significance following mitigation.
- Excessive ultraviolet radiation low significance following mitigation.
- Excessive ergonomic stress medium significance following mitigation.
- Malaria low significance following mitigation.
- Schistosomiasis low significance following mitigation.
- Diarrhoeal diseases low significance following mitigation.

Priority potential health risks for construction workers therefore include:

- HIV, STI and TB transmission.
- Exposure to excessive noise rating levels.
- Exposure to excessive ergonomic stress.

Even following the implementation of the recommended mitigation measures, these risks would still present a medium significance in terms of their impact on the health of construction workers. Effective management of these priority health risks would be required if the impacts on the health of construction workers are to be effectively controlled.

Construction activities could potentially expose the surrounding communities to the following health risks with consequent negative heath impacts:

• HIV, STI, TB – medium significance following mitigation
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- Inhalation exposure to airborne Hazardous Chemical Substances (HCS) low significance following mitigation
- Ingestion exposure to HCS low significance following mitigation
- Excessive ambient noise rating levels low significance following mitigation

Priority potential negative health impacts for surrounding communities therefore include:

• HIV, STI and TB transmission

Even following the implementation of the recommended mitigation measures, these risks would still present a medium significance in terms of their health impact on surrounding communities. Effective management of these priority health risks would be required if the impacts on the health of community members are to be effectively controlled.

Construction activities could however impact *positively* on the following health risks to surrounding communities:

- Malaria low significance following mitigation.
- Schistosomiasis medium significance following mitigation.
- Diarrhoeal diseases medium significance following mitigation.

Whilst the incidence of these diseases is unlikely to change during the construction phase, it is very likely that it will decrease following completion of the bulk water infrastructure. The incidence of schistosomiasis and diarrhoeal diseases within the local populace is likely to decrease significantly following provision of clean water to households.

In summary:

The raising of the Tzaneen Dam is unlikely to have any significant impact on the health of either the construction workers or the surrounding community provided that the recommended mitigation measures are effectively implemented.

The construction of a dam at the Nwamitwa site and the installation of bulk water infrastructure throughout the surrounding areas, is however, likely to have several potential health impacts on both construction workers and the affected communities.

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- The nett health impact of construction activities on construction workers is likely to be negative. The majority of impacts could be effectively mitigated.
- The nett health impact on surrounding communities is likely to be positive, with the benefits of improved access to clean water supplies outweighing the temporary negative impacts associated with construction activities – all of which could be readily and effectively mitigated.

NOTE: The project description details alternatives for the following:

- The supply level of the dam at the Nwamitwa site.
- Re-alignment of the roadways.
- Pipeline routes.
- Reservoir positions.
- Weir position.

Modification of the Health Risk Assessment for each of these alternatives was not deemed necessary as the *health risks* associated with each alternative are not expected to differ significantly from those identified and assessed as part of the initial study. Comments on the effects of these alternatives on Ambient Air Quality and/or Ambient Noise Rating Levels are detailed under the relevant specialist reports.

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