8. DESCRIPTION OF ENVIRONMENTAL ISSUES AND POTENTIAL IMPACTS

The proposed infrastructure components of the GLeWaP project are likely to result in impacts on the:

- quantity and quality of river flows (**Chapter 8.1**);
- terrestrial ecology (**Chapter 8.2**);
- social processes (**Chapter 8.3**);
- economic processes (**Chapter 8.4**);
- physical infrastructure (**Chapter 8.5**);
- public health (**Chapter 8.6**); and
- heritage resources (**Chapter 8.7**).

Specific impacts related to construction activities must also be considered (**Chapter 8.8**). Other impacts considered are mentioned in **Chapter 8.9**).

8.1 QUANTITY AND QUALITY OF RIVER FLOWS

8.1.1 Key Issues related to river flows

A change in the flow and mean annual run-off (MAR) in the downstream Groot Letaba River could result in:

- The degradation of downstream habitat in the Groot Letaba River (both in-stream and riparian). Floods are needed to scour the banks, maintain channels, recharge riverbanks for riparian vegetation growth, to distribute seeds, etc;
- Altered biotic stimuli (i.e. floods induce spawning in certain fish species); and
- Changes in the composition and diversity of aquatic fauna and riparian vegetation.

The dam could create a suitable habitat for aquatic weeds, algae blooms and exotic fish species. The newly created dam basin habitat could also cause an ideal habitat for Bilharzia and malaria vectors.

The proposed dam is situated on the confluence of the Nwanedzi River and Groot Letaba River. No fish or aquatic macro-invertebrate data exist for the Nwanedzi River and not much is known about the extent to which fish in the Groot Letaba River is influenced by this ephemeral tributary, or regarding the interaction between the occurrence of aquatic macro-invertebrates in this tributary and the Groot Letaba River. Inundation of well established riparian vegetation on the southern bank of the Nwanedzi River was also indicated as a concern.

The proposed dam will form a barrier that will further prevent fish migration in the Groot Letaba River and this will result in the further reduction of the genetic stability of the fish population in the long-term. Fish movement/migration from the Groot Letaba River upstream into the Nwanedzi River will also be prevented.

Areas downstream of the proposed dam still have good riparian vegetation, especially the areas in the Hans Merensky Nature Resort, Letaba Ranch and the KNP. Lowering of the conservation status of the Groot Letaba River in the downstream conservation areas, especially the KNP, is a concern.

8.1.2 Reserve Determination

The overexploitation of the Letaba River and the subsequent need for compulsory licences in order to achieve adequate resource protection, led to the Letaba Catchment Reserve Determination Study (DWAF, 2006). The overall objective of this study was to provide a sufficient range of Ecological Water Requirements (EWR) scenarios to allow for an ecological Reserve for the various reaches of the Letaba River and its main tributaries within South Africa.

In the Reserve Determination Study the Letaba River Catchment was delineated into nine Resource Units (RU), each unit being geographically and ecologically homogenous. Not all of these RU's could however be catered for during the Reserve study, either because the characteristics of the river within the RU did not meet the

criteria for an EWR site or as a result of budget limitations. Seven EWR sites were selected within these RUs and represents a critical site within the relevant river section. These sites were selected with the objective to maximize the opportunities for accurately determining a Comprehensive Reserve for the Letaba River:

- EWR1: Groot Letaba River upstream of Tzaneen Dam (Appel). This site is located between Ebenezer and Tzaneen Dam.
- EWR2: Letsitele River (Letsitele Tank)
- EWR3: Groot Letaba River (Hans Merensky). This site is located downstream of the Tzaneen Dam and upstream of the Molototsi River confluence, about 7km upstream of Prieska Weir.
- EWR4: Groot Letaba River upstream of KNP (Letaba Ranch). This site is situated downstream of the Molototsi River and upstream of the confluence with the Klein Letaba River.
- EWR5: Klein Letaba River, downstream of the confluence of the Middle Letaba River and Middle Letaba Dam
- EWR6: Groot Letaba River in KNP (Lonely Bull). This site is situated downstream of the confluence with the Klein Letaba River.
- EWR7: Groot Letaba River in KNP (Letaba Bridge), downstream of EWR6.

Site EWR3 is situated closest to the proposed dam site, downstream from Tzaneen Dam. Data gathered at this site will therefore serve as baseline for the aquatic ecological assessment to be conducted for the GLeWaP study. Data from site EWR3, EWR4, EWR6 and EWR7 will be crucial in the development of a release strategy for the proposed dam. The latter two sites are situated in the KNP and results from these two sites are driving the system.

Present Ecological State (PES) for each Resource Unit of the main ecological drivers (hydrology, geomorphology and water quality) and ecological responses (riparian vegetation, aquatic macro-invertebrates and fish) were determined and integrated into

an overall EcoStatus. Ecological Categories and alternative categories were recommended based on the results of the PES and are summarized in **Table 8.1**.

Table 8.1: The EcoClassification results for the PES of each component per EWR site (from DWAF, 2006)

	EWR1	EWR1	EWR3	EWR4	EWR5	EWR6	EWR7
Hydrology	C	C	D	D	C/D	D	D
Physico-chemical	B	C/D	C	B/C	B	C	C
Geomorphology	C	D/E	C	C/D	C	C	C
Fish	C	C	C	C	B	C	C
Invertebrates	C/D	D	D	D	C	D	D
Riparian Vegetation	C	D/E	D	D	B	C	C
EcoStatus	C	D	C/D	C/D	C	C	C

The above Ecological Categories (EC) is the primary EcoSpecs, and maintenance of these EcoSpecs will form the basis for the Impact Assessment for the proposed dam.

Table 8.2: Present Ecological State (PES), Ecological Importance and Sensitivity (EIS), Socio-cultural Importance (SI) and Recommended Ecological Class (REC) for each EWR site (from DWAF, 2006)

	PES	IMPORTANCE		REC
		EIS	SI	
EWR1	C	Mod	Low	C
EWR2	D	Mod	Low	D
EWR3	C/D	High	Mod	C/D
EWR4	C/D	High	High	C/D
EWR5	C	Mod	Mod	C

	PES	IMPORTANCE		REC
		EIS	SI	
EWR6	C	High	Low	C
EWR7	C	High	Low	C

One of the objectives of the Reserve study was to recommend and motivate specific low and high flows for maintaining ecological conditions within a specific Ecological Category. The methods followed were the Habitat Flow Stressor Responses for low flows and a combination of the Building Block Methodology (BBM) and DRIFT method for the high flows. The results are summarized in **Table 8.3**.

Table 8.3: Instream Flow Requirements for EWR sites in the Letaba River expressed as a percentage of the natural Mean Annual Run-off (MAR) for the recommended Ecological Categories (EC)

	EWR1	EWR2	EWR3	EWR4	EWR5	EWR6	EWR7
REC	C	D	C/D	C/D	C	C	C
Maintenance low flows (%)	10.47	32.06	1.29	2.82	8.48	2.17	3.23
Drought low flows (%)	15.76	4.32	0.23	0.44	0.30	0.93	0.09
High flows (%)	15.76	11.11	11.78	15.84	24.27	7.86	7.65
Long-term mean of MAR (%)	27.56	38.78	14.15	20.76	24.27	10.74	11.26

Various operational flow scenarios were developed for each EWR site and their ecological and social-economic consequences described. Seven different scenarios were evaluated for each EWR site in terms of its impact on the ecology, system, yield, goods & services, and overall economic activities. An optimised scenario was devised that would have the least overall impact on the users and the ecology (**Table 8.4**). The flow regime associated with the selected scenario provides the best balance between ecological sustainability and social and economic development. This scenario was accepted and approved by DWAF at a meeting in September 2005 (DWAF, 2006)

Table 8.4: Selected operational flow scenario summarized as a percentage of the nMAR

	Annual EWR (million m3)	Virgin MAR (million m3)	Annual EWR (% nMAR)
EWR1	19.75	71.27	27.71
EWR2	31.756	86.06	36.90
EWR3	42.448	364.49	11.65
EWR4	69.87	402.26	17.37
EWR5	17.054	95.01	17.95
EWR6	47.0317	546.59	8.60
EWR7	51.52	561.67	9.17

The Reserve study (DWAF, 2006) also included an assessment of the practicality of improving ecological conditions. This is specifically important in view of the fact that KNP officials requested an improved PES within the KNP, in line with their mandate to improve biodiversity within the park. Based on available information, the improvement of the PES within the KNP (from PES of C to a REC of B) is at this stage not regarded as attainable, unless the release strategy from the proposed dam can result in more assured flow in the river during August to October. This aspect will be investigated during the Impact Assessment.

8.1.3 Strategic Downstream Users

A reduction in the quantity and quality of the water in the Groot Letaba River system will potentially impact on downstream users. The Kruger National and Mozambique are two significant downstream users.

International obligations to Mozambique must not be compromised by the implementation of this project. In this regard, the Department of Water Affairs and Forestry is following the recommendations and conditions contained within the Revised SADC Protocol on Shared Watercourses and continuously liaises with the co-basin countries through the Limpopo Basin Permanent Technical Committee.

The Kruger National Park not only contributes significantly to South Africa's responsibility to maintain the country's biodiversity as committed in the signing of the United Nations Convention on Biodiversity (1992), but is also is a major economic driver in the region and contributes significantly to the national economy. The water required (quantity and quality) to maintain these functions is a priority.

8.1.4 Water Quality

The issues with respect to water quality centre around two effects. The first is the storage of a large quantity of water in the proposed dam, which can lead to eutrophic conditions, and an increase in salinity due to the concentrating effect of evaporation losses. These problems tend to be accentuated during periods of prolonged low inflow.

The second issue is a possible change in water quality in the river downstream of the dam. The change can be far-reaching, such as a cumulative change in salinity as a result of reduced flows, or it can be of a local nature, such as changes in temperature directly downstream of the dam due to the release of colder bottom water.

8.2 TERRESTRIAL ECOLOGY

The main factors of disturbance in the project area are human settlements, agriculture and forestry. Nearly 60 % of the project area is transformed or degraded by such developments.

According to Rouget et al (2006):

- Critically Endangered vegetation types have been transformed to such an extent that the remaining habitat is less than that required to represent 75% of species diversity.
- Endangered vegetation types have lost up to 40 % of their original extent, and are exposed to partial loss of ecosystem function.

- Vulnerable vegetation types have lost up to 20 % of their original extent, resulting in some ecosystem functions potentially being altered.

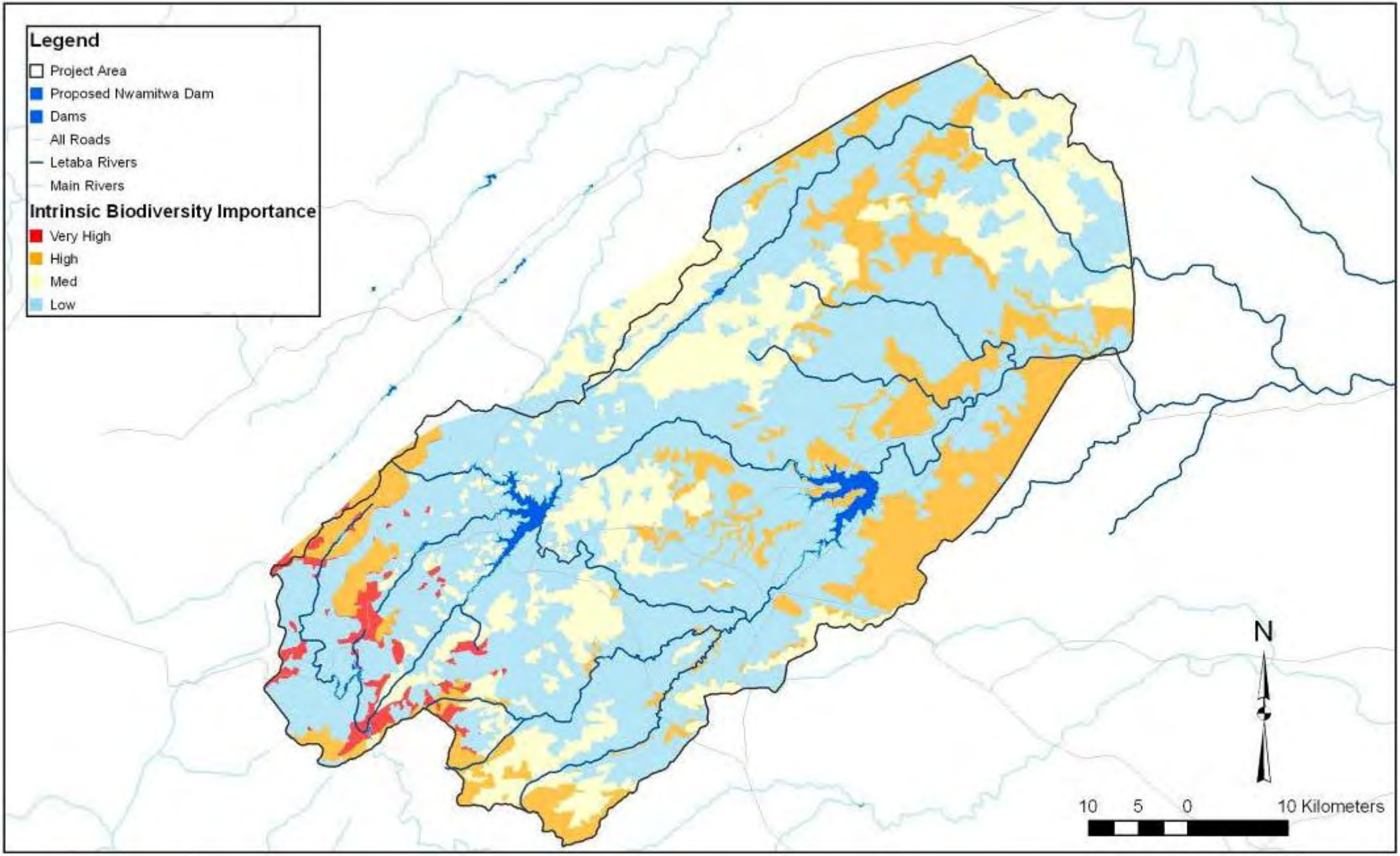
- Least Threatened vegetation types have retained more than 80% of their original extent, and disruption of ecosystem functioning is assumed to be insignificant.

On this basis, Woodbush Granite Grassland is the most threatened of the vegetation types. However, being in the upper catchment, it (and Northern Escarpment Quartzite Sourveld – Vulnerable) is not likely to be directly affected by the proposed developments. Conversely, Tzaneen Sour Bushveld (Endangered) is likely to be impacted by water-supply projects downstream of the proposed Nwamitwa dam. Moreover, the inundation of the dam will directly impact on Granite Lowveld, a Vulnerable vegetation type.

Although a total of 256 species of Red Data flora and fauna could potentially occur in the study area (147 plant, 45 mammal, 48 bird, 9 reptile & amphibian, and 7 invertebrate), at least 107 species could be endemic or near-endemic (locally or regionally), and 284 are likely to be protected, the construction of the infrastructure components of the proposed project will not affect the terrestrial ecology of the entire catchment or study area. There impacts will only be experienced locally in the areas where there are construction activities.

Figure 8.1 depicts an integration of the spatial conservation importance / sensitivity profiles for the biotic groups. This map is designed to inform the development planning process, and to provide a basis for impact assessment.

Vegetation types have been ranked and assigned importance ratings ranging from Low to Very High. Areas designated of high conservation importance for a particular biotic group would be considered ‘sensitive’ to development because of the potential impacts of such development on that particular group. **Table 8.5** summarizes the levels of conservation importance of each vegetation type in terms of the conservation-important biota potentially represented there. It also attempts to rank the vegetation types on the basis of their ‘intrinsic biodiversity’ reflected in the integration of all the component importance values. Thus some idea of intrinsic biodiversity value or ‘ecological sensitivity’ is realized and mapped (**Figure 8.1**).



water & forestry
Department: Water Affairs and Forestry
REPUBLIC OF SOUTH AFRICA

ILISO CONSULTING

GROOT LETABA RIVER WATER DEVELOPMENT PROJECT (GLeWaP)

CONSERVATION IMPORTANCE OF INTRINSIC BIODIVERSITY

FIGURE 8.1

Date: September 2007
Map Ref: P:/ /Letaba_Plants.mxd
System: ArcGIS

Table 8.5: Level of conservation importance of each vegetation type

Importance value	Number of species									
	Granita Lowveld	Gravelotte Rocky Bushveld	Lowveld Ruggd Mopaneveld	Norhtern Escarpment Quartzite Sourveld	Northern Mistbelt Forest	Ohrigstad Moutain Bushveld	Subtropical Freshwater wetlands*	Tsende Mopaneveld	Tzaneen Sour Bushveld	Woodbush Granite Grassland
Plants	High	High	High	Very High	High	High	Med	High	Very High	Very High
Mammals	High	Med	Med	High	High	Med	Low	High	Med	High
Birds	High	Med	High	High	High	Med	Low	High	Med	High
Reptiles & Amphibians	Med	Low	Low	High	High	Low	Med	Med	Med	High
Invertebrates	Very High	High	High	Med	Med	Med	Very High	Very High	High	Very High
RANK	2	8	7	2	5	9	10	2	6	1
Intrinsic Biodiversity Value	High	Med	Med	High	High	Med	Med	High	Med	Very High

Vegetation types with the highest percentage area intact, with the highest biodiversity values, and that are the most threatened are those that are likely to present the greatest constraints to development. Conversely, those with the lowest percentage area intact, with the lowest biodiversity values, and that are the least threatened are those that are likely to present the greatest opportunities for development.

On this basis, it is apparent from **Table 8.6** that those vegetation types that have most area intact do not have a particularly high biodiversity value, and are also not significantly threatened (eg. Gravelotte Rocky Bushveld and Lowveld Rugged Mopaneveld). These would probably offer most opportunity for development. Conversely, those that have least area intact do have High biodiversity values and are significantly threatened (eg. Granite Lowveld, Tsende Mopaneveld and Tzaneen Sour Bushveld). These would probably present the greatest constraints to development.

Table 8.6: Biodiversity Value and Degree of Transformation per vegetation type

Vegetation Type	Ecosystem Status	Intrinsic Biodiversity Value	Natural Area (ha)	Transformed & Degraded area (ha)	% Natural
Granite Lowveld	Vulnerable	HIGH	24 104	72 909	25%
Gravelotte Rocky Bushveld	Least Threatened	MEDIUM	4 480	1 379	76%
Lowveld Rugged Mopaneveld	Least Threatened	MEDIUM	17 737	11 061	62%
Tsende Mopaneveld	Least Threatened	HIGH	23 903	35 549	40%
Tzaneen Sour Bushveld	Endangered	MEDIUM	53 368	60 536	47%
Total			123 592	181 434	41%

Site-specific ecological field surveys and impact assessments will takeplace before development commences. On site surveys of flora and fauna will be undertaken in summer from October 2007 to February 2008. It will therefore be possible to screen all of the conservation-important plant and animal species potentially present in the project area, making assessment of ecological sensitivity at farm scale more objective. The potential impacts of the proposed development would be more clearly identified, and mitigation measures to reduce impacts will be more accurately defined.

8.3 SOCIAL PROCESSES

8.3.1 Potential impacts as a result of demographic processes

The demographic profile of the communities in the study area (**Chapter 5**) is typical of rural communities, with low education and employment levels. Increasing the population density in an area which is already overpopulated and poor could lead to negative and positive impacts. If the community has the capacity to accommodate additional people, the presence of construction workers could lead to a temporary boost in the local economy as a result of construction workers making use of local services. However, a community that is unable to meet its own needs might be unable to sustain additional demands on the local services, which might lead to conflict if services are depleted (e.g. the local grocery store running out of supplies due to the extra demand) or not provided adequately (e.g. sanitation).

Interaction and relations between local communities and construction workers might lead to illnesses, death and/or births. Dam failure can lead to the loss of life and severe injuries, as well as psychological trauma, which leads to demographic changes.

The high percentage of females imply that males out-migrate, and/or are outlived by females. It is possible that there is a high percentage of child-headed households in the study area. The high percentage of young people and women imply they are probably most severely affected by lack of money and resultant developmental problems such as lack of water, walking long distances to fetch water, lack of electricity, accessibility to health facilities, etc. The project should focus on improving the quality of life of these vulnerable groups by giving them job opportunities.

The IDP of the MDM suggests that the level of literacy has a bearing on employment and urbanisation status. The bulk water distribution area, which will benefit from the proposed dam, consists of rural villages. The literacy and employment levels are therefore most likely to be low. This has implications for the type of jobs they will be able to do, and the extent of the economic impact on their lives.

8.3.2 Institutional change processes and municipal service impacts with the project

During construction, institutional changes can be expected as a result of the project as the influx of people will put a strain on institutional structures. The resultant health and safety, and environmental impacts could be significant. This will also depend on whether construction workers will be housed in communities or in a construction village.

During operation, settlements, agricultural production of commercial farmers and emerging black farmers, as well as the tourism industry between the Drakensberg Escarpment and the Kruger National Park will benefit. The positive impacts are the health benefits, increase in social equity, stabilised economic growth, and employment opportunities. However, the significance of the impact depends whether institutional processes are such that:

- Safe, reliable water supplies for domestic and industrial use are supplied;
- The frequency, intensity and duration of restriction on the use of water allocated for irrigation of high value crops are minimized ;
- . Resources are distributed equitably;
- Maintenance is done;
- Unauthorized connections are managed;
- Cost recovery is managed;
- Multi-disciplinary planning and co-operation at appropriate levels of government is done to enable inclusive long term plans to be drawn up;

- The integration of the project with the Spatial Development Frameworks of municipalities;

- The integration of the project with the seven industrial clusters, specifically horticulture and livestock production.

8.3.3 Land use change processes and potential impacts

The proposed dam basin will inundate commercial citrus farms and may potentially impact on some houses and possibly small-scale farming areas.

The size of the dam must therefore be such that it indeed optimally benefits the beneficiaries. The risk is that a dam built to full capacity might not optimally benefit the beneficiaries. For example, the water may cover important infrastructure which might negatively impact on many users in and on the borders of the proposed dam basin. Building a smaller dam might mitigate these impacts. It is therefore necessary to understand the impact of different full supply levels on the beneficiaries to propose an optimal full supply level. This will also have positive implications for DWAF in that the economic and social impacts will be reduced, positively impacting on the sustainability of the GLeWaP.

To determine the optimal full supply level, the impacts of different proposed purchase levels should be assessed in more detail in the EIA Phase. The implication of different full supply and purchase levels on the livelihood and quality of life of beneficiaries should be considered, to contribute to the selection of an optimal full supply level. “Optimal benefit” will have to be defined, based on the definitions of livelihood and quality of life, and the data gathered.

8.3.4 Socio-cultural change processes

Socio-cultural processes are the way in which humans behave, interact and relate to each other and their environment and the belief and value systems which guide these interactions. This includes the movement patterns, which indicate how relationships are maintained, and the way in which space creates a sense of place.

Cultural Landscape

Little information on the cultural landscape and attachment to place within the study area is available at this stage, and will have to be further assessed in the Impact Assessment Phase. Tribal Authorities in the area will have to be identified, and the heritage specialist report will have to be accessed. The nature of the cultural landscape will give an indication of the level of attachment to place. Components that give an indication of the cultural landscape are:

- Genealogical Landscape
- Knowledge of Place
- Place-based Values and Ethics
- Environmental knowledge
- Home place and identity

(Cultural Attachment to Place: A Framework for Identifying and Working with Traditionally Associated Peoples in Southern Appalachia Benita J. Howell, 2003).

Sense of place

The potential impact on socio-cultural behaviour and the related perception of environmental changes could either have a positive or a negative impact on sense of place. It could be positive if people perceive the project as a means of job creation, free water, and infrastructural and/or economic development, not intrusive and safe. Potential negative impacts include the visual impact and the resultant intrusion on sense of place.

People choose to live in an area because of what they value: status, safety, nature, family links, etc. A sense of connectedness a person/community feels towards a place or places develop as a result of these values. Much of what is valuable in a culture is embedded in place, which cannot be measured in monetary terms. Place attachment may be evident at different geographic levels, e.g. site specific (e.g. a house, burial site, tree where religious gatherings take place), area specific (e.g. a region), and physiographic specific (attachment to the look and feel of an area). Personal emotions, memories and cultural activities are associated with a place. It is

because of a sense of place and belonging that some people loath to be moved from their dwelling place, despite the fact that they will be compensated for the inconvenience and impact on their lives. Once the proposed dam basin is filled with water, the current land use, sense of place and cultural landscape will be permanently lost changed. The related impacts on a psycho-social level will be different for different people and will have to be assessed in more detail in the EIA Phase.

Socio-cultural processes and Construction workers

Construction workers form part of a significant section of the South African population known as migratory workers. The social cultural issues associated with this section of the population have been thoroughly researched. Due to their unique situation, construction workers engage in behaviour that makes them vulnerable, such as risky sexual behaviour (e.g. unprotected sex) and destructive behaviour (e.g. alcohol abuse, damaging the environment), which could be explained by their migratory status. When they are separated from their homes, they are also distanced from traditional norms, prevailing cultural traditions and support systems that normally regulate behaviour within a stable community. In addition, it might also be that construction workers who are faced with dangerous working conditions and the risk of physical injury might be more preoccupied by immediate (direct) risks and therefore tend to disregard salient (more indirect) risks, such as HIV infection. Again, it is likely that HIV transmission occurs, as the local population might be uneducated about the risk and transmission of HIV and would therefore more easily engage in risky behaviour as a result of ignorance. More money in circulation from construction workers also impacts on the family structure as preference is given to money over family.

Not only do health issues impact on communities, but the physical safety of communities can also be endangered as a result of the influx of job seekers and construction workers (e.g. potential increase in crime). This has a negative mental health impact, such as fear. Conflict could also occur as a result of alcohol abuse, resentment that locals did not get jobs, and cultural differences.

The construction activities, construction vehicles and movement patterns of these vehicles and equipment could also impact on the health and safety of communities.

However, this only becomes a real concern if such activities occur in close proximity to roads and settlements.

8.3.5 Bio-physical change processes and potential impacts

The construction workers could be housed in a construction village or the surrounding communities. Their presence will impact on the environment, which in turn will impact on the surrounding communities. Littering and water pollution, air, and dust pollution could be experienced during the construction phase of the project.

Vehicles used for construction and maintenance activities could also create air and dust pollution, and further damage the environment. New and/or temporary roads will have to be opened, blasting will take place, noise will increase, and the environment might degrade aesthetically.

As a secondary impact, the presence of roads leading to the dam may open up a previously inaccessible natural environment, resulting in the consequences of tourism activities: destruction of wildlife or waterfowl habitats, over-usage of certain areas, pollution from litter and motor vehicles, wildlife disturbance, etc.

During operation, the presence of the dam could lead to health impacts, for example the presence of mosquitoes and bilharzia could be exacerbated. There are also positive health impacts:

- The availability of water for washing and bathing will prevent diseases such as trachoma, scabies, and fungal skin diseases;
- Water borne diseases e.g., typhoid, dysentery and diarrhoea will be prevented by the provision of clean water and sanitation;
- Removal of breeding sites will prevent diseases e.g. malaria and dengue;
- Removal of habitat can prevent diseases such as guinea worm.

8.4 ECONOMIC PROCESSES

The proposed project could impact on the following economic aspects:

- Economic effect

The proposed project will have an impact on the economy due to the financial spending (estimated to be in the excess of R1 500 million), increased infrastructure investment and increased expenditure by employees.

- Employment

Temporary employment will be created during the construction phase of the project resulting in increased expenditure, as well as additional economic spin-offs that will result.

Since some of the high-intensity citrus farm land will be inundated by the proposed Nwamitwa dam, some of the farmers and farm workers could be negatively affected by job losses.

Temporary employment contracts will be terminated when the construction activities are complete. This could result in a loss of income and spending in the immediate area at that time. Affected parties should be informed of this from the start of the project so that unrealistic expectations are not.

Full-time employment during the operation of the project may also have a permanent effect on the economy. Apart from any permanent directly created jobs there may be scope for other jobs due to spin-off effects in the economy as well as stimulation of additional income generating activities resulting from improved water supply. The proposed project could prevent job losses due to current water supply not meeting demands.

- Business output and sales

The employment opportunities created by the construction of proposed project may lead to an increase in buying power in the area leading to an increase in business sales and the opportunity for the development of new businesses sales.

Any persons that acquire employment in the operation phase of the project could experience an increase in their standards of living. The availability of water in the

region may also stimulate income generating activities and impact on local business sales and standards of living.

- Government income and expenditure

The proposed project may cause an economic injection to the area that could lead to increased government income during both construction and operation. Any resultant new economic activities, such as tourism developments, could increase the tax base and income in the form of Company tax; PAYE; UIF; and Rates and taxes. The capacity of the local municipality to provide services may improve.

- Standards of living

Increased employment opportunities during construction and possibly operation could increase the buying power and size of the market in the area, increase entrepreneurial opportunities due to the needs of construction activities (such as building materials, or foodstuffs), and improve accessibility for local villagers to retail outlets. New businesses may be established and a general increase in sales could raise the general standard of living in the area.

- Agriculture production and loss of agricultural land

Some agricultural land (mostly existing citrus plantations) will be inundated by the proposed Nwamitwa dam. The financial value of the permanent loss of agricultural land will be calculated during the EIA phase.

- Ownership and land use patterns

The proposed project will require land and servitude acquisition. Both private and traditional authority land will probably be affected.

- Stimulation of income generating activities

The improved ability to manage the water resources in the catchment during operation could stimulate the development of recreational opportunities and tourism related development. This could cause a permanent economic upliftment in the area. Property values.

8.4.1 Property values

Property values and the sale of property during the construction period could be negatively affected due to uncertainty of property owners and potential new property owners of the impacts of the proposed project. Potential new property owners could be deterred from purchasing property or farm land that is near to the site due to the perceived negative impacts of the construction such as safety and security, increased crime, increased population, workers camps, etc.

It is not foreseen that property values will be affected negatively during the operation/maintenance phase. Property values on looking the Nwamitwa Dam could even possibly increase in value.

8.5 PHYSICAL INFRASTRUCTURE

Some existing infrastructure (roads, electricity supply, pipelines, tele-communications, railways, other facilities) could be directly impacted on by the proposed infrastructure development project. Any temporary or permanent disruptions in these services must be mitigated.

Of particular concern are the R529, D1292 and P43/3 will have to be re-aligned to accommodate the dam. This may result in longer distances for villagers, general road users, and citrus farmers who need to transport input requirements and citrus products to and from farming enterprises. Temporary road diversions may also be required to accommodate specific construction activities.

8.6 PUBLIC HEALTH

Instead of having a flowing river, the construction of the dam will result in a standing body of water. Not only is the nature of flow different, but the extent of the water means that the vectors of disease associated with water are now closer to where the people are living (**Figure 3.1**).

Construction workers' situations make them vulnerable to high-risk sexual behaviour. There are ample research results to indicate that there is a direct link between temporary migration and HIV infection. Research also seems to indicate that

construction workers might be more at risk of contracting HIV from members of local communities, as opposed to transmitting the infection to community members. An HIV/Aids survey should be carried out before the project and a follow up study once the dam is completed. The study should include the contract workers from and their families who accompany them and advocacy on how to prevent transmission of HIV should be provided. The feasibility of this should be assessed. The United Nations have drawn up guidelines on HIV/Aids and large projects.

The potential benefits of reticulated clean water, with improvements in sanitation and hygiene, as well as those associated with a general increase in the standard of living, are, however, large.

8.7 HERITAGE RESOURCES

Cultural heritage resources are broadly defined as all non-physical and physical human-made occurrences, as well as natural occurrences that are associated with human activity. These include all sites, features and objects of importance, either individually or in groups, in the history, architecture and archaeology of human (cultural) development. The study area is known to have some areas where archaeological sites may occur.

8.8 MINIMISING CONSTRUCTION RELATED IMPACTS

The actual physical construction activities are known to have some very specific impacts in addition to the impacts on the river (**Chapter8.1**), on the terrestrial ecology (**Chapter 8.2**), and on social and economic processes discussed in **section 8.3** and **8.4**. These include increased traffic, noise, and dust.

8.9 OTHER ISSUES

Other issues that have been raised, but not considered key are:

- Water Rights; and
- Climate Change.

8.9.1 Water Rights

Landowners likely to be affected by the proposed dam basin would like to know how their water rights will be affected by expropriation of land for the Government Water Works. This applies firstly to landowners that may lose a part of their farm, but will still be left with a viable piece of land. They would like to know whether they will be able to keep the full current allocation of water that they have. Secondly, many farmers own a few different pieces of land in the area. If they cannot continue to farm on the remainder of land after land acquisition, will they be able to exercise the water allocations currently on land that will be inundated on a completely different piece of land? This includes surface water abstraction and groundwater. Some farmers have boreholes that may be inundated by the proposed dam that they would like to have replaced.

Some people (emerging black farmers) living in the villages in the area would like to have access to more water than they currently have. They would like to know what the process is for them to apply for this.

These issues are not considered environmental impacts of or on the project, but rather process queries that will be addressed directly.

8.9.2 Climate Change

Both the questions of whether climate change has been taken into account in the formulation of the project and whether the project could have an impact on climate change have been considered.

The concerns around the first aspect relate to possible changes in the availability of water or land use conditions in the region as a result of climate change. If this were to actualize, the impact would be on the flow (hydrology) in the river. Available climate change prediction models have been considered, but different models provide different specific local predictions and all with high levels of uncertainty. The possibility of climate change affecting the flows in the river is therefore accommodated in the hydrological modelling by building in a margin for error in the future predictions, which is common accepted practice.

Secondly, the surface area of the dam will be relatively small in terms of global climate change factors. It is expected that the dam will not have any noticeable impact on the climate of the region.

Climate change will therefore not be studied in further detail in the EIA phase of the project.