water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

DEA REF. No 14/12/16/3/3/2/677 (Dam Construction)
14/12/16/3/3/2/678 (Electricity Generation)
14/12/16/3/3/1/1169 (Roads)

SUMMARY OF THE DRAFT ENVIRONMENTAL IMPACT REPORT

Olu xwebhu luyafumaneka nangesiXhosa

November 2014

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

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ENVIRONMENTAL IMPACT REPORT

Draft Summary for Public Comment

1. Introduction

The Mzimvubu Water Project is an integrated multi-purpose (domestic water supply, agriculture, power generation, transport, tourism, conservation and industry) project and provides a socio-economic development opportunity for the region. The purpose of this Environmental Impact Assessment (EIA) is to assess the components of the project that are listed activities in terms of the National Environmental Management Act (NEMA) for which the Department of Water and Sanitation (DWS) has the mandate and intention to implement. The EIA process will provide the information that the environmental authorities require to decide whether the project should be authorised or not, and if so then under what conditions.

This EIA report builds on the Scoping Report. It describes the proposed project and the receiving environment, and presents the findings of the second phase of investigations (EIA phase). The main objectives of the EIA are to:

- *Assess the significance of the environmental issues and impacts identified in the scoping phase, focusing on key impacts;*
- *Recommend appropriate measures to mitigate negative impacts and enhance the benefits, and include them in the draft Environmental Management Programme (EMPR); and*
- *Undertake a public participation process that provides opportunities for all interested and affected parties (I&APs) to be involved.*

2. Additional authorisations required

This EIA includes the assessments required to apply for the following authorisations that the project requires:

- **Water Use Licence**

The construction of the dams and associated infrastructure involves a number of water uses listed in terms of section 21 of the National Water Act, 1998 (No. 36 of 1998) (NWA). An Integrated Water Use Licence Application (IWULA) will be prepared for submission to DWS.

- **Borrow areas and quarries**

Construction materials such as sand, gravel and rock material will be required for the construction of the dams and roads. Existing licensed quarries and borrow pits in the area may not be adequate or suitable to provide all the required construction materials and two new rock quarries and eight borrow pits for sand and earthfill material will be necessary for the Ntabelanga and Lalini Dam sites.

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA), as amended, and the Mineral and Petroleum Resources Development Regulations in GNR 527 of 23 April 2004, DWS has been exempted by virtue of GNR 762 of 25 June 2004 from the application procedures and the approval of rights and permits in terms of sections 16, 20, 22, and 27 of the MPRDA. However, in accordance with section 106(2) of the MPRDA, the DWS is required to compile an Environmental Management Plan (EMPL) for approval in terms of the provisions of section 39 (4) of the Act.

The impacts of the new borrow areas and quarries were investigated in the EIA, and EMPLs will be compiled for approval by the Department of Mineral Resources (DMR).

In terms of GN 704 of the NWA, 1999, the borrow areas must fall outside of the 1:100 year flood line of a watercourse or 100 m from the edge of the watercourse, whichever distance is the greatest. An exemption will therefore be required from DWS since the borrow areas will be located within the 1:100 year flood line (below the full supply level of the proposed dams). This will be included in the WULA.

- **Heritage permits**

The proposed project involves a number of activities listed in terms of section 38 of the National Heritage Resources Act, 25 of 1999 (NHRA), which require authorisation from the relevant heritage authorities.

A Heritage Impact Assessment (HIA) has been conducted as part of the EIA process. The HIA has been submitted to the Eastern Cape Provincial Heritage Resources Authority and the South African Heritage Resources Agency (SAHRA) for decision-making regarding heritage resources.

- **Waste Management Licence**

No Waste Management Licence (WML) Applications are included in this EIA process and if applications are required, they will have to be applied for separately.

- **Licences for the removal of protected trees**

Tree species that are protected in terms of the National Forests Act (Act No. 84 of 1998) have been identified within the project footprint. A licence must be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) to disturb, to damage or to destroy/remove such trees.

3. Need and desirability

The Mzimvubu River catchment in the Eastern Cape of South Africa is within one of the poorest and least developed regions of the country. Development of the area to accelerate the social and economic upliftment of the people was therefore identified as one of the priority initiatives of the Eastern Cape Provincial Government.

Consistent with the National Framework for Sustainable Development (NFSD) (DEA, (2010), it is required that spending on economic infrastructure is focused in priority areas with potential for economic development that serves the broader society's needs equitably. What is needed and desired for a specific area is strategically and democratically determined during the formulation of Integrated Development Plans (IDPs).

- **Integrated Development Plans**

All three District Municipalities (DMs), OR Tambo DM, Alfred Nzo DM and Joe Gqabi DM, impacted by the Mzimvubu Water Project, have published extensive IDPs. All three DM IDPs (Alfred Nzo IDP, 2010; Joe Gqabi IDP, 2012/13; OR Tambo IDP, 2012-17) refer to the DM's responsibility for planning, implementation, operation and maintenance of water and sanitation services. The Alfred Nzo IDP states that "of the estimated 127 878 households approximately 70 000 are serviced with water in one way or another which translates to 45.2% of the population having no access whatsoever to potable water." Additionally, "Communities in rural areas are still highly dependent on undeveloped water sources and there remains a challenge in meeting the water demand, due to source identification". This states the need for an additional water source, such as that which would be provided by the Mzimvubu Water Project.

The Mzimvubu Water Project should thus be promoted as an integrated local development programme in which the activities in the different sectors are coordinated in order to achieve the optimum synergies between them.

- **National Development Plan (NDP)**

The South African Government's vision for the water sector is that before 2030, all South Africans will have affordable access to sufficient safe water and hygienic sanitation.

In the National Development Plan (NDP) (National Planning Commission, 2011: 181), the development potential offered by the Mzimvubu was specifically highlighted: "[the Mzimvubu] water resource development could support agriculture, domestic supply, hydropower production, transport and tourism if planned in a coordinated manner." The NDP proposed that "Programmes in underdeveloped regions, such as a proposed multipurpose development around a new dam on the uMzimvubu River, should also be prioritised since it could mobilise the natural resource advantages of an otherwise underdeveloped area" (National Planning Commission, 2011: 160-161).

- **National Spatial Development Plan (NSDP)**

The NSDP seeks to assist government to achieve the following development objectives and principles for the country:

- *To focus fixed investment in areas with development potential. It is argued that these areas present the greatest possibility for both economic growth and poverty alleviation; and*
- *To ensure that citizens in areas with limited potential are provided with a package of essential public services, focusing on human resource development, labour market intelligence and social grants. It is argued that the prevalence of high poverty in an area does not mean that poverty can be more effectively addressed in that area.*

- **Strategic Integrated Projects (SIP)**

The New Growth Path sets a goal of five (5) million new jobs by 2020, identifies structural problems in the economy and points to opportunities in specific sectors and markets ("job drivers"). The first job driver is infrastructure: laying the basis for higher growth, inclusivity and job creation. In order to address these challenges and goals, Cabinet established a Presidential Infrastructure Coordinating Commission (PICC). Under their guidance, 18 strategic infrastructure projects (SIPs) have been developed. The SIPs cover social and economic infrastructure across all nine provinces, with specific emphasis on lagging regions. The Mzimvubu Water Project is a SIP3.

- **Financial and economic viability**

Financial viability can be defined as the ability to generate sufficient income to cover input costs and make a profit. Economic viability can be measured by the positive economic benefits that the proposed project will provide. It includes identification and quantification of all the benefits expected and typically involves an economic cost-benefits analysis using opportunity costs.

Financial viability is not a requirement for a project of this nature, as the objective of the project is not to make a profit on the investment, but rather to contribute to the development of the project area. The intention of the project is to be economically viable, in that the direct and indirect socio-economic benefits should exceed the financial cost of the project. This EIA therefore only considers economic viability.

4. Project description

The project footprint spreads over three District Municipalities (DMs) namely the Joe Gqabi DM in the north west, the OR Tambo DM in the south west and the Alfred Nzo DM in the east and north east.

*The proposed Ntabelanga Dam site is located approximately 25 km east of the town of Maclear and north of the R396 Road. The proposed Lalini Dam site is situated approximately 17 km north east of the small town Tsolo. Both are situated on the Tsitsa River, a tributary of the Mzimvubu River (**Figure 1**).*

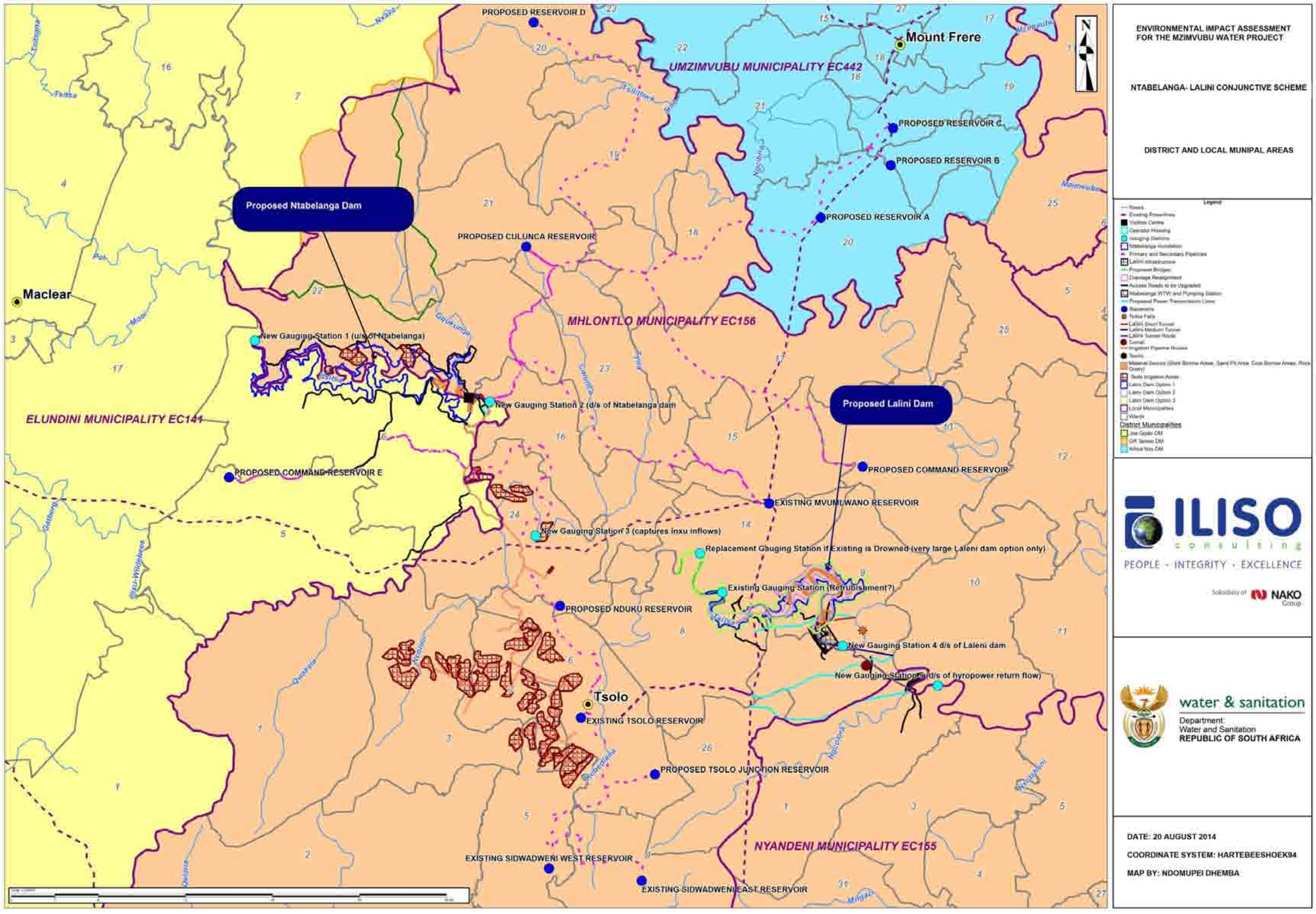

Figure 1: Study Area

The proposed water resource infrastructure includes:

- *A dam at the Ntabelanga site with a storage capacity of 490 million m^3;*
- *A dam at the Lalini site with a storage capacity of approximately 232.5 million m^3;*
- *A tunnel/conduit and power house at the Lalini Dam site for generating hydropower;*
- *Five new flow measuring weirs will be required in order to measure the flow that is entering and released from the dams. These flow gauging points will be important for monitoring the implementation of the Reserve and for operation of the dams.*
- *Wastewater treatment works at the dam sites;*
- *Accommodation for operations staff at the dam sites; and*
- *An information centre at each of the dam sites.*

The Ntabelanga Dam will supply potable water to 539 000 people, which is estimated to rise to 730 000 people by year 2050. The domestic water supply infrastructure will include:

- *An intake structure and associated works;*
- *A regional water treatment works at Ntabelanga Dam;*
- *Potable bulk water distribution infrastructure for domestic and industrial water requirements (primary and secondary distribution lines);*
- *Bulk treated water storage reservoirs strategically located; and*
- *Pumping stations.*

The Ntabelanga Dam will also provide water to irrigate approximately 2 900 ha of arable land. This project includes bulk water conveyance infrastructure for raw water supply to edge of field.

About 2 450 ha of the high potential land suitable for irrigated agriculture is in the Tsolo area and the rest near the proposed Ntabelanga Dam and along the river, close to the villages of Machibini, Nxotwe, Culunca, Ntshongweni, Caba, Kwatsha and Luxeni.

There will be a small hydropower plant at the Ntabelanga Dam to generate between 0.75 MW and 5 MW (average 2.1 MW). This will comprise a raw water pipeline from the dam to a building containing the hydropower turbines and associated equipment, and a discharge pipeline back to the river just below the dam wall. The impact is expected to be similar to that of a pumping station.

The hydropower plant at the proposed Lalini Dam and tunnel (used conjunctively with the Ntabelanga Dam) will have an installed capacity of 37.5 MW if operated as a base load power station and 150 MW if operated as a peaking power station. Base load generation means generating 24 hours a day while peaking (150MW) means the plant runs for 4 to 8 hours a day during peak energy demand periods. The power plant will require a pipeline (approximately 4.6 km) and tunnel (approximately 3.2 km) linking the dam to the power plant downstream of the dam and below the gorge. The power line linking the Lalini power station to the existing Eskom grid will be approximately 13 km.

The area to be inundated by the dams will submerge some roads. Approximately 80 km of local roads will therefore be re-aligned and two bridges over the Tsitsa River will have to be replaced.

Additional local roads will also be upgraded to provide access to the dam sites and support social and economic development in the area. The road design will be very similar to the existing roads as well as be constructed using similar materials.

The project is expected to cost R 12.45 billion and an annual income of R 5.9 billion is expected to be generated by or as a result of the project during construction and R 1.6 billion per annum during operation. It will create 3 880 new skilled employment opportunities and 2 930 un-skilled employment opportunities during construction.

5. Alternatives

The following alternatives to the project were considered during the Scoping Phase:

- *Constructing smaller dams;*
- *Developing groundwater resources;*
- *Provision of water by rain-fed tanks;*
- *Dam site alternatives;*
- *Alternative dam types; and*
- *A number of smaller water sources rather than a dam.*

The following alternatives were assessed during the impact assessment phase:

5.1 Hydropower generation options

The Lalini Dam, downstream of the Ntabelanga Dam but upstream of the Tsitsa Falls, is proposed for generating hydropower. The two dams will be operated together in a conjunctive scheme to improve the economic sustainability of the overall scheme. Water from the Lalini Dam will be conveyed to a Hydro Electric Power generating plant downstream of the Tsitsa Falls, after which the water used for generation is released back into the river.

Power generation can be implemented on a base load only, full-time peaking or part time peaking basis. Up to 37.5 MW can be generated if operated as a base load power station and up to 150 MW if operated as a peaking power station. The difference that these options will make will be in the size and timing of the flows that are released back into the Tsitsa River, and the amount of income generated. Base load generation will result in the release of consistent quantities of water, while peak generation will result in significantly larger flows of water being released for fewer hours in a day.

5.2 Alternative tunnel and associated power line routes

Three alternative power line routes, linking the hydropower plant downstream of the Lalini Dam to the grid, are being considered. The three power line routes correspond to three possible tunnel (or pipeline-tunnel combination) lengths from Lalini Dam to the hydropower plant. The amount of power generated depends on the available head, which increases with distance downstream of the Tsitsa Falls and corresponding increased length of the tunnel.

Alternative 1 consists of a 2.1 km tunnel and 7.1 km power line. Alternative 2 consists of a 4.9 km tunnel and 10.2 km power line. Alternative 3 consists of an approximately 4.6 km pipeline and 3.2 km tunnel and an approximately 13 km power line.

5.3 Alternative dam sizes

*Three dam sizes are proposed for the Lalini Dam, as shown in **Table 1** (and **Figure 2**) and have been considered in the EIA.*

Table 1: Proposed alternatives for the Lalini Dam

Dam size alternatives	*Full Supply Level (meters above sea level)*	*Appropriation line (meters above sea level)*
Lalini Dam size 1 (technically preferred)	*763.61*	*768.61*
Lalini Dam size 2	*752.42*	*757.42*
Lalini Dam size 3	*778.07*	*782.57*

Regarding the road alignments, pipeline routes and reservoir positions, no alternative routes/positions were identified during the feasibility study. The approach to the impact assessment was to identify any sensitive areas that should be avoided, for consideration by the technical team, and where appropriate, to recommend deviations.

The no project option was also assessed.

Figure 2: Lalini Dam alternative dam sizes

6. Public Participation

The public participation process during the Scoping Phase included the following activities:

- *Authority consultation with DEA and the DWS Regional Office;*
- *Authorities Forum meetings for all commenting authorities;*
- *Distribution of notification letters, Background Information Documents and Newsletters (in English and isiXhosa);*
- *Placement of site notices and newspaper advertisements (in English and isiXhosa);*
- *Comment periods for draft and final Scoping report;*
- *Public Meetings; and*
- *Focus Group Meetings.*

The stakeholder database and Issues and Responses Report is updated on an ongoing basis.

I&APs and the public will be informed of the availability of the draft EIA report (through written notification to registered stakeholders), as well as of the authorities' decision and the appeal process in respect of the various applications (through newspaper advertisement and written notification to all registered stakeholders).

The draft EIA report will be distributed to public places and made available for a 30 calendar day public comment period. The draft reports will also be presented at stakeholder meetings, where I&APs will be able to confirm that their issues have been captured correctly, properly understood by the environmental team, and included in the specialist studies and impact assessment. The final documents will be made available for public comment for a 21 calendar day public comment period and be submitted to the authorities. Draft and final reports will be made available for download on the DWS website.

The relevant authorities will be kept up to date with progress on the EIA through the Authorities Forum.

All issues and comments received during the stakeholder consultation process will be captured in the Issues and Responses Report that will form an Appendix to the EIA Report.

7. Description of the affected environment

The study area falls within the South Eastern Uplands Aquatic Ecoregion and the Mzimvubu to Kieskamma Water Management Area (WMA). The Mzimvubu River is one of South Africa's largest rivers (accounting for 5.5% of total river flow in the country). It has four major tributaries, namely the Mzintlava, Kinira, Tina and Tsitsa Rivers. Rivers in this catchment possess water surpluses.

The proposed Ntabelanga and Lalini Dam sites are both situated on the Tsitsa River, a perennial river classified as a Category C (moderately modified).

The pipelines in the northern part of the project area cross the Tina River which is also classified as being in Category C condition (moderately modified). The Tina River is regarded as an important fish sanctuary, translocation and relocation zone and is classified as being a fish support area according to the National Freshwater Ecosystem Priority Areas Database (2011).

Four habitat units have been identified within the study area, namely the Mountain / Rocky Outcrops habitat unit, Grassland / Acacia Thornveld habitat unit, Riparian / Wetland habitat unit and the Transformed (Grassland) habitat unit.

According to the National List of Threatened Terrestrial Ecosystems (2011), sections of the proposed infrastructure fall into a vulnerable ecosystem. Vulnerable ecosystems, have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention. Large areas within the project area have been identified as Critical Biodiversity Areas. These areas are of conservation importance due to the presence of Red Data species, endemic species and potential habitat for these species.

There are extensive areas of severe gulley erosion in the project area. Soil erosion in the catchment is an outcome of high rainfall intensities, steep slopes, erodible soils and land use practices that are conducive to erosion, such as overgrazing and cultivation on unsuitable thin soils with sloping terrain. Erosion and land degradation affect ecosystem health and negatively impact on the majority of downstream rivers, which are characterised by high turbidity and increased siltation. The high sediment loads in rivers will increase water treatment costs and decrease the lifespan of any dams or hydropower schemes.

The mammal species observed in the study area are considered to be mostly common species, found throughout South Africa, that are adaptable to changing and transformed habitats, as well as being known to occur around human settlements. The mountain bushveld habitat located at the Lalini Dam wall provides habitat for scorpion species, including Rock Scorpions, which are protected. A large diversity of avifaunal species was observed in the study area. Avifaunal species of concern include cranes and Cape Vultures.

The following heritage resource types are present in the study area: archaeological sites; buildings and structures; and graves and traditional burial places.

The project impacts the three district municipalities of Joe Gqabi, O. R. Tambo and Alfred Nzo, and four local municipalities: Elundini, Mhlontlo, Umzimvubu and Nyandeni.

The population profile of the people living in the study area is described as:

- *A majority of Black Xhosa speaking people;*
- *More women than men;*
- *A high proportion of children under 15 years and people over 65 years;*
- *Population densities up to 110 people/km^2;*
- *HIV prevalence amongst antenatal women of up to 29.3%;*

- *Unemployment rate up to 35%; and*
- *Very low or negative population growth, with the O. R. Tambo District having the highest population growth at 0.52%.*

The situation regarding schooling in the area improved somewhat between 2001 and 2011. But there is still a need to improve the situation further with the O. R. Tambo District still having over 17% of the population over 20 years of age having no schooling. At a provincial level 10.5% of the population aged over 20 years have no schooling, 19.8% have a matric and 8.7% have a higher education. This places all the district and local municipalities below the provincial level of education with only Umzimvubu, at 8%, having a lower percentage of the population with no education.

In respect of household services, apart from electricity as a source of lighting, where it is surpassed by both the Mhlontlo local and O. R. Tambo District Municipalities, on a general basis the Joe Gqabi District Municipality has the highest level of service delivery.

The proportion of households owning household goods across the area is lower than that of the province. On a general basis, households in the Joe Gqabi municipality own a greater proportion of household goods than those across the other municipalities.

Although there have been some improvements across the region the area remains one of the poorest parts of the country, characterised by high poverty and out-migration resulting in sex ratio imbalances, a high proportion of female headed households and a low population growth rate. At large the population lacks basic amenities and relies heavily on subsistence farming which is not highly successful.

The study area is rural, characterised by low densities and generally low levels of economic activity. The main land uses are pastoral stock and subsistence crop farming.

The proposed project is located on state-owned land which is administered by traditional authorities. The land is therefore currently subject to communal land tenure arrangements. Under this system the State owns the land, but it is managed and allocated to community members by the Traditional Leaders.

About 37.7% of households in the Eastern Cape engaged in agricultural activities over the period June 2011- June 2012. Of these households 24.8% were involved with poultry production, 20.5% with livestock production, 19 % with grains and food crops, 19.9% with fruit and vegetables and only 0.2% with industrial crops (Statistics South Africa, 2012). Of the households in the province involved with different crop planting activities, 23.8% were in backyard gardens, 0.2% in communal gardens and 0.1% in school gardens. The percentage of households classified as food access adequate was 72% while 19.4% were food access inadequate and 8.8% food access severely inadequate. Although in this respect there are no statistics specific to the study area, it is unlikely that the situation in the study area will be significantly different.

An aerial inspection of the immediate area shows that much less crop production is currently practised than in the past and it is estimated that about 20% of the previously contoured lands are currently still cultivated. Farmer support structures would be needed to revive crop production in the region.

Commercial irrigation farming is not the traditional farming method in the area and extensive public consultation will be required to obtain buy-in from traditional leaders and communities and facilitate the transformation of this sector.

8. Key issues identified

Key issues identified in the Scoping phase and discussed in the Scoping Report and its Summary are:

- *Impacts on plants and animals;*
- *Impacts on rivers and wetlands;*
- *Impacts on river flow (water quality and quantity);*
- *Social impacts on the communities in the study area;*
- *Potential impact of HIV/Aids;*
- *Loss of structures and livelihood supporting resources;*
- *Economic impacts, including net societal welfare;*
- *Impacts on heritage resources, including graves, archaeological sites and historical structures; and*
- *Impacts on the landscape and sense of place.*

9. Summary of specialist studies

Nine specialist studies were conducted during the EIA phase and are summarised as follows:

9.1 Plants and Animals

Four habitat units have been identified within the study area, namely the Mountain / Rocky Outcrops habitat unit, Grassland / Acacia Thornveld habitat unit, Riparian / Wetland habitat unit and the Transformed (Grassland) habitat unit. Vegetation surrounding the Ntabelanga Dam wall consists of rocky ridge vegetation, mostly indigenous to the area. Little transformation has occurred within this area.

Large sections of the Lalini Dam basin have undergone vegetation transformation due to small scale agricultural activities, as well as overgrazing and trampling of veld by livestock. More sensitive habitat (Euphorbia forest) located closer to the dam wall will be affected by the construction of the dam and access roads.

The primary concern is the impacts on rocky ridges, mountain bushveld, riparian and wetlands present within the study area. These areas provide highly suitable habitat for sensitive indigenous floral species and several Red Data List (RDL) faunal species. The rocky outcrops and mountain bushveld are ideal habitat zones for threatened scorpions. The wetland systems and associated

grasslands provide suitable habitat for protected Crane species, as well as various small mammals. With the inundation of the dam basins, these habitats will be lost. Rescue and relocation measures for flora can be implemented in more sensitive areas such as the mountain/rocky ridge habitat before construction commences.

With the decreased available faunal habitat, the remaining faunal species will be pushed into the small pockets of remaining habitat, where inter and intraspecific competition amongst the various faunal species for space and resources will cause a decline in overall faunal abundance and diversity.

Upstream towards the tail end of the Ntabelanga Dam, there will be a section of land that, once the water levels have risen, will be transformed into an island. Any faunal species unable to fly or readily swim will be trapped on this island, with limited resources available to survive. It is therefore recommended that any small mammals that become trapped on the island be captured and relocated to the mainland by a qualified and suitable specialist.

A high diversity of bird species was observed on site. The majority of birds observed were within the mountain bushveld, rocky outcrop and riparian habitat zones. As these habitat units will be inundated, the result will be a decrease in viable habitat for foraging and breeding of avifaunal species, forcing avifaunal species to leave the area in search of new suitable larger habitat areas.

The study area provides suitable habitat to RDL bird species, most importantly communities of cranes. Secretary Birds were also observed within the study area during the site assessment as well as a number of raptor species. Inundation of the grassland/ transformed habitat units in the vicinity of the Ntabelanga Dam will result in a loss of foraging habitat for cranes within the study area. The main contributing factors to this decline are loss of wetland breeding areas, loss of grassland foraging areas and collision with high voltage power lines. The construction of the dams and new power lines will have a negative impact on the crane population numbers in the study areas and surrounds, as key breeding populations are lost.

The inundation of the rocky outcrop, mountain bushveld and riparian habitats will push the reptiles further up the slopes of the ridges; however there is suitable habitat for them in these areas. Initially there will be overcrowding of species, but through increased mortality rates and emigration of certain species, the populations should stabilise, albeit at a lower number. The lower carrying capacity and lower population numbers will result in a decreased food source for predators of many reptile species, thereby having a knock on effect further up the food chain.

Inundation resulting from the dams is unlikely to have a negative impact on amphibians or on invertebrate conservation within the area.

One NEMBA listed and protected scorpion species, the Rock Scorpion was observed in the mountain rocky outcrop/ bushveld habitat near the proposed Lalini Dam wall. This species will be

negatively impacted upon through loss of habitat due to the dam wall construction and subsequent inundation.

Hunting from the local community will now be focussed on the remaining areas above the water line. With the decrease in habitat, faunal species will have less space to evade these hunters, resulting in higher losses to hunting, affecting overall population numbers and species composition.

The pipelines will be mainly constructed close to existing roads and the impacts on habitat are expected to be low.

For the proposed road upgrades, re-alignments and construction of new access roads, alien proliferation alongside the road are one of the main concerns and it was found that the proposed new access roads to the Lalini Dam wall and the hydropower plant are located within a highly sensitive habitat area.

Power line alternatives 1 and 3 also cross large sections of indigenous and possible protected trees and other floral species. They should be re-aligned to less sensitive habitats.

Where protected trees are located within the road or pipeline servitudes, the relevant roads and pipelines should be re-aligned to avoid them.

9.2 Aquatic ecology and wetlands

Overall, the various riparian and wetland resources can be considered to be in a moderately modified condition, indicating that loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. Fish diversity is very low.

The proposed project has the potential to lead to loss of niche habitat for wetland-dependent faunal and floral taxa and/or alteration of the aquatic and riparian resources in the study area, with particular mention of the impacts that the two dams will have on the Tsitsa River and its tributaries, as well as the associated wetland and riparian resources. Wetland habitat within the Ntabelanga and Lalini Dam basins will be permanently lost.

In terms of both dams and associated infrastructure, the impacts (inundation of habitat upstream of the dam walls and disruption of natural flow downstream) are considered high and permanent. These impacts result in secondary impacts on flow sensitive species, species of conservation concern and aquatic biodiversity in general. However, adhering to the recommended Environmental Water Requirements (EWR) will ensure that the river downstream of the dams is maintained in an acceptable ecological state.

The area is known to harbour endemic mayflies (Kleynhans 1999). With the location of the two dams situated between two waterfalls, and hence geographically isolated, the area is likely to contain several macro-invertebrate species of conservation concern. Through minimising the time

in which stream flow, water quality and habitat is affected during the construction phase of the project, impact on mayflies can be mitigated to a limited degree.

Construction of the hydropower plant, pipeline/tunnel and power line will be of low impact if mitigated. Mitigation includes minimising the spatial footprint of the development to the greatest degree possible, with special reference to avoiding erosion, silting and sedimentation within the aquatic system. During the operation phase discharge through the hydropower tunnel into the river will also impact on the river. The instream flow requirements of the systems are to be adhered to at all times.

The shorter the length of the section between the dam wall and discharge point, the smaller the area of impact in terms of silting, sedimentation, decrease in water quality and excessive vegetation growth.

Anticipated impacts resulting from construction and use of roads include vegetation removal, increased risk of erosion, sediment loading into the system and inhibition of water flow. If not designed correctly roads can severely impact on instream habitat as well as bankside stability and riparian habitat. Mitigation again includes minimising the spatial footprint of the development to the greatest degree possible, with special reference to avoiding erosion, silting and sedimentation within the aquatic system during both construction and operation. Effective mitigation for wetland crossings includes ensuring the design of crossings allows for the retention of wetland soil conditions. Construction impacts of such infrastructure will be of low significance if mitigated. During the operation phase increased run-off from roads may also result in erosion.

9.3 Heritage

Impacts on heritage resources will be confined entirely to the construction phase.

One archaeological site was identified in the proposed Ntabelanga Dam basin and another site in the proposed Lalini Dam basin. These sites will be destroyed by inundation. The significance of these impacts after mitigation was assessed as low. The identified site at Ntabelanga Dam must be mapped in detail, with judicious sampling, authorised by a permit from the heritage authority. The site may be destroyed once a destruction permit has been issued. The identified site at Lalini Dam must be mapped and excavated/sampled, authorised by a permit from the heritage authority. The site may be destroyed once a destruction permit has been issued. In addition, a detailed survey of potential Early Iron Age sites should be undertaken once crops have been harvested and vegetation clearance has occurred.

All graves, buildings and heritage structures within the full supply level of the Ntabelanga Dam (none were identified within the proposed Lalini Dam basin) will be destroyed by inundation, while those within the footprints of the dams' associated infrastructure could be damaged or destroyed.

All heritage structures have low significance while all human remains have high heritage significance. The significance of these impacts on graves and structures was assessed as low after mitigation.

The location of the graves and burial information must be recorded, affected graves must be relocated with the permission of the next-of-kin and a permit from the heritage authority, all graves within 300 m of any infrastructure must be demarcated, and no infrastructure must be located within 100 m of graves.

Structures that serve a purpose for the relevant families' socio-economic activities must be replaced, in accordance with the provisions made in the Relocation Policy Framework. A destruction permit for all affected structures older than 60 years must be obtained from the heritage authority.

9.4 Visual

The factors that affect the visual characteristics of the project are:

- *high visibility of components within a relatively visually uniform landscape;*
- *impact on the visual quality and the sense of place;*
- *impact on selected critical views;*
- *the height and scale of the components could be dominant in the landscape;*
- *high visibility of construction and operation activity within large areas of uniform visual pattern; and*
- *the low Visual Absorption Capacity of some of the settings which is attributable to:*
- *undulating topography;*
- *uniform and monotonous vegetation cover; and*
- *the lack of visual diversity.*

The significance of the visual impact of the Ntabelanga and Lalini Dams is considered medium-low.

The significance of the visual impact of the power line is regarded as very high for power line alternative 1; medium for power line alternative 2, and low for power line alternative 3, once re-aligned as recommended by the visual and floral specialists (see section 10 below).

The significance of the visual impact of the new and upgraded roads is considered medium-low.

9.5 Social

The study area is underdeveloped and poor and the proposed project holds potential for significant development and growth. There are, however, a number of concerns relating to institutional capacity and the need for correct implementation of the various project benefits, which would need to be in place to ensure project success.

With the Constitutional and policy obligations placed on the authorities to deliver water to the poor, the project holds the potential to move beyond this and uplift the state of development in the area.

However, only through a carefully coordinated, planned and management effort and with close cooperation between the different agencies and broad based community buy in, is the project likely to succeed.

The social impact variables considered across the project are clustered in the following seven main categories:

- *Health and social well-being impacts;*
- *Quality of the living environment (Liveability) impacts;*
- *Economic impacts and material well-being impacts;*
- *Cultural impacts;*
- *Family and community impacts;*
- *Institutional, legal, political and equity impacts; and*
- *Gender relations impacts.*

With regard to the dams and associated infrastructure, most negative impacts will occur during the construction phase of the project as a result of the need for resettlement, the loss of land and the influx of the construction workforce. The size and extent of the project will result in these impacts being significant and wide spread, however, they will largely be of a temporary nature and many can be mitigated. Notwithstanding this, however, the impact of resettlement on both the displaced and host communities must not be under estimated.

In the Ntabelanga Dam basin, 62 structures and 19.9 km^2 of cultivated land will be lost. The Lalini Dam Basin technically preferred Alternative 1 will result in the loss of 12 structures and 7.6 km^2 of cultivated land. In total, it has been established that 160 structures and 0.7 km^2 of cultivated land could be lost as a result of the linear infrastructure components of the project (i.e. pipelines and roads).

Apart from the structures and cultivated areas that will be lost as a direct result of the project, 124 structures have also been identified as being within 5 m of the servitudes of the various infrastructure components and therefore are at risk. The facilities at risk are largely associated with the linear components of the project which include access roads, pipelines and the power line and, as a relatively wide servitude is currently being used for the purpose of identifying these components, it is possible to re-align the routes to avoid the majority, if not all of these structures at risk. The primary mitigation measures applied in these instances is avoidance and considering that the pipeline will be buried it is possible that the servitudes can be restored to their original condition after construction.

As the construction of the dams and associated infrastructure will require a large workforce, it is important to reduce the impact of the influx of construction workers by utilising local labour as far as possible.

The negative operational impacts, although they extend over a long period, are likely to be less significant than the more significant positive impacts, such as economic development and investment and the provision of domestic and agricultural water being of high significance for the area. The provision of water, for both domestic and agricultural use, is likely to have an effect on the division of labour. On the domestic front this is likely to be positive in nature releasing women from the arduous and time consuming task of collecting water. With regard to agriculture, however, this may result in an increased work burden being placed on women due to double or triple cropping with women undertaking such tasks as weeding.

As with the construction of the dams and associated water infrastructure most social impacts associated with the electricity generation and distribution infrastructure are related to the construction phase of the project. As this aspect of the project is not a stand-alone project it must be considered on a cumulative basis together with the rest of the project components, as the cumulative effect will be greatest. A unique aspect of the generation and distribution of electricity concerns exposure to electromagnetic fields. There has been wide international concern regarding the effect that electromagnetic fields have on public health and a possible link to various cancers. The hydro-electricity scheme has the potential to positively contribute to the economy which would have positive social benefits.

The realignment and upgrading of roads is not a separate project and must, at the social level, be assessed together with all the other project components. The unique aspect of the road infrastructure concerns easier access to the area which will carry with it both positive and negative consequences. On the positive side communities living in the area will have easier access into and out of the area as will tourists wanting to visit the area. On a more negative basis, easier access could hasten the effects of globalisation and the changes to local norms and culture. Vulnerable groups may also face greater psychological and social impacts due to rapid change as a result of greater access and exposure to outsiders.

One of the haul roads between the borrow pits and the Lalini Dam construction site will go through the town of Lalini. Due to increased traffic hazards, dust and noise, this would increase the level of health and safety risks. An alternative route should therefore be sought.

9.6 Economics

- **Macro-Economic Impact**

A Macro-Economic Impact Analysis was performed for the construction period of the Ntabelanga and Lalini Dams and the accompanying infrastructure. The analysis was aimed to estimate the impact on Gross Domestic Product (GDP), employment and household income. The motive being the direct employment and payments made to low-income households which provide a good indication of the contribution of the project to poverty alleviation in the area.

The results for the construction of the Ntabelanga Dam and its impact on the provincial economy show that during the peak of the construction period, there will be both direct and indirect employment opportunities created as well as additional induced jobs in the provincial economy. Of

the direct jobs there will be both semi-skilled and low-skilled, which would mostly be recruited from the local community, positions created.

It is anticipated that the macro-economic contribution of the irrigation scheme is estimated to contribute to the total annual GDP and provide a significant total household income for low-income households.

Of the total fulltime employment opportunities, it is estimated that 66% of the work will be on the farms. This 66 % , estimated to be 1 301 jobs, needs to be unpacked because the model provides only fulltime opportunities, while in agriculture and specifically the proposed crop mix will involve a large number of temporary employees. A separate calculation was done based on the accepted employment norms per hectare and the 1 301 unpacked, represents the following number of people:

- Permanently on the farms – 7 per farming unit and 315 in total. This will be tractor drivers, irrigation workers and workshop staff; and
- The temporary workers are estimated at 80 per farming unit with a total of 3 600. This is very often the only job that these workers have and over time a clearer picture will emerge regarding their social situation.

- **Funding**

The funding of the project is an important issue and it is necessary that a number of issues be taken into consideration. The following aspects are important in terms of the different proposals:

Domestic Water Supply

In the Feasibility Report a future population growth of 1% per annum was used to estimate the number of beneficiaries to the year 2050. The latest StatsSA growth figures indicate an overall growth rate for the Eastern Cape Province of 0.44%, while some of the municipalities even show a decrease in the population. This leads to a difference of 133 729 potential beneficiaries with a possible reduced water demand and cost implications. To accommodate the issue a number of scenarios were used in the Economic Cost Benefit Analysis (ECBA) as presented in the following table.

Table 1: Scenarios used in the Economic Cost Benefit Analysis

Scenario	*Population Numbers*	*Water Volume*	*Estimated Construction Cost*
1	*Feasibility Report*	*Feasibility Report*	*Feasibility Report*
2	*Eastern Cape Growth Rate*	*Feasibility Report*	*Feasibility Report*
3	*Eastern Cape Growth Rate*	*Reduced Volume 19%*	*Reduced Cost 19%*

The very high levels of unemployment and poverty in the project area are such that it is improbable that more than 10% of the users will be able to pay for the water. Therefore, an annual subsidy over a very long period will have to be provided for.

Lalini Dam Hydropower Generation

This project component is economically and financially viable but can only be partially funded by loan, as the income from hydropower generation is intended to subsidise the operation and maintenance costs of the project, especially the high power consumption for pumping of potable and raw water.

Irrigation Scheme

It will take up to 10 years to attain maximum production and possibly financial profitability. Financial viability can only be attained by subsidisation of tariffs on an annual basis.

Grant funding and annual subsidisation is acceptable in a developmental situation as is experienced in the project area as long as it is properly motivated, controlled, managed and budgeted for. In the opinion of the economic specialist, the capital for the construction of the Ntabelanga Dam, the domestic water supply and the irrigation scheme will have to be grant funds.

As far as the operational capital is concerned, the annual maintenance of the dam, the domestic water supply infrastructure and the water supply must be subsidised. Income from power generation is intended to subsidise the operation of the water supply scheme. In the case of the irrigation scheme the operational capital will have to be provided as a subsidy on a sliding scale for the first number of years until full crop production is reached. It will gradually build up and then decrease and by the 10th year the situation should be such that it could probably be terminated. This, however, will depend on the management situation on the scheme and general prevailing agricultural economic conditions.

9.7 Irrigation

It is a known and accepted fact that the specific area of the Eastern Cape Province has a largely untapped agricultural potential. However, any agricultural development based on commercial principles will be faced with a number of stumbling blocks which include:

- *The problem of land ownership;*
- *A shortage of management skills, specifically for commercial farming;*
- *Available markets (the project area is far from the main markets);*
- *Support structures such as production inputs; and*
- *Funding.*

The concept of the proposed commercial based irrigation units is sound, but will only be successful if a number of conditions are in place:

a) *The original crop mix proposal does not make any mention of marketing structures. This will have to be investigated and could influence the crop mix.*
b) *The land issue will have to be addressed and some type of long term lease agreement reached with the local population.*
c) *The business model decided on will have to make provision for strong management leadership with a shareholder basis. The Eastern Cape Province has a number of failed irrigation projects that were based on the small farmer model and failed due to incompetent management structures.*

d) The proposal regarding a livestock section for every unit will necessitate an upgrade in the quality of the current livestock. As the proposed grazing crops will only be available during winter, a grazing agreement with the local land owners will have to be in place for the summer period.

e) It will be impossible to have all 45 units up and running within a year or two. It is proposed that the implementation period be stretched to five years. For purposes of the economic cost benefit analysis it was accepted that it will take a unit another five seasons to be at full production and become financially independent.

f) Under current agricultural economic conditions it must be accepted that the start-up capital, Capital expenditure and Operational expenditure, will have to be through grant funding. It will be impossible for the units to start from scratch and for government to expect them to repay the start-up capital.

g) Proper management and financial support structures will have to be in place for the irrigation proposals to be viable.

10. Impact assessment summary

While the project was assessed holistically, it is acknowledged that the impacts associated with the various infrastructure components have different degrees of significance. Impacts are summarised below for the dams and associated infrastructure, electricity generation and distribution infrastructure, and road infrastructure.

10.1 Dams and associated infrastructure

The construction of the dams, and to a lesser extent the associated infrastructure (including construction offices, potable and raw water distribution infrastructure, borrow pits and quarries etc.) will have significant negative impacts on the terrestrial and aquatic ecology, as well as on the wetlands. To a large extent these impacts will be permanent.

The riparian and wetland areas, as well as the mountain/rocky outcrop areas and Euphorbia Forest near the Lalini Dam wall that provide habitat for sensitive indigenous vegetation as well as fauna, including possible red data list and protected species, will be lost and the habitat within the river will be permanently altered. This impact is considered to be of high significance.

In addition, wetlands in the project area provide important ecological services in the way of sediment trapping, nutrient cycling and toxicant assimilation, flood attenuation and biodiversity maintenance. Considering the extensive, and often severe, erosion within the study area and greater catchment, sediment trapping is especially important. In view of this, the permanent loss of wetland habitat due to inundation is regarded as being of high significance. The anticipated cumulative loss of riparian and wetland habitat arising from the construction of the dams is estimated to be 1034.30 hectares. Overall however, the loss of riparian and wetland habitat is deemed to constitute a relatively insignificant fraction of the wetland resources within the Mzimvubu sub Water Management Area.

At Lalini Dam, large scale loss of habitat for animals will result in a loss of animal species numbers and diversity, as species leave the area, adapt to the new environment in lower numbers, or are lost in totality within the study area. In particular, the loss of wetlands, lower grassland areas, mountain bushveld and rocky outcrops will directly impact on the population of red data list and protected species.

At Ntabelanga Dam, the main concern relates to the loss of key breeding crane populations. Wetlands and grasslands within the Ntabelanga Dam basin are used by cranes (Crowned Cranes, Blue Cranes and Wattled Cranes) for breeding and foraging. Cranes are red data list species, threatened with extinction throughout South Africa; Crowned Cranes in particular are listed as endangered by IUCN with rapidly declining populations. Loss of wetlands and grasslands has been identified as one of the main contributing factors. This impact is considered to be of high significance.

Most of the above-mentioned impacts are permanent and thus extend into the operation phase.

The EAP recommends, as indicated by DEA, that any Environmental Authorisation is subject to the Water Use Licence (WUL) being obtained and complied with. The WUL takes the Reserve, which includes the Ecological Water Requirements (EWR), into account. The EWR are determined to protect the in-stream aquatic and riparian ecology of the river by setting the limits of deviation from the natural flow beyond which the impact would be unacceptable.

For this assessment, the specialists and EAP have assumed that the EWR, as defined in the Reserve determinations will be adhered to during the construction and operational phases. Adhering to the EWR will ensure that sufficient water goes over the Tsitsa Falls to prevent the endemic cremnophytes identified at the Falls from being negatively affected, and that the river downstream of the hydropower plant outlet works can also be maintained in an acceptable ecological state.

The most critical socio-economic impacts associated with the construction of the dams relate to relocation and resettlement, the influx of construction workers, and risks and nuisances associated with construction activities. These impacts can be highly disruptive to communities and need to be carefully managed and mitigated.

In terms of affected households and assets, 62 structures and 19.9 km^2 of cultivated land are located within the Ntabelanga Dam basin and will have to be relocated or compensated. At the Lalini Dam site, 12 structures and 7.6 km^2 of cultivated land are located within the dam basin (alternative 1).

Regarding the proposed potable and raw water pipeline routes, 124 structures are located within the pipeline servitudes (feasibility level pipeline routes). This is a large number but it is possible to realign the pipelines during the detailed design stage to avoid most of these structures and minimise, or altogether eliminate, the need for relocation and associated negative social impacts.

The proposed pipelines are largely located within transformed habitat and construction will have a low to very low impact on terrestrial and aquatic ecology and wetlands, provided the mitigation measures contained in the EMPR are adhered to. These include, inter alia, minor realignments to avoid protected trees, and realignments to avoid wetlands where possible.

The Tsitsa River contributes a small percentage of the flow in the Mzimvubu River that reaches the estuary. The Ntabelanga/Lalini system will always be operated in a manner that fulfills the EWR downstream of the hydropower plant outfall, both in terms of minimum and maximum flows. The project is also not expected to impact on the water quality. The sizes of the Ntabalanga and Lalini Dams are such that they will support the EWR and the Best Attainable State for the estuary, as set out in the estuarine Reserve determination.The impact on the estuary is therefore predicted to be negligible.

The Macro-Economic Impact Analysis found that during the peak of the construction period, the Ntabelanga Dam will result in 2 299 direct employment opportunities created in the Province, with another 843 indirect and 1 036 induced jobs. Of the direct jobs an estimated 1 057 will be semi-skilled and 771 low-skilled and should be recruited from the local community. There is a positive impact on the GDP to the value of R282.7 million. Low income households will also receive a total of R82.42 million out of a total of R528.11 million.

Although only for a short period, the construction activity of the Ntabelanga Dam will contribute considerably to the economy of the region and the province.

The proposed construction of the Lalini Dam and accompanying hydropower plant will also contribute considerably to the economy. At the peak of construction of the dam 815 direct jobs will be created with another 491 indirect and 604 induced jobs in the provincial economy. Of the direct jobs an estimated 375 will be semi-skilled and 273 low-skilled, most of which should be recruited from the local community. There is a positive impact on the Gross Domestic Product to the value of R164.6 million. Low income households are expected to receive a total of R52.38 million out of a total of R335.64 million of the total impact on households.

During operation, both dams will indirectly provide important social and economic benefits at a local, provincial and national level, as the water they supply will enable:

- *The provision of potable water to many households in the project area and beyond, which will have a direct positive impact on the quality of life of the recipients;*
- *The emergence of an agricultural sector which will be able to actively contribute to the economy of the area and of the province; and*
- *The provision of electricity to alleviate pressures on the national grid and cross-subsidise the cost of the other components of the project.*

The irrigation component of the project will contribute an estimated R129.3 million per year to the GDP and a total household income at R146.6 million with R38.6 million for low-income households.

The total fulltime employment opportunities is estimated at 1 976 of which 1 301 is direct on the farms.

The agricultural component of the project may, however, place an additional work burden on women who may have to undertake such tasks as weeding.

10.2 Electricity generation and distribution

During construction, the main impact of the electricity generation and distribution infrastructure relates to the construction of the tunnel/conduit and hydropower plant. For the construction of the power line linking the Lalini hydropower plant to the grid, three alternatives were considered and are discussed in more detail below.

During operation, the primary concern relates to the alteration of the natural flow rate and water levels in the Tsitsa River due to releases of water through the tunnel/conduit for hydropower generation. This constitutes a risk for the riparian habitat and the ability of the riparian zone to support biodiversity, with secondary impacts on flow sensitive species, species of conservation concern and aquatic biodiversity in general. The EWR should be adhered to at all times in order to manage this risk. After mitigation, the impact is rated as very low to medium low.

The impact on health of electromagnetic fields associated with power lines has not been determined. From a social point of view, the risk, or perceived risk, is considered to be the main impact of the power line during operation. The precautionary principle will be applied and human settlements and activities within the power line servitude will be restricted.

As far as the electricity generation and distribution component of the project is concerned, the main benefit will be the substantial income generated from the sale of renewable energy, and feeding this power into the national grid.

10.3 Roads

In general, road upgrades, and to a lesser extent new access roads and road realignments will have a low to very low impact on terrestrial and aquatic ecology and wetlands, provided effective mitigation is implemented.

However, the construction of new roads in the vicinity of the Lalini Dam wall (i.e. haul roads), as well as the access road to the Lalini hydropower plant are located within highly sensitive areas with regard to fauna and flora, and will have a very high negative impact. Alternative access routes to the hydropower plant that could avoid the impact on this sensitive area need to be considered. It is also recommended that a walk-down to undertake search and rescue be done by a qualified specialist before construction of the haul road and access road commences.

During operation, roads will result in a risk of collisions with animals, which is likely not to be fully mitigated.

From a social perspective, 26 structures are within the footprint of proposed roads and road servitudes and may require relocation. The preferred mitigation is to realign the roads to avoid structures as much as possible in order to minimise or altogether eliminate the need for relocation and associated negative social impacts.

Road alignments, the new and upgraded roads will facilitate easier access to the areas served which may indirectly stimulate economic development. On the other hand, this could hasten effects of globalisation and changes to local norms and culture.

10.4 Comparative assessment of alternatives

- **Preferred power generation mode**

The EWR have been determined to protect the in-stream aquatic and riparian ecology of the river by setting the limits of deviation from the natural flow beyond which the impact would be unacceptable. Whichever option of hydropower generation results in the greatest financial income while still fully meeting the EWR is therefore recommended. This still needs to be confirmed.

- **Preferred tunnel/power line alternative**

The aquatic assessment found that in order to reduce the area of impact in terms of silting, sedimentation, decrease in water quality and excessive vegetation growth, the shortest possible section between the dam wall and discharge point should be preferred (i.e. Alternative 1: short hydropower tunnel and associated power line). However, fatal flaws have been identified for Alternative 1 in terms of faunal, floral, and visual impacts. In particular, the power line crosses large sections of indigenous and possible protected trees, and the impact on the faunal habitat on the mountain and within the gorge was not considered viable.

After the environmental assessment had been conducted Alternatives 1 and 2 (associated with the short and medium length tunnels respectively) were eliminated by the technical team due to the presence of deep steep gorges which provide no access to where the tunnel daylights and the hydropower plant would be located. In addition Alternatives 1 and 2 would have significantly less head to generate power, leaving only Alternative 3.

Alternative 3 (associated with the longest pipeline/tunnel and power line) as it is currently proposed has a very high visual impact and also crosses more sensitive floral habitats. It was recommended that this power line be realigned in order to avoid sensitive areas in terms of ecology and visual aspects. The power line route recommended by the EAP is shown in ***Figure 3.***

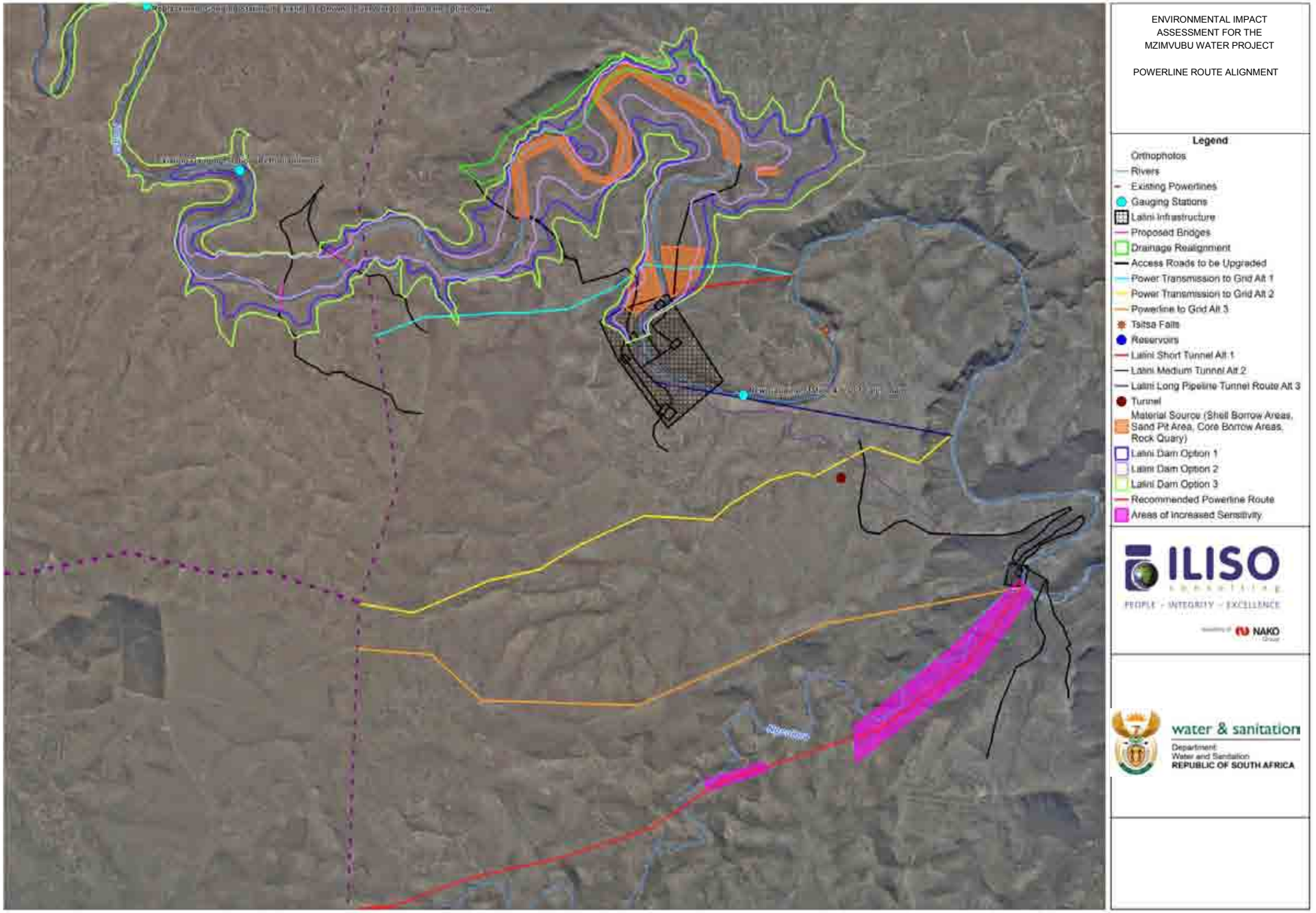

Figure 3: Recommended power line route alignment

- **Preferred dam size for Lalini Dam**

With regard to the Lalini Dam, three dam sizes were considered.

The smallest dam size (Alternative 2) is preferred from a number of perspectives. Firstly, it involves the least loss of cultivated land and structures (i.e. 1 dwelling and 4.9km^2 of cultivated land, compared to 12 structures and 7.6km^2 of cultivated land for technically preferred Alternative 1) and is therefore the socially preferred option. Secondly, it will result in the lowest direct loss of wetland habitat, and is thus considered to be the most viable option in terms of wetland conservation. Thirdly, it will result in the inundation of the least amount of floral and especially sensitive floral vegetation and habitat and is therefore the preferred alternative in terms of floral impacts. Finally, while all 3 alternative dam sizes will lead to a definite impact on population size of endangered, vulnerable and protected indigenous faunal species. Alternative 2 is regarded as impacting the least on faunal RDL species.

Notwithstanding this, no major red flags or fatal flaws were found with technically preferred Alternative 1 (i.e. medium dam size). The technically preferred option is therefore acceptable with the careful application of mitigation measures aimed at reducing the social impact on displaced and host communities, as well as the impacts on ecology and wetlands.

As detailed designs have not yet been finalised for the Lalini Dam, the EAP's recommendation is that the final dam size be within the range of proposed Alternatives 1 and 2 (i.e. a Full Supply Level of between 752.42 mamsl and 763.61 mamsl).

- **No project alternative**

By and large, the no project alternative will result in the status quo being maintained.

The following points can however be noted:

- *Although no loss or decrease in sensitive species and habitats is expected, the current impacts such as overgrazed veld and alien proliferation along the riparian features will continue. Thus the ecological state of these areas will not improve if the no project alternative is implemented.*
- *No loss of faunal habitat and RDL and protected species is expected. This should be seen in contrast to the definite impact on population size of endangered, vulnerable and protected indigenous faunal species resulting from the construction of the Lalini Dam.*
- *In terms of aquatic ecology, the no project alternative will best ensure maintenance of ecological integrity within the system with the current rocky habitat in fast flowing clear water being maintained.*
- *It is expected that wetland habitats will still undergo alterations as a result of the continued impacts of anthropogenic activities such as vegetation clearing, sediment winning, crop cultivation within wetland habitats, etc. Additionally, due to the extensive erosion within the study area and the catchment, sediment inputs to*

wetland and riparian habitats are anticipated, thus potentially altering flow patterns within wetlands and riparian zones, as well as smothering vegetation and aquatic macro-invertebrates.

- *No negative impacts will accrue to heritage resources. In particular, residents will not be subject to the high emotional cost associated with ancestral grave relocation. Conversely, the scientific knowledge inherent in resources such as archaeological sites will remain unrecovered until and unless funding for research is obtained from another source.*
- *There is an obligation on the State to advance the interests of the poor and, in accordance with the Bill of Rights, take adequate measures in ensuring that all citizens have access to basic housing, health care, food, water, social security, education and a healthy. In addition to this South Africa has a policy of recognising the human right to water at both the Constitutional and policy levels. A no project alternative would contradict these obligations as the Department of Water and Sanitation and the Eastern Cape Province would lose an opportunity to supplement the water resources in the area and consequently to deliver both domestic water and water for irrigation. Together with this lost opportunity would be the loss of a number of job opportunities, not only associated with the construction of the dams and infrastructure, but also associated with the productive potential of the irrigation scheme. With the area being one of the least developed and poorest in the country these losses will have severe social consequences. With the Mzimvubu River being the largest undeveloped water resource in the country any loss of benefits associated with the use of this river will be of national significance.*

11. Key mitigation measures

Based on the findings of the EIA, an EMPR has been compiled. The draft EMPR outlines how negative environmental impacts will be managed and minimized, and how positive impacts will be maximised, before, during and after construction.

11.1 Key mitigation measures in the EMPR

While a comprehensive set of mitigation measures has been provided in the EMPR, the following mitigation measures have been identified as essential to minimise significant environmental impacts, and implementation of these measures is a condition to the project proceeding.

- **Key mitigation measures to be implemented during the pre-construction phase**
  - *A walk-down of the areas impacted by the access road to the hydropower plant and haul roads must be undertaken before clearing. Search and rescue of protected vegetation must be undertaken by a suitably qualified specialist. Floral species needs to be relocated to similar habitat types, outside of infrastructure footprint areas.*
  - *The haul road linking the borrow areas to the Lalini Dam construction site must be realigned to avoid going through the town of Lalini, if possible.*

- *Protected tree species Podocarpus fulcatus and P. latifolius were located along the sections scheduled for road upgrades. The following must be ensured:*
  - *Possible re-alignment of the roads where protected tree species were found, in order to avoid cutting and destroying the trees;*
  - *Where protected trees will be disturbed, ensure effective relocation of individuals (if possible) to suitable similar habitat; and*
  - *Permit applications must be obtained from relevant authorities.*
- *Rescue and relocation of medicinal important floral species, RDL and protected floral species is essential to minimise impacts from inundation.*
- *RDL faunal species or species of conservational concern found within the operational footprint area must be relocated to similar habitat within the vicinity of the study area with the assistance of a suitably qualified specialist.*
- *No hunting or trapping of faunal species is to occur.*
- *The construction footprint needs to remain as small as possible, especially in the sensitive habitats.*
- *Aquatic bio-monitoring must take place and if any trends are observed where impacts on the aquatic ecology is becoming unacceptable, measures to reduce the impacts must be immediately implemented.*
- *Baseline studies must be undertaken for noise, air quality, and water quality.*
- *An investigation must be undertaken by a qualified specialist to determine whether any waterfall dependant plants in the gorge and on the cliff could be significantly impacted and whether they require relocation. All findings of the investigation must be implemented.*
- *Areas of increased sensitivity, as shown in the sensitivity maps developed (Figures 4 and 5) should ideally be avoided in terms of the placement of infrastructure in order to minimise the footprints within wetland features. Where it is not possible, mitigation measures to limit the impacts (such as ensuring the design of crossings allows for the retention of wetland soil conditions as presented in the EMPR) must be implemented.*
- *Support structures for pipelines must be placed outside of riparian features, channelled valley bottom wetlands and drainage lines. Should it be essential to place such support structures within these features, the designs of such structures must ensure that the creation of turbulent flow in the system is minimised, in order to prevent downstream erosion. No support pillars should be constructed within the active channels. In order to achieve this all crossings of wetlands should take place at right angles wherever possible.*
- *Where new roads traverse wetland / riparian habitats, with special mention of drainage lines, channelled valley bottom wetlands and riparian habitat, disturbance to any wetland crossings must be minimised and suitably rehabilitated. The crossing designs of bridges must ensure that the creation of turbulent flow in the system is minimised, in order to prevent downstream erosion. All crossings of wetlands should take place at right angles wherever possible.*

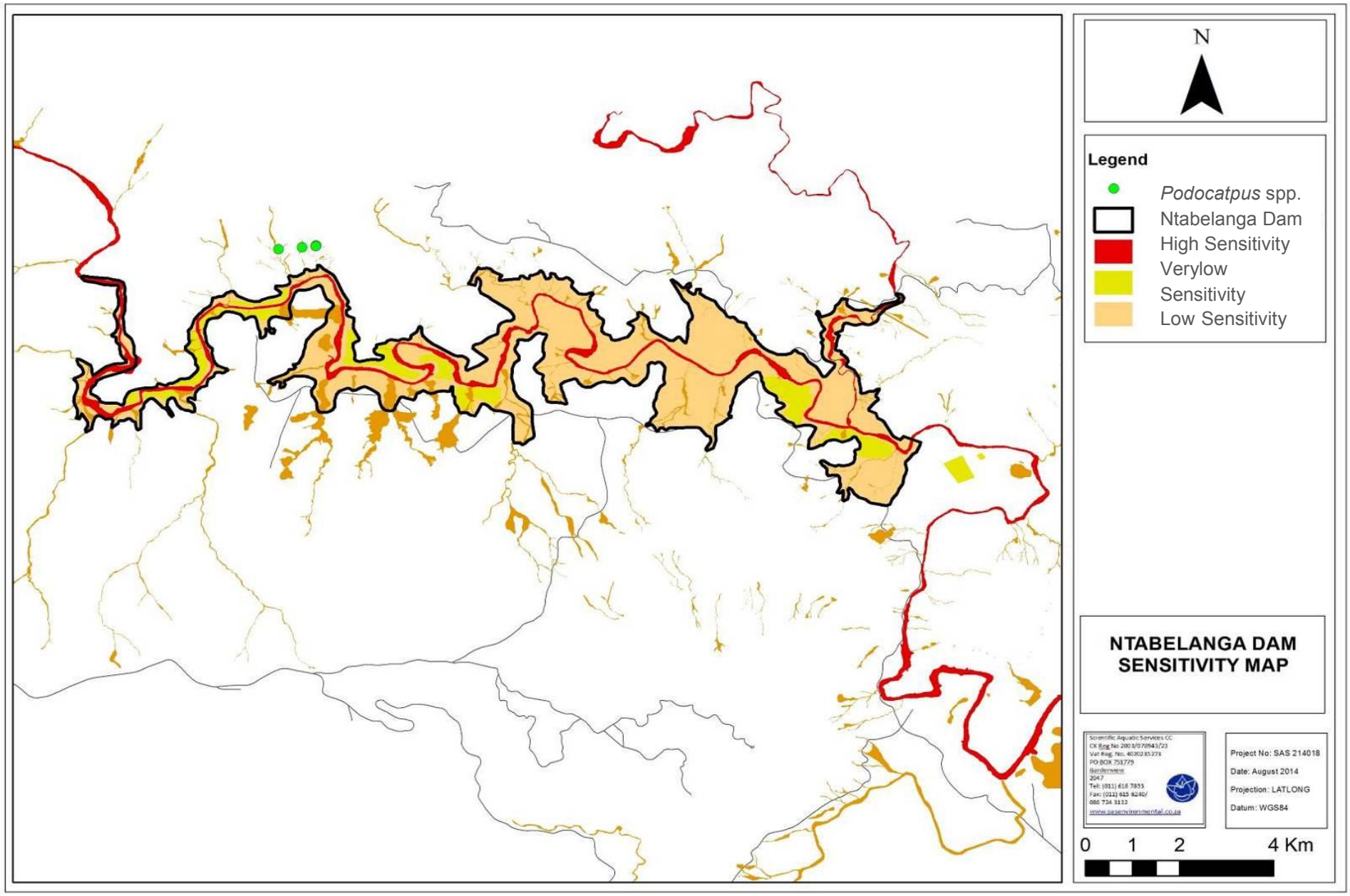

Figure 4: Floral sensitivity map for the Ntabelanga Dam area and associated infrastructure (DWS, 2014a)

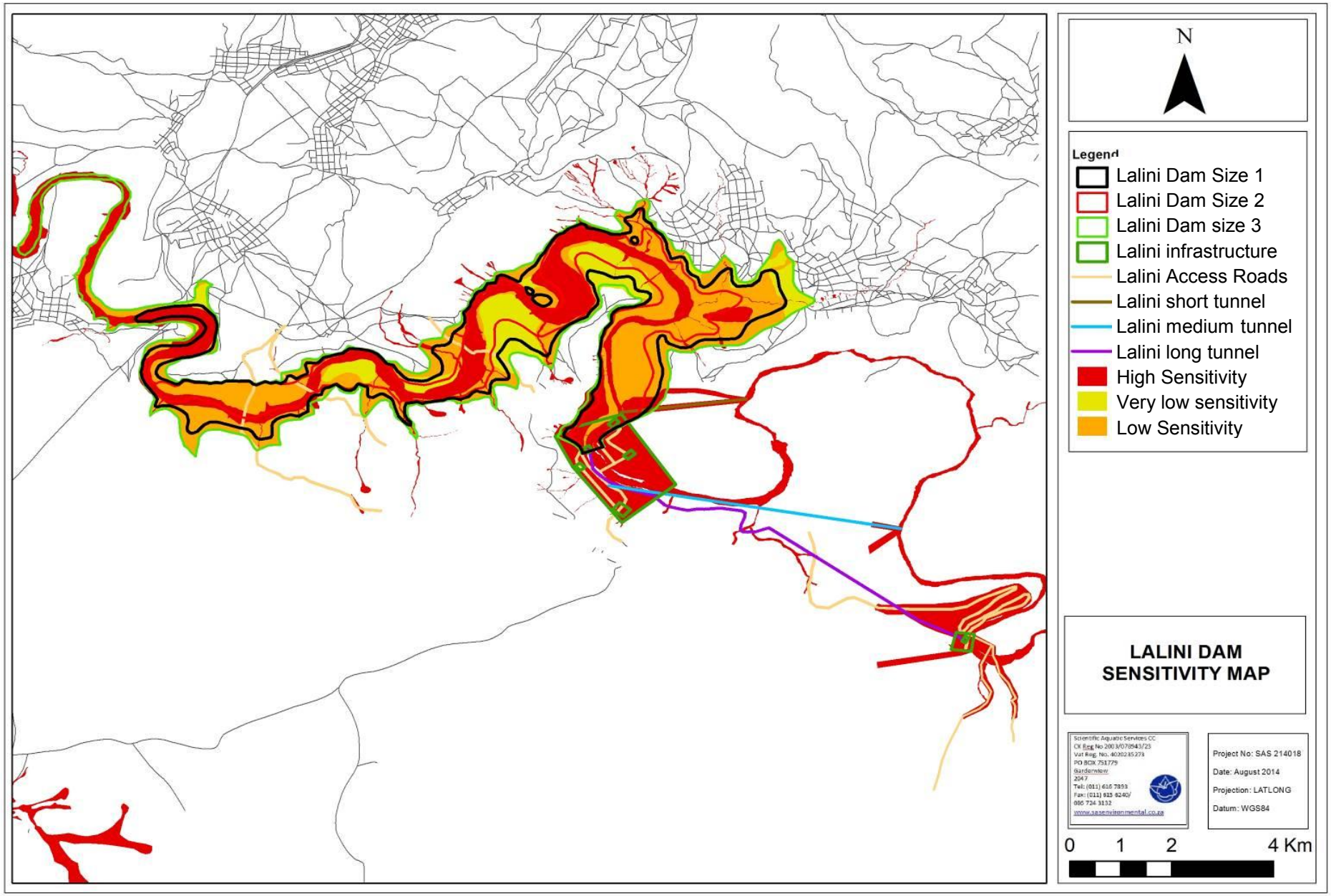

Figure 5: Floral sensitivity map for the Lalini Dam area and associated infrastructure (DWS, 2014a)

- *The design of culverts / bridges should allow for wetland soil conditions to be maintained both upstream and downstream of the crossing to such a degree that wetland vegetation community structures upstream and downstream of the crossing are maintained. In this regard, special mention is made of:*
  - *The design of such culverts and/or bridges should ensure that the permanent wetland zone should have inundated soil conditions throughout the year extending to the soil surface;*
  - *The design of such culverts and/or bridges should ensure that the seasonal wetland zone should have water-logged soils within 500mm of the soil surface during the summer rainfall period; and*
- *Temporary wetland zone areas should have waterlogged soil conditions occurring to within 300mm of the land surface during the summer rainfall period.*
- *Ensure that no incision and canalisation of the wetland system takes place as a result of the construction of the culverts.*
- *It must be ensured that flow connectivity along the wetland features is maintained;*
- *The Ecological Water Requirements (EWR) as set out in the Reserve Determination Volume 1: River (Report P WMA 12/T30/00/5212/7) for the Ntabelanga Dam, and the EWR determined for the Lalini Dam, must be adhered to.*
- *The installation of multiple level outlets, with outlets at approximately 8 m intervals from 6 m below the full supply level of the dams and proper operation is required to mitigate the effect of water quality changes downstream of the proposed dams.*
- *The archaeological site identified in the proposed Ntabelanga Dam basin should be mapped in detail, with judicious sampling, authorised by a permit from ECPHRA. Thereafter the site may be destroyed once a destruction permit has been issued by ECPHRA.*
- *The archaeological site identified in the proposed Lalini Dam basin should be mapped and excavated/sampled, authorised by a permit from ECPHRA. Thereafter the site may be destroyed once a destruction permit has been issued by ECPHRA.*
- *A detailed survey of potential Early Iron Age sites should be undertaken once crops have been harvested and vegetation clearance has occurred.*
- *New roads and pipelines should be realigned as much as possible to avoid structures.*
- *The proposed access road for construction vehicles through Lotana village must be realigned to avoid the village.*
- *Fieldwork to identify heritage resources affected by roads and electrical infrastructure must be undertaken, and mitigation measures recommended, once final infrastructural locations and routes have been finalised, surveyed and pegged.*
- *All graves outside the full supply levels within 300 m of associated infrastructure should be demarcated by the Engineer's environmental representative, in consultation with the next-of-kin, for the duration of construction. These graves should not be disturbed.*
- *The power line linking the Lalini hydropower plant to the grid must be realigned to avoid the ridge, as shown in Figure 3.*

- *All access roads impacted by inundation must be compensated by providing new roads and bridges.*
- *The RPF must be implemented in a consultative manner.*
- *A dedicated Project Management Unit should be set up to manage the project.*
- *Ensure continued liaison with authorities responsible for potable water distribution. The social impacts and institutional arrangements for the proposed commercial irrigated farming scheme (land tenure/ ownership, farming model, farmer identification and support, funding, etc.) needs to be resolved between affected communities and role players before the scheme is implemented.*
- *A Decisions Register must be established and maintained, and must be available to any member of the public who wishes to access it. The register should include all commitments made to stakeholders during the public participation process, which are recorded in the Issues and Responses Report.*
- *An employment and skills development policy, maximising employment opportunities and skills development for local communities and promoting gender inclusivity and equity must be developed.*
- *A procurement policy, promoting business opportunities for local communities and gender inclusivity and equity, must be developed.*
- *An investigation on the necessity and design specifications for an eel-way should be undertaken and findings implemented.*

- **Key mitigation measures to be implemented during the construction phase**
  - *An alien vegetation control programme must be implemented, as encroachment of alien vegetation is already apparent in the study area and is expected to increase as a result of the disturbances resulting during the construction process. Rehabilitation of disturbed areas, utilising indigenous wetland vegetation species, will assist in retaining essential wetland ecological services, particularly flood attenuation, sediment trapping and erosion control, and assimilation of nutrients and toxicants, thus reducing the impacts of construction related activities.*
  - *Prohibit the collection of plant material, outside of the proposed dam basins, for firewood or for medicinal purposes during the construction phase by construction staff.*
  - *Restrict vehicles as far as possible to travel on designated roadways to limit the ecological footprint.*
  - *No hunting or trapping of faunal species is to occur.*
  - *The construction footprint needs to remain as small as possible, especially in the sensitive habitats.*
  - *Sections of power lines that require bird diverters must be identified and implemented.*
  - *Aquatic bio-monitoring must take place, starting six months prior to construction activities, and if any trends are observed where impacts on the aquatic ecology is becoming unacceptable, measures to reduce the impacts must be immediately implemented.*

- *Identified areas where erosion could occur must be appropriately protected by installing the necessary temporary and/or permanent drainage works as soon as possible and by taking other appropriate measures to prevent water from being concentrated in rivers/streams and from scouring slopes, banks or other areas.*
- *Storm water control measures must provide for erosion and sedimentation control, and for reinforcement of banks and drainage features, where required. Possible measures include the use of gabions or reno mattresses and geotextiles, re-vegetation of profiled slopes, erosion berms, drift fences with hessian and silt traps.*
- *It must be ensured that flow connectivity along the wetland features is maintained.*
- *Monitor rivers and wetlands for incision and sedimentation.*
- *Implement a water quality and quantity monitoring programme.*
- *The EWR as set out in the Reserve Determination Volume 1: River (Report P WMA 12/T30/00/5212/7) for the Ntabelanga Dam, and the EWR determined for the Lalini Dam, must be adhered to at all times.*
- *Develop a Water Management Method Statement (WMMS), including measures for water conservation, for approval by the Engineer prior to the commencement of the works.*
- *Construction personnel accommodation on site must be as limited as possible. Construction workers should as much as possible be recruited from neighbouring communities and transport provided to the construction site(s).*
- *Local residents should be recruited to fill semi and unskilled jobs.*
- *Women should be given equal employment opportunities and encouraged to apply for positions.*
- *A skills development plan should be put in place at an early stage and workers should be provided the opportunity to develop their skills which they can use to secure jobs elsewhere post-construction.*
- *A procurement policy promoting the use of local business, where applicable, should be put in place to be applied throughout the construction phase.*
- *Ensure that the appropriate procurement policies are put in place and closely followed.*
- *Ensure that all consultation is gender inclusive.*
- *Ensure that the Decisions Register is maintained, and is available to any member of the public who wishes to access it.*

- **Key mitigation measures to be implemented during the operation phase**
  - *Implement a communication strategy for the implementation phase.*
  - *No hunting or trapping of faunal species by operational staff is to occur.*
  - Aquatic bio-monitoring must take place and if any trends are observed where impacts on the aquatic ecology is becoming unacceptable, measures to reduce the impacts must be immediately implemented.
  - *An alien vegetation control programme must be maintained, as encroachment of alien vegetation is already apparent in the study area and special attention needs to be given to areas disturbed during the construction process. Rehabilitation of*

disturbed areas, utilising indigenous wetland vegetation species, will assist in retaining essential wetland ecological services, particularly flood attenuation, sediment trapping and erosion control, and assimilation of nutrients and toxicants.

- *The EWR as set out in the Reserve Determination Volume 1: River (Report P WMA 12/T30/00/5212/7) for the Ntabelanga Dam, and the EWR determined for the Lalini Dam, must be adhered to at all times.*
- *During operation and maintenance of infrastructure, vehicles must remain on designated roads and not be permitted to drive through sensitive wetland / riparian habitat, particularly on the edges of the dams where loss of wetland habitat and therefore ability of the wetlands to provide ecological services, is already compromised.*
- *Maintenance personnel must ensure that any tools and/or waste products resulting from maintenance activities are removed from the site following completion of maintenance.*
- *Regular maintenance of all roads, with specific mention of wetland / riparian crossings, must take place in order to minimise the risk of further degradation to wetland / riparian habitat.*
- *Ensure that the Decisions Register is maintained, and is available to any member of the public who wishes to access it.*
- *Maintain the potable water infrastructure, control pollution and curb illegal taps. If no such measures are implemented the community may be worse off as a result of water borne diseases or no water at all.*
- *The use of the access road to the hydropower plant by vehicles must be controlled by way of a manned boom gate or other suitable control system.*

11.3 Relocation Policy Framework

Recommendations in the RPF include:

- *Thorough identification of abandoned homesteads and recording of field ownership is required.*
- *The locations of ancestral graves at abandoned homesteads affected by the project must be ascertained.*
- *Certain structures will require replacement so that the relevant family's socio-economic activities can continue.*
- *All graves within the full supply levels of the dam should be relocated, with the permission of the next-of-kin and a permit from ECPHRA.*
- *No associated infrastructure may be located within 100 m of graves outside the full supply levels, and if unavoidable, these graves should also be relocated.*
- *A destruction permit is required from ECPHRA; if possible a single permit should be obtained for all affected structures.*
- *Avoid involuntary resettlement wherever possible.*
- *Undertake consultations with displaced people about acceptable alternatives and strategies and include them in the planning, implementing and monitoring processes.*

- *Choose the relocation site to ensure that the minimum disruption to displaced families and host communities occurs.*
- *Sensitise host communities to the pending arrival of the displaced communities;*
- *Establish a forum or resettlement committee through which resettlement and integration can be controlled by those affected.*
- *A formal accessible grievance procedure should be implemented and communicated to both the displaced and host communities.*
- *Ensure that the receiving environment is prepared and has adequate infrastructure, facilities and social services to support both the displaced and host communities, prior to moving the displaced communities.*

11.4 Offsets

The Mzimvubu Water Project will inundate wetland and riparian habitats that are breeding and foraging areas for protected and endangered cranes. The access road to the hydropower plant site also traverses a highly sensitive area. These impacts have been assessed by the ecologist to be of high significance. It is not possible to avoid, minimize or rehabilitate the impact completely. The only mitigation measure that could potentially reduce the residual negative impact significantly is an offset. One of the difficulties associated with a biodiversity offsets are that during this EIA, it has not been possible to establish whether suitable offset areas exist in the catchment, especially if a like for like principle is applied. The process to be followed would be to compile a detailed Baseline Report of the areas to be lost, to reach agreement of the offset ratios/principles, identify offset options, then implement and manage them indefinitely. Although the likelihood of successful and sustainable implementation of a biodiversity offset is questionable, the EAP is confident that some form of conservation initiative aimed at cranes could be implemented somewhere in the province. This option has also not been investigated any further during this EIA, but offers a wider selection of implementation options.

In order to estimate a budget for implementing a traditional biodiversity offset, the area of wetlands and riparian vegetation to be inundated was calculated (approximately 412 ha at the Ntabelanga Dam and 623 ha at the Lalini Dam site), multiplied by an offset ratio associated with the vegetation type (8:1 for Ntabelanga and 17:1 for Lalini) and multiplied by a factor of 3 to allow for the practical packaging of land parcels, in order to estimate an amount of land that would have to be acquired and set aside for protection. Any current use of this land will have to be compensated for. This is expected to be mostly grazing as dwellings are seldom located in wetlands or river beds and banks. If a budget of R2000-00 per ha is used to cover these costs, then approximately R90 million is required to make the land available. An additional R10 million will be required to implement the offset.

The EAP therefore recommends that the planning and initiation of some form of crane conservation project be stipulated as a condition of the authorisation of this project, and that a budget amount of R100 million be incorporated into the planning process.

Without taking the R100 million for an offset into account, the NPV of the project with population scenario 1 is R 1 827.11 million. Allocating an additional R100 million changes NPV to R 1 748.47 million. This is about a 4% change which doesn't change the economic viability of the project. The same applies to the Benefit-Cost Ratio and Internal Rate of Return.

12. Recommendations for the irrigation component of the project

Although authorisation for the irrigation component of the Mzimvubu Water Project was not applied for as part of this EIA process, the success of the irrigation component is considered essential for the success of the overall project. This will depend on a number of conditions being met, which are presented in the Economic Impact Assessment.

In view of the above, these recommendations are intended to guide relevant parties in planning and designing the proposed irrigation scheme:

- *Careful consideration must be given to the suitability of the crop selection for the irrigation development.*
- *A well-constructed agricultural development training and support system focused on assisting the new farmers will need to be implemented.*
- *Support structures should be available right from the start to assist with management. This support must cover the whole spectrum of the undertaking, from planting to marketing and the overall management. The best possible management will have to be available right from the start, which means the selection of the unit managers as well as the accepted management structure will eventually determine the success of the irrigation scheme.*
- *The assistance of the Department of Rural Development and Agrarian Reform, Tsolo Agricultural College, and Jongiliswe Agricultural College for Traditional Leaders must be enlisted to train, mentor and support developing farmers.*
- *This training must include business training, and training in project planning, monitoring and evaluation.*

Consideration should also be given to the promotion of gender inclusivity and equity.

13. Programme

The draft EIR is available to I&APs for comment from the DWS website (http://www.dwa.gov.za/projects.aspx) and hard copies are also available for perusal from a number of venues in the project area. I&APs have thirty (30) days to comment on the draft EIR.

A round of public meetings will take place in November 2014 in order to provide an update on the project and report back to stakeholders on the findings of the Impact Assessment phase.

14. Conclusion and recommendations

The main aim of the Mzimvubu Water Project is the socio-economic upliftment of the largely undeveloped and impoverished communities within the project area. This is to be achieved through:

- *Supply schemes for domestic and industrial water;*
- *Supply schemes for irrigated agriculture;*
- *Hydropower generation; and*
- *The creation of temporary and permanent jobs.*

The provision of potable water to a number of rural and small urban areas is a very important aspect of the total project and is also a constitutional requirement. It should be noted here that while the bulk water distribution infrastructure will enable this constitutional requirement to be fulfilled, the District Municipalities, and not the applicant, will be responsible for the tertiary infrastructure and ultimately distributing potable water to communities. Coordination with these municipalities is therefore required to ensure they can fulfil this mandate.

The analysis of the socio-economic situation in the proposed area indicates very high levels of unemployment and household poverty, which is seen as an indication that a very small number of households will be able to pay for water. The recommendation is that this is seen as part of a developmental project and that government accepts that this will entail a grant with subsidised funding for the basic water needs over a very long period.

Financial viability is not a requirement for a project of this nature, as the objective of the project is not to make a profit on the investment, but rather to contribute to the development of the project area. However the economic impact assessment found that the project can be economically viable, in that the direct and indirect socio-economic benefits will exceed the financial cost of the project.

The benefits of the project in terms of economic and social development are expected to be high, provided the necessary conditions for the success of the project are met and the recommended mitigation and enhancement measures are adhered to.

However, some significant negative impacts, mostly related to flora, fauna, aquatic ecology and wetlands, have been identified. Some of these impacts are permanent and cannot be mitigated to an acceptable level.

In instances where high residual impacts are expected, an offset is the last resort for mitigating these impacts. In addition to their purpose in terms of mitigation, offsets in this particular context may also constitute an opportunity to enhance the potential benefits of the project.

In view of the above, the positive impacts expected to result from the project, in terms of social and economic development are considered to outweigh the negative impacts.

It is therefore recommended that the proposed project proceed, on condition that the mitigation measures proposed are adhered to and that appropriate offsets are implemented.

As the success of the project in terms of socio-economic development rests largely on parties other than the applicant, and depends on factors outside the control of the applicant, it is critical that the necessary institutional arrangements and cooperation between all parties involved be in place, in order to ensure the primary objective of the project is achieved.