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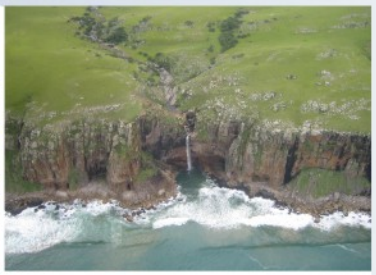
REPORT NO: P WMA 12/T60/00/4711

Feasibility Study for Augmentation of the Lusikisiki Regional Water Supply Scheme (WP 10317)






ENVIRONMENTAL SCREENING

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* *BKS (Pty) Ltd was acquired by AECOM Technology Corporation on 1 November 2012*

LIST OF STUDY REPORTS

This report forms part of the series of reports, prepared for the Feasibility Study for Augmentation of the Lusikisiki Regional Water Supply Scheme. All reports for the Study are listed below.

Report Name	DWA Report Number
Water Resources Assessment	P WMA 12/T60/00/3711
Assessment of Augmentation from Groundwater	P WMA 12/T60/00/3811
Intermediate Reserve Determination	P WMA 12/T60/00/3911
Legal, Institutional and Financial Arrangements	P WMA 12/T60/00/4011
Domestic Water Requirements	P WMA 12/T60/00/4111
Irrigation Potential Assessment	P WMA 12/T60/00/4211
Water Distribution Infrastructure	P WMA 12/T60/00/4311
Materials and Geotechnical Investigations	P WMA 12/T60/00/4411
Zalu Dam Feasibility Design	P WMA 12/T60/00/4511
Regional Economics	P WMA 12/T60/00/4611
Environmental Screening	***P WMA 12/T60/00/4711***
Record of Implementation Decisions	P WMA 12/T60/00/4811
Main Study Report	P WMA 12/T60/00/4911

This report is to be referred to in bibliographies as:

Department of Water Affairs, 2011. FEASIBILITY STUDY FOR AUGMENTATION OF THE LUSIKISKI REGIONAL WATER SUPPLY SCHEME: ENVIRONMENTAL SCREENING REPORT, P WMA 12/T60/00/4711

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Executive summary

AECOM (previously known as BKS (Pty) Ltd) was appointed by the Department of Water Affairs to carry out a Feasibility Study for the proposed Lusikisiki Regional Water Supply Scheme (LRWSS). This ***Environmental Screening Report*** *is the deliverable for* ***Module 10*** *of the study. The report deals with the investigation of potential environmental implications and the adoption of a framework within which aspects arising from or influencing the project are considered.*

The study area comprises the entire region between Lusikisiki (approximately 15 km inland) and the coast, extending from the Mzimvubu River in the south-west to the Msikaba River in the north-east. This area includes the proposed Zalu Dam site in the Xura River and the selected conveyance routes between the dam and the extended supply area. It also includes the boreholes to be selected for augmentation and the routes of the pipelines to augment the water supply to the users.

The Environmental Screening Investigation (ESI) examined potential risks associated with the proposed LRWSS in terms of the biophysical, social and economic environment as well as risks in terms of environmental legislation. The purpose of the ESI is to inform the Environmental Impact Assessment (EIA) process of what risks need to be investigated. The ESI was conducted in 2011 using available literature and information.

The study area is located within the Pondoland centre of plant endemism, which is not adequately conserved. Previous ecological investigations found no ecological sensitivities on the proposed dam site, but the potential impacts on the downstream estuary are regarded to be significant.

No human settlements are found within the dam basin, therefore a relatively small impact can be expected on the local populations. Health and safety risks will include the spreading of HIV/Aids and potential water hazards. Possible accidents between construction vehicles and pedestrians from surrounding communities on the existing access road will be a significant risk associated with the construction phase. The construction of new roads involves the risks in terms of erosion and ecological impacts.

A loss of income for the local communities is possible, as the area to be inundated by the dam will destroy plants with various medicinal and commercial uses as well as grazing land. The proposed dam site is considered to be an arable land with few restrictions to agriculture. It is not expected that the dam site will require any displacement of households. Despite the

potential loss of income, the possible construction of the dam may provide short-term employment, if local people are employed during the construction period. This will also give local people the opportunity to be trained in technical skills.

Due to a lack of information, there are some uncertainties regarding the following issues:

- *Confirmation of the presence of species of conservational concern.*
- *The possible occurrence of heritage resources.*
- *The number of people to be displaced.*
- *The environmental impacts of access roads.*

The screening assessment was undertaken using a rating approach. Every possible risk associated with each environmental issue was rated

***Table i** indicates the average scores of potential risks in terms of various environmental issues. Scoring ranges between 1: Fatal Flaw and 5: Positive Impact. The table also indicates the interpretation of the average score as per the above rating system.*

Table i: Risk Assessment Summary

Environmental issue	*Average score*	*Interpretation of average score*
Biophysical		
Geology	*3.5*	*Uncertain - favourable*
Soil	*3*	*Uncertain*
Fauna/Flora	*2.75*	*Less favourable – Uncertain*
Riverine ecosystem	*2.4*	*Uncertain - less favourable*
Water quality	*3.3*	*Uncertain – favourable*
Hydrology	*4*	*Favourable*
Social		
Agricultural	*3*	*Uncertain*
Heritage	*3*	*Uncertain*
Displacement of persons	*3.3*	*Uncertain – favourable*
Health and safety	*2.6*	*Uncertain – less favourable*
Access route	*2.3*	*Less favourable - Uncertain*
Visual	*4*	*Favourable*
Infrastructural development	*4.3*	*Favourable*
Public Participation	*3.5*	*Uncertain – favourable*
Economic		
Loss of local income due to project	*3*	*Uncertain*
Employment creation	*3.3*	*Uncertain - favourable*

Environmental issue	*Average score*	*Interpretation of average score*
Enviro-legal		
Enviro-legal	*3*	*Uncertain*

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List of abbreviations

AEMC	Attainable Ecological Management Class
ARC	Agricultural Research Council
Ca	Calcium
Cl	Chlorine
DWA	Department of Water Affairs
DM	District Municipality
ESI	Environmental Screening Investigation
IDP	Integrated Development Plan
LRWSS	Lusikisiki Regional Water Supply Scheme
mS/m	milliSiemens per meter
MAE	mean annual evaporation
MAP	mean annual precipitation
MAR	mean annual runoff
mg	milligrams
NO_2	Nitrite
NO_3	Nitrate
NTU	Nephelometric Turbidity Units
ORTDM	OR Tambo District Municipality
PO_4	Phosphate
PPP	Public Participation Process
PSP	Professional Service Provider
Si	Silicon
SO_4	Sulphate
STI	Sexually Transmitted Infections
WRSM	Water Resource Simulation Model
WTW	Water Treatment Works

List of units

a	annum
km	kilometer
km^2	square kilometer
m	meter
masl	meters above sea level
million m^3	million cubic meters
million m^3/a	million cubic meters per annum
mm	millimeter
s	second

1 INTRODUCTION

The Department of Water Affairs appointed **BKS (Pty) Ltd** in association with four sub-consultants (**Africa Geo-Environmental Services, KARIWA Project Engineers & Associates, Scherman Colloty & Associates and Urban-Econ)** with effect from 1 September 2010 to undertake the *Feasibility Study for Augmentation of the Lusikisiki Regional Water Supply Scheme*.

On 1 November 2012, BKS (Pty) Ltd was acquired by **AECOM Technology Corporation**. The new entity is a fully-fledged going concern with the same company registration number as that for BKS. As a result of the change in name and ownership of the company during the study period, all the final study reports will be published under the AECOM name.

1.1 BACKGROUND TO THE PROJECT

In the 1970s consultants O'Connell Manthé and Partners, and Hill Kaplan Scott recommended that a regional water supply scheme based on a dam on the Xura River and a main bulk supply reservoir close to Lusikisiki (located within the then defined administration area of the Zalu Dam) would provide potable water supply for the entire region between Lusikisiki and the coast, extending from the Mzimvubu River in the south west to the Msikaba River in the north east. Some areas up to 15 km inland of Lusikisiki would also be supplied. A **White Paper** describing the scheme was tabled by the Transkei Government in 1979. It was envisaged that the scheme would be constructed in phases (details of the proposed phasing of the scheme are provided in Hill Kaplan Scott's 1986 report).

After the reincorporation of the Transkei Homeland into the Republic of South Africa (RSA) in 1994, the DWA took over the responsibility for further development of the scheme. The Directorate: National Water Resource Planning commissioned the *Eastern Pondoland Basin Study* (EPBS) in 1999 to investigate the water supply situation in the area, with a specific focus on further development in the area that was originally earmarked for the Lusikisiki Regional Water Supply Scheme (LRWSS). This detailed investigation was undertaken for surface and groundwater sources, which re-affirmed that the proposed Zalu Dam was the preferred source of surface water and recommended

further investigation of groundwater sources to augment water supply to the entire area or to sub-areas.

In 2007, SRK Consulting undertook the *Lusikisiki Groundwater Feasibility Study* to investigate groundwater potential and compare the new data with data produced by earlier studies. This study reported that there is a relatively strong possibility of finding high-yielding boreholes, and that a combination of surface water (Zalu Dam) and groundwater would be the most feasible solution for the LRWSS.

1.2 STUDY AREA

The study area comprises the entire region between Lusikisiki (up to about 15 km inland) and the coast, extending from the Mzimvubu River in the south-west to the Msikaba River in the north-east. This area includes the Zalu Dam site in the Xura River and the selected conveyance routes between the dam and the extended supply area. It also includes the boreholes to be selected for augmentation and the routes of the pipelines to augment the water supply to the users.

During the Inception Phase the study area was extended in the vicinity of the Zalu Dam and to the north of Lusikisiki, as agreed with the Client and as indicated on **Figure 1.1**. In the south-western part of the study area the main focus will be on water supply from groundwater, due to the distance from the surface water source, Zalu Dam, as well as the topography.

Figure 1.1: Lusikisiki Regional Water Supply Scheme (study area)

1.3 OBJECTIVE, SCOPE AND ORGANISATION OF THE STUDY

The objective of this study is to complete a comprehensive engineering investigation at the feasibility level for the proposed LRWSS, including the possible Zalu Dam on the Xura River, and to define the most attractive composition and size of the water supply components, considering augmentation from groundwater resources.

This feasibility study assesses all aspects that impact on the viability of utilising a combination of surface water (via the Zalu Dam on the Xura River) and groundwater (via boreholes) to expand the existing water supply scheme to provide all water users in the study area with an appropriate level of water supply. The study is therefore required to:

- Identify all of the technical issues likely to affect implementation, and to define and evaluate all of the actions required to address these issues;
- Provide an estimate of cost with sufficient accuracy and reliability to ensure confident management decisions;
- Determine irrigation viability; and
- Provide sufficient information to enable design and implementation to proceed without much further investigation.

The required activities for this project have been grouped into 14 modules, as shown in **Table 1.1.**

1.4 SCOPE OF THIS REPORT

This **Environmental Screening report** is the deliverable for **Module 10** of the Feasibility Study for Augmentation of the Lusikisiki Regional Water Supply Scheme. It deals with the investigation of potential environmental implications and the development of a framework within which aspects arising from or influencing the project are considered.

The purpose of the Environmental Screening Investigation (ESI) is to identify potential environmental (biophysical, socio-economic and enviro-legal) issues of concern, using available information. It is not an environmental impact assessment and does not quantify any environmental issues. It is also not required by current legislation, but is a valuable tool to identify issues that could influence the outcome of the project. The ESI should serve as input for the Environmental Impact Assessment (EIA) regulatory process.

Table 1.1: Study Structure

New modules	Deliverable
1. PROJECT MANAGEMENT 1.1 Study initiation and inception 1.2 Project management and administration	**Inception Report**
2. WATER RESOURCES	**Water Resources Report**
2.1 Hydrology	♦ Hydrology chapter
2.2 Yield analysis	♦ Yield Analysis chapter
2.3 Reservoir sedimentation	♦ Sedimentation chapter
3. GROUNDWATER AUGMENTATION	**Assessment of Augmentation from Groundwater Report**
4. RESERVE - ECOLOGICAL WATER REQUIREMENTS	**Reserve Determination Report** ♦ Reserve Template
5. WATER REQUIREMENTS	
5.1 Domestic water requirements	**Domestic Water Requirements report**
5.2 Agriculture / Irrigation potential	**Irrigation Development report**
5.3 Water quality	♦ Chapter in Water Distribution Infrastructure report
6. WATER SERVICE INFRASTRUCTURE	**Water Distribution Infrastructure report**
6.1 Distribution infrastructure	♦ Chapter in Water Distribution Infrastructure report
7. PROPOSED ZALU DAM	
7.1 Site investigations	**Materials and Geotechnical Investigations report**
7.2 Dam technical details	**Dam Preliminary Design report, including design criteria, dam type selection and dam sizing**
8. COST ESTIMATE AND COMPARISON	♦ Project cost chapter included in the Main Study Report
9. REGIONAL ECONOMICS	**Regional Economics report**
10. ENVIRONMENTAL SCREENING	**Environmental Screening report** ♦ Scope of work for the EIA
11. PUBLIC PARTICIPATION	♦ Included in Environmental Screening report
12. LEGAL, INSTITUTIONAL AND FINANCIAL ARRANGEMENTS	♦ Legal, institutional and financing arrangements chapter in the Main Study Report
13. RECORD OF IMPLEMENTATION OF DECISIONS (RID)	**RID**
14. MAIN REPORT AND REVIEWS	**Main Study Report**

2 APPROACH

This ESI report documents the results of an environmental screening investigation for the LRWSS. The environmental screening considered the following factors:

- Biophysical
  - Climate
  - Geology
  - Soil (erosion index)
  - Topography
  - Terrestrial Ecology (including fauna and flora)
  - Riverine Ecology
  - Water Quality
  - Hydrology
- Social
  - Agricultural potential
  - Potential mining or quarrying
  - Displacement of persons
  - Heritage and heritage landscapes
  - Health and safety (including HIV/Aids)
  - Access route (accessibility to site)
  - Visual (deterrent in ecological scenic environment)
  - Infrastructural development (water, electricity, etc.)
- Economic
  - Loss of local income due to project
  - Generation of employment by project
- Enviro-legal aspect
- Public participation

The screening assessment was undertaken using a rating system. The following rating system was used:

- Positive Impact (5 points) – sufficient information exists to consider a positive impact.
- Favourable (4 points) – sufficient information exists to make a considered rating that the overall environmental impact would not be significant.

- Uncertain (3 points) – there is uncertainty over the nature and extent of the impact, primarily due to a lack of information on site-specific conditions.
- Less favourable (2 points) – sufficient information exists to determine that the site will be negatively impacted.
- Fatal flaw (1 point) –there could be an impact that cannot be mitigated.

3 OVERVIEW OF THE AFFECTED ENVIRONMENT

3.1 CLIMATE

The distribution of the average, minimum and maximum monthly rainfall in quaternary catchments within the Msikaba River Catchment, based on the recorded period 1920 to 2007, showed a very flat seasonal variation of rainfall and that annual maximum rainfall can occur in any month. November to March constitutes the wet months and May to August is the dry period. However, some of the highest monthly rainfall figures for some years were recorded during July. The catchment's mean annual precipitation (MAP) ranges from 885 mm to 1 116 mm and the MAP at the Zalu Dam site is 850 mm.

Mean annual evaporation (MAE) is relatively constant from year to year, but differs significantly between months and seasons. According to the *WR2000-study*, the Msikaba River Catchment is situated in the WR2005-evaporation Zone 30C with a MAE of 1 150 mm indicating that the MAE exceeds the MAP in the catchment.

3.2 GEOLOGY AND SOILS

The geology of the study area changes from the hard quartzite rock of the Natal Group Sandstones, comprising the coastal plateau, into the rolling hills of the interior where the underlying rock is tillite, shale, mudstone and sandstone of the Karoo Sequence, with intrusions of igneous dolerite, gabbro and related intrusive rocks (Kaperta & Johnson 1979).

The soils formed on the Natal Group sandstones are generally shallow, highly leached, sandy and acidic. In addition, many areas contain aluminium toxicity (Nicolson 1997).

3.3 TOPOGRAPHY

The hard quartzitic rock of the Natal Group Sandstones forms the coastal plateau, which has been deeply incised by numerous rivers, creating spectacular forested gorges. The Natal Group Sandstones are also characterised by large east-west faults that change direction to north-south, causing major displacement. The areas inland, surrounding the town of Lusikisiki, form rolling hills within the Dwyka and Ecca groups.

3.4 TERRESTRIAL ECOLOGY

3.4.1 Flora

The section of the study area that borders the coast falls within the Maputoland-Pondoland Region of Endemism, which is one of the seven centres of floral endemism in southern Africa. More specifically the study area falls within the Pondoland Centre of Endemism, which is a distinct focus area for high plant endemism and diversity in the Maputoland-Pondoland Region of Endemism. Conservation of the Pondoland Centre of Endemism is considered inadequate (van Wyk & Smith, 2001).

The Pondoland Centre of Endemism is largely confined to the quartzitic sandstone formation of the Natal Group, which occurs as surface outcrops in a belt 15-20 km wide along the coastal plateau. At least 130 local endemic plant species and 33 red data listed taxa occur in the Pondoland Centre of Endemism. Endemic species include geophytic orchids, bulbs, large trees and the rare Mkambati Palm (*Jubaeopsis caffra*). The Mkambati Palm has been declared a National Monument. Over 1 300 plant species have been recorded in the Mtamvuna Nature Reserve in the Pondoland Centre of Endemism. Sandstone forests in the river gorges dissecting the coastal plateau are important ecosystems in the Pondoland Centre of Endemism. There are at least 30 endemic or near endemic tree species in these forests.

The study area comprises the transition between the Indian Ocean Coastal Belt biome and the Savanna biome (Mucina and Rutherford, 2006). The vegetation at the proposed Zalu Dam site has been classified as Ngongoni Veld, which is considered vulnerable.

Two vegetation surveys of the proposed dam site, undertaken in the winter of 1999 and summer of 2000, determined that the natural vegetation had been highly disturbed (Anton Bok Aquatic Consultants CC, 2001 c). Two protected species were recorded within the proposed inundated area of the Zalu dam, namely *Harpephyllum caffrum and Scadoxus puniceus* (Colloty, 2011).

The remaining hardwood species (*Acacia karroo, Euclea undulata, Trimeria trinervis*) were being used for construction or firewood. The reeds and sedges (Bulrush, Ruigtegras and Common Reed) were being harvested from the riverbanks, mostly for weaving mats, ropes or baskets. The ropes are used in the roof thatching, which is also done using local thatch grass (*Hyparrhenia hirta*).

All the Savanna species recorded have a grazing value; however, these vegetation types have been degraded and the species that remained have a low nutritional value. With better veld management and burning practices, these conditions could be improved (Anton Bok Aquatic Consultants CC, 2001 c).

The higher-lying reaches of the Zalu Dam site (**Figure 3.1**) are covered in mono-specific stands of either Black Seed Bristle grass (*Setaria nigrirostris*) or Ngongoni Three-awn (*Aristida stipitata*). These two species cover terraced fields that have been left fallow on both sides of the valley. The lower-lying areas of the riverbank are dominated by remnants of riparian forest species (Common Guarii (*Euclea undulata*) and Buffalo-thorn (*Ziziphus mucronata*)) and Small-leaved Trimeria (*Trimeria trinervis*). The woody species have been removed for firewood and the area has been heavily grazed.

Figure 3.1: Area to be inundated

The instream channel is occupied by plants that are associated with water (i.e. Ruigtegras (*Miscanthus capensis*), Cape Bulrush (*Typha capensis*), Sedge (*Schoenoplectus littoralis*) and the Common Reed (*Phragmites australis*)). The rest of the riverbank was covered by the Wild Date Palm (*Phoenix reclinata*), which has been stunted due to grazing.

Small reaches of the riverbank were composed of rock and cliffs. Plants found on these formations include the Cape Aloe (*Aloe ferox, Aloe puridens*), Spekboom (*Portulacaria afra*), Tree Euphorbia, (*Euphorbia triangularis*), Sisal spesies and Giant Turpentine Grass (*Cymbopogon validus*). The only species observed that could have any medicinal value were the Bulrush and *Aloe* species (Anton Bok Aquatic Consultants CC, 2001 c).

3.4.2 Fauna

Proper faunal investigations were not undertaken for the proposed dam site. Therefore, a specialist investigation on sensitive animals on the proposed dam site must be conducted during the Environmental Impact Assessment (EIA).

3.5 RIVERINE ECOLOGY

Investigations undertaken for the *Eastern Pondoland Basin Study*, considering the present ecological status, gave the Eastern Pondoland quaternary catchments a Class B attainable ecological management class (AEMC). Class B AEMC ecosystems are modified mainly due to the destruction of riparian vegetation, poor stream-bank conditions and erosion.

The Class B AEMC was assigned to the study site because man-induced impacts on riverine habitats are widespread and there has been a loss of natural habitats. The Present Ecological Status is also classified as Class B, which indicates that the site is largely natural with few modifications, but some loss of natural habitat, particularly riparian habitat, is evident (Anton Bok Aquatic Consultants CC, 2001 b).

Studies of specific reaches of the Xura River in and near the Zalu Dam site resulted in AEMC classifications of B for the instream and C for the riverine ecosystems. The riparian zones have been degraded by riverbank erosion, which was caused by the removal of stabilising vegetation that binds the soil and erosion gullies that are formed by vehicle tracks and animal paths. The cultivation of maize crops, wood-cutting and intensive grazing have severely impacted the riparian strip (Anton Bok Aquatic Consultants CC, 2001 b).

Currently, impacts on the instream component are relatively small as indicated by the Class B status. The implication of an EMC of Class B for a river is that only water resource developments that have a small risk of modifying the natural biotic template and exceeding the resource base are allowed (*Kleynhans 1999*).

3.6 ESTUARINE ECOLOGY

The proposed dam site is located in the catchment of the Msikaba Estuary (**Figure 3.2**). All potential impacts on this estuary must be determined.

Figure 3.2: Sensitive estuary on the Msibaka River

The Eastern Pondoland estuaries are in a relatively pristine state and are considered to be of significant conservation value. The region lies within the transitional zone between subtropical and warm-temperate zoogeographical zones, with many marine and estuarine species approaching the southern limit of their distribution (*Wooldridge 1999*). The estuaries are relatively small, usually less than about 5 km in length, and range from mangrove systems and shallow lagoons to the 39 m deep Msikaba estuary, which is the deepest estuary along the South African coast. The estuaries with mangrove communities, such as the Mntafufu and Mzintlava, are of particular importance and are very sensitive to disturbances (such as reduced freshwater inflow), which may lead to mouth closure (Anton Bok Aquatic Consultants CC, 2001 a).

The preliminary investigation on the estuarine freshwater flow requirements, or estuarine Reserve (quantity), of the Eastern Pondoland estuaries, indicated that the freshwater requirement of the estuaries may be much higher than those of the riverine zones. In addition, this study emphasised the importance of maintaining the natural base-

flow component of river flows (*Anton Bok Aquatic Consultants CC, 2001 a*). These base-flows are essential for maintaining the natural sediment dynamics, i.e. the natural open/closed mouth condition of these estuaries. The freshwater requirements of the estuaries will define the upper limits to the abstraction of base flows from these rivers, which may have significant implications for water supply schemes in the region (Anton Bok Aquatic Consultants CC, 2001 a).

3.7 HYDROLOGY

A hydrological assessment for the feasibility study area has been conducted (refer to DWA Report No. P WMA 12/T60/00/3711). It used previous studies that generated time series of naturalised monthly flows for different study periods (WR90 and WR2005). WR90 is relevant for a period of up until the year 1990 and WR2005 is the updated version of WR90 for 1990-2005. The outcomes of this assessment are summarised in this section.

3.7.1 Rainfall

The mean annual rainfall in the Msikaba River catchment is relatively uniform over the study area and there is a correlation of monthly rainfall between adjacent rain gauges. There are five rain gauges inside the catchment and three outside of it with enough distance to give a good indication of the rainfall in the Msikaba River catchment. However, a concern is that the distribution of the operational rain gauges does not adequately cover the catchment area, and more rain gauges are required in the drier, upper western portion of the catchment. There are a number of open rain gauges that have long rainfall records, starting in the 1920s, which were used as far as possible to generate the catchment rainfall records.

The decrease in the number of functional gauges in the rain gauge network in the Msikaba River catchment is of great concern and closure of the 0153 875 W rain gauge at Flagstaff and 0154 142 W rain gauge at Lusikisiki–TNK should be re-considered. Data at the 0154 143 W rain gauge at Lusikisiki Prison are considered unreliable. Measurement at the gauge should be improved or monitoring should be discontinued, as the current data cannot be used.

A climate station that at least measures evaporation and rainfall should be established at the proposed Zalu Dam.

3.7.2 Evaporation

No evaporation data are available and the WR2005 evaporation data, which are identical to the WR2005 evaporation data for the evaporation Zone 30C, were used in this study. WR90 and WR2005 are studies that generated time series of naturalised monthly flows for different study periods. WR90 is relevant for a period up until 1990. WR2005 is the updated version of WR90 for 1990-2005.

3.7.3 River Flows

The simulated flow data for the LRWSS are, on average, 3% higher than the results from the Water Resource Simulation Model (WRSM2005) study, and 7% higher than the results from the Pondoland Basin Study. The difference in the results can be ascribed to the good calibration that was achieved at the new gauging station (T6H004) and to the latest updated Sami-parameters for calibration and flow simulation that was included in this study.

The WRSM2005 study did not include a calibration at T6H004, as it was only available after completion of the WRSM2005 study. The WRSM parameters from the WRSM2005 study were changed slightly to achieve a good fit of the observed versus the simulated flow data at T6H004.

The natural and present day flows generated for the hydrological years 1920 to 2007 are summarised in **Table 3.1** (Msikaba River quaternary catchment) and **Table 3.2** (Xura River quaternary catchment).

Table 3.1: Natural and Present-Day MAR for the Msikaba River Quaternary Catchments

Quaternary catchment	Catchment area (km²)	Natural MAR (million m³)	Present day MAR (million m³)
T60E	198.0	29.5	29.0
T60F	463.9	85.8	84.1
T60G	360.0	105.7	105.7
Total (T60E,T60F and T60G)	**1 021.9**	**221.0**	**218.8**

Table 3.2: Natural MAR for the Xura River Sub-Quaternary Catchments

Quaternary catchment	Catchment area (km²)	Natural MAR (million m³)
T60F1	71.4	13.2
T60F2	21.6	4.0
T60F3	271.1	50.2
T60F4	100.0	18.5
Total (T60F)	**463.9**	**85.8**

The water resources in the Msikaba and Xura rivers, in terms of the mean annual runoff (MAR), are presently hardly used. It has been estimated that less than 5% of the MAR of the larger rivers, and even less MAR from the smaller rivers, is being abstracted. Human settlements in the catchments in Eastern Pondoland are largely rural in nature and there is little industrial development.

3.8 WATER QUALITY

The DWA provided water quality data for one monitoring station within the study area (**Figure 3.3**).

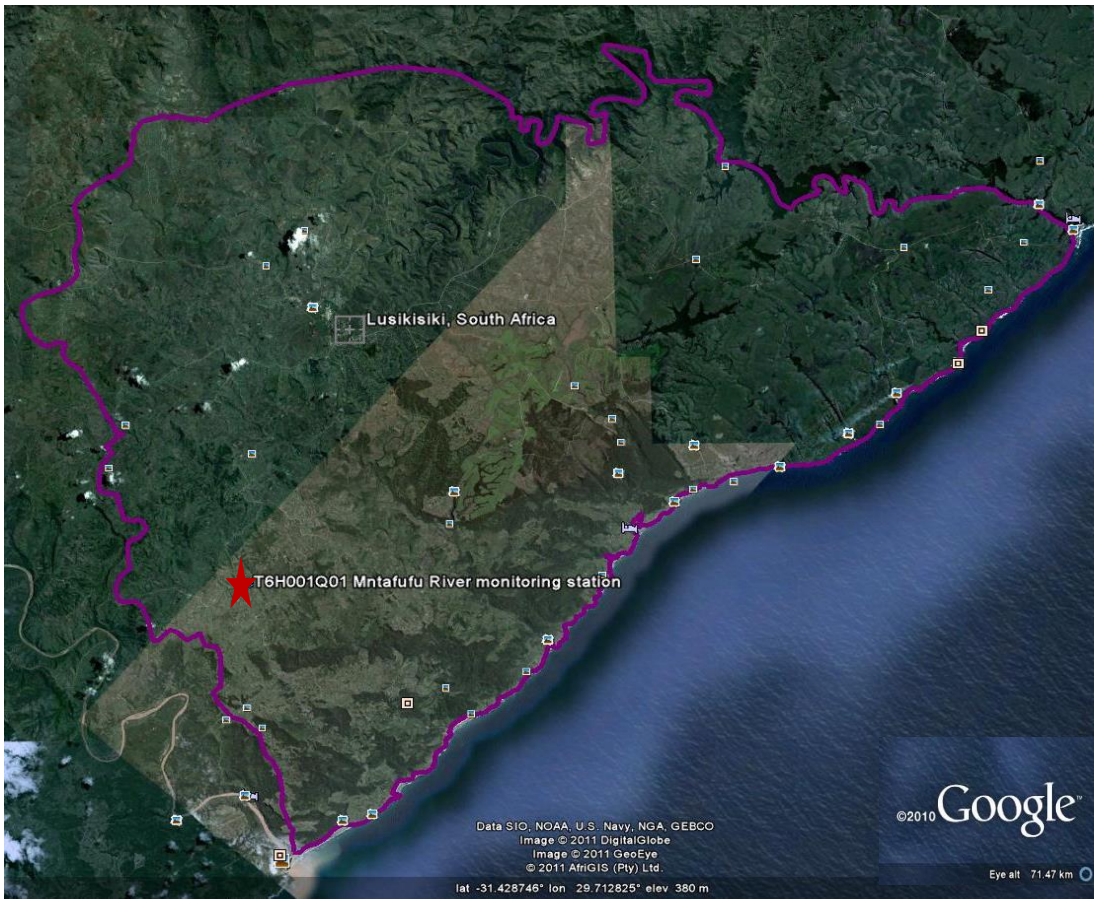

Figure 3.3: Water quality monitoring station within study area

Table 3.3 indicates the minimum, maximum, median, 5th percentile and 95th percentile values for available water quality parameters and compares it to DWA standards for domestic or aquatic ecological use.

Table 3.3: Water quality at monitoring station T6H001Q01 Mntafufu River (DWA, 2011)

Stats of	Min	Max	P5	Median	P95	Target (DWA)			
						Within Domestic Range	Exceeding domestic target		
Ca (mg/l)	5.2	17.1	6.8	9.6	12.3	0-23	>23		
Cl (mg/l)	6.6	42.8	18.7	26.7	37.7	100	>100		
Mg (mg/l)	4.1	16.6	5.3	7.7	10	30	>30		
NO_3+NO_2 (mg/l)	0.02	1.4	0.04	0.1	0.9	6	>6		
pH-dissolved in water (in pH units)	6.8	8.4	7.5	7.9	8.2	6 to 9	<6 and >9		
pH- saturation with respect to $CaCO_3$ (null)	8.1	9.3	8.5	8.6	8.9	7 to 9	<6 and >9		
PO_4 (mg/l)	0.006	0.16	0.006	0.018	0.075	0.005	0.005-0.025	0.025-0.25	>0.25
Si (mg/l)	6.03	15.4	7.04	8.7	10.9	2.8	-		
SO_4 (mg/l)	1	17.8	2	4.6	10.6	0-200	>200		
Electrical conductivity (mS/m)	-	-	17.82	22.7	27.69	40	40-90	90-370	>370

Table 3.3 indicates that the pollution levels in the rivers are low. However, domestic effluent inputs near larger towns such as Lusikisiki can be expected. The OR Tambo District Municipality did not participate in the Green Drop Scoring programme in 2009 and were not assessed. This system could therefore not provide any information on water quality in the study area.

The instream habitat integrity of most of the rivers in the Eastern Pondoland is high, i.e. largely natural, with few modifications.

Riparian habitats of many of the rivers in Eastern Pondoland, particularly in the more densely populated inland areas where the rivers are accessible and close to settlements, have been significantly impacted by human activities.

These anthropogenic impacts on the riparian zones include clearing and cultivation of the floodplain, overgrazing by goats and cattle, harvesting of hardwood trees for building materials and firewood, trampling and destabilisation of riverbanks by stock and destructive veld burning practices.

The water quality in the upper and middle reaches of the Xura River system is good and shows little signs of pollution, with low nitrate, ammonia and phosphate concentrations. At points adjacent to the Port St. Johns / Flagstaff road, there is little indication of human

impacts on the rivers. Microbiological impacts on the Xura River are also relatively low. There is little surface erosion in the upper parts of the catchment. The turbidity values are lower than 25 NTU (Nephelometric Turbidity Units). Turbidity has never exceeded 80 NTU in the Xura River, even after heavy rainfall events.

The region adjacent to the Xura River between the town of Lusikisiki and the proposed Zalu Dam site is more urbanised than the upper catchment. The impact of pollution on the water quality is evident downstream of the confluence of the Lusikisiki and Xura rivers (downstream of the Zalu Dam site). Most of the water treatment works of the town of Lusikisiki discharge effluent into the Lusikisiki River. This effluent does not comply with the standards, and is likely to have severe impacts on water quality during times of low river flows. Any further reductions in the flows due to increased abstraction from the Xura River may degrade the quality of the water in the Xura River significantly.

3.9 AGRICULTURAL POTENTIAL

The geology of the study site changes significantly moving inland from the coast. The coastal soils formed on the Natal Group sandstones are generally of low agricultural potential, because they are usually shallow, highly leached, sandy and acidic. In addition, many areas are affected by aluminium toxicity (*Nicolson 1997*). The poor soils, combined with the rugged landscape, have contributed to the limited economic development and relatively low population density along the Pondoland coastal plain.

Inland the landscape changes to rolling hills and the soils are underlain by tillite, shale, mudstone and sandstone of the Karoo Sequence, with intrusions of igneous dolerite, gabbro and related intrusive rocks (*Kaperta & Johnson, 1979*). In these areas, the soils are generally of higher quality and the conditions are more suitable for agricultural development. These areas support higher population densities and land-use is more intensive. Thus, human-induced impacts on the natural environment are much higher in these areas.

The Agricultural Research Council's (ARC) Institute for Soil, Climate and Water developed and implemented a workable land capability system for South Africa in 2002 on behalf of the Directorate of Agricultural Land Resource Management. Directorate of Agricultural Land Resource Management functions under the National Department of Agriculture to implement the provisions of the Conservation of Agricultural Resources Act, 1983 in respect to natural resource management. The land capability of the proposed Zalu Dam

site in the inland falls within Class 4, which represents land that is arable, but is severely limited and restricted in terms of the type of crop that can be cultivated successfully. Crop yields are generally not optimal and careful management is required (*ARC ISCW, 2002*). According to KARIWA Project Engineers and Associates 94% of the study site is not suitable for sustainable irrigation (*KARIWA Project Engineers and Associates, 2011*).

Land use throughout much of the area consists of small-scale or subsistence agriculture comprising the cultivation of cash crops (predominantly maize and vegetables) and a variety of livestock. Afforestation, invasive alien plants, irrigation and domestic water use are considered the main water users in the Msikaba River catchment.

3.9.1 Irrigation

Information on irrigation was compiled by KARIWA Project Engineers. It indicates that there is no significant irrigation in the Msikaba River catchment at present.

3.9.2 Domestic Abstractions and Return Flows

The historical record of water abstracted for the Lusikisiki Water Treatment Works (WTW) from the Xura River at the bridge (at gauging station T6H004), and metered by T6H005, was used as a measure of the domestic water supplied to the town of Lusikisiki. Water abstraction increased from approximately 0.75 million m^3/a in 1999 to 1.1 million m^3/a in 2007 and 1.4 million m^3/a in 2011.

3.9.3 Afforestation

Google Earth shows very little development in the Msikaba River catchment, and KARIWA confirmed these observations. The WR2005 afforestation area of 2.9 km^2 in T60G was thus accepted as the only significant afforestation in the Msikaba River catchment.

3.9.4 Invasive Alien Plants

In the absence of recent data, the WR2005 invasive alien plants areas were accepted as the best available information related to the reduction of run-off by invasive alien plants. **Table 3.4** summarises the areas of invasive alien plants that were adopted for modelling. The water usage, based on present-day development levels, is provided in **Table 3.5**.

Table 3.4: Areas of invasive alien plants in the Msikaba River catchment

Sub-quaternary catchment	Catchment area (km^2)	Invasive alien plants area (km^2)	% of invasive alien plants in catchment
T60E	198.0	1.6	0.8
T60F	92.9	3.8	4.1
T60G	360.0	0.0	0.0
Total	**650.9**	**5.5**	**0.8**

Table 3.5: Present day water usage

Quaternary catchment	Catchment area (km^2)	Afforestation usage (million m^3/a)	Alien vegetation usage (million m^3/a)	Domestic usage (million m^3/a)
T60E	198.0	0.3	0.2	0.0
T60F1	71.3	0.0	0.6	0.0
T60F2	21.6	0.0	0.0	1.0
T60F3	271.1	0.0	0.0	0.0
T60F4	99.9	0.0	0.0	0.0
T60G	360.0	0.0	0.0	0.0
Total T60E,F&G	**1 021.9**	**0.3**	**0.8**	**1.0**

3.10 HERITAGE

The Albany Museum, located in Grahamstown in the Eastern Cape Province, has no records of archaeologically significant sites in the study area, because the area has not been surveyed (Booth, 2011). According to *Booth* (*2011*), however, archaeologically sensitive areas can be expected in the study area based on the site's characteristics. Early and Middle Stone Age artefacts, as well as Early Iron Age artefacts might be found.

An archaeological specialist study should be conducted on the site during the EIA process.

3.11 DISPLACEMENT OF PERSONS

Based on available information households are not expected to be present in the dam basin. The displacement of people is thus not expected, but this must be confirmed during the EIA. Even though the displacement of people is not expected, local people will be affected by a loss of land and pasture.

3.12 HEALTH AND SAFETY

Sub-Saharan Africa is the region most severely affected by HIV/Aids in Africa (*UNAIDS/WHO, 2004*). The HIV epidemic in Sub-Saharan Africa is likely to continue to spread for the foreseeable future. About 33% of those currently living with HIV/Aids are aged 15-24 years.

Demographic data provides some of the reliable sources of information about HIV/Aids and the workplace. At a symposium on HIV/Aids in the workplace (*University of the Witwatersrand, 2004*), it was identified that:

- The HIV prevalence among contract workers was higher than among permanent employees.
- There was a higher HIV prevalence in lower-paid than higher-paid occupations.
- The HIV prevalence rate peaks between the ages of 30 and 39 years in men, and at a slightly lower age among women.
- The epidemic disproportionately affects women in Southern Africa.

An analysis of this information reinforces the notion that development projects could have a significant impact on the local and regional prevalence of HIV/Aids. Two risk categories can be identified: the risk environment and risk behaviour.

In development projects, most of the workforce is contract workers that typically come from outside the region, and mainly consists of young men, which places the women from the surrounding community at risk of contracting the disease and spreading it within the community.

Socio-cultural, economic and demographic changes associated with population mobility in and out of a project area will determine the risk environment related to HIV/Aids in the communities affected by the project. Within this context, attitudes, values, knowledge and practices affecting safe sex will determine the extent of risk in terms of susceptibility and vulnerability.

3.12.1 Risk Environment

The risk environment is an environment in which the chances of disease transmission are increased by social, economic and cultural factors. Risk environment factors may include:

- Project employees interacting on a regular basis with sex workers
- Wage earners with affordable and disposable income for alcohol, drug abuse and sex workers
- Opportunities for sex workers to establish activities at the project site
- The cultural practices of drunkenness and drug abuse associated with sexual activity
- Lack of awareness and knowledge about unsafe sex and sexually transmitted infections (STIs)
- Sexual relationships between people from different areas with unknown sexual histories (casual sex, multiple sex partners, etc.)
- Feelings of loneliness and sexual deprivation due to an absence of regular partners
- Poverty, which reduces the ability of sex workers to negotiate condom use with their clients, etc.

3.12.2 Risk Behaviour

Individual responses and adaptation to high-risk environments arising from a development project may lead to high-risk behaviour, which is conducive to HIV/Aids transmission and infection. Risk behaviour can be classified under unsafe sexual activities, unprotected commercial sex and substance abuse. Examples of risk behaviour are:

- Unsafe sexual activity (homo, hetero or bisexual) through commercial and casual sex.
- Sex workers are receptive to unsafe sex for more money.
- The high risk behaviour of an individual has a ripple impact on the family, community and society. These include:
    - Exposure of sexual partners to HIV infections.
    - Transmission from infected mothers to their children during pregnancy, delivery and breastfeeding.
    - Exposure of others (outside the project area) to infected sex from workers who leave the project site.
    - Transmission of HIV through sex workers within and outside the project area.

3.13 ACCESS ROADS

Access to the various sites could require the construction of new roads or the upgrading of existing roads. Types of access required during construction and operation of the scheme are classified as:

a) Temporary access roads to the site during construction
b) Permanent access roads to the site
c) Temporary site roads required during construction

3.14 VISUAL IMPACT

Inundation of the current valleys will alter the aesthetic character of the sites. Temporary visual impacts related to the construction phase of the scheme, such as landscape scarring, is expected to be significant due to activities such as clearing of construction servitudes, exposure of soils in previously vegetated areas and construction of access roads and haul roads.

Machinery and construction workers at the construction site over the construction period will also have a relatively significant visual impact on people living in the vicinity.

The dam wall will be visible to the local villages.

3.15 LOCAL INFRASTRUCTURE

3.15.1 Water Use

The local population uses the water resource on the proposed development site for domestic purposes and watering livestock and they harvest the riparian vegetation for firewood, medicine and building materials (Anton Bok Aquatic Consultants CC, 2001 c).

3.15.2 Local Development Planning

Because of its unique attractions, the OR Tambo District Municipality (ORTDM) could develop a community-based tourism industry (OR Tambo District Municipality, 2006). This opportunity has been considered in the Integrated Development Plan (IDP), and will require improvements to infrastructure, accessibility and security. Port St. Johns is currently improving its tourism potential (OR Tambo District Municipality, 2006). The dam

could be a tourist attraction and the associated infrastructure will help improve access to the area and to a reliable water supply in the municipality.

Agricultural land in the ORTDM has not yet been fully exploited and large areas of arable land are not cultivated. There is also a potential for forestry development in the ORTDM. Irrigation schemes stemming from the LRWSS could also assist with developing and sustaining agriculture in the area.

Infrastructure within the study area consists of roads, Eskom Power Lines and water pipes etc. The localities of pipes have not been confirmed yet, but no pipes are expected to be located within the proposed Zalu Dam site. Eskom Power Lines and roads are indicated in **Figure B-1 (Appendix B).**

3.16 LOCAL INCOME

The local people earn income from their environment via agriculture, the collection of medicinal plants and from felling trees for timber or firewood. The following tree species in the area can potentially provide an income for local people:

Acacia ataxacantha: The wood of this plant is mainly used for small implements and tools and it can be fashioned into strips which are used as weaving material for baskets. The roots are also used to make baskets and long-stem tobacco pipes. The plant has medicinal properties and can be used to treat constipation and abdominal pains. In some local cultures the plant is often thought to protect infants from witchcraft (*Turner, 2001*).

Acacia karroo: The sweet gum from this tree is edible and was commercialised as "Cape Gum". The wood can be used as firewood. The bark, leaves and gum can be used for wound poultices, eye treatments and cold remedies. Cattle with tulp poisoning, caused by the eating of poisonous bulb *Homeria*, are treated with sweet thorn (*Aubrey & Reynolds, 2002*).

Aloe species: The leaves and roots of *Aloe* species are used by the Zulus (and other cultures) for roundworm, stomach problems and horse sickness (*Emms, 2007*).

Cussonia species: The leaves are used as a treatment for indigestion. The wood is used to make mole traps. The roots are edible (*Hankey, 2004*).

Euphorbia species: This plant has poisonous latex and is not well commercialised in South Africa. However, it is not susceptible to invasion by wood borers and is thus used as struts for roofs (*Voigt, 2007*).

3.17 SOCIAL ENVIRONMENT

The population size and socio-economic statistics were obtained for the following four distinct geographical areas:

- ***Planning Area*** – this is the smallest geographical area that will directly be influenced by the proposed Zalu Dam. It is the primary geographic area that will be targeted by the socio-economic survey.
- ***Primary Study Area*** – this area represents the Study Area.
- ***Secondary Study Area*** – the Secondary Study Area includes the Primary Planning Area and comprises the Inguza Hill and Port St Johns Local Municipalities (LM).
- ***Tertiary Study Area*** – this is the largest geographical area, which represents the O.R. Tambo District Municipal Area. It provides the wider regional context, within which the Zalu Dam development is planned.

3.17.1 Population

The 2010 population for the Planning Area is estimated at about 78 700 people consisting of 15 400 households. The Primary Area population is estimated at 162 800 people with about 32 800 households. The Planning Area's population represents just over 48% of the Primary Study Area population. The Secondary and Tertiary Area have population sizes of 460 900 people and 1.89 million people, respectively (Department of Water Affairs, 2008).

3.17.2 Socio-Economy

Socio-economic data was provided by the DWA (Department of Water Affairs, 2008) and were analysed by Urban Econ as part of the Feasibility Study (refer to DWA Report No. P WMA 12/T60/00/4111). The outcomes of this assessment are summarised here.

Females outnumber males in the Planning Area and the largest portion of the population is younger than 30 years old.

Half of the population in the Primary Area has not attended school, however, children at the age of 0-5 years have been included in the category, which inflates the number. Of

the people that have some kind of formal education, 24% has primary education and 21% has secondary education.

Approximately 72% of the population in the Primary Area is unemployed and approximately 15% of the population is employed in the formal and informal sectors, mostly in the agriculture and fishing sectors, followed by the finance, insurance and manufacturing sectors in no particular order. The wholesale and retail trade sector in the Primary Area also employs a large portion.

The agriculture and fishing sector is also the largest portion in the Secondary Area, followed by wholesale and retail trade.

More than half of the population in the Primary Area earns no income, with 31.2% earning annual incomes of less than R6 652 per annum. More than half of the Primary Area's main source of income is from social grants, followed by salaries and wages. Non-durable goods represent the largest portion of the expenditure, followed by expenditure on services.

Of the approximately 190 formal and informal businesses in Lusikisiki (*Business Audit, 2011*), 151 were sampled, which altogether employs a total of 1 180 people. Businesses in the *Food and non-alcoholic beverages* outlets, including tuck shops and food stands, are most prevalent, followed by the *clothing and footwear* shops. The majority of businesses in Lusikisiki have been operating for less than 10 years.

According to the Market Survey, the river-stream is the main source of water followed by "piped water less than 200 meters from the dwelling" (29%).

3.17.3 Land Tenure

According to Loxton, Venn and Associates (1997) the various types of land tenure in the Wild Coast region are:

- ***Freehold*** - currently present mainly in urban areas
- ***Leasehold*** - these include formal leases, unregistered leases and government agreements
- ***Quitrent*** - this is similar to leasehold but the land is occupied in perpetuity and a nominal rent is paid to the government

- ***Traditional (communal)*** - the right to use land is granted by the Tribal Authority. Most of the land in the region falls under this category.
- ***Trust*** –government held land.
- ***Agricultural Schemes***- state-run agricultural development schemes.

3.18 PUBLIC PARTICIPATION

BKS conducted a limited public participation process (PPP) as part of this feasibility study. Details of the process are included in **Appendix A**. The PPP achieved the following main objectives:

- facilitate the establishment of a stakeholder committee;
- arrange stakeholder meetings in support of the Environmental Screening Process;
- prepare the initiation of an independent EIA; and
- attend meetings with the EIA team to provide technical information in support of the public participation process.

The following two issues were raised during the PPP:

- There is a poor perception and negative attitude towards groundwater.
- There is a lack of sustainable and safe drinking water sources in the area.

An awareness campaign was conducted in an attempt to improve knowledge about and perception of groundwater. Communication with the stakeholders and the communities surrounding the site should continue to ensure informed participation, decision-making and a clear transparent process throughout.

4 IDENTIFICATION OF POTENTIAL ENVIRONMENTAL RISKS

The screening assessment was undertaken using a rating approach. Risks associated with each environmental issue were rated as per the rating system in **Section** 2.

4.1 GEOLOGY RISK ASSESSMENT

Geological risk occurs at two levels (**see Table 4.1**):

- The construction of the dam wall requires suitable geological conditions to ensure safety factors are met.
- The impounding of water will add a significant weight onto the area and minor geological stresses could be exacerbated.

Table 4.1: Risk to geology

Field	Risk description	Sufficient information	Rating	Average
Geology	Wall foundations	Yes	4	3.5
	Geological stresses	No	3	

4.2 SOIL RISK ASSESSMENT

The removal of plant material, expanding access roads, haul roads, dam construction and other activities can make areas susceptible to erosion (**Table 4.2**). In the short term erosion changes soil stability, which affects the safety of slopes. In the longer term erosion exposes soil and displaces sediment. If erosion prevention measures are implemented, the risk will be lowered.

Table 4.2: Risk on Soil

Field	Risk description	Sufficient information	Rating	Total
Soil	Erosion	Yes	3	3

4.3 TERRESTRIAL ECOSYSTEMS RISK ASSESSMENT

The following risks are expected in terms of the terrestrial ecosystem:

- Some woodlands that provide food sources and habitats will be affected during the construction phase, and will be permanently altered after construction is completed.

- The construction of the dam may reduce the overall connectivity of the ecosystem, as some of the riparian habitats will be lost. However, due to previous impacts, the study site is already fragmented to a certain degree and the impact will be low.
- Vegetation clearance during construction could promote invasion by alien species.
- The risk on animal species is unknown at this stage, because a faunal investigation has not been undertaken.

Table 4.3 outlines the potential risks in terms of impacts on fauna and flora.

Table 4.3: Risk on Fauna and Flora

Field	Risk description	Sufficient information	Rating	Total
Fauna / Flora	Woodlands removal lead to habitat change	Yes	2	2.75
	Loss of connectivity between ecosystems	Yes	4	
	Alien invasion due to vegetation clearance	Yes	2	
	Impact on fauna	No	3	

4.4 RIVERINE ECOSYSTEMS RISK ASSESSMENT

The proposed Zalu Dam may impact the riverine ecosystems in the following ways:

- Vegetation clearance and submergence of the rivers will permanently remove the riverine habitat. This loss in much of the dam basin area will be replaced by lake conditions in the main part of the basin and by inundated areas on the shores and backwaters of the river system.
- The dam wall will create a barrier to the movement of species. This has both a positive and a negative risk:
  - The potential positive risk is that the physical barrier will limit the movement of invasive fauna;
  - A negative risk of the obstruction involves the obstruction of the migration of fish species further up the river.
- The estuaries downstream of the proposed dam are considered very sensitive and some impacts are likely to occur on these ecosystems.

Table 4.4 outlines the potential risks in terms of impacts on the riverine ecosystems.

Table 4.4: Risk on Riverine Ecosystem

Field	Risk description	Sufficient information	Rating	Average
Riverine ecosystem	Vegetation clearance leads to habitat loss	Yes	2	2.4
	Alterations to the aquatic ecosystem, reduction of water quality	Yes	2	
	Shift on animal niches	Yes	2	
	Loss in connectivity between aquatic ecosystems	Yes	4	
	Impacts on downstream estuaries	Yes	2	

4.5 WATER QUALITY RISK ASSESSMENT

Construction activities may result in contamination of the river if management actions are not implemented and enforced. Such actions could include fuel, oil or other chemical spills, poor maintenance of equipment, insufficient facilities for workers and the possible increase in sediment release as part of vegetation clearing and road construction.

The proposed dam will affect water quality in a number ways (**Table 4.5**):

- Reducing oxygen concentrations - This condition depends on stagnant water, density stratification and nutrient availability. Stratification is a separation of the layers of a water body in a dam. The warm water is on top (Epilimnion), the Thermocline layer is in the middle, and the cold water stays on the bottom (Hypolimnion). In summer, the water does not mix and cold and warm water separates, allowing vascular plants, algae and zooplankton to grow and promote oxygen depletion on the bottom layer. This process depends on stagnation time, basin depth and weather conditions (Stratification and Mixing, 2007). Water in a dam is relatively static and is thus less oxygenated than rapidly moving water. Oxygen facilitates the quick and clean breakdown of organic matter and promotes a healthy aquatic environment. Stagnant water in a dam has a lower oxygen concentration and impacts on the aquatic environment.
- If the vegetation is not properly cleared before a proposed dam site is inundated, this biomass will be broken down under anaerobic conditions, facilitating the development of a chemocline, which will affect water quality for the first few years.

Table 4.5: Risk on Water Quality

Field	Risk description	Sufficient information	Rating	Average
Water quality	Chemical pollution during construction	Yes	4	3.3
	Anaerobic breakdown of organic matter forming methane	No	3	
	Water quality impacts due to reduced oxygen concentrations of the water	No	3	

4.6 HYDROLOGY RISK ASSESSMENT

Sedimentation can reduce the net storage capacity of a reservoir. The Reservoir Sedimentation report (P WMA 12/T60/00/3711) that was conducted for the Zalu Dam indicated that almost 100% of the catchment sediment yield is expected to be retained within the Zalu Dam. For planning purposes it was therefore recommended that a maximum expected retained sediment volume per confidence level be used to determine equivalent future sediment volumes.

The proposed Zalu Dam can affect the baseline flow conditions if the needs identified for the Reserve are not met. From a hydrological perspective, the risk is low because the Reserve will prevent this. **Table 4.6** outlines the risks of hydrological impacts.

Table 4.6: Risk on Hydrology

Field	Risk description	Sufficient information	Rating	Average
Hydrology	Storage capacity	Yes	4	4
	Streamflow change	No	4	

4.7 AGRICULTURAL POTENTIAL RISK ASSESSMENT

The development of the proposed Zalu Dam will have an impact on any potential agricultural land but, due to the low quality of arable soil, the risk is not expected to be significant.

The proposed abstraction of groundwater to augment the supply of water may reduce the volumes of water available to downstream farmers that are currently depending on groundwater for irrigation. **Table 4.7** outlines the risks of agricultural impacts.

Table 4.7: Risk on Agricultural Potential

Field	Risk description	Sufficient information	Rating	Average
Agricultural potential	Loss of arable land	No	4	3
	Reduced volumes of groundwater available for downstream farmers	No	2	

4.8 HERITAGE RISK ASSESSMENT

No detailed heritage investigations have been carried out and the risk is thus unknown. **Table 4.8** outlines the potential risks in terms of impacts on heritage resources.

Table 4.8: Risk on Heritage Resources

Field	Risk description	Sufficient information	Rating	Average
Heritage Resources	Loss of heritage resources	No	3	3

4.9 DISPLACEMENT OF PEOPLE RISK ASSESSMENT

No risks are expected in terms of the displacement of people, as there are no known households situated in the proposed dam basin. **Table 4.9** outlines the potential risks in terms of the displacement of people.

Table 4.9: Risk on Displacement of People

Field	Risk description	Sufficient information	Rating	Average
Displacement of people	Displacement of Households	Yes	4	3.3
	Reducing the availability of land to local people	Yes	2	
	Relocating people to areas under different traditional leadership and with different cultures.	Yes	4	

4.10 HEALTH AND SAFETY RISK ASSESSMENT

Typical health and safety risks include:

- An influx of a large number of outsiders, which is likely to result in a number of social ills, such as prostitution, security problems and an increase in sexually transmitted diseases, particularly HIV/Aids.

- Due to the impoundment of water, the dam may become a safety hazard for local people in the event of a dam break or from ordinary drowning.
- An increase in the number of vehicles using the road during the construction may result in a higher incidence of road injuries and/or deaths.

Table 4.10 outlines the potential risks in terms of health and safety impacts.

Table 4.10: Risk on Health and Safety

Field	Risk description	Sufficient information	Rating	Average
Health and Safety	HIV/Aids infection	Yes	2	2.7
	Water hazard	No	3	
	Accidents with construction vehicles	No	3	

4.11 Access Route to Site Risk Assessment

Current access roads could be blocked by trucks, bulldozers and other equipment. Potential issues on this access road are the presence of cattle, goats, children and adults that are frequently walking next to the access roads.

There are potential risks associated with the construction of new access roads in terms of the ecological sensitivity of the area. Construction vehicles can kill animals that are crossing the roads. Disturbed roadsides are also preferred habitats for alien invasive plants.

Access roads that are poorly constructed to support the weight of construction vehicles will erode and there are subsequent associated ecological impacts**. Table 4.11** outlines the potential risks associated with access routes to the sites.

Table 4.11: Risk of Access Roads

Field	Risk description	Sufficient information	Rating	Average
Access routes	Impact of the current road on households, people, children, cattle and goats in or close to access road	No	3	2.3
	Impact on the ecosystems	Yes	2	
	Erosion of access roads	Yes	2	

4.12 VISUAL IMPACT RISK ASSESSMENT

During the public participation phase the visual impact will be discussed with interested and affected parties. **Table 4.12** outlines the potential risks in terms of visual impacts.

Table 4.12: Risk of Visual Impacts

Field	Risk description	Sufficient information	Rating	Average
Visual impacts	Visual impacts	Yes	4	4

4.13 INFRASTRUCTURAL DEVELOPMENT RISK ASSESSMENT

Information on future mining activities on the site was not available. This aspect needs to be investigated, but future mining in the area is not likely.

Local and regional infrastructural development at all sites will most likely have a positive impact on the communities in the area. Service delivery that does not meet expected standards, however, could cause resistance to the project, which will then be a negative impact.

The project managers need to be committed to ensure that the positive impact does not become a negative impact. **Table 4.13** outlines the potential risks in terms of current and planned infrastructure.

Table 4.13: Risk on Infrastructural Development

Field	Risk description	Sufficient information	Rating	Average
Infrastructural development	Impacts on potential tourism and associated infrastructure	Yes	5	4.3
	Impact on potential mining activities	No	3	
	Impact of infrastructure on local community	No	5	

4.14 LOSS OF LOCAL INCOME DUE TO PROJECT RISK ASSESSMENT

This risk includes agricultural land losses as well as the loss of valuable plants that are used by the local communities for medicine, timber or firewood.

Some people could abandon more sustainable working practices in order to obtain short-term work on the construction site. The real impact will depend on whether these people

are able to return to their former working practices or not. **Table 4.14** outlines the potential risks in terms of local income.

Table 4.14: Risk of Losing Local Income

Field	Risk description	Sufficient information	Rating	Average
Loss of local income	Loss of agricultural land	Yes	4	3
	Loss of useful plants	Yes	2	
	People leaving sustainable work for construction work	No	3	

4.15 Social Risk Assessment

The proposed development is likely to have a positive impact on the quality of life of people, as it will improve service delivery. However, negative impacts are possible, if the development reduces local income generation, access to land and health and safety.

Downstream farmers utilise groundwater and will be concern about the impact of the dam on the quantity of groundwater available.

Table 4.15 outlines the potential risks in terms of the social environment

Table 4.15: Risks on Social Environment

Field	Risk description	Sufficient information	Rating	Average
Social Environment	Impact on quality of life of people	No	5	3.5
	Knowledge perception of groundwater	No	2	

4.16 Employment Creation Risk Assessment

The tribal community would probably agree to the proposed development on the condition that local labourers will be used in the construction and operational phases of the project. Training of people in the various technical and social aspects of the construction process is a positive spin-off from such an agreement, and will have a positive impact on the local community.

There are also potential risks associated with creating employment opportunities. Such risks would include teaching people skills for which there will no longer be any local opportunities after the construction of the dam. Should these people have neglected

more sustainable professions such as farming, they will be forced to move to other areas to find employment. **Table 4.16** outlines the risks associated with employment opportunities.

Table 4.16: Risk on Employment Creation

Field	Risk description	Sufficient information	Rating	Average
Employment creation	Employment of local people	No	4	3.3
	Training local people	No	4	
	Neglecting / losing sustainable skills	No	2	

4.17 ENVIRO-LEGAL RISK ASSESSMENT

The enviro-legal impact of the Lusikisiki Regional Water Supply Scheme (LRWSS) must be considered in light of the following legislation:

- National Water Act (No 36 of 1998);
- National Environmental Management Act (No 107 of 1998);
- Conservation of Agricultural Resources Act (No 43 of 1983);
- Mineral and Petroleum Resources Development Act (No 28 of 2002);
- National Heritage Resources Development Act (No 25 of 1999);
- Environment Conservation Act (No 73 of 1989); and
- National Environmental Management: Biodiversity Act (No 10 of 2004).

The Regulations in terms of the Environment Conservation Act (No 73 of 1989) have been replaced by the new Regulations identified in terms of Sections 24 and 24 (d) of the National Environmental Management Act, 1998.

To maximise the probability of obtaining Environmental Authorisation for the proposed dam, impacts on the sensitive ecosystems and social community must be limited or prevented. If direct benefits to the local communities are outweighted by the impact of the development on the communities, there will be a greater risk of failing to secure Environmental Authorisation. **Table 4.17** outlines the risks in terms of environmental legislation.

Table 4.17: Risk on Enviro-Legal

Field	Risk description	Sufficient information	Rating	Average
Enviro-legal	Environmental Authorisation denied	No	3	3

5 CONCLUSIONS

No fatal flaws were identified during the risk assessment. However, the environment is sensitive and requires proper assessment and management. **Table 5.1** summarises the assessment of all the environmental aspects considered.

Table 5.1: Risk Assessment

Environmental issue	Average score	Interpretation of average score
Biophysical		
Geology	3.5	Uncertain - favourable
Soil	3	Uncertain
Fauna/Flora	2.75	Less favourable – Uncertain
Riverine ecosystem	2.4	Uncertain - less favourable
Water quality	3.3	Uncertain – favourable
Hydrology	4	Favourable
Social		
Agricultural	3	Uncertain
Heritage	3	Uncertain
Displacement of people	3.3	Uncertain – favourable
Health and safety	2.6	Uncertain – less favourable
Access route	2.3	Less favourable - Uncertain
Visual	4	Favourable
Infrastructural development	4.3	Favourable
Public Participation	3.5	Uncertain –favourable
Economic		
Loss of local income due to project	3	Uncertain
Employment creation	3.3	Uncertain -favourable
Enviro-legal		
Enviro-legal	3	Uncertain

6 RECOMMENDATIONS

The following investigations should be undertaken during the EIA phase:

- Faunal impact assessment;
- Detailed site-specific environmental investigations when information such as the dam design, areas to be inundated, construction methods and infrastructure becomes available;
- Groundwater, soil and reserve requirements;
- Social impacts (including the possible displacement of people); and
- Heritage impact assessment.

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Appendix A

Public Participation Process

PUBLIC PARTICIPATION REPORT FOR THE FEASIBILTY STUDY FOR AUGMENTATION OF THE LUSIKISIKI REGIONAL WATER SUPPLY SCHEME

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1 INTRODUCTION

1.1 BACKGROUND

BKS Pty Ltd was appointed to conduct a limited public participation process for the feasibility study for augmentation of the Lusikisiki Regional Water Supply Scheme. The main objectives of the process was to facilitate the establishment of a stakeholder committee, arrange stakeholder meetings in support of the Environmental Screening Process and in preparation for the initiation of independent EIA as well as attending meetings with the EIA team to provide technical information in support of the public participation process.
A public participation process (PPP) undertaken so far assisted in the identification of key stakeholders and major role players for the creation of a consultative structure that will enhance the effective management of the study.
The secondary objectives of a PPP are to:

- inform stakeholders and provide background and technical information about the study.
- create networks and feedback mechanisms whereby stakeholders can participate and raise their viewpoints issues, comments, concerns and inputs.

1.2 AIM OF THE REPORT

The aim of this report is to:

- describe the PPP conducted thus far;
- present the register of identified stakeholders
- provide a list of issues raised to date; and
- outline the way ahead.

2 THE PUBLIC PARTICIPATION PROCESS

Public participation provides the opportunity for stakeholders to participate on an informed basis, and to ensure that their needs and requirements are considered. It also allow for adequate consultation which is crucial for the preparation of major role players (Water Service Authority and municipalities) for the possible ownership of the study outcomes. .

A PPP should achieve the following:

- provide a "vehicle" for public and stakeholder input and the facilitation of negotiated outcomes;
- create trust and partnerships;
- minimise negative impacts and maximise positive impacts; and
- provide an up-front indication of issues that may have an impact on the study
- provide an opportunity for stakeholders to obtain clear, accurate and comprehensive information about the project and the impact it will have
- Promote active representative participation as well as incorporating diverse interests, views and opinions in the management of the study
- Create conditions within which new ideas, points of view and a community perspective are infused into the process thereby giving decisions more validity

2.1 APPROACH

The PPP is an integral part of the study.

The approach towards any PPP is dependent upon the details of the project. Each project has a particular geographic and technical nature, and hence the PPP should be structured accordingly. Where possible, and within the required statutory frameworks, it is also desirable to structure such a process to address the process needs of stakeholders. In this case the approach accommodated time frames adjustments responsive to process needs, ongoing engagements and interactions with various relevant government departments as well as the shared understanding of principles, objectives, responsibilities and outcomes of the study.

2.1.1 IDENTIFICATION AND REGISTRATION OF I&APS

Identification of stakeholders and Interested and Affected Parties is an ongoing process Through networking and web searches, 29 stakeholder entities are currently registered on stakeholder register for the study. BKS made an effort to ensure that individuals/organisations were identified from an institutional as well as a geographical point of view.

Geographically, BKS involved provincial government departments, water boards and structures that represent communities (traditional leadership). Institutionally, organisations or individuals that may influence policies and decisions or make a contribution to the study were involved. Not all of these organisations are necessarily in the study's direct sphere of impact.

Table 1 : Stakeholder Register.

Name	Organization	Contact details	Email address
Mr Ashley Starkey	DWA	Tel: 043 604 5400 Fax: 043 642 3647 Cell: 082 809 4981	starkeya@dwa.gov.za
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Nozamili Matwasa	Traditional Leader	Cell: 084 682 2733	

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2.1.2 ESTABLISHMENT OF A STAKEHOLDER COMMITTEE

A meeting was arranged on the 26th of May 2011 to introduce the project to identified stakeholders and constitute a stakeholder committee. Invitation letters were sent to identified potential stakeholders to attend the first stakeholder forum meeting. Representatives from twenty organizations attended the meeting. A resolution was

taken that all organizations that were identified as potential and relevant stakeholders will constitute a stakeholder committee.

2.1.3 ONGOING LIAISON

a) Ongoing Communication

BKS contact details were provided on all written communication to ensure that identified potential stakeholders can interact with BKS.

b) Site Visits

A site visit was arranged for the 27 and 28 October 2010, to observe the site and its surroundings in relation to the study. The study team did a thorough walk-over survey of the dam site. During the visit, the team also identified some of the old boreholes that were drilled as part of the previous geotechnical investigations. The team visited the water treatment plant and was interested in seeing the cores recovered as part of the previous geotechnical investigations. Unfortunately, the staff at the treatment works did not know where the core boxes were stored. The team drove through the study area on the R61 all the way down to Port St Johns in order to get a general feel for the study area.

The following councillors as well as people from the local community accompanied the study team on the visit to the Zalu Dam site:

- Mr Mbambisa Galelo (DWA : Regional Director Water Sector Support).
- Mr Lizo Ruleni Provincial Department of Cooperative Governance and Traditional Affairs
- Mr Mpofane Tenyane (Ward Councillor); and
- Ward committee members

The pump station was found to be in good working condition. The building housing the pump station , needs some maintenance work and security needs to be improved.

2.2 ISSUES RAISED

There are two issues worth noting that have been raised namely poor perception and negative attitude towards groundwater and a lack of sustainable and safe water sources in the area. An awareness campaign has been conducted in an attempt to improve the knowledge perception of groundwater.

3 CONCLUSION

Based on the degree of participation and inputs received during the PPP conducted so far, the following conclusions can be made:

- the PPP process achieved its major objectives
- communication with the stakeholders and the communities surrounding the site, should continue. This is to ensure informed participation, decision-making and a clear process throughout.

Appendix B

Maps

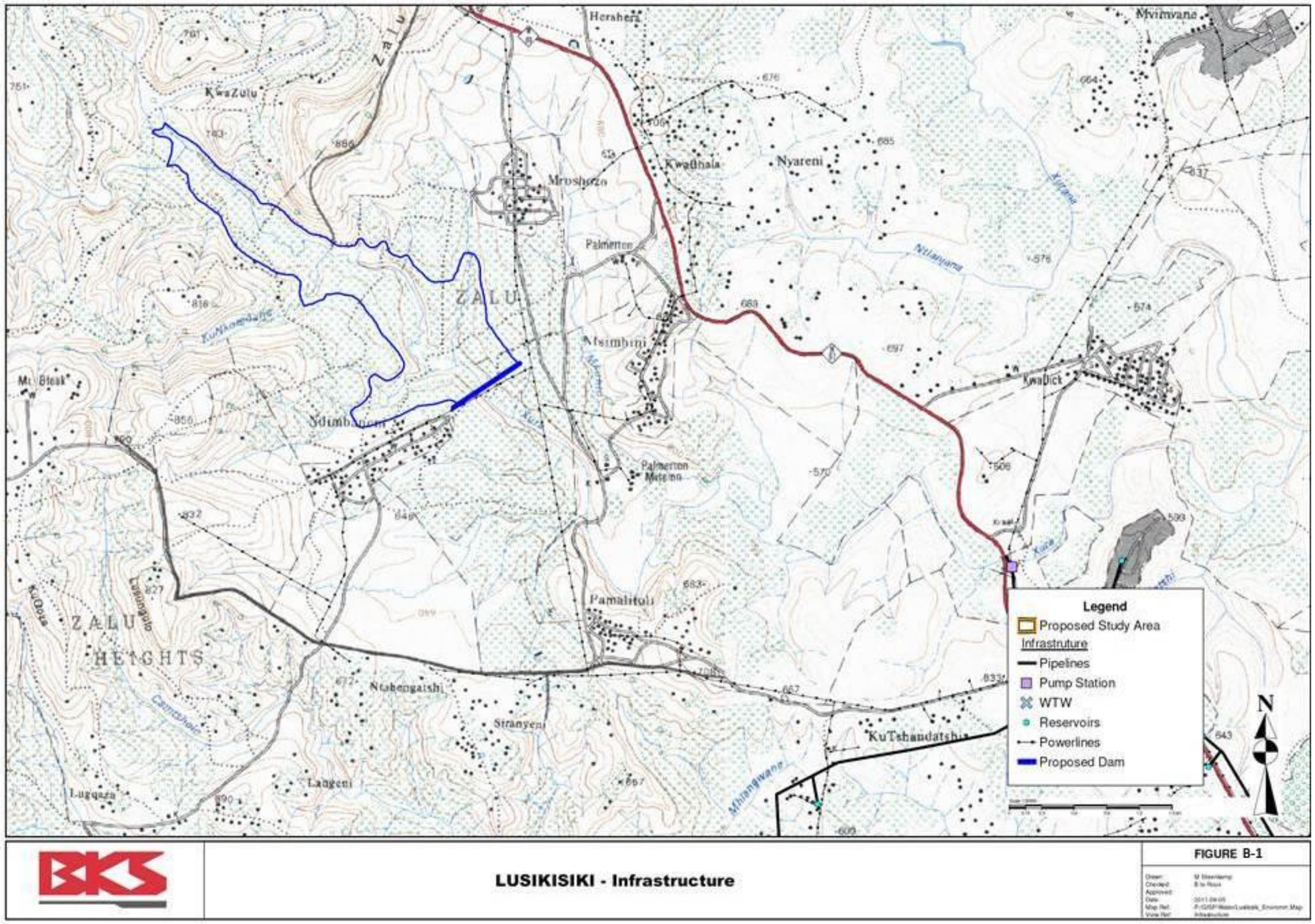

Figure B-1: Infrastructure in the Study Site