water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Mzimvubu Water Project

DEA REF No. 14/12/16/3/3/2/677 (Dam construction application)

14/12/16/3/3/2/678 (Electricity generation application)

14/12/16/3/3/1/1169 (Roads application)

NTABELANGA DAM BORROW PITS AND QUARRY ENVIRONMENTAL MANAGEMENT PLAN

Revision 2

November 2014

Compiled by: ILISO Consulting (Pty) Ltd

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NTABELANGA DAM BORROW PITS AND QUARRY ENVIRONMENTAL MANAGEMENT PLAN

Report Title:	***Ntabelanga Dam borrow pits and quarry Environmental Management Plan***
Authors:	*Sandhisha Jay Narain*
Project name:	***Environmental Impact Assessment for the Mzimvubu Water Project***
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ENVIRONMENTAL IMPACT ASSESSMENT FOR THE MZIMVUBU WATER PROJECT

LIST OF REPORTS

REPORT TITLE	DWS REPORT NUMBER
Inception Report	P WMA 12/T30/00/5314/1
Scoping Report	P WMA 12/T30/00/5314/2
Environmental Impact Assessment Report	P WMA 12/T30/00/5314/3
Environmental Management Programme	P WMA 12/T30/00/5314/14
Water Use Licence Application Supporting Documents	P WMA 12/T30/00/5314/4
Ntabelanga Dam borrow pits and quarry Environmental Management Plan	**P WMA 12/T30/00/5314/5**
Lalini Dam borrow pits and quarry Environmental Management Plan	P WMA 12/T30/00/5314/6
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ACRONYMNS AND ABBREVIATIONS

BID	Background Information Document
BLMC	Biodiversity Land Management Class
CIDB	Construction Industry Development Board
CBA	Conservation Biodiversity Area
CER	Contractor's Environmental Representative
BLMC	Biodiversity Land Management Classes
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DM	District Municipality
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EC	Eastern Cape
ECBCP	Eastern Cape Biodiversity Conservation Plan
ECO	Environmental Control Officer
EER	Engineer's Environmental Representative
EIA	Environmental Impact Assessment
EMPL	Environmental Management Plan
FSL	Full Supply Level
GN	Government Notice
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Parties

IRR	Issues and Response Report
MSDS	Material Strategy Data sheets
MAR	Mean Annual Runoff
MPRDA	Mineral and Petroleum Resources Development Amendment Act, 2008 (Act No. 49 of 2008)
MWP	Mzimvubu Water Project
MWP EMPr	Mzimvubu Water Project Environmental Management Programme
NEMA	National Environmental Management Act (No.107 of 1998)
NEMBA	National Environmental Management Biodiversity Act (No.10 of 2004)
NEMWA	National Environmental Management: Waste Act (No. 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Area
Ntabelanga B&Q EMPL	Ntabelanga Dam Borrow and Quarry Environmental Management Plan
OHSA	Occupation Health and Safety Act (Act 85 of 1993)
SAHRA	South African Heritage Resource Agency
SoER	State of the Environment Report
subWMA	Sub-Water Management Areas
IUCN	International Union for Conservation of Nature
WMA	Water Management Area
EMPR	Environmental Management programme
GG	Government Gazette
GN	Government Notice
V	Vertical (height)
H	Horizontal (height)
IGCN	International Union for conservation of nature

LIST OF UNITS

MW	Mega Watt
m	Meters
mm	milli-meters
m^3	Cubic Meters
km	Kilo meter
km^2	Square Kilometers
ha	Hectare
°C	Degrees Celsius
%	Percentage
Ha	Hectare

1. INTRODUCTION

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.

Harnessing the water resources of the Mzimvubu River, the only major river in the country which is still largely unutilised, is considered by the Eastern Cape Provincial Government, as offering one of the best opportunities in the Province to achieve such development.

The five pillars on which the Eastern Cape Provincial Government proposed to model the Mzimvubu River water resources development are:

- Forestry;
- Irrigation;
- Hydropower;
- Water transfer; and
- Tourism.

As a result of this the Department of Water and Sanitation (DWS) commissioned the Mzimvubu Water Project (MWP) which consists of two multi-purpose dams on the Tsitsa River, a major tributary to the Mzimvubu River. Socio-economic upliftment is expected to be achieved through bulk potable water supply schemes for domestic and industrial water supply, bulk raw water supply schemes for irrigated agriculture, hydropower generation, other associated development, and the creation of temporary and permanent jobs. A Locality Map for the project is provided in **Figure 1**.

Construction materials such as sand, gravel and rock material will be required for the construction of the dams, roads and associated infrastructure. Existing licensed quarries and borrow pits in the area may not be adequate or suitable to provide all the required construction materials and it is estimated that five (5) borrow areas and one (1) rock quarry will be necessary for Ntabelanga Dam and associated infrastructure.

The permitting of the material sources required for the project will be undertaken in accordance with the Mineral and Petroleum Resources Development Amendment Act, 2008 (Act. 49 of 2008) (MPRDA) and its associated Regulations, R527 of 23 April 2004. The applicant, DWS as an organ of state, has obtained exemption from the provisions of sections 16, 20, 22 of the MPRDA in respect of any activity to remove any mineral for the construction and maintenance of dams, harbours, roads and railway lines and for the purposes incidental thereto, as allowed for by the said Act in section 106 (1). Therefore the use of the material sources is subject only to the preparation, submission, and approval of an Environmental Management Plan (EMPL) compiled in accordance with requirements of sections 39 (3) and 41 of the MPRDA.

The purpose of this EMPL (hereafter referred to as Ntabelanga B&Q EMPL) is to identify and assess potential impacts related to the use of five (5) borrow pits and one (1) rock quarry associated with the construction of the Ntabelanga Dam and associated works as a component of the MWP. A separate EMPL for the use of borrow pits and a rock quarry is compiled for the Lalini Dam and associated works as another component of the MWP.

Once approved the Ntabelanga B&Q EMPL must be read and implemented in conjunction with the approved Mzimvubu Water Project Environmental Management Programme (MWP EMPR) and Water Use Licence conditions.

1.1 OBJECTIVES OF THE EMPL

The overall objectives of the EMP are defined as follows:

- To fulfil the requirements of Sections 39 of the MPRDA;
- To fulfil the criteria described in regulations 52 of MPRDA Government Notice, No. 527 of 23 April 2004.
- To inform Interested and affected parties (I&AP) of the Project and to provide them with an opportunity to express any concerns or issues and to participate in the process;
- To identify and assess potential impacts associated with the activity;
- Identify proposed mitigation and management measures to minimize adverse impacts and benefits; and
- Planned monitoring and performance assessment of the environmental management plan.

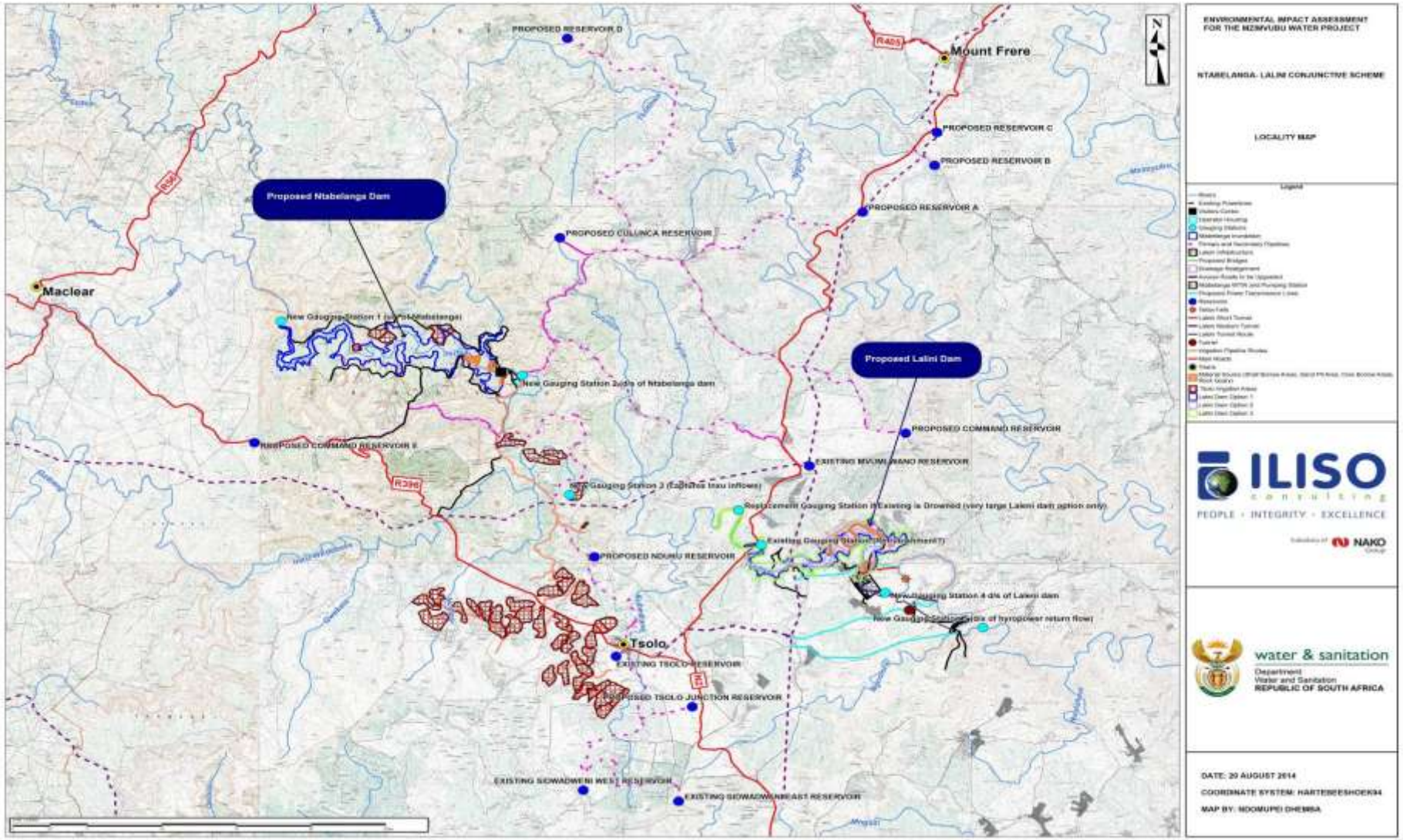


Figure 1: Locality Map

1.2 ORGANISATIONAL STRUCTURE

Effective environmental management during the planning, design and construction phases of the project will be dependent on a number of project personnel. The purpose of this section is to define roles for personnel and allocate responsibilities in the execution of the Ntabelanga B&Q EMPL.

1.2.1 Department of Water and Sanitation (DWS)

The DWS is the applicant of the authorisation, the developer of the project and the client of the Contractor and Engineer. Under the South African environmental law, applicants are accountable for the potential impacts of activities being undertaken as well as managing these impacts. DWS, therefore, has the overall environmental responsibility to ensure that the implementation of the Ntabelanga B&Q EMPL complies with national and provincial legislation as well as with the conditions of the Environmental Authorisation (EA) for the Mzimvubu Water Project.

The DWS may delegate environmental compliance / responsibility to nominated agents such as the Engineer.

1.2.2 Engineer

The Engineer is responsible for design of the works and supervision of the construction contract. The Engineer is the DWS's representative on site and is ultimately responsible for:

- Compliance with legal environmental requirements;
- Confirming that the Ntabelanga B&Q EMPL forms part of the contract documents;
- Placing the Ntabelanga B&Q EMPL on the site meeting agenda;
- Directs on site teams implementation and compliance with the Ntabelanga B&Q EMPL;
- Consults and co-operates with the Environmental Control Officer (ECO) appointed by the DWS on environmental matters;
- Reports to DWS; and

- The Engineer may appoint an Engineer's Environmental Representative (EER) to plan and direct the implementation of the Ntabelanga B&Q EMPL and provide advice on environmental matters.

The EER will:

- Provide support and advice, via the Engineer regarding environmental matters during the entire project lifecycle;
- Distribute all statutory requirements, including permits, authorisations and licences;
- Keep a copy of the Ntabelanga B&Q EMPL on site;
- Provides Environmental Awareness training for the Engineers staff;
- Keep record of all activities on site, problems identified and transgressions noted;
- Submit monthly environmental reports to the Engineer detailing environmental performance of the Contractor;
- Reporting at construction site meetings;
- Conduct and manage a schedule of Internal Audits. Internal audit reports are submitted to the Engineer;
- Maintain and manage a complaints register;
- Maintain and manage an incidents and non-conformance register;
- Monitor records of proof of all training undertaken on site; and
- Keep records relating to monitoring and auditing on site and make these available for inspection to any relevant and competent authority in respect of this development.

1.2.3 Environmental Control Officer (ECO)

An Independent ECO will be appointed by the DWS to monitor and audit compliance and report environmental compliance to the Department of Environmental Affairs (DEA). Once appointed, the name and contact details of the ECO must be submitted to the Director: Compliance Monitoring of the DEA. The ECO will:

- Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO;
- Confirm that the requirements of the Ntabelanga B&Q EMPL are communicated, understood and implemented by personnel on site;
- Manage scheduled audits and inspections on contractors' performance on site.

- Monitor Ntabelanga B&Q EMPL compliance through regular site visits and inspections during the pre-construction, construction and rehabilitation phases;
- Submit findings of compliance to the Ntabelanga B&Q EMPL in monthly compliance reports to DEA;
- Submit emergency incident reports to DEA; and
- All documentation e.g. audit/ monitoring/ compliance reports and notifications, required to be submitted to DEA in terms of this authorisation, must be submitted to the *Director: Compliance Monitoring* at the Department.

1.2.4 Contractor

The Contractor implements the Ntabelanga B&Q EMPL specifications on site. The Contractor may appoint a Contractor's Environmental Representative (CER) to assist with the implementation of the Ntabelanga B&Q EMPL.

The Contractor's Environmental Representative (CER) will:

- Conduct a pre-construction survey prior to commencement of construction activities. This must be in a written report format which includes photographic records, co-ordinates of important features and descriptions thereof;
- Provide Environmental Awareness training for Contractor's Engineers, foremen, site staff and any visitors to the site. A record of all training and visitors induction must be kept on site;
- Tool Box talk relating to specific Environmental Aspects must be communicated to all staff on site. Records of this training must be kept on site;
- Provide Environmental Management input on all method statements to ensure mitigation measures are identified and implemented before the activity commences;
- Undertaking monitoring and analysing of data, the results of which must be submitted in a report format to the Engineer/EER and the ECO on a monthly basis; and
- Maintain and manage an incidents and non-conformance register.

1.2.5 Contractor Management

Contractor management will be affected through specific activities as listed below:

- At the tender briefing meeting environmental management expectations during the project shall be highlighted;

- The Ntabelanga B&Q EMPL shall be included with the tender documents;
- Once the Contractor is appointed they should be instructed to develop a document that should indicate how they plan to ensure compliance with the Ntabelanga B&Q EMPL will be carried out.

1.3 STRUCTURE OF THE REPORT

The report is structured as follows:

- **Chapter 2:** Project Overview
- **Chapter 3:** Legislative requirements
- **Chapter 4:** Applicant Details and Land ownership
- **Chapter 5:** Description of the Environment
- **Chapter 6:** Description of the proposed mining activity
- **Chapter 7:** Regulation 52 (2)(b): Assessment summary rating
- **Chapter 8:** Regulation 52 (2)(c): Proposed Mitigation Measures
- **Chapter 9:** Minimum operation standard
- **Chapter 10:** Regulation 52 (2) (d): Financial Provision
- **Chapter 11:** Regulation 52 (2) (e): Planned Monitoring of the EMPL
- **Chapter 12:** Regulation 52 (2) (g): Record of the Public Participation Process
- **Chapter 13:** Regulation 52 (2) (h): Undertaking to execute the EMPL
- **Chapter 14:** References

2. PROJECT OVERVIEW

The Mzimvubu River Catchment is situated in the Eastern Cape (EC) Province of South Africa. The project footprint spreads over three 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 Maclear and north of the R396. The proposed Lalini Dam site is situated approximately 17 km north east of the small town Tsolo. The Mzimvubu River has four major tributaries, namely the Mzintlava, Kinira, Tina and Tsitsa Rivers. The proposed Ntabelanga and Lalini Dams are situated on the Tsitsa River

2.1 WATER RESOURCES INFRASTRUCTURE

Water Resource Infrastructure for the Mzimvubu Water Project 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 150 million m^3;
- A tunnel/conduit and power house at Lalini dam site for generating hydropower;
- Five new flow gauging stations 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
- Two thirds of the water (annual yield) at the Ntabelanga Dam will be utilised for hydro-energy, one sixth for potable water and one sixth for irrigation.

2.1.1 The Ntabelanga Dam

The technical characteristics of the proposed Ntabelanga Dam are summarised below:

Dam wall crest length:	440 m
Maximum dam wall height:	67 m
Mean Annual Runoff of River at Dam:	415 million m^3/a
Volume impounded by dam:	490 million m^3
Spillway capacity:	5 530 m^3/sec

Dam type:	RCC with integral spillway
Inundated area upstream at max flood level:	± 40 km^2

2.1.2 The Lalini Dam

The Lalini Dam characteristics are summarised below:

Dam wall crest length:	250 m
Maximum dam wall height:	32 m
Mean Annual Runoff of River at Dam:	828 million m^3/a
Volume impounded by dam:	150 million m^3
Inundated area upstream at max flood level:	± 15 km^2

2.1.3 Flow Gauging Weir

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.

Each weir will take about six months to construct and will be a low concrete structure with erosion control measures on both banks to prevent out-flanking. It is envisaged that construction of the weirs will form part of the dam construction contract.

2.2 DOMESTIC WATER SUPPLY INFRASTRUCTURE

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

- An intake structure and associated works at Ntabelanga Dam;
- 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.

A significant portion of the domestic water supply schemes in this area will fall under the OR Tambo and Joe Gqabi DMs. Some communities are already served by

schemes, which have been taken into account in the development of the proposed infrastructure. The total bulk water and potable water pipeline servitudes total approximately 375 km.

2.3 IRRIGATION

The Ntabelanga Dam will also provide water to irrigate approximately 2 900 ha. 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.

Agricultural land near the river will be supplied with raw water pumped by pipeline from the nearest river abstraction point on the Tsitsa River, downstream of the Ntabelanga Dam. For the Tsolo area schemes, raw water would be pumped from the dam to a storage reservoir and delivered to the edge of these fields through a bulk water distribution system. These lands are located near to the following settlements/wards: Godini, Qhotira, KuGubengxa, St Cuthberts, Jwabuleni, Mazizini, KwaNomadolo and Gumbini. For the other areas, raw water would be abstracted directly from the adjacent dam or river using mobile pumping systems.

The proposed farming model is commercial irrigation farming. Forty five (45) rationalised farming units of between 40 and 90 ha each (average of 60 ha) are envisaged. This will require acceptance of a change of land use and mind set from the current subsistence farming approach.

Distribution to the farming units will be mostly gravity based, with booster stations for higher lying areas.

2.4 POWER

The feasibility study results indicate that the viability of the proposed Ntabelanga Dam is dependent on its development as a strategic part of a conjunctive hydropower scheme.

There will also be a small hydropower plant at 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 generate an average output of 30 MW when operated as a base load power station and up to 150 MW if operated as a peaking power station. The power plant will require a tunnel/conduit of approximately 7 km linking the dam to the power plant downstream of the dam and below the gorge. Neither the Lalini Dam nor the hydropower plant will be visible from the Tsitsa Falls.

The power line to link the Lalini power station to the existing Eskom grid will be approximately 18.5 km and the power line linking the Ntabelanga Dam to the Eskom grid will be approximately 13 km. Power lines will also be constructed to supply power from the Eskom grid for construction at the two dam sites and for operating five pumping and booster stations along the bulk distribution infrastructure.

3. LEGISLATIVE REQUIREMENTS

3.1 ENVIRONMENTAL PRINCIPLES

The following principles should be considered at all times during the pre-construction and construction phase activities:

- The environment is considered to be composed of biophysical, economic and social components;
- Construction is a disruptive activity and all due consideration must be given to the environment, including the social environment, during the execution of a project to minimise the impact on affected parties;
- Minimisation of areas disturbed by construction activities (i.e. the footprint of the construction area) should minimise many of the construction related environmental impacts of the project and reduce rehabilitation requirements and costs;
- As minimum requirements, all relevant standards relating to international, national, provincial and local legislation, as applicable, shall be adhered to. This includes requirements relating to waste emissions (e.g. hazardous, airborne, liquid and solid), waste disposal practices, noise regulations, road traffic ordinances, etc.; and
- Every effort should be made to minimise, reclaim and/or recycle "waste" material.

3.2 ENVIRONMENTAL PERMITS, LICENSE AND AUTHORISATIONS

The following authorisations and permits are required prior to the activity commencing:

- **Blasting** - Blasting permits are required from the Department of Mineral Resources in accordance with the Explosives Act (Act 26 of 1956).
- **Waste disposal** - All waste (general and hazardous) generated during the construction may only be disposed of at appropriately licensed sites. Government Notice (GN) 921, promulgated in terms of the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA), lists Waste Management Activities in respect of which a waste management licence is required. These include various activities associated with the storage of waste, reuse, recycling and recovery of waste, treatment of waste (which includes the

remediation of contaminated land) and disposal of waste. The Schedule to the Notice distinguishes between two categories of waste management activities which require licensing and for which a basic assessment process (for Category A Waste Management Activities) or an Environmental Impact Assessment process (for Category B Waste Management Activities) must be conducted.

Construction activities usually result in hazardous as well as general waste.

NEMWA defines "general waste" as waste that does not pose an immediate hazard or threat to health or to the environment, and includes—

(a) domestic waste;

(b) building and demolition waste (which cannot be used as fill or other beneficial use);

(c) business waste; and

(d) Inert waste.

Where

"building and demolition waste" means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition; and

"inert waste" means waste that—

(a) does not undergo any significant physical, chemical or biological transformation after disposal;

(b) does not burn, react physically or chemically biodegrade or otherwise adversely affect any other matter or environment with which it may come into contact; and

(c) does not impact negatively on the environment, because of its pollutant content and because the toxicity of its leachate is insignificant.

- NEMWA GN 926 presents the norms and standards for the storage of waste. The requirements of waste storage facilities; management of waste storage facilities; and general provisions required, are outlined.
- **Storage of hazardous substances** - Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which may include the Hazardous Substances Act, the Occupational Health and Safety Act, and relevant associated Regulations.

- **Health and safety of work teams** - Construction Regulations (2003) published under the Occupational Health and Safety Act (Act 85 of 1993) apply to construction activities including "the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work". A "health and safety plan" which addresses hazards, and includes safe working procedures to mitigate, reduce or control the hazards identified, is required under this Act. A risk assessment must also be undertaken by an appropriately qualified person(s) and the Contractor shall ensure that all employees under his or her control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences, and thereafter at such times as may be determined in the risk assessment.
- **Heritage resources –** Before any heritage resources are demolished or damaged a permit should be obtained prior to any actions been taken. Permit applications must be submitted to South African Heritage Resources Agency (SAHRA).
- **Removal of trees –** The removal of protected and indigenous trees from the dam basin requires a permit in terms of the National Forest Act (Act 84 of 1998).
- **Removal and transportation of endangered fauna and flora -** A permit must be obtained from the relevant nature conservation agency for the removal or destruction of indigenous, protected and endangered plant and animal species. Copies of permits required must be submitted to the DEA for record keeping purposes.
- **Water abstractions –** Water abstracted from any sources for construction purposes requires authorisation by DWS.
- **Removal of graves -** Permits are required for the removal of graves in terms of the National Heritage Resources Act (No 25 of 1999) section 36.
- **Asphalt Plants** - GN 893 of 2013 in GG 37054 dated 22 November 2013 provides a list of activities which result in atmospheric emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage. Activities include Macadam preparation (the mixing of aggregate and tar or bitumen to produce road surfacing in permanent facilities and mobile plants). These activities require an Atmospheric Emission Licence in terms of Section 37 of the Act.
- **Borrow areas and Quarries -** Government Gazette No 26501 dated July 2004 states that the Minister of Mineral Resources, acting in terms of section 106 (1)

of the Mineral and Petroleum Resources Development Act, 2002 (Act No 28 of 2002) (MPRDA) exempts the DWS, amongst other institutions, from the provisions of sections 16, 20, 22 and 27 of said Act in respect of any activity to remove any mineral for the construction and maintenance of dams, harbours, roads and railway lines and for purposes incidental thereto. Section 106 (2) of the MPRDA states that in such cases the DWS must still compile an EMP for approval in terms of Section 39 (4) of the Act.

3.3 CONSTRUCTION INDUSTRY DEVELOPMENT BOARD

The Construction Industry Development Board (CIDB) is a Schedule 3A public entity established by Act of Parliament (Act 38 of 2000) to promote a regulatory and developmental framework that builds the construction delivery capability for South Africa's social and economic growth.

The Construction Registers Service of the CIDB comprises the Register of Contractors and the Register of Projects which have been established in terms of the CIDB Act (Act 38 of 2000). The Register of Contractors grades and categorises contractors according to financial and works capability. It is mandatory for public sector clients to apply the Register of Contractors when considering construction works tenders. The Register of Contractors facilitates public sector procurement and serves as a framework for contractor development.

4. APPLICANT DETAILS AND LAND OWNERSHIP

The details of the applicant in respect of which the Ntabelanga B&Q EMPL is submitted is detailed in **Table 1**. 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. The Department of Water and Sanitation (DWS) (i.e. the applicant), via the Department of Public Works, will formally acquire the land that will be directly affected by the project (e.g. footprint of the dam walls, dam basins and pipeline servitudes). Relevant Traditional Authorities have been consulted during the feasibility stage of the project and throughout the EIA process for the Mzimvubu Water Project. In view of the above, landowner notification was not conducted. **Table 2** identifies the Traditional Authorities notified during the public participation process.

Table 1: Applicant Details

ITEM	Applicant Contact Details
Name	**Department of Water and Sanitation (DWS)**
Tel No.	**012-336 6838**
Fax No.	**012-336 7399**
Postal Address	**Private Bag X313, Pretoria 0001**

Table 2: Local Authorities

Traditional Authorities	Tel:	Email:
Chief Tyali	072 013 5104	gcobanit0@gmail.com
Chief Mabandla	079 397 7131	
Chief Veco	083 720 1973	
Siyanda Madolo	078 950 3595	
Councilor Gaqu	082 551 0477	
Councilor Dawedi	083 430 2159	metrodawedi@gmail.com

5. DESCRIPTION OF THE ENVIRONMENT

5.1 GEOLOGY AND SOILS

The study area is underlain by sedimentary rocks of the Tarkastad Subgroup of the Beaufort of the Karoo Supergroup and post Karoo dolerite intrusives. The Karoo Supergroup consists of light brownish grey, fine to medium grained sandstones and subordinate thinner bluish to reddish grey mudrocks. There are also traces of mudflake congloromates. These sediments were deposited by north flowing braided river systems **(Figure 2).**

There is a low level of tectonic deformations in this region. Dolerite Sills and Dykes are found with thermally metamorphosed adjacent sediments. The dykes are only a few meters wide but stretch for long distances. Dolerite is a dark basic intrusive igneous rock consisting of plagioclase, feldspar and pyroxenes and its soils generally have high potential for both rain fed and irrigated crops and forestry. Beaufort sediments are characteristically erodible.

The bedrock is the main constituent in the study area with some thick colluvial soil deposits covering it. The upper right flank, however, has been weathered exposing hard dolerite outcrops and sub outcrops.

Alluvial sand occurs in the course of the Tsitsa River and major tributary rivers and streams. Due to the steep and incised nature of the rivers, sand is mainly confined to the river channel, with few and only localised over-bank deposits (DWA, 2013b).

The area has Hutton 2200 salm and Hutton 2100 salm soil types. Orthic topsoils overlie red apedal subsoils. Topsoil texture is sandy loam becoming sandy clay loam in the subsoil. Soils thus have luvic character as clay has moved from top to subsoil over time. Textural transition from top to subsoil is gradual providing free root penetration. Soil structure is apedal tending to weak crumb (DWA, 2013a).

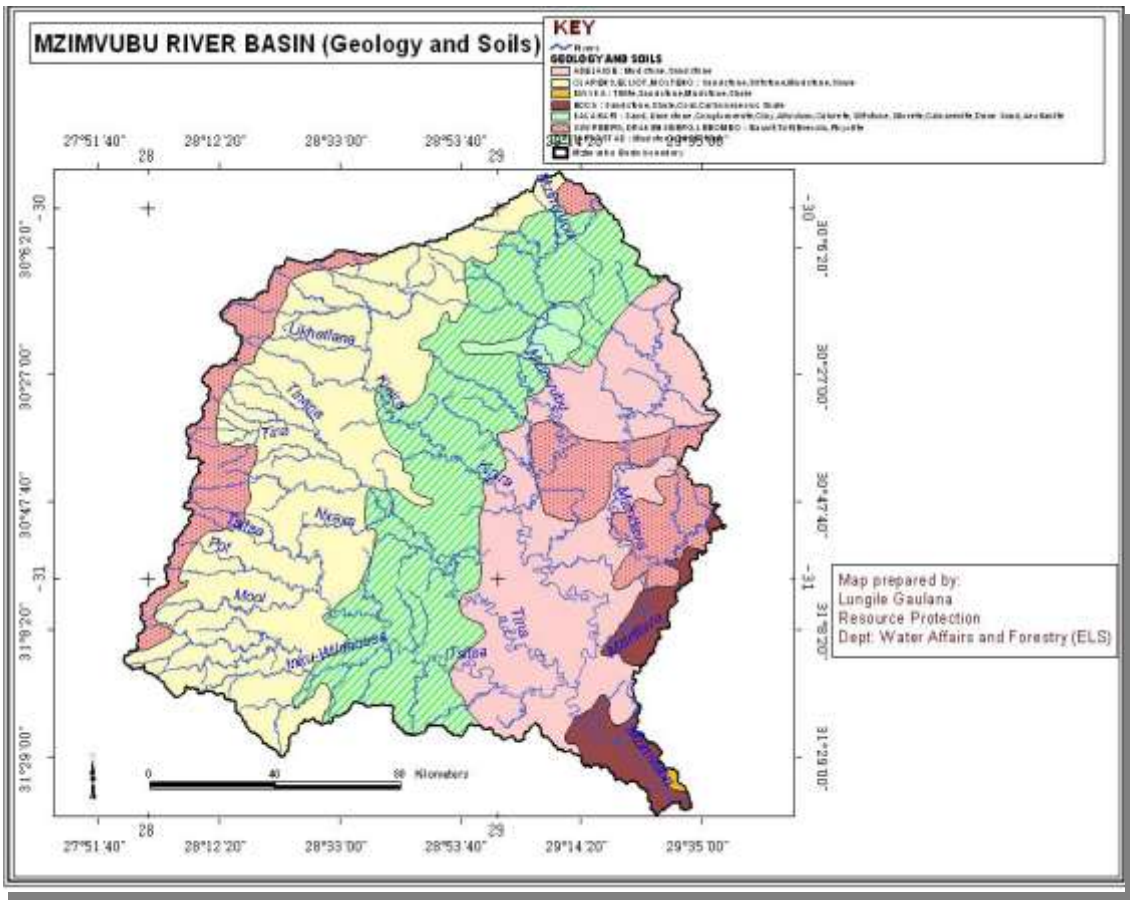


Figure 2: Geology and Soils

Soil erosion

There are extensive areas of severe gulley erosion on the inter-fluvial areas adjacent to stream channels. The erosional and piping characteristics are suggestive of the presence of dispersive soils (DWA, 2013b).

In the Mzimvubu and Tsitsa River catchments, soil erosion is an outcome of high rainfall intensities, steep slopes, erodible soils and land use practices that are conducive to erosion. The latter include overgrazing and cultivation on unsuitable thin soils with sloping terrain, which causes grass to not recover, a loss of root structure and sheet erosion.

Structures placed in the way of water flow paths have caused the interception of flood paths and springs, cutting off recharge to wetlands and the formation of artificial flood barriers, thereby also causing erosion, as well as sedimentation, and damage to the structures themselves.

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 decreases the lifespan of any dams or hydropower schemes.

Good care and management of the way a catchment is used will reduce soil loss due to erosion, improve water quality and quantity in the river, and also increase the efficiency and sustainability of land use in the catchment, which will have environmental and economic benefits. Water treatment costs will be reduced and the lifespan of dams and hydropower infrastructure increased.

A catchment rehabilitation and management programme, aimed at restoring eroded land and thereby reducing the levels of sedimentation that are expected to impact on the yield of the dams, has been initiated in the Mzimvubu River catchment. A budget of R 450 million over the next 10 years has been allocated to the programme. The work has begun in the Tsitsa River catchment in order to synchronise with the proposed new dams currently under investigation. The programme is being implemented by the DEA. It will include alien vegetation eradication, the phased restoration of eroded areas and future erosion preventative measures such as sediment trapping and reuse, planting of erosion reducing vegetation, improving land-use practices by rotational usage regime including rotational fencing of grazing areas for protection purposes.

The benefits of the programme include the restoration of wetlands and productive land, reduction of future erosion and land loss, and the reduction of sediment released into the river resulting in improved water quality, reduced water treatment costs and longer operational lifespan of proposed dams and hydropower plants. Improved runoff and river flow regulation via wetlands will improve base flow and reduce peak flood events. The programme will create temporary and permanent jobs.

While this project will impact positively on the Mzimvubu Water Project, its activities are not a part of the EIA conducted for the Mzimvubu Water Project.

5.2 TERRESTRIAL ECOLOGY

The study area falls within the Sub-escarpment Grassland and Sub-escarpment Savanna Bioregions (Mucina and Rutherford, 2006**) (Figure 3).** A Specialist Flora and Fauna Impact Assessment was carried out as part of the Environmental Impact Assessment (EIA) for the MWP and informs the sub-sections that follow. This section describes the fauna and flora habitat relative to the Ntabelanga Dam basin and associated infrastructure.

5.2.1 Flora Habitat

The habitats at the proposed Ntabelanga Dam basin have been exposed to high levels of anthropogenic activities. The greatest impact on the habitat zones has come from agriculture, mainly crop farming but also to a degree livestock grazing. The largest habitat zone found within the basin is that of the transformed habitat. The remaining habitat types including the *Acacia* thornveld/ grassland, rocky outcrop and riparian habitat zones are spread throughout the study area in small pockets with very little connectivity being displayed amongst habitat zones of the same type. These habitat units are discussed below **(Figure 4).**

***Acacia* Thornveld/ Grassland habitat**

This habitat zone can be found in patches in the southern sections of the Ntabelanga Dam basin, amongst the transformed habitat zone. This habitat zone provides refuge to the more common avifaunal species that are known to occur in open bushveld and grasslands. Harvesting of wood as well as grazing/ browsing activities of goats and cattle is a common activity in this area. This slowly decreases the woody component converting this habitat zone to a more transformed grassland habitat zone. The faunal assemblage was not very high in this habitat, which can be attributed to the various levels of anthropogenic activities occurring within the habitat unit.

The *Acacia* Thornveld/ Grassland habitat unit is considered to have a medium to low ecological sensitivity and conservation value due to the change in floral species composition and vegetation structure as a result of the above mentioned impacts. This habitat unit is furthermore well represented within the region, and loss thereof as a result of sourcing material for dam construction will not significantly affect the floral conservation in the region.

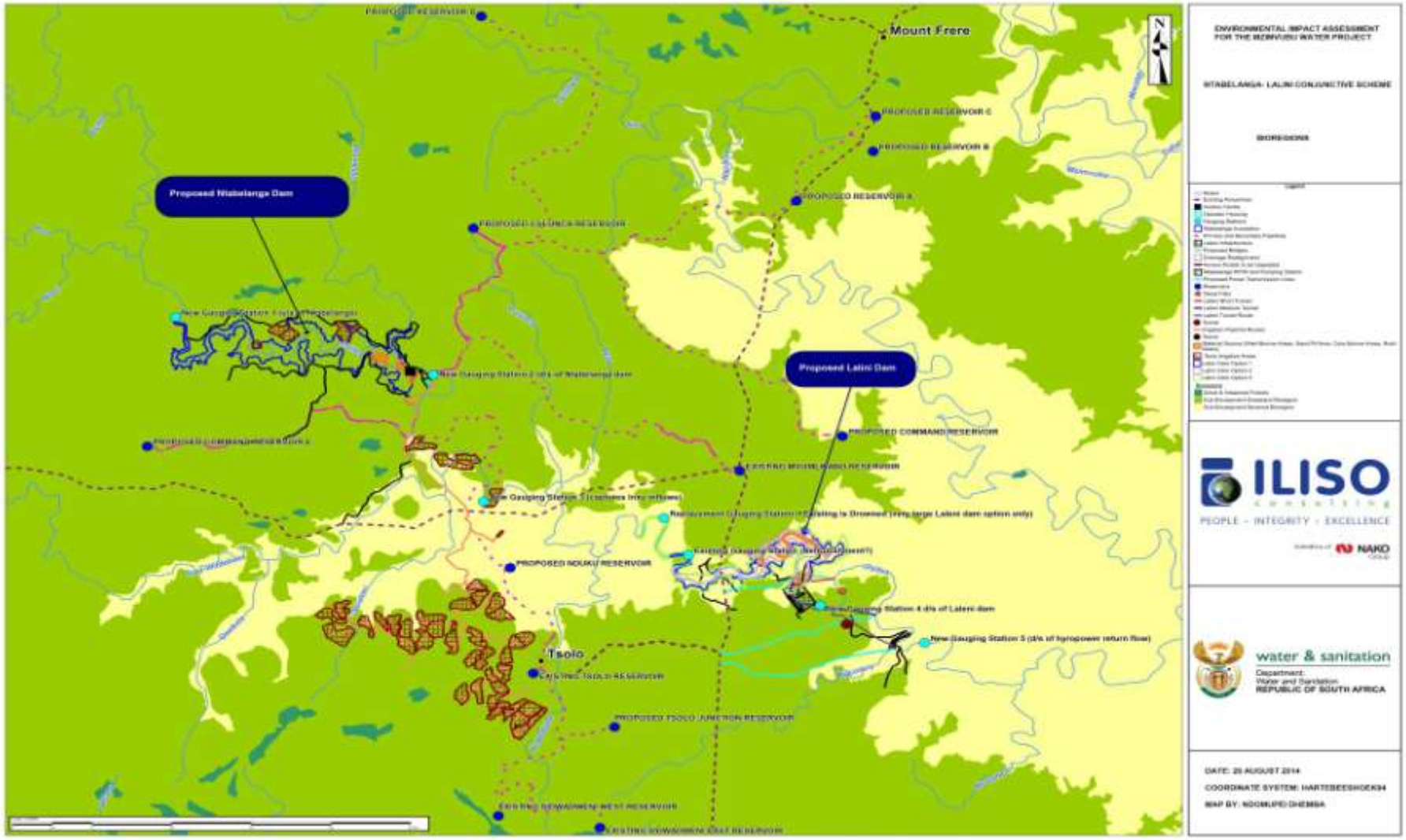


Figure 3: Bioregions

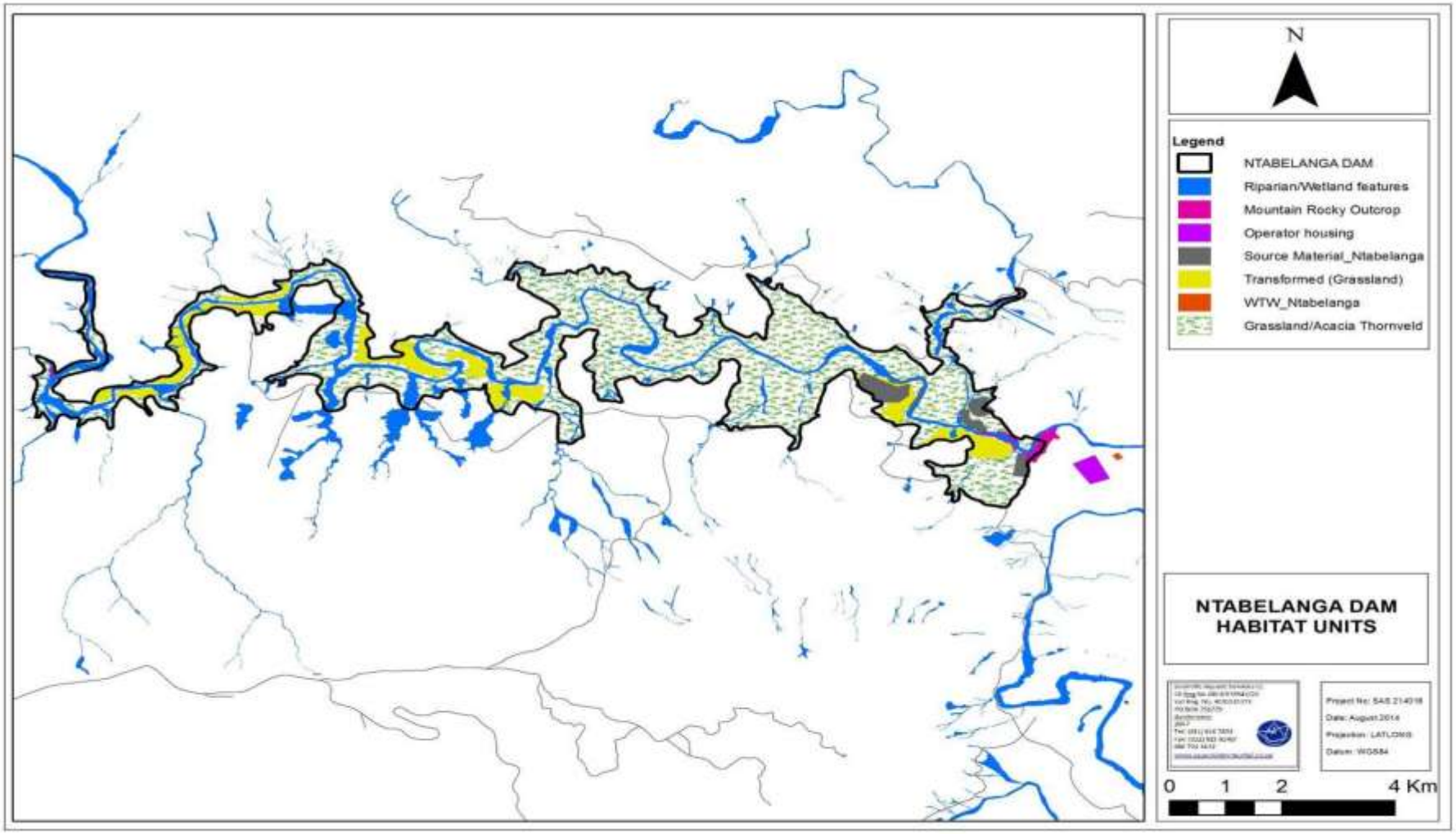


Figure 4: Habitat Units within the Ntabelanga Dam Basin

Rocky Outcrop habitat

This habitat zone is found in small sections towards the tail end of the dam as well as in the vicinity of the proposed dam wall. This habitat zone is most suited to reptile, scorpion and spider species, whilst also providing suitable habitat to a variety of avifaunal species. The remoteness in comparison to the other habitat units has provided a higher level of protection to this habitat unit and as such it is evident that this habitat has remained relatively undisturbed over time. Although the construction of the dam will most likely affect the immediate floral biodiversity and possibly the surrounding area by decreasing the floral species, it is important to note that most of the Mountain / Rocky Outcrop habitat occurs above the full supply level (FSL) of the dam.

Transformed habitat

This habitat unit represents the remnants of old agricultural lands that spread out along the river course and stretched far inland. Very few trees if any in areas exist in this unit, and it is predominated by hardy pioneer grasses. A few grassland bird species were observed in this habitat zone, but it is mostly devoid of faunal species. This area is used for grazing of the local herds of goats and cattle, and small scale crop production.

Riparian / Wetland habitat unit

Various drainage lines, small tributaries and valley bottom wetlands traverse the study area, including the larger iTsitsa River, which drain in an eastern direction towards the dam wall. The vegetation present within the Riparian / Wetland habitat unit contains many species observed within the Grassland / *Acacia* Thornveld habitat and varies from being woody along the larger rivers with associated riparian systems with more open grasslands due to vegetation clearance and erosion along the drainage lines and smaller tributaries. The Riparian / Wetland habitat unit is considered to be of high ecological sensitivity due to the contribution of the various wetland ecoservices and the habitat provided for floral species. Although large sections along the riparian system are dominated by alien invader floral species, pockets of indigenous tree species exist along the iTsitsa River.

5.2.2 Fauna

Mammals

The mammal species observed within and surrounding the proposed Ntabelanga Dam basin 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. None of the observed species are considered to be threatened on a national level or provincial level.

Avifauna

Avifauna represents the largest faunal community observed within the study area. The majority of avifauna observed was within the mountain bushveld, rocky outcrop and riparian habitat zones.

One of the avifaunal species of concern is that of *Balearica regulorum* (Crowned Crane). This species was observed foraging in the grassland/ transformed habitat zones alongside the river system in the vicinity of the Ntabelanga Dam. A second avifaunal species of concern within the study area and surrounds is *Gyps coprotheres* (Cape Vulture). This species is listed as Vulnerable by the International Union for Conservation of Nature (IUCN), and also listed as an endangered and protected species by National Environmental Management Biodiversity Act (Act 10 of 2004) (NEMBA) and is endemic to South Africa.

Although none were observed during the time of assessment, National Freshwater Ecosystem Priority Area (NFEPA) has indicated that the study area is a recognized breeding and foraging area for protected crane species, namely *Anthropoides paradisea* (Blue crane) and *Grus carunculatus* (Wattled crane). Both these species are listed as Vulnerable by the IUCN, and are listed protected species by NEMBA. *A. Paradisea* (secretary bird) is of particular concern as it is indigenous to South Africa, as well as being South Africa's national bird.

Reptiles

Reptiles are notoriously hard to detect in the field due to the shy nature, and as such an intensive search was undertaken within suitable reptile habitat, specifically in the mountain bushveld and rocky outcrop habitat units. Due to the habitat availability and study areas location, a high diversity of reptiles was not expected to occur. The reptiles that were observed are commonly occurring species in the region.

Amphibians

A very low diversity of amphibians was observed at the Ntabelanga Dam and surrounding areas. The fairly isolated nature of the study areas from surrounding amphibian populations in other active rivers, as well as the Titsa waterfall presenting an unsurpassable obstacle may be contributing factors to the low species diversity in the rivers. The mountains surrounding the river system and the waterfall would have limited amphibian colonisation of the river systems, resulting in only a few of the hardier and more far ranging common species being present in the river systems. The inundation of the surrounding land as the dams fill up will not have a significant effect on amphibian species within the two study areas, and will in all likelihood provide a greater expanse of habitat for the increase in amphibian numbers.

Invertebrates

A wide variety of invertebrates was observed at Ntabelanga Dam locations, and to a lesser extent along the proposed pipelines and power line routes as these predominantly followed existing roads. No NEMBA or Eastern Cape SoER (2004) listed invertebrates were observed during the site visit. As expected, the mountain bushveld, rocky outcrops and riparian zones provided the highest diversity of invertebrate species, with the transformed grassland areas providing habitat for common grasshoppers and locusts that are better suited to those habitats.

Spiders and scorpions

Four species of spiders were observed during the site visit; however it is expected that more species do inhabit the study areas. Due to their reclusive nature when faced by a threat as well as their ability to camouflage themselves well, they are very hard to locate. None of the spider species observed are considered to be threatened or of conservation value, nor are any endangered species thought to persist within the study areas.

5.2.3 Threatened Ecosystems

According to the National List of Threatened Terrestrial Ecosystems (2011), sections of the proposed infrastructure, excluding areas demarcated for the proposed mining activity, fall into a vulnerable ecosystem in terms of the original and remaining extent of the associated vegetation types **(Figure 5).**

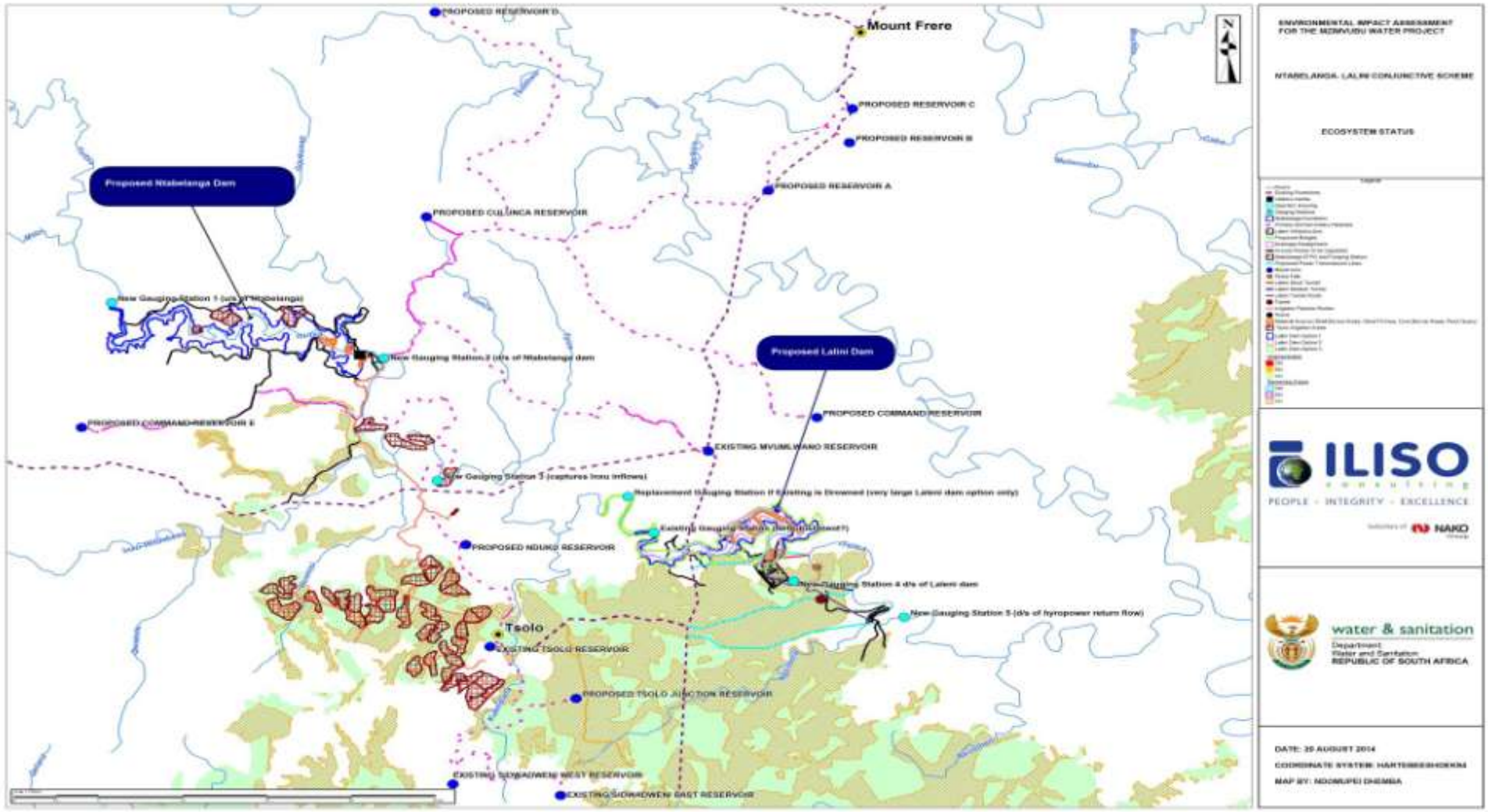


Figure 5: Ecosystem Status

5.2.4 Conservation Importance

The environment in much of the catchment, particularly in the riverine areas, is considered to merit particular protection. The Eastern Cape Biodiversity Conservation Plan (ECBCP) (2007) is a broad scale-biodiversity plan based on identifying Critical Biodiversity Areas (CBAs) and associated land use guidelines. It recommends limits to the total amount of land transformation that should be allowed if biodiversity is to be conserved. The approach rests on the concept of Biodiversity Land Management Classes (BLMCs). Each BLMC sets out the desired ecological state that an area should be kept in to ensure biodiversity persistence. Only land use types that are compatible with maintaining this desired state should be allowed.

Large areas within the project area have been identified as CBAs in terms of the ECBCP. These areas are of conservation importance due to the presence of Red Data species, endemic species and potential habitat for these species to occur. The bulk of the Ntabelanga Dam basin falls within a Terrestrial CBA 2 (BLMC 2 - *Near Natural landscape)* **(Figure 6).**

5.3 DRAINAGE

The study area falls within the Mzimvubu to Kieskamma Water Management Area (WMA). Each WMA is divided into several sub-Water Management Areas (subWMA). The subWMA indicated for the study area is Mzimvubu. 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 Dams 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 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 NFEPA Database (2011).

The Mzimvubu subWMA is indicated as an upstream management area, and is important with regards to fish corridors for movement of threatened fish between habitats. Effective management of activities near and between corridors is therefore

of upmost importance. The subWMA is also important for the conservation of crane species.

The wetland vegetation group in the Ntabelanga Dams' footprint are identified as Sub-escarpment Grassland Group 6 and Sub-escarpment Savanna respectively.
The Mzimvubu subWMA is not considered to be a high groundwater recharge area.

The catchment area contributing to the Ntabelanga Dam is approximately 1 971.1 km^2. The catchment area contributing to the Ntabelanga Dam in the Tertiary catchment T35 is somewhat developed, with approximately 10 % of the catchment area under commercial forestry.

5.4 CLIMATE

Climate data is provided for the towns of Tsolo and Maclear, which are considered to be representative of the general study area. Both towns have sub-tropical climate with moderate rainfall.
Tsolo receives an average annual rainfall of about 749 mm, with most rainfall falling in summer. The lowest (15 mm) average rainfall is experienced in June and the highest (108 mm) in January. The coldest month is July with an average minimum temperature of 3.2°C and January being the hottest month with an average maximum temperature of 26.5°C.

Maclear receives an average annual rainfall of 786 mm, with the wettest month being January receiving an average monthly rainfall of 130 mm. The driest months are June and July, both with 13 mm average rainfall. The hottest temperatures are experienced in summer with average maximum temperature of 20.1°C in January. July is the coldest month with temperatures as low as 0°C.

The variations in temperature and rainfall in the two towns is due to the difference in elevation: Maclear lies at an elevation of 1 280 m above mean sea level whereas Tsolo is at an elevation of 945 m.

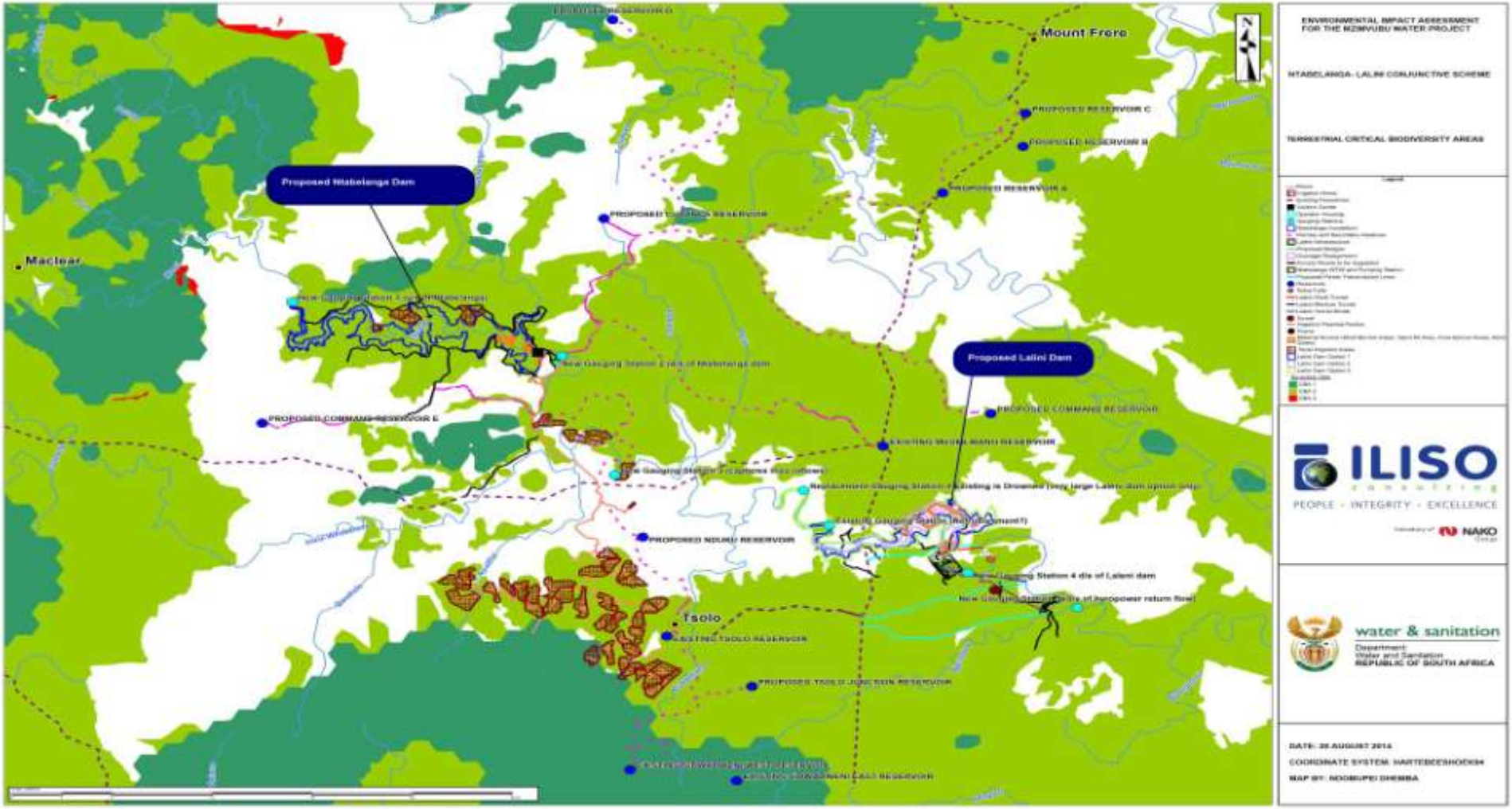


Figure 6: Terrestrial Critical Biodiversity Areas

5.5 HERITAGE IMPACT

Resources may be tangible, such as buildings and archaeological artefacts, or intangible, such as landscapes and living heritage. Their significance is based upon their aesthetic, architectural, historical, scientific, social, spiritual, linguistic, economic or technological values; their representation of a particular time period; their rarity; and their sphere of influence.

Past Heritage Impact Assessments (HIAs) in the area have typically focussed on archaeological sites (and sometimes traditional burial places) to the exclusion of other heritage resources. Literature and database reviews indicate that the following heritage resource types are likely to be present in the study area:

- **Places associated with oral traditions or living heritage**
  Communal areas in southern Africa typically include places (such as mountains, river pools and forests) that are associated with cultural tradition; oral history; performance; ritual; popular memory; traditional skills and techniques; indigenous knowledge systems; and the holistic approach to nature, society and social relationships. Such places may be known to and utilised by entire communities, or only certain individuals, such as traditional healers. They may be visited regularly or only periodically, and their heritage significance could vary from low to high along a local to a national scale.

- **Landscapes and natural features**
  The project area is largely undeveloped and rural with nucleated dispersed settlements (*amalali*) and associated infrastructure within a formalised subsistence agriculture landscape. *Amalali* are grouped as clusters of small family-sized homesteads located across the undulating interfluves between steeply incised drainage basins. The introduction of a dam within this landscape will alter the character considerably due to the size and scale of it. The Visual Impact assessment undertaken as part of the EIA for the MWP determined that the dam will considerably alter the sense of place and Genius Loci of the study area. However, the change in character of the landscape is not considered to be significantly negative and aesthetically unpleasing.

- **Traditional burial places**

  Numerous traditional burial places are known to occur within and adjacent to the project area. Such burials comprise one or more ancestral graves, typically located within or close to homestead precincts, rather than in formal cemeteries managed by a local authority. Graves usually comprise stone-packed mounds, with or without a headstone, although older graves may be less readily identifiable due to the deflation of the mound and scattering of the stone covering.

- **Archaeological sites**

  Due to low survey coverage very few archaeological sites have been recorded within the immediate project area. However, Late Stone Age and Rock Art sites, Early and Later Iron Age and historical sites have been recorded and investigated within the wider Mzimvubu Basin (Prins and Granger, 1993).

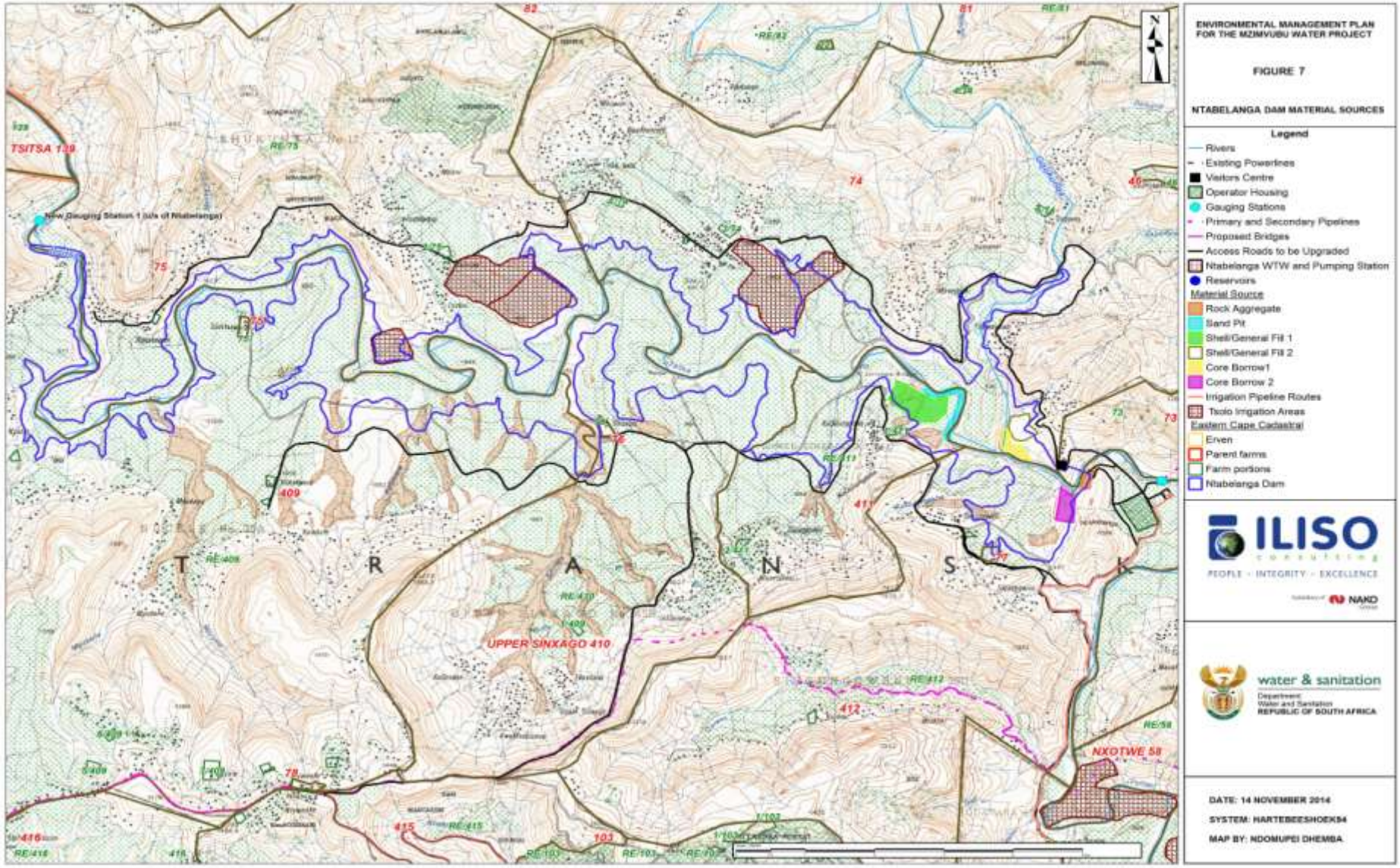
6. DESCRIPTION OF THE PROPOSED MINING OPERATION

A supplementary investigation was carried out to verify suitability of materials required. It is proposed that five (5) borrow areas and one (1) rock quarry will be required for the construction of Ntabelanga Dam and associated works. Borrow areas for clay core material, fill material and sand as well as a rock quarry have been identified to source the required materials.

The proposed borrow areas and rock quarry are located within the expropriation line of the dam basin, upstream of the dam wall and in most cases below the Full Supply Level (FSL) **(Figure 7 and Figure 8). Table 3** details the estimated area and volumes of material required from the borrow areas and the rock quarry.

Table 3: Estimated Volumes and Areas for Ntabelanga Borrow Pit and Quarry

Material to be Mined	Estimated Area (m^2)	Estimated Volume ($m^{3)}$
Core Material Borrow Pit 1	95 549.78	260 000
Core Material Borrow Pit 2	109 899.81	75 000
Shell/General Fill Borrow Pit 1	313 179.38	2 100 000
Shell/General Fill Borrow Pit 2	120 916.02	
Sand Borrow Pit	111 715.65	105 000
Rock Quarry	34 134.72	362 500


ENVIRONMENTAL MANAGEMENT PLAN FOR THE MZIMVUBU WATER PROJECT
FIGURE 7
NTABELANGA DAM MATERIAL SOURCES
Legend
Rivers
Existing Powerlines
Visitors Centre
Operator Housing
Gauging Stations
Primary and Secondary Pipelines
Proposed Bridges
Access Roads to be Upgraded
Ntabelanga WTW and Pumping Station
Reservoirs
Material Source
Rock Aggregate
Sand Pit
Shell/General Fill 1
Shell/General Fill 2
Core Borrow1
Core Borrow 2
Irrigation Pipeline Routes
Tsolo Irrigation Areas
Eastern Cape Cadastral
Erven
Parent farms
Farm portions
Ntabelanga Dam
ILISO consulting
PEOPLE - INTEGRITY - EXCELLENCE
NAKO
water & sanitation
Department: Water and Sanitation
REPUBLIC OF SOUTH AFRICA
DATE: 14 NOVEMBER 2014
SYSTEM: HARTEBEESHOEK94
MAP BY: NDOMUPEI DHEMBA
TSITSA 129
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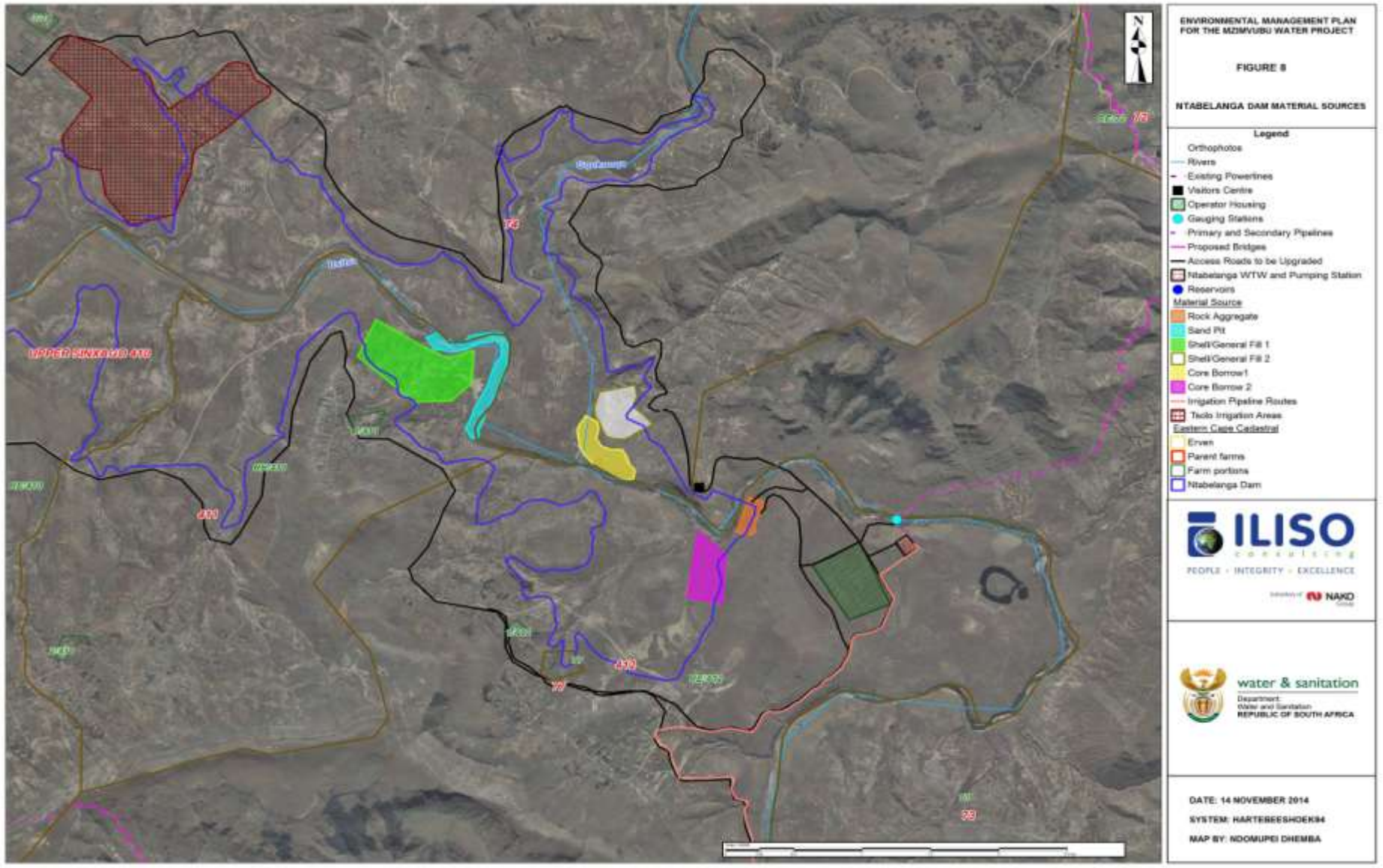
ENVIRONMENTAL MANAGEMENT PLAN
FOR THE MZIMVUBU WATER PROJECT
FIGURE 8
NTABELANGA DAM MATERIAL SOURCES
Legend
Orthophotos
Rivers
Existing Powerlines
Visitors Centre
Operator Housing
Gauging Stations
Primary and Secondary Pipelines
Proposed Bridges
Access Roads to be Upgraded
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MAP BY: NDOMUPEI DHEMBA

6.1 CORE MATERIAL BORROW PIT 1

General Description

The core material borrow pit 1 is located upstream of the dam wall on the left bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed borrow area.

Access

The access/haul roads to the borrow area will be established as part of the dam construction and associated infrastructure. This aspect and management thereof will be covered in more detail in the MWP EMPR. In general access roads will be constructed to acceptable standards and in consultation with the Engineer.

Site Preparation

The borrow area will be clearly demarcated by means of beacons at its corners and/or by fencing off the mining area to prevent unauthorized access of both humans and animals. The mining of and prospecting for material will only take place within the demarcated area. The area to be demarcated will be bigger than the area to be mined to allow for a storage area for topsoil and overburden (stored separately).

Experienced and trained equipment operators will be used during the clearing and grubbing stage of the mining process so that soil disturbance, compaction and displacement are only on those areas ready for immediate use. Similarly only land needed for the immediate term will be cleared and grubbed to limit environmental impact from surface water runoff, dust and to limit cost to control runoff from the mining site. Site preparation will consist of the stripping of topsoil and overburden into stockpiles, which are to be stored separately within the demarcated area. Topsoil and stockpile management will take place in accordance to mitigation measures detailed in chapter 8 of this EMPL. Excavations of the borrow area will be in accordance with the drawing produced by the Engineer and only to the limits approved.

During the course of borrow operations and especially when excavating near the floor and outer boundaries of the borrow area, the Contractor will plan his operations in such a way that the amount of work that will be necessary for the reinstatement of

the borrow pit is reduced as far as possible. Indiscriminant excavation without due regards for the desired final shape of the borrow pit will not be permitted, and shall be rectified by the Contractor.

Bulldozers, loaders, and backactors will be used in the excavation of the borrow pit. The material will be excavated from the face and floor of the borrow pit and if possible loaded directly onto haul trucks. It is proposed that the extent of the area to be mined will be approximately 95 549.78 $m^{2.}$

Drainage

The Contractor will ensure that during exploitation and after reinstatement the borrow pit is kept adequately drained and provision is made to divert surface runoff away from the borrow areas to ensure that pooling of water does not occur.

Stormwater cut-off berms will be constructed to divert up-slope water to protect the active mining area, topsoil and overburden stockpiles from erosion. The storm water will then be channeled towards the natural drainage area. A diversion berm with dissipation beds or the erection of silt fences will be installed down slope of the borrow area to filter out any sediment washed off the site during heavy rainfall. All precaution will be taken to prevent siltation of the river.

Re-instatement of Core Material Borrow Pit 1Area

The borrow pit, or portions therefore, located upstream of the dam and below the FSL of the dam will be reinstated by first dozing back any unsuitable overburden to an even slope not steeper than 1 V: 3 H on the excavated banks. The reinstated surfaces will be in line and levels that conform visually to those of the surrounding natural ground. The storm water berms and dissipation beds will be retained on closure.

For parts of the borrow pit that fall above the FSL these areas will be re-instated by first dozing back any unsuitable overburden to an even slope not steeper than 1 V : 5 H on the excavated banks and sides of the areas left undisturbed within the borrow area. The stockpiled topsoil will then be placed and spread over the area to a uniform thickness, as specified by the Engineer. If topsoil reserves are not sufficient topsoil will have to be imported to ensure re-vegetation. The area will be hydro-seeded using an indigenous grass mix. Monthly inspections will be undertaken during the re-instatement phase and one year liability period by the Engineer and ECO to ensure

that no erosion has taken place and to monitor success of the re-vegetation. The intention will be to achieve an acceptable grass cover. Acceptable grass cover shall mean that not less than 75% of the area grassed or hydro-seeded shall be covered with grass and that no bare patches exceeding 0.25m^2 in an area of 1m x 1m shall occur. In the case of sodding, acceptable cover shall mean that the entire areas shall be covered with live grass at the end of any period not less than three months after sodding. The Contractor will be responsible to ensure that acceptable grass cover is achieved.

6.2 CORE MATERIAL BORROW PIT 2

General Description

The core material borrow pit is located upstream of the dam wall on the right bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed borrow area.

Access

The access/haul roads to the borrow area will be established as part of the dam construction and associated infrastructure. This aspect and management thereof will be covered in more detail in the MWP EMPR. In general access roads will be constructed to acceptable Engineering standards and in consultation with the Engineer.

Site Preparation

The borrow area will be clearly demarcated by means of beacons at its corners and/or by fencing off the mining area to prevent unauthorized access of both humans and animals. The mining of and prospecting for material will only take place within the demarcated area. Areas will also be demarcated for storage of topsoil and overburden (stored separately). These materials should be stored in suitable areas for reuse as fill and rehabilitation of areas above the FSL.

Experienced and trained equipment operators will be used during the clearing and grubbing stage of the mining process so that soil disturbance, compaction and displacement are experienced only on areas ready for immediate use. Only land needed for the immediate term will be cleared and grubbed to limit environmental impact from surface water runoff and to limit the cost to control runoff from the mining

site. Site preparation will consist of the stripping of topsoil and overburden into stockpiles, which are to be stored separately within the demarcated areas. Topsoil and stockpile management will take place in accordance with mitigation measures detailed in chapter 8 of this EMPL. Excavations of the borrow area will be in accordance with the drawing produced by the Engineer and only to the limits approved.

During the course of borrow operations and especially when excavating near the outer boundaries of the borrow area, the Contractor will plan his operations in such a way that the amount of work that will be necessary for the reinstatement of the borrow pit side slopes to 1 V: 3 H is reduced as far as possible. Indiscriminant excavation without due regard for the desired final shape of the borrow pit will not be permitted, and shall be rectified by the Contractor. Care shall also be taken to ensure that all excavations to develop the borrow pit are below the FSL of the dam.

Bulldozers, loaders, and excavators will be used in the excavation of the borrow pit. The material excavated from the borrow pit will, if possible, be loaded directly onto haul trucks. It is proposed that the extent of the area to be mined will be approximately 109 899.81 m^2.

Drainage

The Contractor will ensure that during exploitation and after reinstatement the borrow pit is kept adequately drained and provision is made to divert surface runoff away from the borrow areas to ensure that pooling of water does not occur.

Stormwater cut-off berms will be constructed to divert up-slope water to protect the active mining area, topsoil and overburden stockpiles from erosion. The storm water will then be channeled towards the natural drainage area. A diversion berm with dissipation beds or the erection of silt fences will be installed down slope of the borrow area to filter out any sediment washed off the site during heavy rainfall. All precaution will be taken to prevent siltation of the river.

Reinstatement of Core Material Borrow Pit 2 Area

The borrow pit, or portions therefore, located upstream of the dam wall and below the FSL of the dam will be reinstated by trimming the side slopes to an even slope not steeper than 1 V: 3 H. The reinstated surfaces will be in line and levels that conform

visually to those of the surrounding natural ground. The storm water berms and dissipation beds will be retained on closure.

Care shall be taken to ensure that all excavations for the borrow pit are below the FSL of the dam and no reinstatement is required.

For parts of the borrow pit that fall above the FSL these areas will be re-instated by first dozing back any unsuitable overburden to an even slope not steeper than 1 V : 5 H on the excavated banks and sides of the areas left undisturbed within the borrow area. The stockpiled topsoil will then be placed and spread over the area to a uniform thickness, as directed by the Engineer. If topsoil reserves are not sufficient topsoil will have to be imported. The area will be hydro-seeded using an indigenous grass mix. Monthly inspections will be undertaken during the re-instatement phase and one year liability period by the Engineer and ECO to ensure that no erosion has taken place and to monitor success of the re-vegetation. The intention will be to achieve an acceptable grass cover. Acceptable grass cover shall mean that not less than 75% of the area grassed or hydro-seeded shall be covered with grass and that no bare patches exceeding 0.25m^2 in an area of 1m x 1m shall occur. In the case of sodding, acceptable cover shall mean that the entire areas shall be covered with live grass at the end of any period not less than three months after sodding. The Contractor will be responsible to ensure that acceptable grass cover is achieved.

6.3 FILL MATERIAL BORROW PIT 1

General Description

The fill borrow pit 1 is located upstream of the dam wall on the left bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure within the vicinity of the proposed borrow area.

Access

The access/haul roads to the borrow area will be established as part of the dam construction and associated infrastructure. This aspect and management thereof will be covered in more detail in the MWP EMPR. In general haul roads will be constructed in accordance with acceptable Engineering standards and approved by the Engineer.

Site Preparation

The borrow area will be clearly demarcated by means of beacons at its corners and/or by fencing off the mining area to prevent unauthorized access of both humans and animals. The mining of and prospecting for material will only take place within the demarcated area. Areas will also be demarcated for storage of topsoil and overburden (stored separately). These materials will be stored in suitable areas for reuse as fill and rehabilitation of areas above the FSL

Experienced and trained equipment operators will be used during the clearing and grubbing stage of the mining process so that soil disturbance, compaction and displacement are experienced only on areas ready for immediate use. Only land needed for the immediate term will be cleared and grubbed to limit environmental impact from surface water runoff and to limit cost to control runoff from the mining site. Site preparation will consist of the stripping of topsoil and overburden into stockpiles, which are to be stored separately within the demarcated areas. Topsoil and stockpile management will take place in accordance with mitigation measures detailed in chapter 8 of this EMPL. Excavations of the borrow area will be in accordance with the drawing produced by the Engineer and only to the limits approved.

During the course of borrow operations and especially when excavating near the outer boundaries of the borrow area, the Contractor will plan his operations in such a way that the amount of work that will be necessary for the re-instatement of the borrow pit side slopes to 1 V: 3 H is reduced as far as possible. Indiscriminant excavation without due regards for the desired final shape of the borrow pit will not be permitted, and shall be rectified by the Contractor. Care shall also be taken to ensure that all excavations to develop the borrow pit are below the FSL of the dam.

Bulldozers, loaders, and excavators will be used in the excavation of the borrow pit. The material excavated from the borrow pit will, if possible, be loaded directly onto haul trucks. It is proposed that the extent of the area to be mined will be approximately 313 179.38 m^2.

Drainage

The Contractor will ensure that during exploitation and after reinstatement the borrow pit is kept adequately drained and provision is made to divert surface runoff away from the borrow areas to ensure that pooling of water does not occur.

Stormwater cut-off berms will be constructed to divert up-slope water to protect the active mining area, topsoil and overburden stockpiles from erosion. The storm water will then be channeled towards the natural drainage area. A diversion berm with dissipation beds or the erection of silt fences will be installed down slope of the borrow area to filter out any sediment washed off the site during heavy rainfall. All precaution will be taken to prevent siltation of the river.

Re-instatement of Fill Material Borrow Pit 1 Area

The borrow pit, or portions therefore, located upstream of the dam and below the FSL of the dam will be reinstated by first dozing back any unsuitable overburden to an even slope not steeper than 1 V: 3 H on the excavated banks. The re-instated surfaces will be in line and levels that conform visually to those of the surrounding natural ground. The storm water berms and dissipation beds will be retained on closure. The fill borrow pit 1 falls below the FSL and no hydroseeding will be required for this area as it will be inundated.

6.4 FILL MATERIAL BORROW PIT 2

General Description

The fill material borrow pit is located upstream of the dam wall on the left bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure within the vicinity of the proposed borrow area.

Access

Access/haul roads to the borrow area will be established as part of the dam construction and associated infrastructure. This aspect and management thereof will be covered in more detail in the MWP EMPr. In general haul roads will be constructed to acceptable Engineering standards and in consultation with the Engineer.

Site Preparation

The borrow area will be clearly demarcated by means of beacons at its corners and/or by fencing off the mining area to prevent unauthorized access of both humans and animals. The mining of and prospecting for material will only take place within the demarcated area. Areas will also be demarcated for storage of topsoil and

overburden (stored separately). These materials should be stored in suitable areas for reuse as fill and rehabilitation of areas above the FSL.

Experienced and trained equipment operators will be used during the clearing and grubbing stage of the mining process so that soil disturbance, compaction and displacement are only on those areas ready for immediate use. Only land needed for the immediate term will be cleared and grubbed to limit environmental impact from surface water runoff and to limit cost to control runoff from the mining site. Site preparation will consist of the stripping of topsoil and overburden into stockpiles, which are to be stored separately within the demarcated areas. Topsoil and stockpile management will take place in accordance with mitigation measures detailed in chapter 8 of this EMPL. Excavations of the borrow area will be in accordance with the drawing produced by the Engineer and only to the limits approved.

During the course of borrow operations and especially when excavating near the outer boundaries of the borrow area, the Contractor will plan his operations in such a way that the amount of work that will be necessary for the reinstatement of the borrow pit side slopes to 1 V: 3 H is reduced as far as possible. Indiscriminant excavation without due regards for the desired final shape of the borrow pit will not be permitted, and shall be rectified by the Contractor. Care shall also be taken to ensure that all excavations to develop the borrow pit are below the FSL of the dam.

Bulldozers, loaders, and excavators will be used in the excavation of the borrow pit. The material excavated from the borrow pit will, if possible, be loaded directly onto haul trucks. It is proposed that the extent of the area to be mined will be approximately 120 916.02 m^2.

Drainage

The Contractor will ensure that during exploitation and after reinstatement the borrow pit is kept adequately drained and provision is made to divert surface runoff away from the borrow areas to ensure that pooling of water does not occur.

Stormwater cut-off berms will be constructed to divert up-slope water to protect the active mining area, topsoil and overburden stockpiles from erosion. The storm water will then be channeled towards the natural drainage area. A diversion berm with dissipation beds or the erection of silt fences will be installed down slope of the

borrow area to filter out any sediment washed off the site during heavy rainfall. All precaution will be taken to prevent siltation of the river.

Reinstatement OF FILL MATERIAL Borrow Pit 2 Area

The Borrow pit, or portions therefore, located upstream of the dam and below the FSL of the dam will be reinstated by trimming the side slopes to an even slope not steeper than 1 V: 3 H. The reinstated surfaces will be in line and levels that conform visually to those of the surrounding natural ground. The storm water berms and dissipation beds will be retained on closure. Care shall be taken to ensure that all excavations for the borrow pit are below the FSL of the dam and no reinstatements is required.

For parts of the borrow pit that fall above the FSL these areas will be re-instated by first dozing back any unsuitable overburden to an even slope not steeper than 1 V : 5 H on the excavated banks and sides of the areas left undisturbed within the borrow area. The stockpiled topsoil will then be placed and spread over the area to a uniform thickness, as directed by the Engineer. If topsoil reserves are not sufficient topsoil will have to be imported. The area will be hydro-seeded using an indigenous grass mix. Monthly inspections will be undertaken during the re-instatement phase and one year liability period by the Engineer and ECO to ensure that no erosion has taken place and to monitor success of the re-vegetation. The intention will be to achieve an acceptable grass cover. Acceptable grass cover shall mean that not less than 75% of the area grassed or hydro-seeded shall be covered with grass and that no bare patches exceeding 0.25m^2 in an area of 1m x 1m shall occur. In the case of sodding, acceptable cover shall mean that the entire areas shall be covered with live grass at the end of any period not less than three months after sodding. The Contractor will be responsible to ensure that acceptable grass cover is achieved.

6.5 SAND BORROW AREA

General Description

The area demarcated for the sand borrow pit is located upstream of the dam wall across the left and right banks of the river. The mining operations will take place within the riverine environment.

This activity forms part of the water use license application to DWS for the MWP. The best practice guideline for small scale mining developed by DWS is attached hereto

(Appendix A) and will be adhered to as a minimum requirement together with any other conditions that DWS may impose.

Access

Access/haul roads to the borrow areas will be established as part of the dam construction and associated infrastructure. This aspect and management thereof will be covered in more detail in the MWP EMPR. In general haul roads will be constructed to acceptable Engineering standards and in consultation with the Engineer.

Access to the riverbed for the purpose of conducting excavations in the riverbed, shall as far as possible, be through the use of only one access at a time. The location of the access to the river channel across the river-bank shall, if possible, be at a point of the river bank where the least excavation and damage to vegetation will occur and shall not be wider than is reasonably required. The position of the river access, together with all planned future access points, must be indicated on the layout plan.

Site Preparation

It must be noted that this entire area will not be excavated and sand borrow pits within the proposed borrow area will be verified during the construction phase of the project. Only land needed for the immediate term will be cleared and grubbed to limit impact on the riverine environment. The river sand will be mined from a seasonal drainage channel for the construction purpose. The depth of the mining operations will be less than 1.5 m as sand is not deeper.

Drainage/ Water Management

Mining will be conducted only in accordance with the Best Practice Guideline for small scale mining that relates to storm water management, erosion and sediment control, and waste management, developed by the DWS and any other conditions which that Department may impose.

To reduce sedimentation downstream of the mining activity, silt curtains will be erected at strategic positions across the river banks as determined by the Engineer. A minimum of three silt curtains along the river will be used for the duration of this mining activity to trap sediment and lessen the impact on downstream uses. These silt curtains will be cleaned regularly as determined by the Engineer in consultation with the ECO. The Contractor will take care not to wash silt curtains along the river

banks where deposition of silt can be washed back into the river. The cleaning/ maintenance of silt curtains will be phased to ensure this mitigation measure is always in place.

Re-instatement of the Riparian Zone

Backfilling is not an option as all material in the form of river sand will be removed. The goal of rehabilitation of the area where mining has taken place in the riverbed is to leave the area level and even, and in a natural state containing no foreign debris or other materials, and to ensure the hydrological integrity of the river by not attenuating or diverting any of the natural flow. All scrap and other foreign materials will be removed from the bed of the river and disposed of as in the case of other refuse whether these accrue directly from the mining operation or are washed on to the site from upstream.

It must be noted that this area falls below the FSL and will be inundated, and the measures described above are to mitigate the impact of sand mining during the construction period.

6.6 ROCK QUARRY

General Description

The rock quarry is located upstream of the dam wall on the right bank of the river. As detailed in chapter 5 of this report the area exhibits transformed vegetation and there is no infrastructure or servitude areas within the vicinity of the proposed quarry area.

Access

Access/haul roads to the proposed quarry area will be established as part of the dam construction and associated infrastructure. This aspect and management thereof will be covered in more detail in the MWP EMPR. In general haul roads will be constructed to acceptable Engineering standards and in consultation with the Engineer.

Site Preparation

The quarry area will be clearly demarcated by means of beacons at its corners and/or by fencing off the mining area to prevent unauthorized access of both humans and animals. The mining of and prospecting for material will only take place within the demarcated area. Areas will also be demarcated for storage of topsoil and

overburden (stored separately). These materials should be stored in suitable areas for reuse as fill and rehabilitation of areas above the FSL.

Experienced and trained equipment operators will be used during the clearing and grubbing stage of the mining process so that soil disturbance, compaction and displacement are only on those areas ready for immediate use. Only land needed for the immediate term will be cleared and grubbed to limit environmental impact from surface water runoff and to limit the cost to control runoff from the mining site. Site preparation will consist of the stripping of topsoil and overburden into stockpiles, which are to be stored separately within the demarcated areas.

For construction purposes the quarry will be drilled and blasted to remove overburden. Further drilling and blasting will proceed to obtain the quality of rock required for construction. Measures will be employed as per blasting contractor's legal obligations. A pre-blast survey will be conducted of all structures (if present) in a 500 m radius of the blast zone. Adequate warnings will be given to all neighbours/residents in close proximity to the quarry. Unsuitable overburden, which cannot be reused, will be treated as spoil and will be stockpiled separately below the dead storage level of the dam.

Topsoil and stockpile management will take place in accordance with mitigation measures detailed in chapter 8 of this EMPL. Excavation of the quarry area will be in accordance with the drawing produced by the Engineer and only to the limits approved.

During the course of quarry operations and especially when excavating near the outer boundaries of the quarry area, the Contractor will plan his operations in such a way that the amount of work that will be necessary for the reinstatement of the quarry slopes at 1 V: 3 H is reduced as far as possible. This can be achieved by developing the quarry in terraces and varying the depth of the blast holes to achieve the required final side slopes. Indiscriminant excavation without due regard for the desired final shape of the quarry will not be permitted, and shall be rectified by the Contractor.

Bulldozers, loaders, and excavators will be used in the excavation of the quarry. The material will be excavated from the face and floor of the quarry and if possible

loaded directly onto haul trucks. It is proposed that the extent of the area to be mined will be approximately 34 134.72 m^2.

Drainage

The Contractor will ensure that during exploitation and after reinstatement the quarry area is kept adequately drained to ensure that pooling of water does not occur and provision is made to divert surface runoff.

Stormwater cut-off berms will be constructed to divert up-slope water to protect the active mining area, topsoil and overburden stockpiles from erosion. The storm water will then be channeled towards the natural drainage area. A diversion berm with dissipation beds or the erection of silt fences will be installed down slope of the quarry area to filter out any sediment washed off the site during heavy rainfall.

Re-instatement of the Quarry Area

The quarry area, or portions thereof, located upstream of the dam wall and below the FSL of the dam, will be reinstated by blasting any remaining vertical side slopes to not steeper than 1 V: 3 H. The re-instated slopes will be in line and levels that conform visually to those of the surrounding natural ground. The storm water berms and dissipation beds will be retained on closure.

For parts of the quarry that fall above the FSL these areas will be re-instated by first placing fill material to an even slope not steeper than 1 V: 5 H. The stockpiled topsoil will then be placed and spread over the area to a uniform thickness, as directed by the Engineer. If topsoil reserves are not sufficient topsoil will have to be imported.

The area will be hydro-seeded using an indigenous grass mix. Monthly inspections will be undertaken during the re-instatement phase and one year maintenance period by the Engineer and ECO to ensure that no erosion has taken place and to monitor success of the re-vegetation. The intention will be to achieve an acceptable grass cover. Acceptable grass cover shall mean that not less than 75% of the area grassed or hydro-seeded shall be covered with grass and that no bare patches exceeding 0.25 m^2 in an area of 1 m x 1 m shall occur. In the case of sodding, acceptable cover shall mean that the entire areas shall be covered with live grass at the end of any period not less than three months after sodding. The Contractor will be responsible to ensure that acceptable grass cover is achieved.

7. REGULATION 52 (2) (b): ASSESSMENT AND SUMMARY RATING OF THE POTENTIAL IMPACTS OF THE PROPOSED OPERATION ON THE ENVIRONMENT

7.1 CRITERIA USED FOR THE SIGNIFICANCE RATING

The criteria used for the significance rating is highlighted below and applied to activities applicable to the mining activity in **Table 4.**

- All surface disturbances are rated high
- Dust is rated low if only minimal dust is expected to accumulate over the permit period, medium if it is expected to require dust suppression such as watering, and high if there is a risk that it will migrate beyond the permit area.
- Noise is rated low if no machinery is to be used, medium if machinery is to be used, and high if there is a potential for complaints from public and neighbours.
- All drainage is rated high
- All blasting is rated high
- All dust and noise from loading, hauling and transport is rated high
- Drainage from ablution facilities are rated high.

Table 4: Significance Rating

ACTIVITY Mark with X which activities are applicable			POTENTIAL IMPACT	SIGNIFICANCE RATING		
				LOW	MEDIUM	HIGH
Excavations		**X**	Surface disturbance			X
			Dust	X		
			Noise	X		
			Drainage			X
Blasting		**X**	Fly Rock			X
Stockpiles		**X**	Surface disturbance			X
			Dust	X		
			Drainage			X
Loading, hauling and transport		**X**	Noise	X		
			Dust	X		
Offices, ablution, stores, etc.		**X**	Surface disturbance			X
			Drainage			X
OTHER (Specify)	Riparian Zone		Surface Disturbance			X
			Siltation of the river			X

8. REGULATION 52 (2) (c): PROPOSED MITIGATION MEASURES TO MINIMISE ADVERSE IMPACTS

Prior to commencement of the mining activity the Contractor will submit to the Engineer a Method Statement for the proposed borrow pits and quarry area. The Method Statement will contain mitigation measures proposed in **Table 5** and at least the following:

- Detailed Layout plan with position of the beacons/fences to be erected;
- Positions and approximate dimensions of topsoil stockpiles, unsuitable/spoil stockpiles, overburden, material stockpiles;
- Position and approximate dimensions of all working areas required, including crusher and haul road layouts and positions;
- Detail and positions of storm water controls, site drainage measures, etc.;
- Method adopted to erect silt curtains and cleaning and maintenance thereof;
- Final forms slopes and approximate dimensions of excavation; and
- Details of reinstatement and hydro-seeding where applicable.

Table 5: Mitigation Measures

ACTIVITY **Mark with X which measures are applicable**		**MITIGATION MEASURE**	**DESCRIPTION OF THE MEASURE TO BE PUT IN PLACE**
Excavations	**X**	Site preparation	• The borrow area will be clearly demarcated by means of beacons at its corners and/or by fencing off the mining area to prevent unauthorized access of both humans and animals. • The mining of and prospecting for material will only take place within the demarcated area. • Areas will also be demarcated for storage of topsoil and overburden (stored separately). These materials will be stored in suitable areas for reuse as fill and rehabilitation of areas above the FSL. • Experienced and trained equipment operators will be used during the clearing and grubbing stage of the mining process. • Only land needed for the immediate term will be cleared and grubbed to limit environmental impact from surface water runoff, dust and to limit the cost to control runoff from the mining site

	X	Storm Water Controls	• Stormwater cut-off berms will be constructed to divert up-slope water to protect the active mining area, topsoil and overburden stockpiles from erosion. • The storm water will then be channeled towards the natural drainage area. A diversion berm with dissipation beds or the erection of silt fences will be installed down slope of the quarry area to filter out any sediment washed off the site during heavy rainfall. • Operations will be planned in such a way that if the borrow pit lies above the water table it will be self-draining. Where this is not possible, the borrow pit shall be dewatered using suitable filtration measures. • In gaining materials from borrow areas below the water table, disturbed water within the borrow pit shall not be contaminated.
	X	Reinstatement	• The borrow pit and quarry area will be reinstated by trimming the excavated slopes to the required slope. • The stockpiled topsoil will then be placed and spread over the whole area to a uniform thickness on areas above the FSL of the dam. • The reinstated surfaces shall be in line and levels that conform visually to those of the surrounding natural ground. • The storm water berms and dissipation beds will be retained on closure. • For parts of the excavation that fall above the FSL the area will be hydro-seeded using an indigenous grass mix. • Monthly inspections will be undertaken during the one year liability period by the Engineer and ECO to ensure that no erosion has taken place and to monitor success of the re-vegetation. • The intention will be to achieve an acceptable grass cover. • Acceptable grass cover shall mean that not less than 75% of the area grassed or hydro-seeded shall be covered with grass and that no bare patches exceeding $0.25m^2$ in an area of 1m x 1m shall occur. • In the case of sodding, acceptable cover shall mean that the entire areas shall be covered with live grass at the end of any period not less than three months after sodding.

	X	Dust control measures	• Only land needed for the immediate term will be cleared and grubbed to limit environmental impact due to dust emissions. • A designated water truck will administer dust suppression on haul roads. • Traffic control measures such as limiting vehicle speeds will be implemented. • Haul trucks will be covered with tarps when travelling on public roads.
	X	Noise control measures	• All equipment will be kept in good working order. • Vehicles will be operated within specifications and capacity (no overloading of machines). • Equipment will be turned off when not in use. • No amplified music shall be allowed onsite.
Access Roads/Hauling of Materials	**X**	Establishment of Access/Haul Roads	• The access/haul road to the borrow pits and quarry area will be established in accordance with acceptable Engineering standards and in consultation with the Engineer. • Existing roads will be used as far as possible.
	X	Dust Control Measures	• Traffic control measures such as limiting vehicle speeds will be implemented. 40 km/h for heavy vehicles will be strictly enforced. • Vehicles transporting spoil material must be covered or soil sprayed with water before leaving site if transportation is required in excessively windy conditions and/or on public roads. Covering of trucks transporting soil within the basin will not be required. • Haul roads will be watered down when necessary, or as determined by the Engineer/ECO from visual monitoring and dust fallout rates.
	X	Noise Control Measures	• Vehicles should be routed away from noise sensitive areas wherever possible. • Vehicles will be operated within specifications and capacity (no overloading). • No amplified music shall be allowed onsite. • Equipment will be turned off when not in use.

Blasting (Quarry only)	**X**	General	• Measures to be employed as per blasting contractor's legal obligations. • Traffic movements to be restricted during the blast. • Adequate warnings to be given to all workers on site and neighbours/residents in close proximity to the quarry. • A warning system that may be implemented includes the following: o Warning siren; o Bulk SMS for notifying residents of blast times; o Signage on site warning workers of blast times.
Stockpiles	**X**	Stripping	• Striping of topsoil must be undertaken in all areas where physical disturbance of the surface will occur. • Areas from which the topsoil is to be removed shall be cleared of any foreign material which could reduce the quality of the topsoil. • Topsoil must be kept separate from subsoil and must not be used for building or maintenance of access roads or as backfill. • To the greatest extent possible topsoil and subsoil should be handled only twice, once during removal and the second when it's being reinstated. • All soil stockpiles shall be positioned that they are not in any way impacted or compacted upon by vehicular movements, other materials storage or construction activities in general. • Topsoil stockpiles must be stored in designated areas and shall not exceed two (2) metres in height. • Soil stockpiles shall not be positioned so that they obstruct any water drainage line or area of concentrated runoff. • Where stockpiles are necessarily positioned along any sloped area, diversion berms or rock packs shall be constructed around their uphill sides to prevent scouring of the stockpile. • Soil conservation measures must be implemented to stockpiles to prevent erosion and invasion of weeds. Stockpiles must be kept free of weeds.
	X	Dust Control Measures	• Stockpiles will be watered down when necessary, or as determined by the Engineer/ECO from visual monitoring and dust fallout rates.

	X	Storm water system	• Stormwater cut-off berms will be constructed to divert up-slope water to protect the topsoil and overburden stockpiles from erosion. • Where stockpiles are necessarily positioned along any sloped area, diversion berms or rock packs shall be constructed around their uphill sides to prevent scouring of the stockpile. • Soil stockpiles shall not be positioned so that they obstruct any water drainage line or area of concentrated runoff.
Accommodation, offices, ablution, stores, workshops etc.	**X**	General	• Mobile chemical toilets will be available for use during operations and will be removed at final closure. • Toilets will be provided in a ratio of one toilet for 20 people on site.
Riparian Zone	**X**	Site Preparation	• Only land needed for the immediate term will be cleared and grubbed to limit impact on the riverine environment. • The river sand will be mined from a seasonal drainage channel for the construction purpose. • The depth of the mining operations will be less than 1.5m as sand is not expected to be deeper.
		Access	• Access to the riverbed for the purpose of conducting excavations in the riverbed, shall be through the use of only one access at a time, where possible. • The location of the access to the river channel across the river-bank shall be at a point of the riverbank where the least excavation and damage to vegetation will occur and shall not be wider than is reasonably required. • The position of the river access, together with all planned future access points, must be indicated on the layout plan.
		Sediment Control	• Mining will be conducted only in accordance with the Best Practice Guideline for small scale mining that relates to storm water management, erosion and sediment control and waste management, developed by the DWS and any other conditions which that Department may impose. • Silt curtains will be erected at strategic positions across the river banks as determined by the Engineer/ECO. • A minimum of three silt curtains along the river will be used for the duration of this mining activity to trap sediment and lessen the impact on downstream uses as a phased approach. • The silt curtains will be cleaned regularly as determined by the Engineer or as directed by the ECO.

			• The Contractor will take care not to wash silt curtains along the river banks where deposition of silt can be washed back into the river. • The cleaning/maintenance of silt curtains will be phased to ensure this mitigation measure is always in place.
		Re-instatement	• Backfilling is not an option as all material in the form of river sand will be removed. • The area will be leveled and left in a natural state containing no foreign debris or other materials, and to ensure the hydrological integrity of the river by not attenuating or diverting any of the natural flow. • All scrap and other foreign materials will be removed from the bed of the river and disposed of as in the case of other refuse whether these accrue directly from the mining operation or are washed on to the site from upstream. • It must be noted that this area falls below the FSL and will be inundated.

9. MINIMUM OPERATIONAL STANDARDS THAT WILL BE ADHERED TO FOR ENVIRONMENTAL MANAGEMENT

This chapter details the minimum operation standards required by DMR as stated in the EMP template for small scale mining. The sub-sections that follow must be read in conjunction with details provided in previous chapters of this EMPL as well as the MWP EMPR and Water use Licence conditions.

9.1 DEMARCATION OF THE MINING AREA AND RESTRICTIONS

- The mining area must be clearly demarcated by means of beacons at its corners, and along its boundaries if there is no visibility between the corner beacons.
- The mining of and prospecting for any mineral shall only take place within this demarcated mining area.

9.2 TOPSOIL

- Topsoil shall be removed from all areas where physical disturbance of the surface will occur.
- The removed topsoil, shall be stored in a bund wall or similar structure on the high ground side of the mining area outside the 1:50 year flood level within the boundaries of the mining / prospecting area or other demarcated area.
- Topsoil shall be kept separate from overburden and shall not be used for building or maintenance of access roads.
- The topsoil stored in the bund wall shall be adequately protected from being blown away or being eroded.

9.3 ACCESS ROADS ON THE SITE

- The access/haul road to the mining area and the camp site/ site office must be established in consultation with the landowner/tenant and existing roads shall be used as far as practicable.
- The design, construction and location of access to provincial roads will be in accordance with the requirements laid down by the provincial or controlling authority.

- Should a portion of the access road be newly constructed the route shall be selected that a minimum number of bushes or trees are felled and existing fence lines shall be followed as far as possible. Water courses and steep gradients shall be avoided as far as is practicable. Adequate drainage and erosion protection in the form of cut-off berms or trenches shall be provided where necessary.
- The erection of gates in fence lines and the open or closed status of gates in new and existing positions shall be clarified in consultation with the landowner/tenant and maintained throughout the operational period.
- No other routes will be used by vehicles or personnel for the purpose of gaining access to the site.

9.4 MAINTENANCE OF ACCESS ROADS

- In the case of dual or multiple users of access roads, arrangements for multiple responsibility must be made with the other users. If not, the maintenance of access roads will be the responsibility of the holder of the mining permit.
- Newly constructed access roads shall be adequately maintained so as to minimize dust, erosion or undue surface damage.

9.5 DUST CONTROL ON THE ACCESS AND HAUL ROADS

- The liberation of dust into the surrounding environment shall be effectively controlled by the use of, inter alia, water spraying and/or other dust-allaying agents. The speed of haul trucks and other vehicles must be strictly controlled to avoid dangerous conditions, excessive dust or excessive deterioration of the road being used.

9.6 SATELLITE OFFICE SITES

- Should satellite office sites be required for the mining activity, these offices must be established, as far as is practicable, outside the flood plain, above the 1 in 50 year flood level and within the boundaries of the mining/ prospecting area.
- The area chosen for these purposes shall be the minimum reasonably required and which will involve the least disturbance to vegetation.
- No camp or office site shall be located closer than 100 metres from a stream, river, spring, dam or pan.
- No trees or shrubs will be felled or damaged for the purpose of obtaining firewood, unless agreed to by the landowner/tenant.

- Fires will only be allowed in facilities or equipment specially constructed for this purpose. If required by applicable legislation, a fire-break shall be cleared around the perimeter of the camp temporary office sites.
- Lighting and noise disturbance or any other form of disturbance that may have an effect on the landowner/tenant/persons lawfully living in the vicinity shall be kept to a minimum.

9.7 TOILET FACILITIES AND WASTE WATER

- Chemical toilet facilities or other approved toilet facilities shall be used on the site in such a way that they do not cause water or other pollution.
- In cases where facilities are linked to existing sewerage structures, all necessary regulatory requirements concerning construction and maintenance should be adhered to.
- Spills will be cleaned up immediately by removing the spillage together with the polluted soil and by disposing of them at a licensed facility to receive such waste.

9.8 VEHICLE MAINTENANCE YARDS, STORAGE AREAS AND EQUIPMENT

- The vehicle maintenance yard and secured storage area will be established as part of the Dam Construction and will form part of the MWP EMPR. In general as far as is practicable, such facilities will be established outside the flood plain, above the 1 in 50 year flood level and within the boundaries of the construction domain.
- The area chosen for these purposes will be the minimum reasonably required and involve the least disturbance to tree and plant life.
- The storage area shall be securely fenced and all hazardous substances and stocks such as diesel, oils, detergents, etc., shall be stored therein. Drip pans/trays, a thin concrete slab or a facility with PVC lining, shall be installed in such storage areas with a view to prevent soil and water pollution.
- The location of both the vehicle maintenance yard and the storage areas are to be indicated on the construction layout plan for the Dam camp site.
- No vehicle may be extensively repaired in any place other than in the maintenance yard. If the vehicle is unable to move from a particular area, spill prevention measures must be implemented before a repair of the vehicle can take place.
- Equipment used in the mining process will be adequately maintained so that during operations it does not spill oil, diesel, fuel, or hydraulic fluid.

- Machinery or equipment used on the mining area will not be allowed to constitute a pollution hazard in respect of the above substances.
- The Engineer may order such defective equipment to be repaired or withdrawn from use if he or she considers the equipment or machinery to be polluting and/or irreparable.

9.9 WASTE DISPOSAL

- Suitable covered receptacles shall be available at all times and conveniently placed for the disposal of waste.
- All used oils, grease or hydraulic fluids shall be placed therein and these receptacles will be removed from the site on a regular basis for disposal at a registered or licensed disposal facility to receive hazardous waste.
- All spills must be cleaned up immediately to the satisfaction of the Engineer by removing the spillage together with the polluted soil and by disposing of them at a registered or licensed disposal facility to receive hazardous waste.

9.10 LIMITATIONS ON MINING

- The mining of materials shall take place only within the approved demarcated mining or prospecting area.
- Mining will be limited to the areas indicated as excavations on the plan provided herein **(Figure 7).**
- Operations will not be conducted closer than one and a half times the height of the bank from the edge of the river channel, and undertaken in such manner that the stability of the bank of the river is not affected.
- Precautions shall also be taken to ensure that the bank of the river is adequately protected from scouring or erosion due to the mining activities.
- Damage to the bank of the river caused by the operations, will be rehabilitated to a condition acceptable to the Engineer and ECO.
- Restrictions on the disturbance of riverine vegetation in the form of reeds or wetland vegetation must be adhered to.

9.11 MINING OPERATIONS WITHIN A RIVERINE ENVIRONMENT

- The mining of materials in the river or the banks of the river will be undertaken only:

- if DWS has been consulted;
- if the best practice guideline for small scale mining developed by DWS is attached thereto; and
- In accordance with such guideline and any additional conditions that DWS may impose.

- The canalisation of a river will not be undertaken unless the necessary permission has been obtained from the DWS. Over and above the conditions imposed by the said Department, which conditions shall form part of this EMPL, the following will also apply:

  - The canalisation of the flow of the river over different parts of the riverbed shall be constructed in such a manner that the flow of the river may not be impeded in any way and damming upstream may not occur.
  - The canalisation of the flow may not result in scouring or erosion of the river-bank.
  - Well points or extraction pumps in use by other riparian users may not be interfered with and canalisation may not impede the extraction of water at these points.
  - Access to the riverbed for the purpose of conducting excavations in the river-bed, shall be through the use of only one access at a time. The location of the access to the river channel across the river bank shall be at a point of the river-bank where the least excavation and damage to vegetation will occur and shall not be wider than is reasonably required. The position of the river access, together with all planned future access points, must be indicated on the layout plan.

9.12 ESTABLISHING THE EXCAVATION AREAS

- Whenever any excavation is undertaken for the purpose of locating and/or extracting ore bodies of all types of minerals (materials), the following operating procedures shall be adhered to:

  - Excavations shall take place only within the area indicated;
  - Overburden rocks and coarse material shall be placed concurrently in the excavations or stored adjacent to the excavation,
  - If practicable, the overburden is to be used as backfill material; and
  - Trenches shall be backfilled immediately if no suitable material can be located.

10. REGULATION 52 (d): FINANCIAL PROVISION

10.1 INFORMATION FOR QUANTUM CALCULATION

Table 6 details estimated volumes and the estimated areas demarcated to source material for the construction of Ntabelanga Dam and associated infrastructure. It must be noted that most of these areas are below the FSL of the dam and will be inundated.

Table 6: Re-instatement areas for Ntabelanga Borrow Pits and Quarry

Material to be Mined	Estimated Area (m^2)	Estimated Volume ($m^{3)}$
Core Material Borrow Pit 1	95 549.78	260 000
Core Material Borrow Pit 2	109 899.81	75 000
Shell/General Fill Borrow Pit 1	313 179.38	2 100 000
Shell/General Fill Borrow Pit 2	120 916.02	
Sand Borrow Pit	111 715.65	105 000
Rock Quarry	34 134.72	362 500

10.2 UNDERTAKING TO PROVIDE FINANCIAL PROVISION

The Memorandum of Understanding between the DWS and DMR concerning the financial provision associated with re-instatement of borrow and quarry areas used for the construction of water resource infrastructure is attached as **Appendix B**.

11. REGULATION 52 (2) (e): PLANNED MONITORING FOR EMP

IDENTIFICATION	Mark with an X where applicable	
	YES	NO
Have the interested and affected parties identified that noise must be monitored?		X
Have the interested and affected parties identified that dust must be monitored?		X
Have the interested and affected parties identified that water quality must be monitored?	X	

All aspects of construction will be monitored in accordance with the Environmental Authorisation, the MWP EMPR and the Water Use Licence conditions.

11.1 ENVIRONMENTAL AWARENESS PLAN

General environmental awareness will be fostered among the project's workforce to encourage the implementation of environmentally sound practices throughout its duration. This will ensure that environmental accidents are minimized and environmental compliance maximized. Environmental awareness will be fostered in the following manner:

- A specific tool box talk for all workers on site involved in the mining activity will be administered;
- Refresher courses will be conducted as and when required; and
- Displaying of information posters and other environmental awareness material.

The goal of training is to enable a shared understanding and common vision of the environment, the impact of a mining operation on the environment (and why this is important) and the role of mining/ construction personnel in terms of environmental management and compliance.

The tool box talk will comprise the following steps:

- The first step will include background discussion of the environment concept: of what it comprises and how we interact with it;
- The second step will be a description of the components and phases of the specific mining operation;

- The third step will be a general account of how the mining operation and its associated activities can affect the environment, giving rise to what we call Environmental Impacts; and
- The fourth and most important step will be a discussion of what staff can do in order to help prevent the negative environmental impacts from degrading our environment. This is known as Environmental Impact Management.

12. REGULATION 52 (2) (g): RECORD OF THE PUBLIC PARTICIPATION PROCESS

12.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES

As part of the Environmental Impact Assessment (EIA) for the MWP a Public Participation Process, in accordance with GN 543 regulations 54 – 57, was undertaken. A letter notifying I&APs of the application for the environmental authorisation of the MWP, as well as the applications for the Water Use Licence, heritage permits, quarry and borrow areas approval, was sent to all registered stakeholders, together with a Background Information Document (BID). Both the English and isiXhosa versions were distributed by the local facilitators as well as placed on the DWS website. The BID covers all the applications that form part of the project.

A newspaper advertisement was published in both local and provincial newspapers announcing the EIA process for this project and providing contact details for I&APs to register as a stakeholder. An on-site notice was also posted providing a brief background on the project and contact details in order for I&APs to request further information and/or to register as a stakeholder. All documents are available in **Appendix C.**

12.2 IMPACT OF THE PROPOSED MINE ON INTERESTED AND AFFECTED PARTIES

As part of the Public Participation Process a formal and integrated record of all the issues raised by Interested and Affected Parties (I&APs) at the meetings or by letters, e-mails or telephone were recorded. Responses provided by DWS and the technical team during the public participation process also documented. This information can be found in the Issues and Response Report (IRR) **(Appendix C.6)**.

12.3 INFORMATION REGARDING OBJECTIONS

No I&AP's have objected to the application.

13. REGULATION 52 (2) (h): UNDERTKAING TO EXCECUTE THE EMP

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorised to act as representative of the applicant in terms of the resolution submitted with the application, I herewith confirm that the above report comprises the EMP compiled in accordance with directive, in terms of sections 29 of the Act contained herein, and that the Environmental management plan will be executed as proposed should the permit be issued. I acknowledge that since this Environmental Management Plan is specific to the scale of the mining operation in the hands of the applicant/holder, the operation of the mine specifically by the holder in the manner and scale proposed in the applicable financial and technical ability report and in this Environmental management plan constitute material terms and conditions of the permit, and any change in the scope of the work or the party operating the mine, albeit on a subcontracting or subletting basis, will constitute a contravention contemplated in section 47(1) of the Act.

Full Name and Surname	Menard Mugumo
Identity Number	6903295837180

14. REFERENCES

Department of Water Affairs, South Africa (2013a) *Feasibility Study for the Mzimvubu Water Project: Irrigation Development*. DWA Report No: P WMA 12/T30/00/5212/9. Prepared by Jeffares & Green (Pty) Ltd.

Department of Water Affairs, South Africa (2013b) *Feasibility Study for the Mzimvubu Water Project: Geotechnical Investigations*. DWA Report No: P WMA 12/T30/00/5212/10. Prepared by Jeffares & Green (Pty) Ltd.

Department of Water Affairs, South Africa (2014)*. Environmental Impact Assessment for the Mzimvubu Water Project: Floral Impact Assessment Report.* DWA Report No: P WMA 12/T30/00/5314/10

Department of Water Affairs, South Africa (2014). *Environmental Impact Assessment for the Mzimvubu Water Project: Fauna Impact Assessment Report.* DWA Report No: P WMA 12/T30/00/5314/11

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APPENDIX A

DWS Guideline for Small Scale Mining

APPENDIX B

DWS and DMR Memornadum of Understanding

APPENDIX C

PUBLIC PARTICIPATION PROCESS (PPP) INFORMATION

C1: List of Interested and Affected Parties

C2: Notification letter

C3: Background Information Document (BID)

C4: Newspaper advertisement

C5: Site notice

C6: Issues and Responses Report

C1: List of Interested and Affected Parties

C2: Notification letter

C3: Background Information Document (BID)

C4: Newspaper advertisement

C5: Site notice

C6: Issues and Responses Report

APPENDIX D

Borrow Pits and Quarry Area Coordinates

Ntabelanga Borrow pits and Quarry area co-ordinates

Name	Lat : S Deg	Lat : S Min	Lat : S Sec	LatDecimal	Long : E Deg	Long : E Min	Long : E Sec	LongDecimal	Comments	Y	X
Core	31	6	45.17594	-31.11254887	28	39	36.51665	28.66014351	Core Borrow Pit 2	32419.65	3443502
Core	31	6	43.58361	-31.11210656	28	39	36.89999	28.66025000	Core Borrow Pit 2	32409.64	3443453
Core	31	6	42.1977	-31.11172158	28	39	38.19744	28.66061040	Core Borrow Pit 2	32375.39	3443410
Core	31	6	41.16563	-31.11143490	28	39	38.7577	28.66076603	Core Borrow Pit 2	32360.64	3443379
Core	31	6	42.71489	-31.11186525	28	39	42.03977	28.66167771	Core Borrow Pit 2	32273.53	3443426
Core	31	6	44.85874	-31.11246076	28	39	42.38797	28.66177444	Core Borrow Pit 2	32264.1	3443492
Core	31	6	46.9998	-31.11305550	28	39	41.66876	28.66157466	Core Borrow Pit 2	32282.96	3443558
Core	31	6	49.14692	-31.11365192	28	39	43.26231	28.66201731	Core Borrow Pit 2	32240.53	3443624
Core	31	6	50.0723	-31.11390897	28	39	45.92765	28.66275768	Core Borrow Pit 2	32169.82	3443652
Core	31	6	50.08021	-31.11391117	28	39	48.95207	28.66359780	Core Borrow Pit 2	32089.68	3443652
Core	31	6	51.76672	-31.11437964	28	39	50.01358	28.66389266	Core Borrow Pit 2	32061.39	3443704
Core	31	6	53.91242	-31.11497567	28	39	51.07348	28.66418708	Core Borrow Pit 2	32033.11	3443770
Core	31	6	55.59985	-31.11544440	28	39	52.49083	28.66458079	Core Borrow Pit 2	31995.39	3443822
Core	31	6	57.74138	-31.11603927	28	39	51.94956	28.66443043	Core Borrow Pit 2	32009.54	3443888
Core	31	6	57.75973	-31.11604437	28	39	47.83671	28.66328798	Core Borrow Pit 2	32118.51	3443889
Core	31	6	54.65308	-31.11518141	28	39	41.6416	28.66156711	Core Borrow Pit 2	32282.96	3443794
Core	31	6	51.12368	-31.11420102	28	39	38.27386	28.66063163	Core Borrow Pit 2	32372.53	3443685
Core	31	6	48.97748	-31.11360486	28	39	37.03614	28.66028782	Core Borrow Pit 2	32405.52	3443619
Shell / General Fill	31	6	33.09872	-31.10919409	28	39	52.39203	28.66455334	Fill Borrow Pit 2	32000.11	3443129
Shell / General Fill	31	6	36.00882	-31.11000245	28	39	53.09341	28.66474817	Fill Borrow Pit 2	31981.25	3443219
Shell / General Fill	31	6	38.76076	-31.11076688	28	39	51.83842	28.66439956	Fill Borrow Pit 2	32014.25	3443304
Shell / General Fill	31	6	40.45097	-31.11123638	28	39	54.32312	28.66508976	Fill Borrow Pit 2	31948.25	3443355
Shell / General Fill	31	6	43.36707	-31.11204641	28	39	57.33727	28.66592702	Fill Borrow Pit 2	31868.11	3443445
Shell / General Fill	31	6	47.32688	-31.11314636	28	39	49.6734	28.66379817	Fill Borrow Pit 2	32070.82	3443568
Shell / General Fill	31	6	47.16638	-31.11310177	28	39	46.82746	28.66300763	Fill Borrow Pit 2	32146.25	3443563
Shell / General Fill	31	6	46.7016	-31.11297267	28	39	44.69422	28.66241506	Fill Borrow Pit 2	32202.82	3443549
Shell / General Fill	31	6	45.01461	-31.11250406	28	39	43.45485	28.66207079	Fill Borrow Pit 2	32235.82	3443497
Shell / General Fill	31	6	42.86936	-31.11190816	28	39	42.57293	28.66182581	Fill Borrow Pit 2	32259.39	3443431
Shell / General Fill	31	6	41.3359	-31.11148219	28	39	41.51094	28.66153082	Fill Borrow Pit 2	32287.67	3443384
Shell / General Fill	31	6	39.19204	-31.11088668	28	39	41.16274	28.66143409	Fill Borrow Pit 2	32297.1	3443318
Shell / General Fill	31	6	34.90994	-31.10969721	28	39	42.60114	28.66183365	Fill Borrow Pit 2	32259.39	3443186
Core	31	7	28.76839	-31.12465789	28	40	6.93523	28.66859312	Core Borrow Pit 1	31609.6	3444842
Core	31	7	12.80557	-31.12022377	28	40	9.70335	28.66936204	Core Borrow Pit 1	31537.73	3444351
Core	31	7	11.56374	-31.11987882	28	40	9.87079	28.66940855	Core Borrow Pit 1	31533.41	3444312
Core	31	7	17.68262	-31.12157851	28	40	17.46168	28.67151713	Core Borrow Pit 1	31331.72	3444500
Core	31	7	30.18853	-31.12505237	28	40	16.55273	28.67126465	Core Borrow Pit 1	31354.66	3444885
Sand	31	6	19.331	-31.10536972	28	38	58.00539	28.64944594	Sand Area along river	33442.64	3442710
Sand	31	6	20.71439	-31.10575400	28	39	0.13502	28.65003751	Sand Area along river	33386.07	3442752
Sand	31	6	22.56371	-31.10626770	28	39	4.75348	28.65132041	Sand Area along river	33263.5	3442809
Sand	31	6	20.27302	-31.10563139	28	39	6.71867	28.65186630	Sand Area along river	33211.64	3442738
Sand	31	6	19.37044	-31.10538068	28	39	12.59241	28.65349789	Sand Area along river	33056.08	3442710
Sand	31	6	19.37856	-31.10538293	28	39	15.61655	28.65433793	Sand Area along river	32975.94	3442710
Sand	31	6	22.59771	-31.10627714	28	39	17.38383	28.65482884	Sand Area along river	32928.79	3442809
Sand	31	6	25.65855	-31.10712738	28	39	17.19486	28.65477635	Sand Area along river	32933.51	3442903
Sand	31	6	30.86135	-31.10857260	28	39	16.64234	28.65462287	Sand Area along river	32947.65	3443063
Sand	31	6	33.30707	-31.10925196	28	39	15.38819	28.65427450	Sand Area along river	32980.65	3443139
Sand	31	6	36.21006	-31.11005835	28	39	13.42076	28.65372799	Sand Area along river	33032.51	3443228
Sand	31	6	39.41965	-31.11094990	28	39	11.63008	28.65323058	Sand Area along river	33079.65	3443327
Sand	31	6	42.32503	-31.11175695	28	39	10.5521	28.65293114	Sand Area along river	33107.93	3443417
Sand	31	6	45.07685	-31.11252135	28	39	9.29675	28.65258243	Sand Area along river	33140.93	3443502
Sand	31	6	46.76057	-31.11298905	28	39	9.29062	28.65258073	Sand Area along river	33140.93	3443553
Sand	31	6	47.21449	-31.11311514	28	39	7.33199	28.65203666	Sand Area along river	33192.79	3443568
Sand	31	6	44.60805	-31.11239113	28	39	5.74035	28.65159454	Sand Area along river	33235.21	3443487
Sand	31	6	42.16237	-31.11171177	28	39	6.99461	28.65194295	Sand Area along river	33202.21	3443412
Sand	31	6	38.79829	-31.11077730	28	39	8.2522	28.65229228	Sand Area along river	33169.22	3443308
Sand	31	6	33.45009	-31.10929169	28	39	11.65178	28.65323661	Sand Area along river	33079.65	3443143
Sand	31	6	29.77987	-31.10827219	28	39	12.9104	28.65358622	Sand Area along river	33046.65	3443030
Sand	31	6	27.1811	-31.10755031	28	39	14.16511	28.65393475	Sand Area along river	33013.65	3442950
Sand	31	6	25.65426	-31.10712618	28	39	15.59381	28.65433161	Sand Area along river	32975.94	3442903
Sand	31	6	22.89907	-31.10636085	28	39	15.6038	28.65433439	Sand Area along river	32975.94	3442818
Sand	31	6	21.36412	-31.10593448	28	39	14.00832	28.65389120	Sand Area along river	33018.36	3442771
Sand	31	6	21.81806	-31.10606057	28	39	12.04984	28.65334718	Sand Area along river	33070.22	3442785
Sand	31	6	22.11844	-31.10614401	28	39	9.91402	28.65275389	Sand Area along river	33126.79	3442794
Sand	31	6	22.87802	-31.10635501	28	39	7.77653	28.65216015	Sand Area along river	33183.36	3442818
Sand	31	6	23.63854	-31.10656626	28	39	5.99481	28.65166523	Sand Area along river	33230.5	3442842
Sand	31	6	24.24358	-31.10673433	28	39	3.32418	28.65092338	Sand Area along river	33301.21	3442860
Sand	31	6	24.23683	-31.10673245	28	39	0.83368	28.65023158	Sand Area along river	33367.21	3442860
Sand	31	6	23.61442	-31.10655956	28	38	57.10018	28.64919449	Sand Area along river	33466.21	3442842
Sand	31	6	20.69987	-31.10574996	28	38	54.79828	28.64855508	Sand Area along river	33527.49	3442752
Shell / General Fill	31	6	15.91679	-31.10442133	28	38	40.94044	28.64470568	Fill Borrow Pit 1	33895.19	3442606
Shell / General Fill	31	6	22.99391	-31.10638720	28	38	54.07826	28.64835507	Fill Borrow Pit 1	33546.35	3442823
Shell / General Fill	31	6	26.07362	-31.10724267	28	39	0.82695	28.65022971	Fill Borrow Pit 1	33367.21	3442917
Shell / General Fill	31	6	23.94996	-31.10665277	28	39	7.95052	28.65220848	Fill Borrow Pit 1	33178.64	3442851
Shell / General Fill	31	6	32.52019	-31.10903339	28	39	7.38558	28.65205155	Fill Borrow Pit 1	33192.79	3443115
Shell / General Fill	31	6	37.25031	-31.11034731	28	39	1.85338	28.65051483	Fill Borrow Pit 1	33338.92	3443261
Shell / General Fill	31	6	37.52834	-31.11042454	28	38	51.53407	28.64764835	Fill Borrow Pit 1	33612.34	3443271
Shell / General Fill	31	6	25.54617	-31.10709616	28	38	35.92352	28.64331209	Fill Borrow Pit 1	34027.19	3442903
Rock Aggregate	31	7	12.51753	-31.12014376	28	40	23.74525	28.67326257	Rock aggregate area	31165.71	3444341
Rock Aggregate	31	7	11.59055	-31.11988626	28	40	20.36795	28.67232443	Rock aggregate area	31255.27	3444312
Rock Aggregate	31	7	2.5687	-31.11738019	28	40	23.95724	28.67332146	Rock aggregate area	31160.99	3444034
Rock Aggregate	31	7	3.65097	-31.11768083	28	40	28.22351	28.67450653	Rock aggregate area	31047.85	3444067
Rock Aggregate	31	7	9.61378	-31.11933716	28	40	25.53438	28.67375955	Rock aggregate area	31118.56	3444251
Rock Aggregate	31	7	11.75716	-31.11993254	28	40	25.70497	28.67380694	Rock aggregate area	31113.85	3444317