



CONSTRUCTION OF MTWALUME DAM, VULAMEHLO CROSS- BORDER WATER SCHEME, HARRY GWALA DISTRICT MUNICIPALITY, KWAZULU-NATAL

Environmental Impact Assessment Report

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Prepared for: Ugu District Municipality



Environmental, Social and OHS Consultants



P.O. Box 1673 147 Bram Fisher Drive Tel: 011 781 1730
Sunninghill Ferndale Fax: 011 781 1731
2157 2194 Email: info@nemai.co.za

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Prepared By:	Nemai Consulting		
	☎	+27 11 781 1730	 147 Bram Fischer Drive, FERNDALE, 2194
	☎	+27 11 781 1730	
	✉	kristyr@nemai.co.za	 PO Box 1673, SUNNINGHILL, 2157
	🌐	www.nemai.co.za	
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Authorisation	Name	Signature	Date
Author:	Kristy Robertson		20160602
Reviewed By:	Donavan Henning		20160603

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Amendments Page

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Executive Summary

PROJECT BACKGROUND AND MOTIVATION

The Ugu District Municipality (DM) owns and operates the Vulamehlo Water Treatment Plant (WTP) which supplies potable water to areas within the Vulamehlo and Umzumbe Local Municipalities in Ugu District Municipality as well as to areas within the Ubuhlebezwe Local Municipality in Harry Gwala District Municipality. The WTP is located just off the Mtwalume River in the vicinity of the boundary between Harry Gwala (DM), formerly Sisonke District Municipality and Ugu DM. The existing WTP had an original design and operating capacity of 1.5 Ml/day and has since been upgraded to treat a total of 4.5 Ml/day.

Operations and investigations indicate that the existing infrastructure is not adequate (based on coverage and capacity) to meet the demands of the project area. Thus, ZIYANDA Consulting cc (ZIYANDA) was appointed in May 2013 as the Engineers to undertake detailed design work and construction management for the augmentation of water supply to the project area through a proposed scheme, Vulamehlo Cross Border Water Scheme. The scope entails, inter alia, construction of Mtwalume Dam on the Mtwalume River, upgrading of Vulamehlo WTP, bulk infrastructure (reservoirs and pipelines) and reticulation and the extension of the infrastructure to cover the currently unserved areas including KwaMgayi and Hlokozi areas.

For the raw water impoundment and storage infrastructure, ZIYANDA has collaborated with Bosch Stemele (Pty) Ltd to undertake the engineering planning and detailed design of the works for the proposed Mtwalume Dam, which is to provide adequate raw water for the proposed Vulamehlo Cross-Border Water Scheme. Nema Consulting was appointed by ZIYANDA as the Environmental Assessment Practitioner (EAP) for the project. Only the proposed Mtwalume dam is covered in this EIA.

A significant growth in the water requirements for the system has been predicted through various previous studies, and a substantial portion of that growth can be associated with the increase of the level of service for the rural population as well as the planned extension of the system to cover additional rural areas, which are not presently supplied with water from the scheme. Initial demand forecasts were based on a per capita water consumption of 60 l/c/d. However, both the Ugu and Harry Gwala District Municipalities have indicated that future demand projections should be based on a per capita consumption of 75 l/c/d. The ability of the Mtwalume River to sustain these demands, as well as the subsequent implications regarding the raw water storage infrastructure was investigated.

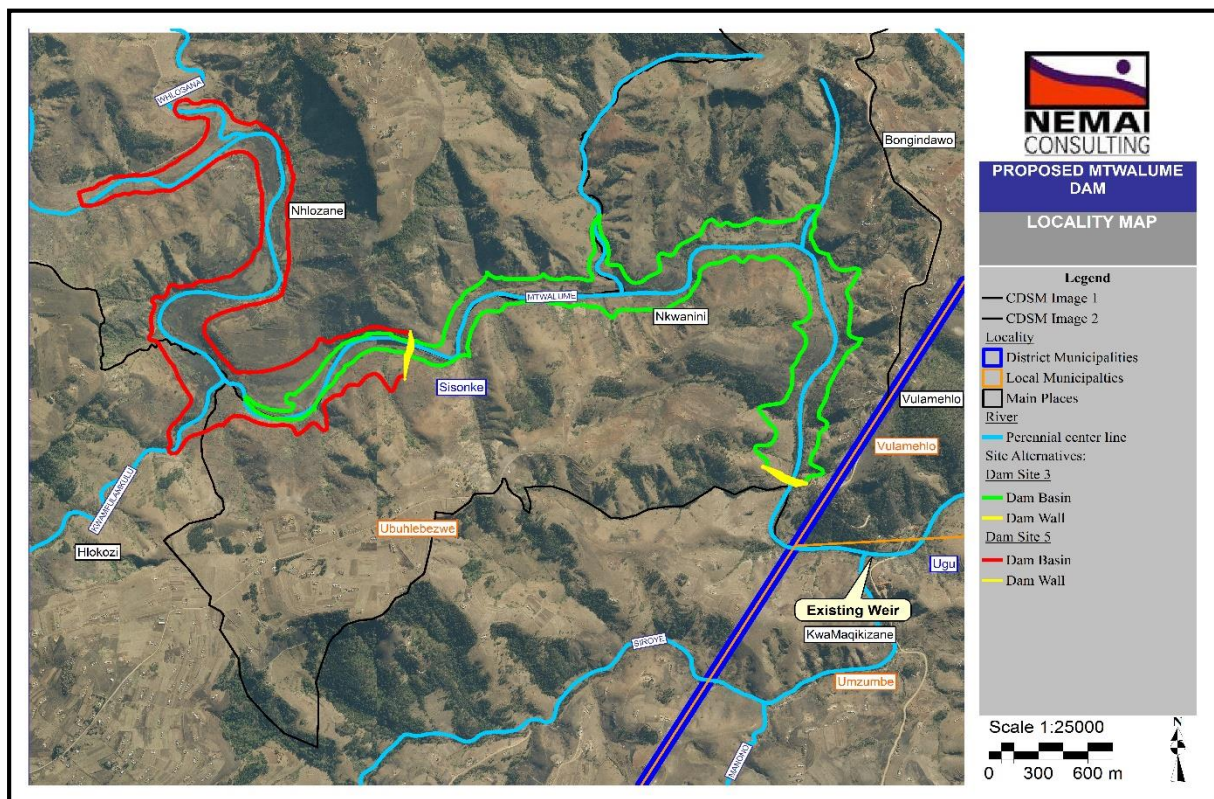
The raw water supplying the WTP is abstracted from a weir on the Mtwalume River. Hydrological assessments of the Mtwalume River conducted by Umgeni Water (2001) and

Terratest Geotechnical, Environmental and Earth Science Consultants (2011) to determine the volume of “run-of-river” streamflow available at the existing Vulamehlo Weir, indicated that in order to meet the current and future domestic water demands of the surrounding community in addition to implementing the ecological water requirements, additional in-catchment storage will be required in the form of a dam on the Mtwalume River.

PROJECT LOCATION

The proposed Mtwalume Dam will be located on the Mtwalume River in a section of the River that falls within the Harry Gwala District Municipality. The dam is located approximately 32km west of Umzinto and approximately 45km west and inland of Scottburgh on the south coast of KwaZulu-Natal.

The area is rural in nature with a number of residential / community areas on the periphery of the proposed dam sites that include schools and clinics as well as some intensive sugar cane farming and forestry. Access to the dam sites is possible via gravel roads that run off the R612 that links the coastal areas with the towns of Ixopo and Highflats.



Locality Map

PROJECT DESCRIPTION

Two Dam Site options have been assessed:

- Dam Site 3 consists of the following:

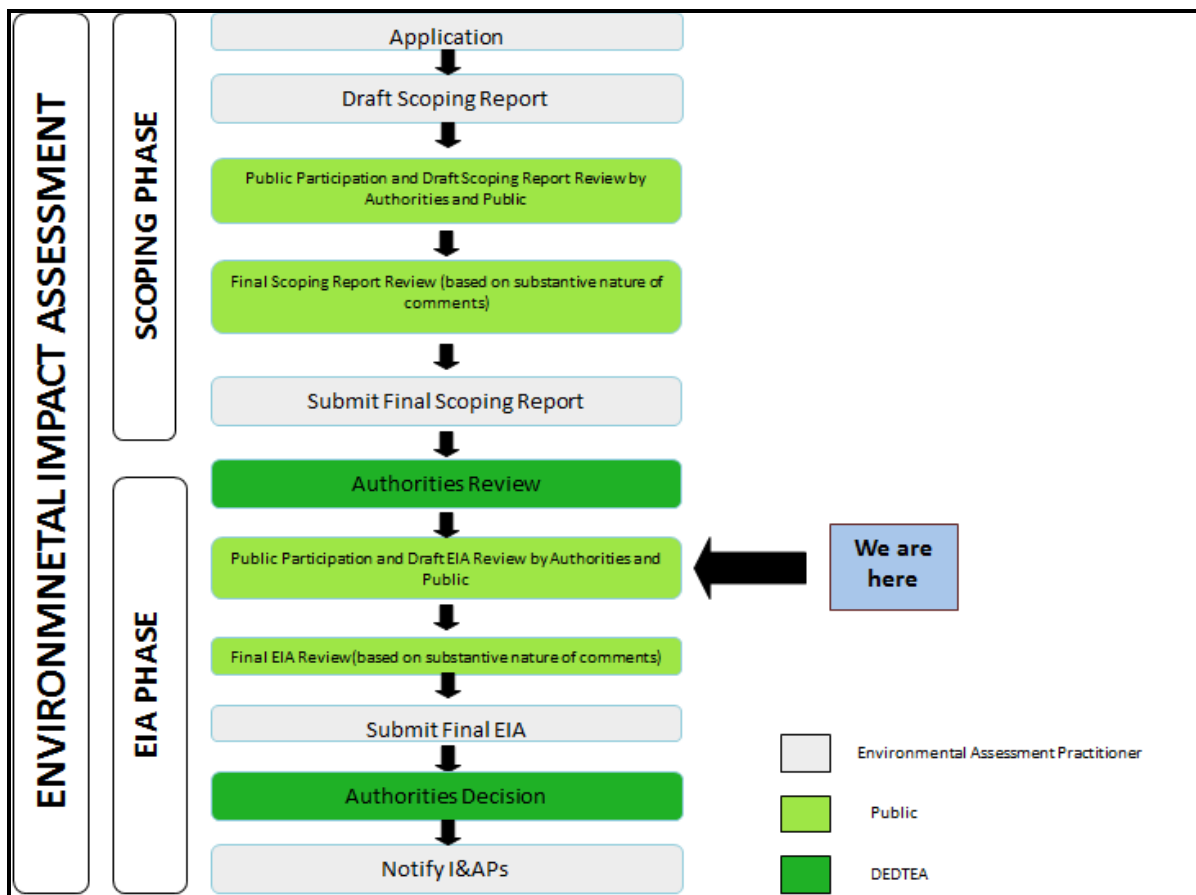
- Dam Wall: The centerline for the proposed dam wall for Dam Site 3 (30°19'26.16" S; 30°19' 25.52" E) is located approximately 1km upstream of the existing Vulamehlo Weir where the river flows through a relatively narrow valley section. The dam wall is proposed to be 40m in height. The valve chamber and intake tower as well as bridges for these structures will be constructed at the dam wall.
- Dam Basin: The dam basin is approximately 260m wide upstream of the proposed centerline. The width remains relatively constant up to the bend in the river where it decreases in width to 230m some 650m upstream of the bend before reducing gradually to the head waters roughly 4300m upstream of the centerline. The total area to be inundated is approximately 117 ha.
- Associated infrastructure: The following structures are to be constructed for temporary use during construction, except for structures where specified, and all structures occur within the proposed construction footprint for the associated infrastructure:
 - Potable Water Pipeline (will be permanent);
 - Concrete Access Road (will be permanent);
 - Water Storage Tank;
 - Mixing & Concrete Batching Plant for Storage of Concrete Materials;
 - Site Camp; and
 - Site Office.
- Dam Site 5 consists of the following:
 - Dam Wall: The centerline for the proposed dam wall for Dam Site 5 (30°19'00.16" S; 30°18'00.89" E) is located approximately 5.1km upstream of the existing Vulamehlo Weir where the river flows through a relatively narrow valley section. The dam wall is proposed to be 35m in height. The valve chamber and intake tower as well as bridges for these structures will be constructed at the dam wall.
 - Dam Basin: The total area to be inundated is approximately 114 ha.
 - Associated Infrastructure: The following structures are to be constructed for temporary use during construction, except for structures where specified, and all structures occur within the proposed construction footprint for the associated infrastructure:
 - Gravel Road (will be permanent);
 - Potable Water Pipeline (will be permanent);
 - Culvert River Crossing (will be permanent);
 - Concrete Access Road (will be permanent);
 - Water Storage Tank;
 - Mixing & Concrete Batching Plant for Storage of Concrete Materials;

- Site Camp; and
- Site Office.

SCOPING AND EIA PROCESS

The proposed Mtwalume Dam entails certain activities that require authorisation in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998). The process for seeking authorisation is undertaken in accordance with the EIA Regulations (GN No. R. 543, R. 544, R. 545 and R. 546 of 18 June 2010), promulgated in terms of Chapter 5 of NEMA. Subsequently, the 2010 EIA Regulations were amended in 2014; however, the Mtwalume Dam Application is in line with the 2010 EIA Regulations. Based on the types of activities involved which include activities listed in GN No. R. 544 and R. 545 of 18 June 2010; the requisite environmental assessment for the project is a Scoping and EIA process.

In terms of the Regulations, the lead decision-making authority for the environmental assessment is the KwaZulu-Natal Department of Economic Development, Tourism & Environmental Affairs as the project proponent is the Ugu District Municipality. Nema Consulting was appointed by Ugu District Municipality as the independent EAP to undertake the Environmental Authorisation for the proposed construction of the Mtwalume Dam.



Scoping and EIA Process

ALTERNATIVES

Two Dam Sites have been considered as alternatives for the Mtwalume Dam project.

The proposed co-ordinates of the centre of the dam walls are as follows:

Site 3	Site 5
30° 19'26.16" S; 30° 19' 25.52" E	30° 19'00.16" S; 30° 18'00.89" E

PROFILE OF THE RECEIVING ENVIRONMENT

The EIA Report provides a general description of the status quo of the receiving environment in the project area, and also provides local and site-specific discussions on those environmental features investigated by the respective specialists. This allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed project.

The study area includes the entire footprint of all the project components, which includes the construction domain and surrounding receiving environment.

The receiving environment is assessed and discussed in terms of the following:

1. Climate
2. Geology
3. Geohydrology
4. Topography
5. Surface Water
6. Flora
7. Fauna
8. Land Capability
9. Land Use
10. Heritage
11. Air Quality
12. Noise
13. Planning
14. Infrastructure
15. Availability of Services
16. Access Roads
17. Waste Management
18. Visual Aesthetics
19. Socio-Economic Environment

SPECIALIST STUDIES

The requisite Specialist Studies 'triggered' by the findings of the Scoping process, aimed at addressing the key issues and compliance with legal obligations, include:

1. Terrestrial Ecological Impact Assessment;
2. Wetland Delineation and Aquatic Impact Assessment;
3. Estuarine Specialist Opinion;
4. Phase 1 Heritage Impact Assessment; and
5. Socio-Economic Impact Assessment.

The information obtained from the respective Specialist Studies was incorporated into the EIA report in the following manner:

1. The assumptions and limitations identified in each study were noted;
2. The information was used to complete the description of the receiving environment in a more detailed and site-specific manner;
3. A summary of each specialist study, focusing on the approach to the study, key findings and conclusions drawn;
4. The Specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment;
5. The evaluations performed by the specialists on the alternatives of the project components were included in the comparative analysis to identify the most favourable option;
6. Specialist input was obtained to address comments made by IAPs that related to specific environmental features pertaining to each specialist discipline; and
7. Salient recommendations made by the specialists were taken forward to the EIA Conclusions and Recommendations.

IMPACT ASSESSMENT

This EIA Report focuses on the pertinent environmental impacts that could potentially be caused by the proposed Mtwalume Dam during the pre-construction, construction and operational phases of the project.

Impacts were identified as follows:

- Impacts associated with listed activities contained in GN No. R. 544, R. 545 and R. 546 of 10 June 2010, for which authorisation has been applied for;
- An appraisal of the project activities and components;
- Issues highlighted by environmental authorities;
- Comments received during public participation;
- An assessment of the receiving biophysical, social, economic and technical environment; and
- Findings from Specialist Studies.

The impacts and the proposed management measures are discussed on a qualitative level and thereafter quantitatively assessed by evaluating the nature, extent, magnitude, duration, probability and ultimately the significance of the impacts. The assessment considered impacts

before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

The proposed mitigation of the impacts associated with the project includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices. The Environmental Management Programme provides a comprehensive list of mitigation measures for specific elements of the project, which extends beyond the impacts evaluated in the body of the EIA Report.

Cumulative impacts are discussed in terms of traffic, protected and endangered fauna and flora species, invasive and alien plant species, and soil erosion cumulative impacts related to the Mtwalume Dam.

ANALYSIS OF ALTERNATIVES

The EIA Report provides an appraisal of all the environmental and technical considerations associated with the various alternatives through a comparative analysis to eventually distil the Best Practicable Environmental Option.

In terms of yield, Dam Site 5 is preferred from a technical perspective. The majority of the Specialist Studies preferred Dam Site 3, with the exception of the Socio-Economic Study. However, the difference in selection of either Dam Site 3 or 5 must be assessed to determine how big of an impact the selection of a certain site will have on each environmental feature. The level of impact between Dam Site 3 and Dam Site 5 was scored for each environmental feature, taking into account the receiving environment, Specialist Studies and the outcome of the impact assessment. It was found that the overall impacts would be greater if Dam Site 3 was selected.

PUBLIC PARTICIPATION

The EIA Report provides a full account of the public participation process that was followed for the EIA phase for the proposed project.

The public review of the Draft EIA Report will occur for a 30-Day review period from 14 June 2016 to 14 July 2016. The authority review of the Draft EIA Report will take place from 14 June 2016 to 25 July 2016 (40-Day review). The Public Meeting is scheduled to take place on 14 July 2016.

Registered IAPs and authorities will be granted an opportunity to review and comment on the Final EIA Report. A link on Dropbox containing the electronic Final EIA Report will be sent to authorities and registered IAPs only. Any further comments from registered IAPs will be forwarded to the Competent Authority.

All authorities and registered IAPs will be notified via email or SMS after having received written notice from DEDTEA on the final decision for the project. Advertisements will also be

placed as notification of the Department's decision. These notifications will include the appeal procedure to the decision and key reasons for the decision. A copy of the decision will also be provided to IAPs on request.

EIA CONCLUSIONS AND RECOMMENDATIONS

Attention is drawn to specific sensitive environmental features (with an accompanying sensitivity map) for which mitigation measures are included in the EIA Report and EMPr.

An Environmental Impact Statement is provided and critical environmental activities that need to be executed during the project life-cycle are also presented.

With the selection of the BPEO, the adoption of the mitigation measures include in the EIA Report and the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

The EIA Report is concluded with key recommendations, which may also influence the conditions of the Environmental Authorisation (where relevant).

Table of Contents

1	DOCUMENT ROADMAP	1
2	PURPOSE OF THIS DOCUMENT	11
3	ENVIRONMENTAL ASSESSMENT PRACTITIONER	13
4	PROJECT BACKGROUND AND MOTIVATION	14
4.1	Introduction	14
4.2	Overview of the Vulamehlo Cross Border Water Scheme	17
4.3	Water Requirements	18
5	PROJECT LOCATION	20
5.1	Regional and Local Context	20
5.2	Property Description	22
5.3	Location of Proposed Activities	23
6	PROJECT DESCRIPTION	24
6.1	Project Components	24
6.1.1	Dam Site Options	24
6.1.1.1	Dam Site 3	24
6.1.1.2	Dam Site 5	25
6.1.2	Associated Infrastructure	28
6.1.2.1	Dam Site 3	28
6.1.2.2	Dam Site 5	28
6.1.3	Spillway	28
6.1.4	Multi-Level Draw-Off Outlet Works	29
6.1.4.1	Outlet Pipes	29
6.1.4.2	Outlet Control	29
6.2	Dam Construction Materials	29
6.3	Project Life-Cycle	30
6.3.1	Feasibility Studies	30
6.3.2	Pre-Construction	30
6.3.3	Construction	31
6.3.4	Operation	32

6.3.5	Decommissioning	32
7	LEGISLATION AND GUIDELINES CONSIDERED	33
7.1	Overview of Legislation	33
7.1.1	Constitution of the Republic of South Africa (Act No. 108 of 1996)	35
7.1.2	National Environmental Management Act (Act No. 107 of 1998)	35
7.1.3	EIA Regulations (04 December 2014)	35
7.1.4	National Water Act (Act No. 36 of 1998)	37
7.1.4.1	Section 21 (a)	38
7.1.4.2	Section 21 (b)	39
7.1.4.3	Section 21 (c)	39
7.1.4.4	Section 21 (i)	39
7.1.5	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	40
7.1.6	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	40
7.1.7	National Environmental Management: Air Quality Act (Act No. 39 of 2004)	40
7.1.8	The National Environmental Management Waste Act (Act No. 59 of 2008)	41
7.1.9	Health Act (Act No. 63 of 1977)	42
7.1.10	Occupational Health & Safety Act (Act No. 85 of 1993)	42
7.1.11	National Heritage Resources Act (Act No. 25 of 1999)	42
7.1.12	Conservation of Agricultural Resources Act (Act No. 43 of 1983)	43
7.1.13	National Forests Act (Act No. 84 of 1998)	43
7.1.14	Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	43
7.1.15	Spatial Planning and Land Use Management Act (Act No. 16 of 2013)	44
7.1.16	Kwazulu-Natal Planning and Development Act (Act No. 06 of 2008)	44
7.1.17	KwaZulu-Natal Nature Conservation Management Act (Act No. 09 of 1997)	44
7.2	Guidelines	44
7.3	Regional Plans	45
8	SCOPING AND EIA PROCESS	46
8.1	EIA Listed Activities (18 June 2010)	46
8.2	Competent Authority	46
8.3	Application Form	46
8.4	Formal Process	46
8.5	Scoping Phase	47

8.6	EIA Phase	48
8.6.1	Alignment with the Plan of Study _____	49
8.6.2	Screening of Alternatives _____	50
8.6.3	Impact Prediction _____	50
9	ASSUMPTIONS AND LIMITATIONS _____	52
10	NEED AND DESIRABILITY _____	54
11	ALTERNATIVES _____	57
11.1	Screening of Alternatives	57
11.1.1	Geotechnical Assessment Findings _____	59
11.1.2	Environmental Screening Findings _____	59
11.2	Dam Site Alternatives	61
11.2.1	Dam Site 3 _____	61
11.2.2	Dam Site 5 _____	62
11.3	No-go alternative	63
12	PROFILE OF THE RECEIVING ENVIRONMENT _____	67
12.1	Climate	68
12.1.1	Temperature _____	68
12.1.2	Wind _____	68
12.2	Geology	69
12.2.1	Geological Overview _____	69
12.2.2	Subsoil conditions Dam Site 3 _____	69
12.2.3	Subsoil conditions Dam Site 5 _____	70
12.2.4	Geological Challenges for Dam Site 3 _____	71
12.2.5	Geological Challenges for Dam Site 5 _____	71
12.3	Geohydrology	71
12.4	Topography	71
12.5	Surface Water	73
12.5.1	Hydrology _____	73
12.5.2	Affected Watercourses _____	76
12.5.3	Ecological Status _____	77
12.5.4	Riparian Habitat _____	78
12.5.5	Wetlands _____	78
12.5.6	Aquatic Biota _____	78

12.5.7	Estuary	79
12.5.8	Water Quality	79
12.5.9	Water Users	80
12.6	Flora	81
12.6.1	Biome and Vegetation	81
12.6.2	Terrestrial Threatened Ecosystems	83
12.6.3	KZN Provincial Biodiversity Plan	84
12.6.4	Plant Species of Conservation Concern	85
12.7	Fauna	86
12.7.1	Mammals	86
12.7.2	Reptiles	88
12.7.3	Amphibians	91
12.7.4	Avifauna	91
12.8	Land Capability	93
12.9	Land Use	94
12.10	Heritage	95
12.11	Air Quality	95
12.12	Noise	96
12.13	Planning	96
12.14	Infrastructure	96
12.15	Availability of Services	96
12.16	Access Roads	97
12.17	Waste Management	97
12.18	Visual Aesthetics	98
12.19	Socio-Economic Environment	98
12.19.1	Population	99
12.19.2	Education and Employment	100
12.19.3	Poverty	102
13	SUMMARY OF SPECIALIST STUDIES	104
13.1	Specialist Studies undertaken as part of the EIA	104
13.2	Terrestrial Ecological Impact Assessment	105
13.3	Wetland and Aquatic Impact Assessment	108
13.4	Estuarine Specialist Opinion	113
13.5	Phase 1 Heritage Impact Assessment	115

13.6	Socio-Economic Impact Assessment	116
14	IMPACT ASSESSMENT	119
14.1	Overview	119
14.1.1	Impacts Associated with Listed Activities	119
14.1.2	Environmental Activities	123
14.1.2.1	Project Phase: Pre-construction	123
14.1.2.2	Project Phase: Construction	124
14.1.2.3	Project Phase: Operation	125
14.1.3	Environmental Aspects	125
14.1.4	Issues raised by Environmental Authorities and IAPs	127
14.1.5	Potential Significant Environmental Impacts	127
14.1.6	Impact Assessment Methodology	131
14.1.7	Impact Mitigation	133
14.1.7.1	Mitigation Hierarchy	133
14.1.7.2	EMPr	134
14.2	Climate	135
14.2.1	Potential Impacts	135
14.2.2	Impact Assessment	136
14.3	Geology and Soil	136
14.3.1	Potential Impacts	136
14.3.2	Impact Assessment	137
14.4	Geohydrology	138
14.4.1	Potential Impacts	138
14.4.2	Impact Assessment	138
14.5	Surface Water	139
14.5.1	Hydrology	139
14.5.1.1	Potential Impacts	139
14.5.1.2	Impact Assessment	140
14.5.2	Riparian Habitat	141
14.5.2.1	Potential Impacts	141
14.5.2.2	Impact Assessment	141
14.5.3	Aquatic Biota	142
14.5.3.1	Potential Impacts	142
14.5.3.2	Impact Assessment	142

14.5.4	Estuary	143
14.5.4.1	Potential Impacts	143
14.5.5	Water Quality	144
14.5.5.1	Potential Impacts	144
14.5.5.2	Impact Assessment	145
14.5.6	Water Users	145
14.5.6.1	Potential Impacts	145
14.5.6.2	Impact Assessment	146
14.6	Terrestrial Ecology - Flora	146
14.6.1	Potential Impacts	146
14.6.2	Impact Assessment	148
14.7	Terrestrial Ecology - Fauna	149
14.7.1	Potential Impacts	149
14.7.2	Impact Assessment	150
14.8	Land Capability	150
14.8.1	Potential Impacts	150
14.8.2	Impact Assessment	151
14.9	Land Use	151
14.9.1	Potential Impacts	151
14.9.2	Impact Assessment	152
14.10	Heritage Resources	152
14.10.1	Potential Impacts	152
14.10.2	Impact Assessment	153
14.11	Air Quality	156
14.11.1	Potential Impacts	156
14.11.2	Impact Assessment	156
14.12	Noise	157
14.12.1	Potential Impacts	157
14.12.2	Impact Assessment	157
14.13	Access Roads	158
14.13.1	Potential Impacts	158
14.13.2	Impact Assessment	158
14.14	Waste Management	159
14.14.1	Potential Impacts	159
14.14.2	Impact Assessment	159

14.15	Visual Aesthetics	160
14.15.1	Potential Impacts	160
14.15.2	Impact Assessment	160
14.16	Socio-Economic Environment	161
14.16.1	Potential Impacts	161
14.16.2	Impact Assessment	162
14.17	No-Go Impacts	165
14.17.1	Catchment Water Requirements	165
14.17.2	Population	165
14.17.3	Water Requirements from the Proposed Dam	165
14.18	Cumulative Impacts	166
15	ANALYSIS OF ALTERNATIVES	168
15.1	“No-Go” Option	168
15.2	Specialist Studies	168
15.3	Technical Preference	169
15.4	Comparative Impacts of Alternatives	170
15.5	BPEO Selection	173
16	PUBLIC PARTICIPATION	174
16.1	Public Participation during the Scoping Phase	174
16.2	Public Participation during the EIA Phase	175
16.2.1	Maintenance of the IAP Database	175
16.2.2	Notification – Approval of Scoping Report and Notification of Public Review of Draft EIA Report	175
16.2.3	Public Review Period of Draft EIA Report	175
16.2.4	Authority Review Period of Draft EIA Report	176
16.2.5	Meetings	176
16.2.5.1	Public Meeting	176
16.2.5.2	Authority Meeting	176
16.2.6	Comments and Responses	176
16.2.7	Review of the Final EIA Report	177
16.2.8	Notification of KZN DEDTEA Decision	177
17	EIA CONCLUSIONS AND RECOMMENDATIONS	178
17.1	Sensitive Environmental Features	178
17.2	Environmental Impact Statement	179

17.3	Recommendations	181
18	OATH OF THE EAP AND DECLARATION OF INDEPENDENCE	187
19	REFERENCES	188

List of Tables

Table 1: Document Roadmap	1
Table 2: Scoping and EIA Core Team Members	13
Table 3: Proposed bulk infrastructure	17
Table 4: Vulamehlo Cross-Border Water Scheme Projections	18
Table 5: Dam Site 3 – Attribute Summary Table	25
Table 6: Dam Site 5 – Attribute Summary Table	25
Table 7: Environmental Legislative Framework	33
Table 8: EIA Listed Activities for the Mtwalume Dam	36
Table 9: Alignment of EIA Report with Plan of Study	49
Table 10: Need and Desirability of the Mtwalume Dam	54
Table 11: Geotechnical assessment of the six potential dam sites	59
Table 12: Comparative extent of inundation and loss of biodiversity	60
Table 13: Hydrological Catchment Data	75
Table 14: Class B EWR Estimate for U80E	78
Table 15: Definitions of Red Data plant status (Raimondo et al. 1999)	86
Table 16: Red Data Plant species recorded in grid cell 3030AB, 3030AD, and 3030BC which could potentially occur in the study area (SANBI data).	86
Table 17: Mammal species recorded in grid cell 3030AB, 3030AD, and 3030BC which could occur in the study area.	87
Table 18: Reptile species recorded in grid cells 3030AB, 3030AD, and 3030BC which could occur in the study area.	88
Table 19: Amphibian species recorded in grid cells 3030AB, 3030AD, and 3030BC which could occur in the study area.	91
Table 20: Water Services (HG DM IDP)	97
Table 21: Sanitation Services (HG DM IDP)	97
Table 22: Details of the Ecological Specialist	105
Table 23: Details of the Aquatic/Wetland Specialist	109
Table 24: Details of the Estuarine Specialist	113
Table 25: Details of the Heritage Specialist	115
Table 26: Details of the Socio-Economic Specialist	117
Table 27: Impacts associated with the Listed Activities	120

Table 28: Activities associated with Pre-construction Phase	123
Table 29: Activities associated with Construction Phase	124
Table 30: Activities associated with Operation Phase	125
Table 31: Environmental Aspects associated with Project Life-Cycle	125
Table 32: Potential Significant Environmental Impacts during Construction Phase	128
Table 33: Potential Significant Environmental Impacts during Operation Phase	129
Table 34: Impact Methodology Table	131
Table 35: Ranking of Overall Impact Score for Impact Assessment	133
Table 36: Summary of Specialists' Preferred Options	168
Table 37: Summary of Technical Team Preferred Options	169
Table 38: Ranking Scores of Level of Impact between Alternatives	170
Table 39: Comparative Impacts	171
Table 40: Locations of Draft EIA Report for Review	175
Table 41: EIA Public Meeting	176

List of Figures

Figure 1: Proposed Site Locations in relation to the south coast of KZN (Google Earth)	15
Figure 2: Residential / Community areas near the proposed dam sites (Google Earth)	15
Figure 3: Locality Map (1:25 000) of the Proposed Development	16
Figure 4: Regional Map	21
Figure 5: Topographical Map	21
Figure 6: Parent Farms	22
Figure 7: Cadastral Map	23
Figure 8: Mtwalume Dam Site 3	26
Figure 9: Mtwalume Dam Site 5	27
Figure 10: Scoping and EIA Process	47
Figure 11: Potential Dam Sites	58
Figure 12: Layout Option Dam Site 3	64
Figure 13: Layout Option Dam Site 3 (Zoomed in on Construction Laydown Area)	65
Figure 14: Layout Option Dam Site 5	66
Figure 15: Monthly average maximum, minimum and mean temperatures (°C) and monthly rainfall (mm) at Port Shepstone (top) and Paddock (bottom)	68
Figure 16: Annual windroses at Sezela (left) and Paddock (right)	69
Figure 17: Photograph of the terrain morphology at the project site	72
Figure 18: Contour Map	73
Figure 19: Upstream view of the Mtwalume River	74
Figure 20: WMA and Quaternary Catchment	74
Figure 21: Daily Average Flow U8H004 (2000 – 2012)	75

Figure 22: 95% Assurance Yields – Dam Site 3	76
Figure 23: 95% Assurance Yields – Dam Site 5	76
Figure 24: Watercourses affected by the proposed Mtwalume Dam.....	77
Figure 25: Mtwalume Estuary.....	79
Figure 26: Biome.....	82
Figure 27: Vegetation Type	82
Figure 28: Photograph showing the hilly landscapes of the site	83
Figure 29: Threatened Ecosystems.....	84
Figure 30: CBA Areas located on the proposed dam sites	85
Figure 31: Nearest IBA is the KwaZulu-Natal Mistbelt Grassland IBA	92
Figure 32: Agricultural potential of project area	93
Figure 33: Cattle grazing at the project area	94
Figure 34: View of the project area.....	98
Figure 35: Location of Harry Gwala (formerly Sisonke) DM.....	99
Figure 36: Percentage distribution of population in five-year age group by sex, Census 2011	100
Figure 37: Percentage of population 20 years and older with no education.....	100
Figure 38: Unemployment in Harry Gwala DM	101
Figure 39: Share of Gross Value Added by industry.....	102
Figure 40: Monthly income level amongst the population	103
Figure 41: The two ichthyofauna, aquatic invertebrate and riparian vegetation sampling points, above and below the proposed dam sites – Mtwalume 1 and Mtwalume 2.	110
Figure 42: Mitigation Hierarchy	133
Figure 43: Layout Diagram for BPEO for Mtwalume Dam	173
Figure 44: Sensitivity Map for Mtwalume Dam	179

List of Appendices

Appendix A: KZN DEDTEA Approval of Final Scoping Report

Appendix B: Curricula Vitae and Declaration of EAP

Appendix C: Maps

Appendix D: Technical Drawings

Appendix E: Bird Species List

Appendix F: Specialist Reports

Appendix F1: Terrestrial Ecological Impact Assessment

Appendix F2: Wetland and Aquatic Impact Assessment

Appendix F3: Estuarine Specialist Opinion

Appendix F4: Heritage Impact Assessment

Appendix F5: Socio-Economic Impact Assessment

Appendix G: Environmental Management Programme (EMPr)

Appendix H: Interested and Affected Party (IAP) Database

Appendix I: Proof of Notification – EIA Phase

Appendix J: Reply Forms and Comments – EIA Phase

Appendix K: Comments and Responses Report

Appendix L: Amended Application Form

Appendix M: Geotechnical Study

Appendix N: Integrated Water Use License Application (IWULA)

List of Abbreviations

AGIS	Agricultural Geo-Referenced Information System
BID	Background Information Document
BPEO	Best Practicable Environmental Option
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
COGTA	Department of Cooperative Governance and Traditional Affairs
DAFF	Department of Agriculture, Forestry and Fisheries
DEDTEA	KwaZulu-Natal Department of Economic Development, Tourism & Environmental Affairs
DM	District Municipality
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EWR	Ecological Water Requirements
GIS	Geographic Information System
GN	Government Notice
GVA	Gross Value Added
ha	Hectare
HIA	Heritage Impact Assessment
IAP	Interested and Affected Party
IBA	Important Bird and Biodiversity Area
IDP	Integrated Development Plan
IWULA	Integrated Water Use License Application
km	Kilometre
KZN	KwaZulu-Natal
KZNPDA	KwaZulu-Natal Planning and Development Act
ℓ/c/d	Litre per capital per day
ℓ/s	Litre per second
LM	Local Municipality
m ³	Cubic metre
m/s	Metres per second
Mℓ	Mega Litre

Mℓ/d	Mega Litre per day
mm	Millimetre
msl	Mean Sea Level
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
NEMA	National Environmental Management Act
NEM:AQA	National Environmental Management: Air Quality Act
NEM:BA	National Environmental Management: Biodiversity Act
NEM:WA	National Environmental Management: Waste Act
NGO	Non-Government Organisation
NWA	National Water Act
OHS	Occupational Health and Safety
PES	Present Ecological State
QDS	Quarter Degree Square
RCC	Roller Compacted Concrete
REC	Recommended Ecological Category
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SEF	Safety Evaluation Flood
ToR	Terms of Reference
WMA	Water Management Area
WSP	Water Service Provider
WTP	Water Treatment Plant

Definitions of Key Terms

Term	Definition
Alternatives	<p>In terms of the 2014 EIA Regulations, alternatives refer to the different means of meeting the general purpose and requirements of the activity, which may include alternatives to:</p> <ul style="list-style-type: none"> a) property or location where the activity is proposed to be undertaken; b) type of activity to be undertaken; c) design or layout of the activity; d) technology to be used in the activity; or e) operational aspects of the activity; <p>And includes the option of not implementing the activity.</p>
Application	<p>In terms of the 2014 EIA Regulations (GN No. R. 982), this is defined as an Application for:</p> <ul style="list-style-type: none"> a) environmental authorisation in terms of Chapter 4 b) amendment to an environmental authorisation in terms of Chapter 5 c) amendment to an EMPr in terms of Chapter 5 d) amendment of a closure plan in terms of Chapter 5
Biodiversity	<p>The variety of life forms, including the plants, animals and micro-organisms, the genes they contain and the ecosystems and ecological processes of which they are a part.</p>
Cumulative Impact	<p>In relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.</p>
Development	<p>The building, erection, construction or establishment of a facility, structure or infrastructure, including associated earthworks or borrow pits, that is necessary for the undertaking of a listed or specified activity, including any associated post development monitoring, but excludes any modification, alteration or expansion of such a facility, structure or infrastructure, including associated earthworks or borrow pits, and excluding the redevelopment of the same facility in the same location, with the same capacity and footprint.</p>
Disposal (waste)	<p>Burial, deposit, discharge, abandoning dumping, placing or release of any waste into, or onto, any land.</p>
Endangered	<p>A taxon is regarded as endangered when it faces a high risk of extinction in the wild. This is defined as a 20% probability of extinction within 20 years.</p>

Term	Definition
Environment	The biophysical, social, economic, cultural, political and historical context within which people live and within which development takes place.
Environmental Impact	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation's activities or may be indirectly caused by them.
Environmental Impact Assessment	A systematic process of identifying, assessing and reporting environmental impacts associated with an activity.
Environmental Issue	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
Environmental Management Programme	A detailed plan of action prepared to ensure that recommendations for enhancing positive impacts and/or limiting or preventing negative environmental impacts are implemented during the life-cycle of a project.
Gross Value Added	Gross Value Added is a measure of output (total production) which measures the total output of a region by considering the value that was created within that region.
Groundwater	Sub-surface water in the zone in which permeable rocks, and often the overlying soil, are saturated.
Habitat	The place where a population (e.g. animal, plant, micro-organism) lives and its surroundings, both living and non-living.
Heritage Resource	Any place or object of cultural significance including buildings, structures, landscapes, graves and geological, archaeological and palaeontological sites.
Independent	<p>relation to an EAP, a specialist or the person responsible for the preparation of an environmental audit report, means:</p> <ul style="list-style-type: none"> a) that such EAP, specialist or person has no business, financial, personal or other interest in the activity or application in respect of which that EAP, specialist or person is appointed in terms of these Regulations; or b) that there are no circumstances that may compromise the objectivity of that EAP, specialist or person in performing such work. <p>Excluding:</p> <ul style="list-style-type: none"> i. normal remuneration for a specialist permanently employed by the EAP; or ii. fair remuneration for work performed in connection with that activity, application or environmental audit;
Interested and Affected Party	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
Mitigation	To anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

Term	Definition
Pollution	Any change in the environment caused by substances, radioactive or other waves, or noise, odours, dust or heat, emitted from any activity where there is an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future. Furthermore, pollution can also be regarded as an undesirable state of the natural environment being contaminated with harmful substances as a consequence of human activities.
Population	Population is defined as the total number of individuals of the species or taxon.
Registered Interested and Affected Party	In relation to an application, means an interested and affected party whose name is recorded in the register opened for that application in terms of regulation 42 of the 2014 EIA Regulations.
Riparian Habitat	The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.
Scoping	This refers to the process of determining the spatial and temporal boundaries (the extent) for the EIA and key issues to be addressed in an environmental assessment.
Significant Impact	An impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.
Specialist	A person that is generally recognised within the scientific community as having the capability of undertaking, in conformance with generally recognised scientific principles, specialist studies or preparing specialist reports, including due diligence studies and socio-economic studies.
Species	A group of organisms that resemble each other to a greater degree than members of other groups and that form a reproductively isolated group that will not produce viable offspring if bred with members of another group.
Storage (waste)	The accumulation of waste in a manner that does not constitute treatment or disposal of that waste.
Taxon (Taxa):	Any group of organisms considered to be sufficiently distinct from other such groups to be treated as a separate unit.
Throughput Capacity	The design capacity or maximum capable capacity of a facility, structures or infrastructure, whichever is the greater.
Treatment	Any method, technique or process that is designed to- a) change the physical, biological or chemical character or composition of a waste;

Term	Definition
	<ul style="list-style-type: none"> b) remove, separate, concentrate or recover a hazardous or toxic component of a waste; or c) destroy or reduce the toxicity of a waste. <p>In order to minimise the impact of the waste on the environment prior to further use or disposal.</p>
Urban Edge	<p>Areas situated within the urban edge (as defined or adopted by the competent authority), or in instances where no urban edge or boundary has been defined or adopted, it refers to areas situated within the edge of built-up areas.</p>
Vulnerable	<p>A taxon is vulnerable when it is facing a medium risk of extinction in the wild in the medium-term future, defined as a 10% probability of extinction within 100 years.</p>
Waste	<p>Any substance, whether or not that substance can be reduced, re-used recycled and recovered –</p> <ul style="list-style-type: none"> a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of; b) which the generator has no further use of for the purposes of production; c) that must be treated or disposed of; d) that is identified as a waste by the Minister by notice in the Gazette <p>and includes waste generated by the mining, medical, and other sector, but-</p> <ul style="list-style-type: none"> i) a by-product is not considered waste; ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste.
Watercourse	<p>The National Water Act defines a watercourse as:</p> <ul style="list-style-type: none"> a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) a wetland, pan, lake or dam into which, or from which, water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998); and <p>a reference to a watercourse includes, where relevant, its bed and banks;</p>
Wetland	<p>Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.</p>

1 DOCUMENT ROADMAP

This document serves as the Draft Environmental Impact Assessment (EIA) Report for the proposed Mtwalume Dam, in the KwaZulu-Natal (KZN) Province. The Application for Environmental Authorisation for the Proposed Mtwalume Dam falls under the previous EIA Regulations: Government Notice (GN) No. R. 543 of 18 June 2010 as it was submitted prior to the gazetting of the current EIA Regulations: GN No. R. 982 of 04 December 2014. As this is a transitional period (being that the application was submitted in terms of the 2010 EIA Regulations but the 2014 EIA Regulations are now gazetted), the requirements of both the 2010 and 2014 EIA Regulations will be adhered to as far as possible.

In order to provide clarity to the reader, a document roadmap is provided below. The document roadmap provides information on both the 2010 EIA and 2014 EIA Regulations requirements as well as a guide on the content of each chapter. Please note that in some cases more information is provided than required in the EIA regulations in which case there will be no correlating section to either the 2010 or 2014 EIA Regulations.

Table 1: Document Roadmap

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
1.	Document Roadmap	-	-	-	-
2.	Purpose of this Document	-	-	-	-
3.	Environmental Assessment Practitioner	31(2)(a)	Details of – i) the EAP who compiled the report; and ii) the expertise of the EAP to carry out an environmental impact assessment.	3 (a)	Details of – i) the EAP who prepared the report; and ii) the expertise of the EAP, including a curriculum vitae.
4.	Project Background and Motivation	31(2)(f)	A description of the need and desirability of the proposed activity.	3 (f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
5.	Project Location	31(2)(c)	A description of the property on which the activity is to be undertaken and the location of the activity on the property.	3 (b)	The location of the activity including – i) The 21 digit Surveyor General code of each cadastral land parcel; ii) Where available, the physical address and farm name; and iii) Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property or properties.
				3 (c)	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or if it is – i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is undertaken; and ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken.
6.	Project Description	31(2)(b)	A detailed description of the proposed activity.	3 (d)	A description of the scope of the proposed activity, including – i) All listed and specified activities triggered and being applied for; and ii) A description of the associated structures and infrastructure related to the development.

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
				3 (g)	A motivation for the preferred development footprint within the approved site.
				3 (t)	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.
7.	Legislation and Guidelines Considered	-	-	3 (e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.
8.	Scoping and EIA Process	-	-	-	An indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks (ii) a motivation for the deviation
9.	Assumptions and Limitations	31(2)(m)	A description of any assumptions, uncertainties and gaps in knowledge.	3 (p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.
10.	Need and Desirability	31(2)(f)	A description of the need and desirability of the proposed activity.	3 (f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity within the context of the preferred location.

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
11.	Alternatives	31(2)(g)	A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment.	3 (h)	i) Details of the development footprint alternatives considered.
12.	Profile of the Receiving Environment	31(2)(d)	A description of the environment that may be affected by the activity.	3 (h)	A full description of the process followed to reach the proposed development footprint within the approved site, including: iv) The environment attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
13.	Summary of Specialist Studies	31(2)(j)	A summary of the findings and recommendations of any specialist report or report on a specialised process.	3 (k)	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.
14.	Impact Assessment	31(2)(h)	An indication of the methodology used in determining the significance of potential environmental impacts.	3 (h)	A full description of the process followed to reach the proposed development footprint within the approved site, including: v) The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
					<p>impacts, including the degree to which these impacts –</p> <ul style="list-style-type: none"> a. can be reversed; b. may cause irreplaceable loss of resources; and c. can be avoided, managed or mitigated. <p>vi) The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks.</p> <p>vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.</p> <p>viii) The possible mitigation measures that could be applied and level of residual risk.</p>
		31(2)(i)	A description and comparative assessment of all alternatives identified during the environmental impact assessment process.	3 (i)	<p>A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including -</p> <ul style="list-style-type: none"> i) A description of all environmental issues and risks that were identified during the

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
					<p>environmental impact assessment process; and</p> <p>ii) An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.</p>
		31(2)(k)	<p>A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures.</p>		<p>An assessment of each identified potentially significant impact and risk, including-</p> <p>(i) Cumulative impacts;</p> <p>(ii) The nature, significance and consequences of the impact and risk;</p> <p>(iii) The extent and duration of the impact and risk;</p> <p>(iv) The probability of the impact and risk occurring;</p> <p>(v) The degree to which the impact and risk can be reversed;</p> <p>(vi) The degree to which the impact and risk may cause irreplaceable loss of resources; and</p> <p>(vii) The degree to which the impact and risk can be mitigated.</p>
		31(2)(l)	<p>An assessment of each identified potentially significant impact, including –</p> <p>i) Cumulative impacts;</p> <p>ii) The nature of the impact;</p> <p>iii) The extent and duration of the impact;</p> <p>iv) The probability of the impact occurring;</p> <p>v) The degree to which the impact can be reversed;</p> <p>vi) The degree to which the impact may cause irreplaceable</p> <p>vii) Loss of resources; and</p>	3 (j)	

Chapter	Title	Correlation with GN No. R. 543	Correlation with Appendix 3 of GN No. R. 982
			viii) The degree to which the impact can be mitigated.
15.	Analysis of Alternatives	31(2)(g)	<p>A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment.</p> <p>3 (h)</p> <p>ix) If no alternative development locations for the activity were investigated, the motivation for not considering such.</p> <p>x) A concluding statement indicating the preferred alternative development location within the approved site.</p>
			<p>3 (n)</p> <p>The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.</p>
16.	Public Participation	31(2)(e)	<p>Details of the public participation process conducted in terms of subregulation (1), including:</p> <p>i) Steps undertaken in accordance with the plan of study;</p> <p>ii) A list of persons, organisations and organs of state that were registered as interested and affected parties;</p> <p>iii) A summary of comments received from, and a summary of</p> <p>3 (h)</p> <p>ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations including copies of the supporting documents and inputs; and</p> <p>iii) A summary of the issues raised by interested and affected parties, and</p>

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
			<p>issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and</p> <p>iv) Copies of any representations and comments received from registered interested and affected parties;</p>		<p>an indication of the manner in which the issues were incorporated, or the reasons for not including them.</p>
17.	EAP Conclusions and Recommendations	31(2)(n)	<p>A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.</p>	3 (l)	<p>An environmental impact statement which contains -</p> <p>i) A summary of the key findings of the environmental impact assessment;</p> <p>ii) A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and</p> <p>iii) A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.</p>
		31(2)(o)	<p>An environmental impact statement which contains –</p> <p>i) A summary of the key findings of the environmental</p>	3 (m)	<p>Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes</p>

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
			<p>impact assessment; and</p> <p>ii) A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.</p>		<p>for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.</p>
				3 (o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.
				3 (q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.
18.	Oath of EAP	-	-	3 (s)	<p>An undertaking under oath or affirmation by the EAP in relation to:</p> <p>(i) The correctness of the information provided in the reports;</p> <p>(ii) The inclusion of comments and inputs from stakeholders and I&APs;</p> <p>(iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and</p> <p>(iv) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.</p>
19.	References	-	-	-	-
	Not Applicable	-	-	3 (r)	Where the proposed activity does not include operational aspects, the

Chapter	Title	Correlation with GN No. R. 543		Correlation with Appendix 3 of GN No. R. 982	
					period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.
Not Applicable		-	-	3 (u)	An indication of any deviation from the approved scoping report, including the plan of study, including- i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks ii) (ii) a motivation for the deviation
Not Applicable		31(2)(r)	Any specific information that may be required by the competent authority.	3 (v)	Any specific information that may be required by the competent authority.
Not Applicable		31(2)(s)	Any other matters required in terms of sections 24(4)(a) and (b) of the Act.	3 (w)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.

The following has also been included in the Appendices to meet the requirements of the 2010 and 2014 EIA Regulations:

Appendix	Title	Correlation with GN No. R. 543	Correlation with GN No. R. 982
F	Specialist Studies	31(2)(n)	Appendix 6
G	Environmental Management Programme (EMPr)	31(2)(p)	Appendix 4

2 PURPOSE OF THIS DOCUMENT

The Draft EIA Report is a very important document as it concludes the second and final phase of the EIA process. The Draft EIA Report aims to outline the final process to be undertaken in line with the approved plan of study for the proposed Mtwalume Dam as well as to set put the environmental impacts, mitigation, closure outcomes, and the residual risks of the proposed activity.

Further, according to Appendix 3 of the 2014 EIA Regulations (GN No. R. 982), the objectives of the EIA process are, through consultation, to:

- a) Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- b) Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- c) Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- d) Determine the--
 - i. Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
 - ii. Degree to which these impacts-
 - aa) Can be reversed;
 - bb) May cause irreplaceable loss of resources, and
 - cc) Can be avoided, managed or mitigated;
- e) Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- f) Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- g) Identify suitable measures to avoid, manage or mitigate identified impacts; and
- h) Identify residual risks that need to be managed and monitored.

To date, the Scoping phase for the project has been completed. The Final Scoping Report and Plan of Study for the EIA were approved on 16 February 2016 by the KZN Department of

Economic Development, Tourism and Environmental Affairs (DEDTEA), who is the Competent Authority in respect to this proposed development (**Appendix A**).

The Draft EIA Report will be made available to Interested and Affected Parties (IAPs) for a 30-Day review period and to Authorities for a 40-Day review period. All comments received will be assessed in the Final EIA Report and will also be noted in the Comments and Responses Report. The Final EIA Report will then be made available for further public review at the same time as being submitted to the KZN DEDTEA. The Environmental Assessment Practitioner (EAP) will forward all comments received by registered IAPs on the Final Scoping Report to the relevant DEDTEA Official to take into consideration when making the decision to approve or reject the Final EIA Report.

3 ENVIRONMENTAL ASSESSMENT PRACTITIONER

Nemai Consulting was appointed by ZIYANDA Consulting cc (ZIYANDA) on behalf of Ugu District Municipality (DM) as the independent EAP to undertake the EIA for the proposed Mtwalume Dam. In accordance with Regulation 28(1)(a) of GN No. R. 543 of 18 June 2010 and Section 2(a) of Appendix 2 of GN No. R. 982 of 04 December 2014, this section provides an overview of Nemai Consulting and the company's experience with EIAs, as well as the details and experience of the EAPs that form part of the Scoping and EIA team.

Nemai Consulting is an independent, specialist environmental, social development and Occupational Health and Safety (OHS) consultancy, which was founded in December 1999. The company is directed by a team of experienced and capable environmental engineers, scientists, ecologists, sociologists, economists and analysts. The company has offices in Randburg (Gauteng), Durban (KwaZulu-Natal), and Rustenburg (North West Province).

The core members of Nemai Consulting that are involved with the Scoping and EIA process for the proposed development are captured in **Table 2** below, and their respective Curricula Vitae are contained in to **Appendix B**.

Table 2: Scoping and EIA Core Team Members

Name	Qualification	Responsibility
Mrs N. Naidoo	BSc – Eng (Chem)	Project Manager and Environmental Engineering
Mr D. Henning	MSc – River Ecology	Technical Input and Quality Review
Ms K. Robertson	MSc – Environmental Sciences	Project Leader on EIA Process, Scoping & EIA Report, and Public Participation

4 PROJECT BACKGROUND AND MOTIVATION

4.1 Introduction

Nemai Consulting was appointed by ZIYANDA on behalf of the Ugu DM as the independent EAP to undertake the Environmental Authorisation for the proposed construction of a dam on the Mtwalume River in the Harry Gwala DM area of KZN. This document serves as the Draft EIA Report for the aforementioned project.

The Ugu DM owns and operates the Vulamehlo Water Treatment Plant (WTP) which supplies potable water to areas within the Vulamehlo and Umzumbe Local Municipalities (LM) in Ugu DM as well as to areas within the Ubuhlebezwe LM in Harry Gwala DM. The Vulamehlo/Braemer and Nyavini Water Schemes are fed from the Vulamehlo WTP. Operations and investigations indicate that the existing infrastructure is not adequate (based on coverage and capacity) to meet the demands of the project area. Thus, ZIYANDA was appointed in May 2013 as the Engineers to undertake detailed design work and construction management for the augmentation of water supply to the project area through a proposed scheme, Vulamehlo Cross Border Water Scheme. The scope entails, inter alia, construction of Mtwalume Dam on the Mtwalume River, upgrading of Vulamehlo WTP, bulk infrastructure (reservoirs and pipelines) and reticulation and the extension of the infrastructure to cover the currently unserved areas including KwaMgayi and Hlokozi areas.

The site is located approximately 32 kilometres (km) west of Umzinto and approximately 45km west and inland of Scottburgh on the south coast of KZN (**Figure 1**). The area is rural in nature with a number of low residential / community areas on the periphery of the proposed dam sites (**Figure 2**) that include schools and clinics as well as some intensive sugar cane farming and forestry. Access to the dam sites is possible via gravel roads that run off the R612 that links the coastal areas with the towns of Ixopo and Highflats. The proposed site locations for the Mtwalume Dam are located on the Mtwalume River in a section of the River that falls within the Harry Gwala DM (formerly known as the Sisonke DM) (**Figure 3**).

The applicant, the Ugu DM, as the Water Service Authority (WSA) and Water Service Provider (WSP) wishes to urgently augment water supply and guarantee security of supply to Nyavini, Kenterton, Braemer, KwaNkosi, Mayfield and KwaMgayi areas in Ugu DM and to Jolivet and Hlokozi areas in Harry Gwala DM. The following schemes (at various stages of implementation) are to serve the community within the project footprint:

- Existing Nyavini scheme, which will be upgraded to include the unserved Hlokozi area in Harry Gwala DM; and

- Existing Vulamehlo/Braemer, which will be upgraded to include unserved KwaMgayi area in Ugu DM.

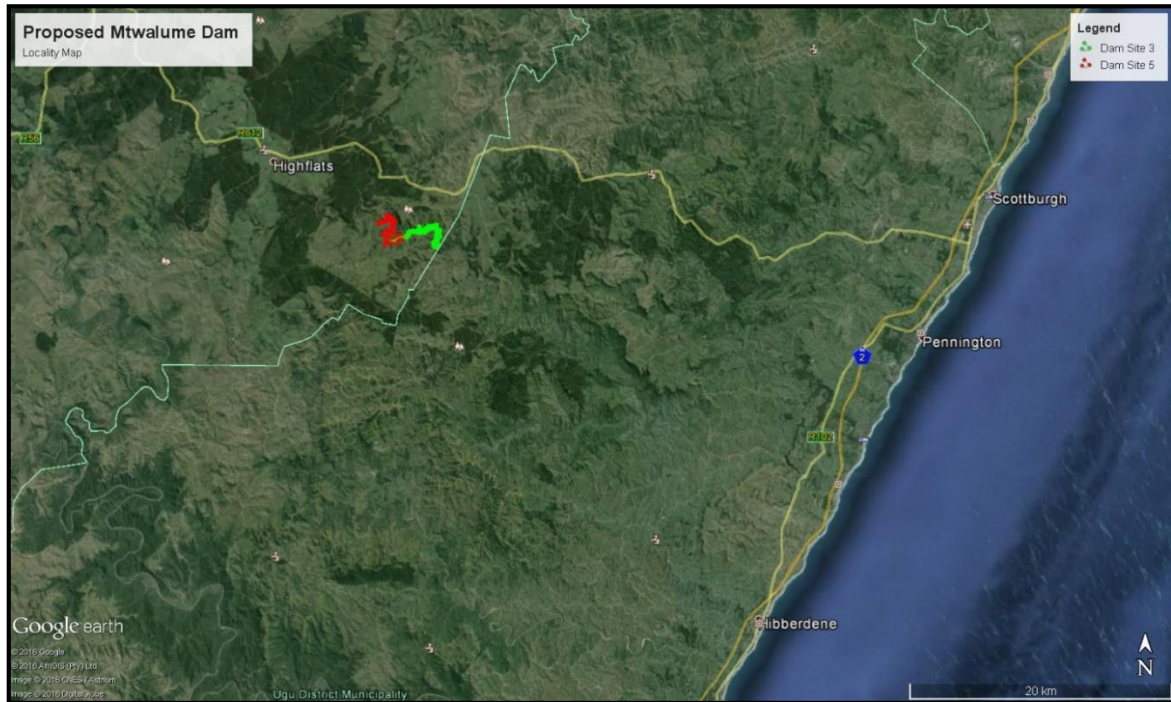


Figure 1: Proposed Site Locations in relation to the south coast of KZN (Google Earth)

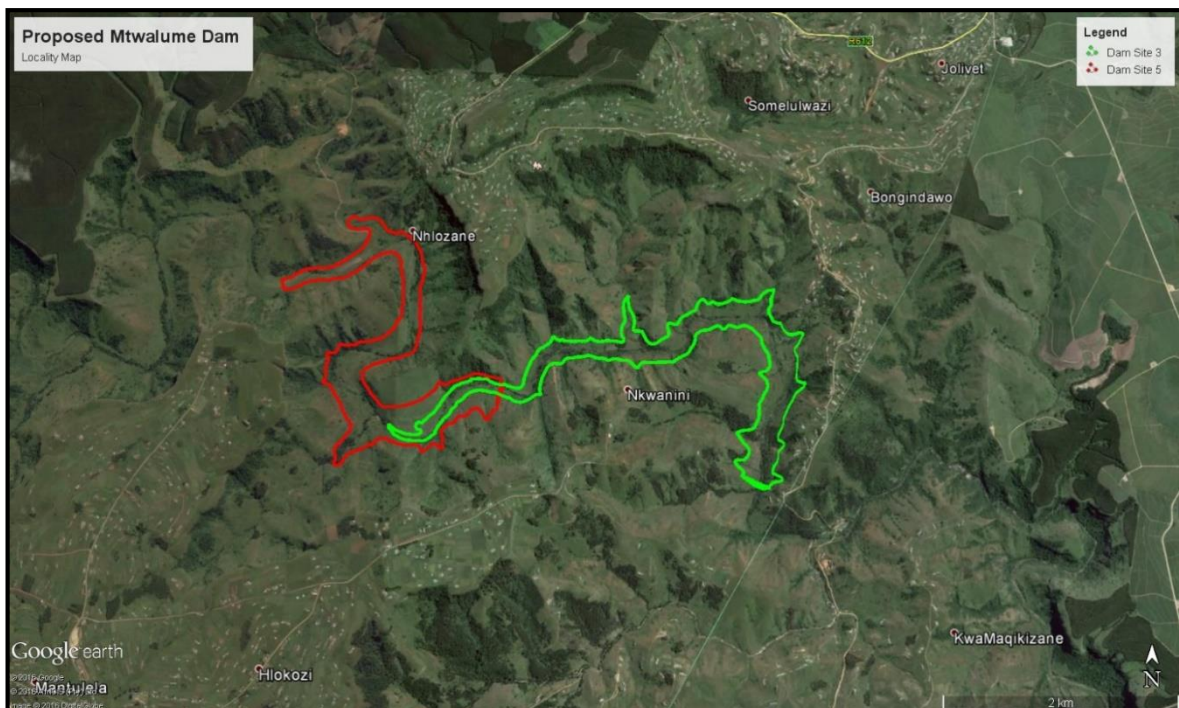


Figure 2: Residential / Community areas near the proposed dam sites (Google Earth)

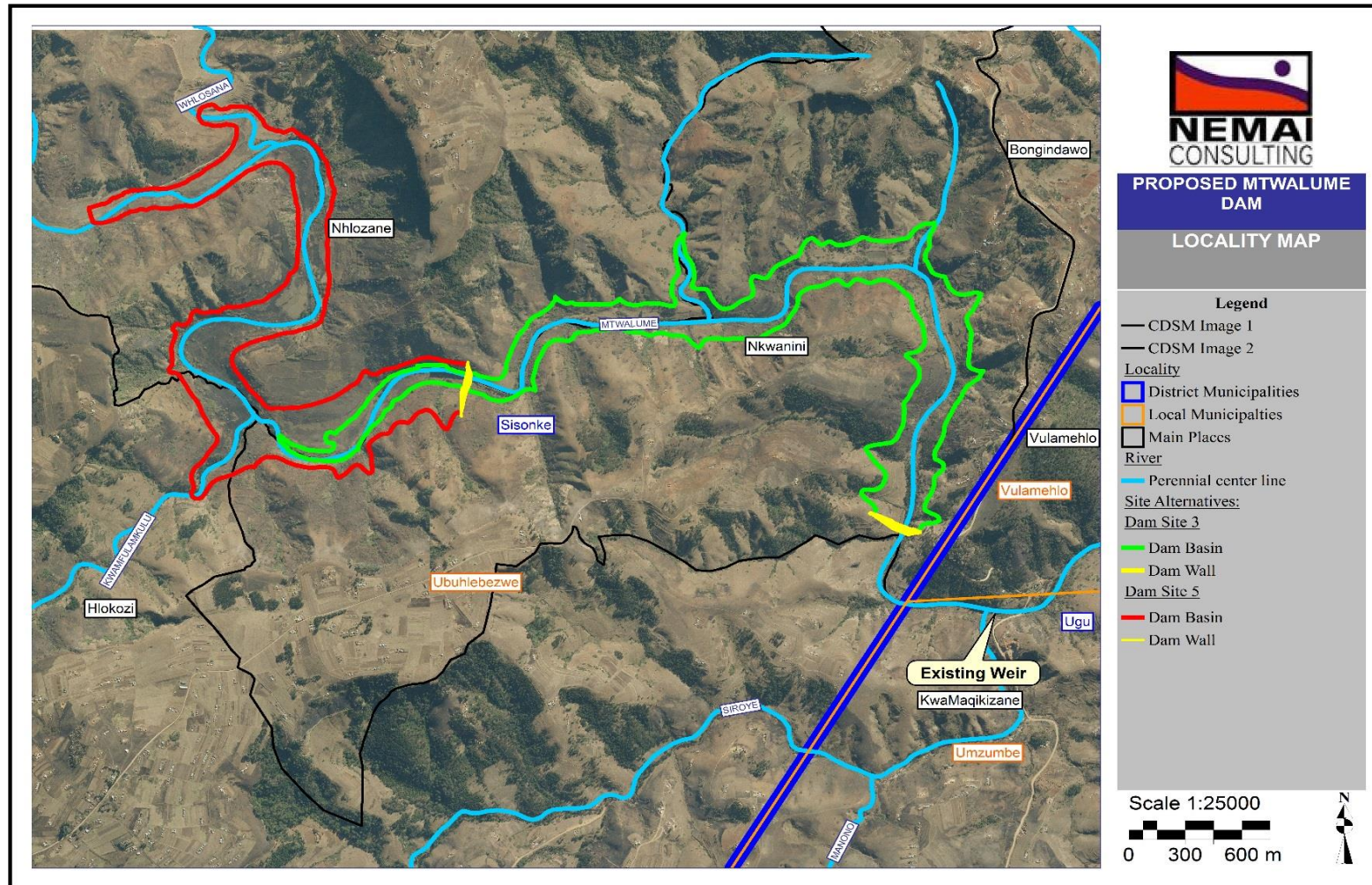


Figure 3: Locality Map (1:25 000) of the Proposed Development

The Vulamehlo Water Scheme is the focus of this project and intends to provide clean and reliable water supply through the upgrading and construction of bulk infrastructure. The overall project is referred to as the Vulamehlo Cross Border Water Scheme project and the proposed construction of the dam forms part of the project.

4.2 Overview of the Vulamehlo Cross Border Water Scheme

The Vulamehlo Cross Border Scheme involves the development of various elements of infrastructure, including the following:

- Raw water impoundment and storage, through a dam on the Mtwalume River;
- Raw Water abstraction infrastructure, including pipelines and associated pump stations;
- Upgrade of WTP;
- Treated distribution infrastructure, comprising bulk & reticulation pipelines and pump stations; and
- Treated water storage infrastructure.

Refer to **Table 3** for a list of the proposed bulk water infrastructure.

Table 3: Proposed bulk infrastructure

Bulk Storage	Bulk Pipelines and Plants
Mtwalume Dam: ~ 17,8 million m ³	Raw mains: 700mm dia. x 0,3km long
Nyavini Reservoir : 1,5 Mℓ	Nyavini mains: 315mm dia. x 4,0km long
KwaNkosi Reservoir: 2,0 Mℓ	KwaNkosi mains: 315mm dia. x 3,5km long
Hlokozi Reservoir: 4,0 Mℓ	Hlokozi mains: 250mm dia. x 7,0km long
Hlutankungu Reservoir: 7,0 Mℓ	Hlutankungu mains: 250mm dia. x 2,3km long
Reservoir A: 7,0 Mℓ	Jolivet (Res A) mains: 350mm dia. x 4,0km long
Sisonke Reservoir: 6,5 Mℓ	Kenterton mains: 300mm dia. x 17,5km long
	Vulamehlo WTP: 10,5 Mℓ/d

All maps are provided in A3 copies in **Appendix C**.

For raw water impoundment and storage infrastructure, ZIYANDA Consulting has collaborated with Bosch Stemele (Pty) Ltd to undertake the engineering planning and Pre-Feasibility works for the Mtwalume Dam, which is to provide raw water for the proposed Vulamehlo Cross-Border Water Scheme. Only the proposed Mtwalume dam is covered in this EIA.

4.3 Water Requirements

A significant growth in the water requirements for the system has been predicted through various previous studies, and a substantial portion of that growth can be associated with the increase of the level of service for the rural population as well as the planned extension of the system to cover additional rural areas, which are not presently supplied with water from the scheme. The Mtwalume Dam Pre-Feasibility Study (ZIYANDA Consulting, 2014), completed in June 2014, identified the following water requirements for the project in terms of the catchment and population.

Initial demand forecasts were based on a per capita water consumption of 60 ℓ/c/d. However, both the Ugu and Harry Gwala DMs have indicated that future demand projections should be based on a per capita consumption of 75 ℓ/c/d. The ability of the Mtwalume River to sustain these demands, as well as the subsequent implications regarding the raw water storage infrastructure was investigated. Hydrological assessments of the Mtwalume River conducted by Umgeni Water (2001) and Terratest Geotechnical, Environmental and Earth Science Consultants (2011) to determine the volume of “run-of-river” streamflow available at the existing Vulamehlo Weir, indicated that in order to meet the current and future domestic water demands of the surrounding community in addition to implementing the ecological water requirements (EWR), additional in-catchment storage will be required in the form of a dam on the Mtwalume River. The Umgeni Water assessment determined that the Mtwalume River could sustain 1.5 Mℓ/day at a 96.8% assurance level, while the Terratest Study indicated that the river could maintain 2.6 Mℓ/day (existing abstraction of 1.5 Mℓ/day + an additional 1.01 Mℓ/day) at a 98% assurance level without allowance for EWR.

The Mtwalume Dam Pre-Feasibility Study focused on the demands given below, where the population of 85 246 was calculated using a household occupancy rate of 7 persons per household, and the future population of 114 814 was estimated using a 1.5 % growth rate of 20 years. The current and future population projections per local municipality are tabulated in **Table 4** below.

Table 4: Vulamehlo Cross-Border Water Scheme Projections

Area	Estimated No. of Houses	Current population	Future Population (1.5 % Growth Rate)
Vulamehlo LM (Ugu DM)	3 336	23 352	31 452
Umzumbe LM (Ugu DM)	2 276	27 825	37 476
Ubuhlebezwe LM (Harry Gwala DM)	4 867	34 069	45 886
Total	12 178	85 246	114 814

Six potential dam sites were identified upstream of the existing Vulamehlo WTP abstraction site based on an assessment of the river channel gradient. Relatively long reaches with flat longitudinal sections of the river were identified as suitable dam sites. Each of these sites then underwent an environmental scoping exercise as well as a high level geotechnical screening. The purpose of this exercise was to determine if any of the sites contained fatal flaws, and which of the sites would be the most favourable from both perspectives. Sites which were found to be very environmentally sensitive or contained poor founding conditions during the scoping exercise and the visual geotechnical assessment were then discarded from the initial assessment phase. Based on the above mentioned comparison of the six potential dam sites, Dam Site 3 and Dam Site 5 were chosen as the preferred locations for the construction of the Mtwalume Dam wall. Refer to Section 11 for more details on the alternative dam sites considered.

5 PROJECT LOCATION

As per R28 (1) (d) of GN No. R. 543 of 18 June 2010 and Section 2 (b) and (c) of Appendix 2 of GN 982 of 04 December 2014, the following information regarding the project location is provided in this section:

- A description of the property on which the activity is to be undertaken and the location of the activity on the property;
- The location of the activity including –
 - The 21 digit Surveyor General code of each Cadastral land parcel;
 - Where available, the physical address and farm name; and
 - Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property or properties.
- A plan which locates the proposed activity or activities applied for at an appropriate scale, or if it is –
 - A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is undertaken; and
 - On land where the property has not yet been defined, the coordinates within which the activity is to be undertaken.

Please note that A3 copies of all maps contained in Section 5 are contained in **Appendix C**.

5.1 Regional and Local Context

Figures 4 and **5** provide the regional and local context of the proposed development, respectively. The site is located in the Ugu DM and Harry Gwala DM of KZN Province, South Africa. The proposed Mtwalume Dam will be located on the Mtwalume River in a section of the River that falls within the Harry Gwala DM. The dam is located in the approximately 32km west of Umzinto and approximately 45km west and inland of Scottburgh on the south coast of KZN.

The area is rural in nature with a number of residential / community areas on the periphery of the proposed dam sites that include schools and clinics as well as some intensive sugar cane farming and forestry. Access to the dam sites is possible via gravel roads that run off the R612 that links the coastal areas with the towns of Ixopo and Highflats.

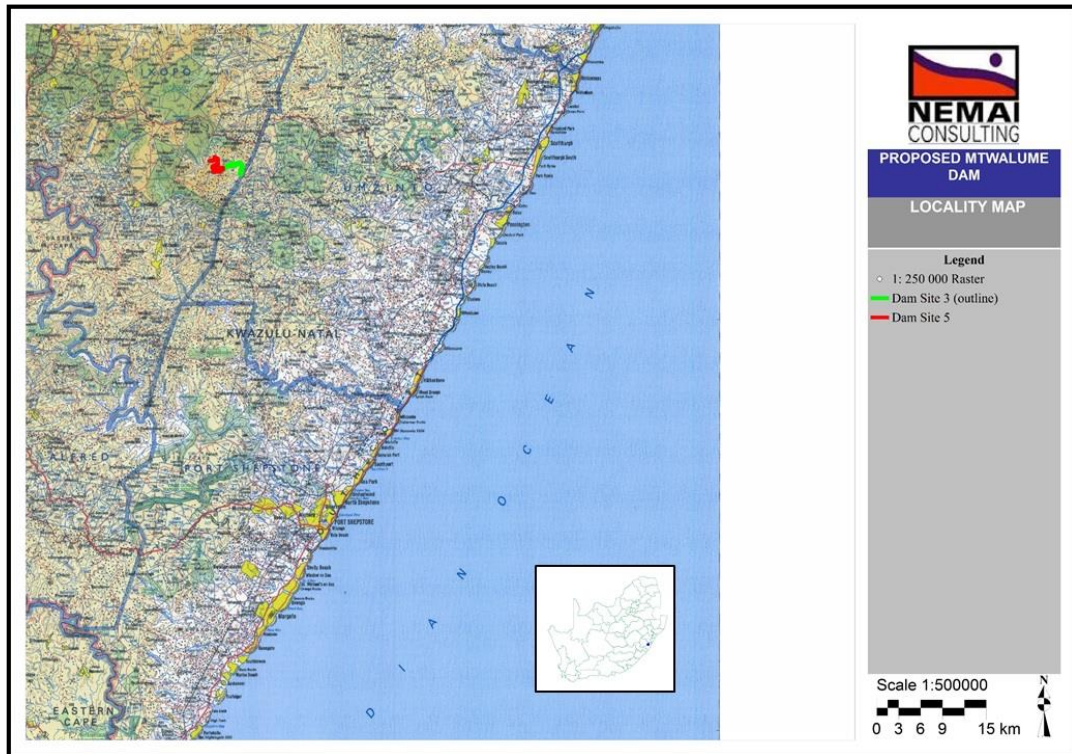


Figure 4: Regional Map

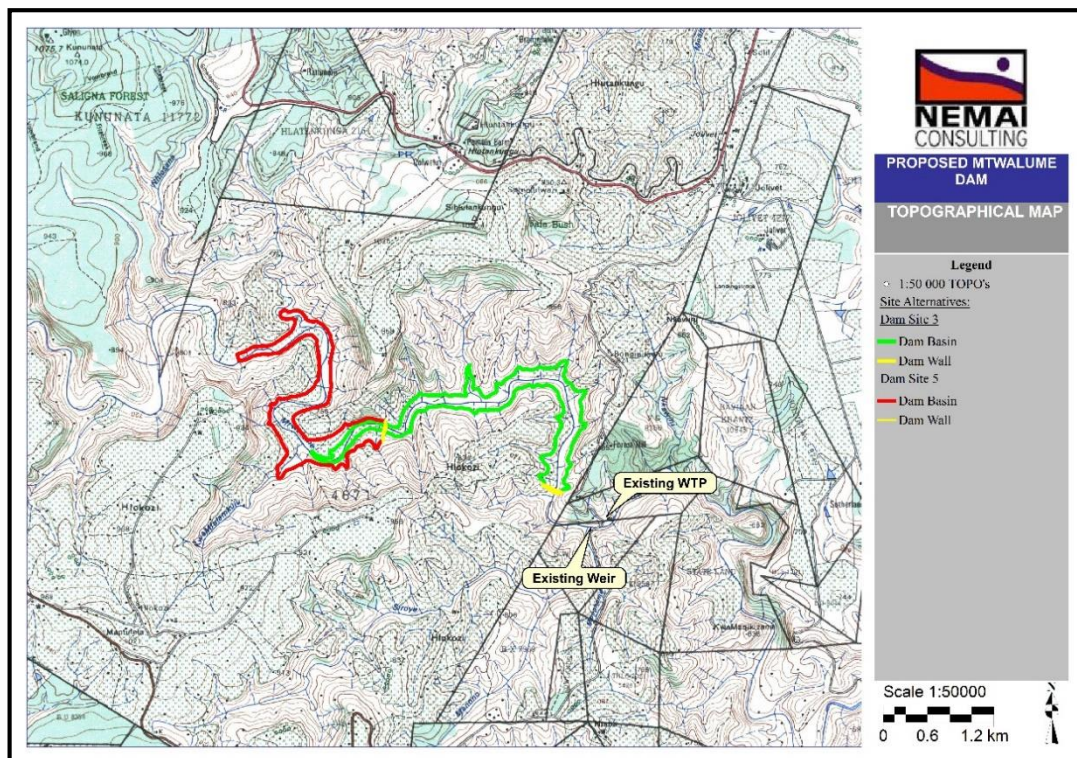


Figure 5: Topographical Map

5.2 Property Description

The proposed Mtwalume Dam is located on one property which is owned by the Ingonyama Trust. The details are provided below and **Figure 6**.

Farm name and number:	Upper Umkomaas Location No. 7 Farm No. 16421
Portion / holding /erf number/ 21 Digit Code	Portion 6 N0ET00000001642100006

However, a small portion of the associated infrastructure for Dam Site 3 occurs on Portion 0 of Fairview Farm 9951 (N0ET00000000995100000) and Portion 5 of Upper Umkomaas Location No. 7 Farm No. 16421 (N0ET00000001642100005) (**Figure 7**).

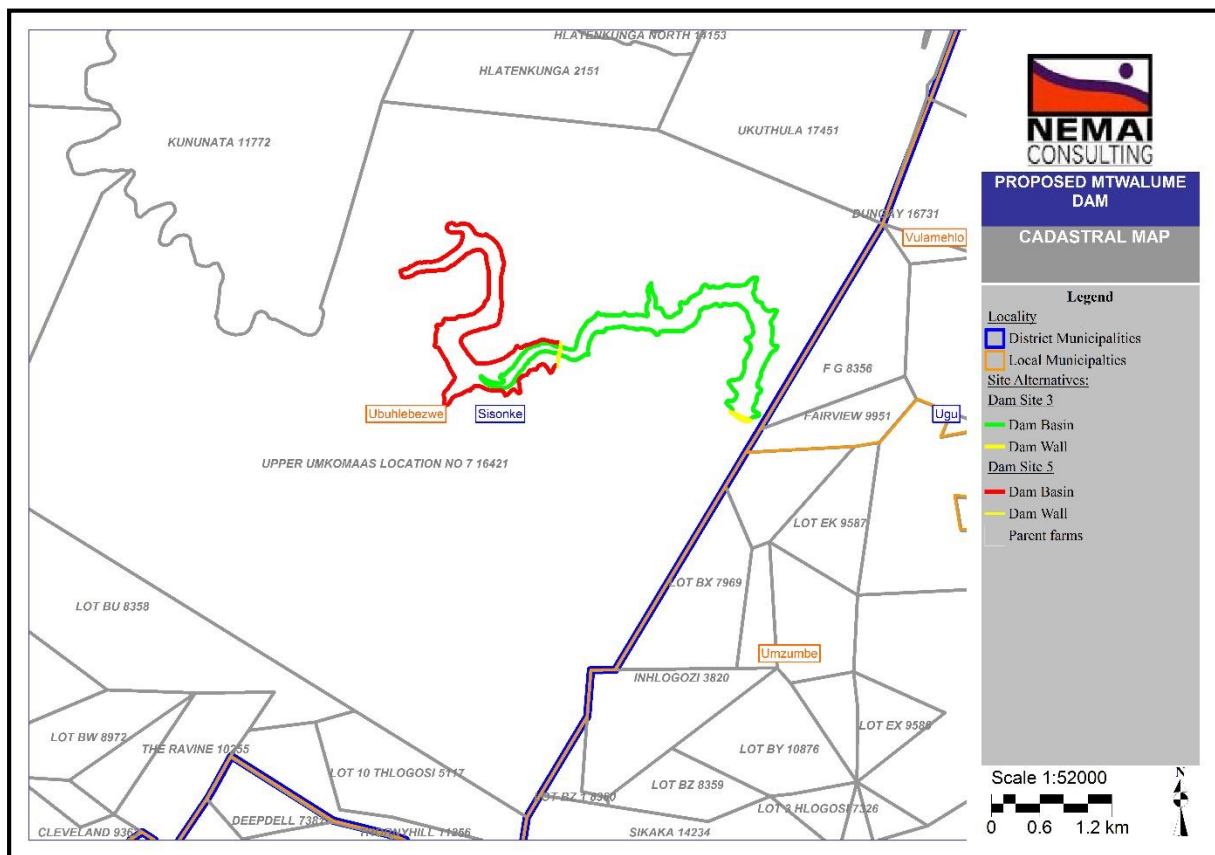


Figure 6: Parent Farms

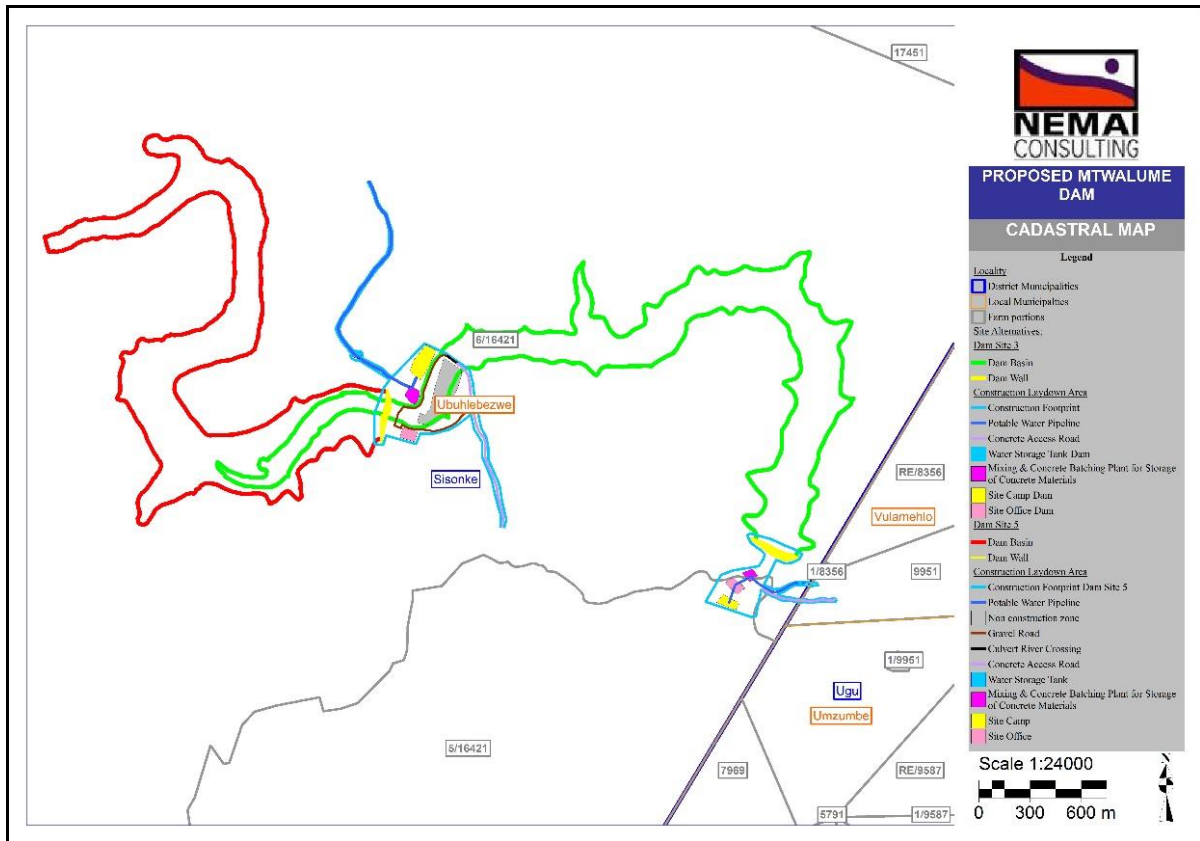


Figure 7: Cadastral Map

5.3 Location of Proposed Activities

All activities related to Mtwalume Dam will take place in the site described in Section 5.1 and 5.2 above. All additional infrastructure related to this project that occurs outside of the proposed site boundary are not included in this application for environmental authorisation (thus this report), only the dam and activities within the proposed site boundary are included. The additional infrastructure requires a Basic Assessment process which is currently being undertaken separately to this application.

6 PROJECT DESCRIPTION

Part of the upgrade requirements to the Vulamehlo Bulk Water Supply Scheme is to provide a raw water storage facility on the Mtwalume River, through the proposed Mtwalume Dam.

The scope of this project included the feasibility and concept design of an approximately 15m high concrete dam wall on the Mtwalume River. The dam originally was envisaged to store approximately 3.6 million m³ of raw water to provide a higher raw water supply level of assurance to the Vulamehlo Bulk Water Supply Scheme. However, once the yield analysis had been completed, it became clear that the available water resources of the catchment are constrained and a minimum dam wall height of 35m to 40m is required to cater for the current and future demands. Two alternative sites for the proposed Mtwalume Dam are being considered, namely Dam Site 3 and Dam Site 5.

6.1 Project Components

6.1.1 Dam Site Options

6.1.1.1 Dam Site 3

The Dam Site 3 (**Figure 8**) consists of the following:

- Dam Wall: The centerline for the proposed dam wall for Dam Site 3 (30°19'26.16" S; 30°19' 25.52" E) is located approximately 1km upstream of the existing Vulamehlo Weir where the river flows through a relatively narrow valley section. The dam wall is proposed to be 40m in height. The valve chamber and intake tower as well as bridges for these structures will be constructed at the dam wall.
- Dam Basin: The dam basin is approximately 260m wide upstream of the proposed centerline. The width remains relatively constant up to the bend in the river where it decreases in width to 230m some 650m upstream of the bend before reducing gradually to the head waters roughly 4300m upstream of the centerline. The total area to be inundated is approximately 117 ha.

A 95% assurance stochastic yield is assumed to be an acceptable level of assurance in rural areas where the demand for water is less. The attributes regarding alternative Site 3 are summarised in **Table 5**.

A dam wall height of 40m at Dam Site 3 is required to provide for the future, projected demand of 10.53 Ml/d. Refer to Design Drawings for these options in **Appendix D**.

Table 5: Dam Site 3 – Attribute Summary Table

Height of Wall (m) (Top of Spillway)	95% Assurance Yield (Mℓ/d)	Per Capita Water Consumption (ℓ/c/d)	Current Demand (Mℓ/d)	Future Demand (Mℓ/d)
40	10.46	75	8.98	10.53

6.1.1.2 Dam Site 5

The Dam Site 5 (**Figure 9**) consists of the following:

- **Dam Wall:** The centerline for the proposed dam wall for Dam Site 5 (30°19'00.16" S; 30°18'00.89" E) is located approximately 5.1km upstream of the existing Vulamehlo Weir where the river flows through a relatively narrow valley section. The dam wall is proposed to be 35m in height. The valve chamber and intake tower as well as bridges for these structures will be constructed at the dam wall.
- **Dam Basin:** The total area to be inundated is approximately 114 ha.

A 95% assurance stochastic yield is assumed to be an acceptable level of assurance in rural areas where the demand for water is less. The attributes regarding alternative Site 5 are summarised in **Table 6**.

A dam wall height of 35m at Dam Site 5 is required to provide for the future, projected demand of 10.43 Mℓ/d. Refer to Design Drawings for these options in **Appendix D**.

Table 6: Dam Site 5 – Attribute Summary Table

Height of Wall (m) (Top of Spillway)	95% Assurance Yield (Mℓ/d)	Per Capita Water Consumption (ℓ/c/d)	Current Demand (Mℓ/d)	Future Demand (Mℓ/d)
35	10.42	75	8.98	10.43

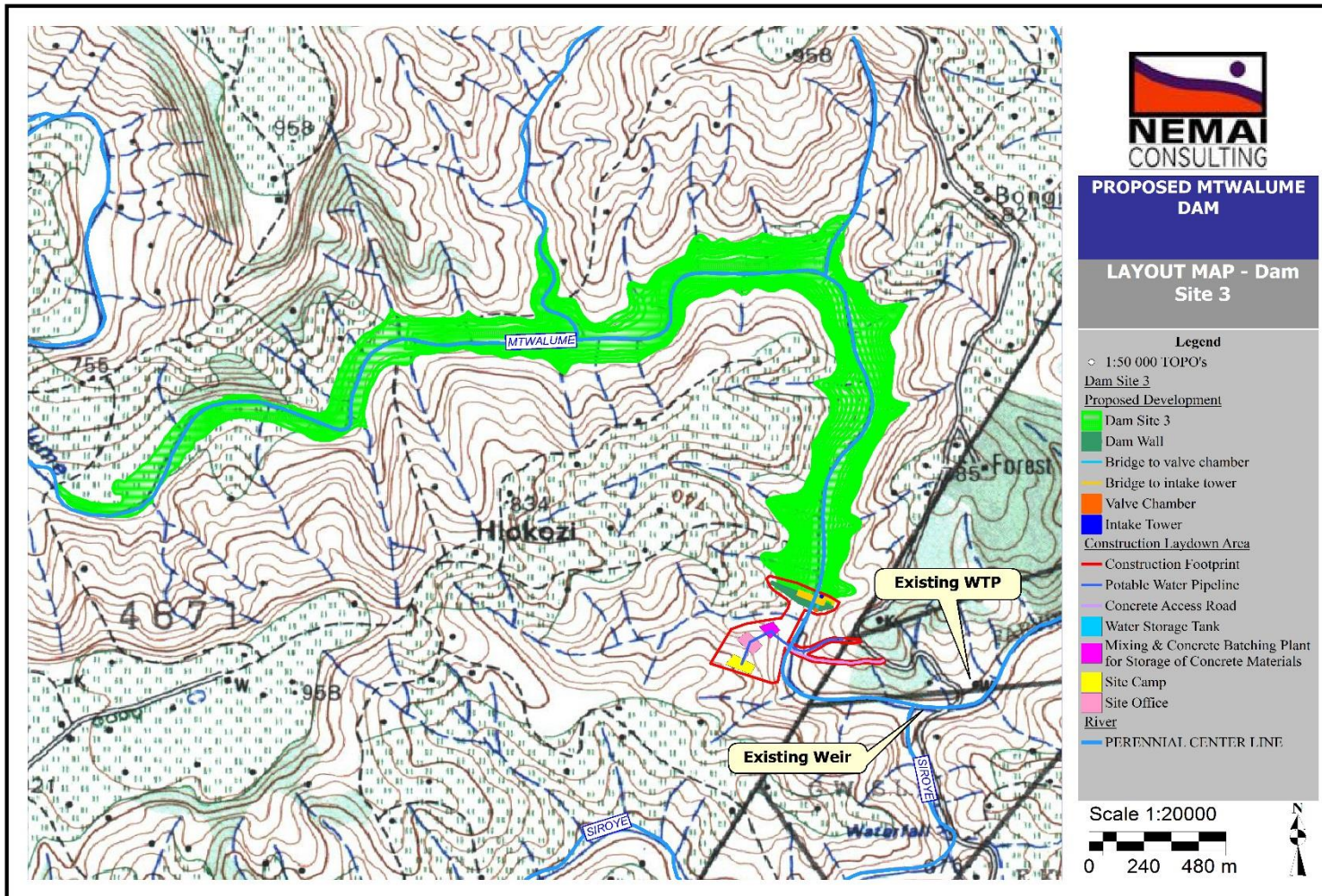


Figure 8: Mtwalume Dam Site 3

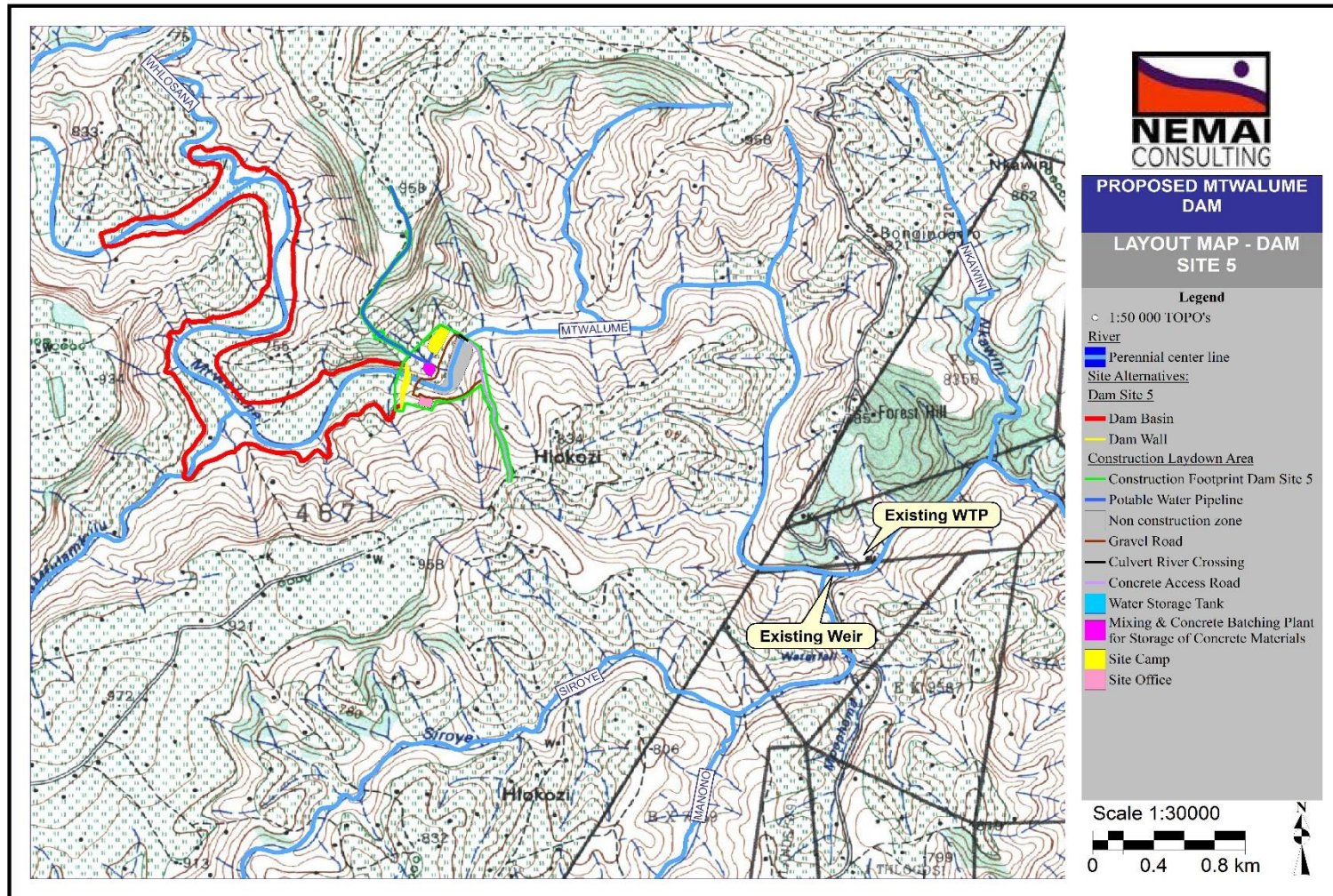


Figure 9: Mtwalume Dam Site 5

6.1.2 Associated Infrastructure

The associated infrastructure required for the construction and operation of the dam will be included in this EIA Application.

6.1.2.1 Dam Site 3

The following structures are to be constructed for temporary use during construction, except for structures where specified, and all occur structures within the proposed construction footprint for the associated infrastructure (represented by the red line in **Figure 8**):

- Potable Water Pipeline (will be permanent);
- Concrete Access Road (will be permanent);
- Water Storage Tank;
- Mixing & Concrete Batching Plant for Storage of Concrete Materials;
- Site Camp; and
- Site Office.

6.1.2.2 Dam Site 5

The following structures are to be constructed for temporary use during construction, except for structures where specified, and all occur structures within the proposed construction footprint for the associated infrastructure (represented by the green line in **Figure 9**):

- Gravel Road (will be permanent);
- Potable Water Pipeline (will be permanent);
- Culvert River Crossing (will be permanent);
- Concrete Access Road (will be permanent);
- Water Storage Tank;
- Mixing & Concrete Batching Plant for Storage of Concrete Materials;
- Site Camp; and
- Site Office.

6.1.3 Spillway

The 1:100 year flood peak (obtained from the Unit Hydrograph Method) and the Safety Evaluation Flood (SEF) were used for the sizing of the spillway. A labyrinth overflow spillway was considered over the design head range as the labyrinth offers savings in spillway width (a labyrinth spillway is an overflow spillway folded in plain view to provide a longer total effective crest length for a given overall spillway width). Its capacity varies with head and is typically about twice that of a standard ogee crest of the same overall spillway width. However, for heads in excess of the design range, their discharge characteristics revert to those of a broad crested weir within the given overall spillway width.

6.1.4 Multi-Level Draw-Off Outlet Works

The multi-level draw-off consists of a concrete “wet tower” situated parallel to the central spillway on the right hand flank wall. Water will be drawn into the tower at four different levels through 500mm x 500mm openings, with two openings located on the upstream wall and one opening located on each of the two side walls of the intake tower. Water will be drawn at levels 645 mean sea level (msl), 640 msl, 630 msl and 620 msl at Site 3, and at levels 680 msl, 675 msl, 665 msl and 655 msl at Site 5. Each opening will be closed off by a sluice gate operated from an overhead platform at dam crest level. Trash racks will be situated immediately ahead of the sluice gates.

6.1.4.1 Outlet Pipes

Three outlet pipes are to be installed from the Multi-Level Draw-Off. The first outlet is a 500mm diameter pipe, cast in to the embankment wall, which will release the required water demand back into the spillway stilling basin where it will be extracted downstream at the Vulamehlo weir for treatment at the Vulamehlo WTP. A second 450mm diameter outlet from the wet well, discharging downstream of the spillway, will also be cast in to the flank wall to release oxygenated water back in to the river for the environmental reserve. The third 200mm bottom diameter outlet pipe will be used to scour as well as to empty the dam in conjunction with the other two outlet pipes if the need to empty the dam should ever arise in the event of an emergency. Gate valves for each pipe will be located in a single valve chamber just downstream of the dam wall.

6.1.4.2 Outlet Control

Upstream control of the outlet pipes will be via sluice gates mounted alongside the intakes to the intake tower. These will be flush with the vertical face of the intake tower with trash racks located ahead of the sluice gate. The sluice gate will be operated from an overhead platform at dam crest level. Downstream control will occur via the gate valves situated in the single valve chamber downstream of the concrete embankment.

6.2 Dam Construction Materials

The following potential materials of construction for the proposed dam were considered:

- Earth Dams - Earth-fill dams are constructed as a simple embankment of well compacted earth.
- Rock-Fill Dams - Rock-Fill Dams are embankments of compacted free-draining granular earth with an impervious zone. The earth utilised often contains a large percentage of large particles hence the term rock-fill.
- Concrete Face Rock Fill Dam (CFRD) - CFRD is a rock-fill dam with concrete slabs on its upstream face.

- Mass Concrete/Gravity Dam - In a gravity dam, the force that holds the dam in place against the push from the water is the earth's gravity pulling down on the mass of the dam.
- Roller-Compacted Concrete (RCC) Dams - RCC is a special blend of concrete that has essentially the same ingredients as conventional concrete but in different ratios, and increasingly with partial substitution of fly ash for Portland cement.

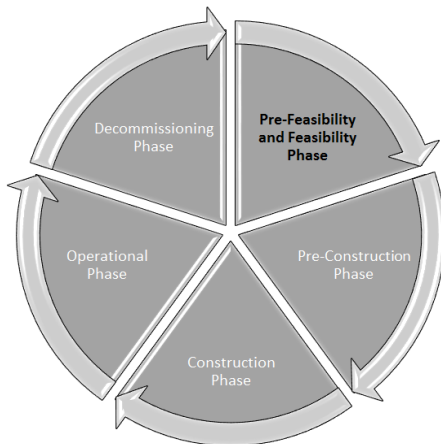
Based on the required height of the dam, shape of the valley, available materials and the high SEF relative to this catchment, a RCC dam wall was selected as the most suitable dam type for this location.

6.3 Project Life-Cycle

To adequately consider the impacts associated with the proposed Mtwalume Dam, the major activities during each phase of the project life-cycle are listed in the sub-sections to follow.

6.3.1 Feasibility Studies

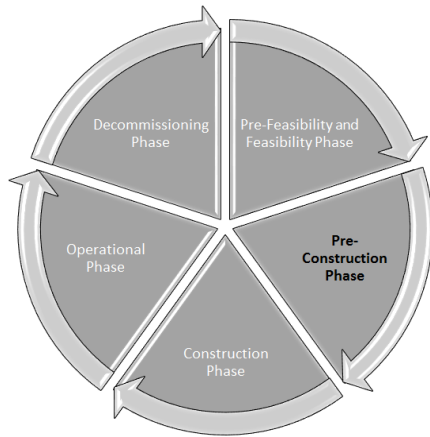
Major activities during the Pre-Feasibility and Feasibility Phases of the project include the following:



- Technical, economic and environmental screening of alternatives; and
- Geotechnical investigations to confirm soil conditions (where needed).

6.3.2 Pre-Construction

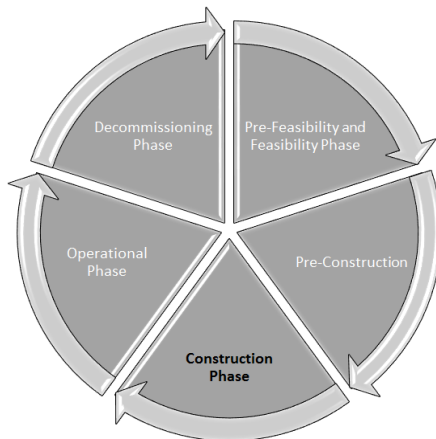
Major activities during the Pre-Construction Phase of the project include the following:



- Detailed layouts and services designs;
- Detailed geotechnical investigations;
- Obtain Environmental Authorisation;
- Procurement process for Contractors;
- Tender for various construction works; and
- Procurement of other necessary materials.

6.3.3 Construction

Major activities during the Construction Phase are as follows:



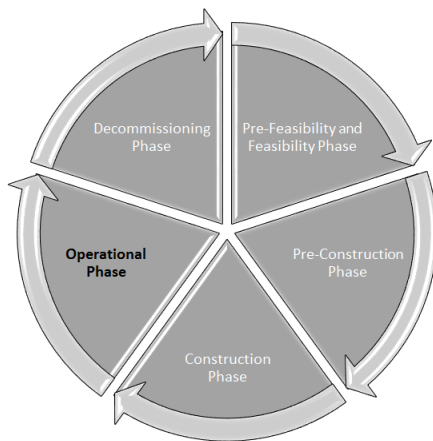
Appointments and site camp set up:

- Appoint Environmental Control Officer;
 - Set up site camp with temporary offices and administrative facilities;
 - Set up ablutions;
 - Set up access control, security; signage and lighting;
 - General materials storage and laydown areas;
-
- Construction of chemicals storage facilities (oil, grease, solvents etc.) and associated infrastructure (bunds, secured / roofed areas etc.);
 - Construction employment;
 - Workshops / areas (e.g. welding, mechanical repair, electrical etc.);
 - Change-houses, chemical toilets and showering facilities (linked to conservancy tanks – removal of contents by exhauster vehicle and disposal at permitted facility); and
 - Temporary waste storage areas; these shall be established and managed in accordance with the Environmental Management Programme (EMPr) requirements to be developed in the EIA phase.
 - Sourcing of construction materials and equipment:
 - All bulk materials (aggregate, cement, steel etc.) will be sourced from existing lawful commercial sources; there will be no direct mining, harvesting or extraction of natural resources;
 - Excavation and earthworks:

- Removal of existing surfacing material (concrete, asphalt etc.) which could involve excavation below ground level;
- Levelling and compaction using heavy machinery / earthmoving equipment;
- Potential for excavations and trenching in order to prepare foundations and laying of below ground level equipment (cables, pipes, sumps, drainage etc.);
- Potential for excavation dewatering in the event of water-table interception;
- Piling / drilling depending on the identified construction / founding technique; and
- Use of general mechanical equipment within construction areas (generators, cutting and welding equipment, compressors etc.).

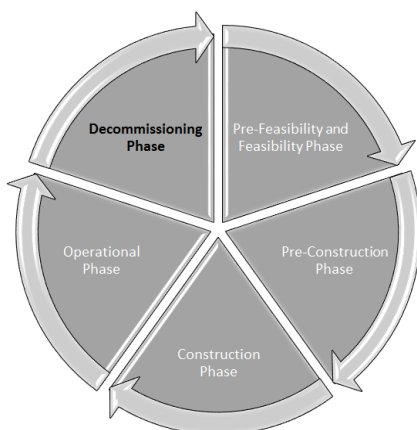
6.3.4 Operation

Major activities during the Operational Phase of the project include the following:



- Operation of the dam;
- Maintenance of infrastructure; and
- On-going consultation with directly affected parties.

6.3.5 Decommissioning



Decommissioning of the Mtwalume Dam is not envisioned. However, should decommissioning be required the activity will need to comply with the appropriate environmental legislation and best practices at that time.

7 LEGISLATION AND GUIDELINES CONSIDERED

7.1 Overview of Legislation

Some of the pertinent environmental legislation that has bearing on the proposed development is captured in **Table 7** below. More detailed information is provided in Section 7.2 to 7.16 This Section aims to satisfy 2(e) of Appendix 2 of GN No. R. 982 of 04 December 2014: A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.

Table 7: Environmental Legislative Framework

Legislation	Relevance
Constitution of the Republic of South Africa (Act No. 108 of 1996)	Chapter 2 – Bill of Rights. Section 24 – environmental rights.
National Environmental Management Act (Act No. 107 of 1998)	Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment). Section 28 – Duty of care and remediation of environmental damage. Environmental management principles. Authority – DEDTEA.
GN No. R. 543 of 18 June 2010 and R. 982 of 04 December 2014 EIA Regulations	Process for undertaking Basic Assessment / Scoping and EIA process.
GNs No. R 544 and 545 of 18 June 2010 and R. 983 and 984 of 04 December 2014 EIA Regulations	Activities that need to be assessed through a Basic Assessment process.
GN No. R. 546 of 18 June 2010 and R. 985 of 04 December 2014 EIA Regulations	Activities that need to be assessed through a Scoping and EIA process.
National Water Act (Act No. 36 of 1998)	Chapter 3 – Protection of water resources. Section 19 – Prevention and remedying effects of pollution. Section 20 – Control of emergency incidents. Chapter 4 – Water use. Authority – Department of Water and Sanitation (DWS).
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	Protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural landscapes. Authority – Department of Environmental Affairs (DEA).
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	Management and conservation of the country's biodiversity.

Legislation	Relevance
	Protection of species and ecosystems. Authority – DEA.
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Air quality management. Section 29 – pollution prevention plans (Notice 172 of 2014: Greenhouse gases as priority air pollutants) Section 32 – dust control. Section 34 – noise control. Section 35 – control of offensive odours. Authority – DEA.
National Environmental Management: Waste Act (Act No. 59 of 2008)	Chapter 4 – Waste management measures Chapter 5 – licensing requirements for listed waste activities. Authority – DEA.
Health Act (Act No. 63 of 1977)	Provisions for measures for the promotion of the health services. Authority – Department of Health.
Occupational Health & Safety Act (Act No. 85 of 1993)	Provisions for Occupational Health & Safety. Authority – Department of Labour.
National Heritage Resources Act (Act No. 25 of 1999)	Section 34 – protection of structure older than 60 years. Section 35 – protection of heritage resources. Section 36 – protection of graves and burial grounds. Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m ² in extent. Authority – KZN AMAFA (Heritage Resources Authority).
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	Control measures for erosion. Control measures for alien and invasive plant species. Authority – Department of Forestry and Fisheries (DAFF).
National Forests Act (Act No. 84 of 1998)	Section 15 – authorisation required for impacts to protected trees. Authority – DAFF.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Permit required for borrow pits. Authority – Department of Mineral Resources (DMR).
Spatial Planning and Land Use Management Act (Act No. 16 of 2013)	Aims to develop a new framework to govern planning permissions and approvals, sets parameters for new developments and provides for different lawful land uses in South Africa. Authority – Department of Rural Development and Land Reform (DRDLR).
Kwazulu-Natal Planning and Development Act (Act No. 06 of 2008)	Directs and regulates planning and development in KZN.

Legislation	Relevance
	An application may be required before land may be used or developed for a particular purpose. All developments need to be in accordance with the municipality's planning scheme. Authority – Ugu DM and Harry Gwala DM.
KwaZulu-Natal Nature Conservation Management Act (Act No. 09 of 1997)	Institutional bodies for nature conservation in KZN. Establish control and monitoring bodies and mechanisms. Authority – Ezemvelo KZN Wildlife (EKZNW).

7.1.1 Constitution of the Republic of South Africa (Act No. 108 of 1996)

The Constitution of the Republic of South Africa (Act No. 108 of 1996) is the supreme law of the land and provides amongst others the legal framework for legislation regulating coastal management in general. It also emphasises the need for co-operative governance. In addition, the Environmental clause in Section 24 of the Constitution provides that:

“Everyone has the right –

- a) to an environment which is not harmful to their health or wellbeing;*
- b) to have the environment protected for the benefit of present and future generations through reasonable legislation and other measures that:

 - I. Prevent pollution and ecological degradation;*
 - II. Promotes conservation;*
 - III. Secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development”**

The Constitution provides the overarching framework for sustainable development.

7.1.2 National Environmental Management Act (Act No. 107 of 1998)

The proposed Mtwalume Dam requires authorisation in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), and the EIA will be undertaken in accordance with the EIA Regulations (2010) as the Application for Environmental Authorisation was submitted in August 2014 prior to gazetting of the new 2014 EIA Regulations. Despite this, where possible the requirements of the new 2014 EIA Regulations will be taken into account.

Important aspects of NEMA are sustainability principles such as the “Polluter Pays” and the “Precautionary Principle” which will also be taken into account in the assessment of the impacts of the proposed development.

7.1.3 EIA Regulations (04 December 2014)

The 2010 EIA Regulations consist of the following:

- EIA procedures - Government Notice No. R. 543;
- Listing Notice 1 - Government Notice No. R. 544;
- Listing Notice 2 - Government Notice No. R. 545; and
- Listing Notice 3 - Government Notice No. R. 546.

The proposed Mtwalume Dam triggered activities under Listing Notices 1, 2 and 3, and thus needs to be subjected to a Scoping and EIA process. The listed activities are explained in the context of the project in **Table 8**.

Table 8: EIA Listed Activities for the Mtwalume Dam

GN	Activity	Description as per GN	Applicability to Project
GNR 544	11 (iv)(ix)(xi)	The construction of: (iv) dams, (ix) spillways and (xi) infrastructure exceeding 50 m ² in size, where such construction occurs within a watercourse or 32m of a watercourse	The development involves the construction a dam and spillway within the Mtwalume River.
	18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from- a watercourse	Construction of dam wall within the Mtwalume River.
	22 (ii)	The construction of a road, outside urban areas, (ii) where no reserve exists where the road is wider than 8 metres,	Access roads to the dam wall, outlet structure, spoil areas, etc.
	47 (ii)	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii)where no reserve exists, where the existing road is wider than 8 metres	Widening or lengthening of existing roads to create access roads.
	56	Phased activities for all activities listed in this Schedule, which commence on or after the effective date of this Schedule, where any one phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold	Possible phased activities that may collectively trigger this activity.
GNR 545	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more;	Large area (approx. 114 ha) to be inundated by Mtwalume Dam.
	19	The construction of a dam, where the highest part of the dam wall as measured from the outside toe of the wall to the highest part of the wall is 5m or higher or where the highest water mark of the dam covers an area of 10 ha or more	The proposed dam is expected to inundate an area of approximately 114 ha with a dam wall of at least 35m to 40m. The total capacity of the dam is

GN	Activity	Description as per GN	Applicability to Project
			approximately 17.8 million cubic meters.
GNR 546	4 (a) (ii)(ee)	The construction of a road wider than 4 metres with a reserve less than 13,5 metres outside urban areas and in- Critical Biodiversity Areas (CBAs)	Possible construction of access roads to dam wall, within CBA 1 areas.
	12 (b)	The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.	Clearance of vegetation within CBA 1 and within endangered KZN Ngongoni Veld and Sandstone Sourveld areas.
	13 (a)	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation,	A portion of the site is located within a CBA area and will involve the removal of more than 1 hectare of vegetation to accommodate the proposed development.
	14 (a)(i)	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation outside urban areas	Construction activities will result in clearance of vegetation in a rural area.
	16 (ii) (a)(ff)	The construction of: (ii) slipways exceeding 10 square metres in size; Outside urban areas within CBAs	Construction of dam within a watercourse within CBA 1 areas.
	19 (a) (ii)(ee)(ii)	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre outside urban areas within CBAs and within 100 metres from the edge of a watercourse	The widening or lengthening of access roads within or close to watercourses and/or within CBA 1 areas.
	26	Phased activities for all activities listed in this Schedule and as it applies to a specific geographical area, which commenced on or after the effective date of this Schedule, where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.	Possible phased activities that may collectively trigger this listed activity.

7.1.4 National Water Act (Act No. 36 of 1998)

The National Water Act (NWA) (Act No. 36 of 1998) regulates the water resource of South Africa. Water is considered a scarce commodity and should therefore be adequately protected. Amongst others, the act deals with the protection of water sources, water uses, water management strategies and catchment management, dam safety and general powers and functions. The purpose of the act is to ensure that South Africa's water resources are protected, used, developed, conserved, managed and controlled. The NWA includes the definition of a Water Resource.

The NWA definition for a Water Resource includes:

1. A Watercourse;
2. Surface Water;
3. An Estuary; and
4. An Aquifer.

The NWA defines a watercourse as follows:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse include, where relevant, its bed and banks.

The Act also specifies that a wetland is defined as land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil. Section 21 of the NWA provides information on what water uses require approval, i.e. a Water Use License Application (WULA). These include:

- a) Taking water from a water resource;
- b) Storing water;
- c) Impeding or diverting the flow of water in a watercourse;
- d) Engaging in a stream flow reduction activity;
- e) Engaging in a controlled activity;
- f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- g) Disposing of waste in a manner which may detrimentally impact on a water resource;
- h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- i) Altering the bed, banks, course or characteristics of a watercourse;
- j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- k) Using water for recreational purposes.

The water uses above that apply to the proposed Mtwalume Dam include 21 a, b, c and i.

7.1.4.1 Section 21 (a)

Consideration of this water use is necessary as abstraction is currently taking place at the existing Vulamehlo Weir. However, the abstraction amount will increase significantly once the

dam has been built. Therefore, the existing WUL for abstraction at the weir needs to be amended to cater for the future demand of 10.53 Ml/d.

7.1.4.2 Section 21 (b)

Consideration of this water use is necessary as construction of the dam requires storage of water.

7.1.4.3 Section 21 (c)

The WULA will need to include the water use in terms of:

(c) Impeding or diverting the flow of water in a watercourse

The definition of impeding is as follows: *“Temporary or permanent obstruction or hindrance to the flow of water into watercourse by structures built either fully or partially in or across a watercourse”*.

The definition of diverting is as follows: *“Temporary or permanent diversion of flow for –*

- a) *Prospecting, mining and quarrying*
- b) *Agriculture*
- c) *Management of waste disposal sites including landfills*
- d) *Construction and maintenance purposes of infrastructure*
- e) *(Obtained from GN No 26187 published in Government Gazette No. 398, dated 26 March 2004)”*

Thus, in simplified terms, this water use entails “causing an obstruction to the flow of water in a watercourse, or diverting some or all of the flow in or from a watercourse”.

7.1.4.4 Section 21 (i)

The WULA will need to include the water use in terms of:

(i) Altering the bed, banks, course or characteristics of a watercourse

Altering the bed, banks, course or characteristics of a watercourse means any changes affecting:

- The morphology and topography (bed, banks, macro-channels) of the watercourse including changes affecting the riparian and instream habitat characteristics; and
- The dynamics of a watercourse including the chemical characteristics, flood dynamics and biotic components (These alterations include changes affecting floodlines and changes in land use, vegetation cover, discharges, soil, sediment, geology, geohydrology and topography).

Further, the current General Authorisation (GA) in terms of Section 39 of the NWA does not apply to the use of water in terms of section 21 (c) and (i) within a 500 metre radius from the boundary of any wetland.

The NWA specifies that for a S21(i) water use the applicant must delineate the watercourse and riparian habitat using the DWS guideline: “A practical field procedure for identification and delineation of wetlands and riparian areas” and indicate the proposed activity location in relation to the riparian area, the 1:50 and 1:100 year floodlines on a map of appropriate scale. Any development within the riparian habitat or 1:100 year floodline (whichever is the greatest distance from the watercourse), will require an authorisation from the DWS. However, the only way to determine the riparian area is through a riparian habitat delineation. Due to the sensitive nature of wetlands, any activity within the 500m buffer of a wetland will also require a WULA.

A Draft Integrated WULA is attached to the report in **Appendix N**, the Final WULA will be submitted to the KZN DWS Regional Office. The watercourses that are affected by the proposed Mtwalume Dam is further discussed in Section 13 and in the Wetland and Aquatic Impact Assessment (**Appendix F2**).

7.1.5 National Environmental Management: Protected Areas Act (Act No. 57 of 2003)

The aim of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) is to provide for the protection and conservation of ecologically viable areas representative of South Africa’s biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special nature reserve world heritage site or nature reserve and also to ensure the use of the natural resources in the area is sustainable.

The proposed development does not occur near any formal Protected Areas according to the South African National Biodiversity Institute (SANBI).

7.1.6 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

The National Environmental Management: Biodiversity Act (NEM:BA) (Act No. 10 of 2004) was promulgated for the management and conservation of South Africa’s biodiversity through the protection of species and ecosystems and the sustainable use of indigenous biological resources.

The main implication of this act is the protection of biodiversity. The potential flora and fauna as well as the terrestrial ecosystem of the proposed site will be discussed further in Section 13 and in the Terrestrial Ecological Impact Assessment (**Appendix F1**).

7.1.7 National Environmental Management: Air Quality Act (Act No. 39 of 2004)

The National Environmental Management: Air Quality Act (NEM:AQA) (Act No. 39 of 2004) provides for the setting of national norms and standards for regulating air quality monitoring, management and control and describes specific air quality measures so as to protect the environment and human health or well-being by:

- Preventing pollution and ecological degradation; and

- Promoting sustainable development through reasonable resource use.

It also includes measures for the control of dust, noise and offensive odours that may be relevant to the construction. No Air Emissions License (AEL) will be required for the proposed Mtwalume Dam as it falls under all thresholds.

7.1.8 The National Environmental Management Waste Act (Act No. 59 of 2008)

The National Environmental Management Waste Act (NEM:WA) (Act No. 59 of 2008) regulates waste management in order to protect the health and environment of South African citizens. This is achieved through pollution prevention, institutional arrangements and planning matters, national norms and standards and the licensing and control of waste management activities.

The latest list of waste management activities that have or are likely to have a detrimental effect (GN No. 921 of 29 November 2013) contains activities listed in Categories A and B that would require licensing from the provincial or national authorities and activities contained in Category C which would require meeting the requirements of various Norms and Standards.

No authorisation will be required in terms of the NEM:WA (Act No. 59 of 2008), as the project will not include any of the listed waste management activities.

The following should be noted with regards to waste management during the construction Phase:

- Temporary waste storage facilities will remain below the thresholds contained in the listed activities of NEM:WA; and
- The EMPr will make suitable provisions for waste management, including the storage, handling and disposal of waste. The EMPr will be used as a guideline for managing and controlling activities that impact adversely on the environment. The following will be implemented to deal with generated waste:
 - a) Control of plant lubricating oil, grease, and petroleum spills: collector trays will be placed underneath all stationery plant/equipment and bunded areas with oil separators will be built around fuel storage areas, workshops, etc. Any inadvertent spills will be cleaned and disposed of in terms of the Act.
 - b) Solid waste: Mobile skips or bins will be located at convenient locations on site including provision of different receptacles for different kinds of solid waste. Periodic collection and disposal to approved landfill sites in the district will be arranged by the contractor. The landfill sites to be used will include Oatland landfill in Hibiscus Coast municipality and/or Umzinto landfill in Umdoni municipality.
 - c) Sanitation: Mobile chemical toilets will be used where people are working and disposed to the designated municipality wastewater works at the agreed intervals.

7.1.9 Health Act (Act No. 63 of 1977)

The Health Act (Act No. 63 of 1977) provides for measures for the promotion of the health of the inhabitants of the Republic; to that end to provide for the rendering of health services; to define the duties, powers and responsibilities of certain authorities which render health services in the Republic; to provide for the co-ordination of such health services; to repeal the Public Health Act of 1919; and to provide for incidental matters.

7.1.10 Occupational Health & Safety Act (Act No. 85 of 1993)

The Occupational Health and Safety Act (Act No. 85 of 1993) provides for the health and safety of people at work as well as the health and safety of persons using plant and machinery.

This act will need to be taken into account should the proposed development be approved.

7.1.11 National Heritage Resources Act (Act No. 25 of 1999)

The National Heritage Resources Act (Act No. 25 of 1999) was promulgated for the protection of National Heritage Resources and the empowerment of civil society to conserve their heritage resources.

The proposed construction of the Mtwalume Dam will trigger certain categories as listed below that require a Heritage Impact Assessment (HIA) in terms of Section 38 of the National Heritage Resources Act. These categories are:

- Any development or other activity which will change the character of a site
 - Exceeding 5 000 m² in extent; or
 - Involving three or more existing erven or subdivisions thereof; or
 - Involving three or more erven or divisions thereof which have been consolidated within the past five years;
 - The costs of which will exceed a sum set in terms of regulations by the South African Heritage Resources Agency (SAHRA) or a provincial heritage resources authority;
- Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

The Act also makes provision for General Protections, which apply automatically to certain categories of heritage resources such as archaeological and paleontological sites, cemeteries and graves, and structures older than 60 years.

Heritage resources in the study area will be discussed further in Section 13 and in the HIA (**Appendix F4**).

7.1.12 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

The Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983) requires the maintenance of riparian vegetation and provides a list of invasive alien vegetation that must be controlled or eradicated.

The proposed development site partly contains agricultural land. The potential impacts of the proposed development will be assessed in the Impact Assessment (Section 14) and the EMPr (**Appendix G**).

7.1.13 National Forests Act (Act No. 84 of 1998)

In terms of the National Forests Act (Act No. 84 of 1998), trees in natural forests or protected tree species (as listed in Government Gazette Notice 1012 of 27 August 2004) may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the DAFF.

This Act has considered in the Terrestrial Ecological Impact Assessment (**Appendix F1**) in terms of the occurrence of any Protected Trees on the proposed site.

7.1.14 Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)

The Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) sets out the requirements with which applicants for prospecting rights, mining rights and mining permits must comply in Sections 16, 22 and 27 of the MPRDA. In terms of Section 27 of the MPRDA, as amended, a mining permit applies when the mineral in question can be mined in 2 years and the area does not exceed 5 hectares. For larger areas a mining right will need to be applied for (Section 22 of MRPDA).

Borrow areas have been identified to source construction material for the project. Under Section 106(1) of the MPRDA, Ugu DM is exempt from the provisions of Sections 16, 20, 22 and 27 "in respect of any activity to remove any mineral for road construction, building of dams or other purpose which may be identified in such notice". According to the MPRD Amendment Act (Act No. 49 of 2008), Section 106(2) states that "*Despite subsection (1), the organ of state so exempted must submit relevant environmental reports required in terms of Chapter 5 of the National Environmental Management Act, 1998, to obtain an environmental authorisation.*" The new EIA Regulations of 2014 include a number of provisions in terms of the transition of the environmental regulation of mining from the MPRDA to NEMA and the introduction of the One Environmental System (National Environmental Management Laws Third Amendment Bill, 2013). Amongst others, this is facilitated by the inclusion of mining activities under the 2014 Listing Notices. Approval will be sought from DMR for the relevant activities associated with the borrow areas (i.e. GN No. R. 983 Activities 21 and 22; GN No. R. 984 Activities 17, 18, 19 and 21).

A Mining Permit will be applied for once Environmental Authorisation is received and approved the Dam Site is confirmed.

7.1.15 Spatial Planning and Land Use Management Act (Act No. 16 of 2013)

The powers of traditional councils in relation to planning and land use are governed by regulation 19(1) and (2) of the Spatial Planning and Land Use Management Act (Act No. 16 of 2013) Regulations. These provisions provide that a municipality can conclude an agreement with a traditional council which would allow a traditional council to take over some of the land planning and land use powers and functions that are vested in the municipality (as long as the traditional council is not empowered to make a decision in relation to land planning and land use). In cases where the municipality does not conclude this type of agreement with a traditional council, the traditional council would be required to provide proof of land allocation in terms of customary law.

7.1.16 Kwazulu-Natal Planning and Development Act (Act No. 06 of 2008)

The proposed project is situated within the area of jurisdiction of the Harry Gwala DM and the Ubuhlebezwe LM, therefore approval is required from the Municipality for the development in terms of the provisions of the KZN Planning Development Act (PDA).

Section 38(1) of Chapter 4, Section 21(1) of Chapter 3, and Section 60(1) of Chapter 6 of the Act requires that an application be made to the Municipality, seeking approval for any subdivisions of land that may be required and for any restrictions on the land that may be changed. Proof of this will be submitted in the EIA phase of the environmental authorisation process.

7.1.17 KwaZulu-Natal Nature Conservation Management Act (Act No. 09 of 1997)

The KZN Conservation Management Act (Act No. 9 of 1997) provides for the establishment of the KZN Conservation and prescribes its powers, duties and functions which include:

- Direct Nature conservation management; and
- Direct Protected areas management.

This is currently carried out by EKZNW.

7.2 Guidelines

- Integrated Environmental Management Information Series, in particular Series 2 – Scoping (DEAT, 2002);
- Guideline on Alternatives, EIA Guideline and Information Document Series (DEA&DP, 2010a);
- Guideline on Need and Desirability, EIA Guideline and Information Document Series (DEA&DP, 2010b);

- Integrated Environmental Management Guideline Series 5: Companion to the EIA Regulations 2010 (DEA, 2010a);
- Integrated Environmental Management Guideline Series 7: Public Participation in the EIA Process (DEA, 2010b); and
- Guidelines for Involving Specialists in the EIA Processes Series (Brownlie, 2005).

7.3 Regional Plans

The following regional plans were considered during the execution of the EIA (amongst others):

- Municipal Spatial Development Frameworks (SDF) (where available);
- Municipal Integrated Development Plans (IDP); and
- Relevant provincial, district and local policies, strategies, plans and programmes.

8 SCOPING AND EIA PROCESS

8.1 EIA Listed Activities (18 June 2010)

The proposed Mtwalume Dam entails certain activities that require authorisation in terms of NEMA. Refer to Section 7 for further discussion on the legal framework.

The process for seeking authorisation is undertaken in accordance with the EIA Regulations (GN No. R. 543, R. 544, R. 545 and R. 546 of 18 June 2010), promulgated in terms of Chapter 5 of NEMA. Subsequently, the 2010 EIA Regulations were amended in 2014; however, the Mtwalume Dam Application is in line with the 2010 EIA Regulations.

Based on the types of activities involved which include activities listed in GN No. R. 544, R. 545 and R. 546 of 18 June 2010 (see **Table 8**); the requisite environmental assessment for the project is a Scoping and EIA process.

8.2 Competent Authority

In terms of the Regulations, the lead decision-making authority for the environmental assessment is the KZN DEDTEA as the project proponent is the Ugu DM.

8.3 Application Form

An Application Form for Scoping and EIA, in terms of Regulation 26 of GN No. R. 543 of 18 June 2010, was submitted to KZN DEDTEA on 22 August 2014. Acknowledgement and Acceptance of the Application was received on 08 September 2014 with the following reference number allocated to the project: DC43/0020/2014. The Application Form has been amended to include the updated Listed Activities to be applied for (as some activities have fallen away over the EIA process) and this Amended Application Form will be submitted to the KZN DEDTEA with the submission of the Draft EIA report (also available in **Appendix L**).

8.4 Formal Process

The environmental assessment process is divided into two phases, namely: 1) Scoping and 2) EIA. An outline of the Scoping and EIA process for the proposed Mtwalume Dam is provided in **Figure 10**.

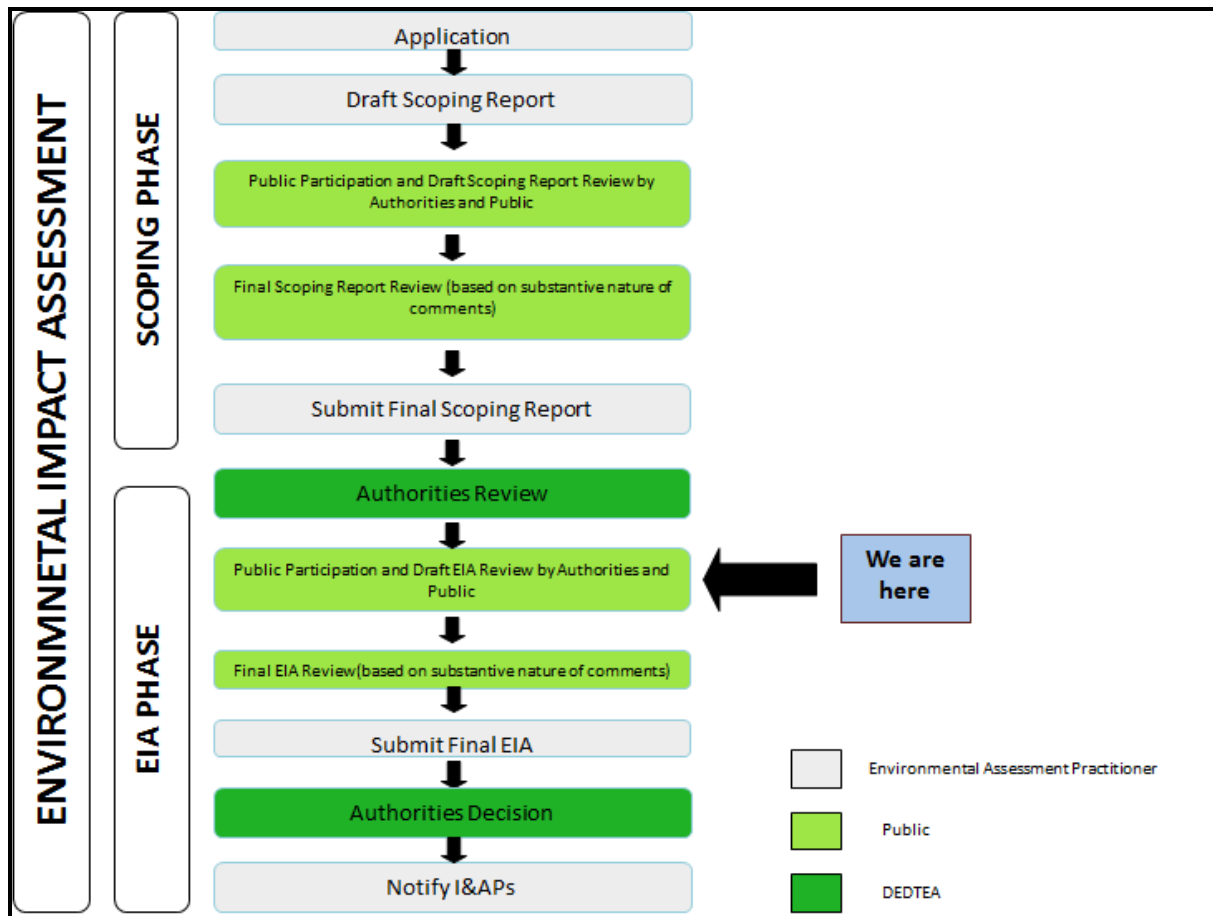


Figure 10: Scoping and EIA Process

8.5 Scoping Phase

The purpose of Scoping, which concluded the first phase of the formal EIA process, was as follows:

1. Introduce the proposed project to all IAPs;
2. Engage with IAPs to allow for participation in the process that is transparent, cooperative, informative and robust. Allow for informed decision-making with regard to the EIA process;
3. Identify the significant issues and impacts to be investigated further during the execution of the EIA phase;
4. Consider suitable and feasible alternatives for achieving the project's objectives; and
5. Determine the scope of the ensuing EIA phase in terms of specialist studies, public participation, assessment of impacts and appraisal of alternatives.

The following milestones have been reached for the Scoping Phase:

- An Application Form for Scoping and EIA, in terms of Regulation 26 of GN No. R. 543 of 18 June 2010, was submitted to KZN DEDTEA on 22 August 2014. Acknowledgement and Acceptance of the Application was received on 08 September 2014 with the following reference number allocated to the project: DC43/0020/2014;
- The public were notified about the project in January and February 2015;
- Several Focus Group Meetings were held;
- A Draft Scoping Report, which conformed to regulation 28 of GN No. R. 543 (18 June 2010), was compiled. This document included the following salient information (amongst others):
 - a) A Scoping-level impact assessment to identify potentially significant environmental issues for detailed assessment during the EIA phase;
 - b) Screening and investigation of feasible alternatives to the project for further appraisal during the EIA phase; and
 - c) A Plan of Study, which explains the approach to be adopted to conduct the EIA for the proposed Mtwalume Dam. This included inter alia the Terms of Reference for the identified Specialist Studies;
- Notification of the review period for the Draft Scoping Report was undertaken in October 2015. The Draft Scoping Report was lodged for a 30-Day public review (21 October 2015 to 19 November 2015) and for a 40-Day authority review (21 October 2015 to 30 November 2015);
- A Public Meeting was held on 12 November 2015 to present the Draft Scoping Report.
- An Environmental Authorities Meeting was also held on 12 November 2015 to provide an overview of the Draft Scoping Report;
- A Comments and Response Report was compiled (which was updated during the execution of the Scoping process), which summarised the issues raised by IAPs and the project team's response to these matters;
- KZN DEDTEA approved the Scoping Report on 16 February 2016 (**Appendix A**), which allowed the commencement of the EIA phase;
- Notification of the review period for the Final Scoping Report was undertaken December 2015. The Final Scoping Report was lodged for a 21-Day review period (11 December 2015 to 26 January 2016);
- The Final Scoping Report was submitted to KZN DEDTEA on 11 December 2015; and
- Notification of IAPs of the approval of the Scoping Report and the review of the Draft EIA Report will be undertaken as a combined exercise in May 2016.

8.6 EIA Phase

The EIA phase, which constitutes the second phase of the formal EIA process, serves to follow from the Scoping phase and will provide the following:

- A detailed description of the proposed development and location;
- A description of the environment that may be affected by the activity and the manner in which physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed development;
- The methodology of the stakeholder engagement process will be described;
- The Comments and Responses Report and Stakeholder Database will be provided as an appendix to the EIA Report;
- A description of the need and desirability of the proposed development and the identified potential alternatives to the proposed activity;
- A summary of the methodology used in determining the significance of potential impacts;
- A description and comparative assessment of the project alternatives;
- A summary of the findings of the specialist studies (Copies of all specialist reports appended to the EIA report);
- A detailed assessment of all identified potential impacts;
- A list of the assumptions, uncertainties and gaps in knowledge;
- An opinion by the consultant as to whether the development is suitable for approval within the proposed site;
- An EMP that complies with 31(2)(p) of GN No. R 543 and Appendix 4 of GN No. R. 982; and
- Any further information that will assist in decision making by the authorities.

8.6.1 Alignment with the Plan of Study

The Plan of Study, which was contained in the Scoping Report and was approved by KZN DEDTEA, explained the approach to be adopted to conduct the EIA for the proposed project. The manner in which the EIA Report addresses the requirements of the Plan of Study is shown in **Table 9**.

Table 9: Alignment of EIA Report with Plan of Study

Plan of Study Requirement	EIA Report Reference
Assess pertinent environmental issues identified during Scoping through: 1) Applying an appropriate impact assessment methodology; 2) Conducting specialist studies; 3) Obtaining technical input; and 4) Identifying suitable mitigation measures.	<ul style="list-style-type: none"> • Section 12; and • Section 13
Assessment of feasible alternatives.	<ul style="list-style-type: none"> • Section 15
Specialist studies to be completed in accordance with Terms of Reference.	<ul style="list-style-type: none"> • Section 13; and • Appendix F
Public participation to include the following:	<ul style="list-style-type: none"> • Section 16

Plan of Study Requirement	EIA Report Reference
<ul style="list-style-type: none"> • Update the IAP Database; • Notification – Approval of Scoping Report; • Convene Public Meeting; • Compile and maintain a Comments and Response Report; • Allow for the review of the Draft EIA Report; and • Notification of DEDTEA Decision. 	
EIA Report to satisfy the minimum requirements stipulated in Appendix 3 of GN No. R. 982 (4 December 2014).	<ul style="list-style-type: none"> • Section 1
Authority Consultation.	<ul style="list-style-type: none"> • Section 16

8.6.2 Screening of Alternatives

Various options to meeting the project’s objectives were considered during the Pre-Feasibility Study, which eventually lead to the identification of alternatives that were investigated as part of the EIA. Refer to further discussion on screened alternatives under Section 11. The “no go” option is also evaluated to understand the implications of the project not proceeding.

The feasible options are taken forward in the impact prediction (see Section 14), where the potential positive and adverse effects to the environmental features and attributes are examined further.

A comparative analysis of the alternatives from environmental (including specialist input) and technical perspectives is provided in Section 15. This includes a systematic comparison of the implications of the project options to enable the selection of a Best Practicable Environmental Option (BPEO).

8.6.3 Impact Prediction

The potential environmental impacts associated with the proposed project were identified through an appraisal of the following:

- Proposed locations and footprint of the project infrastructure and components, which included a desktop evaluation with a Geographical Information System (GIS) and aerial photography, as well as site investigations;
- Project infrastructure and design considerations;
- Activities associated with the project life-cycle (i.e. pre-construction, construction, operation and decommissioning);
- Nature and profile of the receiving environment and potential sensitive environmental features and attributes;
- Input received during public participation from IAPs;
- Findings of specialist studies;
- Legal and policy context; and
- Cumulative impacts.

The Scoping exercise aimed to identify significant environmental impacts for further consideration and prioritisation during the EIA stage. Note that “significant impacts” relate to whether the effect (i.e. change to the environmental feature / attribute) is of sufficient importance that it ought to be considered and have an influence on decision-making. During Scoping the impact prediction was executed on a qualitative level, where the main impacts were distilled by considering factors such as the nature, extent, magnitude, duration, probability and significance of the impacts.

During the EIA stage a detailed assessment is conducted to identify all impacts, which are evaluated via contributions from IAPs, the project team and requisite Specialist Studies, and through the application of the impact assessment methodology contained in Section 14.1.6. Suitable mitigation measures are proposed to manage (i.e. prevent, reduce, rehabilitate and/or compensate) the environmental impacts, and are included in the EMPr (**Appendix G**).

9 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations apply to this EIA process:

- The GIS versions of data available for the public are assumed to be the latest information provided by the Departments (such as EKZNW and SANBI).
- As the design of the project components is still in the preliminary design stage, and due to the dynamic nature of the planning environment, the dimensions and layout of the infrastructure may change as the technical study advances;
- This Scoping and EIA is confined to the scope of works inside the proposed site boundary (Dam basin, dam wall and construction footprint for associated infrastructure). The impacts from any work related to the proposed development outside of the site boundary is not included in this EIA.
- Regardless of the analytical and predictive method employed to determine the potential impacts associated with the project, the impacts are only predicted on a probability basis. The accuracy of the predictions is largely dependent on the availability of environmental data and the degree of understanding of the environmental features and their related attributes.
- The Terrestrial Ecological Impact Assessment noted the following limitations (Nemai Consulting, 2016b):
 - The majority of threatened plant species are seasonal and only flower during specific periods of the year and so desktop surveys were used to provide additional information based on the current state of the receiving environment.
 - Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage and Nemai Consulting can thus not accept responsibility for conclusions and mitigation measures made in good faith based information gathered or databases consulted at the time of the investigation.
- The Wetland and Aquatic Impact Assessment noted the following assumptions and limitations (SDP, 2015):
 - The report focusses on the proposed dam sites and associated construction footprint, the Mtwalume River and riparian area specifically. The associated bulk supply infrastructure was not considered.
 - The nature of the study was to be of a level of detail that would satisfy the requirements of both the environmental approval process and by extension, any requirements for a Water Use License, which will be required by the Department of Water and Sanitation (DWS).

- Although detailed, this report must be considered as a rapid appraisal or “snap shot” of current aquatic and wetland ecological conditions and cannot be considered a complete PES (Present Ecological Status) /Ecstatus report. The findings represent those undertaken in a winter period, under drought conditions, with no comparative data for high precipitation periods and other seasons. Aquatic systems in particular, are dynamic and respond to seasonal changes and unseasonal events such as floods or pollution. Ideally a long term sampling regimen is needed to accurately determine the PES of a river system.
- The Socio-Economic Impact Assessment noted the following limitations (Nemai Consulting, 2016a):
 - It is assumed that information obtained during the scoping phase provide an honest account of the community and community relationship to the dam. It must be noted, however, that comments are not statistically representative.
 - The SEIA was commissioned as a desktop study only. Thus no site visit was conducted and the study relied heavily on records such as photographs generated by the Ecological Assessment Report.
 - The study was done with the information available to the specialist at the time of executing the study, within the available timeframes and budget. The sources consulted are not exhaustive, and additional information which might strengthen arguments, contradict information in this report and/or identify additional information might exist. However, the specialist did endeavour to take an evidence-based approach in the compilation of this report and did not intentionally exclude information relevant to the assessment.
 - The SEIA was compiled before the results of the feasibility were available. Information relating the economic cost and benefit of the project (including employment figures) which was not sufficiently covered in the pre-feasibility stage of the report, and thus are included in this report.

10 NEED AND DESIRABILITY

In terms of Regulation 31(2)(f) of GN No. R. 543 (18 June 2010) and Appendix 2 of GN No. R. 982 of 04 December 2014, this section discusses the need and desirability of the project. The format contained in the Guideline on Need and Desirability (DEA&DP, 2009) has been used in **Table 10**.

Table 10: Need and Desirability of the Mtwalume Dam

No.	Question	Response
Need (Timing)		
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority? (i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP).	Yes, it is part of the mandate of the Ugu DM as Water Service Authority (WSA) and Water Service Provider (WSP) to provide water to communities within its ambit. The Water Services Development Plan (WSDP) for the Harry Gwala DM has undergone an extensive scan of all current and planned rural water schemes in the rural settlements and Ingonyama areas of Harry Gwala DM (Harry Gwala SDF, 2014). The Ugu DM is responsible for the Vulamehlo LM and thus is responsible for the proposed dam because the dam forms part of the Vulamehlo Water Scheme, even though the proposed dam sites fall within the Ubuhlebezwe LM. One of the key programmes identified in the Ugu DM IDP (2014-2015) is the development of water resources (dams).
2.	Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?	Yes. All relevant applications will be submitted to the Municipality.
3.	Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate)	The surrounding rural communities need the project (including the dam) in order for them to receive safe and reliable water supply (Ugu DM SDF, 2011).
4.	Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	The Ugu DM will provide the relevant services such as electricity for the upgraded WTP. A letter of confirmation for the provision of services will be obtained and included in the EIA phase.

No.	Question	Response
5.	Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services)?	Yes. Infrastructure for water service provision includes dams (Harry Gwala DM SDF, 2014).
6.	Is this project part of a national programme to address an issue of national concern or importance?	Yes, there is an urgent need to provide basic services to communities within South Africa.
Desirability (Placing)		
7.	Is the development the best practicable environmental option (BPEO) for this land/site?	Yes. The Harry Gwala DM SDF (2014) intends to provide water supply to the rural communities and especially Ingonyama areas therefore the proposed site is applicable as it occurs near the Mtwalume River and Vulamehlo WTP.
8.	Would the approval of this application compromise the integrity of the existing approved municipal IDP and Spatial Development Framework (SDF) as agreed to by the relevant authorities?	No.
9.	Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?	No. The KZN Biodiversity Plan identifies Critical Biodiversity Areas (CBAs) that are critical for conserving biodiversity and maintaining ecosystem functioning in the province, and provides land use guidelines. The compatibility of the project with the KZN Biodiversity Plan and any other environmental management and planning tools will be considered during the EIA phase.
10.	Do location factors favour this land use (associated with the activity applied for) at this place? (this relates to the contextualisation of the proposed land use on this site within its broader context).	Yes, the proposed dam sites that will be assessed are situated in an area that is in close proximity to the existing WTP. This is important as the water from the dam will be treated by the WTP before distribution to consumers.
11.	How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?	Refer to Section 14 for an assessment of the project's potential impacts.
12.	How will the development impact on people's health and wellbeing (e.g. i.t.o. noise, odours, visual character and sense of place, etc)?	Refer to Section 14 for an assessment of the project's potential impacts.
13.	Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	Opportunity costs, which are associated with the net benefits for the development, will be considered in the Socio-Economic Study. The affected land is rural in nature and primarily used for agricultural purposes.

No.	Question	Response
14.	Will the proposed land use result in unacceptable cumulative impacts?	Cumulative impacts are assessed in Section 14.19.

11 ALTERNATIVES

The 2010 and 2014 EIA regulations require that feasible project specific alternatives are identified (including the “do nothing” option). The Regulations define alternatives as the following:

“Different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

- *property on which or location where the activity is proposed to be undertaken;*
- *type of activity to be undertaken;*
- *design or layout of the activity;*
- *technology to be used in the activity; or*
- *operational aspects of the activity; and*
- *the option of not implementing the activity.”*

The sub-sections to follow discuss the project alternatives considered during the Scoping process. The EIA process will provide a detailed comparative analysis of feasible alternatives from environmental (including specialist input) and technical perspectives.

By conducting the comparative analysis, the BPEO can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that *“provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term”*.

In terms of the 2010 EIA regulations under NEMA, the cardinal activity of the Scoping exercise is the consideration of viable and reasonable alternative sites, processes, and technologies of achieving the objectives of the project. The aim of this comparative environmental analysis is to make the necessary environmental input in the decision making processes in selecting a site that is environmental sustainable, socially acceptable, and economically viable for the location of the dam. In the Pre-Feasibility phase, six potential dam sites were identified upstream of the existing Vulamehlo WTP abstraction site based on an assessment of the river channel gradient. Relatively long reaches with flat longitudinal sections of the river were identified as suitable dam sites.

11.1 Screening of Alternatives

Each of these sites underwent an environmental scoping exercise as well as a high level geotechnical screening. The purpose of the exercise was to determine if any of the sites

contained fatal flaws, and which of the sites would be the most favourable from both a geotechnical and environmental perspective.

Sites which were found to be environmentally sensitive, or contained poor founding conditions during the scoping exercise and the visual geotechnical assessment, were then discarded from the initial assessment phase (**Figure 11**). The Pre-Feasibility Study (ZIYANDA Consulting, 2014) and Comparative Environmental Analysis of the six dam wall positions (Nature and Development Group of Africa, 2013) is summarised below.

At business plan stage, it was proposed to construct a 15m high concrete dam wall on the Mtwalume River by raising the existing Vulamehlo weir. The dam originally was envisaged to store approximately 3.6 million m³ of raw water to provide a higher raw water supply level of assurance to the Vulamehlo Bulk Water Supply Scheme. However, once the yield analysis had been completed, it became clear that the available water resources of the catchment are constrained and a minimum dam wall height of 35m to 40m was required to cater for the current and future demands.



Figure 11: Potential Dam Sites

11.1.1 Geotechnical Assessment Findings

A visual feasibility assessment of the six proposed dam site and basin areas in order to determine the geotechnical suitability of each site as a potential storage dam was undertaken and the results are tabulated below.

Table 11: Geotechnical assessment of the six potential dam sites

Dam Site	Geotech Reconnaissance Site Appraisal
1	Founding conditions not suitable for concrete dam
2	No apparent flaws
3	No apparent flaws
4	Most suitable site based on anticipated geotechnical properties
5	Most suitable site based on anticipated geotechnical properties
6	Too much loose material

Dam Site 1 has been eliminated as a potential site as the residual soils and completely/highly weathered Granite Gneiss beneath the southern flank are not suitable founding material for a dam.

Similarly, Dam Site 6 contains highly jointed hard rock Granite Gneiss which forms the northern abutment of the proposed location. Open jointing is apparent in the bedrock and extensive grouting would be required to prevent large water losses through this section of the proposed structure.

Slightly weathered to unweathered Granite Gneiss bedrock occurs at river base level at both Dam Sites 2 and 3. Hard rock bedrock is similarly exposed within the northern embankments of both sites while highly to completely weathered Granite Gneiss occurs beneath the southern flanks. It is likely that the intact hard bedrock encountered at river bed level will extend beneath the southern flank at a similar elevation to that found at both locations in the river.

Dam Sites 4 and 5 are the most suitable sites based on their anticipated geotechnical properties. Dam Site 4 contains intact Granite Gneiss of the Oribi Gorge Suite which occurs at river bed level. Hard rock Granite Gneiss is exposed in the slope of the southern bank of the river to a height of approximately 5m at Dam Site 4, and bedrock is inferred at a relatively shallow depth beneath colluvial and residual granular soils high on the slope.

11.1.2 Environmental Screening Findings

The cumulative biodiversity impacts for each proposed dam site is summarised in **Table 12** below. It is clear from this table that Sites 5 and 6 have the highest potential impact on the total loss of biodiversity, while Sites 1 and 2 have the least potential impacts.

Table 12: Comparative extent of inundation and loss of biodiversity

Dam Site	Irreplaceability Status (Ha)	Minset (Ha)	Vulnerable vegetation (Ha)	Endangered Vegetation (Ha)	Total Loss of Biodiversity (Ha)
1	15.63	6.63	104.66	0	126.89
2	15.63	6.63	90.88	0	113.14
3	20.89	12.00	109.61	0	142.50
4	29.00	35.37	104.01	0.75	169.13
5	63.69	45.96	143.07	1.57	254.29
6	63.69	45.96	134.66	1.58	245.89

The comparative irreplaceability effects on biodiversity in the feasibility assessment provided an idea of how readily biodiversity could be replaced should some vegetation areas be inundated by the construction of a storage dam. According to **Table 12**, the dam sites that have the highest impact on irreplaceable biodiversity are alternatives 5 and 6, both of which are likely to irreversibly inundate approximately 64 ha each of irreplaceable biodiversity in the area. The alternative with the least impacts on irreplaceability are dam wall Sites 1 and 2.

According to **Table 12**, the potential Dam Sites which have the highest impact on the Minset are alternatives 5 and 6, both of which are likely to irreversibly inundate and lead to the loss of approximately 46 ha each of sets of biodiversity which would otherwise have contributed to meeting the biodiversity targets in this area. The Dam Site alternatives with the least impacts on the Minset are Dam Sites 1, 2 and 3.

Vegetation of the area potentially inundated by the dam falls within one vegetation zone referred to as Ngongoni veld. This vegetation type is described as endemic which implies that more than 70% of the vegetation occurs in KZN only. Furthermore, poor land uses and large scale transformation has significantly reduced Ngongoni veld especially within the coastal regions of KZN. Approximately 50.2% of the Ngongoni veld has been completely transformed or degraded – a condition which is ascribed an ecological definition of ‘endangered’

Dam Sites 4, 5 and 6 all contain the endangered vegetation type, with areas of the endangered Ngongoni veld varying from 0.75 ha (Site 4) to 1.58 ha (Site 6), while the extent of potential inundation of endangered vegetation for Dam Sites 1, 2 and 3 is 0 ha.

Other aspects investigated by the feasibility study included:

- An assessment of the potential storage capacity of each site where stage capacity and stage area curves were produced for each dam site which showed that the Site 5 had the best depth-storage whereas Site 2 had the worst.
- It was established that the Present Ecological Situation (PES) for quaternary catchment U80E was a Class C (moderately modified) and the PES for quaternary

catchment U80F (immediately downstream of U80E) was a Class B (largely natural). The ecological importance and sensitivity of all three rivers were therefore considered to be very high and have been given a Class B Recommended Ecological Category (REC).

- Modelling was undertaken to determine, amongst others, the water resources yield as well as the ecological water requirements.

The following conclusions were made:

- Site 1 was discarded due to existing sub-standard founding conditions;
- Site 2 was determined to be the least environmentally sensitive out of the 6 proposed sites and the geotechnical conditions were deemed suitable. However, this alternative had the worst stage-capacity curve and was therefore discarded;
- Site 3 is preferred as it is the least environmentally sensitive and the geotechnical conditions are favourable for the construction of a concrete dam wall;
- Site 4 was discarded as the alternative had the second to worst stage-capacity curve. This site was also assessed as being fairly environmentally sensitive due to the presence of endangered Ngongoni veld;
- Site 5 was also the preferred option as the location of the dam contains the best founding conditions and the best stage-capacity curve. However, this site is environmentally sensitive due to the presence of endangered Ngongoni veld; and
- Site 6 was discarded due to existing substandard founding conditions and large quantities of loose material.

11.2 Dam Site Alternatives

The conclusion was that Dam Site 3 and Dam Site 5 were the preferred location options for the construction of the Mtwalume Dam.

The proposed co-ordinates of the centre of the dam walls are as follows:

Site 3	Site 5
30° 19'26.16" S; 30° 19' 25.52" E	30° 19'00.16" S; 30° 18'00.89" E

The report then went on to assess both dam sites in terms of Historical Firm Yield (in Mm³), Levels of Assurance Yield, silt and dead storage characteristics, flood hydrology as well as the cost implications of each of the proposed sites.

11.2.1 Dam Site 3

The Dam Site 3 (**Figure 12**) consists of the following:

- Dam Wall: The centerline for the proposed dam wall for Dam Site 3 (30°19'26.16" S; 30°19' 25.52" E) is located approximately 1km upstream of the existing Vulamehlo

Weir where the river flows through a relatively narrow valley section. The dam wall is proposed to be 40m in height. The valve chamber and intake tower as well as bridges for these structures will be constructed at the dam wall.

- **Dam Basin:** The dam basin is approximately 260m wide upstream of the proposed centerline. The width remains relatively constant up to the bend in the river where it decreases in width to 230m some 650m upstream of the bend before reducing gradually to the head waters roughly 4300m upstream of the centerline. The total area to be inundated is 117 ha.
- **Associated Infrastructure:** The following structures are to be constructed for temporary use during construction, except for structures where specified, and all structures occur within the proposed construction footprint for the associated infrastructure (represented by the red line in **Figure 13**):
 - Potable Water Pipeline (will be permanent);
 - Concrete Access Road (will be permanent);
 - Water Storage Tank;
 - Mixing & Concrete Batching Plant for Storage of Concrete Materials;
 - Site Camp; and
 - Site Office.

11.2.2 Dam Site 5

Since the Scoping Phase, further detailed geotechnical assessments confirmed the final location of the proposed dam wall for Dam Site 5 and area of the dam basin to be inundated. The Dam Site 5 (**Figure 14**) consists of the following:

- **Dam Wall:** The centerline for the proposed dam wall for Dam Site 5 (30°19'00.16" S; 30°18'00.89" E) is located approximately 5.1km upstream of the existing Vulamehlo Weir where the river flows through a relatively narrow valley section. The dam wall is proposed to be 40m in height. The valve chamber and intake tower as well as bridges for these structures will be constructed at the dam wall.
- **Dam Basin:** The total area to be inundated is 114 ha.
- **Associated Infrastructure:** The following structures are to be constructed for temporary use during construction, except for structures where specified, and all structures occur within the proposed construction footprint for the associated infrastructure (represented by the green line in **Figure 14**):
 - Gravel Road (will be permanent);
 - Potable Water Pipeline (will be permanent);
 - Culvert River Crossing (will be permanent);
 - Concrete Access Road (will be permanent);
 - Water Storage Tank;
 - Mixing & Concrete Batching Plant for Storage of Concrete Materials;

- Site Camp; and
- Site Office.

11.3 No-go alternative

The 'no-go' alternative refers to a situation where the proposed Mtwalume Dam is not built. This would mean that the area where the two dam sites are proposed to be located would not change in any way and that the environmental conditions within the river valley would generally stay the same.

It would also mean that the ability of the Ugu DM to provide water to residents and communities would be compromised as this is based on the construction of a dam to provide a consistent water supply to the Vulamehlo WTP in order to provide potable water to consumers.

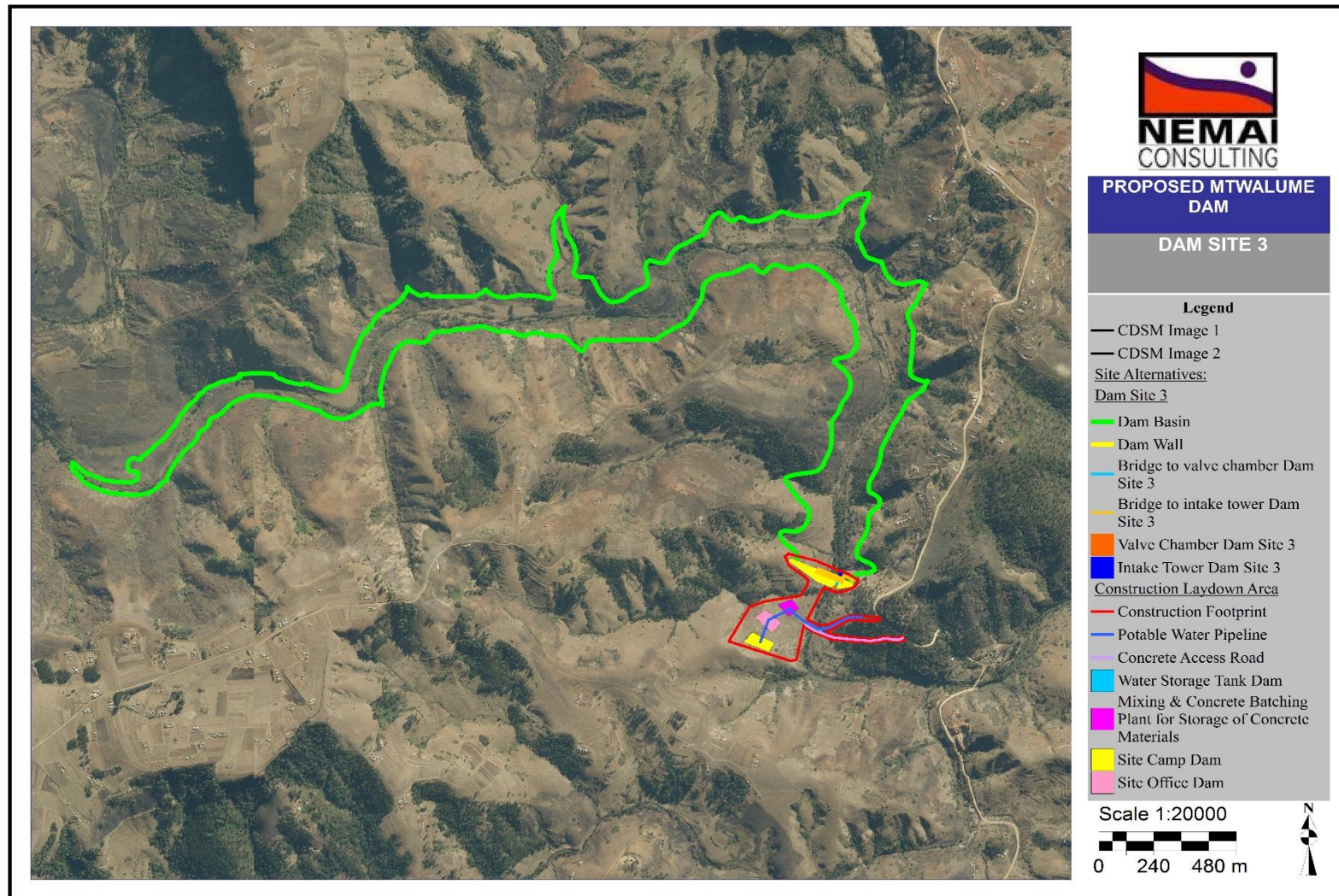


Figure 12: Layout Option Dam Site 3

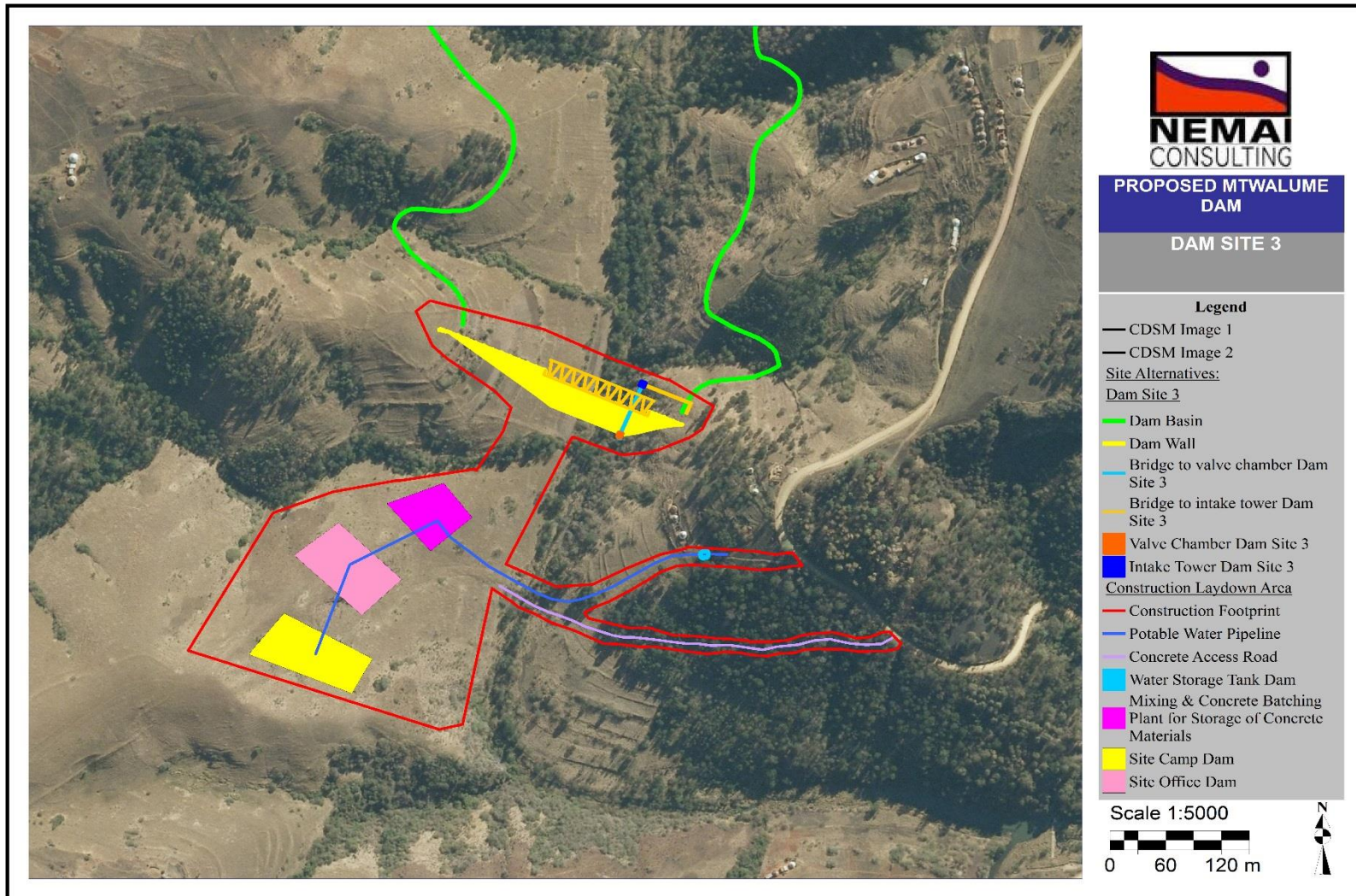


Figure 13: Layout Option Dam Site 3 (Zoomed in on Construction Laydown Area)

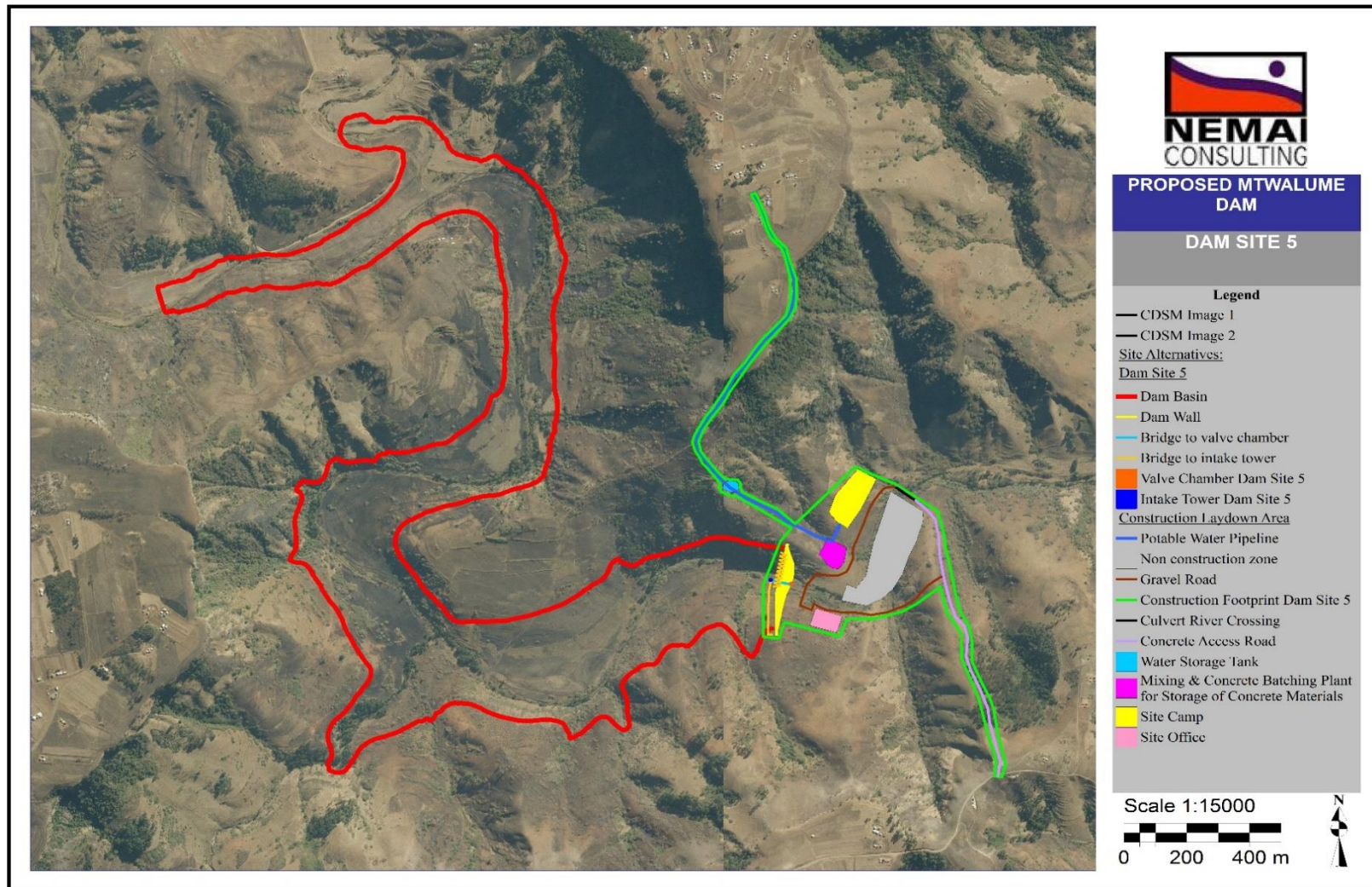


Figure 14: Layout Option Dam Site 5

12 PROFILE OF THE RECEIVING ENVIRONMENT

This section provides a general description of the status quo of the receiving environment in the project area. This serves to provide the context within which the EIA was conducted. It also allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed Mtwalume Dam.

The study area includes the entire footprint of the project components within the identified site boundary (dam basin, dam wall and construction footprint for the associated infrastructure). Where necessary, the regional context of the environmental features is also explained, with an ensuing focus on the local surrounding environment. Refer to Section 13 for more elaborate explanations of the Specialist Studies and their findings for specific environmental features.

This section allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed project. The potential impacts to the receiving environment are discussed further in Section 14.

The following environmental features have been considered:

20. Climate
21. Geology
22. Geohydrology
23. Topography
24. Surface Water
25. Flora
26. Fauna
27. Land Capability
28. Land Use
29. Heritage
30. Air Quality
31. Noise
32. Planning
33. Infrastructure
34. Availability of Services
35. Access Roads
36. Waste Management
37. Visual Aesthetics
38. Socio-Economic Environment

12.1 Climate

12.1.1 Temperature

The climate of Harry Gwala DM is influenced by the cool Drakensberg Mountains to the west. Temperatures vary with altitude, so there is a range of temperatures from warm and humid conditions at sea level, contrasting with very hot and often dry in the bushveld, to very cold at 2000-3000 m above sea level in the Drakensberg.

The meteorological conditions at the South African Weather Service’s monitoring stations on the coast at Port Shepstone and at Paddock, some 16km inland of Port Shepstone, are representative of Ugu DM coastal and inland regions respectively. The mean daily temperature at Port Shepstone is 20.3 °C, ranging from an average minimum of 16.9 °C to an average maximum of 23.7 °C while mean daily temperature at Paddock is cooler than Port Shepstone at 18.1 °C, ranging from an average minimum of 13.7 °C to an average maximum of 22.6 °C (SAWS, 1998) (**Figure 15**).

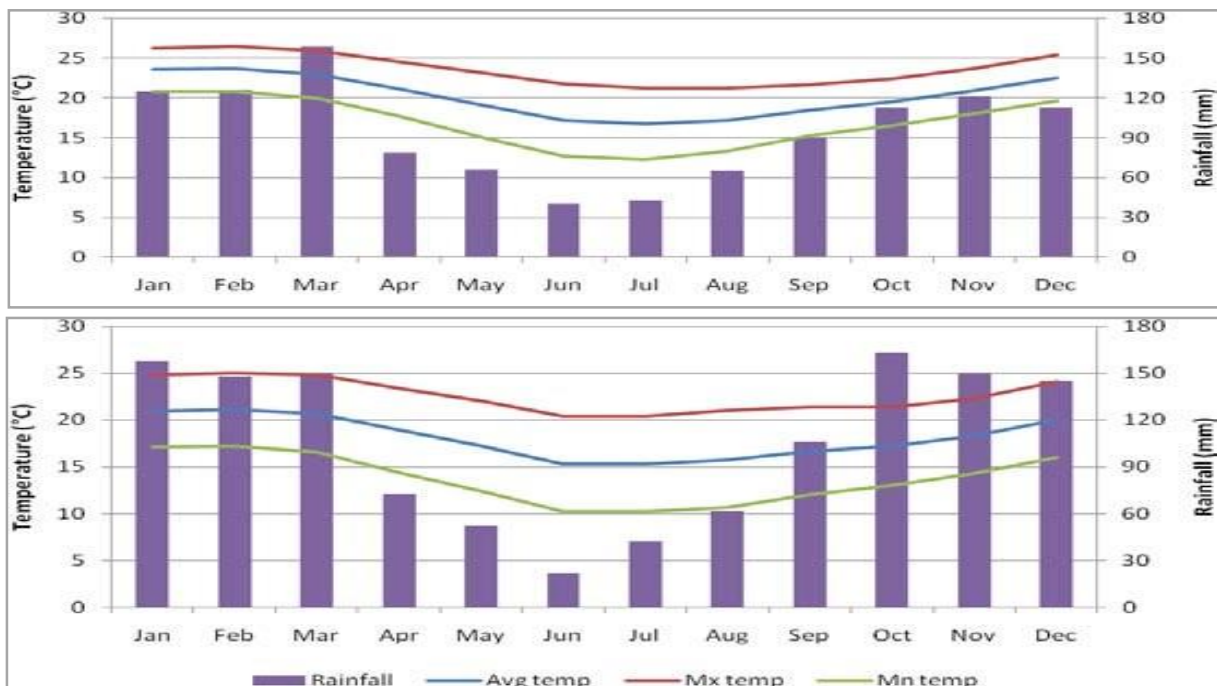


Figure 15: Monthly average maximum, minimum and mean temperatures (°C) and monthly rainfall (mm) at Port Shepstone (top) and Paddock (bottom)

12.1.2 Wind

Wind patterns in Harry Gwala DM are described by windroses at Sezela (Port Shepstone) and Paddock respectively (**Figure 16**). Windroses depict the frequency of occurrence of hourly winds wind from the 16 cardinal wind directions and in different wind speed classes.

The predominant winds are associated with the eastward ridging on the high pressure system, with coastal lows and the passage of frontal systems. These synoptic scale winds are generally aligned with the coastline and at Sezela winds occur predominantly in the sector north to northeast (about 30%) and in the sector southwest to west-southwest (about 20%). The strongest winds (> 8.5 m/s) are from the northeast. Light off-shore north to north-westerly land breezes occur in the winter.

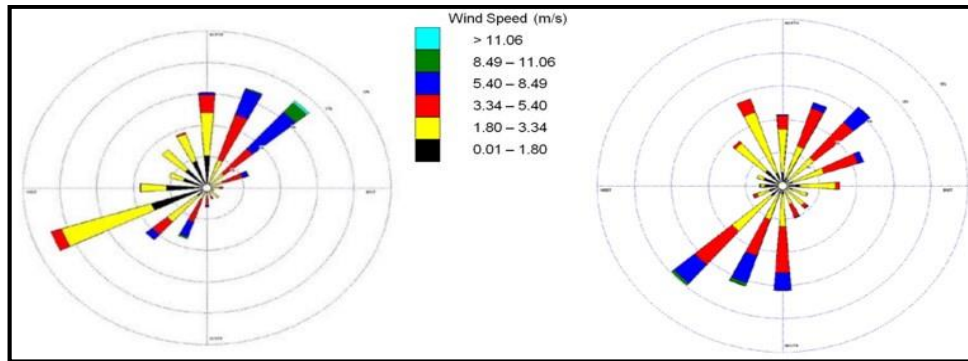


Figure 16: Annual windroses at Sezela (left) and Paddock (right)

12.2 Geology

Further to a preliminary geotechnical investigation undertaken by Davies Lynn & Partners (Pty) Ltd (DLP) in September 2013, DLP was requested to extend this investigation to determine the nature and variance of the subsoils beneath the proposed extended length of the dam wall and spillway section of Dam Sites 3 and 5.

12.2.1 Geological Overview

The proposed dam site is located within an area underlain by grey Charnockitic Granitoid Gneiss belonging to the Oribi Gorge Suite of batholithic intrusive granites of the Natal Structural and Metamorphic Province Sequence. Recent alluvial deposits can be found sparsely confined to the river basin and accumulate in areas where tributaries intersect the Mtwalume River and along the slip off slopes in the meanders of the Mtwalume River.

The Natal Group Sandstone forms the high ground to the area as elevated plateau type landform.

12.2.2 Subsoil conditions Dam Site 3

Hard rock Granitoid Gneiss bedrock occurs at river bed level and outcrops in the sub-vertical eastern flank of the River. Closely spaced columnar type jointing patterns are encountered on the east southeastern flank, whilst widely jointed bedrock is apparent in the river bed.

On the basis of the electrical resistivity profiling it was apparent that the overburden zone is typically 10m thick at the highest elevation on the west north-western bank thinning towards

the valley floor where hard rock is exposed in the river bed and beneath the east-southeastern bank. The resistivity plots indicate that there is little indication of any major structures such as faults or shear zones within the resistant Granitoid Gneiss bedrock, however there was a reduction in resistivity between chainage 150 and 190m which suggested fractured rock at this location.

Hard rock Granitoid Gneiss is exposed in the sub vertical eastern embankment flank, with sparse soil cover. The east-southeastern embankment exhibits moderately to closely spaced, columnar type jointing sets which occur within the rock exposed along the eastern River bank with inclusions of hard rock corestones and boulders. The electrical resistivity survey indicated highly fractured rock to depths of eight to ten meters along the sub vertical eastern embankment. Completely weathered Granitoid Gneiss occurs beneath the western flank of the river beneath a thin dark brown loose to dense moderately clayey sand to sandy clay, typically varying between 0.1m and 0.6m depths across the higher western flank regions. Highly to moderately weathered soft to medium hard Granitoid Gneiss underlies this alluvial layer at depths ranging between 1.0m and approximately 2.8m.

The dam wall should be founded onto the intact Granite Gneiss bedrock, which will require moderately deep to deep excavation to inferred depths of approximately ten to fifteen meters as indicated on the electrical resistivity survey, through the residual soils on the Western flank.

12.2.3 Subsoil conditions Dam Site 5

Boulders are prevalent within the river bed and the lower regions of the northern embankment. Colluvial and alluvial clayey and silty sandy soils occur within the River basin area which is considerably wider than at Dam Site 3.

The soils are saturated and appear to extend to depths of approximately 4 to 5 meters below natural ground level. The northern flank consists of relatively hard rock boulders near the base with a clayey overburden material overlying the bedrock. The clayey soils increase in depth to approximately 10 to 15 meters near the extremities of the proposed dam wall.

A boulder zone was found to be evident beneath the lower regions of the northern flank as illustrated in the resistivity survey results and evident from hard rock boulders observed on site. The overburden material increases in thickness to the crest of the full supply elevation along the northern flank where erosional and shallow slump features are evident. These structures and land features may be indicative of some structural or localised instability in the past. It is indicated that hard rock bedrock will occur at increasing depth progressively up the northern flank slope as illustrated in the resistivity profile.

Deep residual clayey soils occur beneath the southern flank. The soils are typically reddish brown with a clay and silt fraction varying between approximately 73 and 79 percent and exhibiting a Plasticity Index (PI) of 19 per cent. In order to found the dam wall structure into competent bedrock at this site, deep excavations will have to be implemented.

12.2.4 Geological Challenges for Dam Site 3

Trenching into the weathered granite bedrock on the western and eastern flanks of the river at the proposed Dam Wall Site 3 will necessitate the use of a 30 tonne+ excavator in order to achieve the levels of excavation required at this site. Trenching into the weathered rock will classify as intermediate to hard excavation in terms of SANS 1200 D below depths of 10m beneath the western embankment and near ground surface level along the subvertical slope of the eastern embankment

12.2.5 Geological Challenges for Dam Site 5

The residual clayey soils and colluvial sands are considered to classify as soft excavations hence in this regard excavations to approximately 15 – 20m depth below ground level are considered as soft to intermediate excavation beneath the southern embankment of the proposed dam wall site 5, with consideration for hard rock boulder excavation in the lower levels of the Northern flank. Intermediate and variable hard excavation class is likely to be present beneath the northern embankment of this site.

12.3 Geohydrology

According to DWAF (2004), groundwater aquifer types present in the Mvoti to Mzimkulu WMA are almost entirely of the 'hard rock' secondary porosity, 'weathered and fractured', and 'fractured' classes. 'Inter-granular' primary porosity class aquifers are present to a very limited extent in riverbeds in close proximity to the coast. In the 'fractured' class, zones of preferential groundwater presence include faults, major joints, bedding planes, and the contacts of intrusive Karoo dolerite sheets and dykes with the host rock.

By far the most common method of groundwater abstraction in the region is the normal 'hard rock' borehole of 165 mm diameter, with its uppermost portion (10-15 m) cased, and of depth 60 to 120 m. Numerous natural low-flow springs and seepages of groundwater are utilised as water supply sources in the rural portions of the region (DWAF, 2004).

12.4 Topography

The project area lies on undulating terrain with the prominent Mtwalume River that runs through the site in a west-east direction (**Figures 17 and 18**). The 20m contour lines show the gradient of the site is quite steep along the river.



Figure 17: Photograph of the terrain morphology at the project site

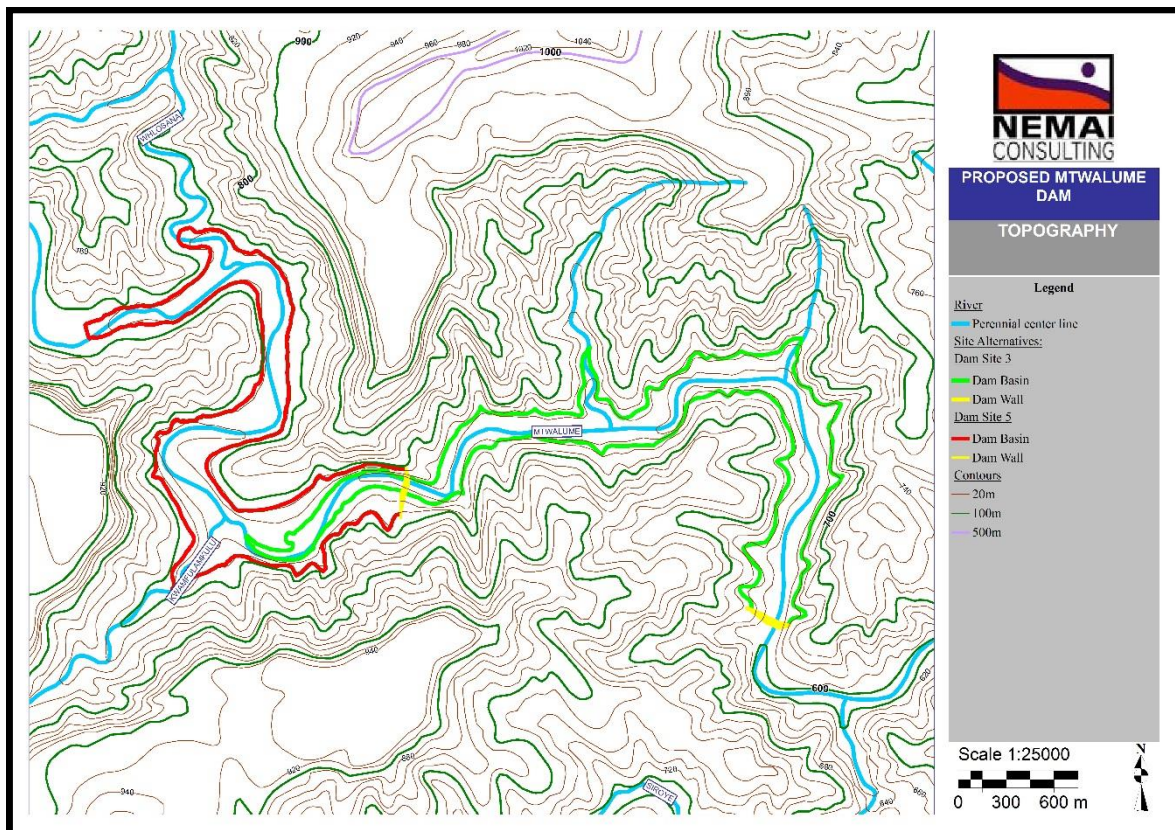


Figure 18: Contour Map

12.5 Surface Water

12.5.1 Hydrology

The Mtwalume River system is characterised by a highly rugged terrain although relatively more gentle along the western banks. Given this topographical nature, the river flows through a relatively narrow landscape tapering in some areas and broadening more in other areas (Figure 19).

The project area falls within the Mvoti to Mzimkhulu Water Management Area (WMA) and is situated in the upper portion of quaternary catchment U80E (Figure 20). The site is upstream of the existing DWS gauging station (U8H004) which is the current abstraction point for the Vulamehlo WTP and downstream of the town of Highflats. DWS currently operates a streamflow gauging station at the U8H004 weir site. Recent daily flow data (2000 – 2013) recorded at this station was sourced from the hydrology department of the DWS KZN Regional Office. Refer to Figure 21 for the recent average daily flow record (Mℓ/day).

Site specific hydrological information for this study was derived from “Surface Water Resources of South Africa 2005” (Table 13).



Figure 19: Upstream view of the Mtwalume River

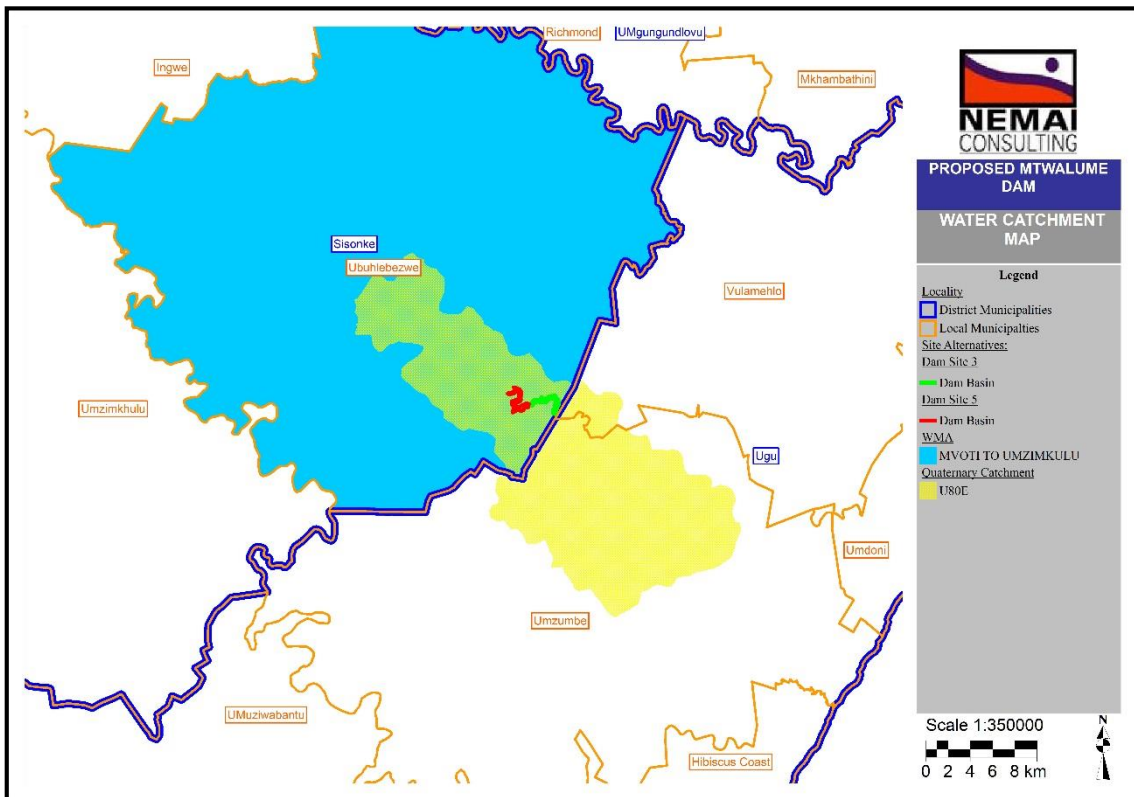


Figure 20: WMA and Quaternary Catchment

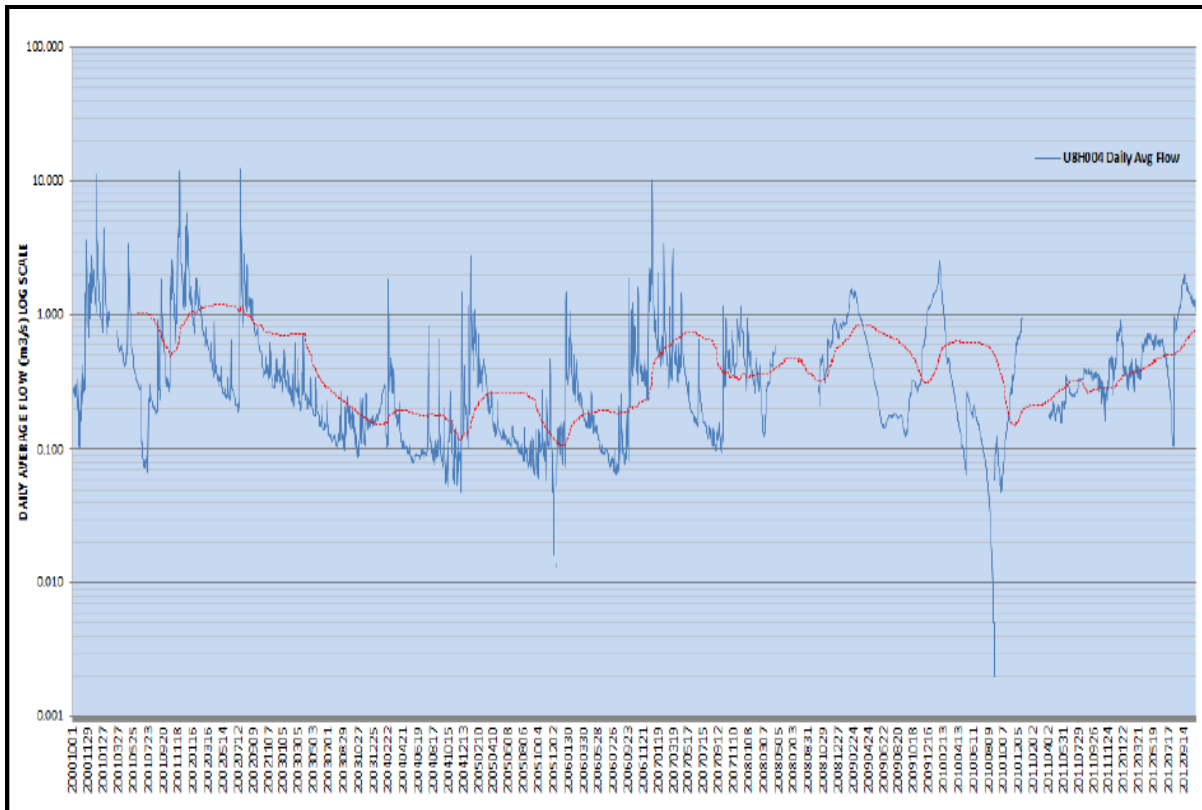


Figure 21: Daily Average Flow U8H004 (2000 – 2012)

Table 13: Hydrological Catchment Data

Dam Site	Quaternary Catchment	Catchment Area (km ²)	MAP (mm)	MAR (x106m ³)	Available MAR (Mm ³)
3	U80E	152.0	851	12.4	9.2
5	U80E	142.6	835	11.4	8.4

Figures 22 and 23 show the resultant stochastic yields for Dam Site 3 and Dam Site 5, respectively, at the 95% level of assurance in Mℓ/day.

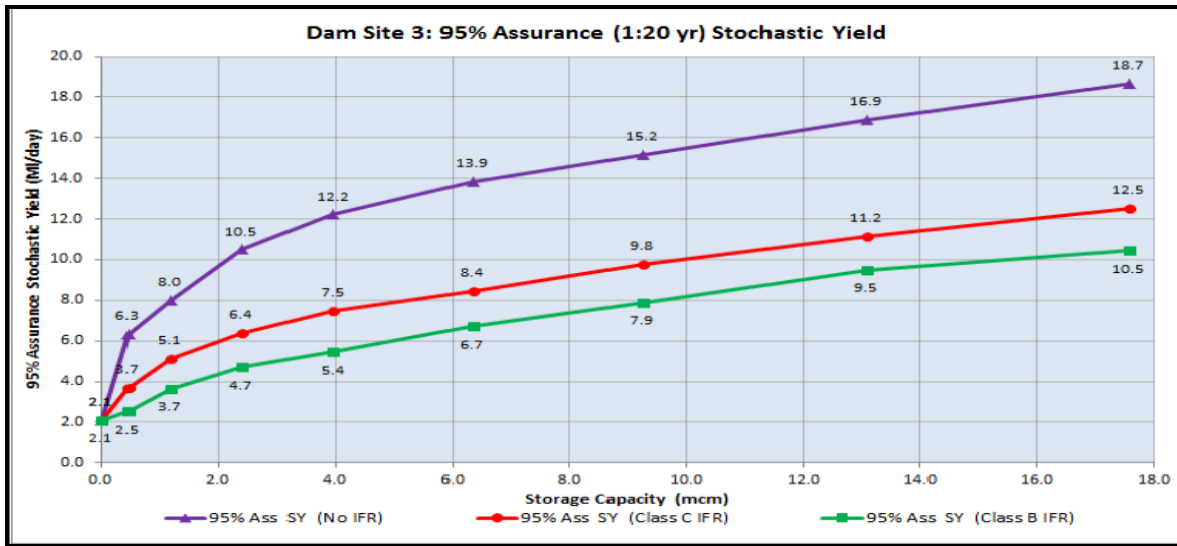


Figure 22: 95% Assurance Yields – Dam Site 3

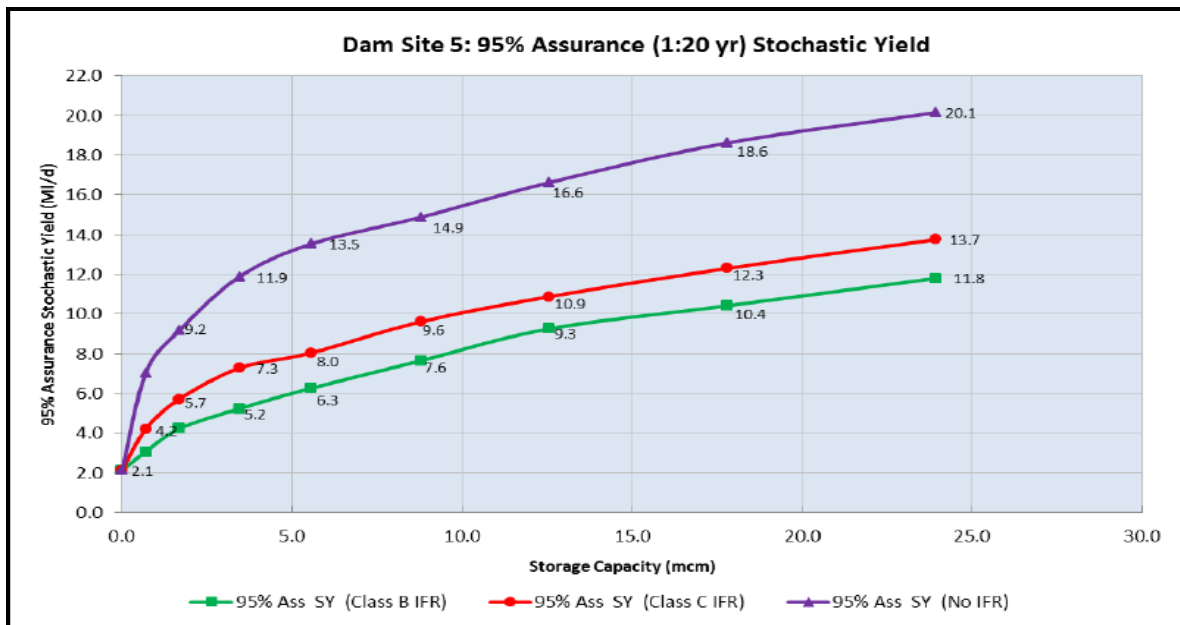


Figure 23: 95% Assurance Yields – Dam Site 5

12.5.2 Affected Watercourses

The proposed Mtwalume Dam will be located on the Mtwalume River. Approximately 5km of the Mtwalume River and associated tributaries will be inundated by the Mtwalume Dam (Figure 24). No wetlands were identified in or near the project area by the Geographic Information System (GIS) used.

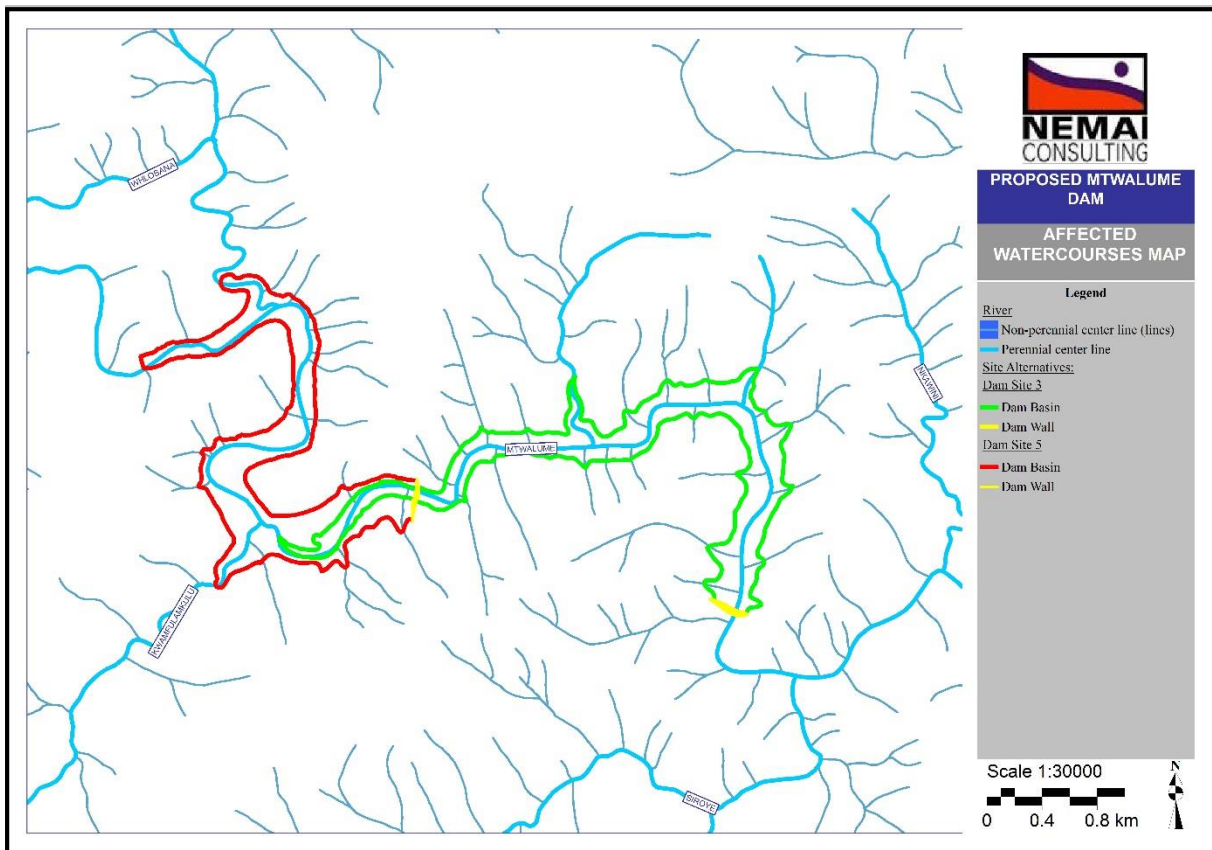


Figure 24: Watercourses affected by the proposed Mtwalume Dam

12.5.3 Ecological Status

The Present Ecological Situation (PES) for quaternary catchment U80E is a Class C (moderately modified). However, the PES for quaternary catchment U80F (immediately downstream of U80E) is a Class B (largely natural). U80F currently relies heavily on both the Mtwalume and the Quha Rivers (both first order rivers within U80E) in order to sustain its current PES. Given that the catchment area of U80F and its main tributary (the Mgeni River) is very small, it depends highly on runoff emanating from its upper receiving streams. The ecological importance and sensitivity (EIS) of all three rivers are therefore considered to be very high and they have therefore been given a Class B Recommended Ecological Category (REC) by the DWS.

The EWR for the proposed dam and catchment for water resource yield modelling purposes have been determined using the default high-level National Desktop Reserve Model as developed by Prof Denis Hughes of Rhodes University's Institute for Water Research (**Table 14**).

The Ecological Reserves was considered in the hydrological and yield assessment, as part of the Pre-Feasibility Study.

Table 14: Class B EWR Estimate for U80E

```

Desktop Version 2, Printed on 2013/09/11
Summary of IFR estimate for: U80E WRS0 (WRP 2003)
Determination based on default National Desktop Reserve model parameters.

Annual Flows (Mill. cu. m or index values):
MAR = 38.072
S.Dev. = 28.768
CV = 0.756
Q75 = 1.120
Q75/MMF = 0.353
BFI Index = 0.492
CV(JVA+JFM) Index = 3.035

ERC - B

Total IFR = 12.227 (32.12 %MAR)
Maint. Lowflow = 7.688 (20.19 %MAR)
Drought Lowflow = 2.176 ( 5.71 %MAR)
Maint. Highflow = 4.539 (11.92 %MAR)

Monthly Distributions (Mill. cu. m.)
Distribution Type : I Reg. Coast

Month      Natural Flows      Modified Flows (IFR)
            Mean      SD      CV      Low flows      High Flows Total Flows
            Mean      SD      CV      Maint.  Drought      Maint.      Maint.
Oct      2.992      5.926      1.981      0.583      0.168      0.374      0.957
Nov      3.088      4.093      1.325      0.609      0.174      0.389      0.988
Dec      3.023      3.351      1.109      0.616      0.176      0.195      0.811
Jan      2.862      2.692      0.941      0.617      0.176      0.321      0.938
Feb      4.142      5.481      1.323      0.704      0.196      0.564      1.267
Mar      6.155      11.703      1.901      0.845      0.229      1.739      2.584
Apr      4.311      5.745      1.333      0.791      0.217      0.545      1.336
May      2.439      2.049      0.840      0.664      0.187      0.152      0.816
Jun      2.748      6.234      2.269      0.631      0.179      0.000      0.631
Jul      2.133      3.702      1.735      0.560      0.162      0.000      0.560
Aug      1.466      1.373      0.937      0.507      0.150      0.000      0.507
Sep      2.713      11.594      4.273      0.559      0.162      0.260      0.819
    
```

12.5.4 Riparian Habitat

The ecological importance and sensitivity (EIS) of all three rivers are therefore considered to be very high and they have therefore been given a Class B Recommended Ecological Category (REC) by the DWS. The riparian area provides habitat for aquatic and terrestrial species, contributes towards maintaining the form of the river channel and serves as filters for sediment, nutrients and light.

12.5.5 Wetlands

Based on a desktop appraisal of the topographical map, a site investigation and the National Wetlands Maps of the SANBI extracted from the Biodiversity GIS dataset, no wetland systems are situated in the project area.

12.5.6 Aquatic Biota

The Present Ecological Situation (PES) for quaternary catchment U80E is a Class C (moderately modified). The ecological importance and sensitivity (EIS) of all three rivers are therefore considered to be very high and they have therefore been given a Class B Recommended Ecological Category (REC) by the DWS.

12.5.7 Estuary

By definition, an estuary constitutes a partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. These systems form a transition zone between river and ocean environments and are subject to both marine influences (e.g. tides, waves, and the influx of saline water) and riverine influences (e.g. flows of fresh water and sediment). The high productivity in estuaries stems from the inflow of both seawater and freshwater, which provide high levels of nutrients in both the water column and sediment.

The Mtwalume Estuary, which is located near Elysium and Mtwalume (**Figure 25**), is a permanently open system and is located approximately 35km from the proposed dam sites. Current threats to the estuary include water pollution and siltation.

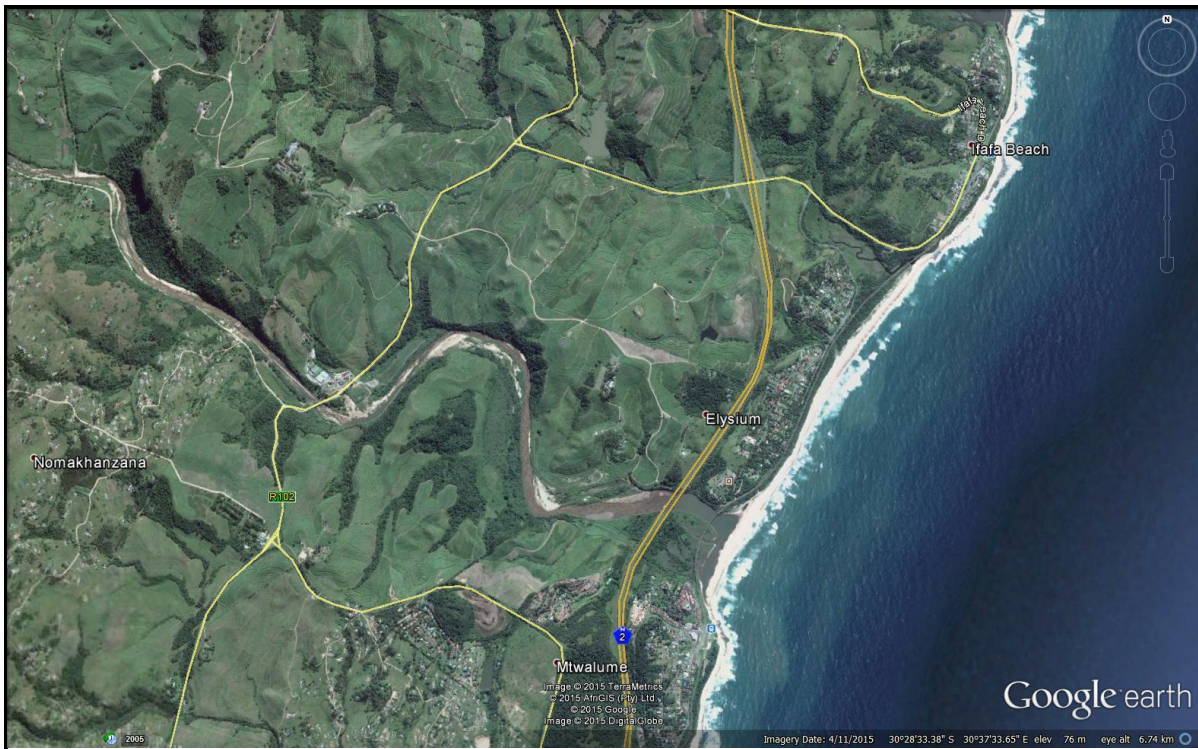


Figure 25: Mtwalume Estuary

12.5.8 Water Quality

No historical measured data of water quality for the Mtwalume River was available for the Pre-Feasibility Study; however, turbidity levels are expected to be high during the summer high flows of November to March, but not excessive as significant overgrazing and erosion is not evident in the catchment. This is borne out by visual inspections of the river at various times of the year.

High total organic carbon, colour, nitrate and soluble reactive phosphorous concentrations is unlikely due to the lack of commercial farming activities, mining or concentrations of formalised settlements in the catchment. Future, potential pollution problems is likely to be restricted to agricultural issues. Good agricultural management of the catchment will play an important part in minimising water quality problems.

Soil conservation strategies, crop setbacks from water courses, nutrient and biocide application control, and where necessary re-vegetation of suitable riparian strips will ensure the protection of the impoundment from catchment run-off related problems.

The following management policies and design adaptations will assist water quality:

- To optimise water quality for treatment, a multi-level draw-off is required to ensure that aerobic water is abstracted at all times. Draw-offs are recommended at 5, 10, 20 and 30m below FSL.
- Spilling (as opposed to scouring) is the recommended release mechanism when algal numbers are high.
- Spill / scour releases are managed to minimise the impact on downstream aquatic life.

These recommendations are incorporated in the design of the dam as follows:

- Provision of a four level intake tower.
- Scours and ecological releases from the dam will be provided such that releases include anaerobic water from a low level and aerobic water drawn from near the surface so that oxygen levels will recover quickly downstream of the dam.
- Spilling to reduce algae will be via the proposed uncontrolled “free overflow” central spillway. This will be done while there is surplus flow in the Mtwalume River, which is a normal situation in summer.

12.5.9 Water Users

Water Users in the catchment area for the Mtwalume River include the following:

- Extensive tracts of forestation are present within the upper and middle catchment. The total area under afforestation is roughly 62.4km² (or 36% of the overall U8H004 catchment area);
- Numerous small farm dams also exist in the upper catchment. Currently there are 35 registered dams covering approximately 1.1km², with a total capacity of roughly 2.41 Mm³ (which represents 51% of the MAR of the catchment upstream of these dams);
- In addition, 1.8km² of small scale irrigation also takes place in the upper catchment (1% of catchment area) of which approximately 1.6km² is served by the above-mentioned farm dams and other “run-of-river” abstractions;
- Fairly significant livestock farming enterprises are located within the upper catchment. It is estimated that approximately 11,000 large stock units (LSU) and 3,200 small stock

units (SSU) are watered daily within the catchment (Southern KwaZulu-Natal Water Resources Pre-Feasibility Study); and

- EWR were determined as part of the Reserve Study for the proposed Mtwalume Dam sites. An Intermediate Reserve determination will be undertaken later in the project and will be used to determine the final Reserve requirements.

12.6 Flora

12.6.1 Biome and Vegetation

The site falls within the Grassland Biome and is characterised by Moist Coast Hinterland Grassland vegetation type (**Figures 26 and 27**). Moist Coast Hinterland Grassland vegetation occurs in KwaZulu-Natal and Eastern Cape Provinces. It is found near Melmoth in the north and near Libode in the south (including Eshowe, New Hanover, Thornville, Richmond, Harding, Lusikisiki) generally occurring below Midlands Mistbelt Grassland. It occurs in rolling and hilly landscapes (**Figure 28**). The dense tall sour grassland is dominated by unpalatable Ngongoni grass (*Aristida junciformis*) with this mono-dominance associated with low species diversity, when in good condition, this vegetation type is dominated by *Themeda triandra* and *Tristachya leucothrix*. This vegetation type is statutorily conserved in Vernon Crookes and Entumeni Nature Reserves.

Poor land uses and large scale transformation has significantly decimated this vegetation type especially within the coastal regions of KZN.

The establishment of dams by their very nature have irreversible impacts on the ecological characteristics of the area that will be inundated. In KZN, transformation of vegetation and consequent loss of habitat and biodiversity is a concern and loss of biodiversity becomes even more of a concern when:

- The vegetation type is endemic or near endemic
- There is significant transformation of the vegetation type
- The ecological classification is endangered or critically endangered

Endemic or near endemic vegetation types require more stringent management objectives. Where endemic or near endemic vegetation types are transformed on a large scale, the ecological definition of the condition would be 'endangered' or 'critically endangered'.

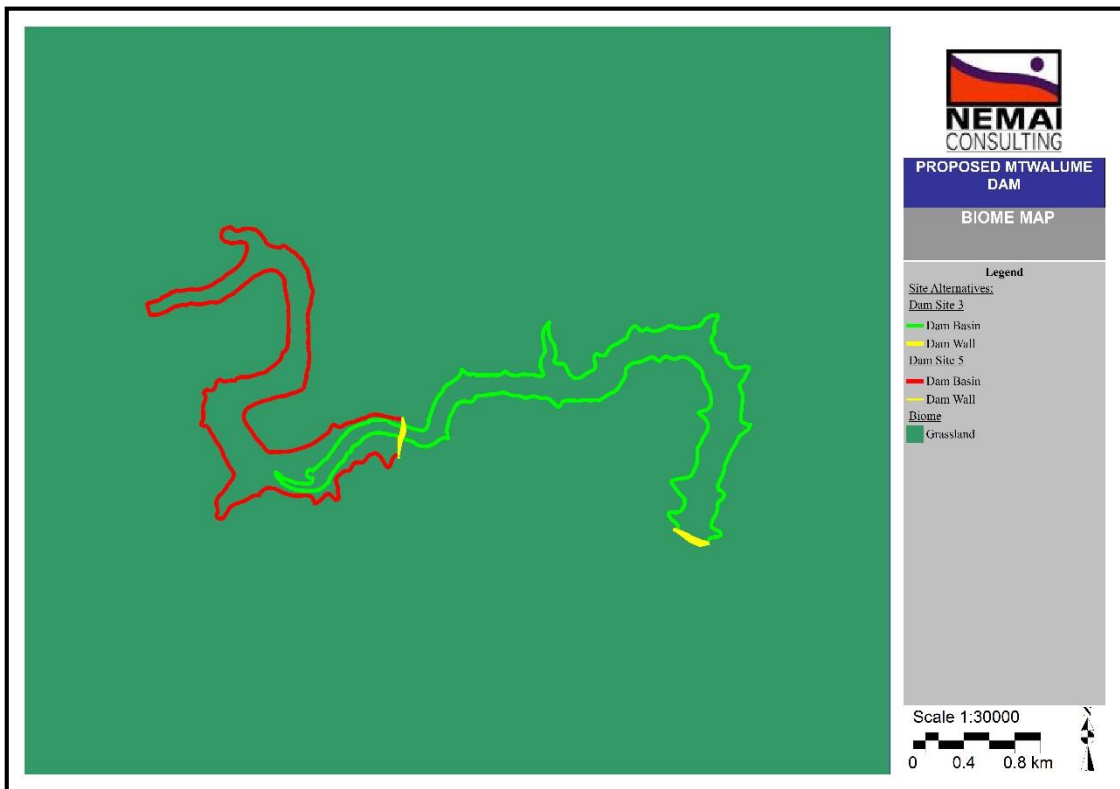


Figure 26: Biome

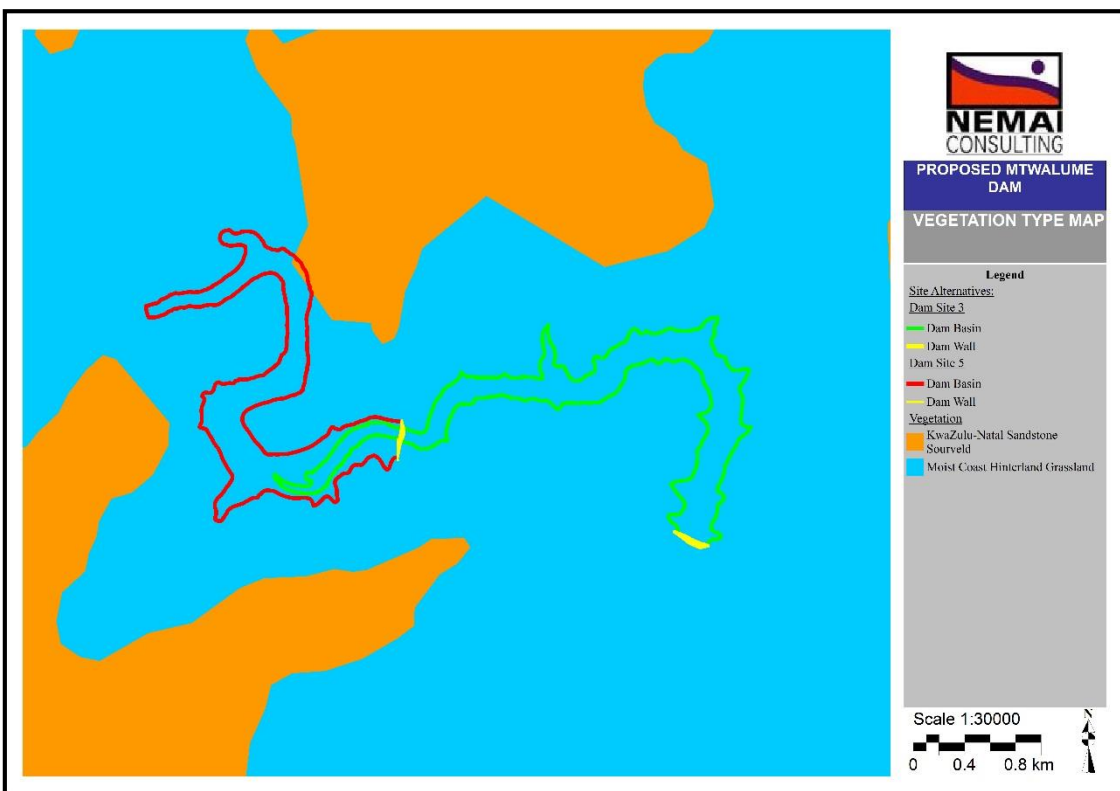


Figure 27: Vegetation Type

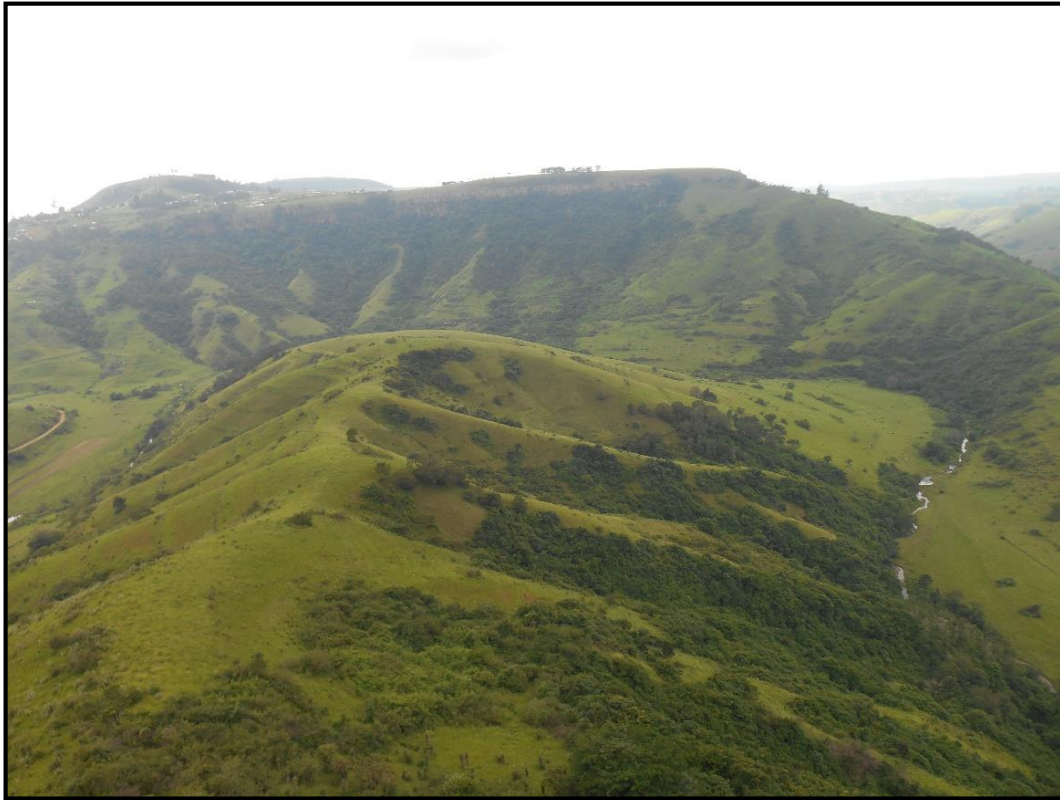


Figure 28: Photograph showing the hilly landscapes of the site

12.6.2 Terrestrial Threatened Ecosystems

The SANBI, in conjunction with the Department of Environmental Affairs (DEA), released a draft report in 2009 entitled “Threatened Ecosystems in South Africa: Descriptions and Maps”, to provide background information on the above List of Threatened Ecosystems (SANBI, 2009). The purpose of this report was to present a detailed description of each of South Africa’s ecosystems and to determine their status using a credible and practical set of criteria. The following criteria were used in determining the status of threatened ecosystems:

- Irreversible loss of natural habitat;
- Ecosystem degradation and loss of integrity;
- Limited extent and imminent threat;
- Threatened plant species associations;
- Threatened animal species associations; and
- Priority areas for meeting explicit biodiversity targets as defined in a systematic conservation plan.

In terms of section 52(1) (a), of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), a national list of ecosystems that are threatened and in need of protection was gazetted on 9 December 2011 (Government Notice 1002). The list classified all threatened or protected ecosystems in South Africa in terms of four categories; Critically

Endangered (CR), Endangered (EN), Vulnerable (VU), or Protected. The purpose of categorising these ecosystems is to prioritise conservation areas in order to reduce the rates of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems.

According to the data sourced from SANBI; the Vulnerable Ngongoni Veld was listed as the only terrestrial threatened ecosystem recorded in the proposed dam sites as indicated in **Figure 29** below. Ngongoni Veld terrestrial threatened ecosystem is distributed in KwaZulu-Natal and Eastern Cape Provinces.

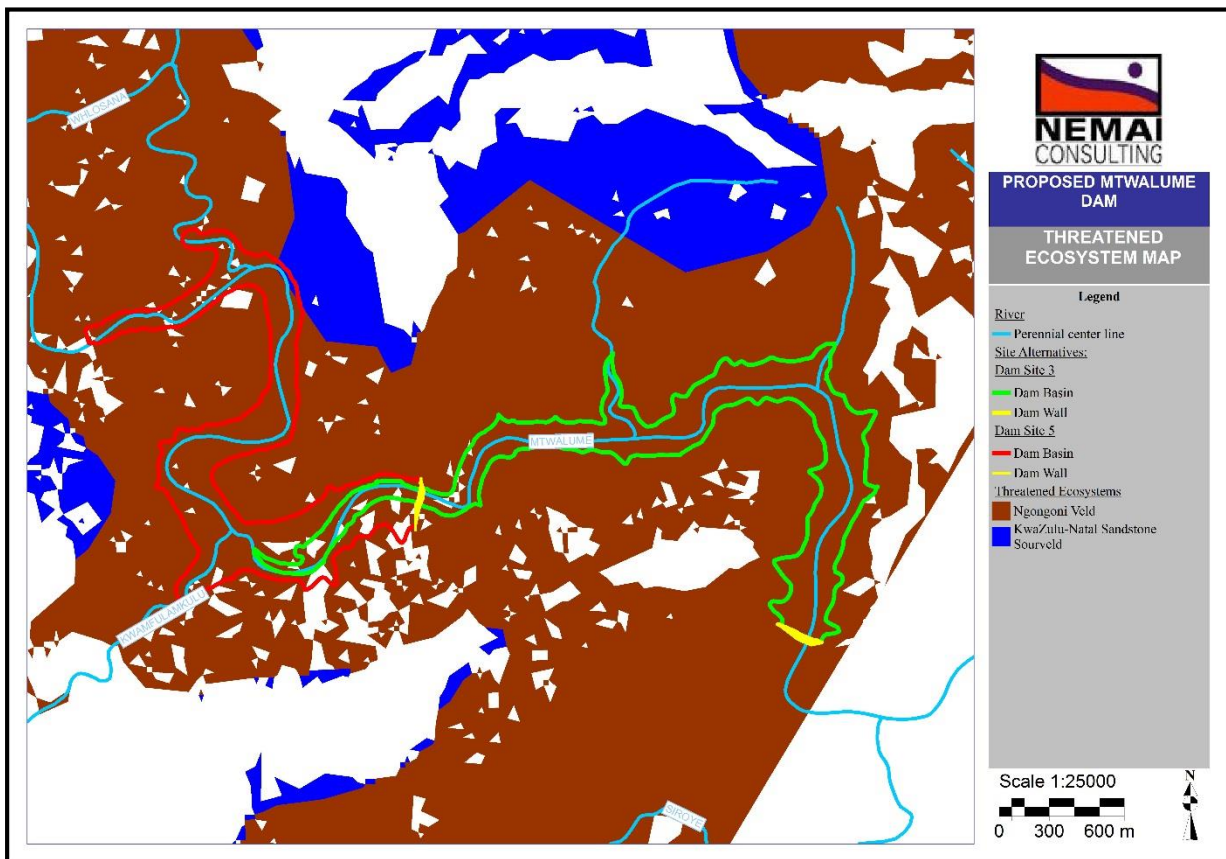


Figure 29: Threatened Ecosystems

12.6.3 KZN Provincial Biodiversity Plan

According to Escott *et al.* 2013, the KZN Provincial Biodiversity Plan is an amalgamation of the four systematic conservation plans and provides a spatial representation of land and coastal marine area that is required to ensure the persistence and conservation of biodiversity within the KZN Province. According to this plan, the project area falls within 0Co (Not areas of Conservation Importance), R2 (Critical Biodiversity Area 1), R0 (Critical Biodiversity Area 3 Optimal, and Ign (100% transformed based on 2005 land cover) (**Figure 30**). It is important to note that the areas designated as CBA Mandatory - are areas required to meet biodiversity targets for both biodiversity pattern and ecological process features, and no other options are

available to meet this target. Whereas areas listed as CBA Optimal – are areas that are the most optimal to meet the biodiversity conservation targets while avoiding high cost areas as much as possible.

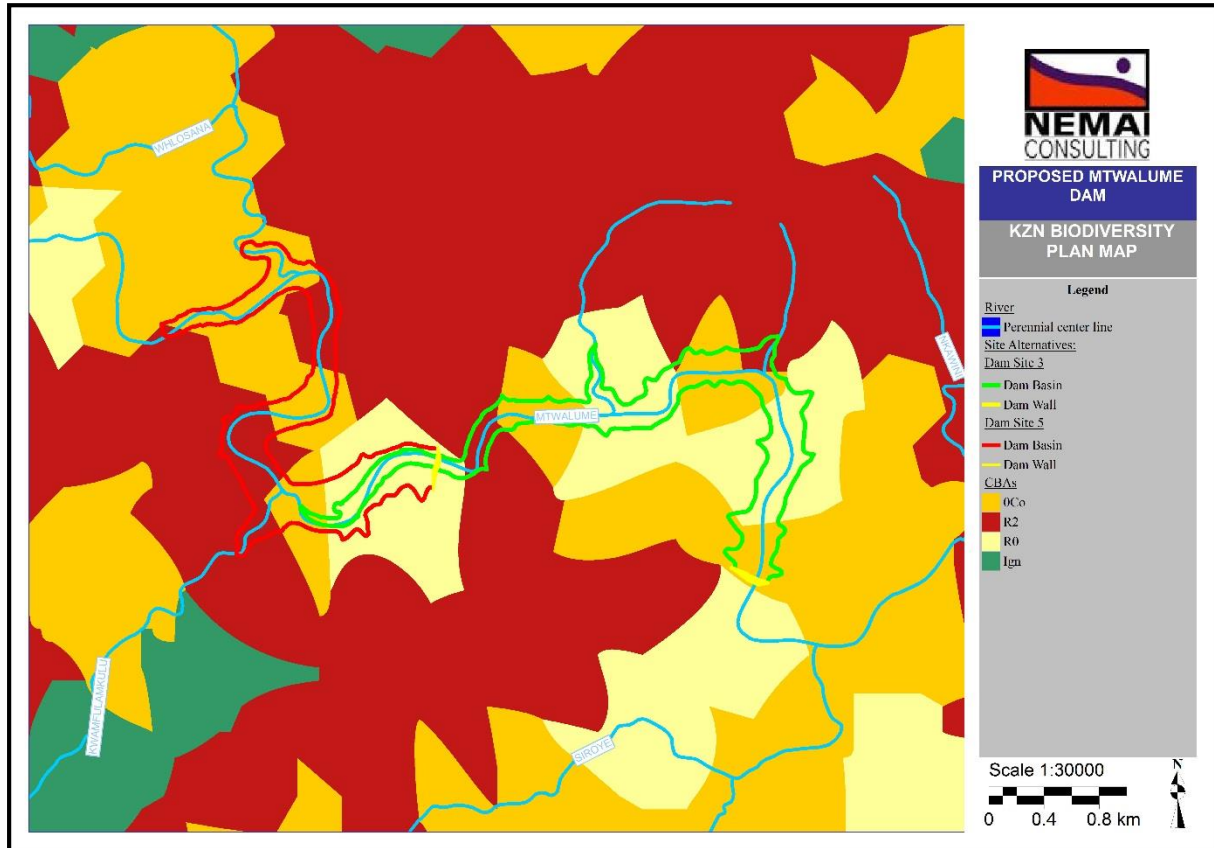


Figure 30: CBA Areas located on the proposed dam sites

12.6.4 Plant Species of Conservation Concern

The proposed development is located within the 3030AB, 3030AD, and 3030BC Quarter Degree Squares (QDS) in terms of the 1:50 000 grid of South Africa. The Pretoria Computerised Information System (PRECIS) list of Red Data plants was obtained from SANBI (<http://posa.sanbi.org/searchspp.php>).

The list was consulted to verify the record of occurrence of the plant species seen in the vicinity of the proposed development. The site sampled is also only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS list may not be present at the areas sampled. Only one threatened plant species was found to occur in the QDS and is provided in the **Table 16** below.

Table 15: Definitions of Red Data plant status (Raimondo et al. 1999)

Symbol	Status	Description
EN	Endangered	A taxon is Endangered when the best available evidence indicates that it meets any of the International Union for Conservation of Nature (IUCN) criteria for Endangered, and is therefore facing a very high risk of extinction in the wild.
VU	Vulnerable	A taxon is Vulnerable when the best available evidence indicates that it meets any of the five) an IUCN criterion for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
NT	Near Threatened	A taxon is Near Threatened when available evidence indicates that it is close to meeting any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.

Table 16: Red Data Plant species recorded in grid cell 3030AB, 3030AD, and 3030BC which could potentially occur in the study area (SANBI data).

Family	Species	Threat status
Amaryllidaceae	<i>Haemanthus deformis</i> Hook.f.	VU
Amaryllidaceae	<i>Crinum macowanii</i> Baker	Declining
Amaryllidaceae	<i>Crinum moorei</i> Hook.f.	VU
Anacardiaceae	<i>Loxostylis alata</i> A.Spreng. ex Rchb.	Declining
Anacardiaceae	<i>Searsia rudatisii</i> (Engl.) Moffett	EN
Apocynaceae	<i>Asclepias schlechteri</i> (K.Schum.) N.E.Br.	EN
Apocynaceae	<i>Brachystelma franksiae</i> N.E.Br. subsp. <i>franksiae</i>	VU
Apocynaceae	<i>Brachystelma sandersonii</i> (Oliv.) N.E.Br.	VU
Aquifoliaceae	<i>Ilex mitis</i> (L.) Radlk. var. <i>mitis</i>	Declining
Asphodelaceae	<i>Aloe cooperi</i> Baker subsp. <i>cooperi</i>	Declining
Asphodelaceae	<i>Kniphofia littoralis</i> Codd	NT
Asphodelaceae	<i>Aloe cooperi</i> Baker subsp. <i>cooperi</i>	Declining
Asphodelaceae	<i>Aloe linearifolia</i> A.Berger	NT
Asphodelaceae	<i>Kniphofia littoralis</i> Codd	NT
Asteraceae	<i>Euryops brevilobus</i> Compton	Rare
Asteraceae	<i>Helichrysum pannosum</i> DC.	EN
Asteraceae	<i>Senecio dregeanus</i> DC.	VU
Aalsaminaceae	<i>Impatiens flanaganiae</i> Hemsl.	VU
Begoniaceae	<i>Begonia dregei</i> Otto & A.Dietr.	EN
Rhynchoalycaceae	<i>Rhynchoalix lawsonioides</i> Oliv.	NT

12.7 Fauna

12.7.1 Mammals

A desktop study of the entire project area (dams and associated infrastructure) established that the potential mammal species that have been recorded in the grid cells 3030AB, 3030AD, and 3030BC (ADU, 2015) in which the project falls are listed in **Table 17** below. According to this list, no mammal species of conservation importance is known to occur in the region. Due

to the habitat disturbance and human interactions, the list is likely to overestimate the occurrence of mammal species in the area and thus should be viewed with a degree of caution.

Table 17: Mammal species recorded in grid cell 3030AB, 3030AD, and 3030BC which could occur in the study area.

Family	Genus	Species	Common name	Red list category
Bovidae	<i>Connochaetes</i>	<i>taurinus</i>	Blue Wildebeest	Not listed
Bovidae	<i>Sylvicapra</i>	<i>grimmia</i>	Bush Duiker	Least Concern
Bovidae	<i>Tragelaphus</i>	<i>scriptus</i>	Bushbuck	Least Concern
Bovidae	<i>Tragelaphus</i>	<i>strepsiceros</i>	Greater Kudu	Least Concern
Canidae	<i>Canis</i>	<i>mesomelas</i>	Black-backed Jackal	Least Concern
Equidae	<i>Equus</i>	<i>quagga</i>	Plains Zebra	Not listed
Hipposideridae	<i>Hipposideros</i>	<i>caffer</i>	Sundevall's Leaf-nosed Bat	Data deficient
Hystricidae	<i>Hystrix</i>	<i>africaeaustralis</i>	Cape Porcupine	Least Concern
Molossidae	<i>Chaerephon</i>	<i>pumilus</i>	Little Free-tailed Bat	Least Concern
Molossidae	<i>Otomops</i>	<i>martiensseni</i>	Large-eared Giant Mastiff Bat	VU
Muridae	<i>Aethomys</i>	<i>ineptus</i>	Tete Veld Aethomys	Least Concern
Muridae	<i>Grammomys</i>	<i>dolichurus</i>	Common Grammomys	Data Deficient
Muridae	<i>Lemniscomys</i>	<i>rosalia</i>	Single-Striped Lemniscomys	Data Deficient
Muridae	<i>Mastomys</i>	<i>natalensis</i>	Natal Mastomys	Least Concern
Muridae	<i>Rhabdomys</i>	<i>pumilio</i>	Xeric Four-striped Grass Rat	Least Concern
Nycteridae	<i>Nycteris</i>	<i>thebaica</i>	Egyptian Slit-faced Bat	Least Concern
Pteropodidae	<i>Epomophorus</i>	<i>wahlbergi</i>	Epomophorus wahlbergi	Least Concern
Rhinolophidae	<i>Rhinolophus</i>	<i>clivus</i>	Geoffroy's Horseshoe Bat	NT
Rhinolophidae	<i>Rhinolophus</i>	<i>simulator</i>	Bushveld Horseshoe Bat	Least Concern
Soricidae	<i>Crocidura</i>	<i>flavescens</i>	Greater Red Musk Shrew	Data Deficient
Soricidae	<i>Crocidura</i>	<i>cyanea</i>	Reddish-gray Musk Shrew	Data Deficient
Soricidae	<i>Crocidura</i>	<i>silacea</i>	Lesser Gray-brown Musk Shrew	Data Deficient
Soricidae	<i>Myosorex</i>	<i>cafer</i>	Dark-footed Mouse Shrew	Data Deficient
Soricidae	<i>Myosorex</i>	<i>varius</i>	Forest Shrew	Data Deficient
Soricidae	<i>Suncus</i>	<i>infinitesimus</i>	Least Dwarf Shrew	Data Deficient
Soricidae	<i>Suncus</i>	<i>varilla</i>	Lesser Dwarf Shrew	Data Deficient
Suidae	<i>Potamochoerus</i>	<i>larvatus</i>	Bush-pig	Least Concern (IUCN ver 3.1)

Family	Genus	Species	Common name	Red list category
Vespertilionidae	<i>Miniopterus</i>	<i>fraterculus</i>	Lesser Long-fingered Bat	NT
Vespertilionidae	<i>Miniopterus</i>	<i>schreibersii</i>	Schreibers's Long-fingered Bat	NT
Vespertilionidae	<i>Myotis</i>	<i>tricolor</i>	Temminck's Myotis	NT
Vespertilionidae	<i>Scotophilus</i>	<i>dinganii</i>	Yellow-bellied House Bat	Least Concern
Vespertilionidae	<i>Neoromicia</i>	<i>nanus</i>	Banana Pipistrelle	Least Concern
Vespertilionidae	<i>Pipistrellus</i>	<i>hesperidus</i>	Dusky Pipistrelle	Least Concern
Vespertilionidae	<i>Scotophilus</i>	<i>dinganii</i>	Yellow-bellied House Bat	Least Concern
Vespertilionidae	<i>Scotophilus</i>	<i>nigrita</i>	Giant House Bat	Not listed

Note: VU=Vulnerable; NT=Near Threatened

12.7.2 Reptiles

Table 18 below lists reptile species which are recorded in the grid cells 3030AB, 3030AD, and 3030BC based on the South African Reptile Conservation Assessment (ADU, 2015). According to the list, Natal Black Snake, Kwa-Zulu Dwarf Chameleon, Green Mamba and Durban Dwarf Burrowing Skink are the species of conservation importance known to occur in the vicinity of the proposed development area. Special attention was paid to the presence of these species on site during the field assessments.

Table 18: Reptile species recorded in grid cells 3030AB, 3030AD, and 3030BC which could occur in the study area.

Family	Genus	Species	Common name	Red list category
Agamidae	<i>Agama</i>	<i>atra</i>	Southern Rock Agama	Least Concern (SARCA 2014)
Agamidae	<i>Acanthocercus</i>	<i>atricollis</i>	Southern Tree Agama	Least Concern (SARCA 2014)
Agamidae	<i>Agama</i>	<i>aculeata</i>	Distant's Ground Agama	Least Concern (SARCA 2014)
Atractaspidae	<i>Aparallactus</i>	<i>capensis</i>	Black-headed Centipede-eater	Least Concern (SARCA 2014)
Atractaspidae	<i>Aparallactus</i>	<i>nigriceps</i>	Mozambique Centipede-eater	Not listed

Family	Genus	Species	Common name	Red list category
Atractaspididae	<i>Atractaspis</i>	<i>bibronii</i>	Bibron's Stiletto Snake	Least Concern (SARCA 2014)
Atractaspididae	<i>Macrelaps</i>	<i>microlepidotus</i>	Natal Black Snake	Near Threatened (SARCA 2014)
Boidae	<i>Python</i>	<i>natalensis</i>	Southern African Python	Least Concern (SARCA 2014)
Chamaeleonidae	<i>Bradypodion</i>	<i>melanocephalum</i>	KwaZulu Dwarf Chameleon	Vulnerable (SARCA 2014)
Chamaeleonidae	<i>Chamaeleo</i>	<i>dilepis</i>	Common Flap-neck Chameleon	Least Concern (SARCA 2014)
Colubridae	<i>Boaedon</i>	<i>capensis</i>	Brown House Snake	Least Concern (SARCA 2014)
Colubridae	<i>Crotaphopeltis</i>	<i>hotamboeia</i>	Red-lipped Snake	Least Concern (SARCA 2014)
Colubridae	<i>Dasypeltis</i>	<i>inornata</i>	Southern Brown Egg-eater	Least Concern (SARCA 2014)
Colubridae	<i>Dasypeltis</i>	<i>scabra</i>	Rhombic Egg-eater	Least Concern (SARCA 2014)
Colubridae	<i>Dispholidus</i>	<i>typus</i>	Boomslang	Least Concern (SARCA 2014)
Colubridae	<i>Duberria</i>	<i>lutrix</i>	South African Slug-eater	Least Concern (SARCA 2014)
Colubridae	<i>Gonionotophis</i>	<i>capensis</i>	Common File Snake	Least Concern (SARCA 2014)
Colubridae	<i>Lamprophis</i>	<i>aurora</i>	Aurora House Snake	Least Concern (SARCA 2014)
Colubridae	<i>Lycodonomorphus</i>	<i>inornatus</i>	Olive House Snake	Least Concern (SARCA 2014)
Colubridae	<i>Lycodonomorphus</i>	<i>laevissimus</i>	Dusky-bellied Water Snake	Least Concern (SARCA 2014)
Colubridae	<i>Lycodonomorphus</i>	<i>rufulus</i>	Brown Water Snake	Least Concern (SARCA 2014)

Family	Genus	Species	Common name	Red list category
Colubridae	<i>Lycophidion</i>	<i>capense</i>	Cape Wolf Snake	Least Concern (SARCA 2014)
Colubridae	<i>Philothamnus</i>	<i>hoplogaster</i>	South Eastern Green Snake	Least Concern (SARCA 2014)
Colubridae	<i>Philothamnus</i>	<i>natalensis</i>	Western Natal Green Snake	Least Concern (SARCA 2014)
Colubridae	<i>Philothamnus</i>	<i>semivariatus</i>	Spotted Bush Snake	Least Concern (SARCA 2014)
Colubridae	<i>Psammophis</i>	<i>brevirostris</i>	Short-snouted Grass Snake	Least Concern (SARCA 2014)
Colubridae	<i>Psammophylax</i>	<i>rhombeatus</i>	Spotted Grass Snake	Least Concern (SARCA 2014)
Colubridae	<i>Thelotornis</i>	<i>capensis</i>	Southern Twig Snake	Least Concern (SARCA 2014)
Cordylidae	<i>Chamaesaura</i>	<i>anguina</i>	Cape Grass Lizard	Least Concern (SARCA 2014)
Elapidae	<i>Dendroaspis</i>	<i>angusticeps</i>	Green Mamba	Vulnerable (SARCA 2014)
Elapidae	<i>Dendroaspis</i>	<i>polylepis</i>	Black Mamba	Least Concern (SARCA 2014)
Elapidae	<i>Hemachatus</i>	<i>haemachatus</i>	Rinkhals	Least Concern (SARCA 2014)
Elapidae	<i>Hydrophis</i>	<i>platurus</i>	Yellow-bellied Sea Snake	Least Concern (SARCA 2014)
Gekkonidae	<i>Afroedura</i>	<i>pondolia</i>	Pondo Flat Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Hemidactylus</i>	<i>mabouia</i>	Common Tropical House Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Lygodactylus</i>	<i>capensis</i>	Common Dwarf Gecko	Least Concern (SARCA 2014)
Gerrhosauridae	<i>Gerrhosaurus</i>	<i>flavigularis</i>	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)

Family	Genus	Species	Common name	Red list category
Gerrhosauridae	<i>Tetradactylus</i>	<i>africanus</i>	Eastern Long-tailed Seps	Least Concern (SARCA 2014)
Lacertidae	<i>Tropidosaura</i>	<i>montana</i>	Natal Mountain Lizard	Not listed
Leptotyphlopidae	<i>Leptotyphlops</i>	<i>scutifrons</i>	Peters' Thread Snake	Not listed
Scincidae	<i>Afroablepharus</i>	<i>wahlbergii</i>	Wahlberg's Snake-eyed Skink	Least Concern (SARCA 2014)
Scincidae	<i>Scelotes</i>	<i>inornatus</i>	Durban Dwarf Burrowing Skink	Critically Endangered (SARCA 2014)
Scincidae	<i>Trachylepis</i>	<i>striata</i>	Striped Skink	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis</i>	<i>varia</i>	Variable Skink	Least Concern (SARCA 2014)
Testudinidae	<i>Stigmochelys</i>	<i>pardalis</i>	Leopard Tortoise	Least Concern (SARCA 2014)
Typhlopidae	<i>Afrotyphlops</i>	<i>bibronii</i>	Bibron's Blind Snake	Least Concern (SARCA 2014)
Varanidae	<i>Varanus</i>	<i>niloticus</i>	Water Monitor	Least Concern (SARCA 2014)
Viperidae	<i>Bitis</i>	<i>arietans</i>	Puff Adder	Least Concern (SARCA 2014)
Viperidae	<i>Causus</i>	<i>rhombeatus</i>	Rhombic Night Adder	Least Concern (SARCA 2014)

12.7.3 Amphibians

According to the Frog Atlas of Southern African (ADU, 2015), the frog species that was recorded in grid cell 2527DD is shown in **Table 19** below. According to Frog Atlas of Southern Africa, Poynton's River Frog is expected to be found within the site.

Table 19: Amphibian species recorded in grid cells 3030AB, 3030AD, and 3030BC which could occur in the study area.

Family	Genus	Species	Common name	Red list category	No. records
Pyxicephalidae	Pyxicephalus	adpersus	Giant Bull Frog	NT	6

Note: NT=Near Threatened

12.7.4 Avifauna

Several conservation and planning tools were reviewed for relevancy in terms of the project area, and it was found that the study area did not contain or form part of any Important Bird

and Biodiversity Area (IBA). IBAs are areas that are considered to be of critical importance for the conservation of avifauna. IBAs are identified based on one or more of the following criteria 1) holding significant numbers of one or more globally threatened species 2) are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species, 3) have exceptionally large numbers of migratory or congregatory species (Fishpool & Evans 2001, Birdlife International 2014).

No IBA was recorded near the proposed project area, as indicated in **Figure 31** below. Observations regarding the number and diversity of birds will provide valuable input to sound management practices. The quarter degree square, within which the study area falls, i.e. 3030AB, 3030AD, and 3030BC, is classified predominantly as grassland by Harrison *et al.* 1997 and all species recorded in these grid cells are indicated in **Appendix E**.

The nearest IBA is the KwaZulu-Natal Mistbelt Grassland IBA, which is situated some distance from the project area.

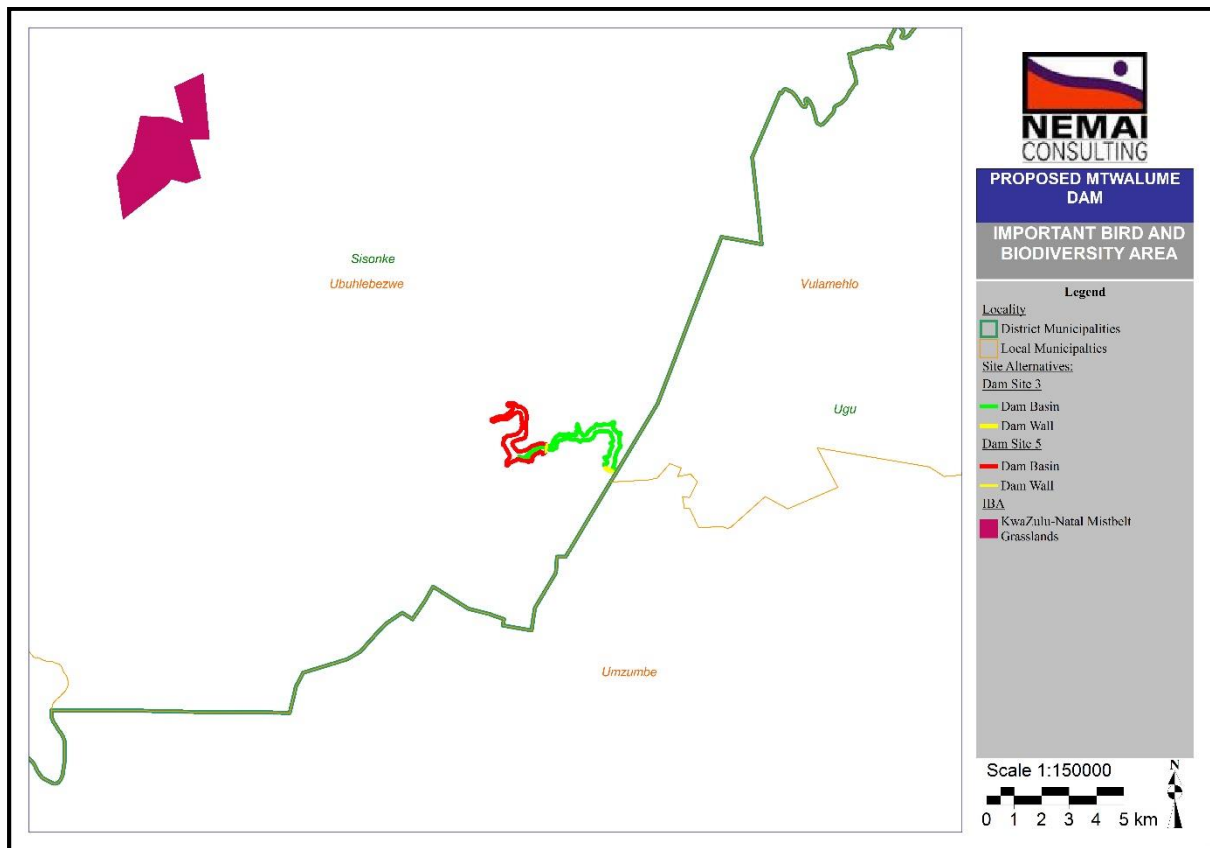


Figure 31: Nearest IBA is the KwaZulu-Natal Mistbelt Grassland IBA

12.8 Land Capability

According to the Agricultural Geo-Referenced Information System (AGIS), the site is located on an area that is considered to have a non-arable, moderate potential in terms of grazing land (**Figure 32**). Both dam sites are located in fairly inaccessible valleys which do not allow for intensive crop farming but which can be used for grazing for and watering of animals (**Figure 33**). Some areas close to Dam Site 3 have been terraced to allow for the cultivation of crops but this takes place on the upper reaches of the river valley.

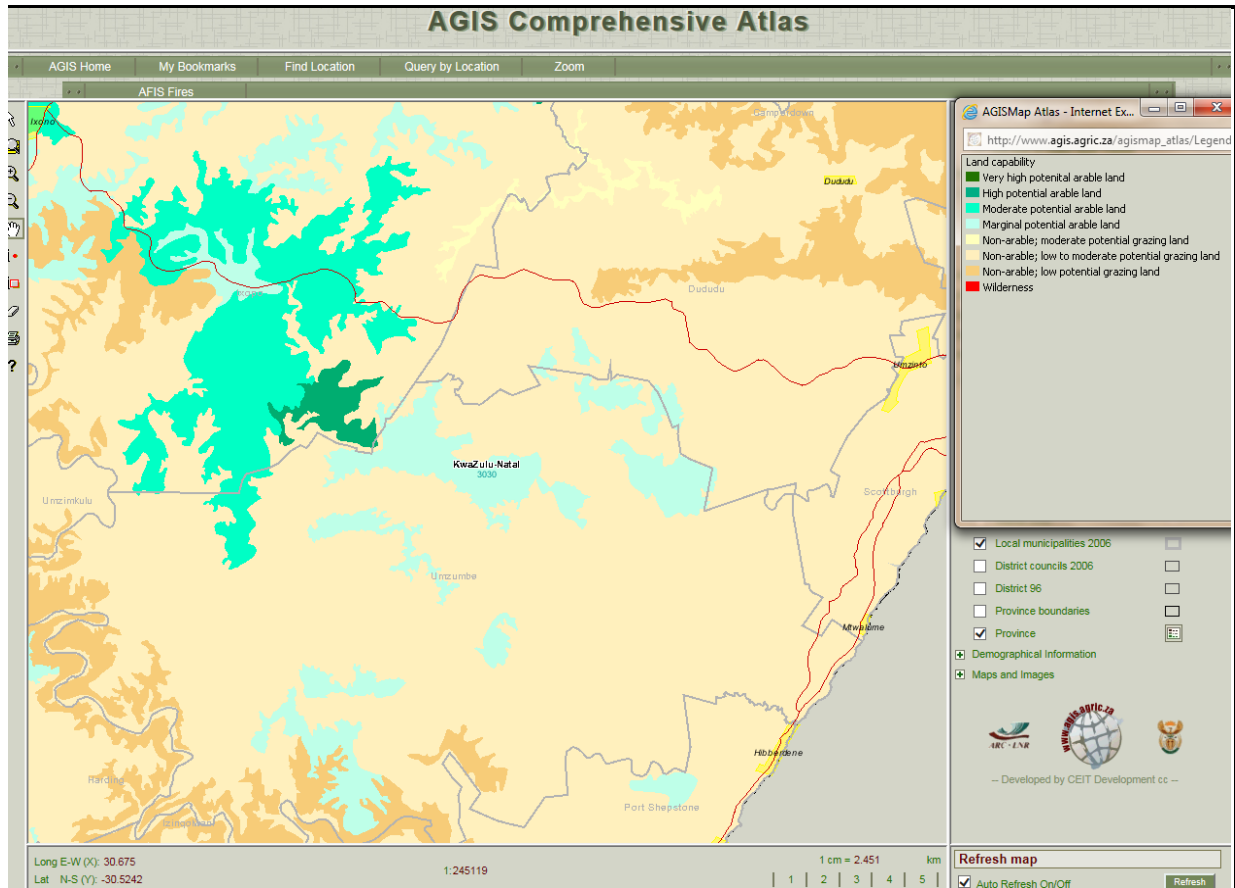


Figure 32: Agricultural potential of project area



Figure 33: Cattle grazing at the project area

12.9 Land Use

The Mtwalume River system is characterised by a highly rugged terrain although relatively more gentle along the western banks. Given this topographical nature, the area where the dam sites are located is in an area that is fairly undeveloped. The land is owned by the Ingonyama Trust and surrounding land uses include small scale subsistence farming including crops and cattle as well as small settlements with schools and clinics. Forestry and sugar cane farming take place some distance from the dam sites.

The Pre-Feasibility Study assessed the dam catchment area using datasets derived from the 2008 KwaZulu-Natal Land Cover Mapping assessment (Ezemvelo- KZN Wildlife, 2008). The data shows that approximately 62.4km² of the upper catchment was afforested by 2008. This included 9.1km² of pine plantation, 40.0km² of eucalyptus plantation, and 13.3km² of wattle plantation.

12.10 Heritage

The following is a brief overview of some of the historical assets in the surrounding area (Ugu DM Integrated Development Plan 2012/2013 – 2016/2017):

- Batstone's Drift, Port Shepstone, where Batstone operated his Pont near the Umzimkulu River;
- Bazleys Harbour Works, Port Shepstone, harbour wall was built in the 1880's to allow access to the Umzimkulu river for small coasters;
- Alfred County Annexation site, Ezingoleni, marks the spot where Alfred County was incorporated into Natal on New Year's Day in 1866;
- Bilamhlolo River, Ramsgate, Dingane's warriors are alleged to have killed members of the family of the early trader Fynn near the mouth of this river in 1839;
- Fynn's Grave, Port Shepstone;
- Green Point/Clansthal Lighthouse, Clansthal between Scottburgh and Umkomaas warns shipping of the presence of the Aliwal Shoal four (4) kilometers offshore;
- Isandlundu / Tragedy Hill, Port Edward where Shaka's warriors are said to have killed a group of Mpondos in 1828;
- Present Marburg commonage, is a site also used by Shaka and his Impis during their Mpondoland raid of 1828;
- Ndongeni ka Xoki's Grave, Port Shepstone, Ndongeni accompanied Dick King on his famous ride in 1842; and
- Execution rock, Dududu, where enemies were executed by the Zulus.

According to the Sisonke (now Harry Gwala) DM's IDP (2012 - 2017), the DM is very rural and therefore has a very rich cultural base with cultural tourism having vast potential throughout the district. The industry is based on traditional villages; production of Arts and Craft; and Traditional Dancing to mention a few. Umzimkhulu Gateway is a great tourist attraction, which is a former border-gate building in Umzimkhulu that has been converted into a tourist information centre which includes a crafts centre, museum, and coffee shop. Other areas of interest include a cultural village in greater Kokstad.

The possibility of finding intact heritage resources such as old homesteads and graves in the area of the dam wall and inundation area is high due to the undeveloped nature of the area.

12.11 Air Quality

Due to the nature of the study area (natural vacant open space), the air quality is regarded to be good. Localised impacts to air quality include burning of emissions from vehicles travelling on the surrounding road network, dust from un-vegetated areas and dirt roads, smoke (veld fires), agricultural activities, and methane release from cattle.

Sensitive receptors to dust and other air quality impacts in the study area include human settlements.

12.12 Noise

The natural state of the study area affords it tranquillity. Dwellings are sparsely situated within the project footprint.

Noise in the region emanates primarily from households, farming operations (e.g. use of farming equipment), and vehicles on the road network. The undulating hills and lowlands serves as noise attenuation features, although the ambient noise levels are regarded as insignificant.

Sensitive receptors to noise include rural dwellings within the dam basin.

12.13 Planning

According to the Harry Gwala DM and Ubuhlebezwe LM IDP and SDF, there is a strategic need for the provision of basic water services to the rural communities within the municipalities.

Access to water and sanitation services is limited. The Harry Gwala DM is responsible for providing water services within the District and Ubuhlebezwe; however, Ubuhlebezwe LM experiences water disruptions on a regular basis. In rural areas, water is mainly drawn from natural sources like streams, rivers and fountains. Many areas in the municipal area do not have purified water and this makes these areas prone to cholera and other diseases. There are boreholes but are not reliable. Water infrastructure is a top priority in the Ubuhlebezwe LM. There is a severe water shortage in the municipal area.

12.14 Infrastructure

The main infrastructure that occurs in the project area is the existing Vulamehlo WTP and weir. There are a few dwellings in the project area, belonging to sustainable farmers in the area. However, no homesteads or structures occur within the proposed dam basin or construction footprint for the associated infrastructure.

12.15 Availability of Services

The dispersed low-density settlement pattern and topography in the project area complicate the provision of service, and substantially increase the costs of installing, maintaining and

operating the associated infrastructure. An indication on the provision of water and sanitation services within Ubuhlebezwe LM are indicated below.

Table 20: Water Services (HG DM IDP)

Municipality	Number of Households	Water Served Households	Percentage of Water Backlogs
uBuhlebezwe LM	26 231	13 503	44.14%

Table 21: Sanitation Services (HG DM IDP)

Municipality	Number of Households	Percentage of Water Backlogs
uBuhlebezwe LM	26 231	13.2%

12.16 Access Roads

There are existing gravel roads in the surrounding area of the proposed site. However, an access road to the Mtwalume dam site will have to be constructed to enable construction machinery to access the site, as well for operation and maintenance of the intake tower and release valves once the dam has been built. A concrete access road will be required for steep gradients, whereas where the gradient is more moderate a gravel access road will suffice.

12.17 Waste Management

The following should be noted with regards to waste management during the construction Phase:

- Temporary waste storage facilities will remain below the thresholds contained in the listed activities of NEM:WA; and
- The EMPr will make suitable provisions for waste management, including the storage, handling and disposal of waste. The EMPr will be used as a guideline for managing and controlling activities that impact adversely on the environment. The following will be implemented to deal with generated waste:
 - a) Control of plant lubricating oil, grease, and petroleum spills: collector trays will be placed underneath all stationery plant/equipment and bunded areas with oil separators will be built around fuel storage areas, workshops, etc. Any inadvertent spills will be cleaned and disposed of in terms of the Act.
 - b) Solid waste: Mobile skips or bins will be located at convenient locations on site including provision of different receptacles for different kinds of solid waste. Periodic collection and disposal to approved landfill sites in the district will be arranged by the contractor. The landfill sites to be used will include Oatland

landfill in Hibiscus Coast municipality and/or Umzinto landfill in Umdoni municipality.

- c) Sanitation: Mobile chemical toilets will be used where people are working and disposed to the designated municipality wastewater works at the agreed intervals.

12.18 Visual Aesthetics

The area is afforded aesthetic appeal through topographical features such as undulating hills, valleys, grassland and watercourses. The undeveloped and rural state of the area further contributes to its visual qualities (**Figure 34**).



Figure 34: View of the project area

12.19 Socio-Economic Environment

The project falls within the Harry Gwala DM and on the boundary between Harry Gwala and the Ugu DM. The information below was provided by the Integrated Development Plan (IDP) of the DM for 2012 – 2017.

The Harry Gwala DM is located in the South West corner KZN. The municipality’s population is sparsely spread throughout an area of 11 127. 9km². The DM is composed of five LMs: Ubuhlebezwe; Ingwe; Kwa-Sani; Greater Kokstad and Umzimkhulu. The proposed dam sites fall in the Ubuhlebezwe LM.

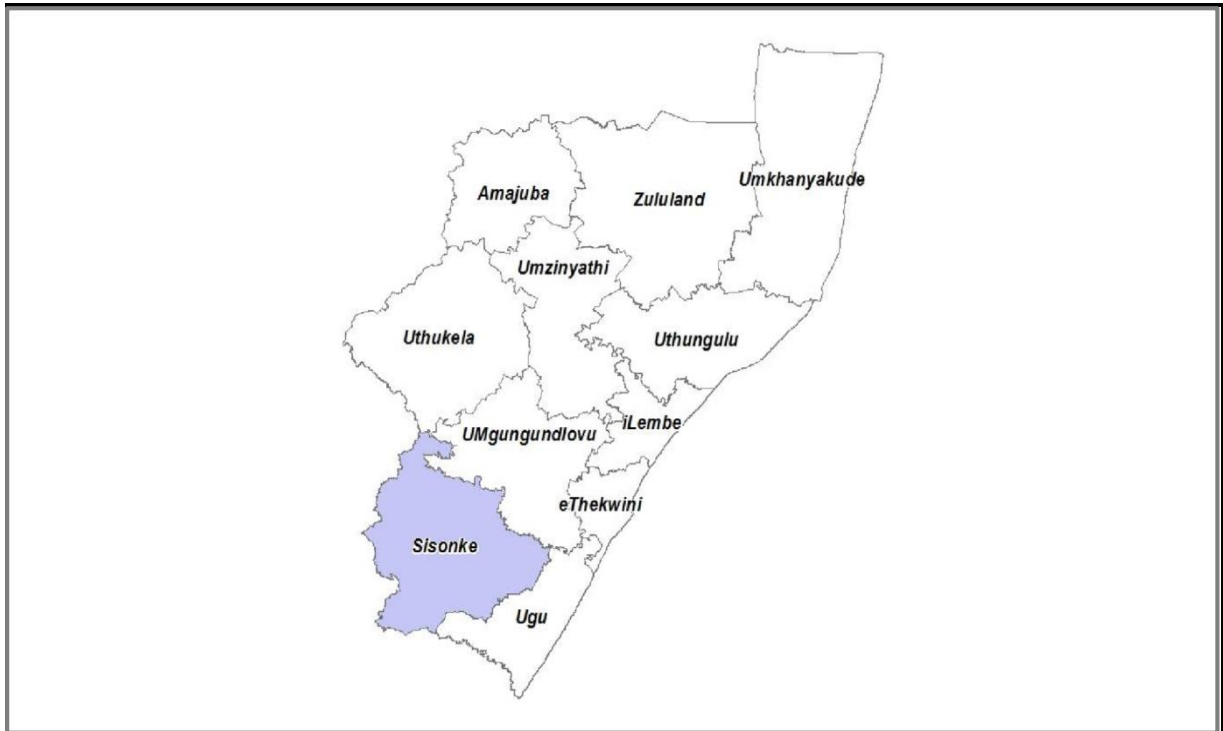


Figure 35: Location of Harry Gwala (formerly Sisonke) DM

The DM is well known for high agro-ecological potential due to an abundance of high quality soils, high altitude, and abundant water. Commercial farms and to a large extent commercial plantations form the bedrock of the economy of the region. Climatic extremes make the area suitable for a variety of products including crops and vegetables, livestock and sugar cane around Ixopo/ Highflats area.

The DM is predominantly rural characterised by small urban centres with larger agricultural, plantations, natural vegetation and traditional authority land. These small urban centres serves as economic hubs for these sub-regions and as administrative areas.

12.19.1 Population

Harry Gwala DM contributed 4.8% to the provincial population and as such is the district with the lowest population number at 461 419 people.

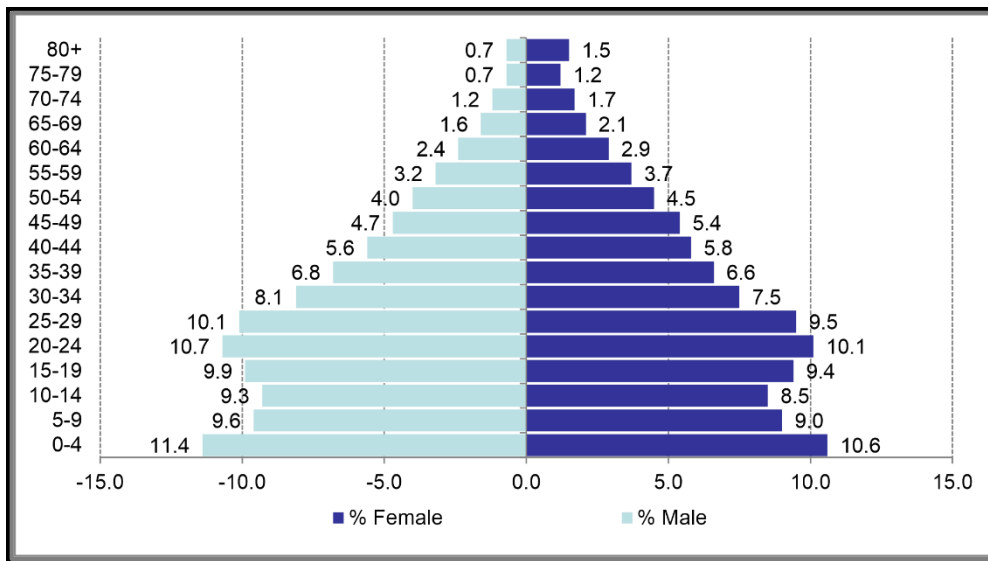


Figure 36: Percentage distribution of population in five-year age group by sex, Census 2011

At a district level the age group between 15 to 34 years, which is categorized as youth, is the most dominant in almost all the local municipalities. This is the same group that forms part of the active labour group, which is also sexually active and vulnerable to social ills including unemployment, HIV/Aids and other infections, involvement in crime and drugs etc. The large numbers of this age group calls for a need for creation of employment opportunities and the provision of educational facilities to cater for their needs.

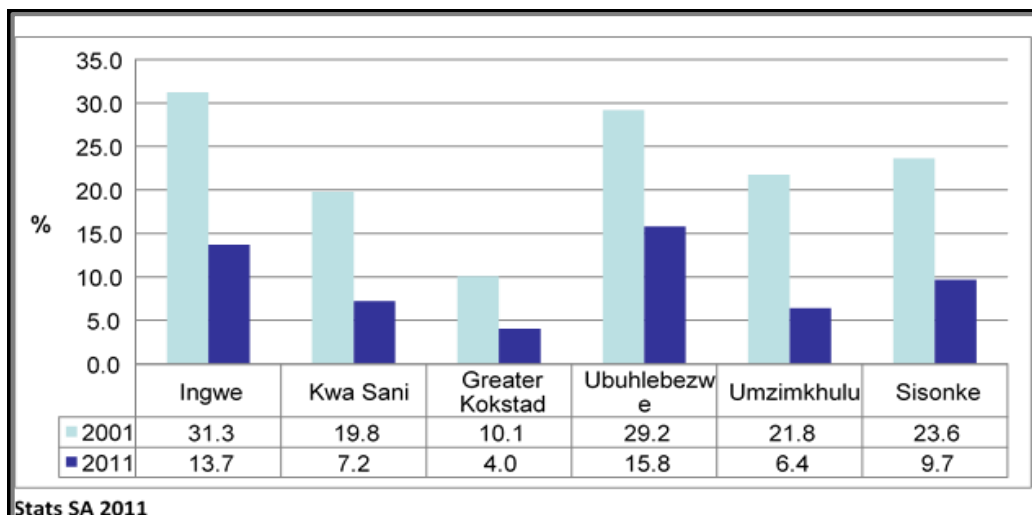


Figure 37: Percentage of population 20 years and older with no education

12.19.2 Education and Employment

The bar graph above shows a significant shift from 23.6% in 2001 to 9.7% in 2011 in the percentage of population that is above the age of 20 with no education clearly showing that

more and more young people are getting educated. This becomes a challenge for the DM if there are limited places of employment for these people.

Although unemployment has come down in all the local municipalities as indicated in **Figure 38** below, unemployment in Harry Gwala DM is higher by 3% than the rest of the Province remaining a concern for the DM.

Out of the population of over 460 000 that resides in Harry Gwala DM, just under 70 000 are employed either formally or informally.

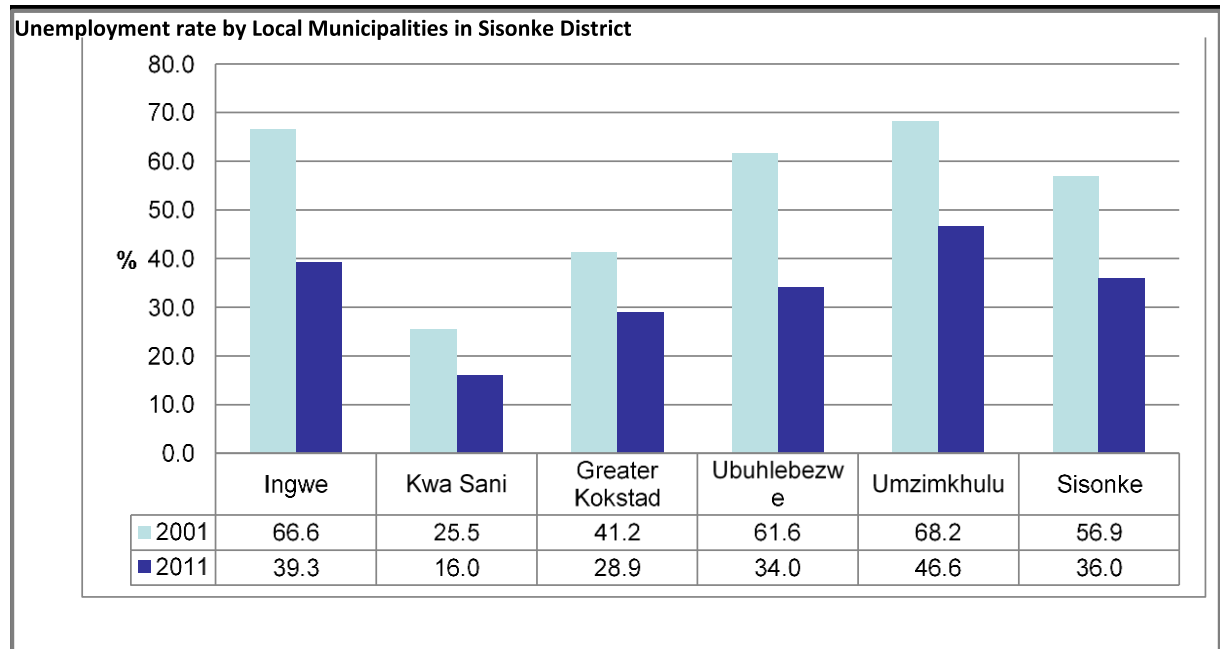


Figure 38: Unemployment in Harry Gwala DM

The dominant role played by agriculture in the district economy is evident in **Figure 39** below. Agricultural activities in the Harry Gwala DM are crop farming (i.e. potatoes and cabbages) and dairy farming. The agriculture sector is one of the main sectors contributing to the regional economy. There are also commercial forestry plantations that provide raw materials for wood-related products. The agricultural sector in the DM has been one of the largest sectors of the district economy. Unfortunately, the sector is failing to fulfil its potential.

A trend analysis allows a greater appreciation of the make-up of the Harry Gwala DM economy, particularly in light of the recent economic recession. The growing capacity of the public sector in the district can be clearly charted, with GVA of community services increasing from R 365 million in 1996 to R 1.513 billion in 2010 (an increase of over 400 %). Analysts estimated that community services will continue this rate of growth over the next four years, reaching R2.539 billion in 2015 (an increase of 168 %). In 2015, community services are projected to make up almost 39 % of the district's GVA.

Agriculture, in contrast, has grown in a more haphazard and slow fashion. It is evident that agricultural GVA in the district has declined in real terms between 2007 and 2010, possibly caused by the recent financial recession.

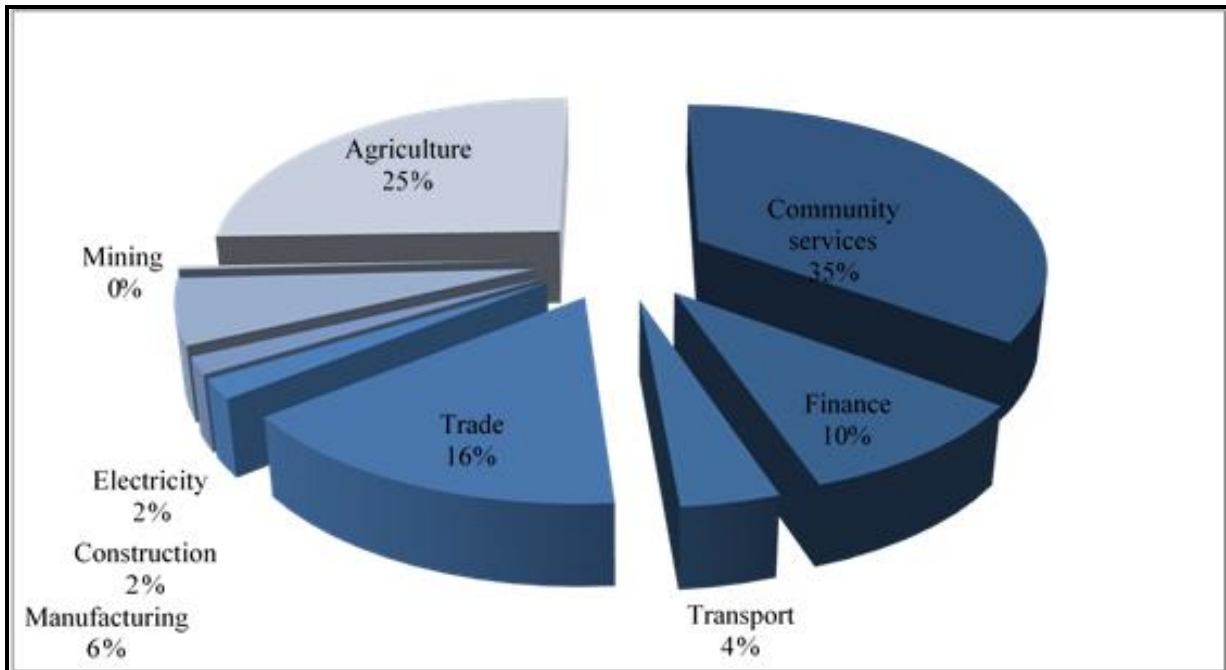


Figure 39: Share of Gross Value Added by industry

12.19.3 Poverty

Income inequality is observed in terms of income distribution. **Figure 40** depicts the distribution of employed residents across monthly income categories using the 2011 Census. It is evident that of those employed, most workers earn low levels of remuneration. Nearly 80% of Harry Gwala DM workers earn R1, 600 per month or less while 40% earn R800 or less. In stark contrast, very few workers earn R122, 800 per month or more – less than 2%.

Given the figures above, it is not surprising that the Harry Gwala DM is home to a significant number of residents who could be classified as living in poverty. In 2011, almost 350,000 residents were classified as “poor”.

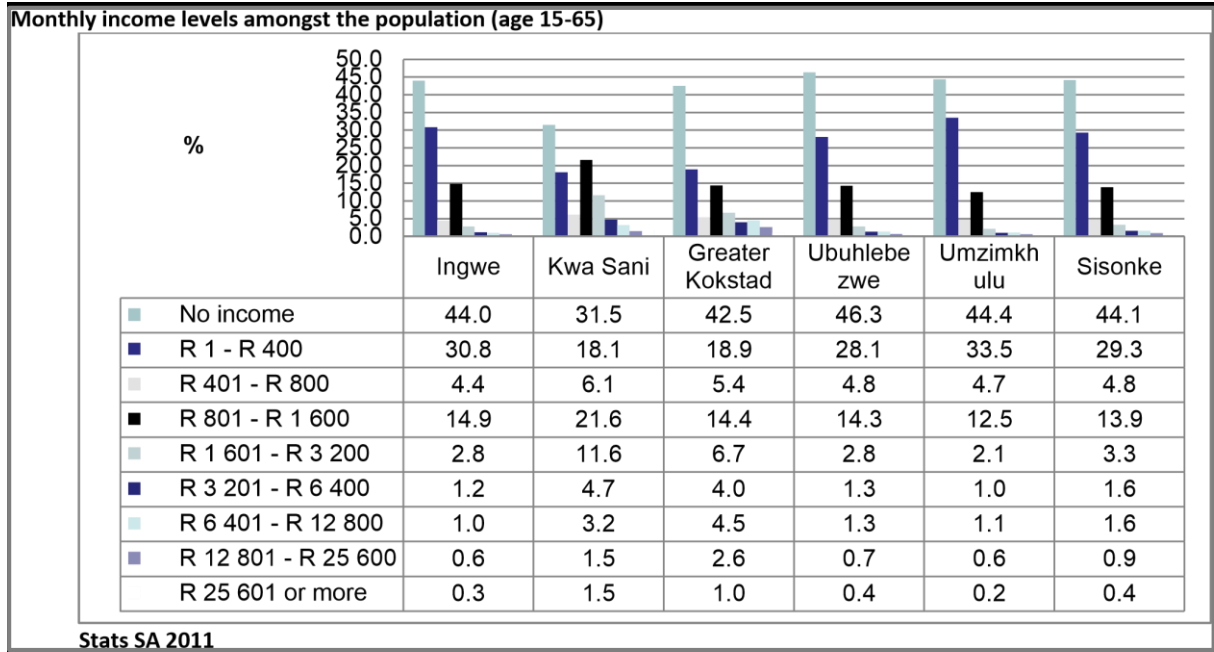


Figure 40: Monthly income level amongst the population

13 SUMMARY OF SPECIALIST STUDIES

13.1 Specialist Studies undertaken as part of the EIA

A crucial element of the Plan of Study for the EIA prepared during the Scoping phase was to provide the Terms of Reference for the requisite Specialist Studies triggered during Scoping. According to Münster (2005), a ‘trigger’ is “a particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an issue and/or potentially significant impact associated with that proposed development that may require specialist input”. The requisite Specialist Studies ‘triggered’ by the findings of the Scoping process, aimed at addressing the key issues and compliance with legal obligations, include:

1. Terrestrial Ecological Impact Assessment;
2. Wetland and Aquatic Impact Assessment;
3. Estuarine Specialist Opinion;
4. Phase 1 Heritage Impact Assessment; and
5. Socio-Economic Impact Assessment.

For the inclusion of the findings of the Specialist Studies into the EIA report, the following guideline was used: *Guideline for the review of specialist input in EIA processes (Keatimilwe & Ashton, 2005)*. Key considerations included:

- Ensuring that the specialists have adequately addressed IAPs’ issues;
- Ensuring that the specialists’ input is relevant, appropriate and unambiguous; and
- Verifying that information regarding the receiving ecological, social and economic environment has been accurately reflected and considered.

The information obtained from the respective Specialist Studies was incorporated into the EIA report in the following manner:

1. The assumptions and limitations identified in each study were included in Section 9;
2. The information was used to complete the description of the receiving environment (Section 12) in a more detailed and site-specific manner;
3. A summary of each specialist study is contained in the sub-sections to follow (Sections 13.1 – 13.6), focusing on the approach to the study, key findings and conclusions drawn;
4. The specialists’ impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment contained in Section 14;

5. The evaluations performed by the specialists on the alternatives of the project components were included in the comparative analysis (Section 15) to identify the most favourable option;
6. Specialist input was obtained to address comments made by IAPs that related to specific environmental features pertaining to each specialist discipline; and
7. Salient recommendations made by the specialists were taken forward to the EIA Conclusions and Recommendations (Section 17).

13.2 Terrestrial Ecological Impact Assessment

The key issues and triggers identified during Scoping for the Terrestrial Ecological Impact Assessment include:

- Species with a known conservation status occur in the project area;
- Potential loss of significant flora and fauna species;
- Impacts to sensitive terrestrial ecological features; and
- Management actions for controlling exotic vegetation.

Table 22: Details of the Ecological Specialist

Organisation	Name	Qualifications	No. of years experience	Affiliation (if applicable)
Nemai Consulting	Mr. Ronald Phamphe	MSc Botany	7	<ul style="list-style-type: none"> • Professional Natural Scientist-Ecological Science (Reg number: 400349/12) with South African council for Natural Scientific Professions (SACNASP) • Professional member of South African Institute of Ecologists and Environmental Scientists (SAIEES) • Professional member of South African Association of Botanists (SAAB)

This section provides a summary of the Terrestrial Ecological Impact Assessment (Nemai Consulting, 2016b), as contained in **Appendix F1**.

The objectives of the study included:

- To apply relevant literature to determine the diversity and eco-status of the plants, mammals, birds, reptiles and amphibians on the two proposed Dam sites;
- To carry out a field surveys to gain an understanding of the diversity and eco-status of taxa which inhabit the proposed study area, as well as the presence of unique habitats that might require further investigation or protection;

- To assess the current habitat and conservation status of plant and animal species on the study site;
- To comment on ecological sensitive species/areas;
- To assess the possible impact of the proposed project on these taxa and/or habitats;
- To list the species on site and to recommend necessary actions in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance; and
- To provide management recommendations to mitigate negative and enhance positive impacts of the two proposed Dam sites.

According to the KZN Provincial Biodiversity Plan, the two proposed Dam sites fall within 0Co (Not areas of Conservation Importance), R2 (Critical Biodiversity Area 1), R0 (Critical Biodiversity Area 3 Optimal), and Ign (100% transformed based on 2005 land cover).

The study site falls within the Grassland Biome. The proposed Dam Site 3 falls entirely within the Moist Coast Hinterland Grassland vegetation type whereas proposed Dam Site 5 falls mostly within the Moist Coast Hinterland Grassland and with a small section falling within the KZN Sandstone Sourveld vegetation types.

According to the data sourced from SANBI; the proposed Dam 3 Site falls entirely within the Vulnerable Ngongoni Veld terrestrial threatened ecosystem whereas the proposed Dam 5 site falls within the Ngongoni Veld and a small section falling within the Endangered KwaZulu-Natal Sandstone Sourveld terrestrial threatened ecosystems.

Most sections of the two proposed Dam sites are heavily dominated by alien invasive plant species or weeds. Numerous exotic and invasive weeds such as *Caesalpinia decapetala*, *Conyza bonariensis*, *Cirsium vulgare*, *Lantana camara*, *Datura stramonium*, *Verbena bonariensis*, and *Ricinus communis* dominated the two sites. These species invade riparian and seep zones with disastrous impacts on water resources, especially within catchments regions. Few patches of natural grasslands still exist. The two proposed Dam sites occur near rural homesteads and this is characterised by communal subsistence agriculture with heavy grazing and some bush clearing for firewood. During the field surveys, no threatened species were observed on sites but two species of conservation importance were noted, namely *Hypoxis hemerocallidea* (Star flower/African potato) and *Boophane disticha* (Century plant). According to Raimondo *et al.* 2009, these two plant species are listed as Declining. It is thus recommended that these plant species must be removed prior construction to areas with suitable survival and growth-enabling conditions. Search, rescue and relocation plan needs to be developed for these sensitive flora species within the construction domain and dam basin. The Plan to be implemented must be in accordance with the project programme to ensure that these sensitive environmental features are rescued prior to potential impact occurrence. Ezemvelo KZN Wildlife is to be consulted to ensure that the Plan incorporates all the Authority's requirements.

The proposed development areas consisted of suitable habitats for mammalian species such as rivers, cliffs, mountains, bushveld and grasslands. During the field assessments, some small rodent species were observed on the study area but the identity of these species could not be verified. The two proposed dam sites are situated not far from the rural homesteads. The fact that communities in these areas hunt for social, cultural and spiritual reasons will mean that few antelopes will be found in the immediate vicinity of the homesteads, although they may be maintaining an existence in natural bush close to the homesteads, albeit in very low numbers. Small predators will be present and, for the most part, will continue to survive in that environment, although they may be killed for muthi purposes. Due to high densities of livestock, especially in the proposed Dam 3 site, these also pose a considerable threat to wildlife, since high numbers of domesticated animals generally cause a displacement of game, as there is less suitable habitat available. Moreover, wild predators such as the Black-backed Jackal have been destroyed by livestock farmers who see these animals as a threat to their livelihoods. Poaching and illegal hunting (dogs) are further reducing the remnant faunal populations. Care should be exercised in order to negate the negative ecological impacts through further habitat fragmentation. Large mammals such as ungulates or carnivores are able to move on to a new area if a given one does not fit their food, cover, or other basic needs, whereas rodents tend to depend on the vegetation in a given area. Seven mammal species were recorded during the field surveys on the two proposed Dam sites and these species were common and of no conservation importance in the area.

Conservation and planning tools were reviewed for relevancy in terms of the project area, and it was found that the two proposed Dam sites do not contain or form part of any Important Bird Area (IBA). An avifaunal study indicated that the rivers, woodlands and exotic trees provided suitable habitats for species recorded on site. During the field assessment, no Red data bird species were noted on sites. Only one endemic bird species was recorded on site, the Jackal Buzzard (*Buteo rufofuscus*). Bird species endemic to southern Africa are important as they do not occur anywhere else in the world. A marginal of the World's bird species have small, restricted ranges, being confined to a particular area, and they are thus endemic to that area. Typically a bird is termed endemic if it is constricted to a range of 50,000 km² or smaller. The constricted range makes these species vulnerable to population reduction. According to Barnes (2000), this species is known to be found in cliffs and ridges, and also on open grasslands. The proposed development is not likely to be associated with large-scale loss of habitat, thus it is highly unlikely that the proposed development would exert an impact of any significance on this endemic bird species.

The woodlands, rivers and grasslands on or near the proposed two sites provide suitable habitats for reptile species recorded on site. Reptiles are extremely secretive and difficult to observe during field surveys. Riparian habitats are traditionally rich in reptile diversity and densities due to the habitat supporting a high abundance of prey species, such as frogs, birds and small mammals. Vegetative cover is also greater within this habitat type. Species are also

very often “ousted” into wetland and riparian zones due to transformation of lands for urban and agricultural purposes. The increased habitat modification and transformation as well as increased human presence and associated disturbances (illegal reptile collecting, indiscriminate killing of all snake species, frequent fires) near the two proposed dam sites are all causal factors in the alteration and disappearance of reptile diversity in the area. The study areas supports suitable habitat for many arboreal species and also provides suitable habitat for terrestrial reptile species such as Ground Agama, Yellow throated Plated Lizard, Montane Speckled or Striped Skink as well as snake species (Rinkhals, Mole Snake, and Black-headed Centipede Eater). Termite mounds were present on both sites and old termite mounds offer important refuges especially during veld fires as well as cold winter months for numerous frog, lizard, snake and smaller mammal species. Large numbers of species of mammals, birds, reptiles and amphibians feed on the emerging alates (winged termites). No termite mounds were destroyed during the brief field surveys. All overturned rock materials were carefully replaced in its original position. Only four reptile species were recorded on both proposed sites, namely the Distant's Ground Agama, Common Dwarf Gecko, Southern Tree Agama and Southern Rock Agama and no Red Data reptile species were noted on sites.

Frog species recorded during the field surveys (3) were common, namely Guttural Toad, Bubbling Kassina and Water Lily Frog. No frog species of conservation concern is known to occur in the proposed development areas and even during the field surveys, no such species were recorded.

Although isolated portions of the basins for Dam site 3 falls within CBA 1, which are associated with high biodiversity, the majority of the inundated areas are areas which have now been transformed by alien plant species, weeds and exotic plants as compared to the proposed Dam site 5. A small section of Dam site 5 falls within the Endangered KwaZulu-Natal Sandstone Sourveld terrestrial threatened ecosystems. It is expected that similar habitat as encountered within the proposed Dam 3 basin is readily available in the greater area to allow for the habitation of relocated species, without resulting in competition with similar species for resources (depending on the conditions of the receiving habitat). The distribution ranges of those species found during the Terrestrial Fauna and Flora are also not endemic to the project area and therefore the proposed Dam 3 possess lesser ecological impacts as compared to the proposed Dam 5 site. It is therefore recommended that Dam site 3 be selected from an ecological perspective.

13.3 Wetland and Aquatic Impact Assessment

The key issues and triggers identified during Scoping for the Wetland and Aquatic Impact Assessment included:

- Impacts associated with instream works during construction in terms of the Mtwalume Dam and river crossings;
- Impacts associated with watercourse crossings by the associated infrastructure and activities;
- Downstream impacts to aquatic ecology due to reduction in water quality in the Mtwalume Dam basin (e.g. temperature and dissolved oxygen stratification);
- Downstream impacts due to alteration of the flow regime;
- Prevention of up- and downstream movement of aquatic biota;
- Fragmentation of the main stem of Mtwalume River;
- Loss of habitat for aquatic biota within the inundation zone;
- Loss of riparian habitat within inundated area;
- Proliferation of aquatic weeds; and
- Impacts to protected fauna and flora species (aquatic and riparian) and sensitive ecosystems.

Table 23: Details of the Aquatic/Wetland Specialist

Organisation	Name	Qualifications	No. of years experience
Sustainable Development Projects	Mr. Alex Whitehead	BSc (Hons) Ichthyology and Fisheries Science	10

This section provides a summary of the Wetland and Aquatic Impact Assessment (SDP, 2015), as contained in **Appendix F2**.

The aim of the study was to undertake an aquatic assessment and wetland delineation of the Mtwalume River study area. The following was undertaken during the course of this study:

1. A desktop review of the study area and the aquatic/wetland habitats and, utilizing aerial imagery, available literature and Geographic Information System (GIS) data.
2. A riparian and wetland habitat delineation and assessment of watercourses and wetlands within 500m of the proposed activity
3. The undertaking of a riparian and aquatic health survey to determine the PES of the Mtwalume River.
4. Assessment of ecological impacts on the Mtwalume River and associated habitats present as a result of the proposed dam and construction activities.

Due to access constraints, two sample sites were selected (**Figure 41**). Mtwalume 1 was situated below the affected area in the vicinity of the existing Vulamehlo Water Treatment Works, while Mtwalume 2 was situated within the upper portion of Dam 5.

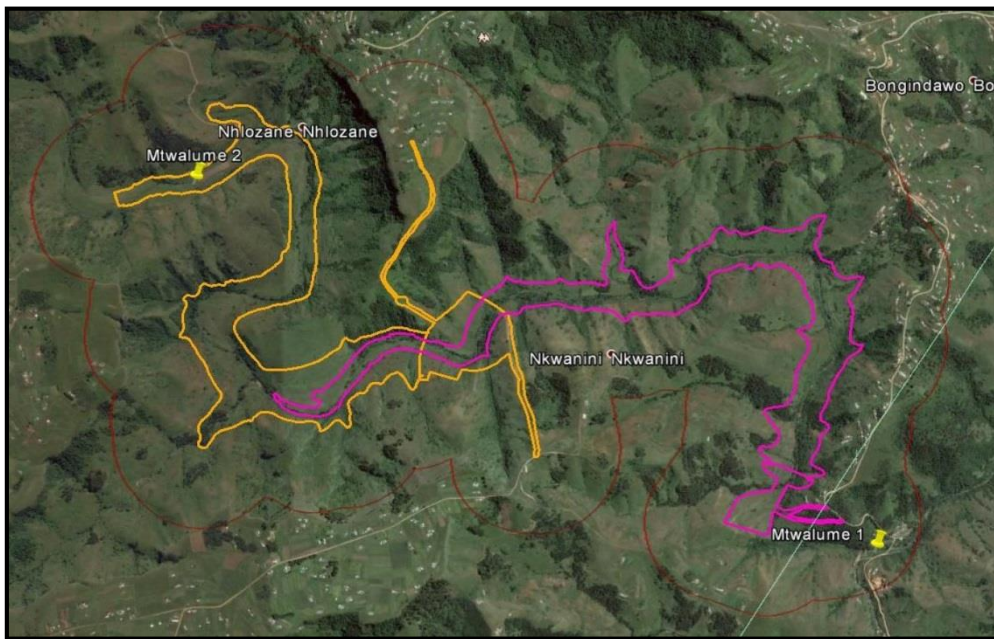


Figure 41: The two ichthyofauna, aquatic invertebrate and riparian vegetation sampling points, above and below the proposed dam sites – Mtwalume 1 and Mtwalume 2.

The Mtwalume River in the vicinity of the proposed dam sites falls within a deeply incised valley characterised by sheer cliffs and steep slopes. The riparian area varies in width and form, from narrow and woody to open grassed floodplain. The floodplain areas were generally alluvial in nature and occurred in the upper portion of the study area. The lower portion was incised and the riparian zone generally constrained to a narrow band adjacent to the active channel. Numerous small ephemeral drainage lines fed the Mtwalume River. These were seldom more than 1km in length and drained the surrounding steep slopes and sandstone scarp formations. Significant scarp forest was noted within the valley and in places was continuous with the riparian vegetation. Hillside seep zones are expected to be associated with the drainage lines.

According to the DWS 2014 PES database, the Mtwalume River reach U80E 05028 is assigned a PES of Category “C” (moderately modified), with a “High” EI (Ecological Importance) and “High” ES (Ecological Sensitivity). The assigned Default Ecological Category for the system is a “B” (largely natural).

The riparian zone was characterised by the presence of both woody and non woody plant species. Woody vegetation generally occurred as isolated patches of scarp/riverine forest/bush, some of which were associated with larger scarp forest systems that extended well beyond the riparian zone. The non woody vegetation component comprised sedge dominated areas and grassland dominated areas. Sedge dominated areas were generally confined to the marginal zones, while grasses occurred in both the marginal and non-marginal riparian areas. *Cyperus latifolius*, *Typha capensis*, *Scirpis ficinoides* and *Schoenoplectus corymbosus* were the most common sedge species encountered. *Miscanthus capensis* and

Aristida junciformis were two common grasses within the riparian zone, the former associated with the marginal zone and the latter a dominant grassland species that occurs in a range of habitats. *A. junciformis* can be an indicator of past veld disturbance and poor veld management, where it becomes dominant, reducing the species diversity. Moderate levels of exotic invasion was noted in the riparian zone. Common exotic invasive species included *Acacia mearnsii*, *Senna didymobrya*, *Lantana camara* and *Solanum mauritianum*. The reference state for the valley in question was likely to have been similar to what is currently present, but with more extensive scarp and riverine forest areas, fewer and more diverse grassland areas and no exotic invasion.

Although the valley is generally uninhabited, abandoned settlements were seen in the valley, indicating past utilisation of the lower portions of the valley for subsistence agriculture, grazing and collection of fire wood. An abandoned agricultural project was noted in the upper portion of the valley within a floodplain area close to Mtwalume 2. Over the years these past activities facilitated the loss of indigenous bush and forest and the expansion of *A. junciformis* dominated grassland. Despite this there was little evidence of activities that would compromise water quality and quantity such as forestry or erosion within the affected riparian zone. The VEGRAI Level 3 model indicated that the riparian zone within the project area can be described as “moderately modified” (EC: C). This was primarily due to moderate level of exotic invasion and a decline in scarp and riverine forest habitat.

Invertebrate sampling results are provided in the report. At Mtwalume 1, 21 taxa were recorded with a total score of 135 and an ASPT of 6.43. At Mtwalume 2, 27 taxa were recorded with a total score of 160 and an ASPT of 5.93. According to the interpretation guidelines for the North Eastern Coastal Belt (Dallas 2007), the invertebrate community of Mtwalume 1 would fall into EC: C or “moderately modified” while Mtwalume 2 would fall on the boundary of EC: C/B “moderately modified” to “largely natural”. The IHAS scored instream habitat at the sites as 95% and 91% respectively, indicating suitable invertebrate habitat present at each site. Despite the sample being undertaken in winter, flow was good and each site, although differing in appearance presented a range of instream habitats supporting a diverse invertebrate community.

The river at Mtwalume 2, the upper site, was narrow, deeper and slower flowing, with aquatic vegetation (*Potamogeton pusilis*) present. At Mtwalume 1, the lower site, the river was wider, shallower with more broken water and riffles present. Both sites provided a range of substrates from GSM to bedrock/large boulders. Mtwalume 1 was positioned in a more disturbed portion of the river and was downstream of an offtake weir and upstream of a small road bridge. The SASS scores recorded are encouraging as a number of high scoring taxa such as Perlidae, Heptageniidae and Philopotamidae were recorded suggesting that the disturbances within the valley and upper catchment have not significantly affected the invertebrate community,

indicating that the water quality and instream habitat of the Mtwalume River are of good quality.

From the Frequency of Occurrence (FROC) data (based primarily on DWS 2014 and Kleynhans *et al.* 2008 for nearby rivers) 7 reference indigenous fish species were noted. During sampling, only two fish species were captured, *Labeobarbus natalensis* and *Micropterus salmoides* (exotic). *L. natalensis* was the most numerous of the two species. Of the 16 specimens noted only 1 was >150 mm (TL). The specimens recorded were most likely immature or recently mature male yearlings. Two of the 3 *M. salmoides* specimens captured were mature and around 300 mm in length. The presence of *M. salmoides* is concerning as it is a highly predaceous exotic species that can have a catastrophic effect on the populations of small indigenous species within a river system. The species has probably been in the system for many years, having been washed out of farm dams in the Highflats area. The presence of *M. salmoides* may explain the absence of other small minnow species that are usually prolific in similar coastal river systems. Seasonal migrations may also be responsible, however the smaller species expected in the system are not known to migrate large distances and should be present, supporting the impact of an outside factor, in this instance *M. salmoides*. Other disturbances that may be influencing the ichthyofauna include the off take weir and the numerous upstream dams. The former is a significant barrier to smaller fish species, preventing them from moving upstream, while the upstream dams are likely to increase the regularity of very low or no flow events within the system which may also prevent fish movement at times. Of the metric groups influencing the fish community, the presence of *M. salmoides* is considered the most significant. The FRAI model assigned the system a PES of “greatly modified” (EC: E) based on the ichthyofaunal community.

The potential impacts during the construction phase identified include sedimentation, contamination, blasting, and habitat disturbance. The potential impacts during the operation phase identified include alien invasion of plants species, habitat alteration, river flow, water quality, and fish migration. The impacts discussed above are applicable to both dam alternatives. Due to the similarity of habitats and position within the same river reach, there is not considered to be any difference in the significance of the impacts or the type of impacts between the dam positions. Essentially either dam option will prove equally detrimental to the receiving environment.

From an ecological perspective it would be fair to conclude that no dams should be built within the valley. That said, the lower portion of the valley may be more suitable due to the presence of the offtake weir and other disturbances such as sand winning, surrounding settlement and exotic weed encroachment in to the riparian zone. Dam site 3 is therefore deemed to be the more acceptable of the two options. The ultimate effect of a dam of this magnitude on the Mtwalume River may be a decline in ecological integrity of the entire section owing to the cumulative effect of the various impacts identified.

Few mitigation measures exist, particularly for the impacts that will arise during the life time of the dam. Of particular concern is the expected proliferation of *M. salmoides*, the barrier effect of the dam to migratory species (*L. natalensis* and *Anguilla* sp.), the additional affect the dam may have on river flow conditions considering the existing number of dams and extent of forestry in the upper catchment and the permanent loss of habitat upstream of the dam and the potential alteration of instream habitat below the dam.

13.4 Estuarine Specialist Opinion

The key issues and triggers identified during Scoping for the Estuarine Specialist Opinion include:

- Proposed Dam along the Mtwalume River is predicted to have an impact on the Mtwalume Estuary located approximately 35km from the proposed dam site.

Table 24: Details of the Estuarine Specialist

Organisation	Name	Qualifications	No. of years experience
Anchor Environmental	Mr. Barry Clark	Ph.D. Marine Biology	25

This section provides a summary of the Estuarine Specialist Opinion (Anchor Environmental, 2015), as contained in **Appendix F3**.

This report contains a specialist opinion on the potential impacts of the estuary. Terms of Reference for the study included the following:

- Undertake a Specialist Opinion on the potential impacts (or lack thereof) of the construction of a dam on the Mtwalume River on the estuary downstream in accordance with any Department of Water and Sanitation Requirements;
- Provide a statement on the potential impacts (or lack thereof) of the construction of the dam on the Mtwalume Estuary; and
- Recommend if a full impact assessment on the Estuary is required.

The PES of the Mtwalume estuary was assessed fairly recently as part of a Water Resources Classification Study undertaken by Rivers for Africa eFlows Consulting (DWS 2013). Results of this assessment for the Mtwalume estuary indicated that the system as a whole is in a “C” category – i.e. “Moderately modified”. Most of the abiotic components were in a “C” category while the Biotic components were in a “C” or “D” category.

Mean annual runoff (MAR) to the estuary under Reference (Natural) conditions was estimated at 57.60 Mm³/a where the Present day MAR was estimated at 42.78 Mm³/a, or 74% of Natural. Reduction in freshwater runoff to the estuary is not seriously problematic at this stage, but the authors did highlight the fact that the potential for water resources development on the

Mtwalume catchment was minimal (<5%) to avoid any further deterioration in the health of the system.

The Mtwalume estuary scored 53.5% in terms of National Biodiversity Importance (i.e. is an “important” estuary: score 3 of out of 5), while the Socio-cultural Importance score is 2.32 (i.e. “Medium” importance). Overall, the Mtwalume estuary was allocated an Integrated Environmental Importance Score of 2 of 5 due to it being in a “C” (or moderately modified) condition. The system is thus considered to be of “Medium” importance.

Data on streamflow in the Mtwalume River at the Vulamehlo Weir (Gauging station U8H004) were obtained from DWS for the period Jan 2000 to July 2015. Runoff is highly variable on an interannual basis but very strongly seasonal, with highest flows (>5000 m³/d) recorded in Summer (Nov–Feb) and low flows (<3000 m³/d) recorded during Winter (May–Aug). Both seasonal and interannual variability is important for estuarine functioning as this affects sediment transport (high flows carry disproportionately more sediment than low flows) and breaching dynamics (i.e. timing and frequency of the opening of the estuary mouth). These process can, in turn, affect important ecological processes such as recruitment of marine species into and emigration from the estuary. The catchment above the Vulamehlo Weir contributes an estimated 32% of the Present Day MAR to the estuary. One of the main risks that the dam poses to the Mtwalume estuary is to change seasonal flow patterns of freshwater runoff to the estuary. However, high flows over the spillway from the dam are expected to mimic natural, seasonal high flows, and the low flow releases from the outlet pipe will be designed to mimic natural, seasonal low flows in order to protect the integrity of the river downstream of the dam. Provided this is the case risks to the estuary from this source are likely to remain low.

It is also assumed that the purpose of regulating flow on the Mtwalume River would be to facilitate abstraction for irrigation and other purposes. Indirect impact on the estuary may thus also include a net reduction in MAR and/or increases in nutrient levels in the flow reaching the estuary due to an increase in agricultural return flows and/or storm water runoff and/or inputs from WWTPs associated with new or expanding human settlements. This may, however, be balanced to some extent by the reduction in nutrient levels in water released from the dam due to the capture and retention of return flows from the forestry and small scale farming upstream of the dam. These issues would need to be investigated in detail in order to fully quantify potential impacts on the Mtwalume estuary.

In summary, therefore, the significance of any potential impacts of dam construction on the Mtwalume estuary cannot be fully quantified without more information on the likely changes in the flow regime of the river below the dam and the likely impacts this may have on runoff to the estuary. However, provided changes in the seasonal flow regime of the river are kept to a minimum impacts on the estuary are likely to be low. From an ecological and socio-cultural perspective, the Mtwalume estuary is considered to be of “Medium” importance, with an

Integrated Environmental Importance Score of 2 of 5. The current health of the system is rated as “moderately modified” or “C” class.

13.5 Phase 1 Heritage Impact Assessment

The key issues and triggers identified during Scoping for the Phase 1 HIA include:

- The size of the area;
- Potential occurrence of heritage resources, graves and structures older than 60 years within project footprint; and
- Heritage significance of the project area.

Table 25: Details of the Heritage Specialist

Organisation	Name	Qualifications	No. of years experience
Private	Ms. Jean Beater	MA (Heritage Studies) MSc Environmental (in progress)	30

This section provides a summary of the Phase 1 HIA (Beater, 2016), as contained in **Appendix F4**.

The aim of the HIA was to undertake a Phase 1 HIA in order to determine the existence of heritage resources in the project area that could be impacted by the proposed activity and provide mitigation measures and recommendations to avoid or limit the impact of the proposed dam on heritage resources.

The project area has never been systematically surveyed for archaeological sites in the past. The Paddock and greater Oribi Gorge areas, situated to the south east of the study area in similar geographical environments are well covered by previous surveys. Later Stone Age rock art sites occur near the coast. The rock art sites form part of the eastern seaboard coastal rock art zone. Most of these occur in sandstone shelters and depict red monochrome paintings. Three rock art sites have been recorded as occurring in the greater Highflats area. Rock art sites also occur to the east of the project area closer to the coast. However, all the recorded sites are situated several kilometres from the project area. The closest one is located almost 12 km to the west of the proposed dam sites.

No archaeological material or sites were observed during the site inspection that was undertaken. This could be as a result of dense vegetation that made visibility poor especially in terms of sub-surface archaeological sites.

A local resident indicated that there were graves situated at a derelict homestead located close to the site of the wall for Dam Site 3. The construction and subsequent inundation of the dam wall will result in the destruction of the graves. The graves are significant reminders of those who lived at the homestead and therefore it is recommended that the graves be removed prior

to the construction of the dam in consultation with the family and affected community as required by Regulation 4 of the KZN Heritage Regulations of 2012 if Dam Site 3 is selected as the site for the Mtwalume Dam.

In terms of Dam Site 5, a number of abandoned homesteads were found in the vicinity of the dam wall. It is possible that there are graves situated near these homesteads although no graves were noted during the site inspection. It is recommended that construction activities keep well clear of the homesteads to avoid any damage to potential graves. A number of graves were found in the valley area that will be inundated by Dam Site 5. The graves are unmarked. There appear to be at least 5 visible grave sites.

A cattle dip was found in the basin of Dam site 5. It appears to still be in use. The dip will be inundated if Dam Site 5 is selected. The structure is considered to be of medium significance as it appears to be the only one in the surrounding area that local farmers use. The inundation of the cattle dip could impact on farming activity and it is recommended that the Applicant provide a new cattle dip in consultation with the farmers if Dam Site 5 is chosen for the proposed dam.

It is recommended that a Phase 2 assessment be undertaken once the dam site is chosen so that a systematic ground survey for both archaeological and grave sites is undertaken to ensure that no graves or significant archaeological sites are inundated/destroyed by the dam. The identified graves at the derelict homestead close to the site of the proposed dam wall must be removed prior to construction if Dam Site 3 is selected. Graves situated close to the abandoned homesteads found in the area above the site of the proposed dam wall for Dam Site 5 must be protected from construction activities including the building of access roads, potable water pipelines, etc. The graves found in the valley that will be inundated by Dam Site 5 will have to be removed in consultation with family members and the community and according to procedures determined by the KwaZulu-Natal 2012 Regulations regarding the relocation of graves.

It was concluded that Dam Site 3 is preferred due to the direct impact on graves and a cattle dip that still appears to be used by local farmers. In addition, Dam Site 3 is located closer to the water treatment plant and there are several existing roads hence limiting impacts whereas Dam Site 5 requires more new access roads, the construction of which could impact on heritage resources.

13.6 Socio-Economic Impact Assessment

The key issues and triggers identified during Scoping for the Socio-Economic Impact Assessment include:

- Potential resettlement of structures in dam basin;
- Construction-related impacts; and

- Influx of people seeking employment and associated impacts (e.g. foreign workforce, cultural conflicts, squatting, demographic changes, anti-social behaviour, and incidence of HIV/AIDS).

Table 26: Details of the Socio-Economic Specialist

Organisation	Name	Qualifications	No. of years experience	Affiliation (if applicable)
Nemai Consulting	Mr. Ciaran Chidley	BA (Economics); BSc Eng (Civil); MBA	22	ECSA
	Ms. Sameera Munshi	B.Com (Hons) (Economics)	6	N/A

This section provides a summary of the Socio-Economic Impact Assessment (Nemai Consulting, 2016a), as contained in **Appendix F5**.

The terms of reference for the Report included the following:

- Undertake a desktop study to determine the specific local socio-economic, land utilisation and acquisition implications of the project.
- Collect baseline data on the current socio-economic environment.
- Assess socio-economic impacts (positive and negative) of the project, and quantify the economic impacts.
- Undertake a thorough review of the following with the purpose of identifying landowner issues:
 - Minutes of public meetings and individual meetings; and
 - Comments and Response Report.
- Suggest suitable mitigation measures to address the identified impacts.
- Make recommendations on preferred options from a socio-economic perspective.

The study was commissioned as a desktop study therefore not site visit was undertaken. Data was accessed through South African Databases, available reports and articles, internet searches. The profile of the baseline conditions includes determining the current status quo of the community, including information on a number of social and economic issues such as demographic factors; economic factors such as income and land tenure; and statutory and regulatory environment.

Dam Site 5 is situated further from the main road therefore located slightly further from population centres than Dam Site 3. In addition, apart from the proximity impacts during the construction phase, the socio-economic impacts of Dam Site 3 and Dam Site 5 will not differ significantly. For this reason, the study prefers Dam Site 5.

The project may impact the directly affected communities negatively during the construction to due to nuisance factors like dust, noise and blasting. Mitigation measures recommended in

this report and other specialist studies are to be followed to reduce these construction impacts. That said, the construction will also inject capital into the area.

The dam will support the current and future agricultural practices in the area with the potential to create sustainable business and employment opportunities.

Employment and SMME opportunities have the potential to empower the communities in the long term. Ugu DM, Ubuhlebezwe LM, Umzumbe LM and Vulamehlo LM are all encouraged to support and maximise the opportunities presented by the dam.

The proposed development will create a significant short term stimulus to the local economy during the construction phase. In an area with high unemployment and limited economic opportunity available, a project of this nature can stimulate opportunities, upskill and empower the communities they impact. In addition, it injects capital in an area where there is a great need for investment and infrastructure development. With the appropriate mitigation measures applied, this development should be supported.

14 IMPACT ASSESSMENT

14.1 Overview

This section focuses on the pertinent environmental impacts that could potentially be caused by the proposed Mtwalume Dam and associated infrastructure during the pre-construction, construction and operational phases of the project.

An 'impact' refers to the change to the environment resulting from an environmental aspect (or activity), whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity. Impacts were identified as follows:

- Impacts associated with listed activities contained in GN No. R. 544, R. 545 and R. 546 of 10 June 2010, for which authorisation has been applied for;
- An appraisal of the project activities and components;
- Issues highlighted by environmental authorities;
- Comments received during public participation;
- An assessment of the receiving biophysical, social, economic and technical environment; and
- Findings from Specialist Studies

14.1.1 Impacts Associated with Listed Activities

As mentioned, the project requires authorisation for certain activities listed in the EIA Regulations (2014), which serve as triggers for the environmental assessment process. The potential impacts associated with the key listed activities are broadly stated in **Table 27**.

Table 27: Impacts associated with the Listed Activities

GN	Activity	Description as per GN	Potential Impact Overview
GN R. 544	11 (iv)(ix)(xi)	The construction of: (iv) dams, (ix) spillways, and (xi) infrastructure exceeding 50 m ² in size, where such construction occurs within a watercourse or 32m of a watercourse	<ul style="list-style-type: none"> • Impacts associated with the footprint of the physical infrastructure - dam, access road, associated infrastructure (potable water pipeline, roads, water storage tank, mixing and concrete batching plant, culvert river crossing, site camp and site office) within 32 m of a watercourse. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species).
	18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from- a watercourse	<ul style="list-style-type: none"> • Construction activities (including bulk earthworks) to be undertaken within a watercourse for physical infrastructure - the inundated area, dam wall and embankment, and construction laydown areas. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside the watercourse. • Destabilisation of affected watercourses.
	22 (ii)	The construction of a road, outside urban areas, (ii) where no reserve exists where the road is wider than 8 metres,	<ul style="list-style-type: none"> • Impacts associated with building the access roads to the construction areas. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Traffic disruptions.
	47 (ii)	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres	<ul style="list-style-type: none"> • Impacts associated with widening existing roads to the various sites (construction and operational phases). • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Traffic disruptions.

GN	Activity	Description as per GN	Potential Impact Overview
	56	Phased activities for all activities listed in this Schedule, which commence on or after the effective date of this Schedule, where any one phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold	<ul style="list-style-type: none"> Impacts associated with type of phased activities. Cumulative impacts.
GN R. 545	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more;	<ul style="list-style-type: none"> Clearance of large areas of indigenous vegetation associated with the construction footprint, including the inundated area, dam wall and embankment, and construction laydown areas including potable water pipeline, roads, water storage tank, mixing and concrete batching plant, culvert river crossing, site camp and site office. Potential loss of sensitive fauna and flora species.
	19	The construction of a dam, where the highest part of the dam wall as measured from the outside toe of the wall to the highest part of the wall is 5m or higher or where the highest water mark of the dam covers an area of 10 ha or more	<ul style="list-style-type: none"> Impacts associated with the footprint of the dam and associated infrastructure. Impacts to the hydrological and sediment flow regime. Impacts to the aquatic environment. Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). Socio-economic impacts associated with inundation of dam basin.
GN R. 546	4 (a) (ii)(ee)	The construction of a road wider than 4 metres with a reserve less than 13,5 metres outside urban areas and in- Critical Biodiversity Areas (CBAs)	Impacts associated with building access roads to sensitive, threatened or protected ecosystems.
	12 (b)	The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.	<ul style="list-style-type: none"> The clearance or inundation of large tracts of indigenous vegetation. Potential loss of sensitive fauna and flora species.
	13 (a)	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation,	<ul style="list-style-type: none"> The clearance or inundation of large tracts of indigenous vegetation. Potential loss of sensitive fauna and flora species.
	14 (a)(i)	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative	<ul style="list-style-type: none"> The clearance or inundation of large tracts of indigenous vegetation. Potential loss of sensitive fauna and flora species.

GN	Activity	Description as per GN	Potential Impact Overview
		cover constitutes indigenous vegetation outside urban areas	
16 (a)(ff)	(ii)	The construction of: (ii) slipways exceeding 10 square metres in size; Outside urban areas within CBAs	Impacts to sensitive, threatened or protected ecosystems associated with infrastructure within watercourse(s) / within 32 m from watercourse(s). Effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside the watercourse.
19 (ii)(ee)(ii)	(a)	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre outside urban areas within CBAs and within 100 metres from the edge of a watercourse	Impacts to sensitive, threatened or protected ecosystems associated with access roads to the various sites (construction and operational phases).
26		Phased activities for all activities listed in this Schedule and as it applies to a specific geographical area, which commenced on or after the effective date of this Schedule, where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.	<ul style="list-style-type: none"> • Impacts associated with type of phased activities. • Cumulative impacts.

14.1.2 Environmental Activities

In order to understand the impacts related to the project it is necessary to unpack the activities associated with the project life-cycle (refer to Section 6.3), as done in the sub-sections to follow.

14.1.2.1 Project Phase: Pre-construction

The main project activities as well as high-level environmental activities undertaken in the pre-construction phase are listed in **Table 28**.

Table 28: Activities associated with Pre-construction Phase

Pre-construction Phase	
Project Activities	
1.	Negotiations and agreements with the affected landowner (Ingonyama Trust), stakeholders and authorities
2.	Initiate legal process required for land acquisition
3.	Detailed engineering design
4.	Detailed geotechnical investigations
5.	Survey and mark construction servitude
6.	Survey and map topography for determination of post-construction landscape, rehabilitation and shaping (where necessary)
7.	Procurement process for Contractors
8.	Development and approval of method statements
9.	Building of Site Office and Site Camp
Environmental Activities	
10.	Diligent compliance monitoring of the EMP, environmental authorisation and other relevant environmental legislation
11.	Undertake Phase 2 HIA
12.	Undertake a walk through survey of the project footprint by the relevant environmental specialists to identify sensitive environmental features
13.	Develop environmental monitoring programme
14.	Develop Search, Rescue and Relocation Management Plan, based on findings of walk through survey
15.	Barricading of sensitive environmental features
16.	Establish Environmental Monitoring Committee (EMC)
17.	On-going consultation with IAPs

14.1.2.2 Project Phase: Construction

The main project activities as well as high-level environmental activities undertaken in the construction phase are listed in **Table 29**.

Table 29: Activities associated with Construction Phase

Construction Phase
Project Activities
1. Site establishment
2. Prepare access road
3. Establish construction laydown area
4. Delivery of construction material
5. Transportation of equipment, materials and personnel
6. Storage and handling of material
7. Construction employment
8. Site clearing
9. Excavation
10. Blasting
11. River diversion for building of dam
12. Establishment and operation of batching plant
13. Construction of embankments, bottom outlet and spillways
14. Concrete works
15. Mechanical and electrical works
16. Cut and cover activities
17. Stockpiling
18. Waste and wastewater management
Environmental Activities
19. Diligent compliance monitoring of the EMP, environmental authorisation and other relevant environmental legislation
20. Ongoing search, rescue and relocation of red data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities) – permits to be in place
21. Implement environmental monitoring programme
22. Reinstatement and rehabilitation of construction domain (outside of inundation areas, as necessary)
23. Convene EMC Meetings
24. On-going consultation with IAPs

14.1.2.3 Project Phase: Operation

The main project activities as well as high-level environmental activities undertaken in the operation phase are listed in **Table 30**.

Table 30: Activities associated with Operation Phase

Operation Phase
Project Activities
1. Maintenance of infrastructure
2. Operation of dam
3. Adhere to Operating Rules
Environmental Activities
4. Erosion monitoring programme
5. Satisfy EWR
6. On-going consultation with IAPs

14.1.3 Environmental Aspects

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment and cause an impact. The following environmental aspects have been identified for the proposed development of Mtwalume Dam and associated infrastructure, which are linked to the project activities (note that only high level aspects are provided):

Table 31: Environmental Aspects associated with Project Life-Cycle

Environmental Aspects
Pre-construction Phase
1. Inadequate consultation with landowners/occupiers of land
2. Inadequate environmental and compliance monitoring
3. Poor construction site planning and layout
4. Land occupancy by temporary buildings, provisional on-site facilities and storage areas
5. Inaccurate pre-construction environmental walk through survey (including search and rescue)
6. Absence of relevant permits (e.g. for protected trees, heritage resources)
7. Lack of barricading of sensitive environmental features
8. Poor waste management
9. Absence of ablution facilities

Environmental Aspects
Construction Phase
1. Inadequate consultation with landowners/occupiers of land
2. Inadequate environmental and compliance monitoring
3. Lack of environmental awareness creation
4. Indiscriminate site clearing
5. Poor site establishment
6. Poor management of access and use of access roads
7. Inadequate provisions for working on steep slopes
8. Poor transportation practices
9. Poor fencing arrangements
10. Erosion
11. Disruptions to existing services
12. Disturbance of topsoil
13. Poor management of excavations
14. Inadequate storage and handling of material
15. Inadequate storage and handling of hazardous material
16. Poor maintenance of equipment and plant
17. Poor management of labour force
18. Pollution from ablution facilities
19. Inadequate management of construction camp
20. Poor waste management practices – hazardous and general solid, liquid
21. Wastage of water
22. Disturbance to landowners/occupiers of land
23. Poor management of pollution generation potential
24. Damage to significant flora (if encountered)
25. Damage to significant fauna (if encountered)
26. Influence to resource quality of the Mtwalume River and its tributaries from river diversions, in-stream works and activities in the riparian zones
27. Environmental damage where drainage lines are crossed
28. Environmental damage of sensitive areas
29. Disruption of archaeological and cultural features (if encountered)
30. Poor reinstatement and rehabilitation
Operation Phase
1. Inadequate consultation with landowners/occupiers of land

Environmental Aspects
2. Inadequate environmental and compliance monitoring
3. Inadequate management of access, routine maintenance and maintenance works
4. Inadequate management of vegetation
5. Not satisfying the EWR
6. Release of poor quality water
7. Downstream erosion

14.1.4 Issues raised by Environmental Authorities and IAPs

The issues raised by authorities (both regulatory and commenting) and IAPs during meetings and contained in correspondence received to date during the execution of the EIA are captured and addressed in the Comments and Responses Report (**Appendix K**). The main comments are summarised below:

- DAFF - DAFF is the authority mandated to implement the National Forests Act No. 84 of 1998 by regulating the use of natural forests and protected tree species. DAFF's concern pertains to the potential impacts of the project on sections of the proposed site such as the valley bottom and areas which constitute clumps of indigenous trees. A Terrestrial Ecological Impact Assessment has been conducted to address these concerns.
- KZN Department of Education (DoE) – Concern in terms of the proposed dam sites being within range of two schools. Specifically, Dam Site 3 is less than 1km away from the nearest settlement, and less than 3km away from a school that serves the settlement. There will be no relocation of any structures for the development as no structures fall within the proposed dam sites. However, KZN DoE is concerned about construction activities have the potential to limit mobility of learners south of the construction site. The considerations recommended by the DoE during construction have been noted and will be included within the EMP. The Socio-Economic Study has considered potential impacts and associated mitigation procedures for education facilities in the vicinity of the dam wall (during construction and operation).

These issues received further attention during the investigations in the EIA phase, including the environmental and technical Specialist Studies.

14.1.5 Potential Significant Environmental Impacts

Note that it is not the intention of the impact assessment to evaluate all potential environmental impacts associated by the project's environmental aspects, but rather to focus on the potentially significant direct and indirect impacts identified during the Scoping phase and any additional issues uncovered during the EIA stage.

The potential significant environmental impacts associated with the project, as listed in **Table 32** (construction phase) and **Table 33** (operational phase), were identified through an appraisal of the following:

- Project-related components and infrastructure (Section 6.1 and 6.2);
- Activities associated with the project life-cycle (i.e. pre-construction, construction, operation and decommissioning) (Section 6.3);
- Proposed alternatives to project components (Section 11);
- Nature and profile of the receiving environment and potential sensitive environmental features and attributes (Section 12), which included a desktop evaluation (via literature review, specialist input, GIS, topographical maps and aerial photography) and site investigations;
- Findings from Specialist Studies (Section 13);
- Understanding of direct and indirect effects of the project as a whole (Section 14);
- Input received during public participation from authorities and IAPs (Section 16); and
- Legal and policy context (see Section 7).

Table 32: Potential Significant Environmental Impacts during Construction Phase

Environmental Factor	Potential Issues/Impacts
Climate	<ul style="list-style-type: none"> • Greenhouse gas emissions
Geology and Soil	<ul style="list-style-type: none"> • Unsuitable geological conditions • Sourcing of construction material • Blasting • Disposal of spoil material
Geohydrology	<ul style="list-style-type: none"> • Groundwater pollution due to spillages and poor construction practices • Potential increased groundwater recharge • Potential disturbance of the aquifer from blasting
Surface Water - Hydrology	<ul style="list-style-type: none"> • Alteration of flow regimes at river due to impediments and diversions
Surface Water – Riparian Habitat	<ul style="list-style-type: none"> • Loss of riparian and instream vegetation within construction domain • Destabilisation of channel morphology at river
Surface Water – Aquatic Biota	<ul style="list-style-type: none"> • Disruptions to aquatic biota community due to water contamination, alteration of flow and disturbance to habitat during construction (particularly relevant to construction activities that take place instream or in close proximity to watercourses) • Spread of noxious / declared weeds
Surface Water - Estuary	<ul style="list-style-type: none"> • Impacts to the Mtwalume Estuary in terms of flow alterations, sediment regime, habitat alteration, water quality and overall ecosystem health
Surface Water – Water Quality	<ul style="list-style-type: none"> • Sedimentation from instream works, runoff from cleared areas and dewatering • Inflow of contaminated storm water • Release of contaminants from equipment and concreting activities • Water quality impacts due to spillages and poor construction practices
Surface Water – Water Users	<ul style="list-style-type: none"> • Water quality deterioration and disturbance to flow caused by construction activities may adversely affect downstream water users • Water abstracted from watercourses for construction purposes

Environmental Factor	Potential Issues/Impacts
Terrestrial Ecology - Flora	<ul style="list-style-type: none"> • Impacts to sensitive terrestrial ecological features • Potential loss of significant flora species • Damage / clearance of habitat of conservation importance • Proliferation of exotic vegetation • Loss of medicinal plants
Terrestrial Ecology - Fauna	<ul style="list-style-type: none"> • Potential loss of significant fauna species • Damage / clearance of habitat of conservation importance
Land Capability	<ul style="list-style-type: none"> • Loss of grazing land within construction domain • Disruptions to farming operations as a result of construction-related use of existing access roads • Loss of fertile soil through land clearance
Land Use	<ul style="list-style-type: none"> • Loss of land used for agriculture • Loss of natural areas • Servitude restrictions
Heritage Resources	<ul style="list-style-type: none"> • Disturbance and possible destruction of heritage resources • Relocation of graves
Air Quality	<ul style="list-style-type: none"> • Excessive dust levels
Noise	<ul style="list-style-type: none"> • Localised noise increase
Access Roads	<ul style="list-style-type: none"> • Increased construction related traffic on local roads • Decreased visibility along roads due to poor dust management
Waste Management	<ul style="list-style-type: none"> • Waste generated from site preparations (e.g. plant material) • Domestic waste • Surplus and used building material • Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags) • Wastewater (sanitation facilities, washing of plant, operations at the batching plant, etc.) • Disposal of excess spoil material (soil and rock) generated as part of the bulk earthworks
Visual Aesthetics	<ul style="list-style-type: none"> • The sense of place will be adversely affected through the various activities associated with the construction phase as well as the permanent project components during the operational phase.
Socio-Economic Environment	<ul style="list-style-type: none"> • Increased employment opportunities (positive) • Increased economic opportunities in the area (positive) • Increased potential for increased land invasions • Loss of land within construction domain • Impact to visual quality and sense of place • Nuisance from noise and dust • Safety and security

Table 33: Potential Significant Environmental Impacts during Operation Phase

Environmental Factor	Potential Issues/Impacts
Climate	<ul style="list-style-type: none"> • Potential changes in the micro-climate of the area surrounding the reservoir (possible increased evaporation) • Greenhouse gas emissions
Geology and Soil	<ul style="list-style-type: none"> • Soil erosion on steep slopes (e.g. re-aligned access road, pipeline route) • Unsuitable geological conditions

Environmental Factor	Potential Issues/Impacts
Geohydrology	<ul style="list-style-type: none"> • High groundwater inflows • Lowering of the local water table • Surface water and groundwater interactions
Topography	<ul style="list-style-type: none"> • Visual impact to river valleys
Surface Water - Hydrology	<ul style="list-style-type: none"> • Changes to seasonal flow patterns • Alteration of flow regimes • Quantity of water releases
Surface Water – Riparian Habitat	<ul style="list-style-type: none"> • Loss of riparian and instream vegetation
Surface Water – Aquatic Biota	<ul style="list-style-type: none"> • Alteration of current biophysical functioning of affected watercourses • Fragmentation of affected river - interruptions to river continuum • Loss of aquatic habitat and change to community composition • Growth and spread of algae and other aquatic weeds • Impacts to migration of aquatic biota
Surface Water - Estuary	<ul style="list-style-type: none"> • Impacts to the Mtwalume Estuary in terms of flow alterations, sediment regime, habitat alteration, water quality and overall ecosystem health
Surface Water – Water Quality	<ul style="list-style-type: none"> • Impact to sediment balance • Quality of water releases • Impacts to water quality due to the physical, chemical and biological processes, sediments and nutrients being trapped in the dam basins and algal growth • Possible temperature and dissolved oxygen stratification could also take place. This will impact on the downstream water quality, depending on the time and manner of release • With the filling of the reservoir, the decomposition of submerged vegetation and soils can deplete the level of oxygen in the water
Surface Water – Water Users	<ul style="list-style-type: none"> • With the damming of the Mtwalume River, the downstream water user requirements need to be safeguarded
Terrestrial Ecology - Flora	<ul style="list-style-type: none"> • Impacts to sensitive terrestrial ecological features • Potential loss of significant flora species • Proliferation of exotic vegetation • Loss of medicinal plants
Terrestrial Ecology - Fauna	<ul style="list-style-type: none"> • Potential loss of significant fauna species
Land Capability	<ul style="list-style-type: none"> • Permanent loss of fertile soil through land clearance • Permanent loss of grazing land within construction domain
Heritage Resources	<ul style="list-style-type: none"> • Inundation of heritage resources
Visual Aesthetics	<ul style="list-style-type: none"> • The sense of place will be adversely affected by the Mtwalume Dam.
Socio-Economic Environment	<ul style="list-style-type: none"> • Impact to visual quality and sense of place • Health-related impacts (water-sourced illnesses) • Improved economic potential of the area • Improved social and community services in the area due to water availability

The cumulative impacts are discussed in Section 14.19.

The findings of the specialists are of particular importance in terms of understanding the impacts of the project and managing these during the project life-cycle, as these studies focused on the significant environmental issues identified during the execution of the EIA.

14.1.6 Impact Assessment Methodology

The impacts and the proposed management thereof are first discussed on a qualitative level and thereafter quantitatively assessed by evaluating the nature, extent, magnitude, duration, probability and ultimately the significance of the impacts (refer to methodology provided in **Table 34**). The assessment considers impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

Table 34: Impact Methodology Table

Nature				
Negative		Neutral		Positive
-1		0		+1
Extent				
Local	Regional	National	International	
1	2	3	4	
Magnitude				
Low		Medium	High	
1		2	3	
Duration				
Short Term (0-5yrs)	Medium Term (5-11yrs)	Long Term	Permanent	
1	2	3	4	
Probability				
Rare/Remote	Unlikely	Moderate	Likely	Almost Certain
1	2	3	4	5
Significance				
No Impact/None	No Impact Mitigation/Low	After	Residual Impact After Mitigation/Medium	Impact Cannot be Mitigated/High
0	1	2	3	

The following definitions apply:

Nature (/Status)
The project could have a positive, negative or neutral impact on the environment.
Extent
<ul style="list-style-type: none"> Local – extend to the site and its immediate surroundings. Regional – impact on the region but within the province. National – impact on an interprovincial scale. International – impact outside of South Africa.
Magnitude
Degree to which impact may cause irreplaceable loss of resources.

<ul style="list-style-type: none"> • Low – natural and social functions and processes are not affected or minimally affected. • Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way. • High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration
<ul style="list-style-type: none"> • Short term – 0-5 years. • Medium term – 5-11 years. • Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. • Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability
<ul style="list-style-type: none"> • Almost certain – the event is expected to occur in most circumstances. • Likely – the event will probably occur in most circumstances. • Moderate – the event should occur at some time. • Unlikely – the event could occur at some time. • Rare/Remote – the event may occur only in exceptional circumstances.
Significance
<p>Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-</p> <p>0 – Impact will not affect the environment. No mitigation necessary.</p> <p>1 – No impact after mitigation.</p> <p>2 – Residual impact after mitigation.</p> <p>3 – Impact cannot be mitigated.</p>

The following scoring system applies:

$$\text{Overall Score} = (N \times M \times S) \times (E + D + P)$$

For example, the worst possible impact score of -117 would be achieved based on the following ratings:

$$N = \text{Nature} = -1$$

$$M = \text{Magnitude} = 3$$

$$S = \text{Significance} = 3$$

$$E = \text{Extent} = 4$$

$$D = \text{Duration} = 4$$

$$P = \text{Probability} = 5$$

$$\text{Worst impact score} = (-1 \times 3 \times 3) \times (4 + 4 + 5) = -117$$

On the other hand, if the nature of an impact is 0 (neutral or no change) or the significance is 0 (no impact), then the impact will be 0.

Impact Scores will therefore be ranked in the following way:

Table 35: Ranking of Overall Impact Score for Impact Assessment

Impact Rating	Low/Acceptable	Medium	High	Very High
Score	0 to -30	-31 to -60	-61 to -90	-91 to -117

In the case of the Specialist Studies, some of the impact assessment methodologies deviated from the approach shown in **Table 34**. However, the quantitative basis for these specialist evaluations of the impacts to specific environmental features still satisfied the intention of the EIA.

14.1.7 Impact Mitigation

14.1.7.1 Mitigation Hierarchy

Impacts are to be managed by assigning suitable mitigation measures. According to DEAT (2006), the objectives of mitigation are to:

- Find more environmentally sound ways of executing an activity;
- Enhance the environmental benefits of a proposed activity;
- Avoid, minimise or remedy negative impacts; and
- Ensure that residual negative impacts are within acceptable levels.



Figure 42: Mitigation Hierarchy

Prevention mitigation measures (1) are the first preference for developments and are usually measures that avoid impacts completely. The impacts for the mitigation measures listed below will mostly fall under the reduction hierarchy (2). This involves mitigation measures that minimise impacts. This EMPr also includes remediation and rehabilitation measures (hierarchy 3) for environmental impacts. Compensation (4) involves compensating the loss of an entire feature. In the case for the environment, this usually means consideration of an off-set associated with rehabilitation and mitigation.

The basis for the management measures which follow below comprise of the following:

- Management objectives – i.e. desired outcome of management measures for mitigating negative impacts and enhancing the positive impacts related to project activities and aspects (i.e. risk sources);

- Targets – i.e. level of performance to accomplish management objectives; and
- Management actions– i.e. practical actions aimed at achieving management objectives and targets;
- Responsibilities; and
- Monitoring requirements.

The proposed mitigation of the impacts associated with the project includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices. Note that the mitigation measures in the subsequent sections are not intended to be exhaustive, but rather focus on the potentially significant impacts identified.

The EMPr (**Appendix G**) provides a comprehensive list of mitigation measures for specific elements of the project, which extends beyond the impacts evaluated in the body of the EIA Report.

14.1.7.2 EMPr

An EMPr represents a detailed plan of action prepared to ensure that recommendations for enhancing positive impacts and/or limiting or preventing negative environmental impacts are implemented during the life-cycle of a project.

The EMPr aims to satisfy the requirements stipulated in Section 31(2)(p) of GN. No. R. 543 (10 June 2010) and Appendix 4 of GN No. R. 982 (04 December 2014).

The scope of the Mtwalume Dam EMPr is as follows:

- Establish management objectives during the project life-cycle in order to enhance benefits and minimise adverse environmental impacts;
- Provide targets for management objectives, in terms of desired performance;
- Describe actions required to achieve management objectives;
- Outline institutional structures and roles required to implement the EMPr;
- Provide legislative framework; and
- Description of requirements for record keeping, reporting, review, auditing and updating of the EMPr.

All liability for the implementation of the EMPr (as well as the EIA findings and environmental authorisation) lies with the project proponent (i.e. Ugu DM).

It is recommended that the following EMPrs be developed as further information becomes available, with the necessary technical or specialist input (as required):

1. Search, Rescue and Relocation Management Plan;
2. Mtwalume Dam Impoundment EMPr, which needs to make provision for the following (amongst others) –
 - a. Dam safety management;

- b. Water quality management;
 - c. EWR releases; and
 - d. Managing impacts to land use and biodiversity in the dam basin;
3. Rehabilitation Management Plan; and
4. Operational EMPr, which will complement the Operation and Maintenance Manual and needs to make provision for the following (amongst others) –
 - a. Dam safety management;
 - b. Operational Rules;
 - c. Erosion management;
 - d. Access management;
 - e. Ongoing engagement with IAPs;
 - f. Control of alien invasive species;
 - g. Firebreak management; and
 - h. Biodiversity management.

14.2 Climate

14.2.1 Potential Impacts

The new Mtwalume Dam will result in a larger surface area exposed to the sun compared to the original Mtwalume river channels that will become inundated. This will lead to an increase in evaporation (and ultimately an increase in precipitation) thus resulting in less water available to use by the dam. However, the operating rules should ensure that local users and, specifically, the EWR are supplied first. Mtwalume Dam may thus cause potential changes in the micro-climate of the area surrounding the reservoir. However, the prevailing local climate conditions need to be taken into consideration.

During the operation of the Mtwalume Dam, the dam will emit methane, carbon dioxide and nitrous oxide which contributes to global warming. These greenhouse gas releases are caused by the decomposition of the vegetation, sediment and soils that flow from the river into the dam. The gases are released at the surface, at spillways, and downstream of the dam. Greenhouse gases are also produced by various other dam-related impacts including the fossil fuels and building materials used during the dam construction as well as land clearing for the construction laydown area and access roads. The trapping of sediments in a dam may act as a carbon sink; it may also indirectly increase the concentration of carbon dioxide in the atmosphere by reducing the amount of river-borne sediments available to fertilize plankton, which are important consumers of carbon dioxide. Climate change will need to be factored into the future management of the dam.

14.2.2 Impact Assessment

Climate							
Project Life-cycle:	Construction						
Potential Impact:	Greenhouse gas emissions (such as from cement batching plants and vehicle emissions)						
Proposed Mitigation:	<ul style="list-style-type: none"> Materials with a high recycled content should be used where possible and the re-use of site materials should be considered. In terms of transportation of workers and materials, collective transportation arrangements should be made to reduce individual car journeys. All vehicles used during the project should be properly maintained and in good working order. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Regional	Medium	Medium	Likely	2	-32
With Mitigation	-	Regional	Low	Medium	Likely	1	-8

Climate							
Project Life-cycle:	Operation						
Potential Impact:	Greenhouse gas emissions (from decomposition of organic material in the dam basin during inundation.)						
Proposed Mitigation:	<ul style="list-style-type: none"> Quantify natural pre-impoundment carbon fluxes. Determine de-bushing requirements. Monitoring of post-impoundment greenhouse gas emissions. Employ the UNESCO GHG Measurement Guidelines for Freshwater Reservoirs (or other acceptable best practice) to determine the dam's greenhouse gas footprint. Clear vegetation within the Dam impoundment. Where possible, woody material can be provided to local communities for use as firewood. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Regional	Medium	Medium	Likely	2	-32
With Mitigation	-	Regional	Low	Medium	Likely	1	-8

14.3 Geology and Soil

14.3.1 Potential Impacts

The construction of Mtwalume Dam will require suitable geological foundation conditions, which were confirmed through the geotechnical investigations as part of the Technical Study (**Appendix M**). The results of the investigations are included in Section 12.2.

The geotechnical investigations found that the dam sites consist of hard, intact granitoid gneiss bedrock for founding of the proposed RCC dam wall structures. Construction material does not need to be sourced from borrow areas as material will be used from the basin. Blasting will be required, based on geotechnical conditions encountered. All blasting will comply with the relevant legislation and SANS stipulations. Specific mitigation measures are contained in the EMPr, including the use of blast mats to safeguard against fly-rock, and the protection of property and accompanying monitoring practices.

During the construction phase large areas will be cleared of vegetation, which may lead to soil erosion. In areas with steep terrain erosion could take place in the absence of suitable stormwater management and stabilisation of the cut and fill areas. The EMPr includes suitable stormwater management measures to prevent the occurrence of erosion.

Soil may be polluted by poor storage of construction material, spillages and inadequate housekeeping practices. Specific mitigation measures are contained in the EMPr, where the primary objective is the effective and safe management of materials on site, in order to minimise the impact of these materials on the biophysical environment. The same objective applies to the correct management and handling of hazardous substances (e.g. fuel).

14.3.2 Impact Assessment

Geology and Soil							
Project Life-cycle:	Construction and Operation						
Potential Impact:	Soil erosion on steep slopes						
Proposed Mitigation:	<ul style="list-style-type: none"> Stabilisation of cleared areas to prevent and control erosion. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to the site specific conditions. Drainage management should also be implemented to ensure the minimization of potential erosion. Acceptable reinstatement and rehabilitation of areas outside of FSL to prevent erosion during operation phase. Install suitable buttressing to prevent future erosion of the structures of the watercourses affected by construction, if required. Monitoring to be conducted to detect erosion (e.g. steep sections along access roads and pipeline, crossing of drainage lines, tie-ins at river banks, left- and right banks of dam, embankment, etc.). 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Medium	Likely	2	-28
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

14.4 Geohydrology

14.4.1 Potential Impacts

Surface water and groundwater interactions were taken into account from a regional perspective when determining the hydrology of the river catchment during the Technical Feasibility Study. In addition, the water table of the proposed Mtwalume Dam was considered during the Geotechnical investigations when assessing the foundation conditions for the dam.

In the surrounding area and downstream of reservoirs, groundwater levels generally rise due to damming, increased infiltration and rise of the hydraulic base level. In the long term, a reservoir bed could be sealed by the deposition of fine sediments, infiltration may decrease and the groundwater level may fall again.

Further Geotechnical investigations will be undertaken during the design phase. This investigation would result in more information to evaluate the geohydrological conditions. The mitigation measures identified as part of these investigations need to be included in the EMP, as relevant.

Groundwater may be impacted by the project as follows during the construction phase:

- Groundwater pollution due to spillages and poor construction practices
- Potential increased groundwater recharge
- Potential disturbance of the aquifer from blasting

14.4.2 Impact Assessment

Geohydrology							
Project Life-cycle:	Construction and Operation						
Potential Impact:	Contamination of groundwater by poor construction practices.						
Proposed Mitigation:	<ul style="list-style-type: none"> • Suitable protection of groundwater during excavations. Implement mitigation measures suggested as part of the geotechnical investigations for managing groundwater. • All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material. • Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. constructed out of geo-textiles and hay bales). 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Medium	Likely	2	-28
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

14.5 Surface Water

For the discussion to follow “watercourses” are considered as rivers, streams, natural channels (perennial and seasonal), wetlands and dams.

Activities linked with the construction and operational phases can cause significant adverse impacts to the “resource quality” of the affected watercourses, which is defined by the National Water Act (Act No. 36 of 1998) as the following:

- Quantity, pattern, timing, water level and assurance of in-stream flow;
- Water quality, including physical, chemical and biological characteristics of the water;
- Character and condition of the in-stream and riparian habitat; and
- Characteristics, condition and distribution of the aquatic biota.

14.5.1 Hydrology

14.5.1.1 Potential Impacts

The following rivers and streams are directly affected by the project infrastructure:

- Mtwalume Dam will be located on the Mtwalume River. The impoundment will inundate a section of approximately 5-6km of the Mtwalume River.
- Some of the associated infrastructure for the dam (such as gravel and concrete access roads, the potable water pipeline, and culvert river crossing) cross the Mtwalume River and tributaries.

The Contractor will prepare detailed method statements on how the river diversions will be undertaken to accommodate the construction of the above-mentioned project infrastructure. Best practices to manage the flow of the rivers to be affected by the diversions are included in the EMPr. The Rehabilitation Management Plan will make provision for reinstating the affected watercourses and preventing future erosion by employing hard and soft engineering techniques, as required. Rehabilitation measures are also included in the EMPr.

A major diversion will be required to allow for the construction of Mtwalume Dam. The purpose of river diversion is to enable construction, especially in the river section, while accommodating the river flows and possible floods at an acceptable risk of delays and damages. This could create changes to the seasonal flow patterns and alter the flow regime in the Mtwalume River from a flowing (lotic) to still (lentic) system. The nature of the impact to the flow will depend on the design and operating regime of the dam. Provision is made for releases from the dam to satisfy the EWR of the Mtwalume River. The dam wall will also trap sediment and could starve the river downstream of its normal sediment load. A lack of sediment in the water may result in increased scouring and erosion of river bed and banks downstream.

Dams generally cause a reduction in river flow through the storage of water that would ordinarily be available to the river downstream of the dam. An impoundment of this size on a

river with a relatively small catchment can have a significant effect on the downstream ecosystem though the reduction of flow. In this instance, the dam is likely to increase the incidence of low or no flow events, particularly if the minimum amount of flow to maintain the ecological reserve (determined by a detailed reserve determination) is not maintained. Similarly the incidence of flooding and high flow events is decreased, often having a profound effect on the functioning of downstream ecosystems, particularly estuaries, which rely on high flow events to maintain a link with the sea, flush sediment and maintain the salinity gradient typical of functional estuaries.

14.5.1.2 Impact Assessment

Surface Water - Hydrology							
Project Life-cycle:	Construction and Operation						
Potential Impact:	Impacts to watercourses from temporary diversions						
Proposed Mitigation:	<ul style="list-style-type: none"> Minimise influence to downstream flow regime when diverting and impeding flow (cofferdams, temporary river crossings, etc.). Prevent erosion caused by temporary in-stream diversion. Install suitable buttressing / stabilisation structures to prevent future erosion, if required. Select appropriate crossing points (geotechnical conditions, sensitivity of riparian habitat and in-stream habitat), depending on technical feasibility. Adequate rehabilitation and reinstatements of affected watercourses. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	High	Short	Almost Certain	2	-42
With Mitigation	-	Local	Low	Short	Moderate	1	-5

Surface Water - Hydrology							
Project Life-cycle:	Operation						
Potential Impact:	Impacts to flow regime in the Mtwalume River during the operation of Mtwalume Dam						
Proposed Mitigation:	<ul style="list-style-type: none"> Compliance with DWS operating rules. Water quality and quantity released from Mtwalume Dam will need to satisfy the EWR for the Mtwalume River and Estuary. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	High	Short	Almost Certain	3	-63
With Mitigation	-	Local	Medium	Short	Moderate	1	-8

The impact assessment to follow was extracted from the Wetland and Aquatic Assessment (SDP, 2015).

Impact	Duration	Before Mitigation*	Motivation for significance rating	Proposed Mitigation	After Mitigation*
Operation					
River flow	Permanent	High	Given the number of upstream catchment dams and extent of forestry within the upper catchment, it is believed that the flow of the upper Mtwalume River is already compromised. The proposed dam will reduce the volume of water available to downstream reaches further.	Ensure the release of water from the dam is in line with the ecological reserve determination requirements.	Moderate

Impact	Before							After						
	N	M	S	E	D	P	Total	N	M	S	E	D	P	Total
Operational Phase														
River flow	-1	3	3	2	4	1	-54	-1	3	2	2	4	0.8	-31.2

14.5.2 Riparian Habitat

14.5.2.1 Potential Impacts

The earth moving activities and the establishment of the construction laydown area will result in the temporary loss of riparian habitat. Instream habitat will also be affected as machines will be working within the active channel. Once construction is complete, the direct disturbance associated with the construction activities will cease, however rectification and revegetation will be required to prevent long term degradation. The extensive back flooding that will be caused by the impoundment will cause the inundation and loss of riparian habitat including areas of scarp/riparian forest.

14.5.2.2 Impact Assessment

The impact assessment to follow was extracted from the Wetland and Aquatic Assessment (SDP, 2015).

Impact	Duration	Before Mitigation*	Motivation for significance rating	Proposed Mitigation	After Mitigation*
Construction Phase					
Habitat disturbance	Temporary	Moderate	Temporary disturbance of riparian and instream habitat during construction as a result of the laydown area and vehicular movement.	Revegetation of riparian areas. No action for instream habitat.	Low
Operation					
Habitat alteration	Permanent	High	Unavoidable. Permanent loss of instream and riparian habitat.	None available	High

Impact	Before						Total	After						Total
	N	M	S	E	D	P		N	M	S	E	D	P	
Construction Phase														
Habitat disturbance	-1	3	3	1	2	1	-27	-1	3	3	1	1	0.8	-16.2
Operational Phase														
Habitat alteration	-1	3	3	1	4	1	-45	-1	3	3	1	4	1	-45

14.5.3 Aquatic Biota

14.5.3.1 Potential Impacts

The vibrations caused by blasting can stun and even kill aquatic organisms. Should blasting be required, it should be done in an efficient manner and limited to areas where it is necessary.

The dam will form a large still water impoundment, which will provide ideal habitat for *M. salmoides*. This species does exceptionally well in South African still waters, often becoming the dominant species, out competing all but the most robust of indigenous fish species. Being highly predaceous *M. almoides* will have an effect on other aquatic and semi aquatic organisms, affecting invertebrate, amphibian and even water bird populations. The impact of this species on the aquatic ecology of the impoundment is likely to be high.

Deposition of sediment will occur within the impoundment, particularly within the upper reaches of the impoundment, where silt content is likely to be higher and the change in water velocity sudden. Sedimentation of lentic ecosystems is a natural process and part of the successional process. The process is slow and causes a gradual shift from an aquatic to terrestrial habitat. Artificial impoundments cause a transformation of a naturally lotic ecosystem into a lentic ecosystem very suddenly. This coupled with sedimentation results in a permanent habitat transformation. In contrast, due to the artificial sediment capture of the impoundment, the downstream portion of river often becomes devoid of sediment, promoting channel scour and erosion. This can cause a subtle change in instream habitat, such as a deepening and narrowing of the channel, or the loss of GSM (gravel, sand and mud) and aquatic macrophytes.

The dam wall will form an impassable obstruction to fish moving upstream and may make the downstream migration of mature *Anguilla* species difficult. This separates fish populations and could affect genetic diversity upstream of the dam. *L. natalensis* the only indigenous fish recorded, is fairly robust and is able to adapt to the presence of large impoundments. The species thrives both above and below numerous large impoundments in Kwazulu-Natal, where suitable spawning habitat is present. The impact on other smaller species present but not captured, may be more significant.

14.5.3.2 Impact Assessment

The impact assessment to follow was extracted from the Wetland and Aquatic Assessment (SDP, 2015).

Impact	Duration	Before Mitigation*	Motivation for significance rating	Proposed Mitigation	After Mitigation*
Construction Phase					
Blasting	Temporary	Moderate	Vibrations from blasting activities can be fatal to aquatic organisms.	Blasting and other high impact disturbances must be done in an efficient manner and only where required.	Low
Operation					
Alien species	Permanent	High	<i>M. salmoides</i> thrives in impoundments and is a highly predaceous species, outcompeting and eliminating smaller indigenous species.	Although removal is theoretically possible, the practical application is dependent on a number of uncontrollable variables. Unlikely to be successful.	High
Fish migration	Permanent	High	The dam wall will be an impassable obstruction to migrating fish species	Fish ladder unlikely to be suitable. Remove existing collection weir, apply a focussed river rehabilitation programme focussing on improve spawning habitat below the dam. Establish artificial spawning grounds if required.	Moderate

Impact	Before							Total	After							Total
	N	M	S	E	D	P	N		M	S	E	D	P			
Construction Phase																
Blasting	-1	2	3	1	4	1	-30	-1	2	3	1	1	0.8	-10.8		
Operational Phase																
Alien species	-1	3	3	1	4	1	-45	-1	3	3	1	4	1	-45		
Fish migration	-1	3	3	2	4	1	-54	-1	3	2	2	4	1	-36		

14.5.4 Estuary

14.5.4.1 Potential Impacts

Indirect impact on the estuary may include a net reduction in MAR and/or increases in nutrient levels in the flow reaching the estuary due to an increase in agricultural return flows and/or storm water runoff and/or inputs from Wastewater Treatment Works associated with new or expanding human settlements. This may, however, be balanced to some extent by the reduction in nutrient levels in water released from the dam due to the capture and retention of return flows from the forestry and small scale farming upstream of the dam. These issues would need to be investigated in detail in order to fully quantify potential impacts on the Mtwalume estuary.

The significance of any potential impacts of dam construction on the Mtwalume estuary cannot be fully quantified without more information on the likely changes in the flow regime of the river below the dam and the likely impacts this may have on runoff to the estuary. However, provided changes in the seasonal flow regime of the river are kept to a minimum impacts on

the estuary are likely to be low. From an ecological and socio-cultural perspective, the Mtwalume estuary is considered to be of “Medium” importance, with an Integrated Environmental Importance Score of 2 of 5. The current health of the system is rated as “moderately modified” or “C” class.

A quantitative impact assessment for the Mtwalume estuary is not deemed necessary.

14.5.5 Water Quality

14.5.5.1 Potential Impacts

During the construction phase, potential contamination of surface water could occur through:

- Sedimentation from working within and alongside the watercourse;
- Diffuse pollution from spillages, silt-laden runoff from disturbed areas, and improper practices (e.g. poor management of waste water, inadequate storage and housekeeping practices, and inadequate disposal of solid waste); and
- Dewatering without filtering of sediments.

The water quality impacts during the construction phase will be managed by employing environmental best practices that will be contained in the EMP.

The SASS scores recorded are encouraging as a number of high scoring taxa such as Perlidae, Heptageniidae and Philopotamidae were recorded suggesting that the disturbances within the valley and upper catchment have not significantly affected the invertebrate community, indicating that the water quality and instream habitat of the Mtwalume River are of good quality.

In order to obtain access to the site of the dam wall, a new road will have to be cut. Sediment laden runoff from this road, as well as runoff from the dam wall construction footprint are likely to cause localised sedimentation immediately downstream. Increased turbidity downstream of the construction site is also likely, particularly during initial earth moving periods and during periods of high precipitation. This impact is temporary in nature and will cease once construction is complete. There is a high likelihood that sediment deposited as a result of construction activities may be removed during the first high flow overtopping event. Hydrocarbon contaminants in the form of oil and fuel may enter the system. This may occur when construction vehicles are working in the river bed or when runoff from the access road enters the river after a period of high vehicular activity. The source of this impact is temporary in nature and will cease once construction is complete. Unless a significant spill occurs, it is unlikely that the contamination will have a significant permanent effect on instream fauna.

Impoundments can cause a number of changes to water quality. Such changes include a reduction in turbidity below the dam and often a reduction in water temperature below the dam relative to the natural situation. This can have a varied effect on instream biota, often changing the invertebrate and fish community structure in the affected area.

14.5.5.2 Impact Assessment

The impact assessment to follow was extracted from the Wetland and Aquatic Assessment (SDP, 2015).

Impact	Duration	Before Mitigation*	Motivation for significance rating	Proposed Mitigation	After Mitigation*
Construction Phase					
Sedimentation	Temporary	Moderate	Sedimentation likely to be localised and may be removed by flow once construction is complete	Ensure adequate stormwater control and utilise silt curtains. Post construction revegetation must be undertaken.	Low
Contamination	Temporary	Moderate	Unless a major spill occurs, any contamination will be small scale and limited in duration	Measures to prevent hydrocarbon contamination must be implemented. Examples include using drip trays for standing plant, not allowing leaky plant to operate in the river and inspecting vehicles on a daily basis to ensure any leaks are identified and can be repaired before use of the plant	Low
Operation					
Water quality	Permanent	Moderate	Changes in water quality are expected, particularly below the dam with respect to temperature and turbidity.	No mitigation available.	Moderate

Impact	Before							After							
	N	M	S	E	D	P	Total	N	M	S	E	D	P	Total	
Construction Phase															
Sedimentation	-1	2	2	2	3	1	-20	-1	2	2	2	1	0.8	-11.2	
Contamination	-1	3	2	2	2	1	-24	-1	3	2	2	1	0.8	-16.8	
Operational Phase															
Water quality	-1	2	3	2	4	1	-36	-1	2	3	2	4	1	-36	

14.5.6 Water Users

14.5.6.1 Potential Impacts

Allowance was made for all existing licensed water use upstream and downstream of the proposed dam. However, as part of the development of the water resource of the Mtwalume River, it is anticipated that a full review of water allocation would be carried out by Ugu DM.

Positive impacts associated with the proposed development of Mtwalume Dam from a water use perspective include:

- Providing additional, high assurance water supplies for domestic use; which would significantly improve the resilience of the limited supplies now available from the Mtwalume River without the benefit of storage, and would make water available to meet any increasing needs for domestic, municipal and industrial use; and
- Regulating the variable runoff in the Mtwalume River to the extent that, after full provision is made for maintaining the Reserve a significant quantity of water would be made available for irrigation development at an appropriate level of assurance.

14.5.6.2 Impact Assessment

Surface Water – Water Users							
Project Life-cycle:	Construction and Operation						
Potential Impact:	Impacts to lawfully entitled water users						
Proposed Mitigation:	<ul style="list-style-type: none"> • Manage water quality during construction. • Existing water use entitlements not to be affected. • Compliance with DWS operating rules. • Water quality and quantity released from Mtwalume Dam will need to satisfy the EWR for the Mtwalume River and Estuary. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Regional	High	Permanent	Almost Certain	3	-99
With Mitigation	0	-	-	-	-	-	0

14.6 Terrestrial Ecology - Flora

14.6.1 Potential Impacts

Vegetation will be lost within the dam basin, as well as in areas that are to be cleared for the associated infrastructure for the dam (potable water pipeline, roads, water storage tank, mixing and concrete batching plant, culvert river crossing, site camp and site office). The potential loss of significant flora species may occur, which needs to be investigated further.

Clearing of vegetation for construction purposes may result in the proliferation of exotic vegetation, which could spread beyond the construction domain. These potential impacts will be managed through suitable rehabilitation and eradication methods contained in the EMPr.

Trees felled as part of construction activities should be made available to the local Tribe. If the basin is to be cleared of all large trees, this may result in a large quantity of timber. Following the search, rescue and relocation activities and during pre-impoundment, the community should be allowed to access the basin to fell trees. Depending on the feasibility of supplying all the wood to the community, the excess plant material may be buried in the basin. Medicinal

plants, which are of great value to the rural population, could also be lost through the activities associated with the project. An agreement needs to be reached with the tribal authority with regards to the harvesting of medicinal plants and firewood.

Consideration must be given whether the dam basin will be selectively de-bushed up to a predetermined level below the FSL, based on the following criteria:

- Viability of commercial harvesting;
- Need of tribal authority and rural dwellers to harvest medicinal plants, firewood, etc.;
- Potential adverse impacts to water quality (including levels of dissolved oxygen) due to the decomposition of flooded vegetation; and
- Potential future use of impoundment, where the existing vegetation will pose dangerous obstacles.

As part of the future management plans to be developed for the project, a Search, Rescue and Relocation Plan is recommended that takes into consideration red data, protected and endangered flora and fauna species, as well as medicinal plants. In this regard, attention will be given to the following plant species of conservation importance: *Hypoxis hemerocallidea* and *Boophae disticha*. The following factors need to be considered (amongst others) as part of this plan for flora species:

1. Detailed plan of action (including timeframes, methodology and costs);
2. Site investigations;
3. Consultation with authorities, stakeholders and landowners;
4. Marking of species to be relocated;
5. Seeking of permits;
6. Identification of suitable areas for relocation;
7. Aftercare; and
8. Monitoring (including targets and indicators to measure success).

The following permits may need to be acquired:

- Permit from the Department of Agriculture, Forestry and Fisheries under the National Forests Act (Act No. 84 of 1998) if protected trees are to be cut, disturbed, damaged, destroyed or removed; and
- Permit for the relocation of species protected under the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) and the Nature and Environmental Conservation Ordinance (Act No. 19 of 1974).

14.6.2 Impact Assessment

Terrestrial Ecology – Flora	
Project Life-cycle:	Pre-construction, Construction and Operation
Potential Impact:	Loss of vegetation of conservation significance through construction activities or inundation.
Proposed Mitigation:	<ul style="list-style-type: none"> Search, rescue and relocation plan is to be developed for sensitive flora species within the construction domain and dam basin. Plan to be implemented in accordance with the project programme to ensure that these sensitive environmental features are rescued prior to potential impact occurrence. Ezemvelo KZN Wildlife is also to be consulted to ensure that the plan incorporates all the authority's requirements. All relevant approvals to be obtained prior to relocation of red data, protected and endangered flora species and medicinal plants. Any protected plants or trees in proximity to construction areas that will remain, should be clearly marked and must not be disturbed. Adequate re-instatement and rehabilitation of areas disturbed by the construction activities – relevant to disturbed areas outside of dam basin and areas to be utilised for operational purposes.
Potential Impact:	Site preparation
Proposed Mitigation:	<ul style="list-style-type: none"> During site preparation, topsoil and subsoil are to be stripped separately from each other and must be stored separately from spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater.
Potential Impact:	Proliferation of exotic vegetation in disturbed areas
Proposed Mitigation:	<ul style="list-style-type: none"> Control of alien invasive species and noxious weeds for areas disturbed by the construction activities, in accordance with the requirements of the Conservation of Agricultural Resources Act (No. 43 of 1983). Eradication method to be approved by the Project Manager. Implement a monitoring programme for eradication of alien invasive plants and noxious weeds.
Potential Impact:	<ul style="list-style-type: none"> Loss of medicinal plants Loss of firewood
Proposed Mitigation:	<ul style="list-style-type: none"> Search, rescue and relocation plan to include medicinal plants. Trees felled should be made available to the local surrounding community, as far as practical. No trees to be felled for fuel purposes.
Potential Impact:	Habitat lost during clearing for the abstraction works.
Proposed Mitigation:	<ul style="list-style-type: none"> During site preparation special care must be taken during the clearing of the works area to minimise damage or disturbance of roosting and nesting sites. Removal of vegetation during stripping and construction will be minimised to reduce the erosion potential. Topsoil will only be removed off areas proposed for borrow areas, access roads and abstraction works. All soils should be stored and managed correctly for rehabilitation. Careful planning of access roads in order to prevent excessive removal of trees and prevent soil erosion.
Potential Impact:	Soil contamination, vegetation loss and vegetation disturbance due to fuel and chemical spills.
Proposed Mitigation:	<ul style="list-style-type: none"> Employ on site personnel responsible for preventing and controlling potential soil pollution through fuel and oil leaks and spills.

Terrestrial Ecology – Flora							
	<ul style="list-style-type: none"> • Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. • Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use. • Require the suitable establishment of erosion control mechanisms. 						
Potential Impact:	Damage to plant life outside of the proposed development areas.						
Proposed Mitigation:	<ul style="list-style-type: none"> • Construction activities should be restricted to the development footprint area. All workers must be trained before construction commences. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	High	Long	Almost Certain	3	-81
With Mitigation	-	Local	Low	Long	Moderate	1	-7

14.7 Terrestrial Ecology - Fauna

14.7.1 Potential Impacts

Permanent inundation will flood terrestrial habitat within the basin and the riparian zone, and will affected ecosystem connectivity. Depending on whether the basin will be de-bushed, certain slower moving animals may drown with the onset on inundation. Further ecosystem disruption may occur downstream of the dam wall along the tributary's banks (riparian area), which are usually associated with rich biodiversity.

Habitat will also be lost where clearing is done within the construction domain. Fauna could also be adversely affected through construction-related activities (noise, illegal poaching, and pollution of the biophysical environment). It is expected that sensitive fauna will move away from the area during the construction area phase.

Should animals of conservation importance be encountered before or during the construction processes, a Rescue and Relocation Plan needs to be developed that will take into consideration red data, protected or endangered fauna species (amongst others). All relocations will need to comply with the requirements of Ezemvelo KZN Wildlife, in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) and Natal Nature Conservation Ordinance, 1974 (Act No. 15 of 1974).

The EMPr will include measures to manage the potential adverse impacts to fauna associated with the construction activities.

14.7.2 Impact Assessment

Terrestrial Ecology – Fauna							
Project Life-cycle:	Pre-construction, Construction and Operation						
Potential Impact:	<ul style="list-style-type: none"> Loss of habitat and animals of conservation significance through construction activities or inundation. Loss of livestock. 						
Proposed Mitigation:	<ul style="list-style-type: none"> Should animals of conservation importance be encountered before or during the construction processes, a Rescue and Relocation Plan needs to be developed that will take into consideration red data, protected or endangered fauna species (amongst others). Such Plan should be implemented in accordance with the project programme to ensure that these sensitive environmental features are rescued prior to potential impact occurrence. Ezemvelo KZN Wildlife is to be consulted to ensure that the Plan incorporates all the authority's requirements. Proper access control to be maintained to prevent livestock from accessing construction areas. Stringent and dedicated control of poaching. No fishing allowed. No wilful harm to any animals, unless a direct threat is posed to a worker's health or safety. Captured animals to be safely released to a similar representative habitat. 						
Potential Impact:	Habitat lost during clearing for the abstraction works.						
Proposed Mitigation:	<ul style="list-style-type: none"> During site preparation, special care must be taken during the clearing of the works area to minimise damage or disturbance of roosting and nesting sites. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	High	Long	Likely	3	-72
With Mitigation	-	Local	Low	Long	Unlikely	1	-6

14.8 Land Capability

14.8.1 Potential Impacts

From the Scoping exercise the following impacts in terms of agriculture in the study area were identified:

- Loss of arable land and grazing land within the basin. This could place pressure on the remaining grazing resources.
- Livestock currently have access to the Mtwalume River for drinking purposes. Future access arrangements to the dam for livestock watering to be considered further.
- Disruptions to farming operations as a result of construction-related use of access roads.
- Impacts to existing water users that abstract from the river for agricultural use.

14.8.2 Impact Assessment

Land Capability							
Project Life-cycle:	Construction						
Potential Impact:	Disruptions to existing farming operations						
Proposed Mitigation:	<ul style="list-style-type: none"> • Restrict site clearing activities to construction area / domain and basin. • Negotiations and arrangements with landowners regarding: <ul style="list-style-type: none"> ○ Access; ○ Existing structures and infrastructure; ○ Fencing requirements; ○ Traversing patterns of game and/livestock; ○ Access to livestock drinking points; and ○ Security. • All structures to be affected by construction to be recorded. • Registration of construction servitudes and land acquisition process to adhere to all legal requirements. • Adequate compensation for loss of crops, assets and farming infrastructure during construction. • In areas where livestock occur, erect fences according to appropriate specifications (depending on the type on animals that occur on the farms) for the construction camps and construction servitude to protect animals from construction-related activities. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	High	Short	Almost Certain	3	-63
With Mitigation	-	Local	Medium	Short	Unlikely	1	-4

14.9 Land Use

14.9.1 Potential Impacts

Land is required for constructing and operating the proposed dam. The following approach is recommended for land acquisition:

- Land inside Mtwalume Dam's purchase line as well as land required for associated works must be acquired in accordance with statutory requirements;
- The relevant servitudes must be required; and
- Land required for housing and other infrastructure required for the operation of the scheme also needs to be acquired.

The negotiations with the landowner for the registration of the servitudes or acquisition of land will be undertaken by Ugu DM. This process, which does not form part of the EIA, will adhere to all statutory requirements.

The land use mostly comprises of rural settlements and subsistence agriculture on land owned by the Ingonyama Trust Board. Mtwalume Dam will inundate land of approximately 114 ha,

with accompanying loss of land used for agriculture. Regardless of the alternative chosen, the land use of the area will be altered. Impacts associated with land use were indirectly assessed as part of the Socio-Economic Impact Assessment.

14.9.2 Impact Assessment

Land Use							
Project Life-cycle:	Construction and Operation						
Potential Impact:	Land acquisition and servitude restrictions						
Proposed Mitigation:	<ul style="list-style-type: none"> Engage and negotiate with affected landowner (Ingonyama Trust). Ugu DM will need to conform to all its legal obligations as part of the acquisition of land for the construction and operation of the project. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	High	Permanent	Almost Certain	2	-60
With Mitigation	-	Local	Low	Permanent	Almost Certain	1	-10

14.10 Heritage Resources

14.10.1 Potential Impacts

Observations with regards to historical and cultural features in the project area include the following:

- Given the occurrence of sandstone outcrops overlooking the potential dam sites it is possible that ground surveys may locate rock art sites in the immediate vicinity of the footprint of the dams.
- Given the abundance of archaeological sites in areas to the east and west of the project area it is possible that the study area may contain archaeological sites. In addition, sandstone cliffs are situated above both proposed dam sites and these may harbour rock shelters with potential Later Stone Age deposits and rock art.
- A local resident indicated that there were graves situated at a derelict homestead located close to the site of the wall for Dam Site 3. The construction and subsequent inundation of the dam wall will result in the destruction of the graves. The graves are significant reminders of those who lived at the homestead and therefore it is recommended that the graves be removed prior to the construction of the dam in consultation with the family and affected community as required by Regulation 4 of the KZN Heritage Regulations of 2012 if Dam Site 3 is selected as the site for the Mtwalume Dam.
- In terms of Dam Site 5, a number of abandoned homesteads were found in the vicinity of the dam wall. It is possible that there are graves situated near these homesteads

although no graves were noted during the site inspection. It is recommended that construction activities keep well clear of the homesteads to avoid any damage to potential graves. A number of graves were found in the valley area that will be inundated by Dam Site 5. The graves are unmarked. There appear to be at least 5 visible grave sites. A cattle dip was found in the basin of Dam site 5. It appears to still be in use. The dip will be inundated if Dam Site 5 is selected. The structure is considered to be of medium significance as it appears to be the only one in the surrounding area that local farmers use. The inundation of the cattle dip could impact on farming activity and it is recommended that the Applicant provide a new cattle dip in consultation with the farmers if Dam Site 5 is chosen for the proposed dam.

14.10.2 Impact Assessment

Heritage Resources	
Project Life-cycle:	Construction
Potential Impact:	Loss of Graves
Proposed Mitigation:	<p>Dam Site 3 - Although only one grave site has been pointed out to the specialist by a local resident, there is a fairly high possibility that more graves could be inundated by the dam hence the recommendation / mitigation measure that a Phase 2 assessment is undertaken. If this site is selected, then the removal of the identified graves will mitigate the impact on them by the construction of the dam.</p> <p>Dam Site 5 - Several graves were found close to the foundations of a dwelling in the valley that will be inundated by the dam. In addition, there are several residences above the valley that could fall within the inundation area of the dam where additional graves could be found hence the recommendation that a Phase 2 assessment be undertaken. The identified graves are well over 60 years and are protected by both the KZN Heritage Act and the NHRA. If this site is selected, then the removal of the identified graves will mitigate the impact on them by the construction of the dam.</p>

The impact assessment to follow was extracted from the HIA (Beater, 2016).

Graves – Dam Site 3	Extent	Duration	Magnitude	Probability	Significance	Nature
Before mitigation	Local/municipal (2)	Permanent (5)	Low (2)	High probability (4)	Medium $2+5+2 \times 4 = 36$	Negative
After mitigation	Local/municipal (2)	Permanent (5)	Low (2)	Medium probability (3)	Low – medium (27)	Negative

Graves – Dam Site 5	Extent	Duration	Magnitude	Probability	Significance	Nature

Before mitigation	Local/municipal (2)	Permanent (5)	Low (2)	Definite (5)	Medium 45	Negative
After mitigation	Local/municipal (2)	Permanent (5)	Low (2)	Medium (3)	Low – medium (27)	Negative

Heritage Resources	
Project Life-cycle:	Construction
Potential Impact:	Loss of Protected Structures
Proposed Mitigation:	<p>Dam Site 3 - No structures that are protected in terms of section 33 (1)(a) of the KZN Heritage Act and section 34 (1) of the NHRA, were discovered in the area of inundation of the dam. The ages of the homesteads found just below the dam wall that could be affected by the construction lay down area could not be established but they are in a poor state of repair and their significance is expected to be low. However, the potential presence of graves close to the homestead require that the area is cordoned off so that construction activities do not impact on the homesteads.</p> <p>Dam Site 5 - The cattle dip found in the valley could be older than 60 years and appears to be utilised by the local land owners. It is therefore of importance to the surrounding community and if this site is selected, it is recommended that the Applicant provide another cattle dip in consultation with the landowners.</p>

The impact assessment to follow was extracted from the HIA (Beater, 2016).

Structures – Dam Site 3	Extent	Duration	Magnitude	Probability	Significance	Nature
Before mitigation	Local/municipal (2)	Permanent (5)	Low (2)	High probability (4)	Medium $2+5+2 \times 4 = 36$	Negative
After mitigation	Local/municipal (2)	Short-term (2)	Low (2)	Medium probability (3)	Low – medium (18)	Negative

Structures – Dam Site 5	Extent	Duration	Magnitude	Probability	Significance	Nature
Before mitigation	Local/municipal (2)	Permanent (5)	Very high / don't know	Definite (5)	Medium-high 60	Negative

			(5)			
After mitigation	Local/municipal (2)	Permanent (5)	Moderate (3)	Definite (5)	Medium-high (50)	Negative

Heritage Resources	
Project Life-cycle:	Construction
Potential Impact:	Loss of Archaeological sites
Proposed Mitigation:	<p>Dam Site 3 -Although no archaeological sites were found during the site inspection, the area was densely overgrown thereby reducing visibility hence the recommendation that a Phase 2 assessment is undertaken to determine the presence, or not, of archaeological sites (including rock art sites) in the area of inundation of the chosen dam site.</p> <p>Dam Site 5 - No archaeological sites were identified during the site inspection. However, it is recommended that a Phase 2 assessment is undertaken to ascertain the presence or not of archaeological sites if Site 5 is selected.</p>

The impact assessment to follow was extracted from the HIA (Beater, 2016).

Structures – Dam Site 3	Extent	Duration	Magnitude	Probability	Significance	Nature
Before mitigation	Provincial (3)	Permanent (5)	Low (2)	High probability (4)	Medium 40	Negative
After mitigation	Provincial (3)	Permanent (5)	Low (2)	Medium probability (3)	Low – medium (30)	Negative

Structures – Dam Site 5	Extent	Duration	Magnitude	Probability	Significance	Nature
Before mitigation	Provincial (3)	Permanent (5)	Low (2)	High probability (4)	Medium 40	Negative
After mitigation	Provincial (3)	Permanent (5)	Low (2)	Medium probability (3)	Low – medium (30)	Negative

14.11 Air Quality

14.11.1 Potential Impacts

Dust will be generated during the construction period from various sources, including blasting, operations at the batching plant(s) and crusher area(s), aggregate stockpiles, use of access roads, transportation of spoil material, soil stockpiles and general construction activities on site.

As part of impoundment, the dams could contribute to greenhouse gas emissions, where inundated plant material that decays in an anaerobic environment will release methane and carbon dioxide.

Mitigation measures are included in the EMPr to ensure that the air quality impacts during the construction phase are suitably monitored (dust fallout and particulate matter) and managed and that regulated thresholds are not exceeded. The EMPr also includes measures to control and minimize greenhouse gas emissions by optimizing the utilisation of construction resources.

14.11.2 Impact Assessment

Air Quality							
Project Life-cycle:	Construction						
Potential Impact:	Excessive dust levels as a result of construction activities						
Proposed Mitigation:	<ul style="list-style-type: none"> • Appropriate dust suppression measures or temporary stabilising mechanisms to be used when dust generation is unavoidable (e.g. dampening with water, chemical soil binders, straw, brush packs, chipping), particularly during prolonged periods of dry weather. Dust suppression to be undertaken for all bare areas, including construction area and access roads. Note that all dust suppression requirements should be based on the results from the dust monitoring and the proximity of sensitive receptors. • Speed limits to be strictly adhered to. • The Contractor will take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, pre-notification of affected parties). • Air quality to be monitored (baseline and during construction) for dust fallout and particulate matter. Sampling locations to consider major sources of dust and sensitive receptors. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

14.12 Noise

14.12.1 Potential Impacts

During construction, localised increases in noise will be caused by blasting, operations at the batching plant(s) and crusher area(s), vehicles on access roads, and general construction activities on site. Vibration would be felt close to construction equipment.

Noise that emanates from construction and operational activities will be addressed through targeted best practices for noise monitoring and management in the EMP. The associated regulated standards need to be adhered to.

Project personnel working on the construction site will experience the greatest potential exposure to the highest levels of noise and vibration. Workplace noise and vibration issues will be managed as part of the Occupational Health and Safety Management System to be employed on site, which will include specific measures aimed at preventing hearing loss and other deleterious health impacts.

14.12.2 Impact Assessment

Noise							
Project Life-cycle:	Construction						
Potential Impact:	Excessive noise levels as a result of construction activities						
Proposed Mitigation:	<ul style="list-style-type: none"> The provisions of SABS 1200A will apply to all areas within audible distance of residents. Working hours to be agreed upon with Project Manager, so as to minimise disturbance to landowners/occupiers and community members. Construction activities generating output levels of 85 dB or more will be confined to normal working hours. Noise preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to be employed. Blasting operations to be controlled to ensure sound pressure levels are kept below the generally accepted 'no damage' level of 140 decibels. Noise to be monitored (baseline and during construction). Sampling locations to consider major noise sources and sensitive receptors. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

14.13 Access Roads

14.13.1 Potential Impacts

The following potential traffic related impacts relating to the project have been identified. Note that some impacts will occur over the course of construction of the dam while others will be permanent.

During construction, there may be increased construction traffic on existing roads. Construction vehicles will travel along all roads transposing sources of material and the dam wall and will interact with existing general traffic on these roads. As a result of the construction increased traffic volumes will occur along the sections of road. The road condition used to haul material will be negatively impacted upon by heavy construction haul vehicles during construction. The safety of general traffic along the roads surrounding the dam may be compromised as a result of construction haul vehicles on these roads.

The access road will be constructed before the dam can be built. Once the access road has been constructed, the machinery to construct the dam wall will travel down the new access road to the dam, and the access roads to the neighbouring households should not be affected in any way.

14.13.2 Impact Assessment

Access Roads							
Project Life-cycle:	Construction						
Potential Impact:	<ul style="list-style-type: none"> Inadequate road conditions; Disruptions to existing road users; Safety risks; and Increase in dust levels. 						
Proposed Mitigation:	<ul style="list-style-type: none"> Make provision for community members to access their homesteads. Speed limit of 40km/h on public and other roads within the project area to be adhered to. Access roads to be maintained in a suitable condition. Suitable erosion protective measures to be implemented for access roads during the construction phase. Traffic safety measures (e.g. traffic warning signs, flagmen) to be implemented. Clearly demarcate all access roads. Clearly mark pedestrian-safe access routes. Ensure that service nodes such as schools, clinics, places of worship, etc. remain easily and safely accessible at all times. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Short	Almost Certain	3	-42
With Mitigation	-	Local	Low	Short	Moderate	1	-5

14.14 Waste Management

14.14.1 Potential Impacts

Waste management aims to avoid waste pollution of both land and water resources during and as a consequence of construction of the Mtwalume Dam. The following describes the impacts during the construction phase:

- Waste generated from site preparations (e.g. plant material);
- Domestic waste;
- Surplus and used building material;
- Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags);
- Wastewater (sanitation facilities, washing of plant, operations at the batching plant, etc.); and
- Disposal of excess spoil material (soil and rock) generated as part of the bulk earthworks.

14.14.2 Impact Assessment

Waste Management	
Project Life-cycle:	Construction
Potential Impact:	<ul style="list-style-type: none"> • Use of veld/ riparian areas for ablution purposes • Land, air and water pollution through poor waste management practises
Proposed Mitigation:	<ul style="list-style-type: none"> • No ablution facilities to be positioned within riparian area. • Sufficient ablution facilities to be provided at the Construction Camp and along construction servitude. • Suitable litter receptacles to be positioned strategically across the site at all working areas. • Waste must be separated at source (e.g. containers for glass, paper, metals, plastics, organic waste and hazardous wastes). • The Contractor shall dispose of all refuse generated on site or from the activities of construction or its related activities. The contractor shall on a weekly basis dispose of all refuse at an approved refuse disposal site. Proof of disposal must be kept on record. • Littering by the workers is prohibited. Clearly marked litterbins must be provided on site. • Monitor the presence of litter on site. All staff shall be sensitised to this effect. • The entire site will be cleared of construction material, metal, tins, glass bottles, and food packaging or any other type of empty container or waste material or waste equipment used by the construction team on a daily basis. • Waste material that may harm man or animals should be removed immediately. • No hazardous materials, e.g. oil, diesel and fuel should be disposed of in the veldt. Any diesel, oil or petrol spillages are to be collected and stored in specially marked containers and disposed of at a permitted waste disposal site and must be treated as hazardous waste. • No refuse or litter is allowed to be burnt on site. • The recycling of all waste is to be encouraged of both the contractor and staff.

Waste Management							
	<ul style="list-style-type: none"> All vehicle parking areas and vehicle servicing areas are to be inspected carefully for diesel, oil and other spillages weekly. Excess spoil material should remain in the inundated area. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Short	Likely	3	-36
With Mitigation	-	Local	Medium	Short	Unlikely	1	-8

14.15 Visual Aesthetics

14.15.1 Potential Impacts

A substantial area will be cleared within the construction domain to build the physical infrastructure associated with the project and to accommodate the construction laydown area, potable water pipeline, batching plant, site camps, site offices and access roads.

The sense of place will be adversely affected through the various activities associated with the construction phase as well as the permanent project components during the operational phase. The attractive riverine scenery behind the Mtwalume Dam wall will also be inundated.

Mtwalume Dam will replace the existing landscape from a natural area to a water body. From the areas that are granted a view of the dam, it could be argued that the landscape would be improved as the body of water (apart from the physical infrastructure) over time could also be viewed as a natural area.

14.15.2 Impact Assessment

Visual Aesthetics	
Project Life-cycle:	Construction and Operation
Potential Impact:	<ul style="list-style-type: none"> Reduction in visual quality due to construction activities. Visual impacts associated with the operation of the dam.
Proposed Mitigation:	<ul style="list-style-type: none"> On-going housekeeping to maintain a tidy construction area. The site will be shielded / screened to minimise the visual impact, where practicable. Where practicable, development designs to compliment the natural surroundings in order to preserve a sense of place. In general, no slopes steeper than 1(V):3(H) are permitted in cut-and-fill areas (outside dam basin), unless otherwise specified by the Project Manager. Steeper slopes require protection. New slopes must mimic the natural slopes and topography, where possible. After the construction phase, the areas disturbed that are located outside of the dam basin and that are not earmarked for operational purposes must be rehabilitated by appropriate landscaping, levelling, topsoil dressing, land preparation, alien plant eradication and vegetation establishment. Monitor the re-growth of invasive vegetative material (outside of the dam basin).

Visual Aesthetics							
	<ul style="list-style-type: none"> Manage encroachment of exotic vegetation in the dam draw down zone, as necessary. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Short	Almost Certain	2	-28
With Mitigation	-	Local	Medium	Short	Likely	1	-12

14.16 Socio-Economic Environment

14.16.1 Potential Impacts

The following impacts were identified by the Socio-Economic Impact Study:

Impact on the Economy - The community is poor, with low education and income levels. This project has the opportunity to stimulate the economy, particularly in the construction phase through the large capital injection. Only the pre-feasibility report was available at the time of study, which estimated that the costs of the dam wall was in the order of R280 million using 2016 figures (ZIYANDA Consulting, 2016). By way of comparison, the Ubuhlebezwe Local Municipality GVA for 2013 was R1 222 million. Although all of the construction value will not be realised within the local municipality, however, given the relative scale of the economies, this dam will result in noticeable economic stimulus. Construction activity on this scale will provide economic stimulus to the area which will last for the length of construction. The economic impact will reduce during the operational phase and will not be a significant source of income for the community.

Tourism - The proposed Mtwalume Dam has the potential to create possible tourism opportunities. The dam can attract people to the area which can increase the economic activity in the region and increase welfare. Depending on the type of tourism activity, there can be a number of sustainable jobs that will be created through the sector. The tourism sector is also a sector that can be extremely inclusive of the community and that can contribute directly to community empowerment. It is recommended that potential tourism activities are identified during the development of the Resource Management Plan (RMP) for the Mtwalume Dam.

Construction Impacts - The construction phase will commence once the environmental and other approvals are authorised. The construction activity will impact the social environment both positively and negatively. Given the quiet pristine nature of the project area, construction activity is likely to cause a number of social nuisances as well as economic implications on the communities and farming activities.

- SMME Development;
- Job Creation and Skills Development;
- Induced Migration;

- Proximity;
- Impact on Road Conditions;
- Security;
- Culture; and
- Health.

14.16.2 Impact Assessment

Socio-Economic Environment – Impact on Economy							
Project Life-cycle:	Pre-construction, Construction and Operation						
Potential Impact:	Exploitation of Agricultural opportunities owing to the Mtwalume Dam						
Proposed Mitigation:	<ul style="list-style-type: none"> • The opportunities for the dam to create real social-economic benefits to the surrounding community must be exploited by Ugu DM as the implementing agent. • In addition to Ugu DM, Umzumbe LM and Ubuhlebezwe LM in addition to various provincial and national departments in an attempt to identify and exploit these opportunities. • Ugu DM must be proactive in ensuring that the beneficiaries of opportunities identified in the area are from the local communities. This will ensure that the profits of the scheme are spend in the municipality and benefit the local economy. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	+	Local	Low	Short	Likely	1	6
With Mitigation	+	Regional	High	Permanent	Likely	3	90

Socio-Economic Environment – Tourism							
Project Life-cycle:	Operation						
Potential Impact:	Tourism Opportunities						
Proposed Mitigation:	<ul style="list-style-type: none"> • Ugu DM must implement a RMP. The RMP should identify opportunities for tourism activities within the dam basin • The RMP must be focused on empowerment and local economic opportunities for the surrounding communities. 						
Potential Impact:	Local Economic Development						
Proposed Mitigation:	<ul style="list-style-type: none"> • Communication of the outcomes of the RMP to the local community in the local language to allow them the opportunity to benefit from the dam. • Where possible Ugu DM should ensure that identified economic opportunities are implemented in a manner that allows majority of the profits generated to remain within the municipal boundary and benefit the local economy. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	+	Local	Low	Short	Likely	1	6
With Mitigation	+	Regional	High	Permanent	Likely	3	90

Socio-Economic Environment – Construction	
Project Life-cycle:	Construction
Potential Impact:	Skills transfer
Proposed Mitigation:	<ul style="list-style-type: none"> Ugu DM must develop a skills development program for the duration of the construction activity. Beneficiaries of educational programs should be residents who live close to the project area. The selection process should be transparent. In order to increase the size of local employment, women should also be employed in the construction of the dam. A Community Liaison Officer (CLO) must be appointed to report on labour targets during the construction phase.
Potential Impact:	Increased Employment
Proposed Mitigation:	<ul style="list-style-type: none"> Employment of workers for the project should be controlled through a CLO and should favour residents of the surrounding areas. One hundred percent of unskilled employment during the construction phase should come from local labourers who live in the study area. In order to increase the size of local employment, women should also be employed in the construction of the dam. The selection process should be transparent. Employment of females and youth is encouraged to ensure the empowerment of the most vulnerable to unemployment and poverty.
Potential Impact:	Influx of Workers
Proposed Mitigation:	<ul style="list-style-type: none"> Where imported labour is required, such employment should be drawn from contractor's and sub-contractor's permanent staff. Accommodation within host communities is encouraged as a way of ensuring a wider distribution of economic benefits from construction.
Potential Impact:	Impact on SMMEs and Indirect Employment
Proposed Mitigation:	<ul style="list-style-type: none"> Construction and other materials to be sourced from local suppliers to boost the regional economic and drive the creation of more sustainable jobs. SMME opportunities should be made broadly available through notification to representative community structures. Ugu DM should support and encourage the development of SMMEs and local or regional suppliers. Where possible, procurement should come from local and regional business so that the profits stay in the area, increasing economic activity. Local employment through spaza shops; eateries and other business will result as workers need to be fed. Ugu DM should make use of existing council structures to identify beneficiaries of the program.
Potential Impact:	Impact on Road Conditions
Proposed Mitigation:	<ul style="list-style-type: none"> Ensure that the necessary signage and traffic measures are implemented for safe and convenient access to the site. Roads must be maintained at all times and rehabilitated after construction. Construction machinery drivers are to travel at appropriate speeds. Applicable speed limits as set on regional roads must be observed at all times. Haul routes must be clearly defined and drivers of all construction vehicles must not deviate the haul routes.

Socio-Economic Environment – Construction							
	<ul style="list-style-type: none"> The main contractors appointed by the client are to enforce the same mitigation measures on their sub-contractors. 						
Potential Impact:	Proximity						
Proposed Mitigation:	<ul style="list-style-type: none"> No community or household structures should be located within the dam basin of both dams. At the date of this study no such structures existed. Should such structures be erected subsequent to this report, appropriate measures should be taken to relocate outside the dam basin. In this regard the traditional council should be consulted, along with the affected households Where blasting activity is in within a 500m radius of any structures, a blasting study must be conducted to determine the impact on the structures. Compensation must be provided for any damage to structures during construction activity. 						
Potential Impact:	Increase in Noise and Dust						
Proposed Mitigation:	<ul style="list-style-type: none"> Dust and disturbance can be mitigated through the use of appropriate dust suppression mechanisms – both on site and along access roads. Noise and dust mitigation measures management should be adhered to according the relevant specialist studies. 						
Potential Impact:	Safety and Security						
Proposed Mitigation:	<ul style="list-style-type: none"> Access to the construction site must be strictly controlled with closed off access points. A security policy must be drafted and strictly enforced by the contractors; The closest police station should be engaged with regards the project to ensure that local police management are aware of the construction activity. 						
Potential Impact:	Impact on Cultural Beliefs						
Proposed Mitigation:	<ul style="list-style-type: none"> Graves to be relocated in accordance to the HIA. Communication of the dam needs to take into account cultural beliefs which need to be treated sensitively and with respect. Where there is a loss of medicinal plants, the community must be provided with an opportunity to harvest the plants. Mitigation measures management should be adhered to according the relevant specialist studies. 						
Potential Impact:	Communication						
Proposed Mitigation:	<ul style="list-style-type: none"> A communication strategy must be developed for the project to ensure that all aspects of the project are communicated effectively. The strategy should be aligned to established communication protocols of the Traditional Authorities and local government. The surrounding communities must be provided with a point of contact to address all issues that affect them. This could be a CLO. The response time for reporting back to the community should not exceed two weeks. It is important that the contractors and sub-contractors are sensitive to the community's belief structures and any established communication protocols followed by the community at all times. 						
	Nature	Extent	Magnitude	Duration	Probability	Significance	Score
Without Mitigation	-	Local	Medium	Short	Almost Certain	3	-42
With Mitigation	-	Local	Low	Short	Almost Certain	2	-14

14.17 No-Go Impacts

14.17.1 Catchment Water Requirements

Extensive tracts of forestation are present within the upper and middle catchment. The total area under afforestation is roughly 62.4 km² (36% of the overall U8H004 catchment area). Numerous small farm dams also exist in the upper catchment. Currently there are 35 registered dams covering approximately 1.1 km², with a total capacity of roughly 2.41 Mm³ (which represents 51% of the MAR of the catchment upstream of these dams).

In addition, 1.8 km² of small scale irrigation also takes place in the upper catchment (1% of catchment area) of which approximately 1.6 km² is served by the above-mentioned farm dams and other “run-of-river” abstractions. Fairly significant livestock farming enterprises are located within the upper catchment. It is estimated that approximately 11 000 large stock units and 3 200 small stock units are watered daily within the catchment (ZIYANDA Consulting, 2014).

14.17.2 Population

The Mtwalume Dam Pre-Feasibility Study focused on the demands given below, where the population of 85 246 was calculated using a household occupancy rate of 7 persons per household, and the future population of 114 814 was estimated using a 1.5 % growth rate of 20 years. The current and future population projections per local municipality are tabulated in **Table 4**.

14.17.3 Water Requirements from the Proposed Dam

Initial demand forecasts were based on a per capita water consumption of 60 l/c/d. However, both the Ugu and Sisonke Municipalities have indicated that future demand projections should be based on a per capita consumption of 75 l/c/d.

Preliminary calculations have been based on the assumption that the target supply areas will remain predominately rural. There are also a number of illegal connections (especially at Sisonke), and both the Ugu and the Sisonke Municipalities propose to legalise these illegal yard/house connections in the near future. Initial demand forecasts were based on a per capita water consumption of 60 l/c/d. However, both the Ugu and Harry Gwala DMs have indicated that future demand projections should be based on a per capita consumption of 75 l/c/d. The ability of the Mtwalume River to sustain these demands, as well as the subsequent implications regarding the raw water storage infrastructure was investigated. Hydrological assessments of the Mtwalume River conducted by Umgeni Water and Terratest Geotechnical, Environmental and Earth Science Consultants to determine the volume of “run-of-river” streamflow available at the existing Vulamehlo Weir, indicated that in order to meet the current and future domestic water demands of the surrounding community in addition to implementing the EWR, additional in-catchment storage will be required in the form of a dam or weir on the Mtwalume River. The assessment determined that the Mtwalume River could sustain 1.5

Mℓ/day at a 96.8% assurance level, while the Terratest Study indicated that the river could maintain 2.6 Mℓ/day (existing abstraction of 1.5 Mℓ/day + an additional 1.01 Mℓ/day) at a 98% assurance level without allowance for EWR.

In contrast, should the proposed development of Mtwalume Dam not go ahead, any potentially significant environmental issues associated with the project (refer to Section 14) would be irrelevant and the status quo of the local receiving environment would not be affected by the project-related activities. The objectives of the project and the economic benefits discussed above would however not materialise.

14.18 Cumulative Impacts

According to GN No. R. 543 (18 June 2010), a “cumulative impact”, in relation to an activity, means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Cumulative impacts can be identified by combining the potential environmental implications of the proposed development of Mtwalume Dam with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the project area.

The potential cumulative impacts associated with the project include the following:

- The construction period will be associated with traffic-related impacts to the local road network. If it is deemed necessary to obtain construction material from a commercial source, the cumulative impacts to the roads that are to be affected would need to be considered and a Traffic Impact Assessment would need to be implemented. No other large-scale developments are known to be earmarked for the greater area, and there is thus no cumulative impact to the transportation network.
- The Terrestrial Ecological Study identified species of conservation importance that could be adversely affected by the project activities. These studies took into consideration the existing local impacts to the biodiversity and the incremental loss of conservation-worthy species of the project within the context of the provincial conservation goals and targets.
- Through the Search, Rescue and Relocation Plan a concerted effort will be made to prevent the loss of Red Data, protected and endangered fauna and flora species that will be affected by the project. With the relocation of these species to suitable habitat the cumulative impact to biodiversity could be adequately managed.
- Exotic vegetation is encountered in the project area and is mostly associated with historical disturbances such as grazing. Large areas will be cleared during the construction phase of the project and all disturbed areas outside of the dam basin will

need to be appropriately rehabilitated to ensure that a cumulative impact is not caused in this regard.

- The soils in some parts of the project area are erodible. Any previous disturbance (including grazing) will be aggravated by the construction activities if this impact is not properly managed.
- The routes of linear infrastructure associated with the project may impact on properties that are already traversed by existing infrastructure. These properties will thus have a network of infrastructure with the associated servitude restrictions.
- Although the Vulamehlo Associated Infrastructure project (pipeline and reservoirs) does not form part of the scope of this EIA, cumulative impacts related to this proposed development will apply.
- The development of the Mtwalume Dam would provide additional, high assurance water supplies for domestic use, as well as provide a significant quantity of water for irrigation development. Apart from stimulating the local economy from an agricultural perspective, the development may contribute towards to the local tourism potential.

15 ANALYSIS OF ALTERNATIVES

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project. By conducting the comparative analysis, the BPEOs can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that “provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term”.

15.1 “No-Go” Option

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the project is included in the evaluation of the alternatives. The implications of the ‘no go’ option are discussed in Section 14.18. The ‘no go’ alternative is not supported due to the high assurance of water supplies for domestic use that would be supplied by Mtwalume Dam would be lost. The socio-economic benefits, including additional economic activity in the region, employment opportunities and the empowerment of emerging farmers, which are associated with the irrigation scheme, will not be realised.

The ultimate economic benefits of the project are in favour of the project being implemented based on the prime objectives of socio-economic upliftment.

15.2 Specialist Studies

Table 36 summarises the findings of the various relevant specialists in terms of their respective preferences for the project alternatives.

Table 36: Summary of Specialists’ Preferred Options

Alternative	Specialist Study Preference				
	Terrestrial Ecological	Aquatic and Wetland	Estuary	Heritage	Socio-Economic
3	✓	✓	✓	✓	
5			✓		✓

No fatal flaw was identified by any specialist. The majority of the Specialist Studies preferred Dam Site 3.

15.3 Technical Preference

Future water demand projections were based on a per capita consumption of 75 l/c/d. The 20 year future demand, based on a per capita water consumption of 75 l/c/d, would therefore be 8.98 Ml/d. This figure has been increased to 10.43 Ml/d based on an estimated increase in population growth of 1.5% as opposed to 1.2% that the initial projections were based on as well as an increase in average occupancy per household from 6 to 7 persons.

This therefore has implications on the size of the dam wall for both sites. The wall for Dam Site 3 will have to be raised to 40m, and the wall for Dam Site 5 will have to be raised to 35m to cater for the future demand of 10.43 Ml/d. The raising of the dam wall will also have cost implications as the higher the dam wall, the higher the material and construction costs.

In terms of yield, Dam Site 5 is preferred however this site may be more ecologically sensitive than Dam Site 3. A comparison of the project options by the technical team is provided in **Table 37**.

Table 37: Summary of Technical Team Preferred Options

Alternative	Technical Preference		
Dam Site	Advantages	Disadvantages	Preference
3	<ul style="list-style-type: none"> Future demand will still be met. Associated Infrastructure for the dam (such as the water pipeline and concrete access road) are much shorter in length than the construction footprint for Dam Site 5. 	<ul style="list-style-type: none"> Higher dam wall required at Dam Site 3 than Dam Site 5 due to Stage-Capacity Curves. Higher dam wall (40m) – higher costing overall. A RCC type dam wall at Site 3 must be founded onto the intact Granite Gneiss bedrock which will require deep excavation through the residual soils and highly weathered bedrock. Consequently, large costs will be incurred due to the amount of concrete required for the construction of the dam wall. 	
5	<ul style="list-style-type: none"> Lower dam wall required at Dam Site 5 than Dam Site 3 due to Stage-Capacity Curves. Lower dam wall (35m) – lower costing overall. Most suitable geotech conditions. 	<ul style="list-style-type: none"> Associated Infrastructure for the dam (such as the water pipeline and concrete access road) are much longer in length than the construction footprint for Dam Site 3. 	✓

15.4 Comparative Impacts of Alternatives

The majority of the Specialist Studies preferred Dam Site 3; however, the difference in selection of either Dam Site 3 or 5 must be assessed to determine how big of an impact the selection of a certain site will have on each environmental feature. The level of impact between Dam Site 3 and Dam Site 5 was scored for each environmental feature (**Table 38**) by the EAP, taking into account the receiving environment (Section 12), Specialist Studies (Section 13) and the outcome of the impact assessment (Section 14). The lower the difference, means there is not a major difference in preference of the alternatives. The higher the difference, means there is a significant difference in preference between the alternatives.

Table 38: Ranking Scores of Level of Impact between Alternatives

	Low	Low-Medium	Medium	High	Very High
Score Rating	1	2	3	4	5

The alternatives for the dam sites are compared in **Table 39** taking into account the following environmental perspectives:

1. Biophysical;
2. Cultural;
3. Economic; and
4. Technical.

In terms of the biophysical environment, Dam Site 3 was selected as the preferred site (and thus was scored a 1) but it was found that the impacts would not be much greater on the biophysical environment if Dam Site 5 was selected (and thus was scored a 2). This excluded the estuarine impacts as there was no preference in dam site selection. In terms of the cultural environment, both sites have heritage resources that will be impacted upon such as graves, but Dam Site 5 has a slightly higher number of resources that will be affected (thus was scored a 2) and therefore Dam Site 3 was selected as the preferred site. With regards to economic and technical environment, Dam site 5 was preferred (and thus was scored a 1). The most striking reason for why Dam Site 5 is preferred is due to the cost of the project. Due to the lower dam wall, Dam Site 5 is over three hundred million Rand cheaper than Dam Site 5. This is significantly preferred when considering the impact on the economy. Technically, the geological conditions at Dam Site 5 are preferred as well.

Therefore, it was found that the overall impacts would be greater if Dam Site 3 was selected (average score of 1.9) and thus Dam Site 5 is deemed the best site option (average score of 1.4). Even though the majority of the Specialist Studies preferred Dam Site 3; certain environmental features (such as socio-economic and financial implications on the economy) outweigh other environmental features such the biophysical and cultural impacts.

Table 39: Comparative Impacts

Environmental Feature		Dam Site and Scoring			
		Dam Site 3	Score	Dam Site 5	Score
Biophysical	Terrestrial Ecology	Although isolated portions of the basins for Dam site 3 falls within CBA 1, which are associated with high biodiversity, the majority of the inundated areas are areas which have now been transformed by alien plant species, weeds and exotic plants as compared to the proposed Dam site 5. Overall Construction Footprint is smaller than Dam Site 5.	1	Larger area of CBA 1 affected. Dams Site 5 also falls within the Endangered KwaZulu-Natal Sandstone Sourveld terrestrial threatened ecosystems. Overall Construction Footprint is larger than Dam Site 3.	2
	Surface Water	The lower portion of the valley may be more suitable due to the presence of the offtake weir and other disturbances such as sand winning, surrounding settlement and exotic weed encroachment in to the riparian zone.	1	Dam Site located in the lesser disturbed area of the river.	2
	Estuarine	No preference.	1	No preference.	1
Cultural	Heritage Resources	Dam site 3 is closer to the existing WTP therefore there are shorter access roads reducing the potential impact on heritage resources. Approximately 3 graves occur on this site as well as remains of dwellings.	1	More heritage resources were found on this dam site, approximately 5 graves and a cattle dip.	2
Economic	Socio-Economic	In terms of the construction impacts of the dam, the only difference would be that Dam Site 3 is closer to potential labour sources and it would thus be cheaper to get to work during the construction period.	2	There are differences between the two sites in proximity. In this regard Dam Site 5 is located further away from population centres, and thus is less likely to impact resident's way of life.	1

Environmental Feature		Dam Site and Scoring			
		Dam Site 3	Score	Dam Site 5	Score
				Having regard to the totality of the impacts and without regard to the relative construction costs, the socio-economic impact assessment has found no definitive grounds to prefer one site over the other, although having the dam located further from population centres would result in less long term impact. Hence Dam Site 5 would be given a weak preference over Dam Site 3.	
	Cost	Dam Site 3 will cost R 587,563,210.97, which is considerably more expensive than the cost of Dam Site 5 (over three hundred million Rand more expensive).	5	Dam Site 5 will cost R 278,055,869.84, which is considerably less expensive than the cost of Dam Site 3.	1
Technical	Geology	A RCC type dam wall at Site 3 must be founded onto the intact Granite Gneiss bedrock which will require deep excavation through the residual soils and highly weathered bedrock.	2	Dam Site 5 has more suitable geotech conditions.	1
			Avg = 1.9		Avg = 1.4

15.5 BPEO Selection

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts, the following Dam Site option identified as the BPEO for the Mtwalume Dam:

- Dam Site 5 with the following associated infrastructure:
 - Gravel Road (will be permanent);
 - Potable Water Pipeline (will be permanent);
 - Culvert River Crossing (will be permanent);
 - Concrete Access Road (will be permanent);
 - Water Storage Tank;
 - Mixing & Concrete Batching Plant for Storage of Concrete Materials;
 - Site Camp; and
 - Site Office.

A layout diagram of the selected development is included in **Figure 43**.

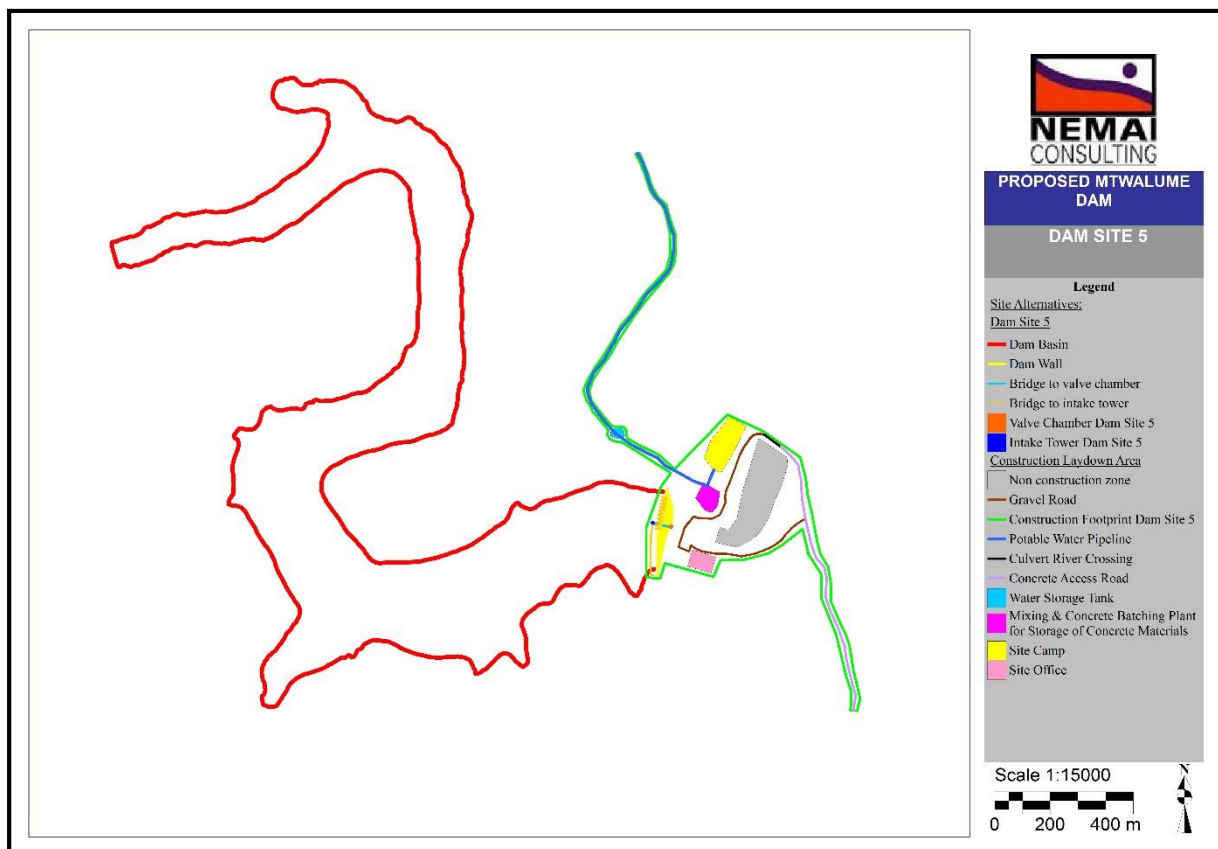


Figure 43: Layout Diagram for BPEO for Mtwalume Dam

16 PUBLIC PARTICIPATION

The purpose of the public participation process for the proposed development includes:

- Providing IAPs with an opportunity to obtain information about the project;
- Allowing IAPs to express their views, issues and concerns with regard to the project;
- Granting IAPs an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the project; and
- Enabling the project team to incorporate the needs, concerns and recommendations of IAPs into the project, where feasible.

The public participation process that was followed for the proposed project is governed by NEMA and GN No. R. 982. **Figure 4** outlines the key milestones in the public participation process undertaken for the Scoping (completed) and EIA phases for the proposed Mtwalume Dam.

The approved Plan of Study for the EIA stipulates the activities to be undertaken as part of the public participation for the project, in accordance with regulatory requirements, which forms the basis of the discussion to follow. Note that the public participation conducted for the Scoping phase will not receive attention in this section as it was comprehensively discussed in the Scoping Report. Emphases will thus primarily be placed on the EIA public participation process.

16.1 Public Participation during the Scoping Phase

The primary tasks undertaken as part of public participation during the Scoping phase included the following (details provided in Scoping Report):

- Compiling a database of IAPs;
- Notifying the affected landowners of the project;
- Announcing the project, which included distributing Background Information Documents (BIDs) and Reply Forms, placing onsite notices, and placing newspaper adverts;
- Convening public meetings and authorities meetings to announce the project and to present the Draft Scoping Report;
- Granting IAPs and authorities an opportunity to review the Draft Scoping Report; and
- Compiling and maintaining a Comments and Responses Report.

16.2 Public Participation during the EIA Phase

16.2.1 Maintenance of the IAP Database

A database of IAPs (refer to **Appendix H**), which includes authorities, different spheres of government (national, provincial and local), parastatals, stakeholders, landowners, interest groups and members of the general public, was maintained during the EIA phase.

16.2.2 Notification – Approval of Scoping Report and Notification of Public Review of Draft EIA Report

Registered IAPs were notified of the approval of the Final Scoping Report and the public review of the Draft EIA Report at the same time. Registered IAPs were notified of the approval and review period by emails or SMS. These notices also included information on the public meeting for the EIA Phase.

16.2.3 Public Review Period of Draft EIA Report

In accordance with G.N. No. R. 982 of 04 December 2014, IAPs are granted an opportunity to review and comment on the Draft EIA Report. Hard copies and of the document will be placed at the venues listed below (**Table 40**). An electronic copy of the report will also be available on Dropbox. Emails or SMSes will be sent to all registered IAPs which will include the details of the review period of the Draft EIA Report. Proof of the notification of the public review period will be included in the Final EIA Report.

Table 40: Locations of Draft EIA Report for Review

Venue	Address	Contact Details
South African Police Service - Sawoti	R612 Main Road, Braemer, Umzinto	039 971 9000
Umzinto Public Library	Lot 328 Main Road, Umzinto	039 974 1121
Vulamehlo WTP	Vulamehlo WTP Ingonyama Trust Fairview Farm No. 9951, Jolivet	039 976 1333 (Park Rynie office)

The public review of the Draft EIA Report will occur for a 30-Day review period **from 14 June 2016 to 14 July 2016**. Refer to proof of notification in **Appendix I**.

For any remarks on the Draft EIA Report, the reviewer can complete a Comment Sheet, which will be attached to the hardcopies of the Draft EIA Report. These completed Comment Sheets need to be forwarded to Nema Consulting by 14 July 2016. Comments received from IAPs from the review of the Draft EIA Report will be contained in a Comments and Responses Report in the Final EIA Report, which will be submitted to KZN DEDTEA.

16.2.4 Authority Review Period of Draft EIA Report

Hard copies of the document were also provided to the following key regulatory and commenting authorities:

- KZN DEDTEA;
- KZN Regional DWS;
- KZN Department DAFF;
- KZN DMR;
- SAHRA;
- Amafa aKwaZulu-Natali;
- Ezemvelo KZN Wildlife;
- KZN Department of Transport;
- KZN COGTA;
- Harry Gwala and Ugu DM; and
- Ubuhlebezwe, Umzumbe and Vulamehlo LM.

An electronic copy of the report will also be available on Dropbox. Emails or SMSes will be sent to all commenting authorities which will include the details of the review period of the Draft EIA Report. Proof of the notification of the authority review period will be included in the Final EIA Report.

The authority review of the Draft EIA Report will take place from **14 June 2016 to 25 July 2016** (40-Day review). Refer to proof of notification in **Appendix I**.

16.2.5 Meetings

16.2.5.1 Public Meeting

A public meeting to present the Draft EIA Report and to provide IAPs with a platform for project related discussions will be held. The details of the public meeting are provided in **Table 41**.

Table 41: EIA Public Meeting

Date	Time	Venue
14 July 2016	13h30 - 15h30	Vulamehlo WTP, Ingonyama Trust Fairview Farm No. 9951, Jolivet (30°19'38.05"S; 30°19'51.85"E)

16.2.5.2 Authority Meeting

An Authority Meeting will be held on **14 July 2016** to present the Draft EIA.

16.2.6 Comments and Responses

The EIA Comments and Responses Report (**Appendix K**) summarises the correspondence received by IAPs and Organs of State completed via the Reply Forms, Comments Sheets, letters, faxes and emails. This report also includes a summary of the discussions from Focus

Group Meetings and Stakeholder Meetings held to date, during the Public Participation phase. This report captures all the significant issues and queries raised, any statements that were made, and a record of all IAPs that registered. This report also attempts to address every comment through responses and input provided by the project team.

All comments received following the public review of the Draft EIA Report will be included in the Final EIA Report Comments and Response Report.

16.2.7 Review of the Final EIA Report

Registered IAPs and authorities will be granted an opportunity to review and comment on the Final EIA Report. A link on Dropbox containing the electronic Final EIA Report will be sent to authorities and registered IAPs only. Any further comments from registered IAPs will be forwarded to the Competent Authority.

16.2.8 Notification of KZN DEDTEA Decision

All authorities and registered IAPs will be notified via email or SMS after having received written notice from KZN DEDTEA on the final decision for the project. Advertisements will also be placed as notification of the Department's decision. These notifications will include the appeal procedure to the decision and key reasons for the decision. A copy of the decision will also be provided to IAPs on request.

17 EIA CONCLUSIONS AND RECOMMENDATIONS

17.1 Sensitive Environmental Features

Within the context of the project area, cognisance must be taken of the following sensitive environmental features (shown in in **Figure 44**) for which mitigation measures are included in the EIA Report and EMPr:

- The Mtwalume River and tributaries (including drainage lines), are regarded as sensitive and require suitable protection from the construction activities. All construction activities to comply with the National Water Act (Act No. 36 of 1998).
- All existing infrastructure and structures are regarded as sensitive and need to be safeguarded from construction activities.
- Endangered KwaZulu-Natal Sandstone Sourveld terrestrial threatened ecosystem and fauna and flora species of conservation concern occur in the area, which need to be protected against the project's potential adverse impacts. All construction activities to comply with the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), National Forests Act (Act No. 84 of 1998) and Nature and Environmental Conservation Ordinance (Act No. 19 of 1974). Sensitive species to be identified as part of the pre-construction survey. If relocation is not required, then these species need to be adequately protected from construction activities.
- All traffic and pedestrians on the public roads are regarded as sensitive and measures need to be implemented to safeguard these road users.
- A number of grave sites were identified within the project area. The final locations of all heritage and cultural features will be confirmed as part of the Phase 2 HIA. These features may not be disturbed without following legal protocol.
- Existing communication channels need to be duly respected and adhered to when engaging with the community.
- Private land may not be accessed unless consent has been granted by the landowner, or until the land acquisition process has been concluded, or a construction servitude has been registered.
- Livestock and unauthorised access to the construction domain needs to be prevented. Excavations to be adequately safeguarded.

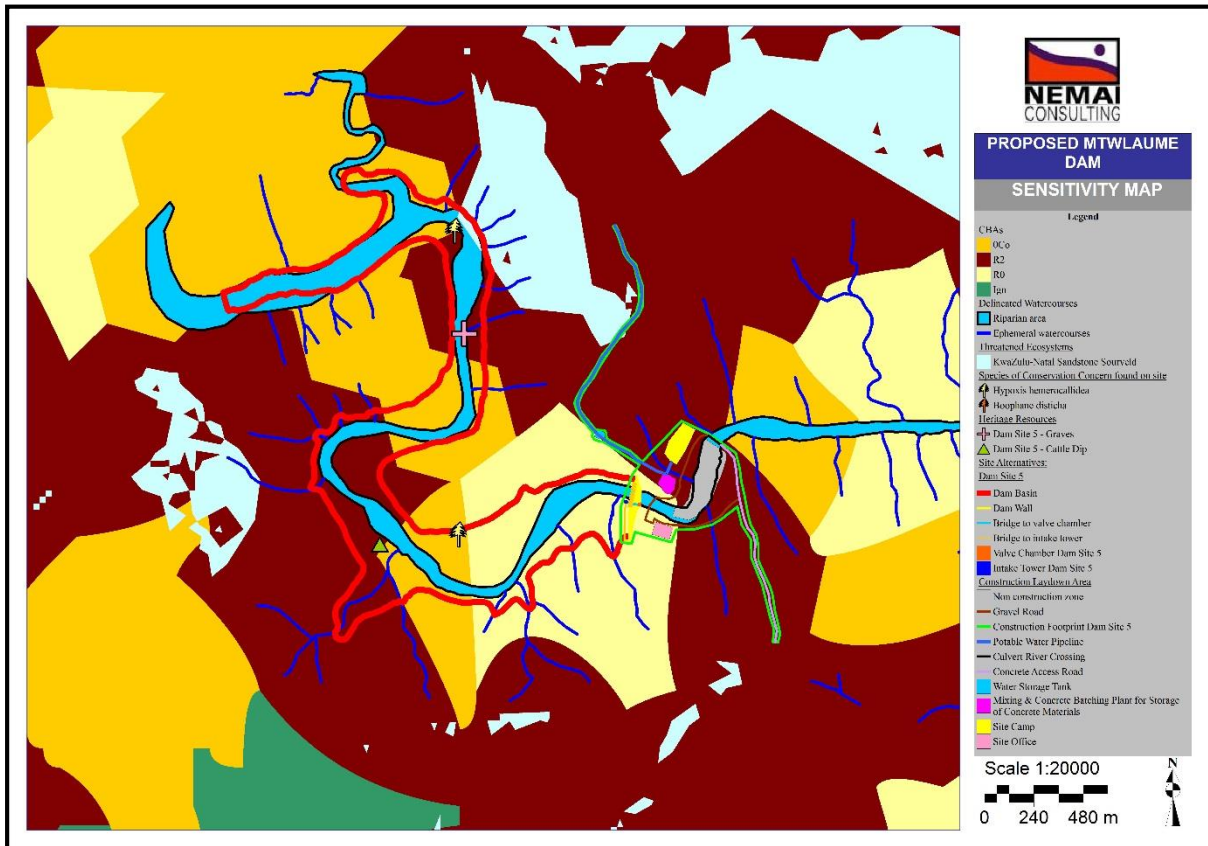


Figure 44: Sensitivity Map for Mtwalume Dam

The sensitivity map shown in **Figure 44** needs to be made available to the implementation team (including the Project Manager, Environmental Control Officer and Contractor) in GIS format to allow for further consideration and adequate interpretation at an appropriate scale.

17.2 Environmental Impact Statement

Hydrological assessments of the Mtwalume River indicated that in order to meet the current and future domestic water demands of the surrounding community in addition to implementing the EWR, additional in-catchment storage will be required in the form of a dam or weir on the Mtwalume River. The need for the Mtwalume Dam involves providing people with access to water. This area suffers greatly due to the lack of water available for domestic use, especially during droughts.

As part of the EWR, the proposed dam should not have an impact with either a magnitude or significance that would be considered as a fatal flaw. The Reserve requirements will ultimately feed into the licensing process with DWS and the operation of the system.

The proposed dam is located on Ingonyama Trust land. Following thorough engagement with the affected landowners as part of the public participation process as well as specialist studies,

all the concerns were identified and included in the EIA's recommendations and mitigation measures. Of particular importance is that the land acquisition and compensation process needs to adhere to all legal requirements, in negotiation with the affected landowners.

Critical environmental activities that need to be executed during the project life-cycle include the following:

- Pre-construction Phase
 - Diligent compliance monitoring of the EMP, environmental authorisation and other relevant environmental legislation;
 - Undertake Phase 2 HIA;
 - Undertake a walk through survey of the project footprint by the relevant environmental specialists to identify sensitive environmental features;
 - Develop Search, Rescue and Relocation Management Plan, based on findings of walk through survey;
 - Search, rescue and relocation of Red Data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities);
 - Develop environmental monitoring programme (air quality, water quality, noise, traffic, social);
 - Conduct further baseline environmental studies for environmental monitoring programme;
 - Barricading of sensitive environmental features (e.g. graves);
 - Permits if protected trees are to be cut, disturbed, damaged, destroyed or removed;
 - Permits if heritage resources are to be impacted on and for the relocation of graves;
 - Establish EMC;
 - On-going consultation with IAPs; and
 - Other activities as per EMP;
- Construction Phase
 - Diligent compliance monitoring of the EMP, environmental authorisation and other relevant environmental legislation;
 - Ongoing search, rescue and relocation of Red Data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities) – permits to be in place;
 - Implement environmental monitoring programme (air quality, water quality, noise, traffic, social);
 - Develop Rehabilitation Management Plan for approval by DEDTEA;
 - Reinstatement and rehabilitation of construction domain (outside of inundation areas, as necessary);

- Convene EMC Meetings;
- On-going consultation with IAPs; and
- Other activities as per EMPr;
- Operational Phase
 - Satisfy EWR; and
 - On-going consultation with IAPs.

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts, the following dam site was identified as the BPEO for the related project components:

- Dam Site 5 with associated infrastructure:
 - Gravel Road (will be permanent);
 - Potable Water Pipeline (will be permanent);
 - Culvert River Crossing (will be permanent);
 - Concrete Access Road (will be permanent);
 - Water Storage Tank;
 - Mixing & Concrete Batching Plant for Storage of Concrete Materials;
 - Site Camp; and
 - Site Office.

Where the other alternative was more favourable, the residual impacts following the recruitment of suitable mitigation measures were not regarded as sufficiently significant or overriding to sway the ultimate selection of the alternative.

With the selection of the BPEO, the adoption of the mitigation measures include in the EIA Report and the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

17.3 Recommendations

The following key recommendations, which may also influence the conditions of the Environmental Authorisation (where relevant), accompany the EIA for the development of Mtwalume Dam and the associated infrastructure:

1. The operating rule for Mtwalume Dam must ensure that the existing water use entitlements are not affected and that the EWR for the Mtwalume River and Estuary are satisfied.

2. Where relevant, the construction domain needs to be contained within the dam basin area as much as possible to avoid disturbance outside of the eventual impoundment footprint. All external areas that are not associated with permanent infrastructure and the operation of the dam need to be adequately rehabilitated.
3. It is recommended that the following EMPs be developed as further information becomes available during the implementation of the project:
 - a. Search, Rescue and Relocation Management Plan for Red Data, protected and endangered species, medicinal plants, heritage resources and graves;
 - b. Mtwalume Dam Impoundment EMP;
 - c. Rehabilitation Management Plan for disturbed areas outside of the dam inundation area; and
 - d. Operational EMP.
4. As discussed in the EMP, various forms of monitoring are required to ensure that the receiving environment is suitably safeguarded against the identified potential impacts, and to ensure that the environmental management requirements are adequately implemented and adhered to during the execution of the project. The types of monitoring to be undertaken include:
 - a. Baseline Monitoring needs to be undertaken to determine to the pre-construction state of the receiving environment, and serves as a reference to measure the residual impacts of the project by evaluating the deviation from the baseline conditions and the associated significance of the adverse effects;
 - b. Environmental Monitoring entails checking, at pre-determined frequencies, whether thresholds and baseline values for certain environmental parameters are being exceeded; and
 - c. Compliance Monitoring and Auditing for the independent Environmental Control Officer (ECO) to monitor and audit compliance against the EMP and Environmental Authorisation.
5. Pertinent recommendations from the Terrestrial Ecological Impact Assessment (Nemai Consulting, 2016b) include:
 - a. During the field surveys, two species of conservation importance were noted, namely *Hypoxis hemerocallidea* (Star flower/African potato) and *Boophane disticha* (Century plant). It is thus recommended that these 'declining' plant species must be removed prior construction to areas with suitable survival and growth-enabling conditions. Search, rescue and relocation plan needs to be developed for these sensitive flora species within the construction domain and dam basin. Plan to be implemented must be in accordance with the project programme to ensure that these sensitive environmental features are rescued prior to potential impact occurrence. Ezemvelo KZN Wildlife is to be consulted to ensure that the Plan incorporates all these authority's requirements.

- b. Care should be exercised in order to negate the negative ecological impacts through further habitat fragmentation.
 - c. One endemic species recorded on site was the Jackal Buzzard (*Buteo rufofuscus*). The proposed development is not likely to be associated with large-scale loss of habitat, thus it is highly unlikely that the proposed development would exert an impact of any significance on this endemic bird species. Before construction commences, all sensitive habitats, such as wetlands and patches of forest must be clearly demarcated with fencing or orange mesh netting. Buffer zones associated with wetlands must be adhered to in order to minimise disturbances associated with the ecological functioning of the wetlands. All development footprint areas should remain as small as possible and should not encroach onto surrounding areas.
6. Pertinent recommendations from the Wetland and Aquatic Impact Assessment (SDP, 2015) include:
- a. Measures to prevent hydrocarbon contamination must be implemented. Examples include using drip trays for standing plant, not allowing leaky plant to operate in the river and inspecting vehicles on a daily basis to ensure any leaks are identified and can be repaired before use of the plant.
 - b. Implement berms and silt curtains to control stormwater runoff from the access road and capture sediment.
 - c. Blasting and other high impact disturbances must be done in an efficient manner and not drawn out or undertaken outside of the required area.
 - d. Re-vegetation. The construction area must be revegetated once construction is complete to prevent erosion and continued sedimentation of the river. The most appropriate method would be to use a grass seed mix containing *Eragrostis tef*, which is a fast growing pioneer grass.
 - e. A fish ladder/fishway may be possible, the cost thereof and the success thereof is questionable and alternative mitigation measures must be implemented.
 - f. Once operational, sufficient water must be released from the dam to maintain the ecological reserve. Baseline and present state data is available for the Mtwalume River, however according to the DWS website (<https://www.dwa.gov.za/rdm/Status.aspx>) a reserve determination for the Mtwalume River has not yet been completed. This should form a condition of the water use license (adequate release of water) and clarification of the requirements must be obtained from DWS.
 - g. Although theoretically possible, removal of *Labeobarbus natalensis* and *Micropterus salmoides* from the project area will not be sufficient as the species would re-colonise from upstream dams. A catchment wide eradication programme would need to be implemented. Practically this would be a huge undertaking given the extent of the infestation. Private landowner co-operation

would also be required complicating matters further. The success of such an undertaking in this instance is highly unlikely.

7. Pertinent recommendations from the Estuary Specialist Opinion (Anchor Environmental, 2015) include:
 - a. In summary, the significance of any potential impacts of dam construction on the Mtwalume estuary cannot be fully quantified without more information on the likely changes in the flow regime of the river below the dam and the likely impacts this may have on runoff to the estuary. However, provided changes in the seasonal flow regime of the river are kept to a minimum impacts on the estuary are likely to be low. From an ecological and socio-cultural perspective, the Mtwalume estuary is considered to be of “Medium” importance, with an Integrated Environmental Importance Score of 2 of 5. The current health of the system is rated as “moderately modified” or “C” class.
8. Pertinent recommendations from the HIA (Beater, 2016) include:
 - a. Undertake a Phase 2 HIA;
 - b. There is the possibility of the existence of graves situated close to the abandoned homesteads found in the area above the site of the proposed dam wall. Damage to or destruction of these graves could occur during the construction of the wall through the construction of access roads and other activities taking place in the area. It is therefore recommended that construction activities should be kept well away from these abandoned structures. Alternatively, a highly visible buffer of 10m should be placed around the structures to avoid to these sites.
 - c. The graves found in the area of inundation of Dam Site 5 will have to be relocated if this dam is chosen. Relocation must follow the requirements as set in the KZN Heritage Regulations.
 - d. The cattle dip will also be inundated by the dam. It is regarded to have medium to high significance as it is still in use. It is therefore recommended that if Dam Site 5 is chosen, the Applicant consider providing a cattle dip in an area outside the inundation area of the dam in consultation with affected farmers. If the cattle dip is to be inundated, then a complete photographic record must be taken of the structure. Application for its destruction must be made to Amafa.
9. Pertinent recommendations from the Socio-Economic Impact Assessment (Nemai Consulting, 2016a) include:
 - a. It is recommended that potential tourism activities are identified during the development of the RMP for the Mtwalume Dam.
 - b. Where possible, the Ugu DM should support and encourage the development of SMMEs and local or regional suppliers. Where possible, procurement should come from local or regional business so that the profits stay in the area, increasing economic activity.

- c. Local employment should be encouraged to reduce the unemployment rate in the area. Furthermore, the local community will be able to benefit from a project that directly affects them.
- d. Ugu DM must monitor the employment process at all times. Employment audits should be conducted and there should be full transparency of the process. A CLO should be employed to manage the process and report on issues. It is important that women are also provided employment opportunities. Audits should pay attention to the employment process of women to ensure that exploitation does not take place.
- e. To mitigate against the low numbers of available male workers, the proposed project should try increase the local workforce through employing women. This would affect the gender power distribution, providing women with more bargaining power in the households due to the reliance on their income.
- f. Where there is an employment gap: where the supply of particular categories of worker is limited within the host community, it will be necessary to rely on imported labour. Imported labour should be housed within the local community and wherever possible drawn from within the ranks of the permanent staff of the contractor.
- g. Adequate warning of potential noise pollution through blasting should be communicated to the affected communities.
- h. It is important that the contractors are sensitive to the road conditions and ensure that throughout the construction process that these roads are maintained and suitable for use by heavy vehicles.
- i. A security policy must be drafted and strictly enforced by the contractors. Given the remote location of the project, access to policing and security services are largely inaccessible in the area. As good practice and mitigation against security risks, Ugu DM should provide some level of security and emergency response services for the duration of the construction phase.
- j. Dam safety will also need to be considered to ensure that people do not drown or access the dam infrastructure. It is important to have an effective communication strategy to prevent the loss of lives and property in this regard.
- k. It is important that the project team are sensitive to cultural beliefs surrounding the dam and water. Given the plants with medicinal use will be inundated, the community must be provided with an opportunity to harvest these plants. The legal and cultural processes as dictated by the Heritage Impact Assessment and Ecological Assessment must apply.
- l. There should also be awareness and education campaigns conducted within the contractor's staff on health and social risks such as HIV/AIDs and crime prevention. These programs should aim to gather support from the traditional

authorities and local government to ensure that social problems that could arise can be resolved as early as possible.

- m. During the construction and operational phase, Health and Safety regulations must be adhered to.

18 OATH OF THE EAP AND DECLARATION OF INDEPENDENCE

I (name and surname) _____

At (address) _____

ID No. _____

Hereby make an oath and state that:

In Accordance with Appendix 3 of G.N. R. 982 (04 December 2014), this serves as an affirmation by the Environmental Assessment Practitioner (EAP) in relation to:

Section 3(s)

- i. The correctness of the information provided in this report;
- ii. The inclusion of comments and inputs from stakeholders and interested and affected parties (IAPs);
- iii. The inclusion of inputs and recommendations from the Specialist Reports where relevant; and
- iv. Any information provided by the EAP to IAPs and any responses by the EAP to comments or inputs made by IAPs.

1. I know and understand the contents of this declaration.
2. I do not have any objection in taking the prescribed oath.
3. I consider the prescribed oath to be binding on my conscience.

Signature _____ Date _____

I certify the deponent has acknowledged that he/she knows and understands the contents of the statement and the deponent signature was placed there in my presence.

Commissioner of Oath

Full name

Designation

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