water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

REPORT NO:
P WMA 15/Q92/00/2113/21

PROPOSED DEVELOPMENT OF FOXWOOD DAM & ASSOCIATED INFRASTRUCTURE

SCOPING REPORT

DRAFT

June 2015

EXECUTIVE SUMMARY

PROJECT BACKGROUND AND MOTIVATION

The Department of Water and Sanitation (DWS) is investigating the feasibility of developing a multi-purpose dam on the Koonap River outside of Adelaide in the Eastern Cape. The proposed site is known as the Foxwood Dam site.

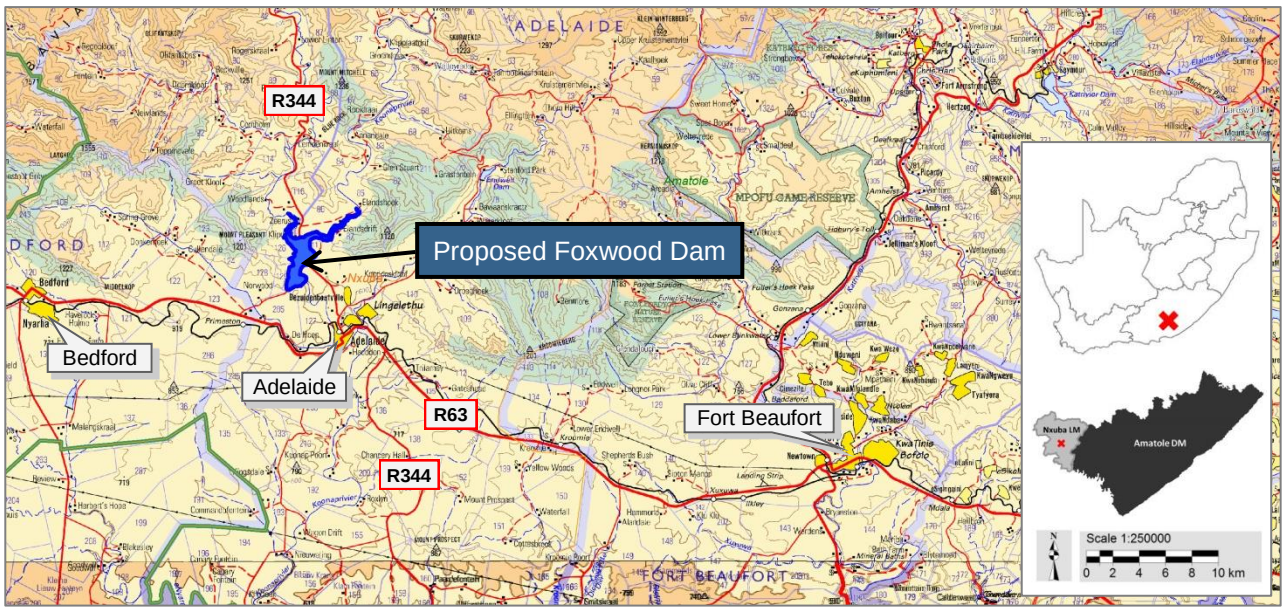
Foxwood Dam could provide additional assurance of water supply to improve resilience of domestic water supply within the region. In addition, the project is being considered for implementation as a strategic initiative to mobilize the water resources in the area as a stimulus for socio-economic development in this rural, economically depressed region. This initiative would support the objectives of the National Development Plan and is consistent with the National Water Resource Strategy 2.

This document serves as the draft Scoping Report for the proposed development of Foxwood Dam and its associated infrastructure.

PROJECT LOCATION

The project area is situated in central part of the Eastern Cape, in the Amatole District Municipality and Nxuba Local Municipality. From a southern direction the proposed dam wall site (coordinates 32˚40’30”S, 26˚16’0”E) is accessed via the R344 (off the R63). The town of Adelaide and the Bezuidenhoutville Township are located to the south-east of the dam.

The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices, except for the land in the south-eastern part of the project footprint which is owned by the municipality.



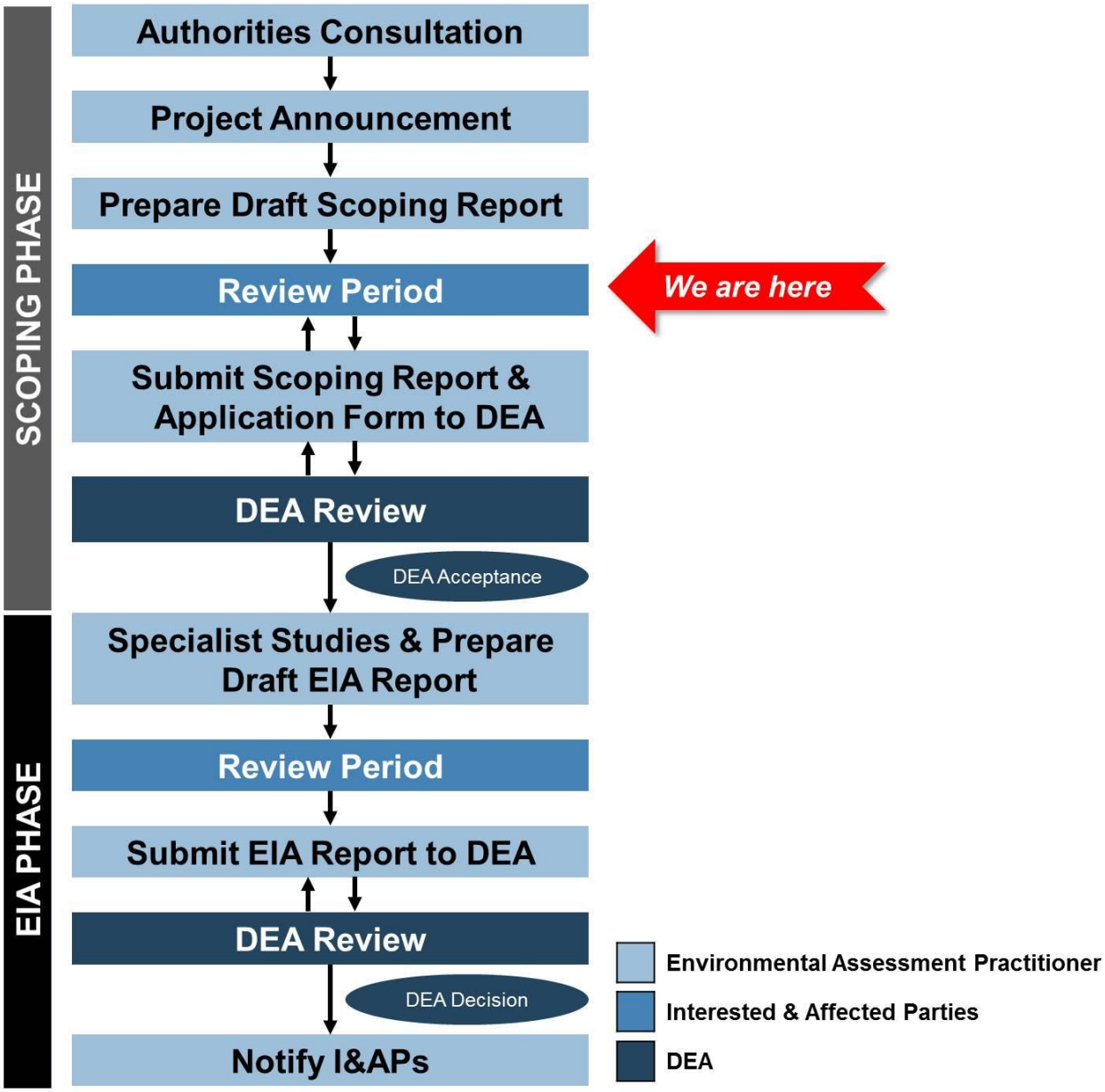
Regional map of project area (not all project components shown)

SCOPING AND EIA PROCESS

An Application for Environmental Authorisation in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998) and the EIA Regulations (2014) will be made for the proposed development of Foxwood Dam and its associated infrastructure.

In terms of NEMA the lead decision-making authority for the environmental assessment is the Department of Environmental Affairs (DEA), as the project proponent (DWS) is a national department. Based on the outcomes of the pre-application consultation meeting held with DEA, the Application Form and draft Scoping Report will be submitted to the Department at the same time.

The process for seeking authorisation is undertaken in accordance with Government Notice (GN) No. R. 982 of 4 December 2014, promulgated in terms of Chapter 5 of NEMA. Based on the types of activities involved, which include activities listed in GN No. R. 983, R. 984 and R. 985 of 4 December 2014, the requisite environmental assessment for the project is a Scoping and EIA process. An outline of the process is provided in the diagram to follow.



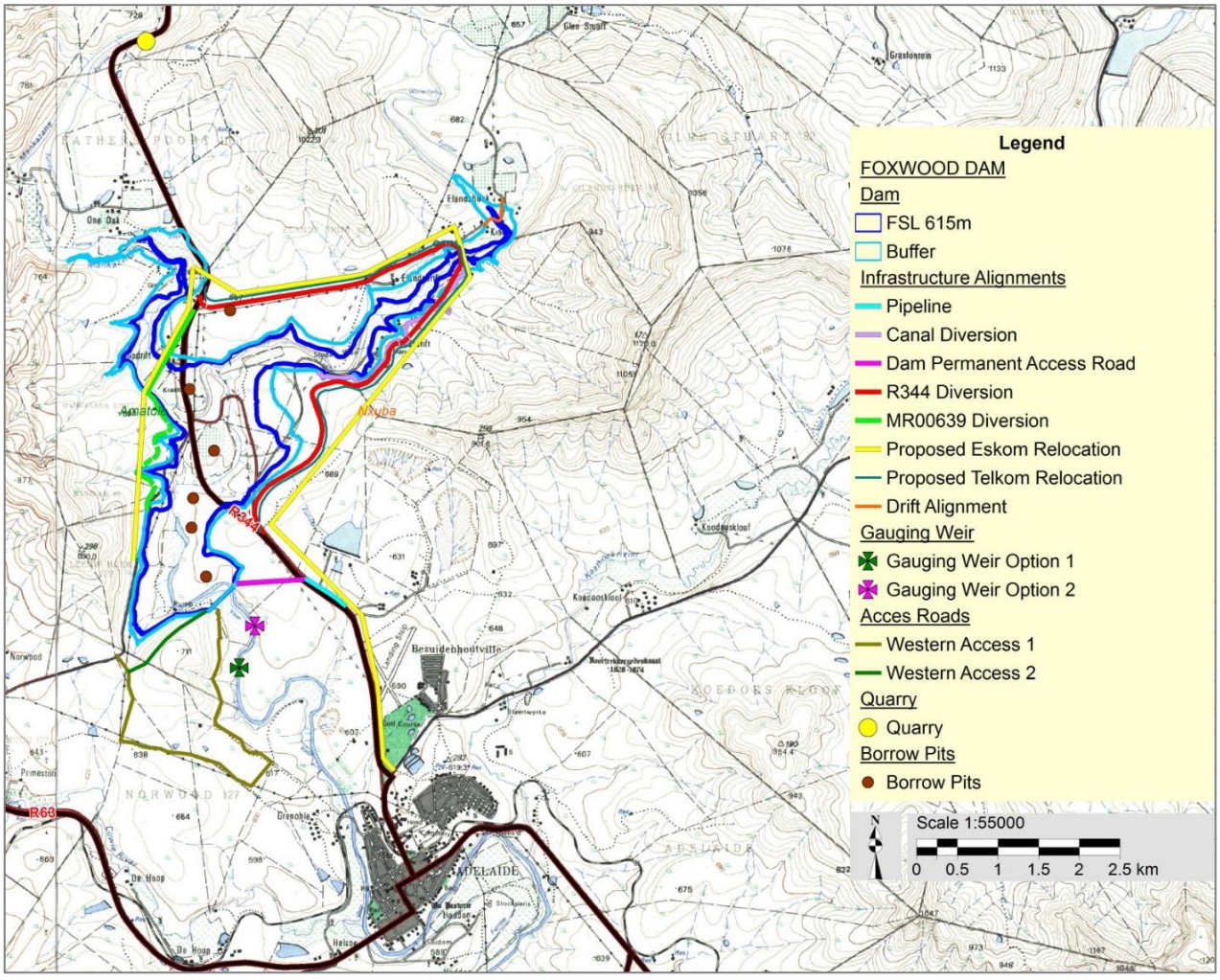
Overview of Scoping and EIA process

PROJECT DESCRIPTION

The project consists of the components listed in the table to follow, as shown in the accompanying map.

List of Project Components

Project Components	Associated Infrastructure
Major storage dam (Foxwood Dam)	1. Dam wall 2. Embankment 3. Dam outlet works (including dam intake tower, tunnel and outlet valve house) 4. Access roads (construction and operation) 5. Quarry and earthfill borrow areas 6. Electrical supply 7. Construction camp (temporary) 8. Operator's offices and accommodation (permanent)
Bulk water supply pipeline	1. Pump station 2. Pipeline and associated structures (chambers, Cathodic Protection measures, AC mitigation measures, pipeline markers)
Gauging Weir	1. Weir and associated instrumentation 2. Access roads (construction and operation) 3. Electrical supply 4. Satellite construction camp
Relocation of Infrastructure	1. Relocate water supply canal 2. Relocate R344 3. Relocate MR00639 4. Relocate Telkom telephone line 5. Relocate Eskom power line



Map showing Project Components

ALTERNATIVES

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives.

The Technical Feasibility Study assessed the capability of existing water supply systems to provide Adelaide's current and projected domestic water demand and discussed the options for developing these supply schemes where required to improve their resilience and ability to contribute to Adelaide's water requirements. The following supply options were considered:

1. Koonap River Weir and Off-Channel Storage System;
2. Fish River Pumping Scheme;
3. Groundwater; and
4. Water Conservation and Water Demand Management.

The following alternatives to the project components are discussed in the Scoping Report:

- Major Storage Dam –
  - Dam type;
  - Dam capacity;
- Gauging weir – location; and
- Power line deviation - route alignment.

As a standard practice and to satisfy regulatory requirements, the option of not proceeding with the project is included in the evaluation of the alternatives.

PROFILE OF THE RECEIVING ENVIRONMENT

The Scoping Report 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 Scoping exercise was conducted. It also 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 the project components and related activities.

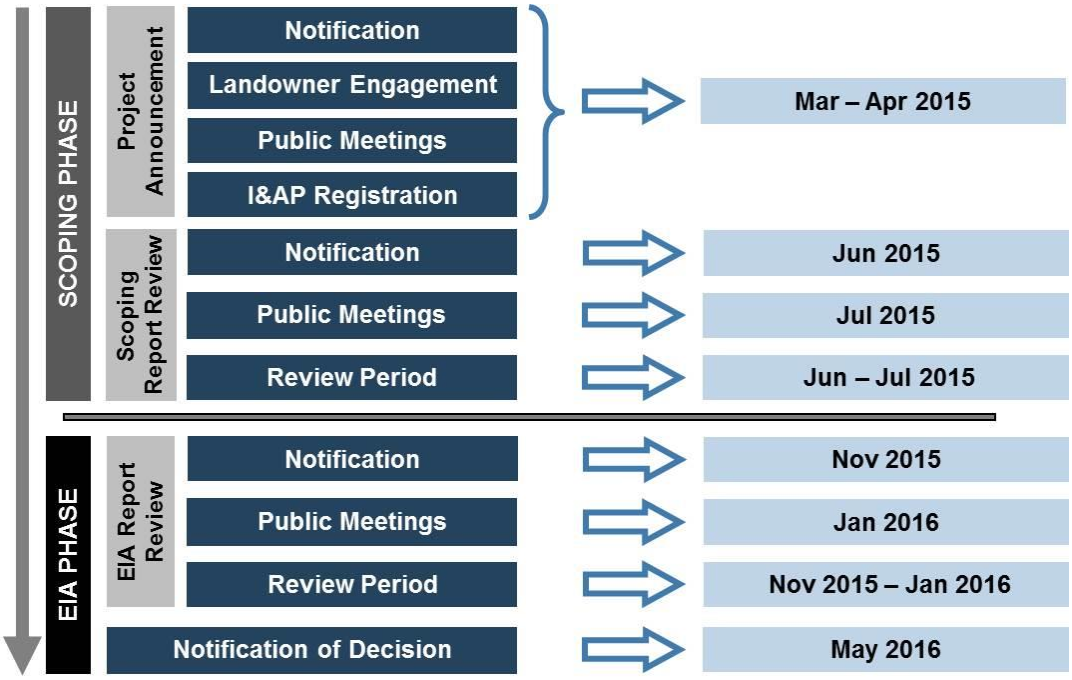
A brief overview is also provided of the manner in which the environmental features may be affected (positively or negatively) by the proposed development of Foxwood Dam and its associated infrastructure.

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

- Land Use and Land Cover
- Climate
- Geology
- Soils
- Geohydrology
- Topography
- Surface Water
- Terrestrial Ecology
- Protected Areas
- Socio-Economic Environment
- Agriculture
- Air quality
- Noise
- Historical and Cultural Features
- Planning
- Existing Structures and Infrastructure
- Transportation
- Existing Waste Disposal Facilities
- Aesthetic Qualities
- Tourism

PUBLIC PARTICIPATION

The diagram to follow outlines the public participation process for the Scoping (current) and EIA phases (pending) of the proposed project.



Outline of Public Participation Process

ENVIRONMENTAL ISSUES

In accordance with the purpose of the Scoping exercise as part of the overall environmental assessment, the Scoping Report identifies potentially significant environmental issues for further consideration and prioritisation during the EIA stage. This allows for a more efficient and focused impact assessment in the ensuing EIA phase, where the analysis is largely limited to significant issues and reasonable alternatives.

The issues raised by Interested and Affected Parties (I&APs) during the Announcement and Scoping phases of the project, as contained in the Comments and Response Report, were grouped into the following main categories:

- Alternatives;
- Water use;
- Socio-economic impacts;
- Impacts to agriculture;
- Impacts to terrestrial ecology;
- Impacts to freshwater and estuarine ecology;
- Proposed Irrigation Scheme;
- Traffic, road network and access;
- Existing infrastructure;
- Historical and Cultural Features;
- Public participation; and
- Electrical requirements.

Pertinent environmental issues, which will receive specific attention during the EIA phase through a detailed quantitative assessment and relevant specialist studies (where deemed necessary), are discussed in the Scoping Report.

Cumulative impacts were identified by combining the potential environmental implications of the proposed development of Foxwood 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.

A methodology to quantitatively assess the potential impacts is also provided, which will be employed during the EIA phase.

PLAN OF STUDY FOR EIA

The Scoping Report is concluded with a Plan of Study, which explains the approach to be adopted to conduct the EIA for the proposed project in accordance with the following pertinent tasks and considerations:

- Key environmental issues identified during the Scoping Phase to be investigated further;
- Feasible alternatives to be assessed during EIA Phase;
- Specialist studies to be undertaken, which include –
  - Terrestrial Ecological Impact Assessment;
  - Aquatic and Riverine Assessment;
  - Wetland Assessment and Delineation;
  - Agricultural Impact Assessment;
  - Heritage Impact Assessment;
  - Visual Impact Assessment;
  - Socio-economic Impact Assessment; and
  - Traffic Impact Assessment.
- Public Participation process to be followed;
- Contents of the EIA Report;
- Consultation with authorities; and
- EIA timeframes.

CONCLUSION

Key outcomes of the Scoping phase for the proposed development of Foxwood Dam are as follows:

- Stakeholders were effectively identified and were afforded adequate opportunity to participate in the scoping process;
- Alternatives for achieving the objectives of the proposed activity were duly considered.
- Significant issues pertaining specifically to the pre-construction, construction and operational phases of the project were identified;
- Sensitive elements of the environment to be affected by the project were identified;

- A Plan of Study was developed to explain the approach to executing the EIA phase, which also includes the Terms of Reference for the identified specialist studies; and
- The scoping exercise set the priorities for the ensuing EIA phase.

It is the opinion of the EIA team that Scoping was executed in an objective manner and that the process and report conform to the requirements of regulation 21 and Appendix 2 of GN No. R. 982 (4 December 2014), respectively. It is also believed that the Plan of Study for EIA is comprehensive and will be adequate to address the significant issues identified during Scoping, to select the Best Practicable Environmental Option, and to ultimately allow for informed decision-making.

TITLE AND APPROVAL PAGE

Project Name:	***Proposed Development of Foxwood Dam & Associated Infrastructure***
Report Title:	***Draft Scoping Report***
Authors:	***D. Henning, N Naidoo***
Authority reference no.:	***To be provided by DEA***
DWS report reference no.:	***P WMA 15/Q92/00/2113/21***
Status of report:	***Draft***
Date of issue:	***June 2015***

Consultants: *Nemai Consulting*

Approved for Consultants by:

……

N Naidoo

Project Manager

DEPARTMENT OF WATER AND SANITATION (DWS)

Approved for Directorate: Options Analysis by:

……	……
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Project Engineer: Options Analysis (South)	*Acting Director: Options Analysis*

Prepared by Nemai Consulting

for DWS

AMENDMENTS PAGE

Date	Nature of Amendment	Amendment No.	Signature
June 2015	Draft for Project Team Review	0	

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LIST OF ACRONYMS & ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
AIP	Alien Invasive Plants
ATWG	Agricultural Technical Working Group
BID	Background Information Document
BPEO	Best Practicable Environmental Option
CBA	Critical Biodiversity Area
COGTA	Cooperative Governance and Traditional Affairs
CR	Critically Endangered
°C	Degrees Celsius
DBSA	Development Bank of Southern Africa
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEDEAT	Department Economic Development, Environmental Affairs and Tourism
DEAT	Department of Environmental Affairs and Tourism
DM	District Municipality
DMR	Department of Mineral Resources
DRDAR	Department of Rural Development and Agrarian Reform
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EBA	Endemic Bird Area
EC	Eastern Cape
EC	Ecological Category
ECBCP	Eastern Cape Biodiversity Conservation Plan
ECDRPW	Eastern Cape Department of Roads and Public Works
ECRDA	Eastern Cape Rural Development Agency
EFR	Estuarine Freshwater Requirements
EHI	Estuarine Health Index
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIS	Estuary Importance Score
EMPr	Environmental Management Programme
EN	Endangered
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Area
FRPS	Fish River Pumping Scheme
FSL	Full Supply Level

GIS	Geographical Information System
GN	Government Notice
GVA	Gross Value Added
ha	Hectare
HIV	Human Immunodeficiency Virus
IAIAsa	International Association of Impact Assessors South Africa
I&AP	Interested and Affected Party
IBA	Important Bird Area
IDP	Integrated Development Plan
km	Kilometre
km^2	Square kilometre
kV	Kilovolts
ℓ	Litres
LM	Local Municipality
l/s	Litres per second
m	Metre
masl	Meters above sea level
m/s	Metres per second
m^2	Square meters
m^3	Cubic metre
MAR	Mean Annual Runoff
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
Ml	Mega litre
Ml/day	Mega litre per day
mm	Millimetre
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEM:WA	National Environmental Management: Waste Act (Act No. 59 of 2008)
NDP	National Development Plan
NFEPA	National Freshwater Ecosystem Priority Area
NPAES	National Protected Area Expansion Strategy
NWA	National Water Act (Act No. 36 of 1998)
NWRS2	National Water Resource Strategy 2
OHS	Occupational Health and Safety
PES	Present Ecological State
PMF	Probable Maximum Flood
RDF	Recommended Design Flood
REC	Recommended Ecological
RIS	Reservoir-Induced Seismicity
RMP	Resource Management Plan
SAAB	South African Association of Botanists
SACNASP	South African Council for Natural Scientific Professions

SAIEES	South African Institute of Ecologists and Environmental Scientists
SAHRIS	South African Heritage Resources Information System (
SANBI	South African National Biodiversity Institute
SANS	South African National Standard
SASAqS	South African Society for Aquatic Scientists
SAWS	South African Weather Services
SDF	Spatial Development Framework
SKEP	Succulent Karoo Ecosystem Programme
SFR	Streamflow Reduction
SIP	Strategic Integrated Project
TE	Threatened Ecosystem
ToR	Terms of Reference
URV	Unit Reference Value
VU	Vulnerable
WARMS	Water Use Registration Database
WC&WDM	Water Conservation and Water Demand Management
WfW	Working for Water
WMA	Water Management Area
WSA	Water Services Authority
WTW	Water Treatment Works

1 PURPOSE OF THIS DOCUMENT

The Department of Water and Sanitation (DWS) is investigating the feasibility of developing a multi-purpose dam on the Koonap River outside of Adelaide in the Eastern Cape (EC). The proposed site is known as the Foxwood Dam site. The feasibility study is being undertaken at sufficient detail to provide reliable information to support high level decision-making regarding approval of the proposed development.

This document serves as the draft Scoping Report for the proposed development of Foxwood Dam. The proposed project consists of the following:

- Major storage dam (Foxwood Dam);
- Bulk water supply pipeline and pump station;
- Gauging weir;
- Access roads (construction and operational phases);
- Quarry and borrow areas;
- Eskom supply to the dam and gauging weir;
- Relocate existing infrastructure (including water supply canal, R344, MR00639, Telkom telephone line and Eskom power line);
- Construction camp; and
- Permanent offices and accommodation for dam operator.

The purpose of Scoping, which constitutes the first phase of the formal Environmental Impact Assessment (EIA) process, includes the following (amongst others):

- Identify and engage with Interested and Affected Parties (I&APs) and allow for adequate participation in the process;
- Assess the receiving environment in terms of current state and potential positive or negative impacts;
- Duly consider alternatives for achieving the project's objectives;
- Identify significant issues to be investigated further during the execution of the EIA phase;
- Determine the scope of the ensuing EIA phase, in terms of specialist studies, public participation, assessment of impacts and appraisal of alternatives; and
- Allow for informed decision-making with regard to the EIA process.

2 DOCUMENT ROADMAP

As a minimum, the Scoping Report aims to satisfy the requirements stipulated in Appendix 2 of Government Notice (GN) No. R. 982 (4 December 2014). **Table 1** presents the document's composition in terms of the aforementioned regulatory requirements.

Table 1: Scoping Report Roadmap

Chapter	Title	Correlation with GN No. R. 982, Appendix 2	Overview
1	Purpose of this Document	–	–
2	Document Roadmap	–	–
3	Project Background and Motivation	2(f)	A motivation for the need and desirability for the proposed development.
4	Project Location	2(b) & 2(c)	A description of the location of the activity.
5	Legislation and Guidelines Considered	2(e)	A description of the policy and legislative context within which the development is proposed.
6	Scoping and EIA Process	2(a)	Details of Environmental Assessment Practitioner (EAP) who prepared the report and the expertise of the EAP.
7	Assumptions & Limitations	–	–
8	Need & Desirability	2(f)	A motivation for the need and desirability for the proposed development.
9	Project Description	2(c) & 2(d)	A description of the scope of the proposed activity.
10	Alternatives	2(h)(i)	Details of all the alternatives considered.
		2(h)(vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected.
11	Profile of the Receiving Environment	2(h)(iv)	Environmental attributes associated with the alternatives.
		2(h)(vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected.
12	Public Participation	2(h)(ii)	Details of the public participation process.
		2(h)(iii)	A summary of the issues raised by I&APs.
13	Environmental Issues	2(h)(v)	Impacts and risks identified for each alternative.
		2(h)(vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected.
14	Methodology to Assess the Identified Impacts	2(h)(vi)	The methodology used in determining and ranking the potential environmental impacts and risks associated with the alternatives.
15	Plan of Study for EIA	2(i)	A plan of study for undertaking the environmental impact assessment process.
Page i	EAP Affirmation	2(j) and 2(k)	An undertaking under oath or affirmation by the EAP.
N/A		2(l)	Where applicable, any specific information required by the competent authority.

Chapter	Title	Correlation with GN No. R. 982, Appendix 2	Overview
N/A		2(m)	Any other matter required in terms of section 24(4)(a) and (b) of the Act.

Note that the following sections of Appendix 2 of GN No. R. 982 (4 December 2014) will be investigated further and reported on in the Environmental Impact Report (EIR), following the execution of the relevant specialist studies and targeted public participation:

- Section 2(h)(v) - *The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts-*
  (a) can be reversed;
  (b) may cause irreplaceable loss of resources; and
  (c) can be avoided, managed or mitigated.
- Section 2(h)(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.*
- Section 2(h)(viii) - *The possible mitigation measures that could be applied and level of residual risk.*
- Section 2(h)(ix) - *The outcome of the site selection matrix.*
- Section 2(h)(xi) - *A concluding statement indicating the preferred alternatives, including preferred location of the activity.*

3 PROJECT BACKGROUND AND MOTIVATION

3.1 DWS Project Life-cycle

The standard DWS project life-cycle consists of the phases presented in **Figure 1**.

The DWS is investigating the feasibility of developing the proposed Foxwood Dam as a multi-purpose dam on the Koonap River outside of Adelaide in EC. A Technical Feasibility Study was completed by Arup (Pty) Ltd at sufficient detail to refine the scheme configuration and costs and to investigate all aspects of the proposed option(s) in sufficient depth to enable the decision-maker to make an informed and accountable decision. The overall Feasibility Study, which includes the EIA, makes a final recommendation on the preferred option which is submitted with motivation to management for approval and funding.

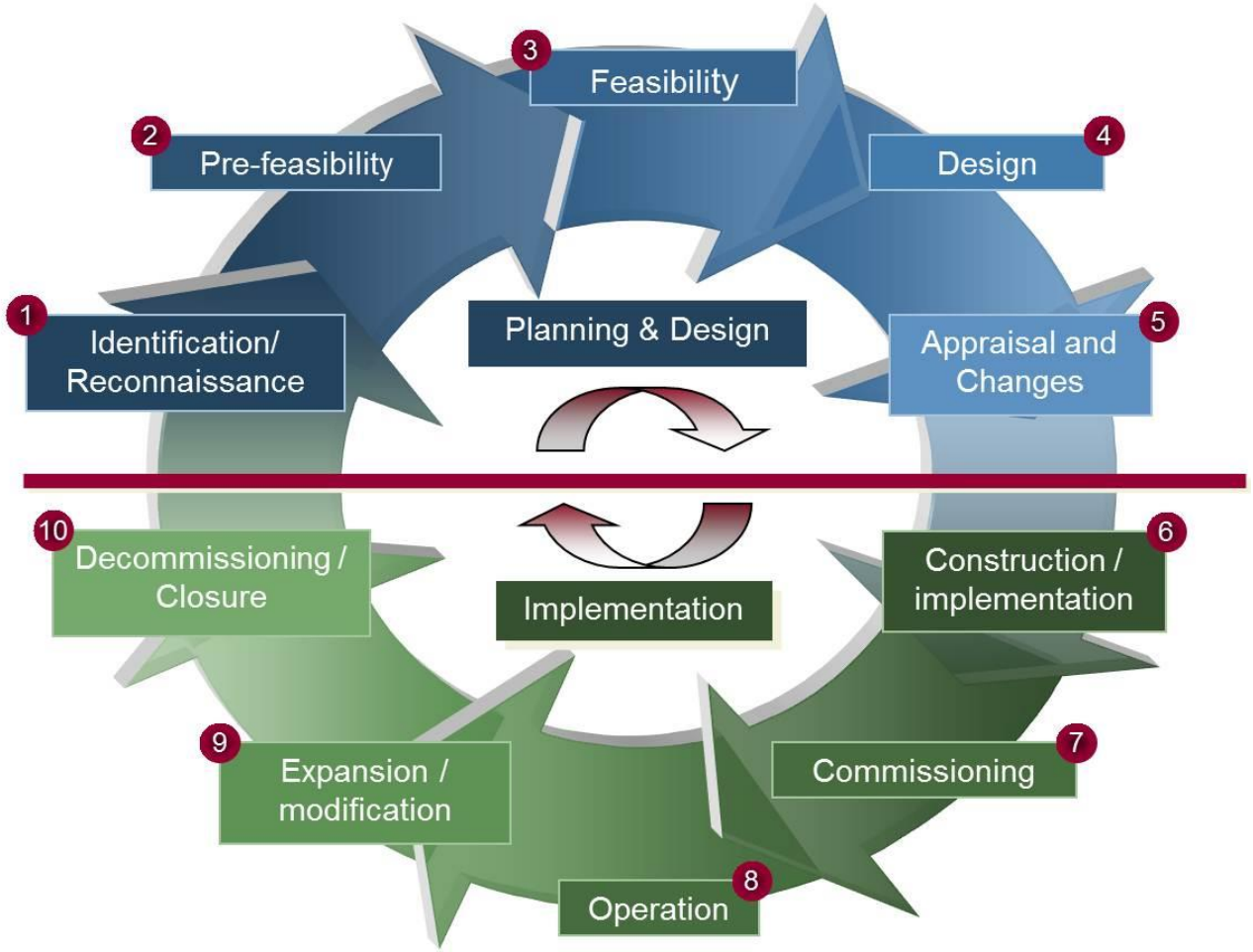

Figure 1: Generic DWS Project Life Cycle for Water Resource Management

3.2 Background and Motivation

Adelaide (and surrounding towns) have suffered water shortages in the past. Investigations into the potential development of the water resource within the Koonap River Valley date back to the 1960's. In the 90's Foxwood Dam was re-considered to augment domestic supplies as well as for some development of commercial irrigation. The scheme was not developed due to farmers not accepting the resultant cost of water.

The Nxuba Local Municipality (LM) raised the issue of water shortages at the 2009 EC Water Indaba. In response, DWS proposed a comprehensive Feasibility Study for Foxwood Dam alongside other options, which included:

- Improvement of water-use efficiency (Water Conservation and Demand Management);
- Enlargement of the off-channel storage scheme;
- Exploration and exploitation of groundwater resources; and
- Enlargement of the Fish River to Adelaide pipeline.

The motivation for the project stems from the strategic initiative to mobilize the water resources in the area as a stimulus for socio-economic development in this rural, economically depressed region. This initiative would support the objectives of the National Development Plan (NDP) and is consistent with the National Water Resource Strategy 2 (NWRS2).

Development of the Foxwood Dam would, in the first instance, provide additional, high assurance water supplies for domestic use; this would significantly improve the resilience of the limited supplies now available from the Koonap River without the benefit of storage, and would make water available to meet any increasing needs for domestic, municipal and industrial use.

The effective development of a major storage dam at the Foxwood site would regulate the variable runoff in the Koonap River to the extent that, after full provision is made for maintaining the Reserve to ensure the health and integrity of the resource itself, a significant quantity of water would be made available for irrigation development at an appropriate level of assurance. It is this resource that would be mobilized, together with

land and human resources in the region, to provide a stimulus for socio-economic development. This vision is assessed in the context of agricultural development, land reform and rural development policies within the framework of the NDP.

3.3 Water Resource Context

The Koonap River is a tributary of the Great Fish River, within the Fish-Tsitsikamma Water Management Area (WMA). The area of the Foxwood Dam catchment is 1 091 km^2 which is 33% of the total catchment area of the Koonap River catchment.

Figure 2: View of Koonap River immediately upstream of proposed dam site

The Foxwood Dam catchment is rural in nature with agriculture representing a major land use. The small towns of Adelaide and Bedford are located within the lower Koonap River catchment. Water related infrastructure is dominated by run of river abstractions or diversions for domestic use and for the irrigation of crops.

Figure 3: Example of agricultural land use downstream of proposed dam site

3.4 Irrigation Development

A strategic intent of the project is to mobilize the water resources in the area for irrigation development downstream of the proposed Foxwood Dam. **Note that the proposed irrigation scheme does not form part of the scope of the EIA and a separate process will be undertaken to further pursue this venture**. However, for the sake of completeness, an overview of the scheme follows.

The intention is to utilize the water resources of the Koonap River, the naturally occurring irrigable soils along the Koonap River downstream of the Foxwood Dam site, and the human resource potential in the Amatole District Municipality (DM) to stimulate socio-economic development. The depressed socio-economy of this district of the EC is urgently in need of stimulus to address the major issues of poverty, work opportunities and equity. The concept of a Government Irrigation Scheme offers a vehicle for realizing the potential socio-economic value of these three main resources in a way that is consistent with the NDP.

The DWS has the mandate to develop the water resource potential and to make water supplies available for use in economic activities for the benefit of the country. This

initiative will require the investment of large amounts of capital and can be contemplated only in the confidence that other government entities are in a position to identify and support individuals who are willing and able to participate as new farmers in a Government Irrigation Scheme. In such a developmental project the need for training, development, financial support and ongoing technical support of new irrigation farmers, for a long period into the future, is critically necessary for success. This implies the long term commitment of an appropriately resourced Implementing Agent.

As part of the Technical Feasibility Study for the project, the locality and extent of irrigable land that can be supplied from releases from the proposed Foxwood Dam were investigated based on aerial survey, soil depth and type data, minimum slope criteria and verified through consultation with current commercial farmers. Historic and current cropping trends were reviewed and verified through consultation with local farming stakeholders through the establishment of an Agricultural Technical Working Group.

The study identified 1 250 ha of irrigable agriculture on suitable soils along the Koonap River, which at present comprises portions of privately owned farms, that can be utilized for the irrigation development associated with the proposed Foxwood Dam. It is estimated that 13 000 ha of land would need to be purchased to allow for the proposed irrigation scheme, of which 1 250 ha is irrigable land. Refer to **Figure 4** for the irrigable soils identified through this study along the Koonap River downstream of the proposed Foxwood Dam site.

Due to the potential high margins that can be achieved with high value tree crops, and given the existing development of high value tree crop planting in the Koonap River valley, when assessing the financial potential for an Government Irrigation Scheme, the Technical Feasibility Study focused on high value tree crops, namely peaches, lemons and macadamias. However, subject to appropriate detailed investigations at the time of implementation of an irrigation scheme other crops or combinations of crops may be considered.

It is envisaged that water would be released down the Koonap River from the Foxwood Dam and be abstracted at appropriate points along the river to serve the various blocks of

new irrigation. No bulk water distribution infrastructure would be required and the objective of always providing the Reserve in the river would be satisfied.

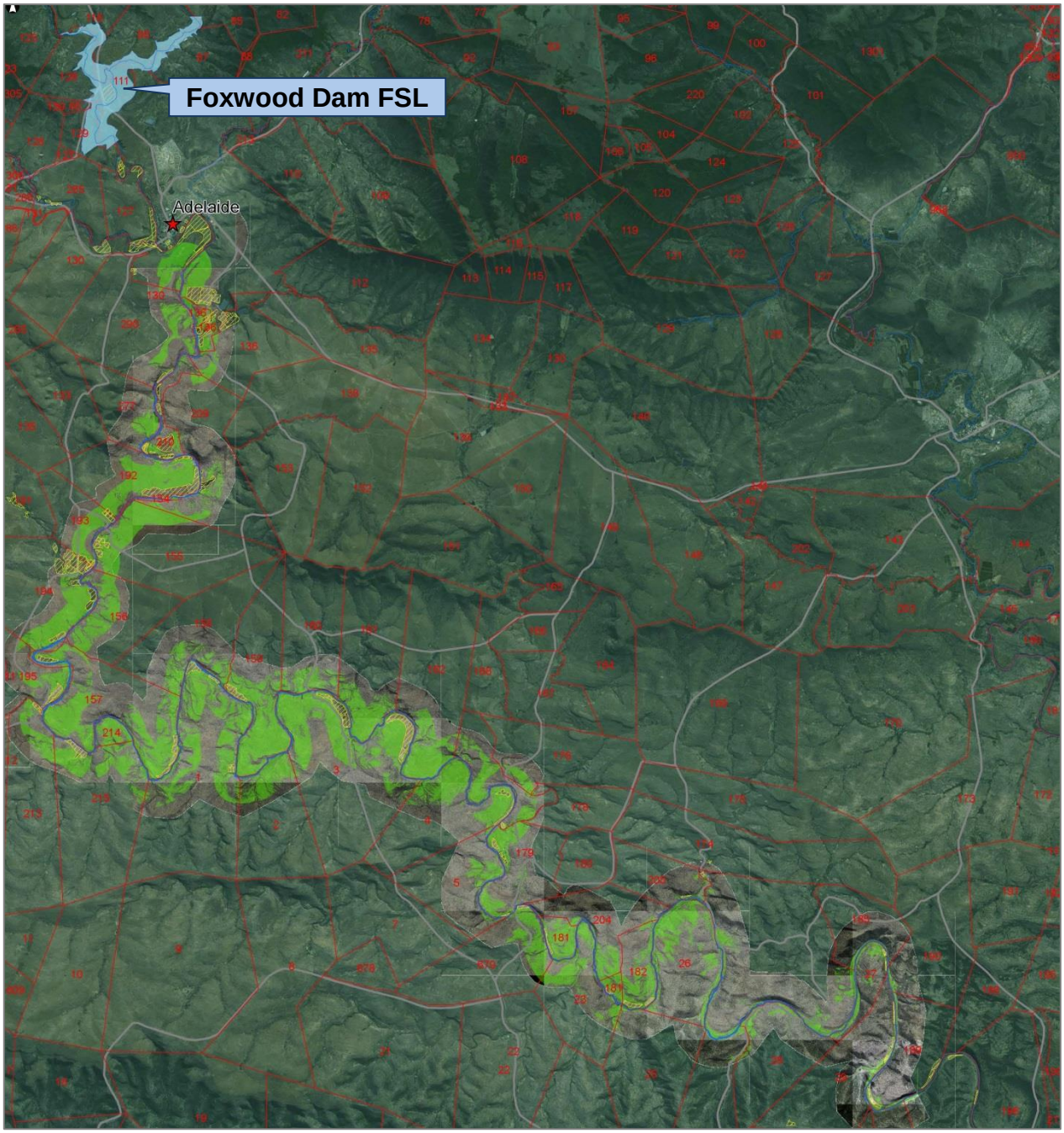

Figure 4: Irrigable soils along the Koonap River downstream of the proposed Foxwood Dam site

The irrigable soils along the Koonap River are located on various properties in private ownership, usually of commercial farmers. In order to initiate and successfully develop the envisaged Government Irrigation Scheme it will be necessary for an Implementing

Agent of the Government to, in a carefully planned and managed way, acquire land from private ownership, plan and develop the Irrigation Scheme on this land with the long term in view, and allocate this land in viable units to candidate new irrigation farmers.

Whereas in the past, many rural development agricultural schemes have focused on small holder and even subsistence farming to maximize the number of beneficiaries, in many cases this productivity of lands has dropped dramatically therefore being in contradiction to the necessary economic development within the NDP and ultimate failure of the schemes limiting the skills and capacity development of the new farmers. It is generally accepted that smallholder farmers in under developed regions such as South Africa will not be able to effectively utilise the natural resource potential unless special support systems and appropriate sustainable technologies are adopted.

4 PROJECT LOCATION

The project area is situated in central part of the EC, in the Amatole DM and Nxuba LM (refer to maps contained in **Figures 5** and **6**, as well as in **Appendix A**). From a southern direction the proposed dam wall site (coordinates 32˚40'30"S, 26˚16'0"E) is accessed via the R344 (off the R63).

The town of Adelaide and the Bezuidenhoutville Township are located to the south-east of the dam. Adelaide lies 37 km west of Fort Beaufort, on the R63 between Bedford and Fort Beaufort, and is situated in the foothills of the Winterberg Mountain range. Adelaide serves as an administrative and decision-making centre in the region. It is predominantly a farming town, in a beef, mutton, wool and citrus farming district.

The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices, except for the land in the south-eastern part of the project footprint which is owned by the municipality. The properties that are directly affected by the proposed development are shown in **Figure 7** and listed in **Table 2**.

Table 2: Directly affected properties

SG Code	Farm Name & No.	Erf / Ptn
C02500000000008700002	Olifants Drift 87	2
C02500000000008700000	Olifants Drift 87	
C02500010000000100000	Adelaide	1
C02500000000011100000	111	
C02500010000056900000	Adelaide	569
C01000000000012900000	Leeuw Hoek 129	
C01000000000008600000	Rooidam 86	
C01000000000012600002	Mancasana Drift (Petronella) 126	2
C01000000000012600000	Mancasana Drift (Petronella) 126	
C01000000000012600001	Mancasana Drift (Petronella) 126	1
C01000000000012600003	Mancasana Drift (Petronella) 126	3
C02500000000008600005	Elands Drift 86	5
C02500000000008600003	Elands Drift 86	3
C02500000000008600007	Elands Drift 86	7
C02500000000008600004	Elands Drift 86	4
C02500000000008600006	Elands Drift 86	6
C02500000000008600001	Elands Drift 86	1
C02500000000008600002	Elands Drift 86	2
C01000000000011600000	Fathers Poort 116	
C01000000000011500000	Doornkloof Mouth 115	

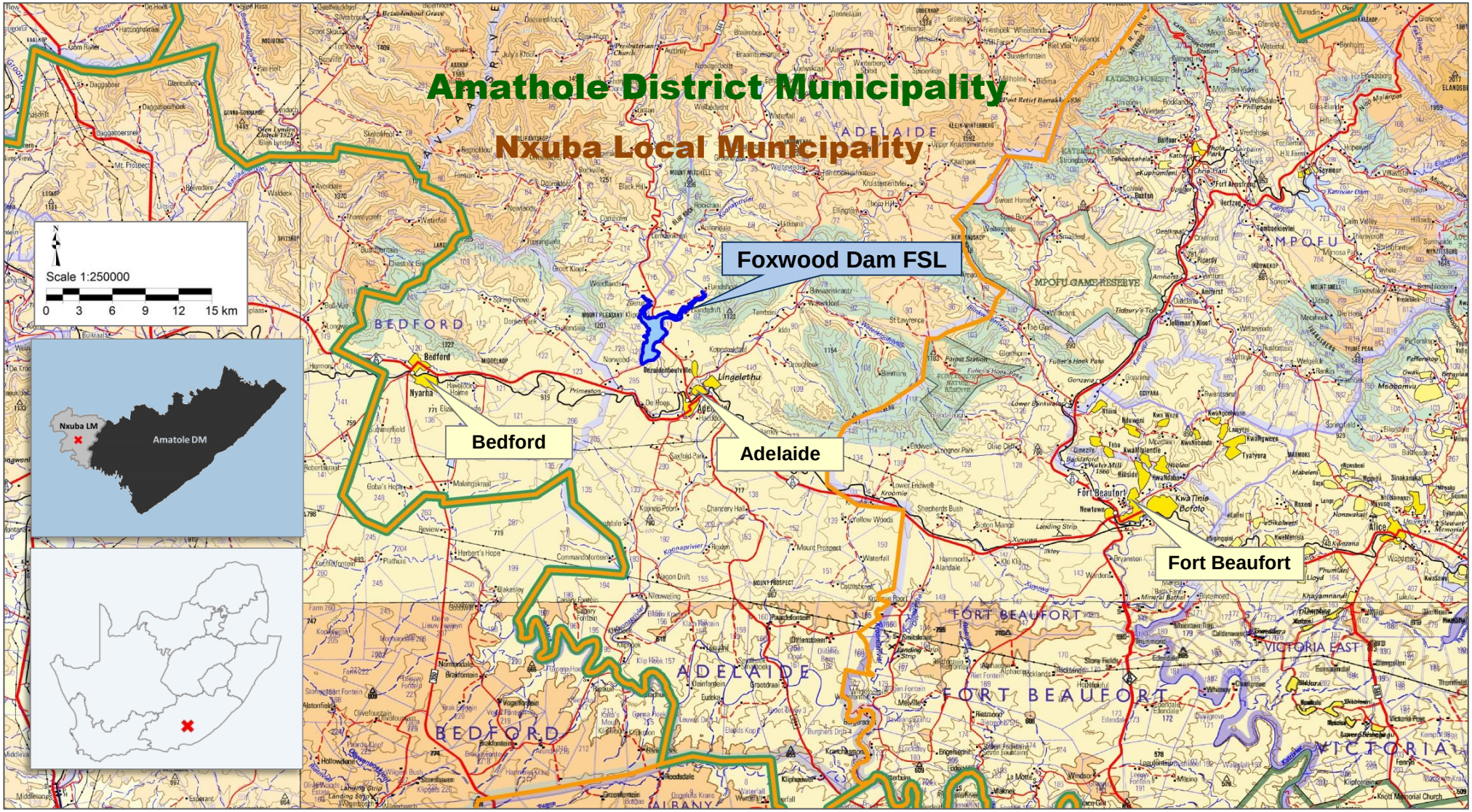

Figure 5: Regional Map (*Note – not all sub-components shown*)

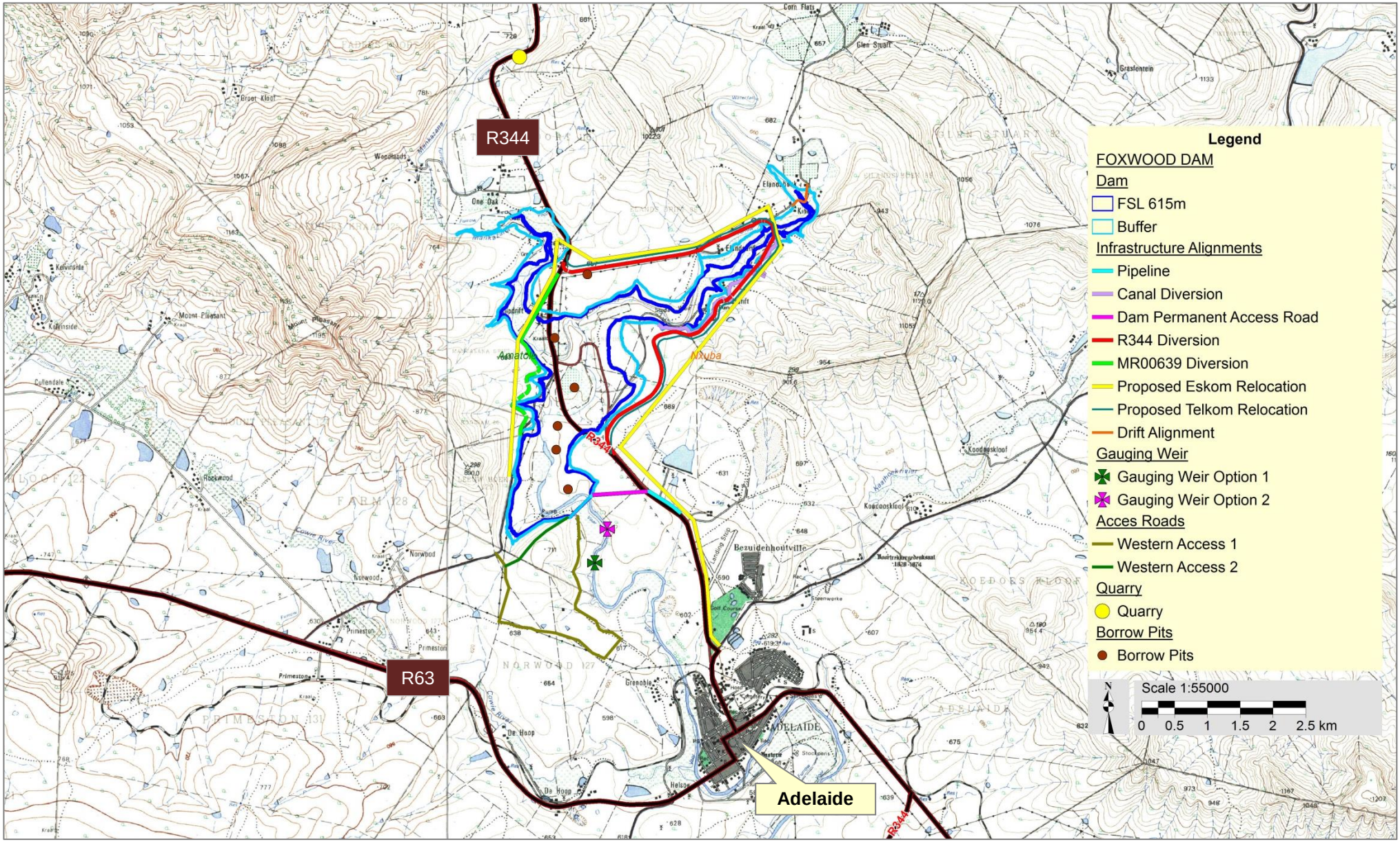

Figure 6: Locality and Topographical Map

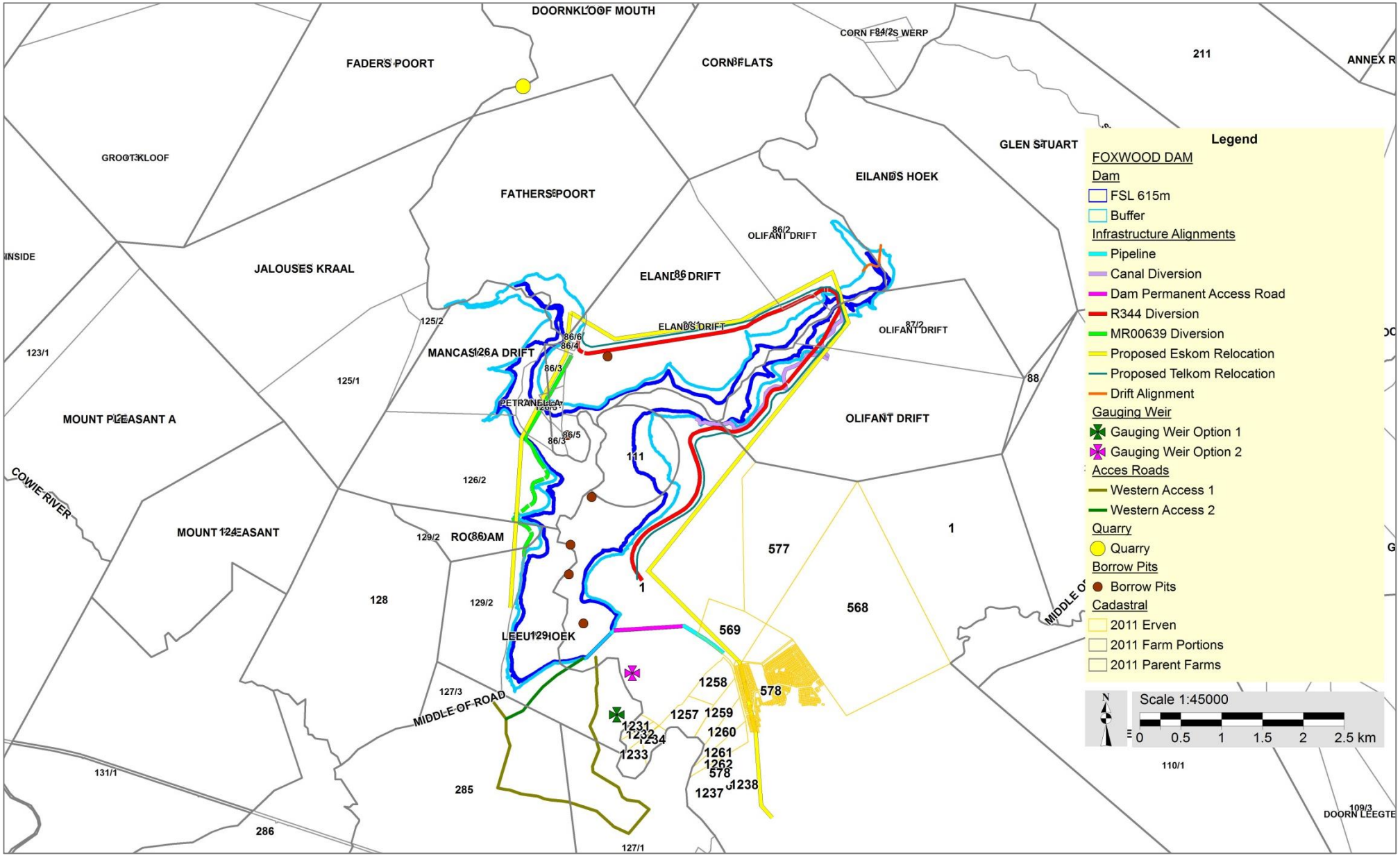

Figure 7: Cadastral Map

5 LEGISLATION AND GUIDELINES CONSIDERED

5.1 Legislation

5.1.1 Environmental Statutory Framework

The legislation that has possible bearing on the proposed project from an environmental perspective is captured in **Table 3** below. **Note:** *this list does not attempt to provide an exhaustive explanation, but rather represents an identification of the most appropriate sections from pertinent pieces of legislation*.

Table 3: Environmental Statutory Framework

Legislation	Description and Relevance	
Constitution of the Republic of South Africa, (No. 108 of 1996)	• Chapter 2 – Bill of Rights. • Section 24 – Environmental Rights.	
National Environmental Management Act (NEMA) (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. • Authorities – Department of Environmental Affairs (DEA) (national) and EC Department Economic Development, Environmental Affairs and Tourism (DEDEAT) (provincial).	
GN No. R 982 of 4 December 2014	• Purpose - regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.	
GN No. R. 983 of 4 December 2014 (Listing Notice 1)	• Purpose - identify activities that would require environmental authorisations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA. • The investigation, assessment and communication of potential impact of activities must follow a Basic Assessment process, as prescribed in regulations 19 and 20 of GN No. R 982 of 4 December 2014. • Activities under Listing Notice 1 that are relevant to this project follow.	
	GN No. R.983 – Activity no. 9: *The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water-* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or* *(b) where such development will occur within an urban area.*	Relocation of existing gravity canal with proposed pipeline - 600 mm and 3,5 km length.
	GN No. R.983 – Activity no. 12: *The development of-* *(i) canals exceeding 100 square metres in size;* *(ii) channels exceeding 100 square metres in size;*	Various infrastructure within watercourse(s) / within 32m from watercourse(s), including: • Dam; • Gauging weir; • Access roads;

Legislation	Description and Relevance	
	(iii) bridges exceeding 100 square metres in size; *(iv) dams, where the dam, including infrastructure and water surface area, exceeds 100 square metres in size;* *(v) weirs, where the weir, including infrastructure and water surface area, exceeds 100 square metres in size;* *(vi) bulk storm water outlet structures exceeding 100 square metres in size;* *(vii) marinas exceeding 100 square metres in size;* *(viii) jetties exceeding 100 square metres in size;* *(ix) slipways exceeding 100 square metres in size;* *(x) buildings exceeding 100 square metres in size;* *(xi) boardwalks exceeding 100 square metres in size; or* *(xii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs-* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -* *excluding-* *(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such development occurs within an urban area; or* *(ee) where such development occurs within existing roads or road reserves.*	• Relocated infrastructure (roads with bridges, power line, telephone line, water supply canal); and • Pump station and pipeline.
	GN No. R.983 – Activity no. 14: *The development of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.*	"Dangerous goods" that are likely to be associated with the greater project, are fuel stores, as well as any dangerous goods to be used during the construction phase.
	GN No. R.983 – Activity no. 19: *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 of more than 5 cubic metres from-* *(i) a watercourse;* *(ii) the seashore; or* *(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater -* *but excluding where such infilling, depositing ,*	Associated with the construction of various infrastructure within watercourse(s), including: • Dam; • Gauging weir; • Access roads; • Relocated infrastructure (roads with bridges, power line, telephone line, water supply canal); and • Pump station and pipeline.

Legislation	Description and Relevance	
	dredging, excavation, removal or moving- *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.*	
	GN No. R.983 – Activity no. 21: *Any activity including the operation of that activity which requires a mining permit in terms of section 27 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).*	Quarry and borrow areas to be created to obtain construction material.
	GN No. R.983 – Activity no. 24: *The development of-* *(i) a road for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding-* *(a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or* *(b) roads where the entire road falls within an urban area.*	• Access roads to the various sites (construction and operational phases). • Relocation of roads, including R344 and MR00639 that will be inundated.
	GN No. R.983 – Activity no. 27: *The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	Clearance of large areas associated with the construction footprint. Status of vegetation to be confirmed as part of the Terrestrial Ecological Impact Assessment.
	GN No. R.983 – Activity no. 28: *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;* *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*	Inundation of a large tract of land, where portions have been / are currently used for agriculture. Inundation at Full Supply Level (FSL) (615 masl) = 463 ha.
	GN No. R.983 – Activity no. 30: *Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).*	Possible occurrence of sensitive biodiversity features at affected areas. To be confirmed as part of the Terrestrial Ecological Impact Assessment.
	GN No. R.983 – Activity no. 31:	Removal of bridge structure(s) and water

Legislation	Description and Relevance	
	The decommissioning of existing facilities, structures or infrastructure for- *(i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;* *(ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;* *(iii) any development and related operation activity or activities and expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;* *(iv) any phased activity or activities for development and related operation activity or expansion or related operation activities listed in this Notice or Listing Notice 3 of 2014;* *or* *(v) any activity regardless the time the activity was commenced with, where such activity:* *(a) is similarly listed to an activity in (i), (ii), (iii), or (iv) above; and* *(b) is still in operation or development is still in progress;* *excluding where-* *(aa) activity 22 of this notice applies; or* *(bb) the decommissioning is covered by part 8 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies.*	supply canal.
	GN No. R.983 – Activity no. 45: *The expansion of infrastructure for the bulk transportation of <u>water</u> or storm water where the existing infrastructure-* *(i) has an internal diameter of 0,36 metres or more; or* *(ii) has a peak throughput of 120 litres per second or more; and* *(a) where the facility or infrastructure is expanded by more than 1000 metres in length; or* *(b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;* *excluding where such expansion-* *(aa) relates to transportation of water or storm water within a road reserve; or* *(bb) will occur within an urban area.*	Relocation of existing gravity canal with proposed pipeline - 600 mm and 3,5 km length.
	GN No. R.983 – Activity no. 48: *The expansion of- .* *(i) <u>canals where the canal is expanded by 100 square metres or more in size</u>;* *(ii) channels where the channel is expanded by 100 square metres or more in size;* *(iii) <u>bridges where the bridge is expanded by 100 square metres or more in size</u>;* *(iv) <u>dams, where the dam, including infrastructure and water surface area, is expanded by 100 square metres or more in size</u>;* *(v) weirs, where the weir, including infrastructure and water surface area, is expanded by 100 square metres or more in*	• Relocation of water supply canal with 600 mm pipe (3.5 km length). • Upgrade of existing bridge(s) along access road(s) (see **Figure 58**).

Legislation	Description and Relevance	
	size; *(vi) bulk storm water outlet structures where the bulk storm water outlet structure is* *expanded by 100 square metres or more in size; or* *(vii) marinas where the marina is expanded by 100 square metres or more in size;* *where such expansion or expansion and related operation occurs-* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding-* *(aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such expansion activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such expansion occurs within an urban area; or* *(ee) where such expansion occurs within existing roads or road reserves.*	
	GN No. R.983 – Activity no. 49: *The expansion of -* *(i) jetties by more than 100 square metres;* *(ii) slipways by more than 100 square metres;* *(iii) buildings by more than 100 square metres;* *(iv) boardwalks by more than 100 square metres; or* *(v) infrastructure or structures where the physical footprint is expanded by 100 square metres or more;* *where such expansion or expansion and related operation occurs-* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding-* *(aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such expansion activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such expansion occurs within an urban area; or* *(ee) where such expansion occurs within existing roads or road reserves.*	• Relocation of water supply canal with 600 mm pipe (3.5 km length). • Upgrade of existing bridge(s) along access road(s) (see **Figure 58**).
	GN No. R.983 – Activity no. 56:	• Access roads to the various sites

Legislation	Description and Relevance	
	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* *excluding where widening or lengthening occur inside urban areas.*	(construction and operational phases). • Relocation of roads, including R344 and MR00639 that will be inundated.
	GN No. R.983 – Activity no. 67: *Phased activities for all activities -* *i. listed in this Notice, which commenced on or after the effective date of this Notice; or* *ii. similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices;* *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;* *excluding the following activities listed in this Notice-* *17(i)(a-d); 17(ii)(a-d); 17(iii)(a-d); 17(iv)(a-d); 17(v)(a-d); 20; 21; 22; 24(i); 29; 30; 31; 32; 34; 54(i)(a-d); 54(ii)(a-d); 54(iii)(a-d); 54(iv)(a-d); 54(v)(a-d); 55; 61; 62; 64; and 65.*	Possible phased activities that may collectively trigger this listed activity.
GN No. R. 984 of 4 December 2014 (Listing Notice 2)	• Purpose - identify activities that would require environmental authorisations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA. • The investigation, assessment and communication of potential impact of activities must follow a Scoping and EIA process, as prescribed in regulations 21 - 24 of GN No. R 982 of 4 December 2014. • Activities under Listing Notice 2 that are relevant to this project follow.	
	GN No. R.984 – Activity no. 4: *The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.*	"Dangerous goods" that are likely to be associated with the greater project, are fuel stores, as well as any dangerous goods to be used during the construction phase.
	GN No. R.984 – Activity no. 15: *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	Clearance of large areas associated with the construction footprint. Status of vegetation to be confirmed as part of the Terrestrial Ecological Impact Assessment.
	GN No. R.984 – Activity no. 16: *The development 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 5 metres or higher or where the highwater mark of the dam covers an area of 10 hectares or more.*	Foxwood Dam on the Koonap River. Inundation at Full Supply Level (FSL) (615 masl) = 463 ha. Maximum height = 48.5 m.
	GN No. R.984 – Activity no. 17: *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks, directly related to the extraction of a mineral*	Quarry and borrow areas to be created to obtain construction material.

Legislation	Description and Relevance	
	resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	
	GN No. R.984 – Activity no. 18: *Any activity including the operation of that activity which requires an exploration right as contemplated in section 79 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks.*	Quarry and borrow areas to be created to obtain construction material.
	GN No. R.984 – Activity no. 19: *The removal and disposal of minerals contemplated in terms of section 20 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks, directly related to prospecting of a mineral resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).*	Quarry and borrow areas to be created to obtain construction material.
	GN No. R.984 – Activity no. 21: *Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening and washing but excluding the smelting, beneficiation, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.*	Quarry and borrow areas to be created to obtain construction material.
	GN No. R.984 – Activity no. 27: *The development of -* *(i) a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998);* *(ii) a road administered by a provincial authority;* *(iii) a road with a reserve wider than 30 metres; or* *(iv) a road catering for more than one lane of traffic in both directions;* *but excluding the development and related operation of a road for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010, in which case activity 24 in Listing Notice 1 of 2014 applies.*	Relocation of Roads R344 and MR00639 that will be inundated.
GN No. R. 985 of 4 December 2014 (Listing Notice 3)	• Purpose - list activities and identify competent authorities under sections 24(2), 24(5) and 24D of NEMA, where environmental authorisation is required prior to commencement of that activity in specific identified geographical areas only. • The investigation, assessment and communication of potential impact of activities must follow a Basic Assessment process, as prescribed in regulations 19 and 20 of GN No. R 982 of 4 December 2014. • Activities under Listing Notice 3 that are relevant to this project follow.	
	GN No. R.985 – Activity no. 4(b)(ii): *The development of a road wider than 4 metres with a reserve less than 13,5 metres.*	• Access roads to the various sites (construction and operational phases). • Relocation of roads, including R344 and MR00639 that will be inundated.

Legislation	Description and Relevance	
		Activity to be confirmed following Terrestrial Ecological Impact Assessment.
	GN No. R.985 – Activity no. 10(b)(ii): *The development of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.*	"Dangerous goods" that are likely to be associated with the greater project, are fuel stores, as well as any dangerous goods to be used during the construction phase. Activity to be confirmed following Terrestrial Ecological Impact Assessment.
	GN No. R.985 – Activity no. 12(a): *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.*	Clearance of large areas associated with the construction footprint. Activity to be confirmed following Terrestrial Ecological Impact Assessment.
	GN No. R.985 – Activity no. 14(c)(ii): *The development of-* *(i) canals exceeding 10 square metres in size ;* *(ii) channels exceeding 10 square metres in size;* *(iii) bridges exceeding 10 square metres in size;* *(iv) dams, where the dam, including infrastructure and water surface area exceeds 10 square metres in size;* *(v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square metres in size;* *(vi) bulk storm water outlet structures exceeding 10 square metres in size;* *(vii) marinas exceeding 10 square metres in size;* *(viii) jetties exceeding 10 square metres in size;* *(ix) slipways exceeding 10 square metres in size;* *(x) buildings exceeding 10 square metres in size;* *(xi) boardwalks exceeding 10 square metres in size; or* *(xii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs -* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.*	Various infrastructure within watercourse(s) / within 32m from watercourse(s), including: • Dam; • Gauging weir; • Access roads; • Relocated infrastructure (roads with bridges, power line, telephone line, water supply canal); and • Pump station and pipeline. Activity to be confirmed following Terrestrial Ecological Impact Assessment.
	GN No. R.985 – Activity no. 18(b)(ii): *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.*	• Access roads to the various sites (construction and operational phases). • Relocation of roads, including R344 and MR00639 that will be inundated. Activity to be confirmed following Terrestrial Ecological Impact Assessment.
	GN No. R.985 – Activity no. 23(b)(ii): *The expansion of-* *(i) canals where the canal is expanded by 10 square metres or more in size;* *(ii) channels where the channel is expanded by*	• Relocation of water supply canal. • Upgrade of existing bridge(s) along access road(s) (see **Figure 58**).

Legislation	Description and Relevance	
	10 square metres or more in size; *(iii) bridges where the bridge is expanded by 10 square metres or more in size;* *(iv) dams where the dam is expanded by 10 square metres or more in size;* *(v) weirs where the weir is expanded by 10 square metres or more in size;* *(vi) bulk storm water outlet structures where the structure is expanded by 10 square metres or more in size;* *(vii) marinas where the marina is expanded by 10 square metres or more in size;* *(viii) jetties where the jetty is expanded by 10 square metres or more in size;* *(ix) slipways where the slipway is expanded 10 square metres or more in size;* *(x) buildings where the building is expanded by 10 square metres or more in size;* *(xi) boardwalks where the boardwalk is expanded by more than 10 square metres or more in size; or* *(xii infrastructure or structures where the physical footprint is expanded by 10 square metres or more;* *where such development occurs-* *(a) within a watercourse;* *(b) in front of a development setback adopted in the prescribed manner; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.*	Activity to be confirmed following Terrestrial Ecological Impact Assessment.
	GN No. R.985 – Activity no. 26: *Phased activities for all activities –* *i. listed in this Notice and as it applies to a specific geographical area, which commenced on or after the effective date of this Notice; or* *ii. similarly listed in in any of the previous NEMA notices, and as it applies to a specific geographical area, which commenced on or after the effective date of such previous NEMA Notices 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; -* *excluding the following activities listed in this Notice - 7; 8; 11; 13; 17; 20; 21; 24.*	Possible phased activities that may collectively trigger this listed activity. Activity to be confirmed following Terrestrial Ecological Impact Assessment.
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. • Chapter 12 – Safety of Dams. • Authority – DWS.	
National Environmental Management Air Quality Act (Act No. 39 of 2004)	• Air quality management • Section 32 – Dust control. • Section 34 – Noise control. • Authority – DEA.	

Legislation	Description and Relevance
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	• Management and conservation of the country's biodiversity. • Protection of species and ecosystems. • Authority – DEA.
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.
National Environmental Management: Waste Act (Act No. 59 of 2008)	• Chapter 5 – licensing requirements for listed waste activities - GN No. R. 921 of 29 November 2013. • Authority – Minister (DEA) or MEC (provincial authority)
National Forests Act (No. 84 of 1998)	• Section 15 – Authorisation required for impacts to protected trees. • Authority – Department of Agriculture, Forestry and Fisheries (DAFF)
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	• Permit required for borrow pits and quarries. • Authority – Department of Mineral Resources (DMR).
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, etc. • Authority – EC Provincial 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 Agriculture.
Integrated Coastal Management Act (Act No. 24 of 2008)	• Management of Estuary. • Authority – DEA.
National Road Traffic Act (Act No. 93 of 1996)	• Authority – EC Department of Roads and Public Works.
Tourism Act of 1993	• Authority – South African Tourism Board.

The relationship between the project and certain key pieces of environmental legislation is discussed in the subsections to follow.

5.1.2 National Environmental Management Act

According to Section 2(3) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), "*development must be socially, environmentally and economically sustainable*", which means the integration of these three factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.

The proposed Foxwood Dam requires authorisation in terms of NEMA and the EIA will be undertaken in accordance the EIA Regulations (2014) that consist of the following:

- EIA procedure – GN No. R 982 (4 December 2014);
- Listing Notice 1 - GN No. R 983 (4 December 2014);
- Listing Notice 2 - GN No. R 984 (4 December 2014); and
- Listing Notice 3 - GN No. R 985 (4 December 2014).

The project triggers 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 3**. Note that the dimensions of the project infrastructure and components should be regarded as approximates due to the dynamic nature of the planning and design process. As a conservative approach, all possible activities that could possibly be triggered by the project were included in the Application Form that will be submitted to the Department of Environmental Affairs (DEA) with the Scoping Report, and a refinement of these activities will take place as the EIA process unfolds.

5.1.3 National Environmental Management: Waste Act

Amongst others, the purpose of the National Environmental Management: Waste Act (NEM:WA) (Act No. 59 of 2008) includes the following:

1. To reform the law regulating waste management in the country by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development;
2. To provide for institutional arrangements and planning matters;
3. To provide for specific waste management measures;
4. To provide for the licensing and control of waste management activities;
5. To provide for the remediation of contaminated land; and
6. To provide for compliance and enforcement.

No authorisation will be required in terms of the National Environmental Management: Waste Act (NEM:WA) (Act No. 59 of 2008), as the project will not include any listed waste management activities in terms of GN No. R. 921 of 29 November 2013. The following should be noted with regards to waste management during the construction phase:

- Excess material would be spoilt within the dam basin;
- Temporary waste storage facilities will remain below the thresholds contained in the listed activities under Schedule 1 of NEM:WA; and

- The Environmental Management Programme (EMPr) will make suitable provisions for waste management, including the storage, handling and disposal of waste;
- The storage of general or hazardous waste in a waste storage facility will comply with the norms and standards in GN No. R. 926 of 29 November 2013.

5.1.4 Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)

Borrow areas and quarries have been identified to source construction material for the project. Under Section 106(1) of the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002), DWS 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*".

The new EIA Regulations of 2014 include a number of provisions to provide for the transition of the environmental regulation of mining from the MPRDA to NEMA and the introduction of the One Environmental System. Amongst others, this is facilitated by the inclusion of mining activities under the 2014 Listing Notices. Approval will be sought for the relevant activities associated with the borrow areas and quarries (refer to activities identified in **Table 3**).

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

The project entails the following activities that constitute water uses in terms of Section 21 of the National Water Act (NWA) (Act No. 36 of 1998):

- Taking water from a water resource (water abstraction from Foxwood Dam to supply the town of Adelaide);
- Storing water (Foxwood Dam);
- Impeding or diverting the flow of water in a watercourse (instream works for Foxwood Dam, gauging weir, road realignment, access roads, etc.); and
- Altering the bed, banks, course or characteristics of a watercourse (instream works for Foxwood Dam, gauging weir, road realignment, access roads, etc.).

An Integrated Water Use Licence Application will be compiled and submitted to the DWS EC Regional Office.

The following requirements of the NWA will be catered for (amongst others):

- Releases from Foxwood Dam will make provision for the Reserve requirements;
- Existing water use entitlements will not be affected;
- In terms of Chapter 12 of the NWA, DWS will satisfy the requirements of the departmental Dam Safety Office and will ensure compliance with the requirements of the Dam Safety Regulations (GN No. R. 139 of 24 February 2012). Only dams with a safety risk (i.e. dams with a maximum wall height that exceeds 5,0 m and with a storage capacity of more than 50 000 m^3, or any other dam declared as a dam with a safety risk) are subject to these Regulations. Foxwood Dam will be a Category III dam, with an associated 48,5 m wall height, full capacity of 54,9 million m^3 and high hazard rating. The contributing catchment at the dam wall is 1 091 km^2

5.2 Guidelines

The following guidelines were considered during the preparation of the Scoping Report:

- 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).

5.3 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);
- Relevant provincial, district and local policies, strategies, plans and programmes; and
- Eastern Cape Biodiversity Conservation Plan (ECBCP).

5.4 Protocols

The following strategic priorities and corresponding policy principles as part of the World Commission on Dams, published in November 2000, need to be adhered to:

- Gaining public acceptance;
- Comprehensive options assessment;
- Addressing existing dams;
- Sustaining rivers and livelihoods;
- Recognising entitlements and sharing benefits;
- Ensuring compliance, and
- Sharing rivers for peace, development and security.

The guide to best practice in the operation, maintenance and safety of dams, developed by the Development Bank of Southern Africa (DBSA), will also be adhered to by DWS.

6 SCOPING AND EIA PROCESS

6.1 Environmental Assessment Practitioner

Nemai Consulting was appointed by DWS as the independent EAP to undertake the environmental assessment for the proposed development of Foxwood Dam.

In accordance with Appendix 2 Section 2(a) of GN No. R. 982 (4 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 (KZN) and Rustenburg (North West Province).

The core members of Nemai Consulting that are involved with the Scoping and EIA process for the project are captured in **Table 4** below, and their respective Curricula Vitae are contained in to **Appendix C**.

Table 4: Scoping and EIA Core Team Members

Name	Qualifications	Experience	Duties
Ms D. Naidoo	B.Sc Eng (Chem)	19 years	• Project Manager • Quality Control • EIA Process
Mr D. Henning	• B.Sc (Hons) Aquatic Health • M.Sc River Ecology	14 years	• EIA Process • Scoping & EIA Reports
Mr C. Chidley	• B.Sc Eng (Civil); • BA (Economics, Philosophy) • MBA	20 years	• Quality Review • Technical Input • EMPr

6.2 DEA Pre-application Consultation Meeting

A Pre-application Consultation Meeting was convened with DEA on 18 March 2015 (refer to **Appendix D** for a copy of the minutes of the meeting). The purpose of the meeting included the following:

- To introduce the project to DEA;
- To seek clarification regarding certain matters that pertain to the EIA process;
- To determine DEA's requirements; and
- To confirm the process and timeframes.

Key outcomes of the Pre-application Consultation Meeting include the following:

- DEA expressed concern regarding the uncertainties pertaining to the irrigation development, and the reliance of the overall project on this component.
- DEA suggested that the Application Form and draft Scoping Report, which has been subjected to a 30-day review period, be submitted to DEA at the same time to avoid potential problems associated with the strict timeframes.
- It was agreed that the Scoping Report will include a discussion on the screened alternatives and that the feasible alternatives will include the dam type and size, which will be comparatively assessed.
- DEA advised that the Biodiversity Assessment for the project first needed to be concluded to understand what will be lost and mitigation measures first need to be considered before a Biodiversity Offset Study is triggered.

6.3 Environmental Assessment Triggers

An Application for Environmental Authorisation in terms of NEMA will be made for the proposed development of Foxwood Dam and its associated components. Based on the outcomes of the pre-application consultation meeting with DEA, the Application Form and draft Scoping Report will be submitted to the Department at the same time (see **Section 6.2**).

The process for seeking authorisation under NEMA is undertaken in accordance with GN No. R. 982 of 4 December 2014, promulgated in terms of Chapter 5 of NEMA. From the

date of effect of these amended EIA Regulations they replaced the previous EIA Regulations that had been promulgated on 18 June 2010.

Based on the types of activities involved the requisite environmental assessment for the project is a Scoping and EIA process. Refer to **Section 5** for the project's legal framework and specifically the activities triggered by the project in terms of Listing Notices 1, 2 and 3 of the EIA Regulations (2014).

6.4 Environmental Assessment Authorities

In terms of NEMA the lead decision-making authority for the environmental assessment is DEA, as the project proponent (DWS) is a national department. However, due to the geographic location of the project the EC DEDEAT is regarded as one of the key commenting authorities in terms of NEMA during the execution of the EIA, and all documentation will thus be copied to this Department (amongst others).

6.5 Scoping Process

6.5.1 Formal Process

The purpose of Scoping, which constitutes the first phase of the formal EIA process, is as follows:

- Identify and engage with Interested and Affected Parties (I&APs) and allow for adequate participation in the process;
- Duly consider alternatives for achieving the project's objectives;
- Identify significant issues to be investigated further during the execution of the EIA phase;
- Clarify the roles and responsibilities of various stakeholders in the process;
- Determine the scope of the ensuing EIA phase, in terms of specialist studies, public participation, assessment of impacts and appraisal of alternatives; and
- Allow for informed decision-making with regard to the EIA process.

The Scoping Report serves to build on the environmental investigations that were undertaken as part of the Environmental Screening (DWA, 2013) exercise under the Technical Feasibility Study for the Foxwood Dam. The findings of this study were incorporated into the Scoping Report, where relevant.

An outline of the Scoping and EIA process for the proposed development of Foxwood Dam is provided in **Figure 8**.

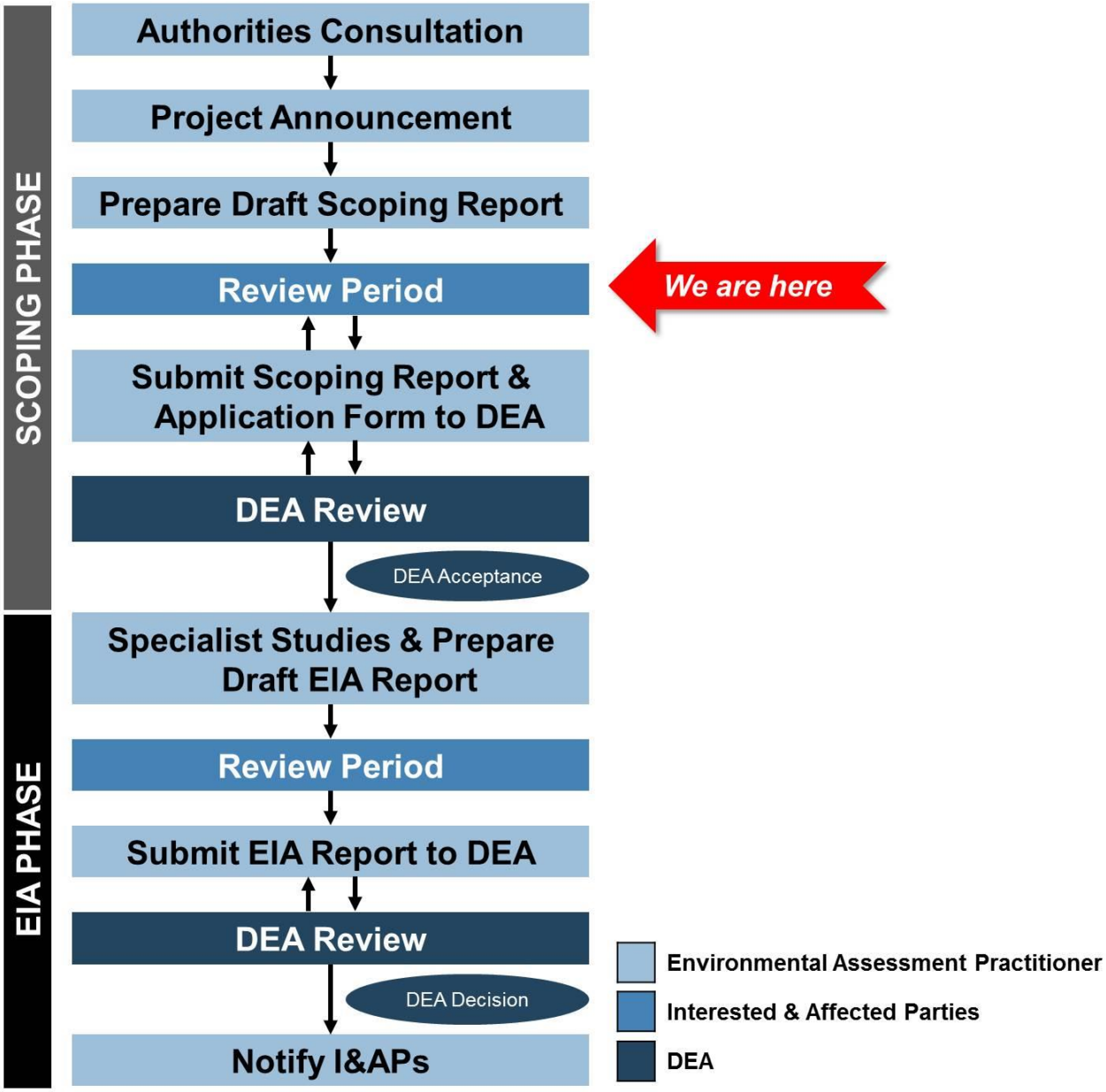

Figure 8: EIA process

6.5.2 Landowner Consent

According to regulation 39(1) of GN No. 982 (2014), if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land. This requirement does not apply *inter alia* for linear developments (e.g. pipelines, power lines, roads) or if it is a Strategic Integrated Project (SIP) as contemplated in the Infrastructure Development Act, 2014. The development of Foxwood Dam qualifies as a SIP and landowner consent is thus not required.

6.5.3 Landowner Notification

Table 2 lists the various farms affected by the project (refer to cadastral map contained in **Figure 7**). The details of the affected landowners are included in the I&AP database contained in **Appendix G**.

Proof of written notification to the landowners / persons in control of the land is included in **Appendix J**.

6.5.4 Application Form

A copy of the Application Form, which will be submitted to DEA with the Scoping Report, is provided in **Appendix B**.

The Application Forms makes provision for all the activities associated with the project and the following associated works:

1. All the construction sites;
2. Construction camp;
3. Storage facilities;
4. Storage of hazardous materials;
5. Plants, e.g. concrete mixing, crushers, etc.;
6. Relocation of infrastructure, e.g. roads, power line, telephone line, canal, etc.;
7. Access roads and haul roads for construction purposes;
8. Earthfill borrow areas and quarries for sourcing construction material;

9. Power supply for construction purposes; and
10. River flow gauging

It is assumed that the electrical infrastructure required to provide power to the relevant project components will not exceed the thresholds stipulated in the Listing Notices of the EIA Regulations (2014), nor trigger any other related activities. However, this will need to be confirmed during the design phase of the project. If necessary, separate approval will need to be sought by DWS or Eskom for activities associated with new electrical infrastructure required for the project. The current application only makes provision for relocating the power line affected by the proposed dam basin.

The activities triggered in terms of Listing Notices 1, 2 and 3 were confirmed based on the following:

- Project description;
- Information contained in the Technical Feasibility Study reports, including the Environmental Screening Report (DWA, 2013);
- Input received from DWS and the technical team responsible for conducting the Technical Feasibility Study; and
- Feedback received from DEA and the other environmental authorities.

6.5.5 Screening of Alternatives

Various options to meeting the project's objectives were considered during the Technical Feasibility Study, which eventually lead to the identification of alternatives to be investigated as part of the EIA. The "no go" option will also be evaluated to understand the implications of the project not proceeding.

The feasible options are taken forward in the impact prediction, where the potential positive and adverse effects to the environmental features and attributes are examined further. The EIA phase will include a detailed comparative analysis of the project's feasible alternatives that emanate from the Scoping exercise, which will include environmental (with specialist input) and technical evaluations. This will ultimately result in the selection of a Best Practicable Environmental Option (BPEO).

See **Section 10** for further discussions on alternatives.

6.5.6 Impact Prediction

The potential environmental impacts associated with the proposed project were identified during the Scoping phase 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;
- 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 authorities and I&APs; and
- Legal and policy context.

The Scoping exercise aimed to identify and qualitatively predict significant environmental issues for further consideration and prioritisation during the EIA stage (see **Section 13**). Note that “significance” relates 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 the EIA stage a detailed quantitative impact assessment will be conducted via contributions from the project team and requisite specialist studies, and through the application of the impact assessment methodology contained in **Section 14**. Suitable mitigation measures will be identified to manage (i.e. prevent, reduce, rehabilitate and/or compensate) the environmental impacts, and will be included in the EMPr.

7 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations accompany the Scoping exercise:

- In accordance with the purpose of Scoping, the report does not include detailed specialist investigations on the receiving environment, which will only form part of the EIA phase. The environment in the project area was primarily assessed in the Scoping phase through site visits and appraisals, desktop screening, incorporating existing information from previous studies, and input received from authorities and I&APs. A refinement of all maps will also be undertaken in the EIA phase, if necessary.
- As the design of the project components is still in feasibility stage, and due to the dynamic nature of the planning environment, the dimensions and layout of the infrastructure may change during the detailed design phase.
- The need for the project is rooted in the potential to develop a Government Irrigation Scheme within the Koonap River valley downstream of the proposed Foxwood Dam, which needs to be taken forward by an appropriate Implementing Agent such as the EC Rural Development Agency (ECRDA). Although this scheme is excluded from the EIA, the Technical Feasibility Study (including associated engagements that took place with the relevant government departments and stakeholders) provided the necessary footing for this venture to be pursued further.
- During Scoping the presence of mineral resources in the dam basin could not be confirmed. This will receive attention during the EIA phase.

8 NEED AND DESIRABILITY

This section serves to expand on the motivation / need and desirability for the proposed development that is provided in **Section 3.2**. The format contained in the Guideline on Need and Desirability (DEA&DP, 2010b) has been used in **Table 5**.

Table 5: Need and Desirability of the Project

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).	It is noted in the Nxuba LM IDP Review 2014/2015 that the construction of Foxwood Dam will probably provide opportunities for tourism and water resources needed by investors. In addition, is also indicates that Foxwood Dam will provide opportunities for agriculture, which is the main economic activity in the municipal area. In the State of the District Address (29 April 2011), water resources development in Nxuba is noted which includes developing the Foxwood Dam as a multipurpose water resource, feeding the farming community with water for irrigation while also serving as an important backup system for drinking water purposes. There are no indications that the timing of the proposed development of Foxwood Dam is in conflict with the projects and programmes listed in either the Amathole DM or Nxuba LM's IDPs.
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?	The strategic need for the project is explained in **Section 3.2**. The project is being considered for implementation as a strategic initiative to mobilize the water resources in the area as a stimulus for socio-economic development in this rural, economically depressed region.
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 proposed Government Irrigation Scheme has been conceived so as to address key directives and developmental objectives in the National Development Plan (NDP) and also to internalise the following two key elements of the National Water Resource Strategy (NWRS2): ❖ Development of Human Capacity and Skills; and ❖ Agricultural Development and Land Reform.
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?	Based on the nature of the development, the necessary services are available to implement the project. The services required for the development are explained in **Section 9.10**.

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)?	Provision is made for the development. Refer to response provided above to item no. 1.
6.	Is this project part of a national programme to address an issue of national concern or importance?	Yes. Refer to response provided above to item no. 3.
DESIRABILITY ('placing')		
7.	Is the development the best practicable environmental option (BPEO) for this land/site?	A number of factors were considered in selecting the site for the Foxwood Dam, such as streamflow hydrology, geological conditions, topography, availability of construction material, seismic hazard, sediment yields, etc. The BPEO will only be determined following a comparative analysis of the feasible alternatives during the EIA phase.
8.	Would the approval of this application compromise the integrity of the existing approved municipal IDP and SDF as agreed to by the relevant authorities?	It is not anticipated that the proposed project will contradict or be in conflict with the municipal IDPs and SDFs (refer to response provided above to item no. 1).
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?	The compatibility of the project with the Eastern Cape Biodiversity Conservation Plan (ECBCP) (2007) and other environmental management and planning tools will be considered in detail during the EIA phase, following the undertaking of the relevant specialist studies. The ECBCP identifies Critical Biodiversity Areas (CBAs) that are critical for conserving biodiversity and maintaining ecosystem functioning in the province, and provides land use guidelines. It further serves as a key input to future bioregional plans in the Province. The ECBCP developed two maps, one showing terrestrial (land-based) CBAs and the other showing aquatic (freshwater) CBAs. In terms of the Terrestrial CBA, the western part of the impoundment falls within Other Natural Areas and the northern and eastern sections are mostly located within a CBA 2. Refer to discussion in **Section 11.8.1.2**. For the Aquatic CBA the reach of the Koonap River up to the confluence of the Mankazana River falls within a CBA 2. The remaining part of the impoundment and project components are not situated within an Aquatic CBA. Refer to discussion in **Section 11.7.3.2**. The impact of this project on the characteristics of the Koonap River will also be investigated from a multi-disciplinary perspective as part of the EIA phase.

No.	Question	Response
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, as part of the technical analysis a number of locational factors were considered in selecting the sites for the proposed Foxwood Dam and associated infrastructure, such as streamflow hydrology, geological conditions, topography, availability of construction material, seismic hazard, sediment yields, etc. The specialist studies, as part of the EIA phase, will further investigate the location based on sensitive environmental features and receptors.
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)?	See compilation of significant environmental issues associated with the proposed project contained in **Section 13**.
12.	How will the development impact on people's health and wellbeing (e.g. in terms of noise, odours, visual character and sense of place, etc.)?	
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 forgone for the development alternative, will be considered in the Socio-economic Study during EIA phase. The affected land is rural in nature and primarily used for agricultural purposes.
14	Will the proposed land use result in unacceptable cumulative impacts?	Cumulative impacts, as considered in **Section 13.4** will be evaluated in the EIA phase.

9 PROJECT DESCRIPTION

9.1 General

The information presented in this section was primarily sourced from the Technical Feasibility Study reports produced by Arup (Pty) Ltd, and in particular the following deliverables under this study:

- Koonap River Hydrology;
- Water Requirements;
- Bulk Water Supply Infrastructure; and
- Project Feasibility Costing.

Note: The sizing and location of the project-related infrastructure takes place within a dynamic planning environment, with various role-players, affected landowners, authorities and other stakeholders. Subsequent project modifications that emanate from discussions with the I&APs, findings from specialist studies and technical considerations will be conveyed during the public participation of the EIA phase and will be incorporated into the draft EIA report, which will be lodged in the public domain.

9.2 Summary of Water Resources

The Ecological Water Requirements (EWR) (also referred to as the Ecological Reserve) operating rule recommended for the Foxwood Dam system is that high flow EWRs should be met by spills from Foxwood Dam and that the low flow EWRs can be met by inflows from the incremental catchments downstream of Foxwood Dam. This operating rule impacts the storage size of Foxwood Dam as it is important that regular spills can occur.

Box 1:	What is the "Reserve"?
The **Reserve** is central to water resource management and enjoys priority of use according to the National Water Act (No. 36 of 1998). The Reserve relates to the quantity and quality of water required to satisfy the following two elements: • The **Basic Human Needs Reserve**, which provides for essential needs of individuals; and • The **Ecological Reserve**, which relates to the water required to protect the functional integrity of aquatic ecosystems.	

The table below indicates the yields that are available (for various degrees of assurance) where high EWR flows are supplied by natural spills from the dam and not by releases

from the dam. This criterion (i.e. high flow EWRs supplied by spillages) is satisfied only for dam capacities ≤ 1 Mean Annual Runoff (MAR). In these circumstances the critical period is relatively short and natural spills from the dam would satisfy the high flow EWRs. The maximum yield available when this criterion is satisfied is 19,1 million m^3/annum at 95% assurance and for a 1MAR dam.

Table 6: Scenario 3 – Foxwood Dam system with low flow EWR supplied by releases, high flows from spills

Reservoir capacity as a ratio of nMAR	Live storage	Dead Storage	Full Supply Capacities (FSC)	Long term yield (10^6m^3/a) at Recurrence Interval		
	(10^6m^3)	(10^6m^3)	(10^6m^3)	1:20	1:50	1:100
0,5 nMAR	23,81	6,11	29,92	12,8	11,0	9,5
0,75 nMAR	35,71	6,11	41,82	17,2	13,8	12,4
1,0 nMAR	47,61	6,11	53,72	19,1	16,4	14,6
1,5 nMAR	71,42	6,11	77,52	22,9	20,3	18,0
2,00 nMAR	95,22	6,11	101,33	26,2	22,8	20,6

For dam capacities ≥ 1,5 MAR the critical period becomes much longer, up to approximately 16 years, and the high flow EWR's would have to be supplied from the dam by releases down river, i.e. Scenario 2. The abridged Scenario 2 table below indicates the yield available from the dam for various dam sizes and this operating rule to satisfy the EWR's.

Table 7: Scenario 2 – Foxwood Dam system with total EWR (incl. high flows) supplied by releases from storage

Reservoir capacity as a ratio of nMAR	Live storage	Dead Storage	FSC	Long term yield (10^6m^3/a) at Recurrence Interval		
	(10^6m^3)	(10^6m^3)	(10^6m^3)	1:20	1:50	1:100
0,5 nMAR	23,81	6,11	29,92	9,7	7,	6,7
0,75 nMAR	35,71	6,11	41,82	13,7	11,1	9,3
1,0 nMAR	47,61	6,11	53,72	15,9	13,3	11,3
1,5 nMAR	71,42	6,11	77,52	19,8	16,9	14,9
2,00 nMAR	95,22	6,11	101,33	22,8	19,5	17,2

These analyses indicate that the consequence of creating storage larger than approximately 1 MAR is to sacrifice net yield to the need to satisfy EWR's because water must be released from storage for this purpose. Comparison of the tables for Scenario 3 and Scenario 2 indicates that the larger dam (1,5 MAR) yields about the same as the smaller dam (1 MAR), i.e. just more than 19 million m^3/annum. A level of assurance of

1:20 years has been used to determine the yield from the dam during the Feasibility Study due to the primary water requirement being for irrigated agriculture.

9.3 Water Requirements

The domestic water requirements of the three towns that could potentially benefit from a water supply from the Foxwood Dam are Adelaide, Bedford and Fort Beaufort. The existing water sources available to these towns are reported to be sufficient to meet projected water needs to the year 2035 provided the water services infrastructure is well maintained and is operated effectively. The creation of additional sources can significantly improve the security of supply to Adelaide which is reliant predominantly on run-of-river diversions from the Koonap River with no significant storage.

It is envisaged that development of the water resources of the Koonap River will stimulate the implementation of new irrigation opportunities for emerging farmers. Irrigable land has been shown to exist along the Koonap River and the use of this resource can make a significant contribution to the objectives of the NDP, namely to create sustainable work opportunities, eradicate poverty and reduce inequalities. An agricultural development model that builds a partnership between existing commercial farmers and new emerging farmers is envisaged. This would be real socio-economic development and would make a significant impact on rural development and agrarian reform. Such new irrigation development would make full and effective use of the water that could be made available from a new major dam in the Koonap River.

9.4 Geotechnical Overview

A summary of the findings from the geotechnical investigation is provided below:

- The site and available construction materials are suitable for either an earth embankment dam (homogenous or with clay core), a rockfill embankment dam with clay core, or for a concrete gravity dam.
- Extensive quantities of soil shell material are available but are potentially dispersive requiring gypsum stabilization.

- Shallow sandstone bedrock is expected in the left flank area which will be suitable for the location of a side spillway in the case of a rockfill or earthfill structure. However, the topography of the left flank is such that significant excavation would be required to achieve the required spillway levels for dam sizes of 1MAR and below.

9.5 Project Components

9.5.1 General

The project components are listed in **Table 8**.

Table 8: Project Components

Project Components	Associated Infrastructure
Major storage dam (Foxwood Dam)	1. Dam wall 2. Embankment 3. Dam outlet works (including dam intake tower, tunnel and outlet valve house) 4. Access roads (construction and operation) 5. Quarry and earthfill borrow areas 6. Electrical supply 7. Construction camp (temporary) 8. Operator's offices and accommodation (permanent)
Bulk water supply pipeline	1. Pump station 2. Pipeline and associated structures (chambers, Cathodic Protection measures, AC mitigation measures, pipeline markers)
Gauging Weir	1. Weir and associated instrumentation 2. Access roads (construction and operation) 3. Electrical supply 4. Satellite construction camp
Relocation of Infrastructure	1. Relocate water supply canal 2. Relocate R344 3. Relocate MR00639 4. Relocate Telkom telephone line 5. Relocate Eskom power line

A description of the major project components follows. Note that all property descriptions are based on 2006 cadastral information. All distances and coordinates provided should be regarded as approximates, as they are based on a desktop estimate from a Geographical Information System (GIS).

9.5.2 Dam Structure

9.5.2.1 General

The proposed dam to supply water to Adelaide is a 1 MAR composite concrete gravity and earth embankment dam. The concrete gravity section is made up of a spillway section and a non-overflow section. **Figure 9** illustrates the main components of the dam structure and the characteristics of the dam are presented in **Table 9**. The general arrangement of the dam is contained in **Appendix E**.

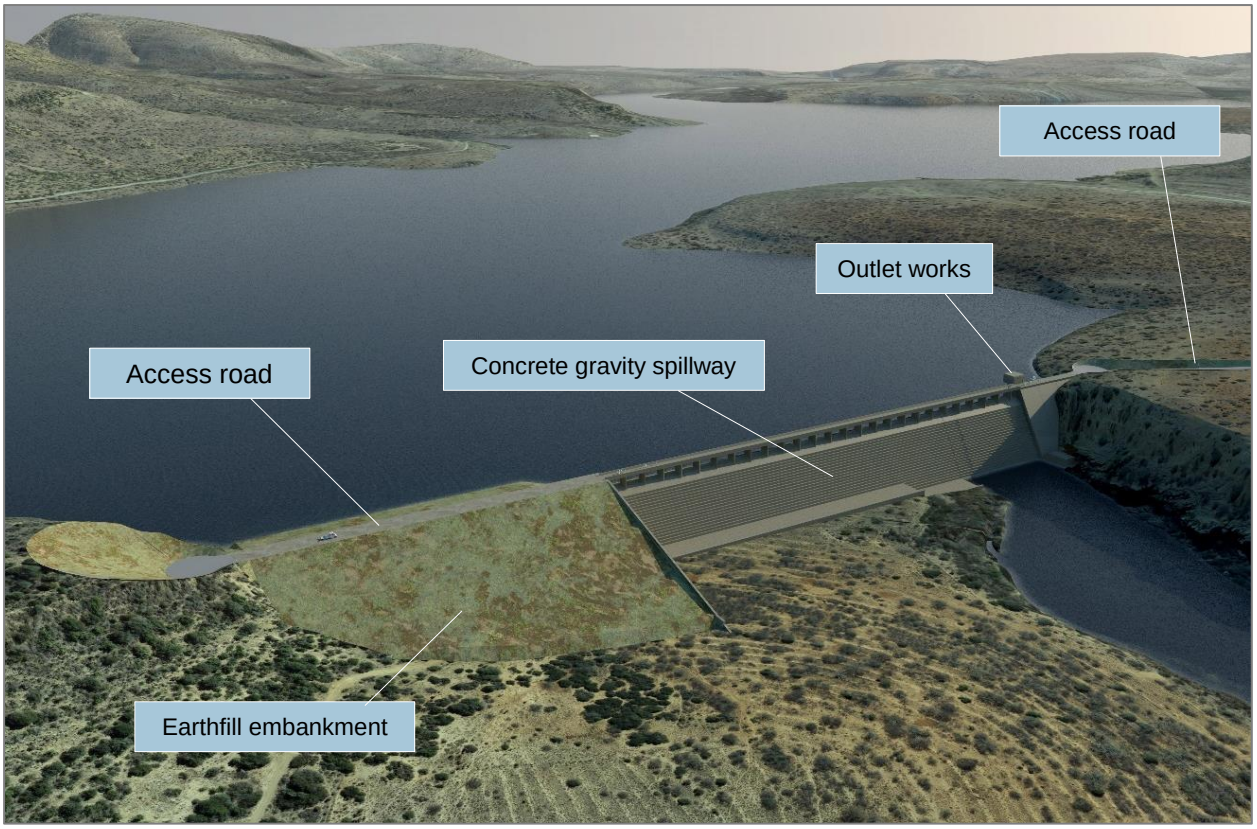

Figure 9: Composite dam primary structure

The dam's outlet works will release and regulate water flow from the impoundment to meet downstream flow requirements. The facility will consist of an intake tower, tunnel and outlet valve house (refer to drawings in **Appendix E**). Permanent access will be provided via an access road from the R344 to the left flank. Access to the right flank has been proposed in the Feasibility Study as being via a bridge across the spillway however this is not favoured by DWS and access to the right flank may be from the MR00639 and through private land.

Table 9: Foxwood Dam Characteristics

Parameter	Description
Catchment Area	1 091 km^2
Gross MAR	47,61x106 m^3
Full Supply Level - 1MAR storage	615 MSL
Full Supply Capacity	54,9 million m^3
50 year silt volume	6,11 million m^3
Water Surface Area at FSL	463 ha
Dam wall length	485 m
Length of spillway	267 m
Maximum height	48,5 m

The proposed dam wall and embankment are located on Erf no. 1 of the Adelaide Town, which is municipal-owned land. **Figure 10** provides up- and downstream views, respectively of the proposed dam site (coordinates of dam wall site: 32˚40'30"S, 26˚16'0"E).

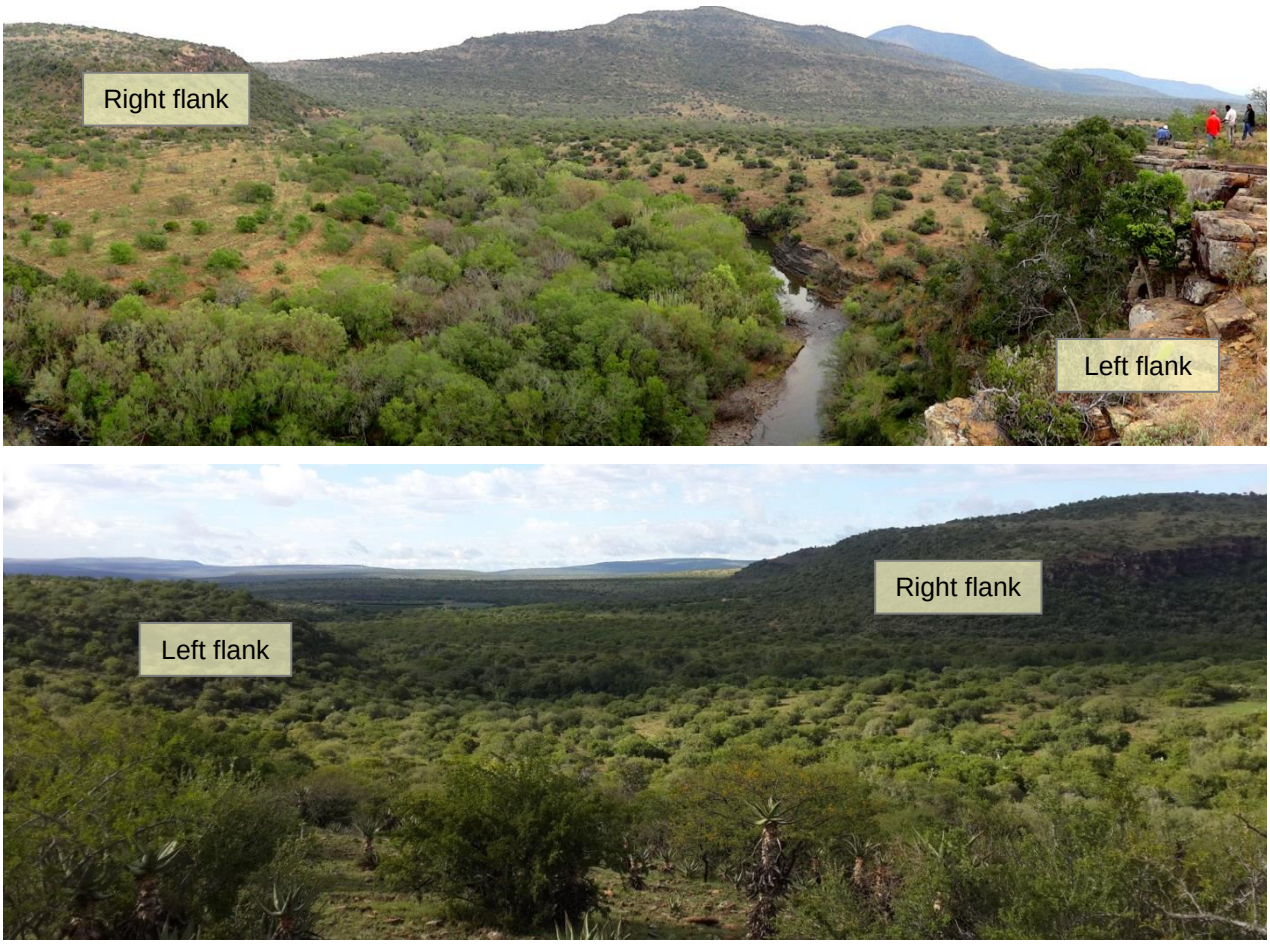

Figure 10: Up- (top) and downstream (bottom) view of proposed dam site

9.5.3 Water Supply and Bulk Infrastructure

9.5.3.1 General

Water supply from Foxwood Dam to Adelaide will be via a pressurised pipeline routed from the dam and tying into the existing supply pipeline from Adelaide Dam to the Adelaide Water Treatment Works (WTW). The pump will be rated 20 kW to supply 0.046 m^3/s against 69 m head along a 180 mm HDPE pipeline.

See **Figure 11** as well as the layout contained in **Appendix E** for the proposed pipeline route.

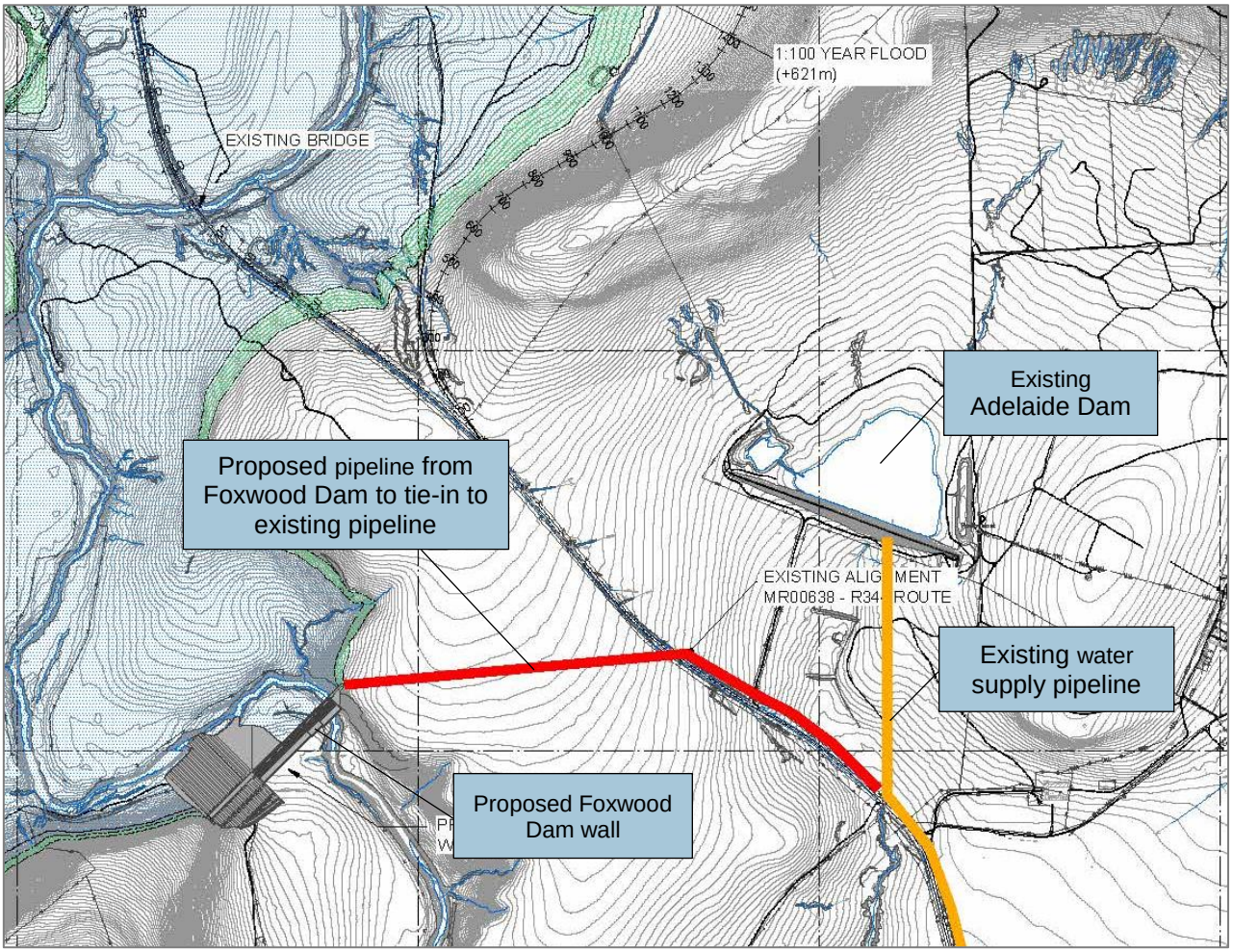

Figure 11: Water supply pipeline

9.5.3.2 Pipeline Specifications

An overview of the pipeline specifications is provided in **Table 10**.

Table 10: Bulk Water Pipeline Specification

Pipe diameter	:	180 mm
Pipe material	:	High-density polyethylene (HDPE) Pipes to be lined and coated to safeguard against corrosion (and associated impacts on water quality) and lengthen their lifespan.
Peak throughput		0,046 m^3/s
Installation	:	• Underground, with a minimum cover above the pipe of 1,5m. • Access/valve chambers will be located where necessary along the route. These will be concrete structures protruding slightly above natural ground level.
Servitude Width	:	15 metre wide permanent servitude and a further 15 metre wide temporary construction servitude
Servitude Conditions	:	• Permanent access to the pipeline servitude will be required after construction. • Pipeline markers (concrete posts) will be installed at changes in direction and at regular intervals along the route • Farming activities (stock and crop farming) can continue within the servitude area after construction, taking cognisance of the need for permanent access to the pipeline servitude. • No encroachment of infrastructure (buildings) or the establishment of trees will be allowed as roots compromise the stability of the pipeline.

9.5.3.3 Pipeline Route

From the dam wall the proposed pipeline travels in a north-easterly direction over municipal-owned land until the R344, where it turns south-easterly to follow the road until it ties into the existing supply pipeline from Adelaide Dam.

Table 11 lists the properties traversed by the water pipeline, starting from the dam wall.

Table 11: Pipeline Route (west to east)

Property Description	Distance (approximate)	Dominant Direction	Coordinates (approximate)
Erf 1 Adelaide	859 m 196 m	NE SE	32°40'25.97"S, 26°16'23.00"E (start point)
Erf 569 Adelaide	36 m	SE	
Erf 1 Adelaide	106 m	SE	
Erf 569 Adelaide	464 m	SE	32°40'35.47"S, 26°17'14.30"E *(end point)*

9.5.4 Relocation of Adelaide Canal

9.5.4.1 General

The Koonap Canal system has been the primary source of domestic water supply to Adelaide since the 1950's and comprises the following components:

- Diversion weir and intake structure on the Koonap River;
- A total length of some 8,1 km of lined, partially lined and open channel of various cross section (see **Figure 12**), some sections provided with precast concrete covers, and incorporating two inverted siphons, one tunnel and approximately 1,2 km of 600 mm dia drainage pipe with manholes;
- A measuring flume at the outlet to the dam;
- The Adelaide off-channel storage dam with capacity 0,7 million m^3 (see **Figure 13**); and
- Some 4 km of 315 mm dia PVC gravity fed pipeline which delivers the raw water from the dam into the Adelaide WTW.

Figure 12: Photographs of Adelaide canal

Figure 13: Photograph of Adelaide Off-Channel Storage Dam

The proposed Foxwood Dam basin will inundate a section of the existing gravity canal. The proposed relocation of the canal is shown in **Figure 14** and consists of a ± 3,4 km steel pipe. The layout is contained in **Appendix E**.

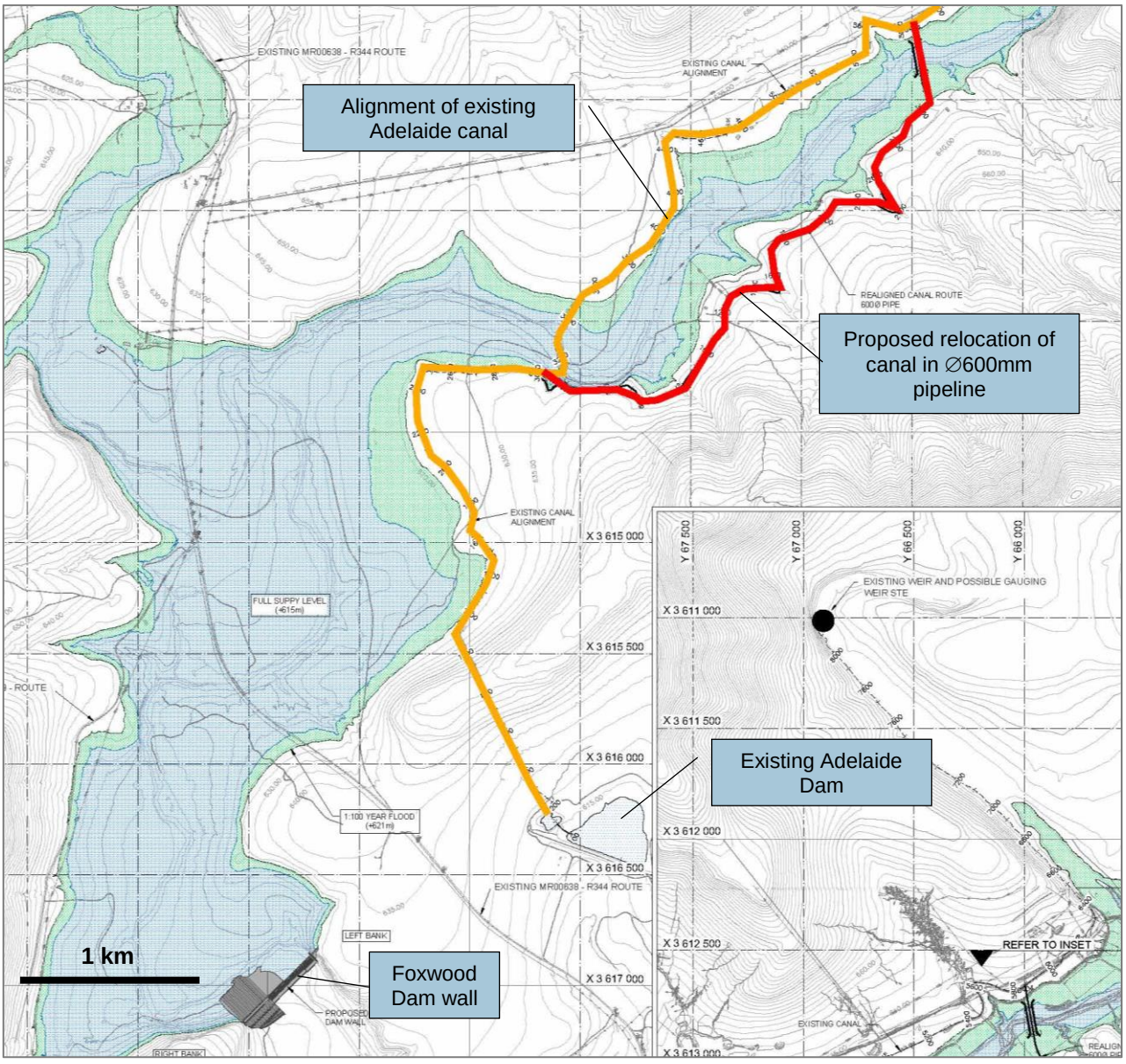

Figure 14: Proposed relocation of Adelaide canal

9.5.4.2 Pipeline Specifications

An overview of the specifications of the pipeline that will serve to relocate the canal is provided in **Table 12**.

Table 12: Pipeline Specification

Pipe diameter	:	600 mm
Pipe material	:	Steel pipes to be lined and coated to safeguard against corrosion (and associated impacts on water quality) and lengthen their lifespan.
Peak throughput		0.100 m^3/s
Installation	:	• Underground, with a minimum cover above the pipe of 1,5m. • Access/valve chambers will be located where necessary along the route. These will be concrete structures protruding slightly above natural ground level.
Servitude Width	:	15 metre wide permanent servitude and a further 15 metre wide temporary construction servitude
Servitude Conditions	:	• Permanent access to the pipeline servitude will be required after construction. • Pipeline markers (concrete posts) will be installed at changes in direction and at regular intervals along the route • Farming activities (stock and crop farming) can continue within the servitude area after construction, taking cognisance of the need for permanent access to the pipeline servitude. • No encroachment of infrastructure (buildings) or the establishment of trees will be allowed as roots compromise the stability of the pipeline.

9.5.4.3 Pipeline Route

The existing canal will be relocated in a pipeline from approximately 32°38'11.64"S, 26°18'07.05"E. From here the pipeline travels in a south-easterly direction and crosses the Koonap River at the proposed bridge of the deviated R344. After this crossing the pipeline route turns south-westerly and passes an existing farm dam. The route continues in a predominantly south-western direction and runs outside of the dam's purchase line until it connects with the existing canal at a point just south of the canal's crossing of the Koonap River.

The properties affected by the proposed pipeline route are listed in **Table 13**.

Table 13: Pipeline Route (north to south)

Property Description	Distance (approximate)	Dominant Direction	Coordinates (approximate)
Ptn 2 of Elands Drift 86	190 m	SE	32°38'11.64"S, 26°18'07.05"E (start point)
Ptn 2 of Olifants Drift 87	631	SW	
Rem of Olifants Drift 87	2 196 m	SW	
Erf 1 Adelaide	363	NW	32°39'02.64"S, 26°17'01.36"E (end point)

9.5.5 Relocation of Roads

9.5.5.1 General

The following two public roads will be inundated by the Foxwood Dam reservoir (refer to **Figure 15**):

1. Approximately 2 km of the R344 (MR00638), which connects Adelaide and Tarkastad (including two bridges); and
2. Approximately 1 km of the MR00639, which provides a connection from the R63 to the R344.

The proposed re-alignment of these roads is shown in **Figure 15**. and the layouts are contained in **Appendix E**. Photographs of the existing roads are provided in **Figure 16** and **Figure 17**.

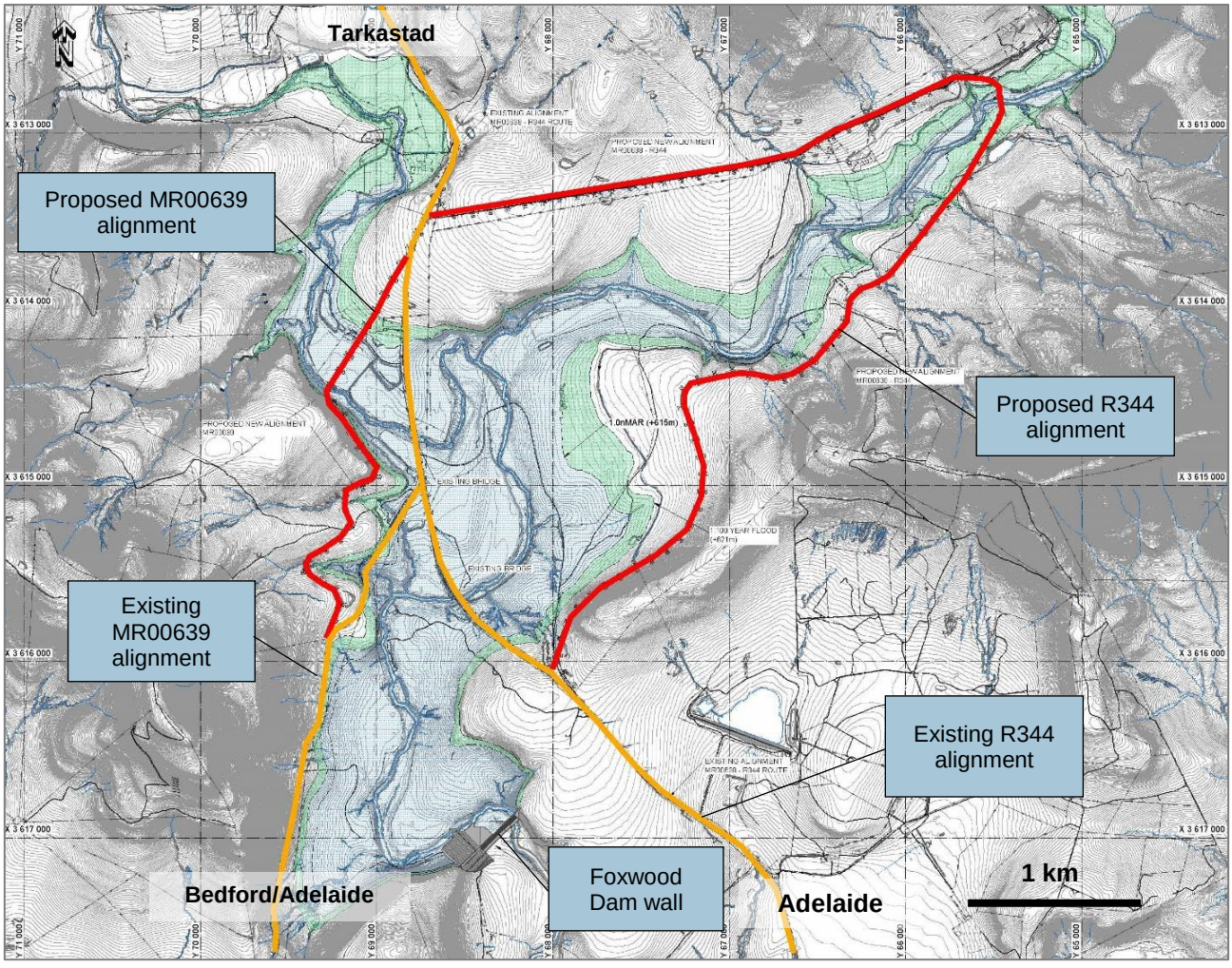

Figure 15: Proposed road relocations

Figure 16: Photographs of existing R344 (bridge structures shown)

Figure 17: Photographs of existing MR00639

9.5.5.2 Roads' Specifications

The specifications for the relocated R344 and MR00639 are provided in **Tables 14** and **15**, respectively.

Table 14: R344 relocation – road specifications

Road length	:	8 400 m
Road width	:	10 m
Road type	:	Gravel (450 mm thick pavement construction – 100 mm G7 base, 150 mm gravel subbase,150 mm G9 material subgrade). Stormwater management with daylighting channels and/or culverts as required.
Structures	:	90 m post-tensioned concrete bridge, 11 m wide

Table 15: MR00639 relocation – road specifications

Road length	:	3 400 m
Road width	:	10 m
Road type	:	Gravel (450 mm thick pavement construction – 100 mm G7 base, 150 mm gravel subbase, 150 mm G9 material subgrade). Stormwater management with daylighting channels and/or culverts as required.
Structures	:	450 m post-tensioned concrete bridge, 11 m wide

9.5.5.3 Routes of Deviated Roads

R344 deviation

The R344 is deviated from approximately 32°40'06.70"S, 26°16'36.22"E and follows a predominantly north-eastern route outside of the dam's purchase line before crossing of the Koonap River by means of a bridge structure. The route then turns south-westerly and follows the DR 02491 (refer to photographs in **Figure 18**) until it meets up with the existing R344 alignment. The properties affected by the proposed deviation of the R344 are listed in **Table 16**.

Figure 18: Photographs of existing DR 02491

Table 16: Route of R344 Deviation (south to north)

Property Description	Distance (approximate)	Dominant Direction	Coordinates (approximate)
Erf 1 Adelaide	2 661 m	NE	32°40'06.70"S, 26°16'36.22"E (start point)
Rem of Olifants Drift 87	1 627 m	NE	
Ptn 2 of Olifants Drift 87	585 m	NE	
Ptn 2 of Elands Drift 86	445 m	NW	
Ptn 1 of Elands Drift 86	3 067 m	SW	
Ptn 4 of Elands Drift 86	7 m	N	
Ptn 6 of Elands Drift 86	56 m	NE	32°38'31.56"S, 26°16'06.72"E (end point)

MR00639 deviation

The proposed deviation of the MR00639 starts at approximately 32°39'57.27"S, 26°15'41.12"E and the new road alignment travels in a predominantly north-eastern direction outside of the dam's purchase line. The deviated road traverses two watercourses along its route and eventually crosses the dam basin via a bridge structure. It then continues north-easterly until it connects to the existing

R344 at the intersection with the DR 02491. The properties affected by the proposed deviation of the MR00639 are listed in **Table 17**.

Table 17: Route of MR00639 Deviation (south to north)

Property Description	Distance (approximate)	Dominant Direction	Coordinates (approximate)
Rem of Leeuw Hoek 129	46 m	N	32°39'57.27"S, 26°15'41.12"E (start point)
Ptn 2 of Leeuw Hoek 129	62 m	NW	
Rooidam 86	192 m 215 m	NW NE	
Ptn 2 of Mancasana Drift (Petronella) 126	1 477 m	NW	
Ptn 1 of Mancasana Drift (Petronella) 126	330 m	NE	
Ptn 3 of Mancasana Drift (Petronella) 126	196 m	NE	
Ptn 7 of Elands Drift 86	97 m	NE	
Ptn 3 of Elands Drift 86	483 m	NE	32°38'37.79"S, 26°16'03.26"E (end point)

9.5.6 Relocation of Power Line and Telephone Line

9.5.6.1 General

An existing 11 kV over-head power line is routed along the western side of the dam basin through the area of inundation (see photograph in **Figure 19**). It will be necessary to relocate this power line around the extent of the basin. Two possible routes are illustrated in **Figure 20**.

Figure 19: Photograph of existing power line along MR00639

An existing overhead telephone line is routed along the existing R344, which will be affected by the proposed dam basin and will need to be relocated. Refer to proposed new route shown in **Figure 20**.

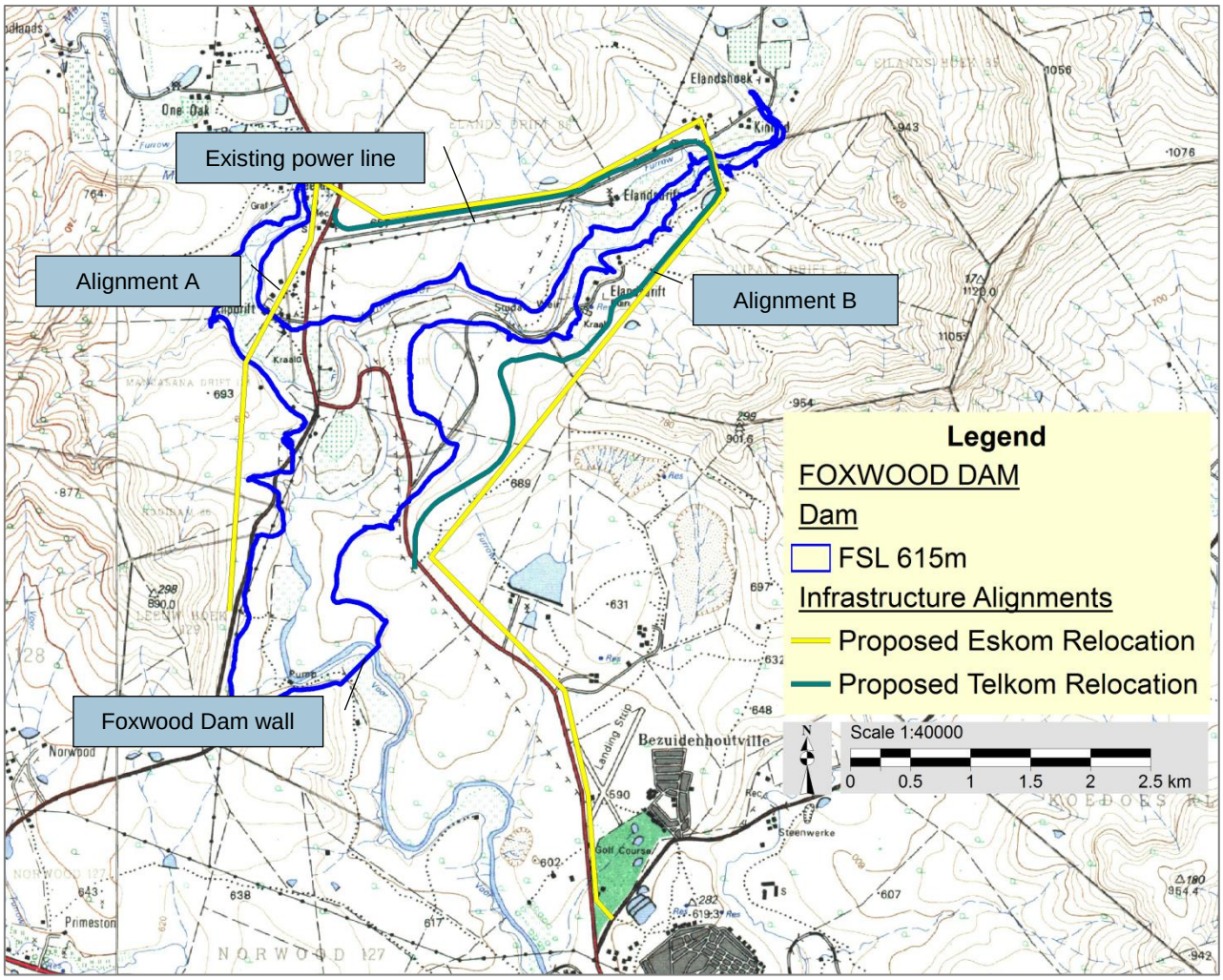

Figure 20: Proposed relocation of power line and telephone line

9.5.6.2 Routes of Deviated Power Line and Telephone Line

Alignment A of the deviated power line mostly follows the MR00639 deviation. Alignment B commences from the Adelaide Golf Course and travels in a north-western direction along the R344, past Bezuidenhoutville. The route then turns north-easterly and mostly follows the R344 deviation.

Due to the nature of this type of infrastructure the number of bend points along the power line deviations has been kept to a minimum. The affected properties are shown in **Table 18**.

Table 18: Routes of Deviated Power Line (south to north)

Property Description	Distance (approximate)	Dominant Direction	Coordinates (approximate)
Alignment A			
Ptn 2 of Leeuw Hoek 129	707 m	NW	32°40'17.37"S, 26°15'34.74"E (start point)
Rooidam 86	344 m	NW	
Ptn 2 of Mancasana Drift (Petronella) 126	1 125 m	NW	
Ptn 1 of Mancasana Drift (Petronella) 126	514 m	NW	
Ptn 3 of Mancasana Drift (Petronella) 126	83 m	NW	
Ptn 3 of Elands Drift 86	503 m	NW	
Ptn 1 of Elands Drift 86	40 m	NW	
Ptn 4 of Elands Drift 86	64 m	NW	
Ptn 6 of Elands Drift 86	84 m	NW	
Fathers Poort 116	289 m	NW	32°38'20.79"S, 26°16'02.78"E (end point)
Alignment B			
Adelaide Golf Course	779 m	NW	32°40'17.37"S, 26°15'34.74"E (start point)
Erf 578 Adelaide	214 m	NW	
Bezuidenhoutville (various erven)	955 m	NW	
Erf 569 Adelaide	634 m	NW	
Erf 1 Adelaide	930 m 1 896 m	NW NE	
Rem of Olifants Drift 87	1 616 m	NE	
Ptn 2 of Olifants Drift 87	384 m 246 m	NE NW	
Ptn 2 of Elands Drift 86	404 m 760 m	NE SW	
Ptn 1 of Elands Drift 86	2 042 m 401 m	SW NW	
Ptn 6 of Elands Drift 86	70 m	NW	
Fathers Poort 116	151 m	NW	32°38'20.79"S, 26°16'02.78"E (end point)

The proposed route of the deviated telephone line follows the R344 re-alignment and affected the same properties listed in **Table 18**.

9.5.7 Gauging Weir

9.5.7.1 General

A gauging station is a site on a river which has been selected, equipped and operated to provide the basic data from which systematic records of water level (stage) and discharge may be derived. Essentially it consists of a natural or artificial river cross-section where a continuous record of stage can be obtained and where a relation between stage and discharge can be determined (Lambie, 1978).

The project requires that a gauging weir be constructed below Foxwood Dam to determine the discharges (i.e. spills and releases) for application in the dam balance. The alternative sites for the weir structure are shown in **Figure 21**.

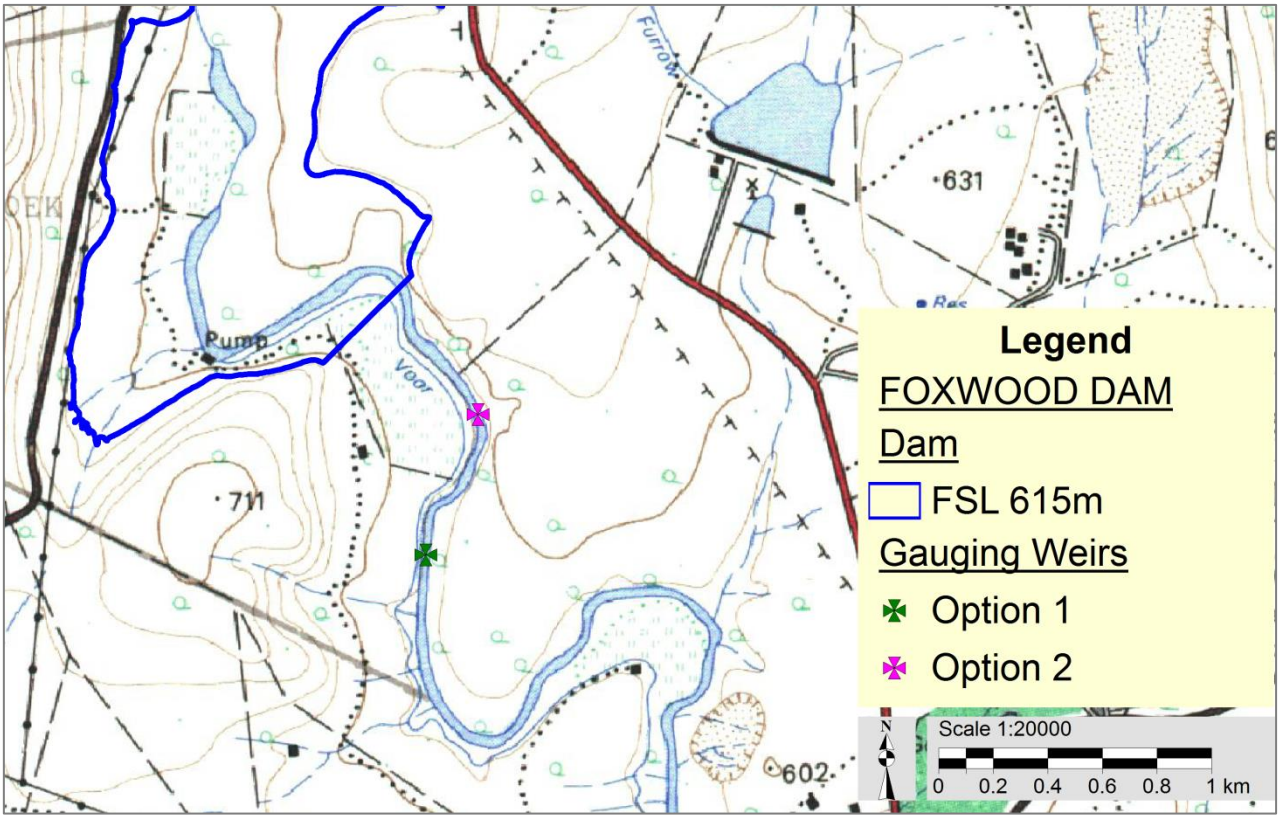

Figure 21: Proposed gauging weir site options

Figure 22 shows an example of a weir downstream of a dam, which was built for the same purpose as the one proposed for Foxwood Dam.

Figure 22: Example of a gauging weir downstream of Spring Grove Dam

9.5.7.1 Location of Gauging Weir

The locations of the two gauging weir site options are provided in **Table 19**.

Table 19: Locations of gauging weir site options

	Property Description	Coordinates (approximate centre points)
Option 1	Rem of Leeuw Hoek 129	32°40'59.78"S, 26°16'24.21"E
Option 2	Erf 1 of Adelaide	32°40'43.26"S, 26°16'31.54"E

9.5.8 Borrow Pits and Quarry

9.5.8.1 General

The borrow pits and quarry identified as part of the geotechnical investigations during the Technical Feasibility Study to source construction material are shown in **Figure 23**. A photograph of the quarry site is provided in **Figure 24**.

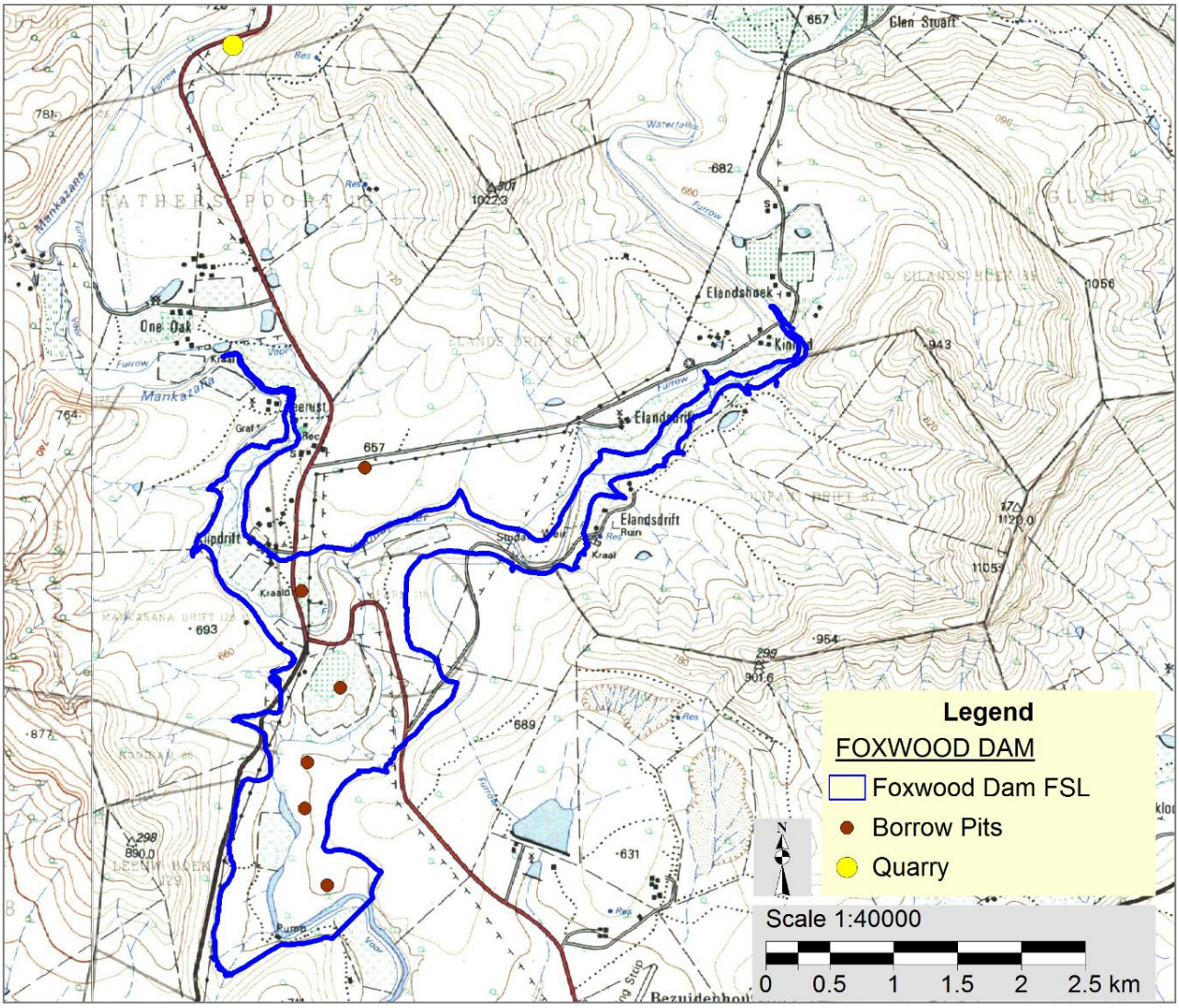

Figure 23: Borrow pits and quarry site

Figure 24: Photograph of proposed quarry site

9.5.8.2 Locations of Borrow Pits and Quarry

The locations of the proposed borrow pits and quarry are provided in **Table 20**.

Table 20: Locations of Borrow Pits and Quarry (from south to north)

	Property Description	Coordinates (approximate centre points)
Borrow Pits	Erf 1 of Adelaide	32°40'23.36"S, 26°16'08.84"E
	Erf 1 of Adelaide	32°40'04.19"S, 26°16'01.88"E
	Erf 1 of Adelaide	32°39'52.55"S, 26°16'02.86"E
	Erf 1 of Adelaide	32°39'33.73"S, 26°16'12.60"E
	Ptn 5 of Elands Drift 86	32°39'09.26"S, 26°16'01.19"E
	Ptn 1 of Elands Drift 86	32°38'38.27"S, 26°16'20.12"E
Quarry	Doornkloof Mouth 115	32°36'51.48"S, 26°15'40.75"E

9.5.9 Raising of Drift

9.5.9.1 General

A drift (low level crossing) is located along the DR 02491 where it crosses the Koonap River (see photograph in **Figure 25**). Provision has been made for the aforementioned drift to be raised to mitigate against the inundation levels of the proposed impoundment (refer to **Figure 26**).

Figure 25: Photograph of existing drift along DR 02491

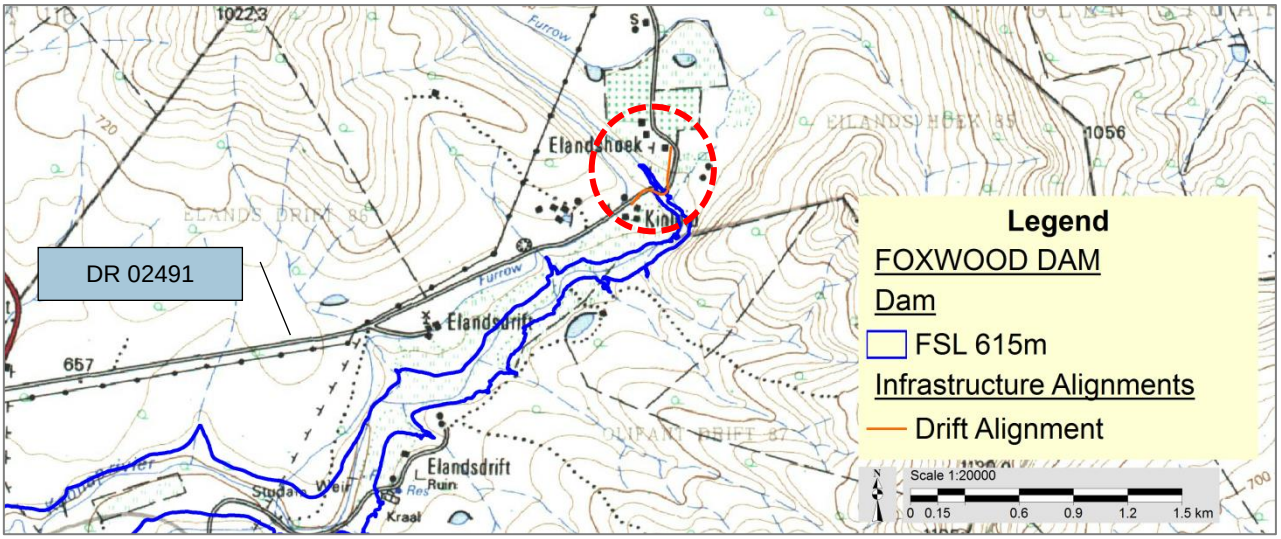

Figure 26: Proposed raising of drift

9.5.9.1 Drift Specifications

Road level to be raised by 3 m height raised over 100 m length. Mass concrete road structure with 900 mm diameter concrete culverts.

9.5.9.2 Location of Drift Alignment

The location of the drift alignment is provided in **Table 21**.

Table 21: Location of drift alignment (west to east)

Property Description	Distance (approximate)	Dominant Direction	Coordinates (approximate)
Ptn 2 of Elands Drift 86	245 m	NE	32°38'04.37"S, 26°18'19.42"E (start point)
Eilands Hoek 85	228 m	NE	32°37'54.27"S, 26°18'27.80"E (end point)

9.5.10 Access Roads

9.5.10.1 General

The proposed access roads for the project include the following (refer to **Figure 27**):

- Permanent access roads –
  - Access road to dam wall (from R344);
  - Access road to right bank crest (from MR00639);
  - Access road to right bank earth embankment (from MR00639).

- Temporary access roads –
  - Access roads to construction laydown areas (from R344);
  - Access road to right bank (from MR00639);

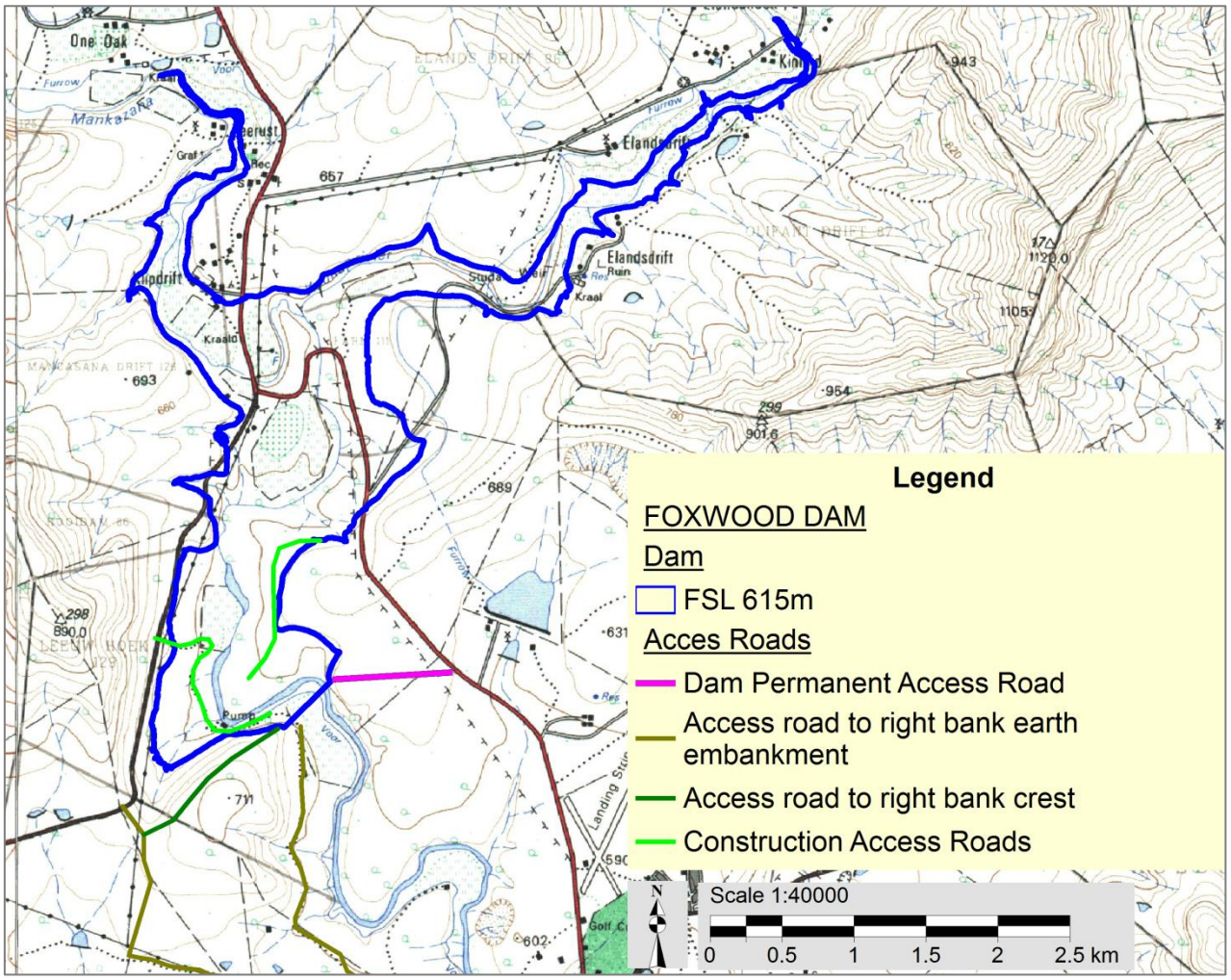

Figure 27: Proposed Access roads

9.5.10.2 Access Roads' Specifications

Road length	:	850 m
Road width	:	10 m
Road type	:	Gravel (450 mm thick pavement construction – 150 mm G5 material, 150 mm G7 material, 150 mm rip and recompact in situ)

9.5.10.1 Routes of Access Roads

Where possible, the access roads attempted to follow existing tracks and farms roads. The properties affected by the access roads are listed in **Table 22**.

Table 22: Routes of Access Roads (south to north)

Property Description	Distance (approximate)	Dominant Direction	Coordinates (approximate)
Permanent access road to dam wall			
Erf 1 of Adelaide	834 m	SW	32°40'24.75"S, 26°16'55.28"E (start point) 32°40'26.30"S, 26°16'23.11"E (end point)
Access road to construction laydown area 1			
Erf 1 of Adelaide	1 266 m	SW	32°32'39.55"S, 26°16'19.75"E (start point) 32°40'26.09"S, 26°16'00.71"E (end point)
Access road to right bank			
Rem of Leeuw Hoek 129	1 277 m	SE	32°40'17.40"S, 26°15'37.29"E (start point)
Erf 1 of Adelaide	252 m	NE	32°40'34.09"S, 26°16'06.31"E (end point)
Access road to right bank crest			
Farm 285	293 m	NE	32°41'01.14"S, 26°15'32.51"E (start point)
Rem of Leeuw Hoek 129	692 m	NE	-
Erf 1 of Adelaide	226 m	NE	32°40'37.40"S, 26°16'08.65"E (end point)
Access road to right bank earth embankment			
Farm 285	2 026 m	SE	32°40'54.95"S, 26°15'26.91"E (start point)
Ptn 1 of Norwood 127	816 m 388 m 1 244 m	SE NE NW	-
Rem of Leeuw Hoek 129	948 m	N	
Erf 1 of Adelaide	117 m	NW	32°40'36.80"S, 26°16'14.46"E (end point)

9.5.11 Construction Laydown Area

9.5.11.1 General

A laydown area is an area that has been cleared for the temporary storage of equipment and supplies to be used during the construction period. Laydown areas are usually covered with rock and/or gravel to ensure accessibility and safe manoeuvrability for transport and off-loading of vehicles.

The proposed options for the laydown area are shown in **Figure 28**. The approximate size of the laydown area is 250 m by 250 m (62 500 m^2).

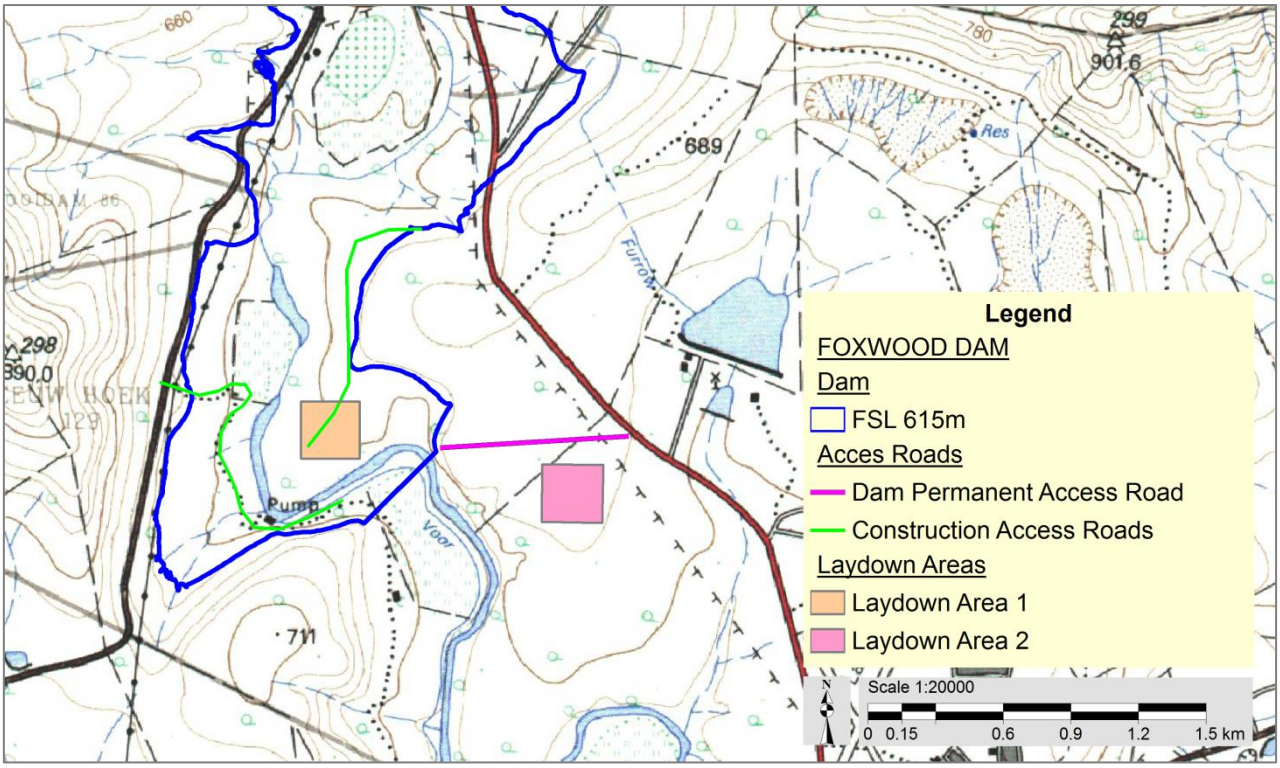

Figure 28: Proposed Construction Laydown Areas

9.5.11.2 Location of Construction Laydown Area Options

The locations of the two laydown area options are provided in **Table 23**.

Table 23: Locations of laydown area options

	Property Description	Coordinates (approximate)
Laydown Area 1	Erf 1 of Adelaide	NW corner: 32°40'28.76"S, 26°16'40.30"E SW corner: 32°40'36.97"S, 26°16'40.30"E NE corner: 32°40'28.76"S, 26°16'50.64"E SE corner: 32°40'36.97"S, 26°16'50.64"E
Laydown Area 2	Rem of Leeuw Hoek 129	NW corner: 32°40'19.76"S, 26°15'59.58"E SW corner: 32°40'27.88"S, 26°15'59.58"E
	Erf 1 of Adelaide	NE corner: 32°40'19.76"S, 26°16'09.40"E SE corner: 32°40'27.88"S, 26°16'09.40"E

9.5.12 Hydropower

Provision has been made for future installation of a generator in the outlet works of the dam. However, average power generating capacity has been estimated at 180 kW and it is understood that DWS do not currently intend to install hydropower when constructing the dam.

9.6 Alternatives Suggested by Interested and Affected Parties

This section provides an overview of alternatives that were identified by I&APs. Refer to the Comments and Response Report (**Appendix O**) for further discussions on alternatives identified during the Public Participation process.

The following alternatives pertaining to the development of Foxwood Dam were recommended by I&APs:

- Alternative supply of aggregate materials (concrete, stones, gravel, etc.) for the construction phase can be obtained from a privately owned source located approximately 6 km south of Adelaide;
- The bulk water pipeline from Foxwood Dam should rather go to the existing Adelaide Dam as a backup supply in case there is a breakdown with the pump;
- The option of possibly gravity feeding water to the Adelaide WTW from downstream of the Foxwood Dam rather than pumping;
- Increase the capacity of the existing Adelaide Dam instead of building a new dam; and
- Bulk water pipeline from Foxwood Dam to follow the contour in a southern direction and to then turn easterly to connect to the existing pipeline at the same place. This will allow for the route to avoid an area that is deemed to be suitable for creating a landing strip in the future.

9.7 Operation of the Scheme

As a Government Waterworks, Foxwood Dam will be managed and operated by DWS in accordance with the NWA.

River releases from Foxwood Dam will be via a multi-level intake tower and conduit. The outlets will be controlled with sleeve valves, enabling a wide range of flows to be released.

The following operational requirements will be satisfied:

1. The in-stream flow requirements (EWR) at environmental control sites will be adhered to.
2. Release for downstream water users; and
3. Abstraction (demand driven) for conveyance to the Adelaide WTW.

Information pertaining to the operation of Foxwood Dam will be contained in the Operation and Maintenance Manual to be developed by DWS.

Figure 29: Example of controlled release from outlet works at an RCC dam type (Spring Grove Dam)

9.8 Project Life-cycle

To adequately consider the impacts associated with the development of Foxwood Dam, the major activities during each phase of the project life-cycle are listed below:

1. Pre-feasibility and Feasibility phases –
   a) Streamflow and yield modelling;
   b) Assessment of base conditions (including geology, construction material investigation, assessing the seismic hazard, topographical survey, analysing sediment yields, etc.);
   c) Technical, economic and environmental screening of alternatives;
   d) Geotechnical investigations to confirm borrow areas and quarries; and
   e) Sizing and costing of dam and infrastructure.

2. Design and Pre-construction phases –
   a) Negotiations and agreements with the affected landowners, stakeholders and authorities;
   b) Detailed engineering design;
   c) Detailed geotechnical investigations, including geophysical investigations;
   d) Survey and mark construction servitude;
   e) Survey and map topography for determination of post-construction landscape, rehabilitation and shaping (where necessary);
   f) Possible removal of trees within construction servitude;
   g) Procurement process for Contractors;
   h) Selective improvements of access roads to facilitate the delivery of construction plant and materials;
   i) Arrangements for accommodation of construction workers (off site);
   j) The building of a site office and ablution facilities;
   k) Development of resettlement plan;
   l) The harvesting of timber that will be inundated (if deemed necessary);
   m) Permits if protected trees are to be cut, disturbed, damaged, destroyed or removed;
   n) Permits if heritage resources are to be impacted on and for the relocation of graves;
   o) Confirmation of arrangements with individual landowners and/or land users for managing and mitigating issues such as fencing and gate dimensions for traversing servitude, traversing patterns of livestock over servitude, access to

livestock drinking points, security, opening and closing of gates and access to private property;

p) Confirmation of the location and condition of all buildings, assets and structures within the servitude; and

q) Determining and documenting the road conditions for all identified haul roads.

3. Construction phase –

a) Site establishment;

b) Relocation of infrastructure;

c) Prepare access roads;

d) Establish construction laydown areas;

e) Bulk fuel storage;

f) Storage and handling of material;

g) Construction employment;

h) Site and basin clearing;

i) Excavation;

j) Blasting;

k) River diversion for building of major storage dam;

l) Establishment and operation of crusher;

m) Establishment and operation of batching plant;

n) Establishment and operation of materials testing laboratory;

o) Create haul roads;

p) Create quarry and borrow areas;

q) Construction of embankment, bottom outlet, and spillway;

r) Concrete Works;

s) Steel works;

t) Mechanical and Electrical Works;

u) Temporary river diversion for gauging weir and river crossings;

v) Construction of gauging weir;

w) Electrical supply;

x) Construction of pipeline;

y) Cut and cover activities;

z) Stockpiling (sand, crushed stone, aggregate, etc.);

aa) Waste and wastewater management;
bb) Relocation of dwellings, graves, protected species; and
cc) Reinstatement and rehabilitation of construction domain (outside of inundation area, as necessary).

The methodology for the installation of the water pipeline (including the pipeline to allow for the deviation of the canal) is as follows:

- Site clearing;
- Remove topsoil in the area where construction will take place and stockpile separately for later re-instatement;
- Excavate pipe trench;
- Install and compact pipe bedding;
- Install pipe sections by means of side booms (special cranes) and weld joints;
- Repair field joints and backfill and compact pipe trench in layers;
- Construct air and scour valves chambers. Air valves, which are generally positioned at high points along the route, release air from the pipeline as it fills, allow air into the pipeline when it is draining and 'bleed' off air during normal operations. The scour valves serve to drain water from the pipeline (typically during maintenance), and are located a low points along the route for drainage purposes. A detailed hydraulic analysis for the positioning of the valves will be performed as part of the detail design;
- Construct access chambers;
- Re-shape the impacted area to its original topography and replace stripped topsoil;
- Install final Cathodic Protection;
- Install AC mitigation measures;
- Install pipeline markers at changes in direction and at regular intervals along the route; and
- Rehabilitation.

Watercourse crossings will generally consist of pipe sections encased in concrete in accordance with the relevant DWS criteria. The typical construction methodology for a river crossing is as follows:

- An earthen berm (coffer dam) and temporary bypass canal is constructed to divert the water around the construction site;
- The trench is excavated across the dry river channel;
- A concrete bedding is constructed first, followed by the installation and restraining of the pipe to prevent flotation. Encasement is completed by the construction of further concrete lifts;
- Once the concrete has set, the temporary coffer dam is removed and the bypass canal backfilled to re-instate the flow;
- The impacted area is re-shaped to its original topography;
- The disturbed area is rehabilitated; and
- If erosion of the disturbed river banks is a concern, suitable measures will be implemented to ensure the stabilisation of the river structure.

Figure 30: Examples of typical river crossings

4. Operational phase –
   a) Maintenance of infrastructure;
   b) Operation of dam;
   c) Bulk Water Pipeline –
      - Create access track along pipeline servitude;
      - Conduct routine maintenance inspections of the project infrastructure;
      - Scouring of pipeline, where the water conveyed and stored within this system will be released into the receiving watercourses along the alignment from

scour valves. A detail hydraulic analysis will be conducted to determine the optimum positioning of the scour valves;

- ❖ Undertake maintenance and repair works, where necessary; and

d) On-going consultation with directly affected parties.

Note that the following components of the overall development will not be operated and maintained by DWS:

- ❖ Relocated water supply canal – Amatola Water;
- ❖ Relocated R344 and MR00639 – EC Department of Roads and Public Works;
- ❖ Relocated telephone line – Telkom; and
- ❖ Relocate power line – Eskom.

5. Decommissioning phase –

Under suitable maintenance the lifespan of the dam is estimated to be more than 50 years. Depending on water supply requirements, the dam could possibly be upgraded or at least maintained to cater for projected needs. Decommissioning is thus not considered applicable to the scheme. However, should decommissioning be required the activity will need to comply with the appropriate environmental legislation and best practices at that time.

9.9 Preliminary Implementation Programme

The preliminary programme for the implementation Foxwood Dam is shown in **Table 24**. It should be noted that the development of Foxwood Dam needs to be integrated with the programme associated with the development of the irrigation scheme. It is thus not possible to provide dates at this stage.

Table 24: Preliminary Implementation Programme for Foxwood Dam

Task	Duration	End Date
Feasibility Study and Review	27 months (completed)	
EIA	18 months	May 2016
Securing Financing		
Detailed Design and Tender	18 months	
Construction	30 months	

Note that the finalisation of the programme will be affected by various factors, which include the securing of finance, institutional arrangements, statutory approvals (e.g. EIA), environmental and social baseline studies, etc.

9.10 Resources Required for Construction and Operation

This section briefly outlines the resources that will be required to execute the project.

9.10.1 Water

During the construction stage, water will be required for various purposes, such as concrete batching, washing of plant and equipment in dedicated areas, dust suppression, potable use by construction workers, etc. Water for construction purposes will be sourced directly from watercourses on site and groundwater (boreholes) will also be utilised. Water tankers will also supply water to the site.

All water uses triggered in terms of Section 21 of the NWA must comply with DWS' requirements.

Water for operational purposes will include domestic supply to the offices and permanent accommodation facilities.

9.10.2 Sanitation

Sanitation services will be required for construction workers in the form of chemical toilets, which will be serviced at regular intervals by the supplier. Conservancy tanks will be provided at the residential labour camps and site offices.

Ablution facilities will also be provided as part of the permanent infrastructure for the operational phase at the offices and accommodation facilities for the dam operators, which will include septic tanks.

9.10.3 Roads

Permanent access roads will be required for the operational phase, whereas temporary access and haul roads will need to be created for construction purposes. Refer to **Section 9.5.10** for a discussion on access roads.

9.10.4 Waste

Solid waste generated during the construction phase will be temporarily stored at suitable locations (e.g. at construction camps) and will be removed at regular intervals and disposed of at an approved waste disposal site. According to the Nxuba LM IDP Review (2014/2015), there is a waste disposal site in Adelaide (not permitted) and Bedford (permitted). All the waste disposed of will be recorded.

All storage of general or hazardous waste in a waste storage facility (e.g. onsite waste transfer station) will comply with the national norms and standards (GN R. 926 of 29 November 2013)

Wastewater, which refers to any water adversely affected in quality through construction-related activities and human influence, will include the following:

- Sewage;
- Water used for washing purposes (e.g. equipment, staff); and
- Drainage over contaminated areas (e.g. cement batching / mixing areas, workshop, equipment storage areas).

All wastewater discharges will comply with legal requirements associated with the NWA, including the General Authorisation that specifically deals with S21(g) water use (i.e. disposing of waste in a manner which may detrimentally impact on a water resource). Suitable measures will be implemented to manage all wastewater generated during the construction period.

9.10.5 Electricity

It is anticipated that power generation will be provided at the quarry site using diesel generators. The estimated power requirement is 250 kVA.

A separate EIA will be conducted to seek approval for supplying electricity to the project, depending on whether this infrastructure will trigger the need for approval. Based on discussions held with Eskom during the Scoping phase, there is sufficient capacity to cater for the project's electrical requirements at the dam site.

9.10.6 Construction Workers

The appointed Contractor will make use of skilled labour where necessary. In those instances where casual labour is required, DWS will request that such persons are sourced from local communities as far as possible. The Labour Charter will be negotiated.

9.10.7 Construction Laydown Area

Refer to **Section 9.5.11** for a discussion on the project's construction laydown area.

9.10.8 Operator's Facilities

The structures required at Foxwood Dam for the operational phase include:

- Operator's offices;
- Operator's accommodation;
- Workers' accommodation;
- Boat store;
- Workshop; and
- Covered parking area.

Where appropriate, the operational phase structures will be constructed in a similar position as used for the construction phase.

9.11 Land Acquisition

9.11.1 General

Land is required for constructing and operating the proposed works. Section 64 of the NWA enables the Minister of Water and Sanitation, or a Water Management Institution authorised by the Minister in writing, to expropriate any property for any purposes contemplated by this Act if the purchase is for public purposes or in public interest. Servitudes with specific purposes can also be registered.

The following approach is recommended for this project:

- Land inside Foxwood Dam's purchase line as well as land required for appurtenant works must be acquired in accordance with statutory requirements;
- A servitude is required for the maintenance and the right to provide water for the raw water pipeline ; and
- Land required for housing and other infrastructure required for the operation of the scheme also needs to be acquired.

The negotiations with the landowners for the registration of the servitudes or acquisition of land will be undertaken by DWS, which will include the appointment of a land valuer. This process, which does not form part of the EIA, will adhere to all statutory requirements.

The areas to be acquired, as well as the methodology for calculating these areas, are discussed in the sub-sections to follow.

9.11.2 Foxwood Dam

DWS determines the land to be acquired for state-owned dams, known as the Purchase Line, based on the following factors:

- The Full Supply Level (FSL);
- The natural 1:100 year floodline for the portion of the river to be inundated;
- The expected volume of silt to be deposited over a 50 year period in the dam, as well as the profile thereof;

- The 1:100 year backwater profile (1:100 year high flood level) for the proposed dam, taking the 50 year sediment into account;
- The point of no influence of the proposed dam; and
- Add a buffer strip to the backwater profile for the 1:100 year recurrence interval. This buffer strip is the greater of the horizontal distance for a height of 1,5 m above the 1:100 year recurrence interval backwater level or 15 m horizontally from the 1:100 year recurrence interval backwater level.

The preliminary purchase line for Foxwood Dam is shown in **Figure 31**.

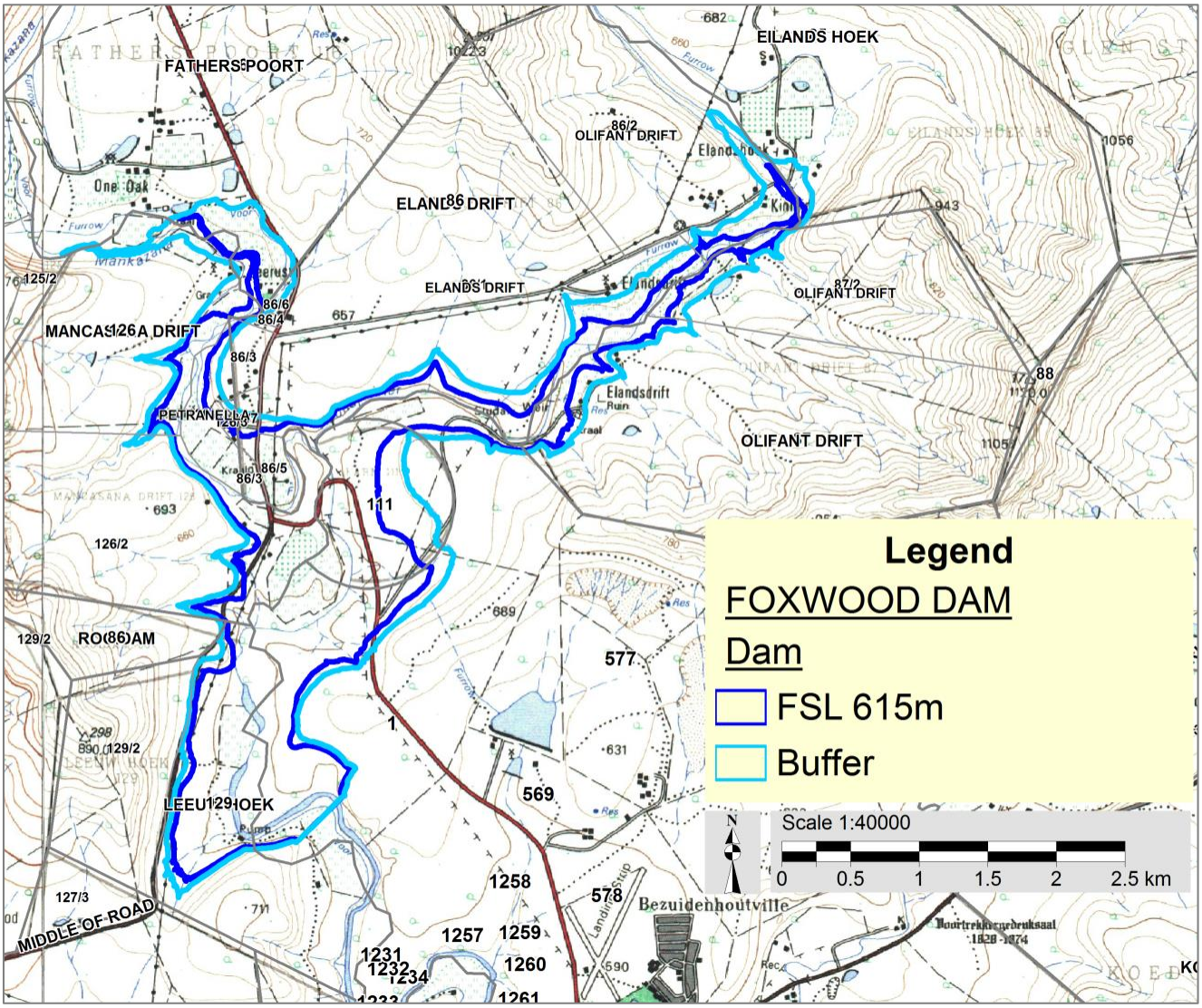

Figure 31: Foxwood Dam Purchase Line

9.11.3 Bulk Water Pipeline

The proposed servitude for the bulk water pipeline from the dam to the connecting point on the existing water supply pipeline is 15 m.

9.11.4 Flow gauging weirs

The proposed purchase line for the gauging weir is based on the backwater level for the design flood of the weir, plus a 15 m buffer zone.

9.11.5 Access and deviation of roads

The proposed width of the servitudes for the access roads is 20 m.

9.11.6 Re-aligned canal & pipeline

The proposed servitude for the realignment of the water supply canal through a new pipeline is 15 m.

9.12 Resource Management Plan for Foxwood Dam

A Government Waterworks refers to a waterworks (e.g. water storage dams, water transfer schemes and flood attenuation works) owned or controlled by the Minister of Water and Sanitation and includes the land on which it is situated. The future use of the Foxwood Dam, as a Government Waterworks, will be detailed in a Resource Management Plan (RMP) which will be compiled by the relevant unit within DWS. This plan will take into consideration aspects highlighted to date in the EIA process, such as the access to and utilisation of the dam for recreational purposes. The RMP development process is shown in **Figure 32**.

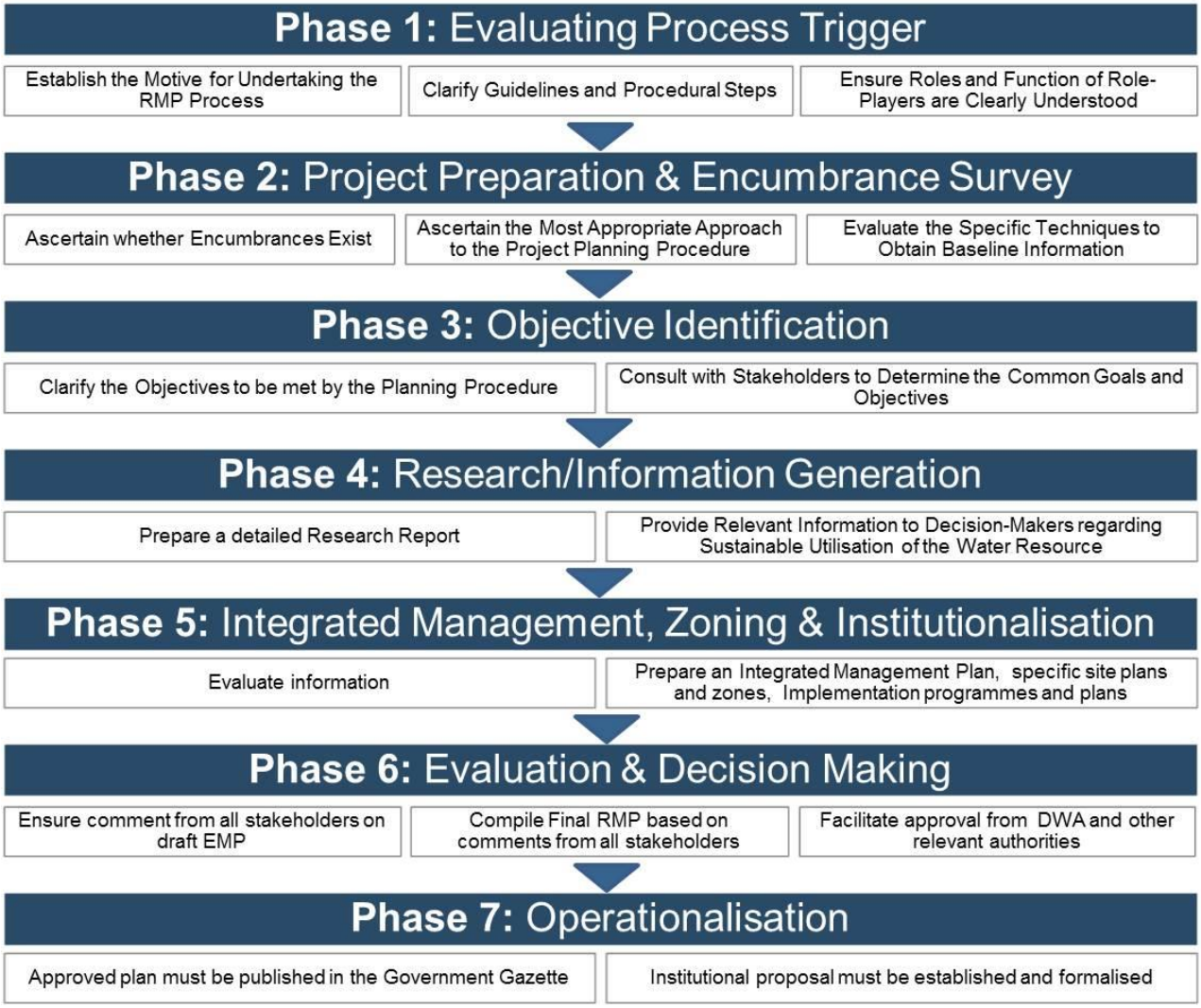

Figure 32: RMP Development Process

According to the Guidelines for the Compilation of Resource Management Plans (RMPs) (DWAF, 2006), the main aim of an RMP is to *"…compile workable, functional sustainable access and utilisation plans for water resources and in particular State Dams through a process based on the attainment of harmony within the natural and cultural environment while addressing the needs and expectations of both the community, users and visitors …."*. Broadly, an RMP comprises an Integrated Environmental Management Plan (including a zonation plan), a proposal for institutionalising the implementation of the plan and a Business Plan that informs decision-makers of the required actions and resources associated with the RMP.

10 ALTERNATIVES

10.1 Introduction

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.

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 Best Practicable Environmental Option (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*".

10.2 Adelaide's Existing Water Supply Systems

Previous investigations have taken place to assess the opportunities to augment water supply to Adelaide, with particular attention being paid to the option of building a dam at the Foxwood site. Adelaide Municipality commissioned a report in 1992 (Adelaide Municipality, 1992) to investigate the option of building a dam at Foxwood and a subsequent report was commissioned by the then Department of Water Affairs and Forestry (DWAF) in 1992 to consider smaller dam options at the Foxwood site. Amathole DM commissioned an investigation into the water and sanitation services in Adelaide in 2008.

The Technical Feasibility Study assessed the capability of existing water supply systems to provide Adelaide's current and projected domestic water demand and discussed the options for developing these supply schemes where required to improve their resilience

and ability to contribute to Adelaide's water requirements. The following supply options were considered:

1) Koonap River Weir and Off-Channel Storage System

Koonap River Weir and Off-Channel Storage System is the primary source of potable water to Adelaide. The purpose of the investigation was to determine the feasibility and extent of work required for upgrading or refurbishing of the existing off-channel storage dam supply system by refurbishing the weir at the abstraction point, refurbishment or increasing the capacity of the existing canal and dam or possibly by adding a smaller second off-channel storage dam in close proximity to Adelaide.

2) Fish River Pumping Scheme (FRPS)

The FRPS is a pipeline that was constructed to transfer water from the Fish River to Bedford and which was subsequently extended to provide an additional supply option to Adelaide. Upgrading the capacity of the FRPS by increasing the capacity of the existing pump/pipeline infrastructure from the intake on the Fish River via Bedford to Adelaide. Cognisance was taken of the water rights, the increasing demand from other users of the water and whether additional water for domestic purposes could be obtained by increasing the capacity of the FRPS. Adelaide is currently receiving water from the FRPS.

3) Groundwater

An assessment of existing groundwater utilisation around Adelaide and the opportunity for expansion of the existing borehole abstraction system by drilling for additional boreholes was reviewed.

Groundwater has limited use currently in Adelaide although one municipal borehole is being pumped significantly (equivalent to 3.6l/s). Water supply could be augmented by further wellfield development however it is noted that expected yields are low and with possible low water quality, requiring large wellfields and associated costs infrastructure costs. Given the opportunity to develop the existing supplies from the Koonap canal and FRPS groundwater development is not considered a priority.

It is stressed that prior to additional funding being made available at a national, district or local level to further develop and augment water supply infrastructure, it is important that the maximum benefit is being gained from existing infrastructure. South Africa is considered a water scarce country and all opportunities to conserve available water supplies and manage water demand must be explored and implemented where possible.

4) Water Conservation and Water Demand Management (WC&WDM)

South Africa is considered a water scarce country and all opportunities to conserve available water supplies and manage water demand must be explored and implemented where possible.

It is stressed that prior to additional funding being made available at a national, district or local level to further develop and augment water supply infrastructure, it is important that the maximum benefit is being gained from existing infrastructure.

It is noted that Amathole DM are actively addressing WC&WDM shortcomings and interventions in and around Adelaide. Further work to address the issues raised in a recently completed Amathole DM study should be carried out to significantly reduce the imbalance between water resources and water demand. The focus of this work should be on retrofitting plumbing in the townships around Adelaide and replacing of old water reticulation in Adelaide Town.

A primary finding of the Technical Feasibility Study was that the design of the existing water supply infrastructure in Adelaide is capable of meeting Adelaide's current and projected domestic water demand. However, it is noted that significant portions of the water supply infrastructure is in need of significant maintenance and improved operation procedures.

Development of the Foxwood Dam would, in the first instance, provide additional, high assurance water supplies for domestic use; this would significantly improve the resilience of the limited supplies now available from the Koonap River without the benefit of storage, and would make water available to meet any increasing needs for domestic, municipal and industrial use. In addition, Foxwood Dam would regulate the variable runoff in the

Koonap River to the extent that, after full provision is made for maintaining the Reserve to ensure the health and integrity of the resource itself, a significant quantity of water would be made available for irrigation development at an appropriate level of assurance.

10.3 Existing Irrigation

Existing irrigation is supplied via run-of-river (gravity fed canals and pumping schemes that feed off-channel storage dams). However irrigation potential is limited due to low surety of availability of water in the Koonap River.

10.4 Alternatives to Project Components

10.4.1 General

The alternatives to the project components, as listed in **Table 25**, are discussed in the subsections to follow. An option selection process was carried out on a number of dam construction types and sizes during the feasibility process with evaluation being undertaken based on selected major bulk material quantities.

Table 25: Alternatives of Project Components

Component	Alternatives
Major Storage Dam	Dam type
	Dam capacity
Gauging weir	Location
Power line deviation	Route alignment

10.4.2 Dam Type and Capacity

In order to select the preferred dam type and size cost estimates of four types of dam were considered during the Technical Feasibility Study, based on topographical and geotechnical conditions, namely:

- Earthfill (**Figure 33**);
- Rockfill (**Figure 34**)
- Concrete Gravity (**Figure 35**), and
- Composite Gravity Spillway and Earthfill.

The capacities from 0.5 MAR to 2 MAR, with a sedimentation allowance, were evaluated. Refer to **Section 9.2** for the consequences of various storage scenarios.

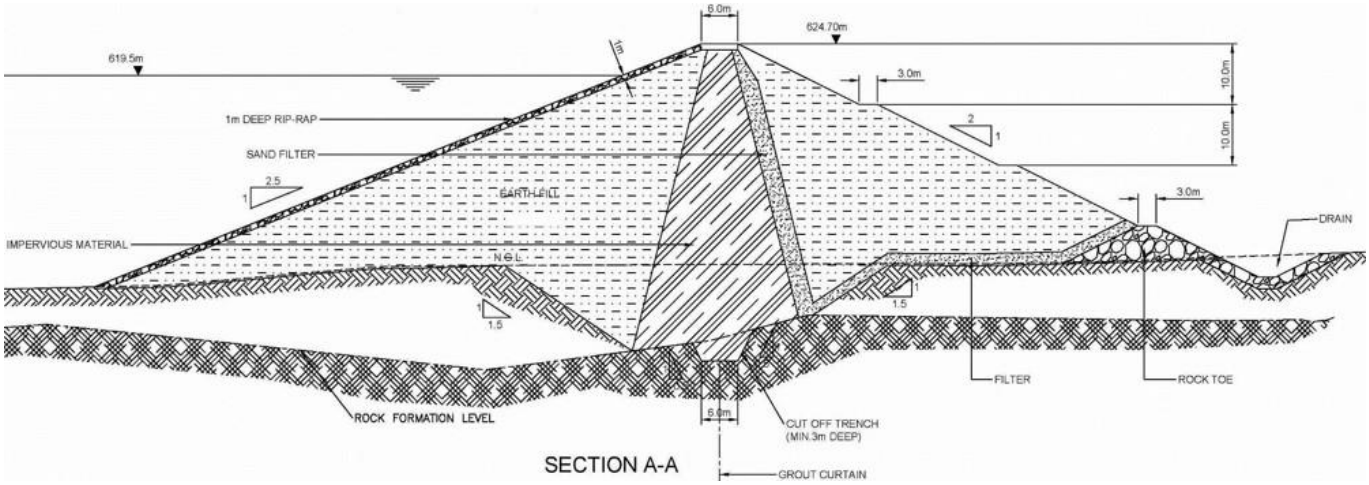

Figure 33: Cross section of Earthfill dam type

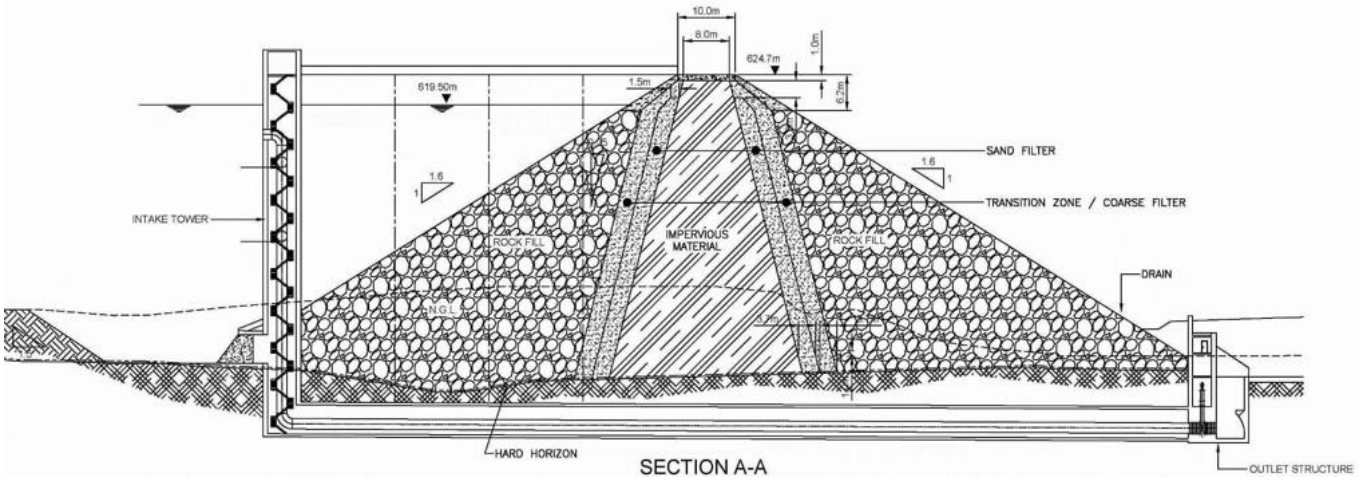

Figure 34: Cross section of Rockfill dam type

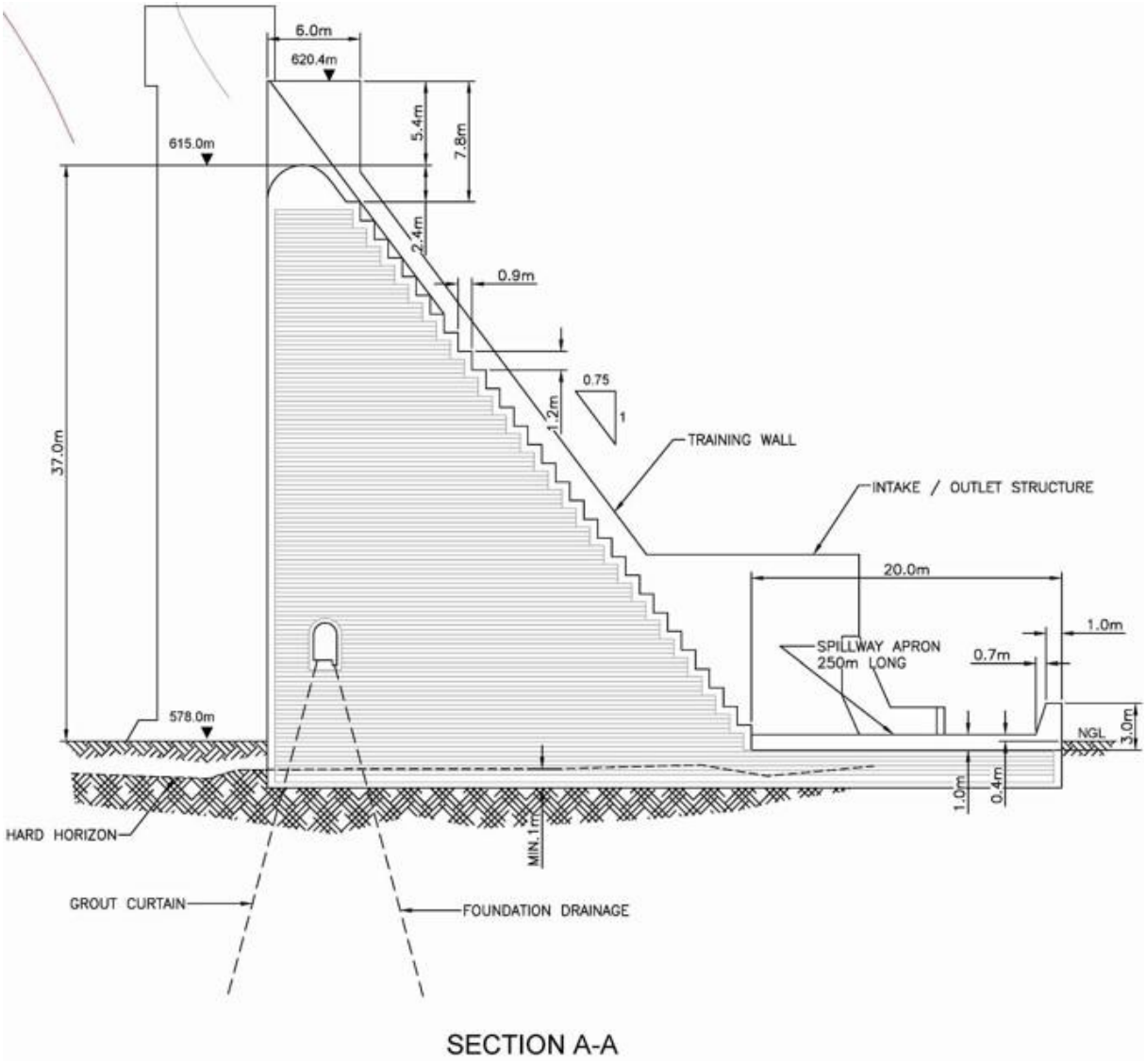

Figure 35: Cross section of Concrete dam type

10.4.2.1 Cost estimates

Cost estimates were based on escalated unit rates for all major construction items from recent DWS projects. These estimates were validated against resource-based costs and benchmarked against current rates for dam construction provided by a contractor. These rates were applied in the bills of quantities for each combination of size and type of dam. **Table 26** provides a summary of the estimated dam construction costs. **Figure 36** illustrates the cost breakdown by major BoQ item for the 1MAR dam options. The cost comparison is based on selected major material and construction quantities.

Table 26: Summary of estimated dam construction costs

DAM OPTIONS COSTS				
	0.5 MAR	1.0 MAR	1.5 MAR	2.0 MAR
Earthfill	R 1,100,609,905	R 1,065,266,128	R 1,032,278,740	R 997,119,004
Rockfill	R 1,182,934,223	R 1,157,190,750	R 1,128,368,899	R 1,093,577,285
Gravity Concrete	R 754,079,833	R 942,822,832	R 1,090,354,742	R 1,213,159,821
Composite	R 751,689,283	R 903,883,873	R 1,030,187,388	R 1,140,320,471

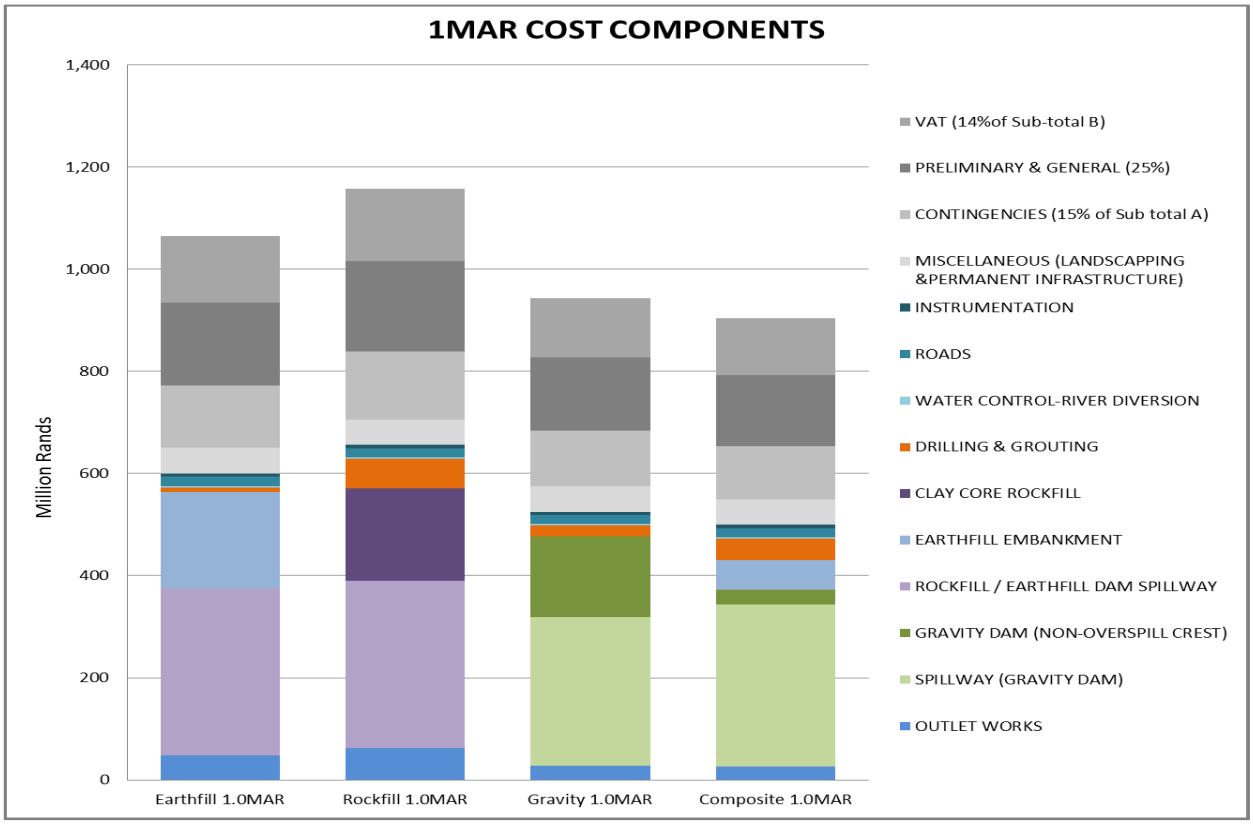

Figure 36: Cost Breakdown for 1 MAR dam options

10.4.2.2 Unit Reference Value

Using the DWS Unit Reference Value (URV) method for comparing projects over the project planning period (45 years) was followed. It is noted that varying the social discount rate does not impact on the outcome of the comparison of the different dam types for the same dam size. The calculated URVs for an 8% social discount rate are shown in the graph below.

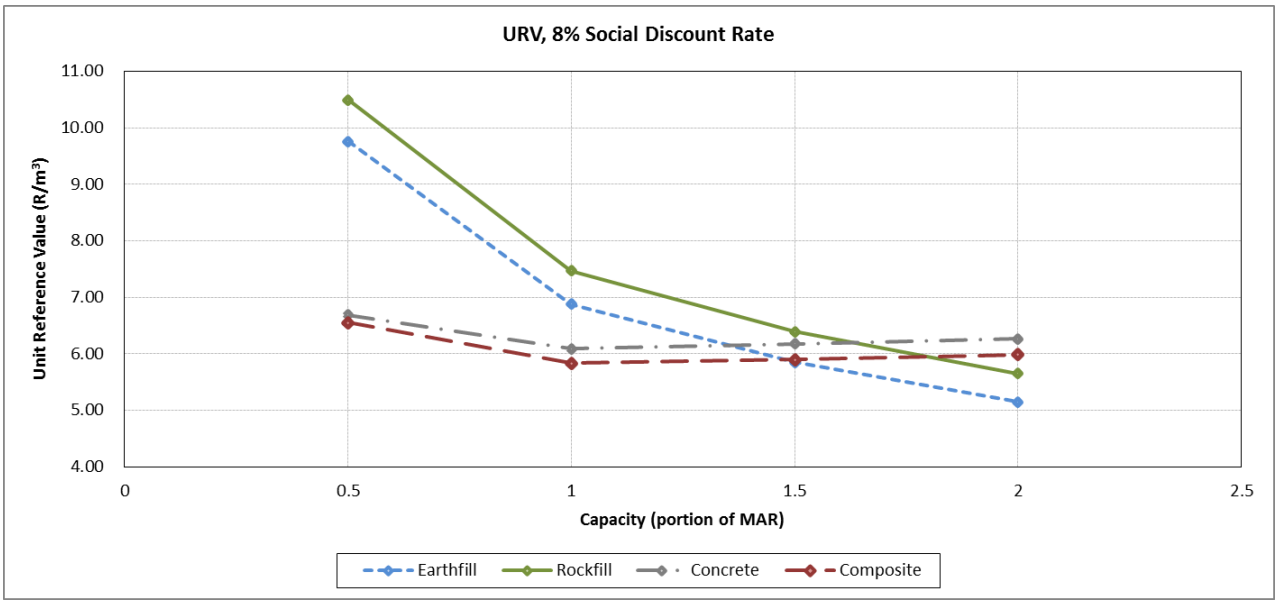

Figure 37: Unit Reference Value trends for 8% social discount rate

10.4.2.3 Conclusion and Recommendation

The URVs demonstrate that the construction costs of the earthfill and rockfill dams for sizes less than 1 MAR are very much warped by the huge cost of spillway excavations. Gravity dams are more cost effective on the basis of URVs up to 1,5 MAR storage.

Dam size

It is recommended that a 1 MAR dam is developed at the Foxwood Dam site:

- Impounding the Koonap River with a larger dam would impact on the natural ecological system of the river valley.
- The analysis indicates that the available yields from a new dam are approximately equivalent for 1 MAR storage and 1,5 MAR storage due to releases from dams with larger storage capacities being needed to supply high flow EWR's (1 MAR yield of 19,1 million m^3/annum vs 1,5 MAR yield of 19,8 million m^3/annum).
- Providing for the Reserve from natural spillages reduces opportunity for human error.
- Storage capacities larger than 1 MAR at Foxwood would prejudice further water resource development elsewhere in the catchment.

- It is very unlikely that there will be sufficient domestic or industrial water demand in a regional context to make full use of the yield of dam larger than 1 MAR.
- Providing for the development of a 1 250 ha irrigation scheme on irrigable land located on various properties, now in successful production by established commercial farmers, will be a very significant development and will provide the basis for other similar schemes.
- Since rural development, irrigated agriculture and agrarian reform are competencies located in other government departments, their participation in implementation of the envisaged scheme to provide opportunities for new farmers to enter this sector is imperative. These departments have been consulted in formulating the development proposals and they have participated in deliberations of the Project Steering Committee. No institutional models, with supporting financial arrangements, have so far been put forward as a basis for implementing the irrigation scheme as a government initiative.

Dam type

A 1 MAR **Composite Gravity Dam with Earthfill Embankment on the right flank** (see **Figure 38**) is recommended for development at the Foxwood Dam site with the following motivation:

- Lowest URV among the four options for a 1 MAR dam.
- The spillway energy dissipation is more complicated for a side-channel spillway option (refer to **Figure 39**), with significant changes of direction and the discharge of water into the river.
- No long term maintenance of a deep spillway excavation cut.
- Reduces the risks of material selection which include some elements of dispersive materials.
- The Probable Maximum Flood (PMF) (the largest flood that could conceivably occur at a particular location) and Recommended Design Flood (RDF) (the flood that the spillway must be able to pass with the required freeboard) are best catered for with a concrete gravity dam although preliminary estimates indicate that the PMF flood will predominate for the composite option.

- Outlet works are incorporated within the gravity structure to an elevation suitable for effective discharge into the river bed. The other options require free standing towers and tunnels at founding depths similar to the cut off foundation.

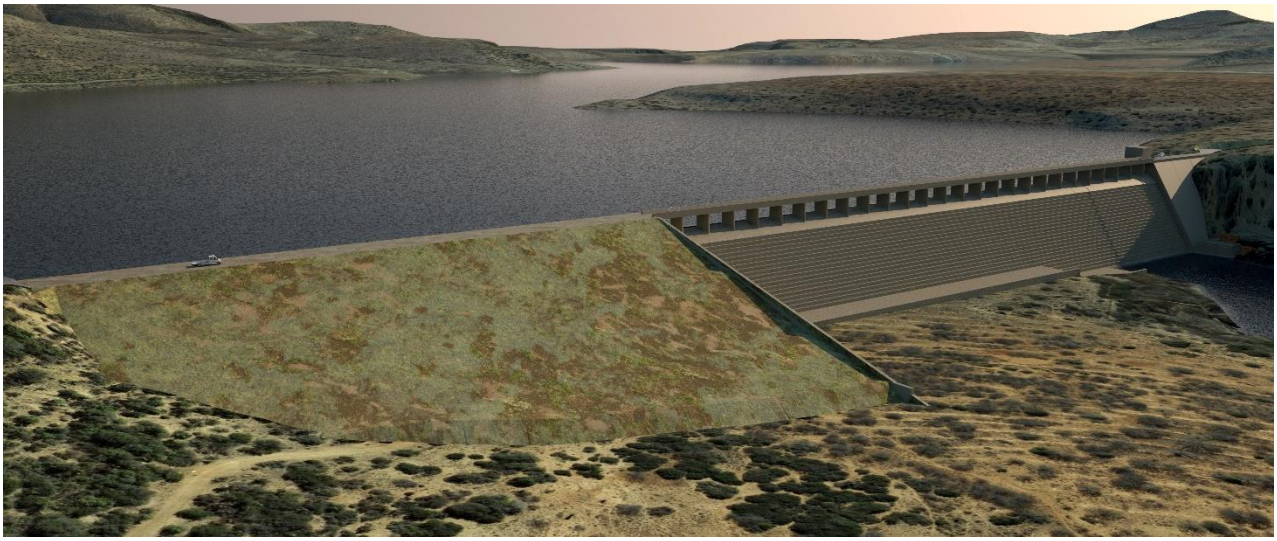

Figure 38: 3 dimensional view of Composite Gravity Dam with Earthfill Embankment on the right flank (preferred)

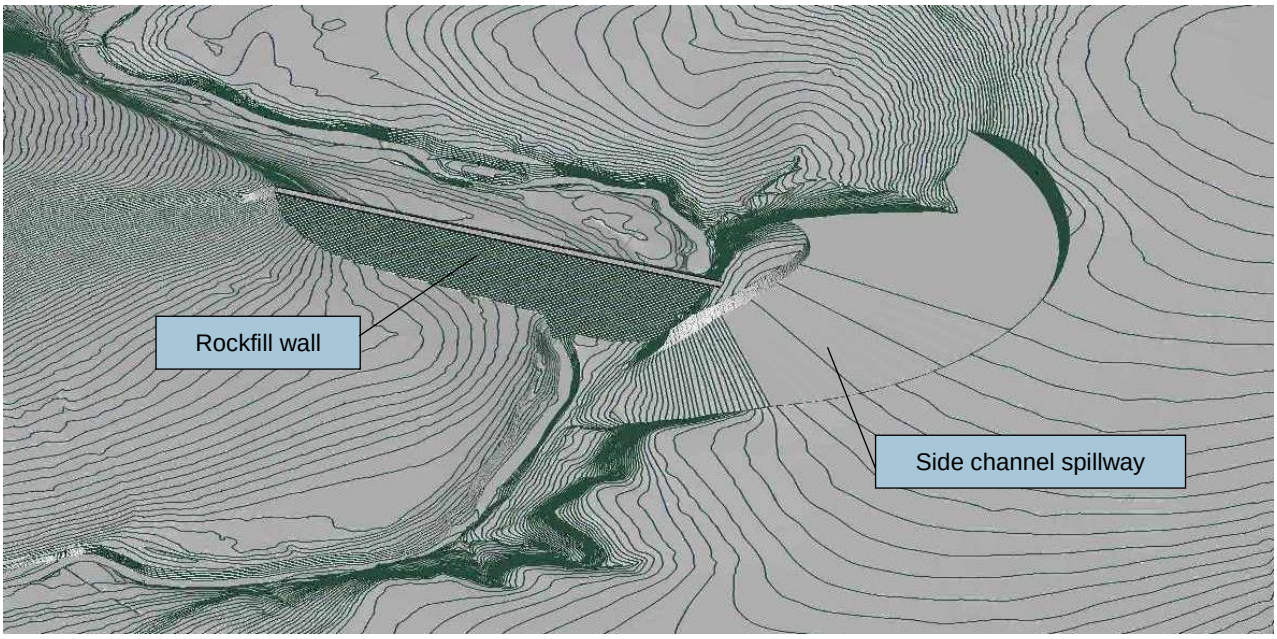

Figure 39: 3 dimensional view of Rockfill wall with side-channel spillway (not preferred)

10.4.3 Power Line Deviation Route

Alternative alignments for the deviation of the power line are discussed in **Section 9.5.6**.

10.4.4 Gauging Weir Location

The following key factors are generally considered when selecting a site for a gauging weir:

- Adequate foundation conditions;
- Steep slope downstream from the site and a gradual to flat slope upstream;
- A bend in the river, upstream and downstream, must be avoided to facilitate straight flowlines over the weir;
- The river banks must be stable; and
- Easy access to the site.

Alternative locations for the gauging weir are discussed in **Section 9.5.7**.

10.5 No-go

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the project is included in the evaluation of the alternatives.

As part of the Technical Feasibility Study an Economic Impact Assessment was undertaken of the construction and operation of the proposed dam and the potential for irrigated agriculture which is created by the dam.

A large portion of the yield from the multi-purpose dam at Foxwood would be supplied to establish an irrigated agriculture industry within the Koonap River valley and an independent study investigated the most suitable crops which could be grown in the valley based upon soil and slope conditions and a range of other agricultural conditions, including market conditions and prevailing prices. This economic impact study has worked closely with the model assumptions used to perform the agricultural analysis and used the various inputs and operating parameters to establish an economic base case and then evaluate the various scenarios postulated.

The impact of the potential irrigation scheme on the agriculture sector in Nxuba LM, relative to the baseline scenario where no irrigation scheme is developed, was carried out. An average growth of agricultural sector employment over fifteen years of 5.3% is

realised with 1 934 irrigated agriculture employment opportunities created, or 55% of the total of 3 488 employment opportunities project for Nxuba LM by the year 2028. An average growth of agricultural sector Gross Value Added (GVA) over fifteen years of 9.1% is realised with R 201 million irrigated agriculture economic activity created, or 82.1% of the total of R 245 million agricultural sector GVA for the local municipality by the year 2028.

Table 27 highlights the particular impact on employment and GVA that is projected to be stimulated from the modelled irrigation development resulting from the construction of Foxwood Dam.

Table 27: Economic impact of the Irrigation Development on Nxuba LM agricultural sector

Year - Irrigation Development Project			1	6	7	8	9	10
Year - Calendar	**2011**	**2013**	**2019**	**2024**	**2025**	**2026**	**2027**	**2028**
Employment								
Existing Agriculture Employment	1,313	1,339	1,422	1,494	1,509	1,524	1,539	1,555
Average Irrigation Development Jobs	0	0	677	1,160	1,354	1,547	1,740	1,934
Total Agriculture Jobs	1,313	1,339	2,099	2,654	2,863	3,071	3,279	3,489
Irrigation Development as % of total	0%	0%	32%	44%	47%	50%	53%	55%
Growth of total Agriculture Jobs		**2.0%**	**5.3%**	**4.2%**	**7.3%**	**6.8%**	**6.4%**	**6.0%**
Gross Value Added								
Existing Agriculture GVA (thousand Rands)	R 37,169	R 37,912	R 40,245	R 42,298	R 42,721	R 43,148	R 43,579	R 44,015
Average Irrigation Development GVA (thousand Rands)	R 0	R 0	R 70,448	R 120,767	R 140,895	R 161,023	R 181,151	R 201,279
Total Agriculture GVA (thousand Rands)	R 37,169	R 37,912	R 110,692	R 163,065	R 183,616	R 204,171	R 224,730	R 245,294
Irrigation Development as % of total (thousand Rands)	0%	0%	64%	74%	77%	79%	81%	82%
Growth of total Agriculture GVA		**2.0%**	**9.5%**	**6.4%**	**11.2%**	**10.1%**	**9.1%**	**8.4%**

Certain of the important economic benefits which are realized if the project proceeds include:

- Additional economic activity is stimulated in a region which needs it – R 520 m added in year 10 of the development,
- Additional employment opportunities are created – 1 940 sustainable direct employment opportunities and 2 892 peak direct employment opportunities during construction;
- Emerging and BEE farmers will be established and empowered with financial benefits and skills transfer;
- Food security in South Africa is enhanced;
- The economic return on the capital costs justify the project (related to irrigation development);
- The municipality will earn additional rates and charges from the project;
- The national fiscus will receive additional taxation which will ultimately justify the capital expenditure of the project – R 29 m in year 10;
- The potential exists for the further beneficiation of the agricultural product; and
- Potential exists for agricultural product export promotion.

The Economic Impact Assessment concluded that the ultimate economic benefits of the combined project, the Foxwood Dam and the irrigated agriculture are in favour of the project being implemented based on the prime objectives of socio-economic upliftment.

In contrast, should the proposed development of Foxwood Dam not go ahead, any potentially significant environmental issues associated with the project (refer to **Section 13**) 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.

11 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 Scoping exercise was conducted. It also 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 the project components and related activities. Where necessary, the regional context of the environmental features is also explained, with an ensuing focus on the local surrounding environment. More in-depth discussions on the receiving environment will be provided in the EIA Report, where the findings of the requisite specialist studies will be incorporated into the document.

A brief overview is also provided of the manner in which the environmental features may be affected (positively or negatively) by the proposed project during the project life-cycle. Significant environmental issues are discussed further in **Section 13**. These preliminary impacts are only discussed concisely on a qualitative level, as part of the Scoping phase. The EIA Report will provide a comprehensive evaluation of the potential impacts, and will quantify the effects to the environment based on the methodology presented in **Section 14**.

11.1 Land Use & Land Cover

Status Quo

An aerial view of the project components is provided in **Figure 40**.

The land cover is mapped in **Figure 41**. The study area is situated in a rural area except for the southern section of the Power Line Deviation Alignment B which passes the urbanised area of Bezuidenhoutville. The land cover is predominantly natural, with pockets of cultivated land along the Koonap River and Mankazana River.

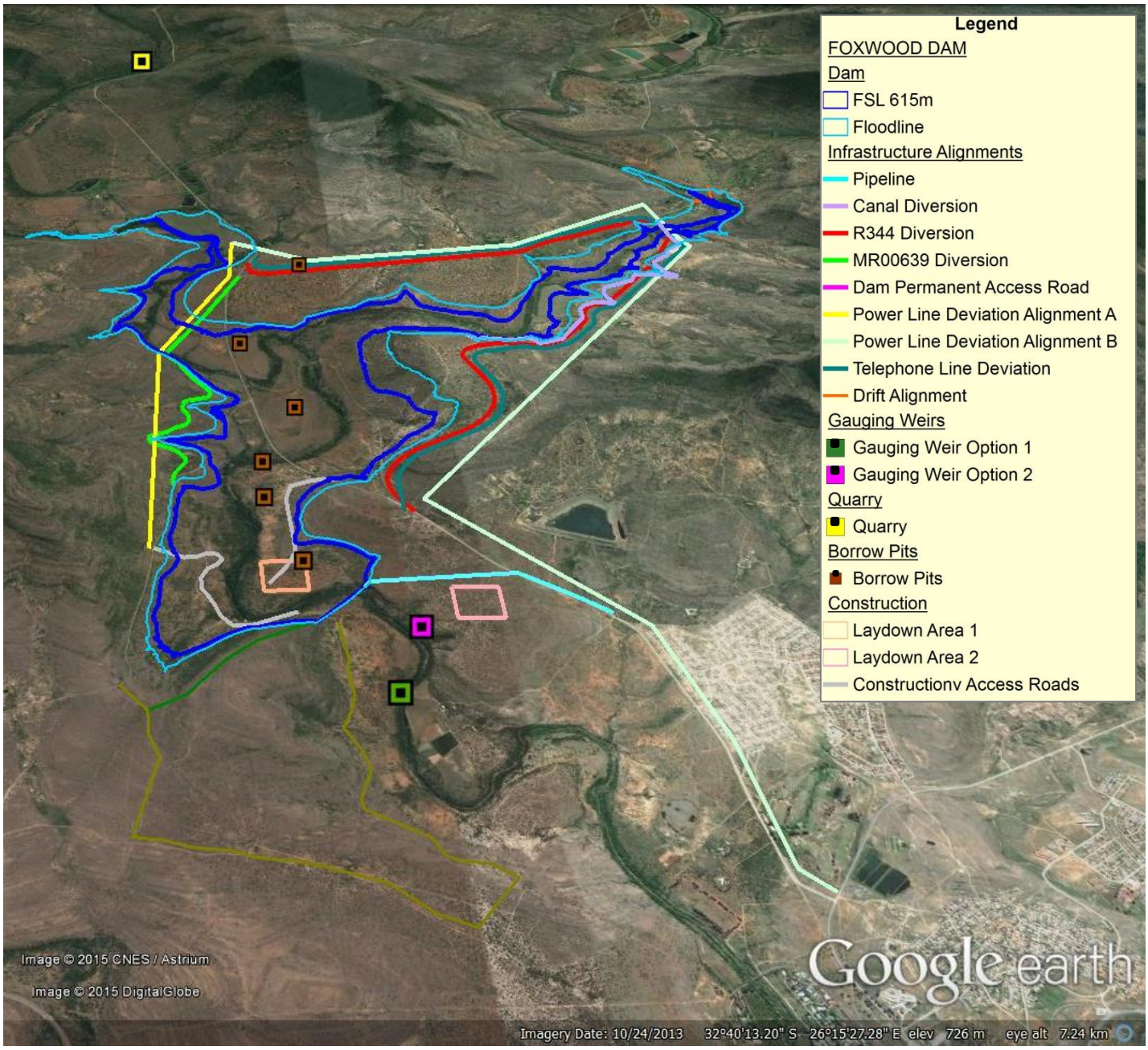

Figure 40: Arial view (Google Earth image) of project area

The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices, except for the land in the south-eastern part of the project footprint which is owned by the municipality.

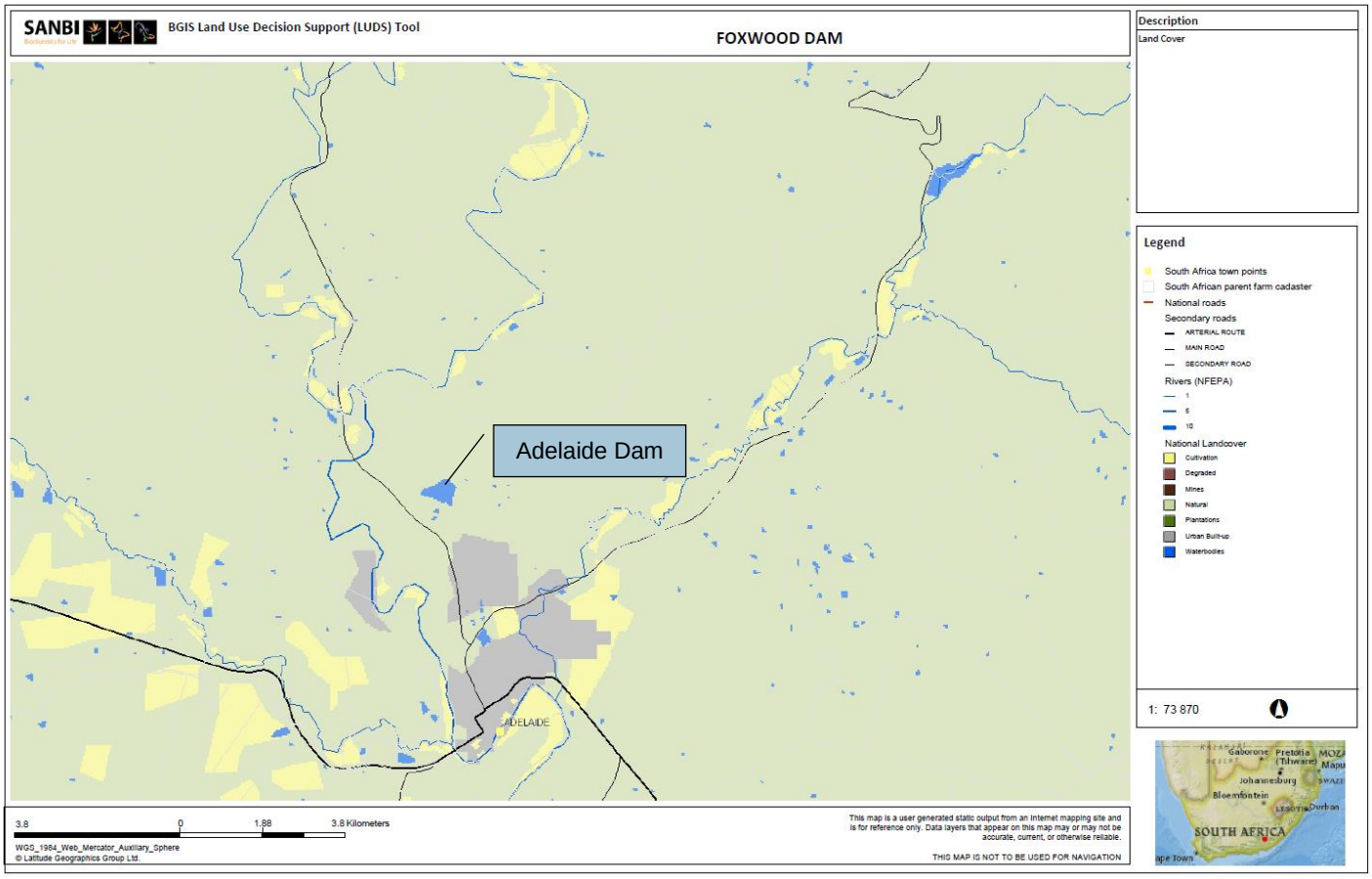

Figure 41: Land Cover (Source: BGIS LUDS Tool)

Potential Impacts / Implications

- Foxwood Dam will inundate land of approximately 463 ha, with accompanying loss of land used for agriculture and game farming.
- The purchase line includes cultivated land along the affected watercourses.
- Linear components of the project, such as the deviation of the R344, power line and telephone line will traverse cultivated land.
- Servitude restrictions (where relevant) to be considered for project components.
- Recreational use of Foxwood Dam will need to be established in consultation with the authorities, stakeholders and I&APs as part of a RMP process prior to the impoundment of the basin.
- Residential dwellings and buildings will be affected, particularly in the northern and north-eastern parts of the study area.
- No significant land use impacts associated with the gauging weir.

Specialist Study Triggered / Additional Investigations

No direct specialist studies associated with land use to be conducted. Indirect studies associated with the inundation of the land include Terrestrial Fauna and Flora Study, Heritage Impact Assessment, Agricultural Impact Assessment, Visual Impact Assessment and Socio-economic Impact Assessment.

The EMPr will contain measures to mitigate impacts to existing land uses.

11.2 Climate

Status Quo

11.2.1 General

Based on feedback from the South African Weather Services (SAWS) the nearest meteorological station is located in Fort Beaufort, EC. The information to follow was obtained from SAWS for this station.

The prevailing climate in Adelaide is known as a local steppe climate (semi-arid). The region is a convergence zone for warm, moist, subtropical air from the north, cooler, southern coastal winds and also the drier, hotter winds which originate in the arid interior of the country.

11.2.2 Temperature

Average daily maximum and minimum temperatures for the last fifteen years are shown in **Tables 28** and **29**, respectively. A summary follows:

Table 28: Average Daily Maximum Temperature (°C) – Fort Beaufort station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2000	27.9	28.9	26	24.1	21.1	23	22.8	25.1	24	25.5	25.5	28.9
2001	29.2	30.7	29.9	23	25.4	22.5	20.9	22.8	23.2	26.7	26.7	28.3
2002	30.3	31.1	31.3	28.4	24.3	20.6	21.2	22.2	22.5	26.3	27.7	29.4
2003	31.6	32.6	28	27	22.9	20.2	21.4	21.3	24.3	27	26.9	29.5
2004	30.3	29.8	27.5	26.4	25	22.7	20	23.6	22.5	26.8	30.4	30.3
2005	28.2	29.7	28.8	25.5	24.1	21.4	23.9	22.3	25.5	27.7	25.4	26.9
2006	30	29.9	28.8	25.6	20.9	21.7	22.1	20.6	23.4	23.3	25.7	26.3
2007	30	30.5	26.8	26.5	25.7	21.6	21.6	23.2	25.8	24.9	27.3	28.5

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2008	28.5	29	27.9	24.9	25.1	21	23.2	22.6	24.6	26.5	27.4	29.2
2009	29.7	28.9	29.4	27.7	24.1	20.2	21.3	22.8	24.6	24.5	28.3	28.7
2010	29.8	30.8	30.5	26.5	25.3	20.7	22.5	25.5	26	24.5	26.6	26.9
2011	29.3	31.9	29.8	24.2	21.3	18.6	18	21	24.1	25.2	25.2	27.5
2012	32	28.1	27.6	24.1	23.2	19.5	19.4	21.2	24.1	21.9	26.9	28.7
2013	28.9	30.4	29.1	24.5	23.2	21.7	21.1	23	24.7	25.4	26.6	26.8
2014	31.3	29.4	28.8	25.5	23.6	22	22.4	22.8	26	25.3	25.8	28
2015	31.8	27.4	28.8	23.3	24.0=							

Notes:
*** indicates data is missing or is not yet available in the current month
--- indicates that data is unavailable or was not requested
= indicates that the average is unreliable due to missing daily values

Table 29: Average Daily Minimum Temperature (°C) - Fort Beaufort station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2000	16.2	17.2	16.2	12.6	7.7	6.7	6.9	8.8	8.2	11.7	14	15.1
2001	15.1	15.7	16.4	13.4	10.3	7.7	5.3	8.1	9.9	13.5	14.9	15.7
2002	16.3	16	16.1	13.9	8.9	6.4	7	9.1	11.2	11.1	11.9	17
2003	16.8	18.8	15.2	14.7	10.1	6	4.9	5.8	8.1	11.4	13.8	14.4
2004	17.1	17.5	14.6	11.8	9.5	7.1	4.6	7.6	7.7	12.3	16.1	17.6
2005	17	17.5	15.4	11.7	10.3	4.5	6.2	6	9.6	10.8	13	12.9
2006	17.8	18.4	13.7	12.8	7.9	8	6.7	7.6	10.1	12.5	13.2	14.9
2007	16.7	17.2	14.1	12.2	9.3	6.8	5.1	6.6	10.1	11.3	12.5	15.5
2008	16.8	17.6	15.1	10.6	10.4	7	6.1	6.6	6.5	10.8	13.7	15.8
2009	16.8	16.8	14.9	12.8	9.4	7	7.4	7.7	8.3	12.3	13	14.5
2010	16.8	17.8	16.1	12.9	10.7	6.5	6.6	7.4	10	11.5	14	15.3
2011	17.2	19.4	17	11.8	9.7	6.7	4.4	6	8.9	11.2	12.2	14.7
2012	18	16.6	15.5	10.7	8.3	6.4	4.4	6.7	8	11	11.9	16.5
2013	15.9	15	14.2	10.3	8	5.3	6.8	5.7	6.6	10.8	12.6	15
2014	17.2	17.3	14.2	11	9	5.9	5.8	8.8	10.2	10.3	12.6	15.3
2015	16.1	14.9	15	10.9	9.1=							

Notes:
*** indicates data is missing or is not yet available in the current month
--- indicates that data is unavailable or was not requested
= indicates that the average is unreliable due to missing daily values

11.2.3 Precipitation

The monthly daily rainfall for the last ten years is shown in **Table 30**.

Table 30: Monthly Daily Rain (mm) - Fort Beaufort station

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2000	133.4	33.4	123.4=	114.8	2	8.8	1.4	0.8	75.2	28	87.4	32
2001	113.2	16.4	104.4	94	4.6	3.2	9.6	21.6	43.6	31.3	29.2	45.5
2002	68	14	47.4	19	2.8	20.6	34.2	84.8	71.2	10.2	24.2	80.6
2003	7.4	86.6	50.0=	28.2	56	2.2	4.2	12.8	4.6	39	26.1	17.6
2004	45	69.4	31.2	65.4	5.4	9	6.6	8.8	85.6	9.8	18.6	114.2
2005	41.4	41.4	42	49	21.8	2	4	45	2.8	26.8	127.2	29.6
2006	14	57.6	23.8	50	33.2	6	3.8	99.6	31.2	86.4	26.6	47.8
2007	45.4	26.4	98.8	17	5.2	21.2	7.4	13.6	3.2	34.8	27.8	81.2

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2008	56.2	70.6	46.8	30.2	3.8	8.2	0.4	29.6	3.8	6.8	45.2	41
2009	19	62.8	58.4	19	4.2	10.2	23.4	6	16.6	46.6	6.2	25
2010	102.4	33.8	9.4	25	2	19.4	2.2	4.2	8.4	34.2	46	44.4
2011	82.8	13.2	37.6	30	98.8	95.4	47.8	15.2	1.4	35.6	34.6	63.4
2012	78.2	81.2	80.8	14.8	8.6	24.4	25.8	13.4	11.8	74.4	7.8	77.8
2013	10.6	41.2	47.2	31.4	15.2	3.6	16.8	13.6	0.2	63.2	72.2	54.6
2014	46	70.6	18.8	88.4	5	1.6	0.2	4.8	17.6	33.8	76.6	41.2
2015	83.6	46	72.2	61	0.0=							

Notes:
*** indicates data is missing or is not yet available in the current month
--- indicates that data is unavailable or was not requested
= indicates that the average is unreliable due to missing daily values

11.2.4 Wind

The wind rose (succinct view of how wind speed and direction are typically distributed at a particular location) shown in **Figures 42** for a 10-year period (2003 – 2013) is interpreted as follows:

- Prevailing wind direction is from SE and SSE (blowing from these directions approximately 12% of the time);
- Highest percentage of winds blow with speeds of 0.5 – 2.5 m/s; and
- Winds were calm 9.8% of the time.

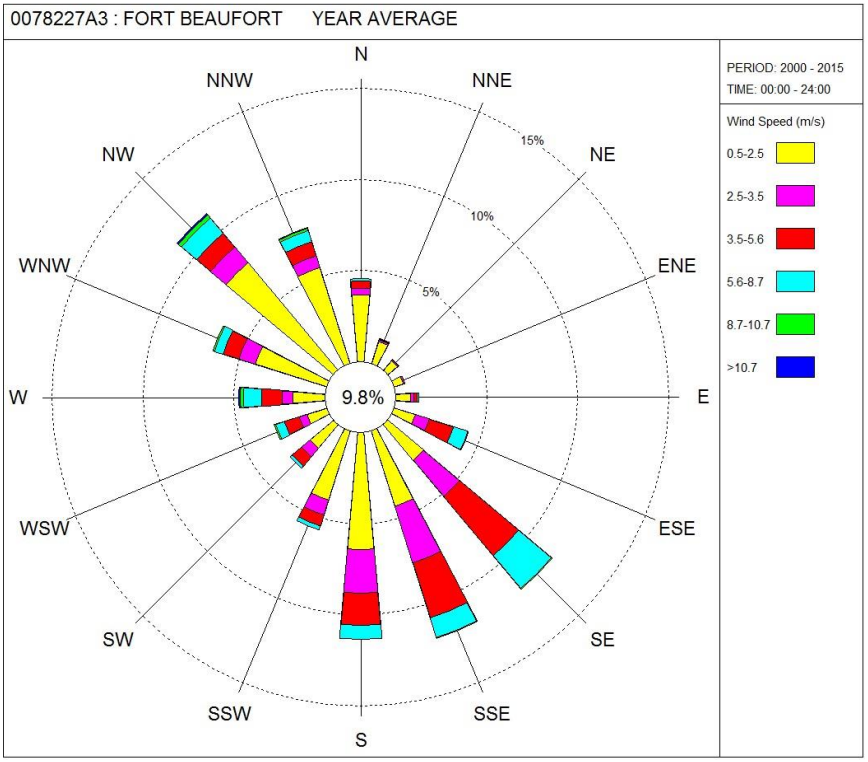

Figure 42: Wind rose for the Fort Beaufort station

11.2.5 Hydro-Meteorological Data

As part of the Technical Feasibility Study, hydro-meteorological data was analysed which involved the review of rainfall period (1920 to 2011), evaporation and streamflow data. This information was used in the rainfall runoff model and in the yield model for Foxwood Dam, which ultimately determined the final storage capacity of the impoundment.

Potential Impacts / Implications

Foxwood Dam will have a larger surface area than the original river channels on the Koonap and Mankazana Rivers that will become inundated. This will lead to an increase in evaporation.

Foxwood Dam may also cause potential changes in the micro-climate of the area surrounding the reservoir. Changes to the microclimate are the result of the changes to the energy balance due to the presence of the water body, which has greater heat capacity than the ground and absorbs greater latent heat because of the increase of evaporation. Although, in the EIA conducted for the Mooi-Mgeni River Transfer Scheme Phase 2, specialists were of the opinion that the proposed Spring Grove Dam (surface area of approximately 10.3 km^2) in the KZN Midlands would not likely have an impact on the microclimate of the area except for an approximate band of 100 m around the dam, and localised impacts could include changing local wind patterns and nocturnal temperature inversions (DWAF, 2009). A Kariba Dam Case Study provides evidence that a dam the size of Kariba (maximum surface area 5 577 km^2) did not have a significant impact on either the local or the regional climate. The prevailing local climate conditions also need to be taken into consideration.

The dam could contribute to greenhouse gas emissions, where inundated plant material that decays in an anaerobic environment will release methane and carbon dioxide.

Specialist Study Triggered / Additional Investigations

Further consideration of the potential impacts to the micro-climate and climate change associated with Foxwood Dam will be given during the EIA phase.

11.3 Geology

Status Quo

11.3.1 Geotechnical investigations

Geotechnical investigations were carried out as part of the Technical Feasibility Study. The Scope of Work comprised amongst others:

- Collate and assess all geotechnical information recovered from geological plans; topography sheets; and geohydrological maps;
- Review data from earlier geological investigations of 1962 which includes borehole drilling undertaken for the centreline and a proposed spillway on the left flank;
- Undertake a drilling investigation along the dam centreline, spillway sites and potential hard rock quarries;
- Undertake detailed geotechnical field investigations of the dam centreline and potential borrow pit sites;
- Meet geophysicists, from the Council of Geosciences, on site to demarcate lines along which seismic geophysics investigations have taken place; and
- Collate field data on completion of the field activities and compile the detailed geotechnical report.

Some of the key findings follow.

11.3.1.1 Geology

The dam site and reservoir basin is underlain by sedimentary rocks of the Balfour Formation; Adelaide Subgroup; Beaufort Group; Karoo Supergroup. Rocks consist mainly of grey mudstone and shale with subordinate grey and buff-coloured sandstone. An extract from the Council for Geoscience 1: 250 000 geological map: King William's Town Sheet 3226, of the dam site and surrounds, is presented as **Figure 43**.

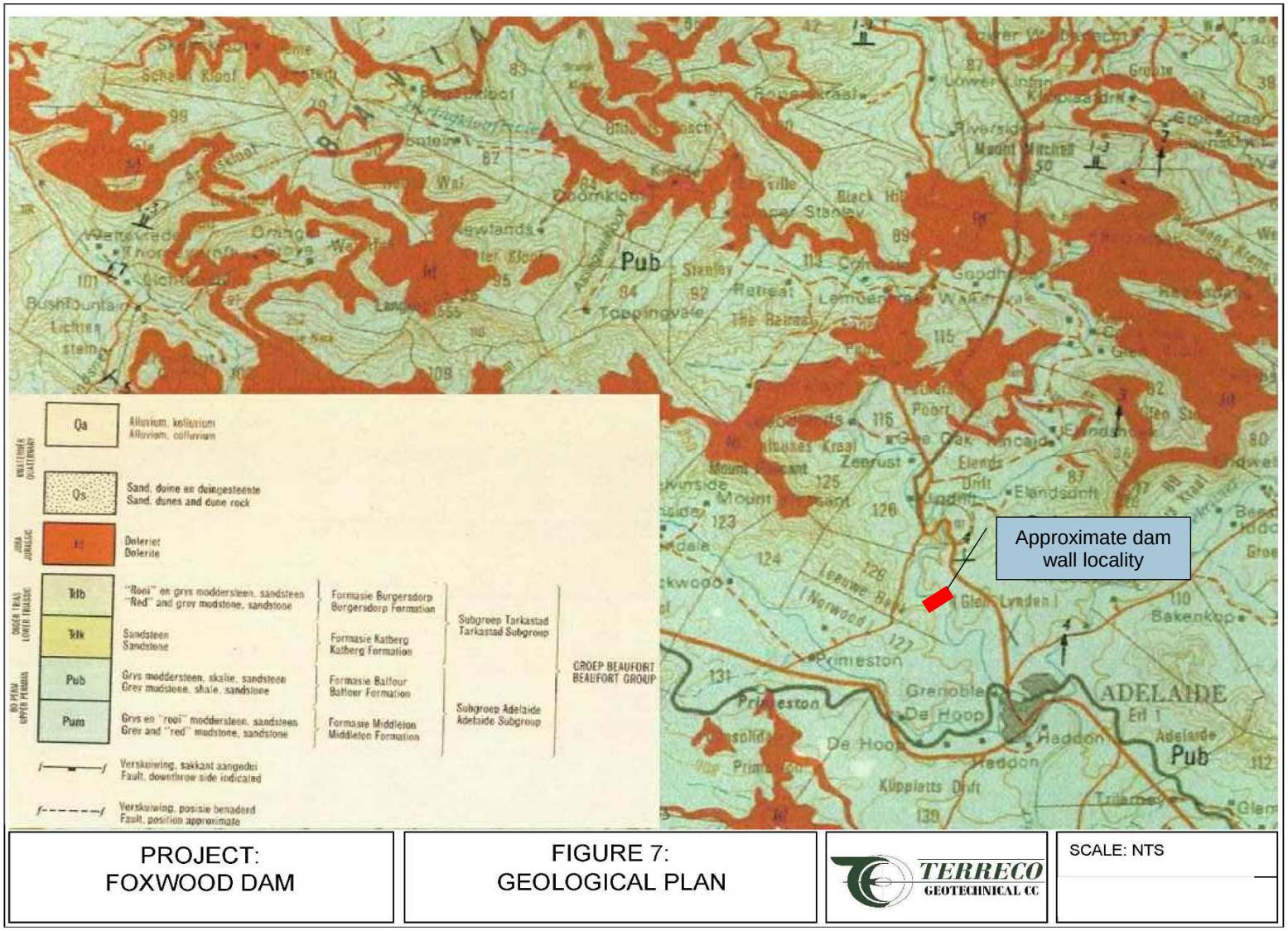

Figure 43: Geological map showing dam site

It is evident from the desk study and the geotechnical investigation that a significant amount (3,0m – 14,0m depth) of alluvial silt, sand and cobbles & boulders overly underlying competent mudstone and/ or siltstone rock. It is clear from the boreholes drilled that the rock immediately underlying the alluvial sediment is weathered to depths as great as 24,8m; in some cases highly weathered. The rock underlying weathered rock is only slightly weathered to unweathered and persists to the end of each borehole at an approximate depth of 30 m.

The mudrocks, comprising mostly olive and grey mudstone, with a high silt component at times approaching siltstone classification, alternate with sandstone units less than a metre up to tens of metres thick consisting of buff/grey, fine grained ultra-lithofeldspathic sandstone, in the approximate ratio 20% sandstone and 80% mudstone.

The sandstone displays flat-bedding, through cross-bedding and micro-crosslamination. Sandstone rock is mostly massive. Relatively rapid refusal of excavation will occur in areas underlain by slightly weathered or unweathered sandstone or siltstone. Sandstone is a much hardier rock and is less prone to weathering on exposure than mudstone is.

The mudstone is poorly stratified or massive. Near-surface rock generally comprises relatively softer or medium hard rock which quickly hardens with depth to rock that is hard and difficult to excavate. Mudstone undergoes differential weathering on exposure and rapidly fragments into angular pebble to cobble sized rock rubble.

Post-Karoo dolerite occurs in the area as large sheets; sills and dykes. Dolerite deposits are extensive starting approximately 5 km north of the dam site. In its unweathered state dolerite is a dark grey, hard, hypabyssal igneous rock intruded into the host sedimentary rocks. No dolerite was encountered in any of the boreholes drilled along the centreline or spillway, however, boreholes were drilled in dolerite at the target quarry site, Q1, some 5 km distance from the dam itself

along the R344 gravel road. Given its rather erratic occurrence dolerite can be expected to occur on a localised scale.

Seismic geophysics conducted at site revealed numerous palaeochannels situated in the mudstone bedrock below the dam centreline and borrow sites C6, D1 and D2. These palaeochannels are mostly aligned parallel to the current Koonap River channel and are inferred as old tributaries that would have once flowed into the river. An inferred fault plane was observed north of the left flank spillway and partially relates to closely to widely jointed sandstone retrieved from boreholes drilled at the site. The geological plan shows no indication of faulting, however, localised faulting is not uncommon and should be expected.

A description of the dam site follows.

Left Flank

The left flank (**Figure 44**) is characterised by a steep sandstone scarp, or cliff, overlying a gentler lower slope of exposed mudstone, followed lower down by a pediment of sandstone fragments combined with alluvial detritus overlying mudstone.

Figure 44: Left flank slope – steep scarp

Central and lower parts of the flank slope consist of mudstone which has disintegrated to some extent over time. This has resulted in undermining of the sandstone capping resulting in sandstone debris - both small fragments and large blocks – forming scree talus on the lower parts of both abutment slopes.

The Left Flank of the dam is underlain by a layer of colluvium and near-surface weathered rock overlying unweathered rock at depths less than 2 m.

River Section

The wide river section (**Figure 45**) has a gentle rise from the river channel on the left side towards higher ground on the right flank and is flanked immediately by the steep left ridge of the left flank.

The river section comprises a thick layer of alluvium overlying slightly to unweathered mudstone/ siltstone.

Figure 45: River section

Right Flank

The right flank (**Figure 46**) is not as steep as the left and has a greater proportion of slope debris or talus. The sandstone capping is prominent at the top of the flank but most of the central and lower slope geology is concealed by a layer of colluvium; bush and grass.

The Right Flank of the dam is underlain by a layer of colluvium and near-surface weathered rock with underlying unweathered rock less than 5 m from surface in places.

Figure 46: Right flank

11.3.1.2 Seismicity

There are two areas of seismicity that need to be investigated to determine the likelihood, or otherwise, of seismic risk for dam reservoirs. The first is reservoir-induced seismicity (RIS) whereby the additional hydrostatic pressure of reservoir impoundment triggers a seismic or several seismic events, and the second is to undertake a seismic hazard evaluation as based on the predicted peak ground acceleration as determined from seismic history and tectonic stability of a particular area.

Reservoir Induced Seismicity Risk Appraisal

Literature survey research indicates that it is well established that *large* dams can trigger earthquakes. As with most aspects of seismology, the actual mechanisms of RIS are not well understood, and it is impossible to predict accurately which dams will induce earthquakes or how strong the tremors are likely to be. Most cases have been observed for dams over 100 metres high – but even dams half those heights are also believed to have induced quakes. Reservoirs can both increase the frequency of earthquakes in areas of already high seismic activity and cause earthquakes to happen in areas previously thought to be seismically inactive.

The above is a significant item for this project since the height of the Foxwood Dam is well short of the description of large dams and therefore probably unlikely to promote any RIS activity.

The most widely accepted explanation of how dams cause earthquakes is related to the extra water pressure created in the micro-cracks; joints and fissures in the rock under and near a reservoir. When the pressure of the water in the rocks increases, it acts to lubricate faults which are already under tectonic strain, but previously prevented from slipping by the friction within the rockmass surfaces. With added pressure and fault lubrication the rockmass shifts with resultant earthquake or seismic results.

*This is the second significant item for the project which indicates no geological faulting (see **Figure 43**) in the Foxwood Dam reservoir basin.*

The extra *excess* water or hydrostatic pressure created by vast deep reservoirs, and the reaction of the rockmass to deep moisture lubrication and resultant movements along older fault lines already under tectonic strain, appears to be the most accepted explanation for the seismic activity.

Internationally there appear to be no known or recorded examples of RIS for smaller dams less than 30m in height. Even though the Foxwood Dam will exceed 30m in height (~48.5m) it appears unlikely that it - because of its relatively small size in comparison to large dams (>100m) and lack of basin geological faults – could be capable of inducing seismic activity. Nevertheless, as the dam reaches half the height of large dams; it should not be totally exempt from RIS activity.

Seismic Hazard Evaluation

Foxwood Dam is located on the African Tectonic Plate which, in comparison with other tectonic plates, is stable with low movement - especially so when compared to other inter-plate obduction or subduction zones. Much of the Africa Plate and specifically the South African area can be considered to be a zone of 'low tectonic activity'. This does not mean that this particular area is totally exempt of any seismic activity but rather that the risk is relatively lower.

Seismic Hazard is represented by the peak ground acceleration of any particular area: the higher the value the greater the risk of seismic activity. The *probable* ground acceleration for a particular area as based on a history of earthquake activity in that area. Such evaluation has already been undertaken for most parts of southern Africa. The higher seismically active areas are located in the gold mining zones of Gauteng and the Free State where seismic events are triggered, on occasion, through deep mining. Other higher category areas include the Ceres area of the Western Cape; southern Namibia (hot spot); parts of Lesotho (Katse Dam), and the southern and northern borders of KwaZulu Natal. A Seismic Hazard Evaluation of South Africa, as conducted by the Council of Geosciences, indicates a seismic hazard subdivision into zones varying in 'g' value ranging from less than 0,04g to a maximum of 0,24g.

The EC Province has a general *low* acceleration value of 0,04g with the zone around Adelaide being approximately of 0.06g. This is a particularly low 'g' value which indicates that the Foxwood Dam area is in a low risk seismic area and therefore has a *low seismic hazard risk* potential. This is supported by the

UNESCO (2007) Earthquake Risk in Africa assessment where this area falls into the lower earthquake intensity modified Mercalli Scale of I – V.

Potential Impacts / Implications

The construction of Foxwood Dam will require suitable geological foundation conditions, which were confirmed through the geotechnical studies.

The impounding of water adds a significant weight to the area and weak geological stresses could be exacerbated. The geotechnical investigations found that the dam is unlikely to promote any RIS activity due to it relatively small size and lack of basin geological faults. In addition, the Foxwood Dam area is in a low risk seismic area and therefore has a low seismic hazard risk potential.

Construction material will need to be sourced from a nearby quarry and borrow areas. Such extraction could result in a variety of environmental impacts including visual impacts, loss of habitat, noise and dust to local communities and wildlife. Where possible, the borrow areas are situated within the dam basin to manage the permanent impacts. Refer to discussion under **Section 9.5.8**.

Other important considerations from a geological perspective for the EIA phase include *inter alia* blasting and the management of spoil material that will generated during the construction phase.

Specialist Study Triggered / Additional Investigations

As mentioned, geotechnical investigations were carried out as part of the Technical Feasibility Study. The results of the investigation indicate that the site is suitable for the construction of an earth or rockfill dam. Additional findings from the geotechnical studies will be included in the EIA Report, as necessary.

11.4 Soils

Status Quo

The soil classes in the greater area is shown in **Figure 47**.

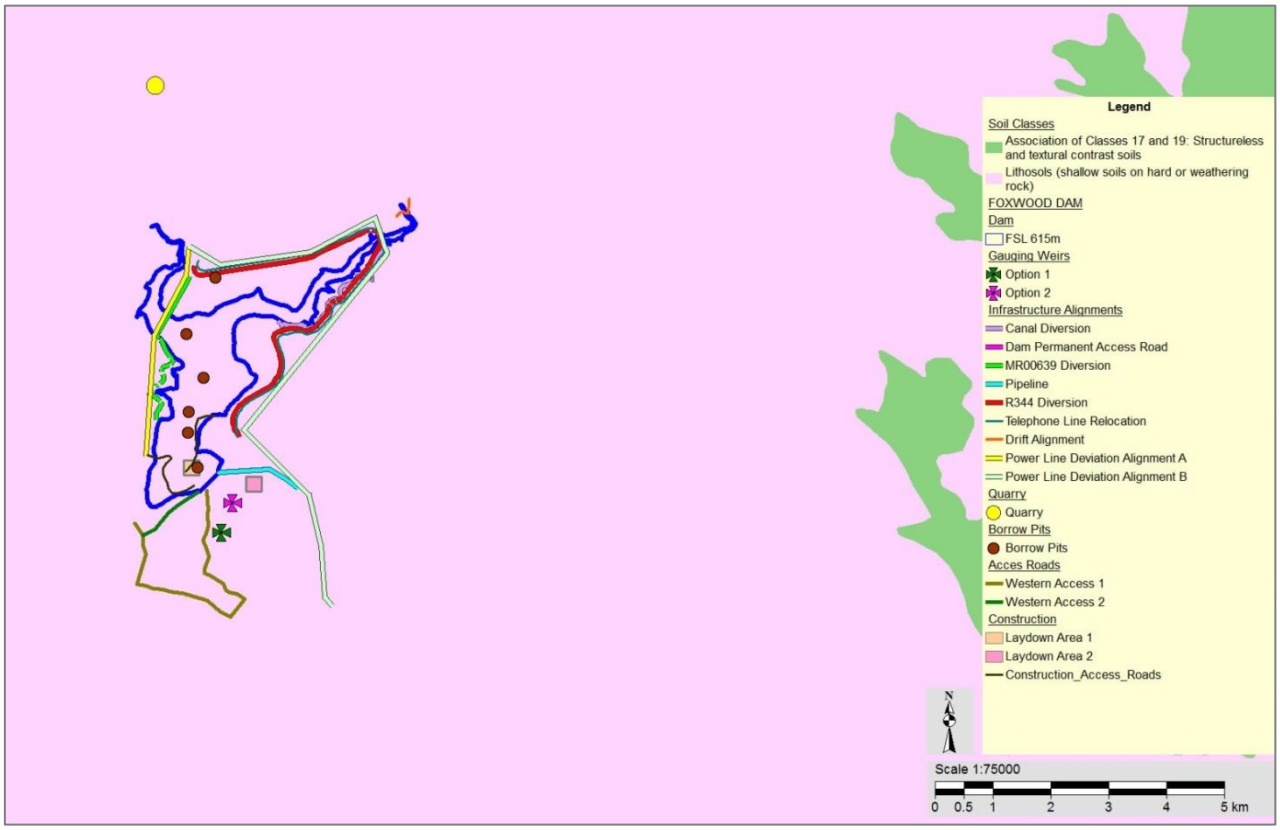

Figure 47: Soil Classes

According to the findings of the geotechnical investigations, the dam site is underlain by a relatively thick mantle of transported and residual soils overlying succession mudstone, siltstone and intercalated sandstone horizons of the Balfour Formation of the Beaufort Group. The valley floors have a covering of colluvial and alluvial soils which vary in depth and type as determined by factors such as geological parentage; distance from source; river gradient, and deposition period.

Despite grazing, cultivation and other forms of historic land disturbances, soil erosion was not evident during the site visit (see photographs in **Figure 48**). Although, the area had experienced a rainfall event in the period leading up to the site visit, which would have promoted vegetative growth.

Figure 48: Surface conditions in central part of basin (top) and north-eastern part of study area (bottom)

Potential Impacts / Implications

A dam can hold back the sediment load normally found in the river flow, which deprives the downstream system. In order to make up for the sediments, the downstream water erodes its channels and banks.

During the construction phase large areas will be cleared of vegetation, which may lead to soil erosion. Soil could also be contaminated through inadequate storage and handling of hazardous materials, spillages from equipment and plant and poor management of waste and wastewater.

Where construction activities will take place in terrain that is characterised by a steep gradient (e.g. left and right flank of dam wall) as well as at instream works erosion could

take place in the absence of suitable stormwater management and stabilisation of the cut and fill areas.

Specialist Study Triggered / Additional Investigations

Geotechnical investigations were carried out as part of the Technical Feasibility Study. Additional findings will be included in the EIA Report, as necessary.

The EMPr will contain measures to mitigate against impacts to soil, for example the management of topsoil, preventing soil contamination during construction, etc.

11.5 Geohydrology

Status Quo

11.5.1 General

According to the Reconciliation Strategy for Adelaide (DWA, 2010), the town of Adelaide is underlain by the Adelaide Subgroup within the Beaufort Group of the Karoo Supergroup. The Adelaide Subgroup consists of grey and brownish-red mudstone (80%); interspersed with fine-grained sandstone layers (20%). These form shallow inter-granular and weathered, fractured-rock aquifers. Dolerite intrusions are common in the area and the contact to a large inclined sill is present 2-3 km north-west, north and north-east of the town. The contact zone of the intrusion is often highly fractured in the host rock (i.e. the Adelaide Subgroup) making this zone the preferred groundwater target.

11.5.2 Groundwater Assessment

A component of the Foxwood Dam Technical Feasibility Study included a groundwater assessment, which comprised the following:

1. Accessing existing information including borehole locations and yields;
2. Assessing the assured groundwater yield of the area;
3. Identifying potential groundwater targets within an economic radius of the town;
4. Identifying potential borehole sites on the favourable drilling targets and estimating their individual and collective yields; and

5. Assessing the groundwater quality of the area.

As part of the groundwater assessment, two study areas were delineated using topographic and quaternary catchment boundaries. The first area, “Groundwater Area 1”, is the largest area and includes the mountain range to the north-west of the town, and all lineaments surrounding the town. The second area, “Groundwater Area 2”, is a much smaller area that incorporates the mountain range to the north-west of town and includes the area around the Koonap River upstream of the proposed dam site.

Information gathered from the National Groundwater Archive (NGA) database and the SRK report revealed a total of 62 boreholes lie within the large delineated polygon, “Groundwater Area 1”. The positions of the boreholes are shown in **Figure 49**.

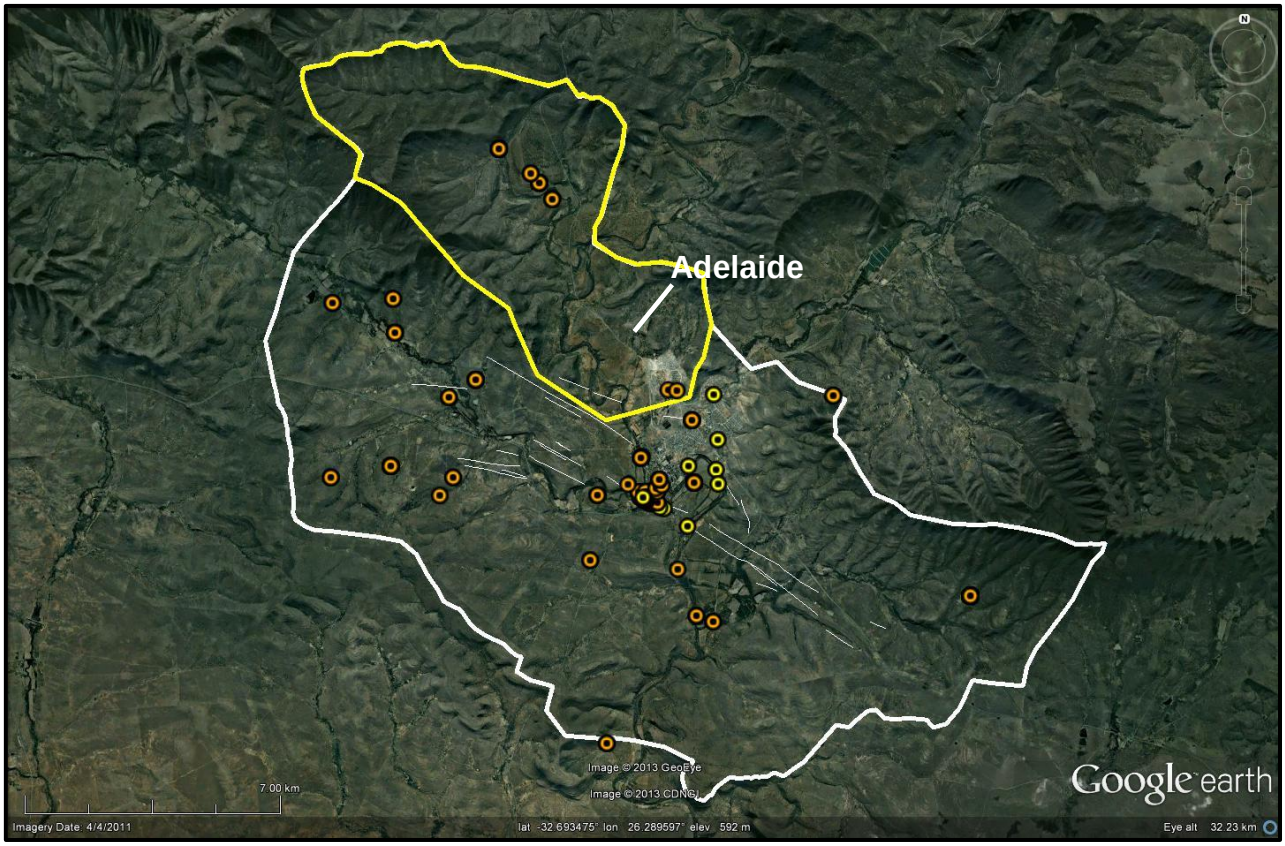

Figure 49: NGA boreholes (orange) and SRK boreholes (yellow) with lineaments as white lines

In general, the groundwater assessment found that the groundwater potential is limited by the low-permeability mudstones that dominate this area. For this reason, individual

borehole yields are generally low, and many would be required to obtain the yields needed to support the town's future requirements. The groundwater quality is also poor in places and would require desalination or dilution with surface water in order for it to be suitable for domestic purposes. While groundwater may not appear favourable as the first choice for bulk supplies, it can provide a reliable back-up in times of emergencies such as droughts. The low permeability of the mudstones means that groundwater cannot "flow away", and thus will be a reliable resource even during severe droughts so long as borehole pumping rates are optimally set for each borehole.

It is noted that further development of groundwater resources is identified within the National Water Strategy 2 as a key intervention in the development of water resources throughout South Africa.

11.5.3 Geotechnical Investigations

The geotechnical investigations found the following:

- Water Rest Levels (WRLs) have been measured at all borehole localities indicating that in most instances the natural WRL is situated in the weathered mudstone rockhead. The levels vary per borehole and show a general trend that follows the shape of the river valley i.e. WRL's are elevated closer to the flanks and are more depressed closer to the riverbed. It is evident that the mudstone acts as an impermeable layer onto which water seepage through the unconsolidated alluvial sediments accumulates.
- It should be noted that as a general rule perched groundwater can be expected to occur at the soil-rock boundary or interface. Groundwater can be expected to proliferate during or after the wet season of rainfall events.

Potential Impacts / Implications

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 Foxwood Dam was considered during the geotechnical investigations when assessing the foundation conditions for the dam.

Specialist Study Triggered / Additional Investigations

Groundwater assessment and geotechnical study undertaken as part of the Technical Feasibility Study.

Further geotechnical investigations will be undertaken during the design phase. This investigation would result in more information to evaluate the geohydrological conditions.

The EIA phase will investigate potential impacts to groundwater (e.g. pollution during construction, blasting) and suitable mitigation measures will be identified to manage these impacts.

11.6 Topography

Status Quo

The Koonap and Mankazana Rivers rise on the southern slopes of the Winterberg and flow through mountainous terrain. South of the town of Adelaide mote gentle terrain is encountered, comprising small hills, separated by dry river courses and lightly wooded savannah grasslands

The dam site is located in a near-symmetrical portion of the Koonap River valley as orientated across a wide centreline approaching 500m.

The relief map is shown in **Figure 50**. The terrain morphology of the project area is classified as low mountains.

The 20m contour intervals are shown in **Figure 51**. The highest point in the project area is approximately along the central portion of the power line deviation alignment B, where the elevation is approximately 700 masl (metres above sea level).

Figure 50: Relief Map

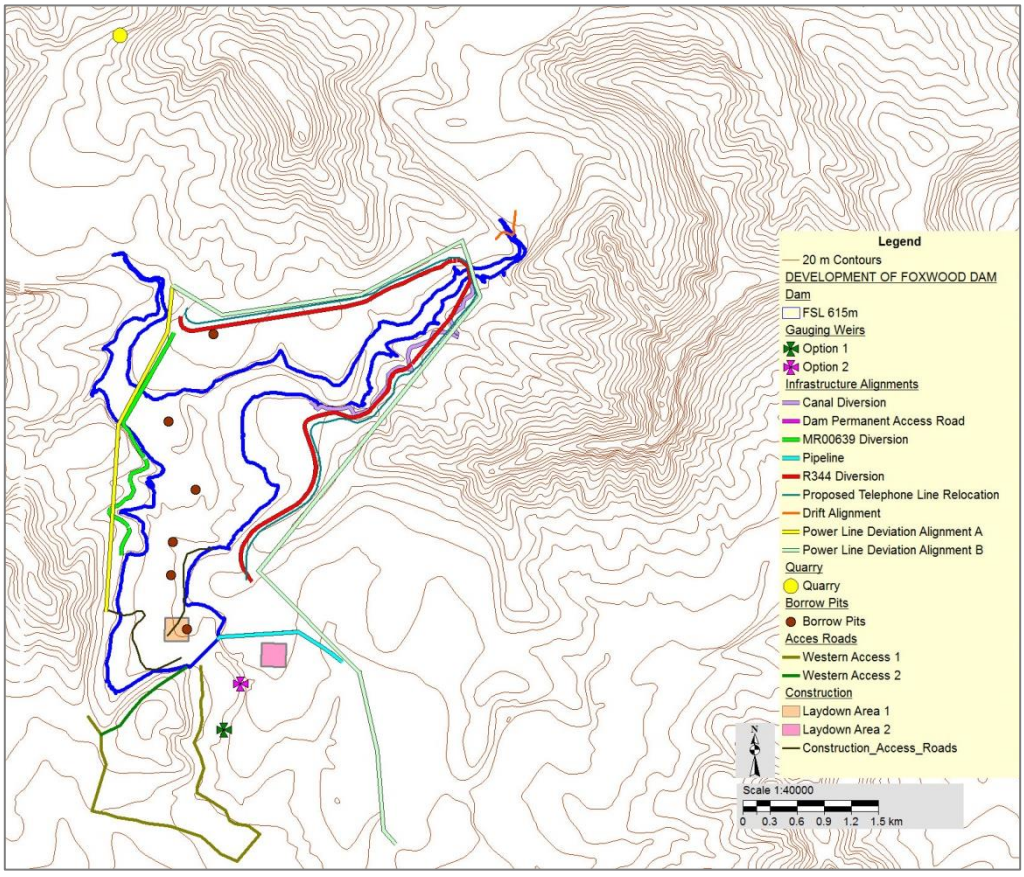

Figure 51: 20 m Contours

Potential Impacts / Implications

Apart from weir structures, the flow in the Koonap and Mankazana Rivers is unregulated and the proposed Foxwood Dam will be the first impoundment. Upstream of the dam wall these watercourses will change from river valleys to reservoirs, which will alter these topographical features.

The topography provides a picturesque backdrop to the project area. The project activities associated with the construction phase as well as the permanent infrastructure could impact on the visual quality of the local environment (refer to further discussion on this matter contained in **Section 11.19**).

Specialist Study Triggered / Additional Investigations

Visual Impact Assessment to assess impact associated with the building of the infrastructure.

11.7 Surface Water

11.7.1 Hydrology

Status Quo

The Koonap River has a catchment area of 3 334 km^2 (shown in **Figure 52**) and lies within the Fish to Tsitsikamma Water Management Area (WMA). The headwaters of the Koonap River are in the Winterberg Mountains from which it flows southwards past the town of Adelaide. The Koonap River is a tributary of the Great Fish River. The river is situated in the quaternary catchments Q92A to Q92G.

The natural Mean Annual Runoff (MAR) of the Koonap River for the period 1920 to 2011 is 79,6 million m³/a. The runoff ranges from 75 mm in Q92A1 in the Winterberg Mountains to 7 mm in the dry Enyara (Q92F) River catchment. The average runoff from the Koonap catchment is 24 mm.

Currently there are no major reservoirs in the Koonap River catchment. There are several small reservoirs, off-channel storage dams and farm dams that are used for domestic (Adelaide Dam and Andrew Turpin Dam), irrigation and livestock water requirements. Storage dams impact the hydrological behaviour of available water resources in a catchment by virtue of the storage capability provided by reservoirs and weirs, which have the benefit of increasing the assurance of supply to water users.

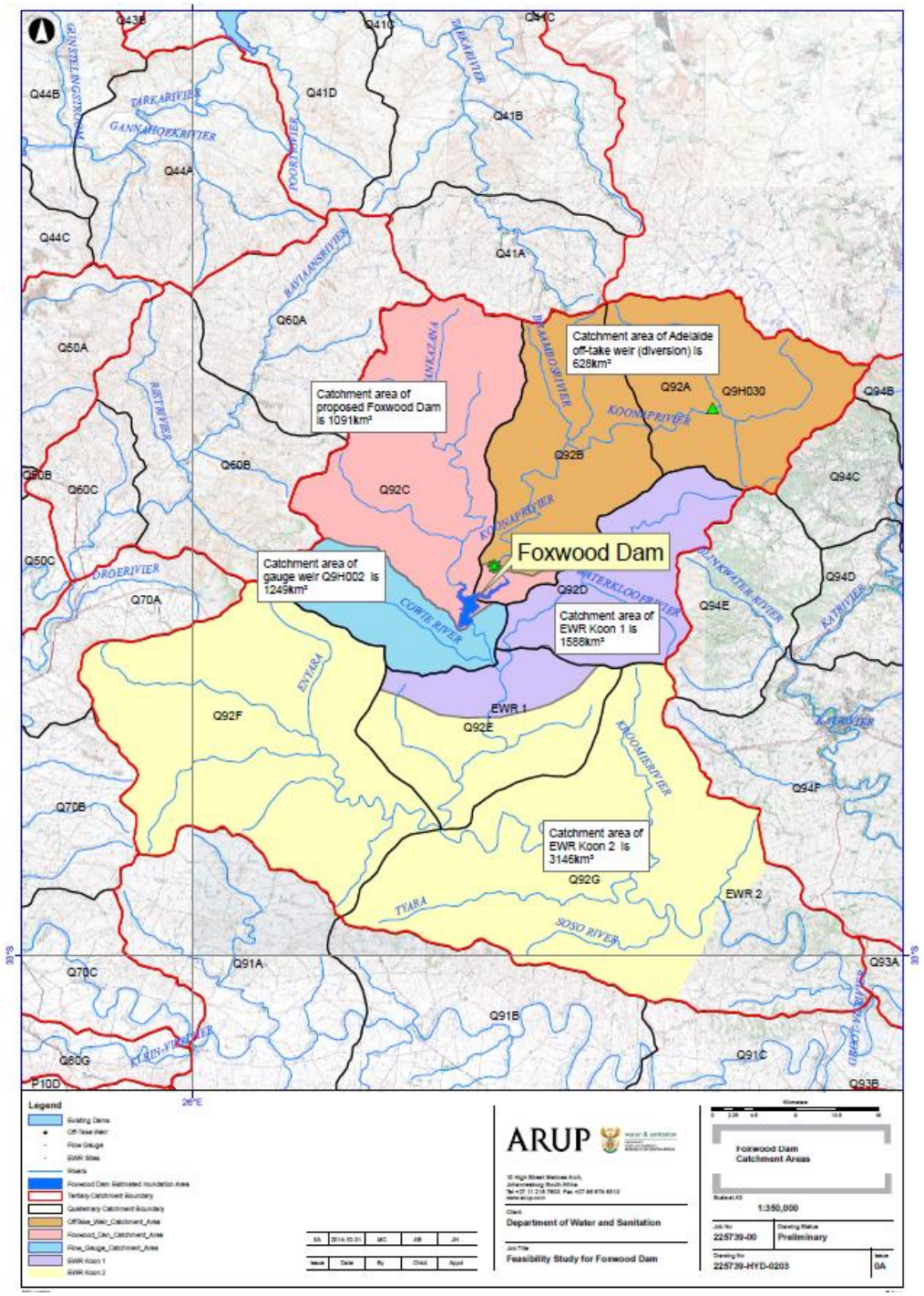

Figure 52: Foxwood Dam Catchment Areas

As part of the Technical Feasibility Study, hydrological and yield analyses were undertaken to assess the impact of current development levels on the availability and reliability of water supply to users in the Koonap River catchment. The following tasks were undertaken as part of the water resources assessment:

- Data collection;
- Land-use assessment;
- Water requirements and returns flows;
- Hydrological analysis of the Koonap River catchment; and
- Yield Analysis at Foxwood Dam site.

The long term yield of Foxwood Dam, which makes provision for EWR, is shown in **Figure 53**.

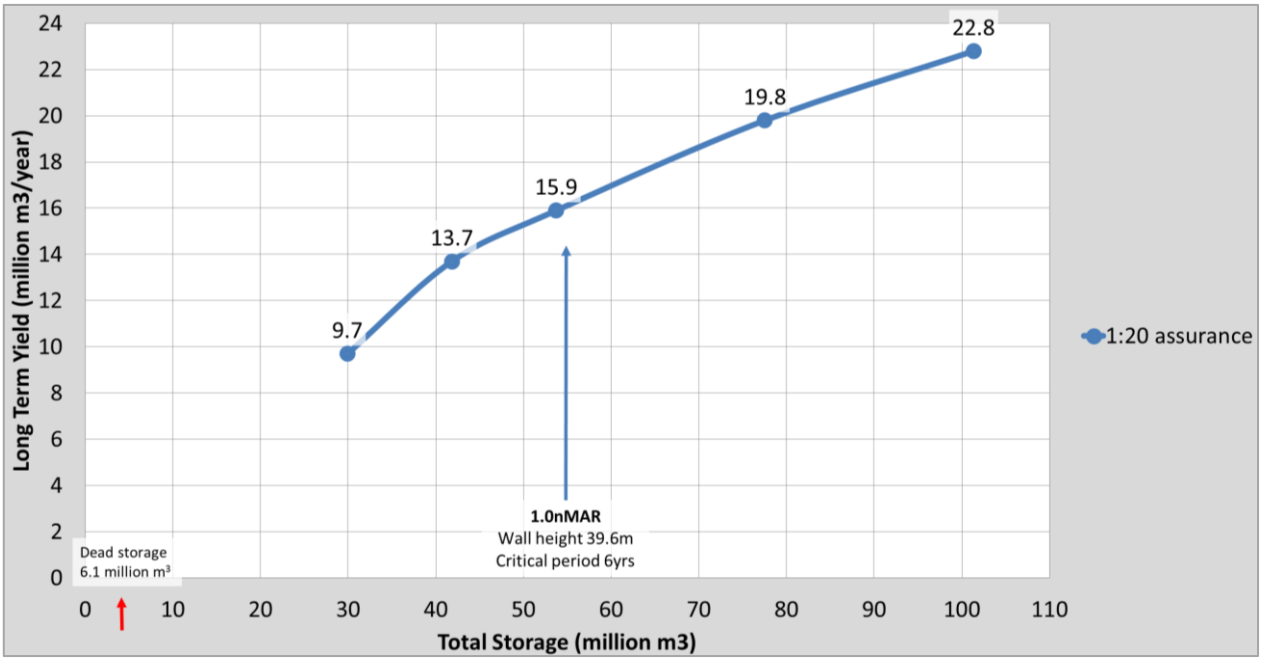

Figure 53: Foxwood Dam Long Term Yield

Potential Impacts / Implications

Foxwood Dam could create changes to the seasonal flow patterns and alter the flow regime in the Koonap River as well as the Great Fish River. The nature of the impact to the flow in the affected watercourses will depend on the design and operating regime of the dam.

The dam wall will 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.

Water quality and quantity released from Foxwood Dam will need to comply with the requirements of the Ecological Reserve (EWR) for the Koonap River.

Specialist Study Triggered / Additional Investigations

Findings from hydrological analysis and EWR study conducted as part of the Technical Feasibility Study to be incorporated into the EIA Report, as necessary.

The impacts to the watercourses that are affected by the project infrastructure will be evaluated as part of an Aquatic Assessment during the EIA phase.

11.7.2 Water Use

Status Quo

The Koonap catchment is rural in nature with farming the main activity. There is some irrigation, which is mostly run of river abstractions and some cattle farming. The urban centres of Adelaide and Bedford are located in the catchment. Adelaide gets much of its water from local resources within the Koonap catchment while Bedford is supported by local resources and transfers from the Great Fish River.

For the purposes of calculating the yield of the proposed Foxwood Dam as part of the Technical Feasibility Study, all historical and current human interventions that impact on the streamflow generated within the modelled catchments were taken into account. Water use and return flows occur in the Koonap River catchment are associated with the towns of Adelaide and Bedford as well as agricultural developments such as irrigation. Also considered is the extent and impact on streamflow of commercial forestry and alien invasive plants. A summary of the findings follows.

Irrigation

According to the Water Use Registration Database (WARMS) a total field area of 21,48 km^2 (2148 ha) is registered for irrigation in the Koonap River catchment. Of the total area registered, 1992 ha are registered to surface water resources with most abstractions from run of river (88%). The WARMS information has been used to represent the current (2011) development level as no other information was readily available.

Forestry

The climatic conditions in the Koonap River catchments are generally not conducive for the development of commercial forestry. If the information about forestry is accurate the streamflow from the catchment area upstream of Foxwood Dam site is not impacted.

Alien Invasive Plants

Information about the extent of Alien Invasive Plants (AIP) was obtained from the relevant environmental authorities in the EC. The information provided reflects the current day (early 2012) situation and comes from the Post Retief Working for Water (WfW) Project. The streamflow reduction (SFR) from AIP's in the Foxwood Dam catchment is estimated at 0,5 million m^3/a.

Groundwater abstractions

Groundwater abstractions can impact streamflow but only in catchments that have baseflows indicating interaction between the surface and ground water regimes. Catchment Q92B is the only catchment that has significant groundwater abstractions of around 0,3 million m^3/a. The SFR from groundwater abstractions in this catchment is estimated at 0,12 million m^3/a.

Ecological Water Requirements

EWR were determined as part of the Desktop Reserve Study at two sites on the Koonap River downstream of the proposed Foxwood Dam site. An Intermediate Reserve determination will be undertaken later in the project and will be used to determine the final Reserve requirements.

Reservoirs and dams

Currently there are no major reservoirs in the Koonap River catchment. There are several small reservoirs, off-channel storage dams and farm dams that are used for domestic (Adelaide Dam and Andrew Turpin Dam), irrigation and livestock water requirements.

Potential Impacts / Implications

- Positive impacts associated with the proposed development of Foxwood 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 Koonap 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 Koonap 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.
- Existing water abstraction (e.g. pump houses) and conveyance (furrows) infrastructure might be impacted on by the proposed dam. Provision needs to be made to relocate this infrastructure.

Specialist Study Triggered / Additional Investigations

As part of the Technical Feasibility Study 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 Koonap River, it is anticipated that a full review of water allocation would be carried out by DWS.

Impacts to water users in terms of water quantity and quality to be considered further during the EIA phase.

The NWA makes provision for DWA to explore the recreational use of Government Water Works. A RMP serves as the tool used by DWA to determine and gazette the sustainable and equitable use and management of the water surface and state-owned land during the

operational phase of a dam. Recreational use of Foxwood Dam will need to be established in consultation with the authorities, stakeholders and I&APs as part of a RMP process.

11.7.3 Ecological Status

Status Quo

11.7.3.1 National Freshwater Ecosystem Priority Areas

The conservation status of the rivers in the study area, as defined by the National Freshwater Ecosystem Priority Areas (NFEPA) assessment, is provided in **Figure 54**. FEPA rivers, wetlands and estuaries need to stay in a good condition in order to conserve freshwater ecosystems and protect water resources for human use (Nel *et al*, 2011). The current and recommended condition for all river FEPAs is A (unmodified, natural) or B (largely natural) ecological category.

The following is noted with regards to the FEPA river map (note that wetlands and estuaries as discussed separately):

- The entire sections of the Koonap and Mankazana Rivers that will be inundated by Foxwood Dam are classified as FEPAs. River FEPAs achieve biodiversity targets for river ecosystems and threatened/near threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.
- The sections of the Koonap and Mankazana Rivers up to their confluence fall within upstream management areas, which are are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.
- The dam wall is located within a Phase 2 FEPA, which refers to a moderately modified rivers (C ecological category), only in cases where it was not possible to meet biodiversity targets for river ecosystems in rivers that were still in good condition (A or B ecological category).

- Fish support areas occur downstream of the proposed dam site, prior to its confluence with the Great Fish River.

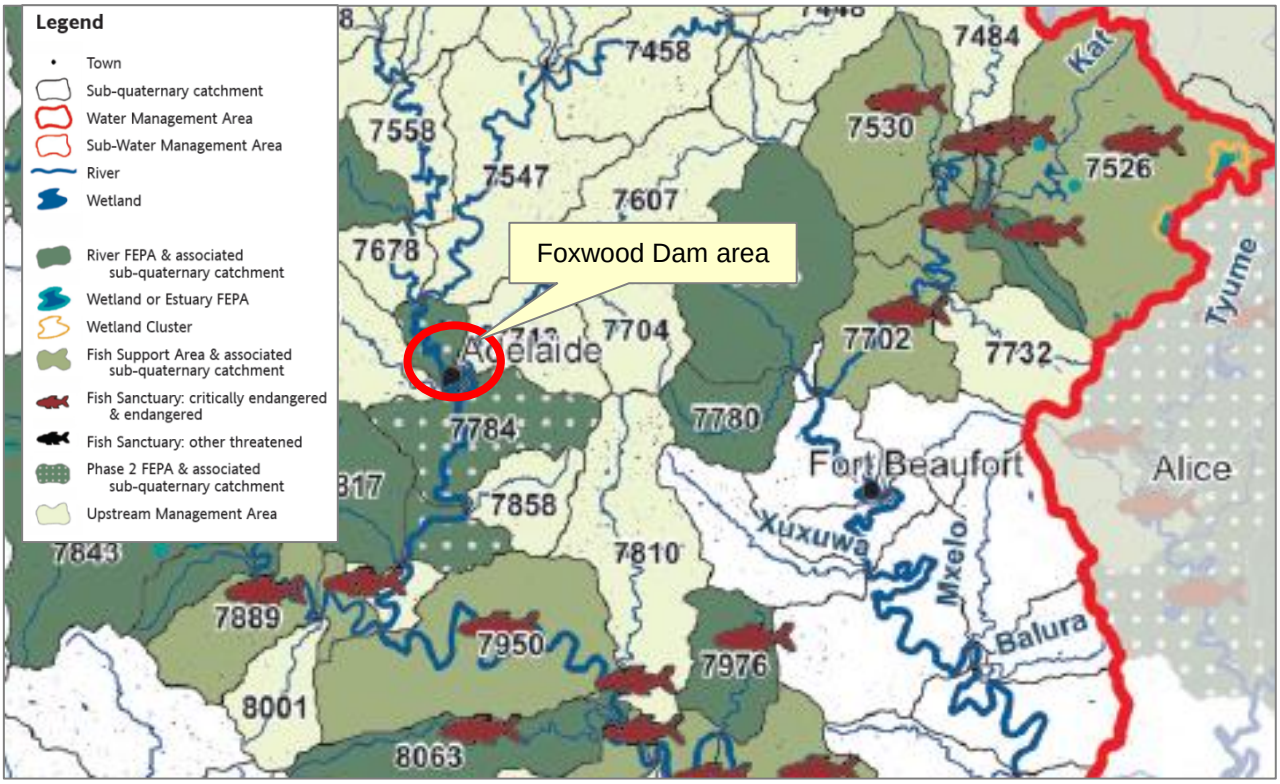

Figure 54: **River FEPA information related to project footprint (adapted from Net *et al*, 2011)**

11.7.3.2 Aquatic Critical Biodiversity Areas

The Eastern Cape Biodiversity Conservation Plan (ECBCP) (2007) identifies Critical Biodiversity Areas (CBAs) that are critical for conserving biodiversity and maintaining ecosystem functioning in the province, and provides land use guidelines.

Aquatic CBAs were identified on the basis of sub-quaternary catchments, addressing the linkages between catchments, important rivers and sensitive estuaries. Priorities were identified through a systematic conservation planning analysis. In terms of the Aquatic Critical Biodiversity Areas (CBA) (see **Figure 55**), the reach of the Koonap River up to the confluence of the Mankazana River falls within a CBA 2. The remaining part of the impoundment and project components are not situated within an Aquatic CBA.

The compatibility of the project with the ECBCP (2007) and other environmental management and planning tools will be considered further during the EIA phase.

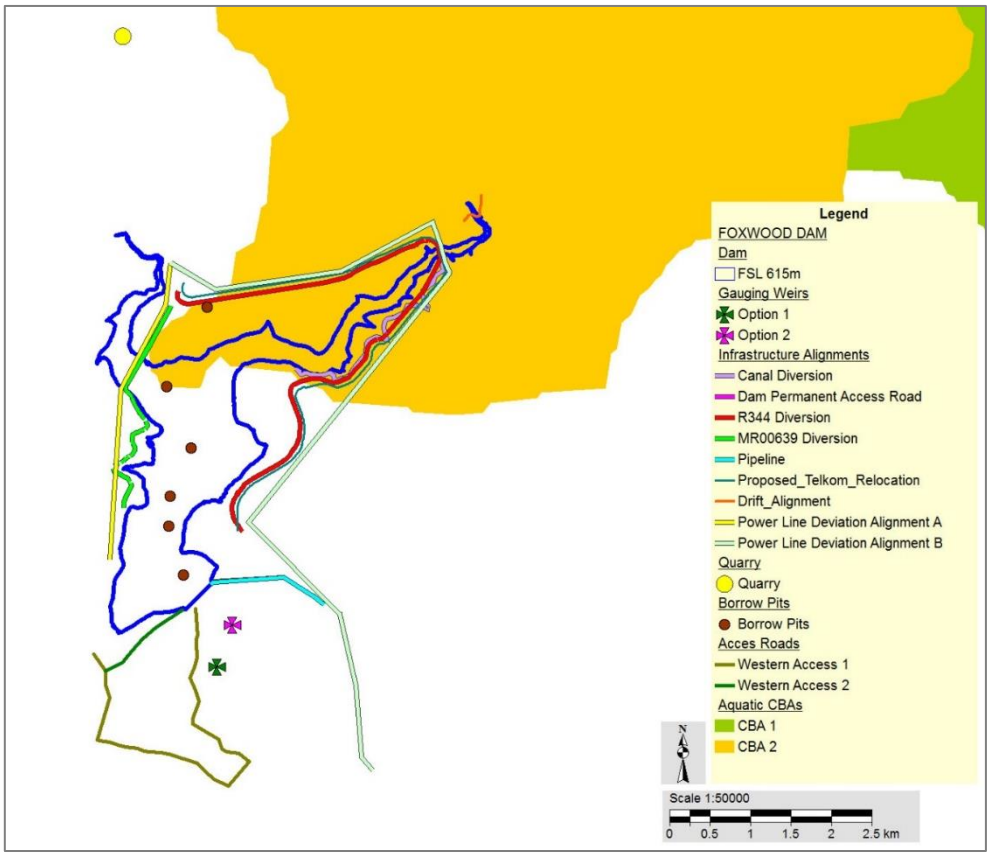

Figure 55: Aquatics CBAs

11.7.3.3 EWR Study

An extract from the EWR Study for Foxwood Dam follows.

Study Area

The EWR study area comprised the Foxwood Dam site on the Koonap River, the selected conveyance routes between the dam site and the extended supply area as well as the proposed area to be developed for irrigation. In terms of the river Reserve study, the catchment is from Foxwood Dam to the Fish River confluence.

The objectives of the study were to:

- Determine the EWR for different ecological states at each EWR site;
- Determine the Present Ecological State (PES) and describe alternative ecological states if relevant;
- Set the EWR;
- Address scenarios in terms of the existing and new dams in the Koonap River; and
- Determine the Ecological and Goods and Services consequences of the operational scenarios.

The locality of the EWR sites in the Koonap River within the Management Resource Units (MRUs) as identified during this study are provided in **Table 31** and shown in **Figures 56- 57**.

Table 31: Locality and characteristics of EWR sites

EWR site	Latitude	Longitude	Level II EcoRegion	Geo-zone	Altitude (m)	MRU	Quat[1]	Gauge
KOON1	-32.76671	26.28989	18.02	Lower Foothills	538	MRU Koo A: Foxwood Dam site to the eNyara River.	Q92E	Q9H002
KOON 2	-32.94719	26.51870	18.02	Lower Foothills	340	MRU Koo B: Downstream of MRU 1 to the Great Fish confluence.	Q92G	None

1 Quaternary catchment

Figure 56: EWR KOON 1 (top) and EWR KOON 2 (bottom)

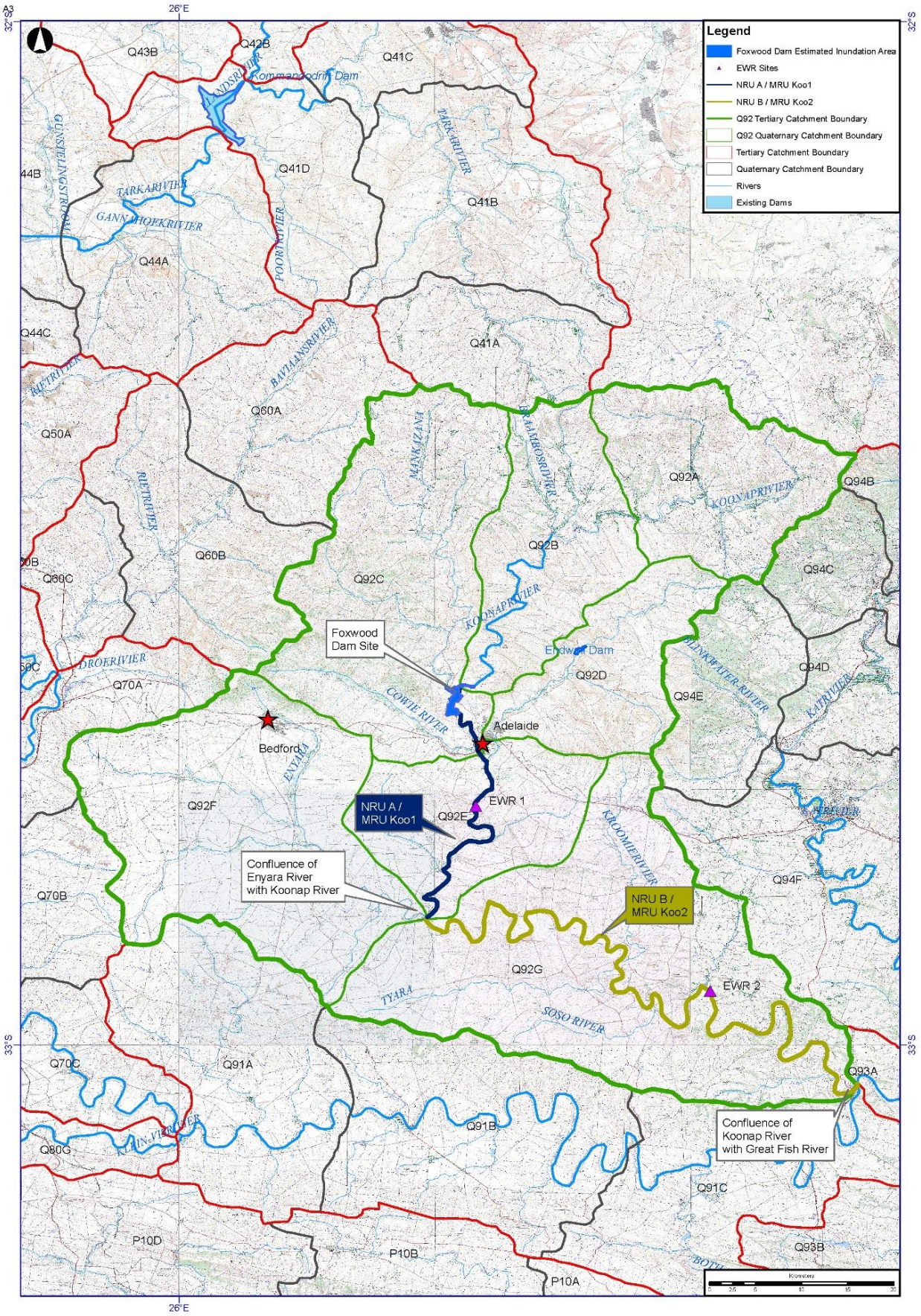

Figure 57: Study area indicating EWR sites

Approach

EWRs were determined applying the following steps:

- EcoClassification;
- EWR quantification of different ecological states;
- The Habitat Flow Stressor Response method was used to determine the low (base) flow EWRs;
- Consequences of operational scenarios on Goods and Services: A scenario-based approach was followed; and
- Ecological consequences of operational scenarios. A table is provided which compares the impact of each scenario per site against the PES and Recommended Ecological Category (REC). The resulting Ecological Category for each component is provided as well as the EcoStatus. The table is then summarised according to whether the scenarios meet the REC or not, and if not, to what degree.

The following coding is used throughout the document and an example is provided below.

✓ REC EcoStatus or REC instream IS met.
X REC EcoStatus or REC instream is NOT met.

Light green with black ✓:	Meets REC EcoStatus including all components.
Dark Green with black ✓:	Meets the REC EcoStatus, but not all the components.
Purple with X:	The scenario results in an EC below the PES; but still above a D EC.
Red with X:	The results are below an E EC.

Results

EcoClassification

The EcoClassification results are summarised below.

Table 32: EcoClassification results summary

EWR KOON 1

EIS: MODERATE
Highest scoring metrics were intolerance of instream biota to no flow and physico-chemical changes, diversity of instream habitat types, unique riparian species and important riparian migration corridors.

PES: C
- Deteriorated water quality (increased salinity and nutrients) due to WWTW and irrigation return flows.
- Flow alteration due to farm dams and irrigation leading to reduced baseflows.
- Clearing for agriculture, targeted removal of woody species and the presence of alien vegetation.

REC: C
EIS was MODERATE and the REC was therefore to maintain the PES.

Driver Components	PES and REC
IHI HYDROLOGY	C
WATER QUALITY	B/C
GEOMORPHOLOGY	B
Response Components	**PES and REC**
FISH	C
INVERTEBRATES	C
INSTREAM	C
RIPARIAN VEGETATION	C
ECOSTATUS	C
INSTREAM IHI	C
RIPARIAN IHI	C
EIS	MODERATE

EWR KOON 2

EIS: MODERATE
Highest scoring metrics were rare and endangered species (*Sandelia bainsii*) intolerance of instream biota to no flow and physico-chemical changes, diversity of instream habitat types, four unique riparian species and important riparian migration corridors.

PES: C
- Reduced base flows and flow alteration due to abstractions and agricultural return flows.
- Reduced water quality due to agriculture.
- Migration barriers result in decrease species frequency of occurrence.
- Presence of alien vegetation and removal of indigenous species.

REC: C
EIS was MODERATE and the REC was therefore to maintain the PES.

Driver Components	PES and REC
IHI HYDROLOGY	C
WATER QUALITY	C
GEOMORPHOLOGY	B
Response Components	**PES and REC**
FISH	C
INVERTEBRATES	B/C
INSTREAM	C
RIPARIAN VEGETATION	C
ECOSTATUS	C
INSTREAM IHI	C
RIPARIAN IHI	B/C
EIS	MODERATE

EWR quantification

The final flow requirements are expressed as a percentage of the natural Mean Annual Runoff (MAR).

Table 33: Summary of results as a percentage of the natural MAR

					Long term mean					
EWR site	PES	REC	NMAR (MCM)	PMAR (MCM)	Low flows (MCM)	Low flows (%NMAR)	High flows (MCM)	High flows (%NMAR)	Total flows (MCM)	TOTAL (%NMAR)
KOON 1	C	C	62.93	52.04	2.997	4.8	7.08	11.25	10.076	16
KOON 2	C	C	77.54	65.30	6.917	8.9	9.624	12.41	16.541	21.33

Ecological consequences of operational scenarios

A comparison of the ecological consequences of the scenarios at EWR KOON 1 and EWR KOON 2 are provided below.

Comparison of ecological consequences at EWR KOON 1 and EWR KOON 2

KOONAP RIVER				
EWR SITE	Sc 1	Sc 2	Sc 3	Sc 4
EWR 1	✓	✓	✓	✓
EWR 2	X	X	✓	✓

Poor Good

This analysis shows that none of the scenarios fully meet the ecological objectives at both sites. Scenario 3 and 4 maintain the REC at EWR 1 and EWR 2, although not for all components and has a higher risk of failure. Scenario 1 and 2 are not recommended as these scenarios result in an EC dropping below the PES at EWR KOON 2.

Optimised Scenario

Although Sc 4 does not meet the ecological objectives, it does represent the best of the four options. This scenario includes a desktop estimate of the low flow

EWR. To determine an optimised scenario, Sc 4 should be used as the basis and must include the EWR (low flows) as determined during this task.

Consequences of operational scenarios on Goods and Services

Given the nature of ecological Goods and Services utilisation in the area under consideration, none of the scenarios have an impact with either a magnitude or significance that would be considered as a fatal flaw at either EWR KOON1 or EWR KOON 2. With regard to ranking scenarios at EWR KOON 1 the following applies:

- Although Sc 1 has positive impacts, it also has the most negative impacts and the nature of these impacts is such that this scenario cannot be considered as a viable option in future;
- Sc 2 and Sc 3 have very similar impacts and is marginally more preferable to Sc 1; and
- Sc 4 is the most preferable and has more positive impacts than negative with an overall positive impact on ecological Goods and Services.

With regard to ranking scenarios at EWR KOON 2 the following applies:

- Although Sc 2 has positive impacts, it also has the most negative impacts and the nature of these impacts is such that this scenario cannot be considered as a viable option in future;
- Sc 1 is marginally better than Sc 2;
- Sc 3 is marginally more preferable to Sc 2 as it has a marginally positive impact on ecological Goods and Services; and
- Sc 4 is the most preferable and has more positive impacts than negative with an overall positive impact on ecological Goods and Services.

The reports generated by the Revised Desktop Ecological Model are provided for each site and include:

- Hydrology summary;
- Parameters that were adjusted from the default;
- Final output results (EWR rules) for the Recommended Ecological Category (REC).

Potential Impacts / Implications

The dam will transform the watercourse from a free-flowing river ecosystem to a reservoir habitat, with accompanying changes in temperature, chemical composition, dissolved oxygen levels and the physical properties.

The potential changes to flow patterns arising from the damming of the Koonap River may influence the current biophysical functioning of the watercourse. The influence to the natural cycles in the river (e.g. elimination of natural flooding) will also impact on the downstream ecosystem.

The impoundment will result in the loss of habitat for aquatic biota within the inundation zone, including rapids and riffles, as well as marginal and instream vegetation. The presence of similar stretches of rivers within the affected Eco-regions will need to be investigated.

The trapping of sediments and nutrients behind the dam could cause the growth and spread of algae and other aquatic weeds. Further, due to lack of movement, water in the reservoir becomes stagnant, resulting in loss of oxygen. Ultimately, this cycle can reduce the number of organisms living in the reservoir.

The dam will trap sediments, which are critical for maintaining physical processes and habitats downstream of the dam. The downstream river, which is deprived of sediment load, may seek to recapture it by eroding the river bed and banks. In addition, the dam will also hold back debris (leaves, twigs, branches, trees, organic remains of dead animals) which provides food and micro-habitat for aquatic biota.

Most indigenous fish species in this country undertake annual migrations within river systems for a number of reasons, such as feeding, dispersal, refuge areas during unfavourable conditions and reproductive success. A dam wall on the Koonap River, as well and the proposed gauging weir structure will act as barriers that will prevent the up- and downstream movement of aquatic biota. The dam will also lead to the fragmentation of the affected river, where the interconnected relationship of the system could be adversely influenced.

The harmful effect of barriers to migration is particularly severe in coastal rivers, where catadromous species, which need to migrate from their marine or estuarine spawning grounds into freshwater reaches of rivers for feeding purposes. As these fish migrate upstream as small juveniles, even low barriers of less than a metre can be impassable.

Severe changes in the natural flow pattern, as well as substrate type and availability, can lead to enhancement of conditions that favour pest and problem species such as blackflies, mosquitoes and snail vectors of bilharzia.

During construction, the instream works (i.e. at the dam wall, gauging weir, river crossings) will increase the turbidity in the affected watercourses, which could lead to the clogging of gills of aquatic fauna from increased silt loads and the alteration of micro-habitats.

Specialist Study Triggered / Additional Investigations

According to Net *et al.* (2011), where free-flowing rivers have to be dammed, there are some measures that can be implemented to mitigate the worst effects of these dams which include:

- Undertaking comprehensive environmental flow assessments prior to dam construction to understand and mitigate the consequences of the dam on the social, economic and ecological environments;
- Designing dams that allow for environmental flow releases; and
- Constructing passages for fish to by-pass the dam wall.

The above matters (amongst others) will be investigated further in the EIA phase.

The proposed EWR operating rule recommended for the Foxwood Dam system is that high flow EWRs should be met by spills from Foxwood Dam and that the low flow EWRs can be met by inflows from the incremental catchments downstream of Foxwood Dam.
An EWR outlet flow of 6 m^3/s is recommended. The Reserve requirements will ultimately feed into the licensing process of DWS and the operation of the system.

Aquatic Assessment to be conducted during the EIA phase. Amongst others, the NFEPA maps, ECBCP, as well as the DWSA River Health Programme results, will be further scrutinised by the relevant specialists. In addition, the need for fish ladders at the dam and gauging weir structure to be investigated further.

Suitable mitigation measures will be included in the EMPr, which will form part of the EIA Report, to ensure the safeguarding of the aquatic biota.

11.7.4 Affected Rivers and Streams

Status Quo

The following rivers and streams are directly affected by the project infrastructure (refer to **Figure 58**):

- Foxwood Dam will be located on the Koonap River. The impoundment will inundate a section of approximately 10 km of the Koonap River and approximately 4 km of the Mankazana River (tributary of the Koonap River).
- The alternative gauging weir sites are instream structures in the Koonap River.
- The diversion of the canal, R344, power line alignment B and telephone line will traverse the mainstem of the Koonap River as well as non-perennial tributaries.
- The diversion of the MR00639 and power line alignment A will traverse the mainstem of the Mankazana River as well as non-perennial tributaries of the Koonap River.
- Some of the access roads cross non-perennial tributaries of the Koonap River.

Potential Impacts / Implications

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**.

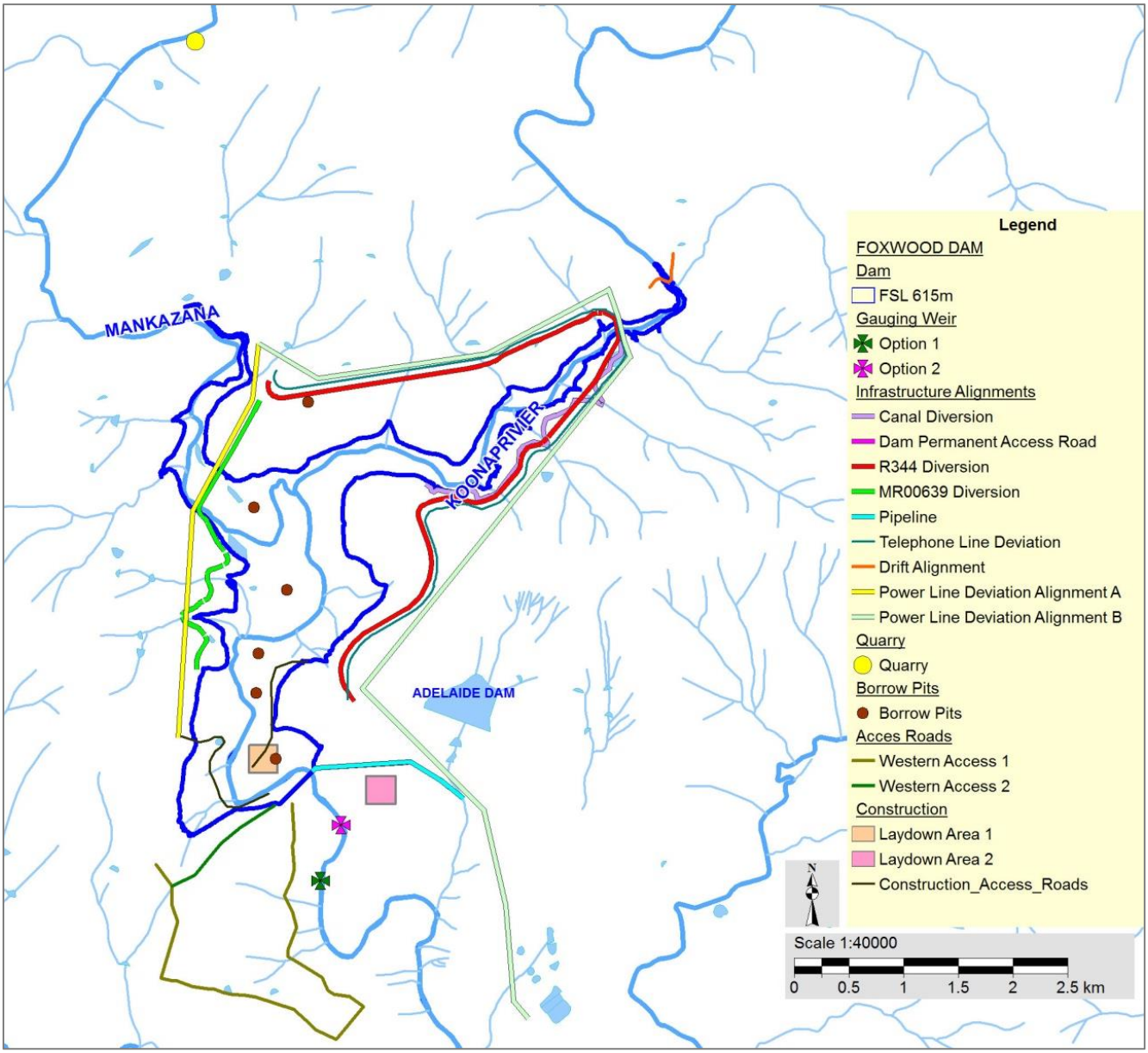

Figure 58: Watercourses in project area

Specialist Study Triggered / Additional Investigations

Aquatic Assessment to be conducted during the EIA phase to investigate impacts to resource quality of affected watercourses. Best practices to mitigate impacts to be included in EMPr.

11.7.5 Water Quality

Status Quo

Land uses and activities in the upper catchments of the Koonap and Mankazana Rivers that may adversely impact on water quality include:

- Agriculture;
- Animal husbandry;
- Alien invasive terrestrial weeds; and
- Erosion (natural and accelerated).

As part of the Technical Feasibility Study, the quality of the water within the Koonap River was assessed in terms of requirements for treatment for use for potable or irrigation purposes. In addition, recommendations were made regarding the dam design to optimize impact on water quality resulting from construction and operation of the dam.

Historical water quality data for the period 29 August 1971 to 19 June 2012 was obtained from the DWS water quality database (see results contained in **Appendix F**). Three sample locations have been referenced. Their location is shown in **Figure 59** and their details are provided in **Table 34**

Table 34: Water quality monitoring points on the Koonap River

Monitoring Point Name	Latitude	Longitude	Number of samples
Q9H014Q01 Koonap River at Frisch Gewaagd/Groenkop	-32.4647	26.51083	191
Q9H016Q01 Koonap River at Schurftekop	-32.4992	26.36556	343
Q9H002Q01 Koonap River at Adelaide	-32.7139	26.29667	595

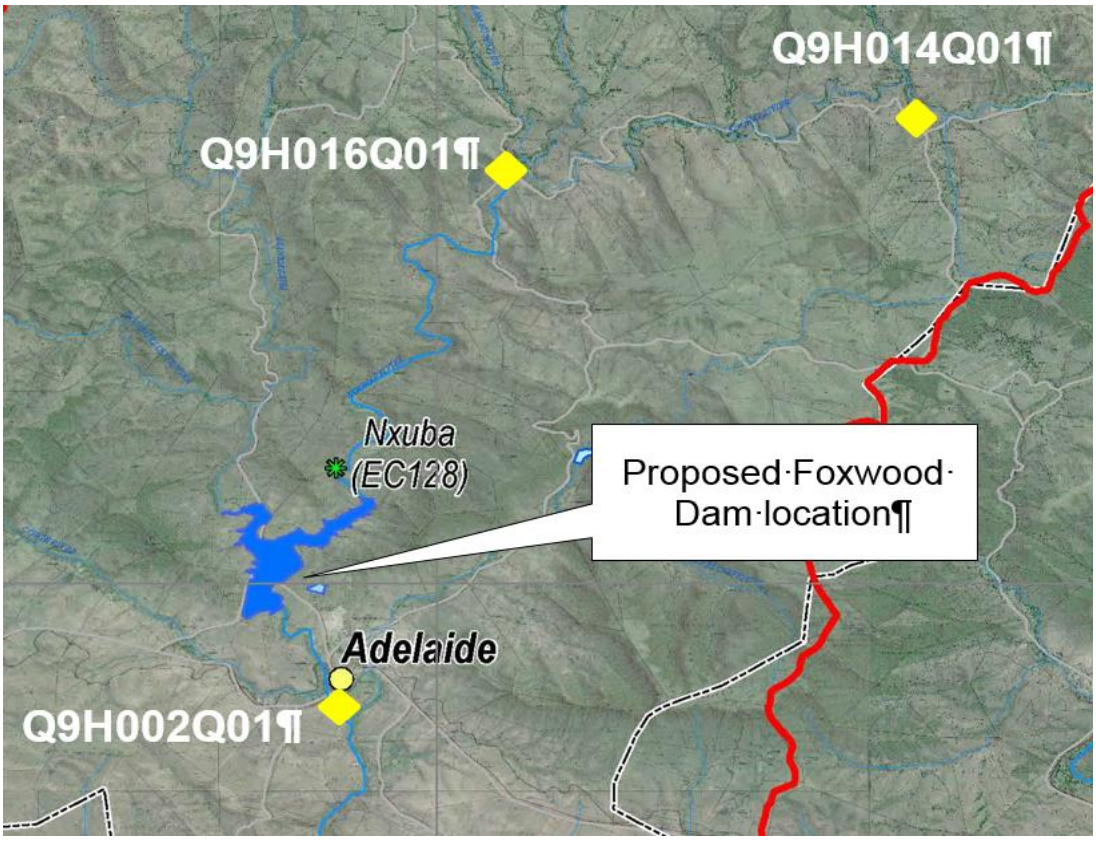

Figure 59: DWA water quality sample locations on the Koonap River

Key findings of the Water Quality Assessment include:

- The historical record for the Koonap River water quality confirms that the water is suitable for treatment and is able to provide Class 0 drinking water for more than 75% of the time. The construction of the proposed Foxwood Dam will alter the water quality to the works in that there will be less seasonal variation (and possibly an increase in the availability of Class 0 Water to more than 95% of the time). However the size of the impoundment might result in summer stratification of the water column and there are possible risks in terms of anaerobic water and nutrient release during overturn events (generally in autumn).
- It is recommended that the off-take structure be provided with draw-offs at regular intervals to 25 m below top water level. The top highest outlet should be 5 – 8m below full supply level with two further outlets at regular intervals down to a level of approximately 25 m below full supply level.
- One shortcoming of the water quality data is the limited data on the turbidity and suspended solids for Koonap River. As both parameters can impact on the siltation, storage reduction and treatment requirements it is recommended that, in the event

that the project proceeds beyond feasibility study, consideration be given to weekly sampling of the Koonap River to determine the seasonal silt loads and to confirm water quality upstream of Adelaide.

- There is a concern that organic matter could promote anaerobic conditions in the deep sections of the dam. For that reason, it would be preferred if the vegetation within the dam basin was removed prior to filling.

Potential Impacts / Implications

Water quality considerations for the proposed Foxwood Dam include:

- Potential impacts to water quality could result due to the physical, chemical and biological processes, sediments and nutrients being trapped in the dam basin 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. It would be expected that, in dams of greater than 20 metres depth, in the summer months sections of the dam would develop a thermocline. The consequence of this is that there will be a segregation of the upper 20 to 25 metres of the dam with warmer water, while the base layers will be significantly colder. At the end of summer the water column will destabilize and chemical changes could be expected following overturn. At this stage it is not possible to predict if oxygen levels will drop in the hypolimnion (bottom layer), but if they do nutrients will be redistributed into the water column. For this reason it is recommended that the off-take structure be provided with draw-offs at regular intervals to 25 m below top water level. The top highest outlet should be 5 – 8m below full supply level with two further outlets at regular intervals down to a level of approximately 25 m below full supply level. Any abstractions points deeper than 25 m below crest should only be available for use in winter months and during periods of drought (when these off-takes are less than 20 m below water surface). A bottom outlet will be provided for scouring. There is a concern that organic matter.
- With the filling of the reservoir, the decomposition of submerged vegetation and soils can deplete the level of oxygen in the water which could promote anaerobic conditions in the deep sections of the dam. For that reason, it would be preferred if the vegetation within the dam basin was removed prior to filling.

These potential impacts (amongst others) were evaluated as part of a Water Quality Assessment conducted under the Technical Feasibility Study.

Other potential water quality issues related to the operation and maintenance of dams include sedimentation from shoreline or streambank erosion.

During the construction phase, potential contamination of surface water could occur through sedimentation from instream works, silt-laden runoff from disturbed areas, and improper practices (e.g. poor management of waste water and disposal of solid waste).

Specialist Study Triggered / Additional Investigations

Detailed findings of the Water Quality Assessment to be included in the EIA Report.

Water quality and quantity released from Foxwood Dam will need to comply with the requirements of the Ecological Reserve (EWR) for the Koonap River.

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

Water quality and biological monitoring is recommended during the pre-construction, construction and operational phases to assess impacts on the environment, and to optimise dam management.

11.7.6 Riparian Habitat

Status Quo

As shown in **Figure 60**, the riparian habitat of the Koonap River is relatively intact and the same applies to the Mankazana River. The vegetation encountered in the riparian zone is typical of the Great Fish Thicket.

Figure 60: Riparian habitat of the Koonap River

Potential Impacts / Implications

The riparian and instream vegetation will be affected by the following infrastructure:

- Inundation within the basin of Foxwood Dam;
- Gauging weir; and
- Infrastructure crossings (canal, R344, MR00639, power line, telephone line, access roads).

Specialist Study Triggered / Additional Investigations

Aquatic and Riverine Assessment to be conducted, which will include an appraisal of the riparian habitat at the various areas affected by the project infrastructure and activities. The riparian habitat of the various watercourses will be delineated as part of the aforementioned study. The uniqueness of the portions of riparian vegetation to be lost within the dam basin to be evaluated in terms of the extent of this vegetation types in the region.

Findings of Reserve determination with regards to the riparian habitat to be incorporated into the EIA phase, where relevant.

Mitigation measures will be established during the EIA phase to manage the potential impacts to riparian vegetation and to address the overall reinstatement and rehabilitation of the areas outside of the dam basin.

11.7.7 Wetlands

Status Quo

The wetlands (based on CSIR, 2011) in the project area are shown in **Figure 61**.

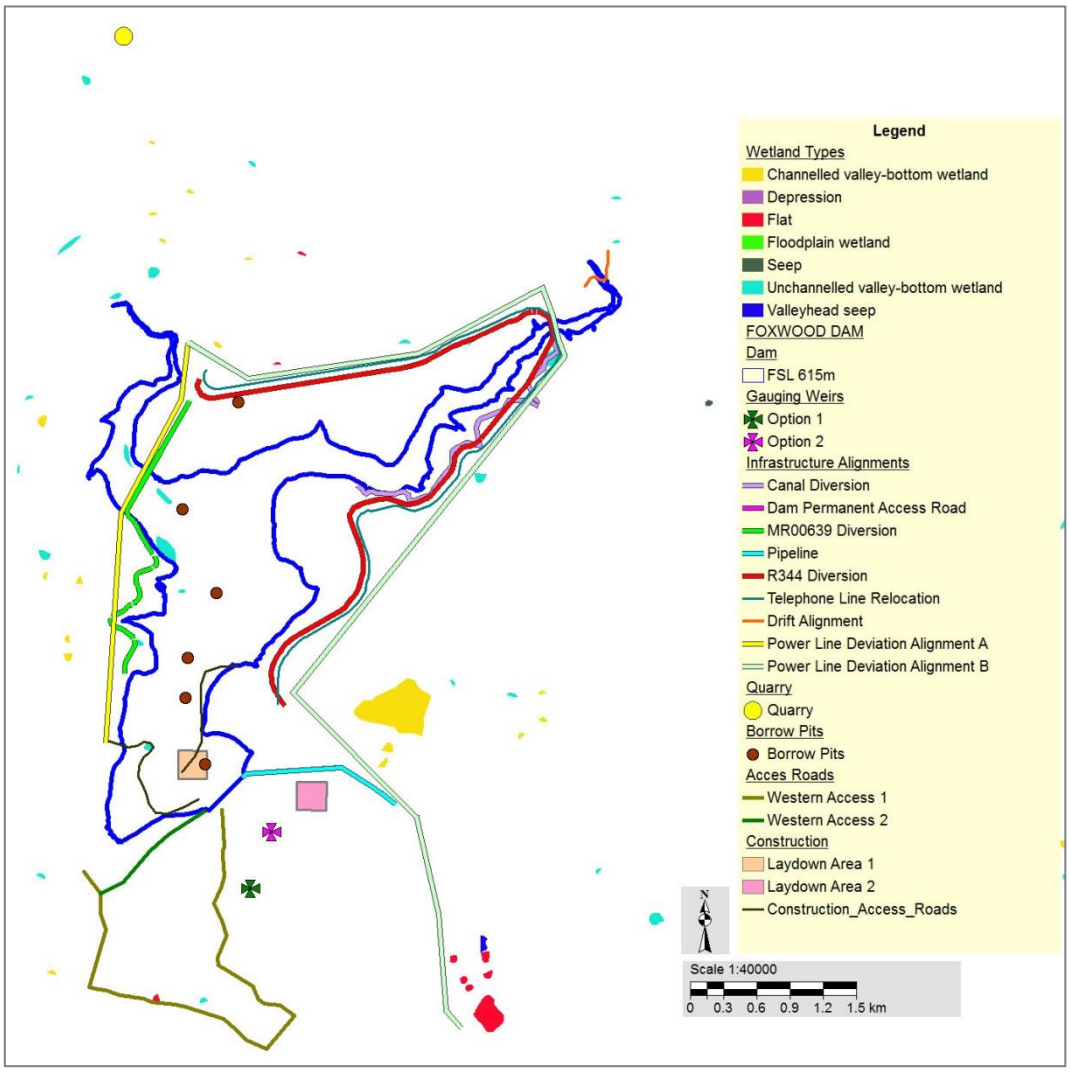

Figure 61: FEPA Wetlands

The following is noted with regards to wetlands in the project area:

- Foxwood Dam will inundate various unchannelled valley bottom wetlands;
- The diversions of the canal, R344, power line deviation alignment B and telephone line cross unchannelled valley bottom wetlands; and
- Western access 1 crosses a flat wetland.

The wetlands discussed above were identified on a desktop level based on the NFEPA coverage (CSIR, 2011) and a number of the 'wetland features' are farm dams. Ground-truthing of wetlands affected by the project will occur in the EIA phase.

Potential Impacts / Implications

Based on GIS data, various wetlands are affected by the project, where some wetlands will be inundated by the Foxwood Dam and other wetlands are traversed by infrastructure. In the case of the former, there will be an outright loss of wetlands within the dam's basin. Wetlands that are affected by infrastructure crossings may be impacted on in terms structure and function.

Specialist Study Triggered / Additional Investigations

Wetland Assessment and Delineation Study to be undertaken in the EIA phase. Status of wetlands and impacts to these systems to be assessed as part of the aforementioned study. Ground-truthing of FEPA information will be undertaken.

Where impacts to significant wetlands cannot be prevented, suitably minimised or rehabilitated, consideration will be given to offsets as part of the EIA investigations.

11.7.8 Estuary

Status Quo

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.

An assessment of the potential impacts of the Foxwood Dam on the Great Fish Estuary was conducted by CSIR in 2014, as part of the Reserve Determination. This study summarised the PES (health state), the REC (the future state of health) and the quantity and quality of freshwater inflows and other conditions required to maintain this. The analysis involved estimating the characteristics of the system in its original condition as well us under a range of potential future scenarios. An extract from this study follow.

The 650 km Great Fish River enters the Indian Ocean at 33°29'38.08"S, 27° 8'10.61"E. The estuary is nearly permanently open and maintained by enhanced freshwater inputs from an interbasin transfer scheme bringing water from the Orange River. The geographical boundaries of the Great Fish Estuary (**Figure 62**) study area are defined as follows:

Downstream boundary:	33°29'38.08"S, 27° 8'10.61"E
Upstream boundary:	33°23'59.83"S, 27° 1'29.89"E 27° 1'29.89"E
Lateral boundaries:	5 m contour above Mean Sea Level (MSL) along each bank

Figure 62: Geographical boundaries of the Great Fish Estuary (Source: Google Earth)

The Estuarine Health Index (EHI) scores allocated to the various abiotic and biotic health parameters for the Great Fish Estuary and the overall PES for the system under the present state are calculated from the overall EHI score. The EHI score for the Great Fish

Estuary in its present state was estimated to be 71 (i.e. 70% similar to natural condition, which translates into a PES of C).

The Great Fish Estuary is presently in a C Category which is largely attributed to the following three factors:

1. Elevated base flows as a result of agricultural return flow and possibly allocated water not been taken up by the relevant water users;
2. Increase nutrient input as a result of poor agricultural practises; and
3. Overexploitation of the living resources (especially linefish species such as dusky kob *A. japonicus*) in the estuary).

The functional importance of the estuary was deemed to be very high (100), because of the following:

- 16 (38%) of the fish species recorded in the Great Fish Estuary are southern African endemics;
- The Great Fish Estuary is one of the most important nursery areas in South Africa for both dusky kob *A. japonicus* and spotted grunter *P. commersonnii*; and
- Large numbers of catadromous anguillid eels and mullet recruit up the Great Fish River, with the former occupying almost the entire catchment and the latter found mainly in the lower catchment (up to 110 km from the estuary).

The Estuary Importance Score (EIS) for the Great Fish Estuary, based on its present state, was therefore estimated to be 92, i.e., the estuary is rated as “Highly Important”.

Taking into consideration the PES and EIA, the REC for the estuary is an A or it’s Best Attainable State which is estimated as a Category B/C.

Potential Impacts / Implications

According to the CSIR (2014), four scenarios (Scenario 1 – 4) were evaluated in detail as part of a rapid Great Fish EWR study in 2013 (Van Niekerk *et al*, 2013). These scenarios are listed here for comparative reasons as they allow for a calibration between the Reference Conditions, Present State and the new Scenario 5. Scenario 5 was evaluated

in terms of is relative impact as determined by the disturbing of the abiotic states and related expected biotic impacts (**Table 35**).

Table 35: Summary of the scenarios evaluated in this study

Scenario name	Description	MAR (million m^3)	Percentage remaining
Natural	Reference Condition	513.29	100.0
Present	**Present Day**	**463.30**	**90.3**
Scenario 1	With 30 Ml/day abstraction for water treatment (which could include some desalination), includes a 2.5 m high abstraction weir and abstraction works on the left bank of the river.	452.30	88.1
Scenario 2	**Foxwood Dam**	**434.64**	**84.7**
Scenario 3	With full delivery from Orange Transfer scheme	490.47	95.6
Scenario 4	No input from Orange Transfer scheme	322.84	62.9
Scenario 5 (new)	**Foxwood Maximum development**	**453.57**	**88.4**

Based on historical data and projected future flow modifications four typical abiotic conditions were identified for the Great Fish Estuary (**Table 36**).

Table 36: Typical abiotic conditions linked to projected river inflow

State	Description	Flow range (m^3/s)
1	Closed, marine dominated	<1
2	Strong marine influence (open mouth)	1-5
3	Brackish (open mouth)	5-10
4	Freshwater dominated (open mouth)	>10

Table 37 provides a summary of the percentage occurrence of the abiotic states under Natural Conditions, Present State and Scenario 1 to 5. The table shows that the change in the occurrence of abiotic states under Scenario 5 is similar to that of Scenario 2, with a slight improvement in the occurrence of State 2 (Strong marine influence).

Table 37: Percentage occurrence of abiotic states under Reference Conditions, Present State and Scenario 1 to 5.

	Natural	Present	Sc1	Sc2	Sc3	Sc4	Sc5
State 1 (Closed)	4.9	**0.0**	0.0	**0.0**	0.0	49.0	**0.0**
State 2	49.3	**52.0**	54.6	**55.4**	49.5	22.9	**52.5**
State 3	14.2	**21.3**	19.5	**19.9**	21.4	9.2	**21.6**
State 4	31.6	**26.8**	25.9	**24.7**	29.1	18.8	**25.9**
Years Estuary can close	10	**0**	0	**0**	0	0	**0**
% Years closed	12	**0**	0	**0**	0	0	**0**

The individual EHI scores, as well as the corresponding ecological category under the different scenarios are provided in **Table 38**. The estuary is currently in a C Category. Based on the findings of the rapid EWR study and the occurrence of the abiotic states under the five scenarios the following insights can be drawn:

- *Scenario 1:* The Great Fish Estuary will only deteriorate slightly in health under Scenario 1 (expected to remain in a C Category). In contrast, the river reach upstream of the estuary is expected to significantly decline in health largely due to two factors: 1) An abstraction weir that acts as a barrier to migratory fish; and 2) the possible release of sediment pulses from the sand traps during low flow periods. This type of flushing holds a significant risk to migratory fish species such as eels and fresh water mullet which will be aggregating below the abstraction weir.
- *Scenario 2:* The estuary will only deteriorate slightly in health under Scenario 2 and is expected to remain in a C Category.
- *Scenario 3:* The health of the estuary will remain similar to Present State under Scenario 3.
- *Scenario 4:* The estuary will deteriorate significantly under Scenario 4 to a D Category.
- *Scenario 5:* The estuary will only deteriorate slightly in health under Scenario 5 and is expected to remain in a C Category.

Table 38: EHI score and corresponding Ecological Category under the different runoff scenarios

Component	Present	1	2	3	4	5
ESTUARY HEALTH SCORE	71	68	69	71	46	70 - 69
PRESENT ECOLOGICAL STATUS	C	C	C	C	D	C

Therefore none of the future runoff scenarios presented as part of this study or the Rapid Reserve (van Niekerk *et al*, 2013) meets the REC of B/C. Scenario 5 will maintain the PES albeit at a slightly reduce condition (1 – 2 % reduction in ecological condition), but will not meet the REC of a B/C.

Specialist Study Triggered / Additional Investigations

Study to assess the potential impacts of the Foxwood Dam on the Great Fish Estuary as undertaken as part of the Reserve Determination (CSIR, 2014). Findings included in above sections.

11.8 Terrestrial Ecology

11.8.1 Flora

Status Quo

11.8.1.1 General Description

The study area is situated within the Albany Centre of Endemism (**Figure 63**). According to Rutherford and Westfall (1994), the project footprint primarily falls within the Albany Thicket Biome with the western access roads also lying within the Grassland Biome (**Figure 64**).

Albany Thicket occurs in the semi-arid areas of the Eastern and Western Cape. The vegetation of the Albany Thicket Biome is described as a dense, woody, semi-succulent and thorny vegetation type, of an average height of 2-3 m, and relatively impenetrable in an unaltered condition. It comprises a broad spectrum of physiognomic types reflecting gradients in climate, geology, soil and herbivory. There is a wide range of growth forms and a high diversity of plant species, including leaf and stem succulents, deciduous and semi-deciduous woody shrubs and dwarf shrubs, geophytes, annuals and grasses.

Albany Thicket is highly transformed and shows high levels of degradation which is attributed to cultivation in the moister regions, herbivory by livestock in the driers regions and urban settlements along the coast. Within the Albany Centre of Endemism, 126 plant species are threatened with extinction. Game ranching, which is a popular land use in the region, is contributing towards the preservation of the biome.

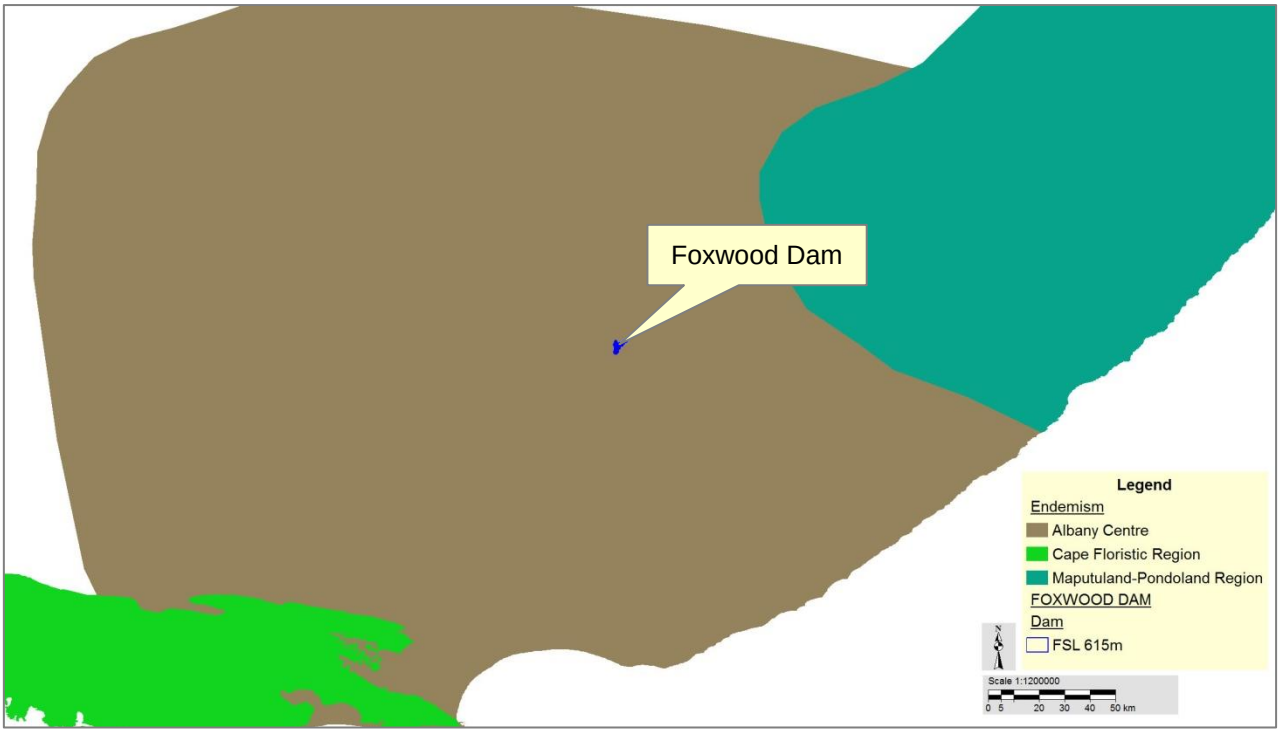

Figure 63: Endemism in project area

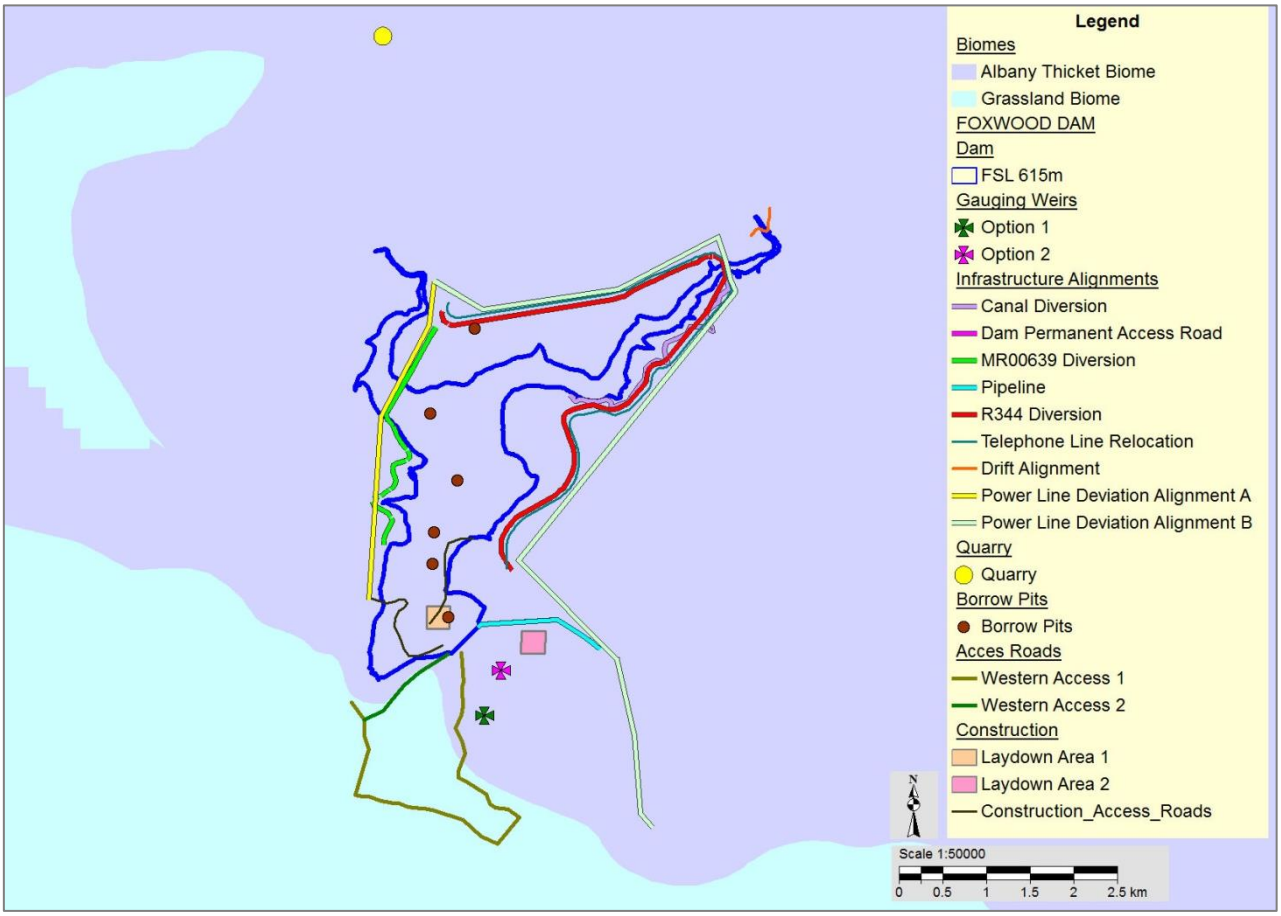

Figure 64: Biomes in project area

The vegetation types in the study area are shown in **Figure 65**. All the project components lie within the Great Fish Thicket, except for the quarry which is located within EC Escarpment Thicket and sections of the western access roads that cross through the Bedford Dry Grassland.

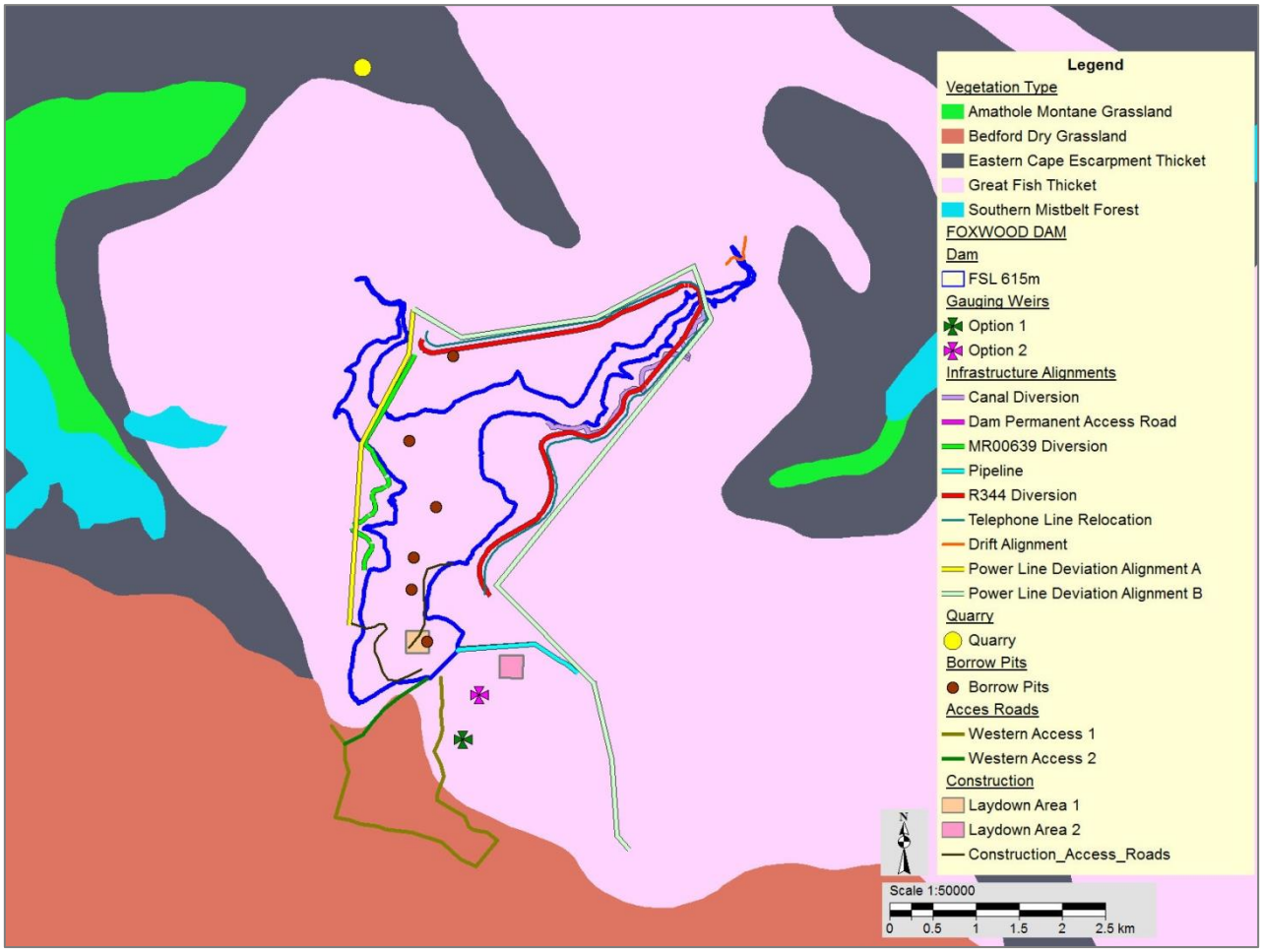

Figure 65: Vegetation types in project area

Landscape features associated with Great Fish Thicket include steep slopes of deeply dissected rivers supporting short, medium and tall thicket types, where both the woody trees and shrubs and the succulent component are well developed, with many spinescent shrubs (Mucina and Rutherford, 2006).

According to Mucina and Rutherford (2006), the conservation status of this vegetation type is Least threatened, with a target of 19%. A total of 6% of this vegetation unit is protected in seven statutory reserves, especially in the Great Fish River Complex Nature Reserve and 4,5% in addition in at least nine private

conservation areas. Great Fish Thicket has not been radically altered, only 3% by cultivation and 1 % by urbanisation. Erosion is very variable, from high to low.

It is the easternmost vegetation unit assigned to the Albany Thicket Biome, except for Buffels Thicket that only occurs near the coast. The climate in these deep, wide river valleys is hotter and dryer than the surrounding countryside and the area covered by this vegetation unit may constitute an effective physical barrier to species migration in an east-west direction through this region. The vegetation unit also marks the transition between more concentrated summer rainfall and nonseasonal rainfall. The northeastern side of this vegetation unit is marked by the east-west-running Amathole-Winterberg mountain ranges (with its band of EC Escarpment Thicket), further enhancing the barrier nature of this area (Mucina & Rutherford, 2006).

A photograph showing the dominant vegetation in the central part of the dam basin is provided in **Figure 66**. Impacts to vegetation in the study area mostly include cultivation (historical and current) and livestock.

Figure 66: View of vegetation in dam basin

11.8.1.2 Terrestrial Critical Biodiversity Areas

The ECBCP (2007) identifies CBAs that are critical for conserving biodiversity and maintaining ecosystem functioning in the province, and provides land use guidelines. The map of Terrestrial CBAs (see **Figure 67**) was compiled by undertaking a systematic biodiversity planning analysis and adding all biodiversity priority areas identified by other systematic biodiversity planning projects (such as STEP) in the Province.

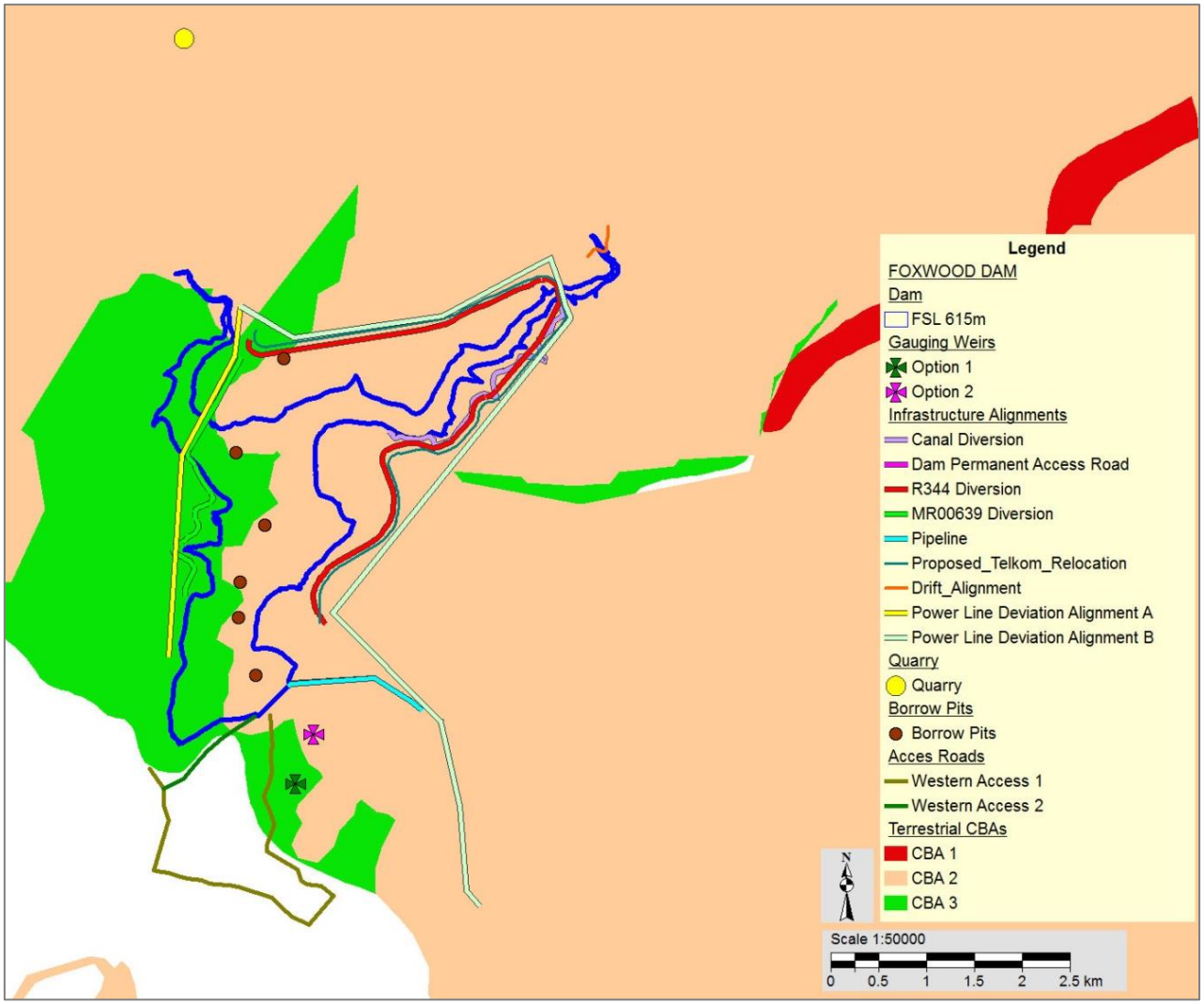

Figure 67: Terrestrial CBAs

The project footprint in relation to Terrestrial CBAs is as follows:

- Western part of the impoundment, gauging weir option 1, the majority of the routes for the MR00639 deviation and power line alignment A, as well as

sections of the deviation of the R344, power line alignment B and telephone line fall within CBA 3;

- Northern and eastern sections of the impoundment, canal deviation, pipeline, dam permanent access road, gauging weir option 2, borrow pits, quarry, construction laydown areas, as well as the majority of routes for the deviation of the R344, power line alignment B and telephone line fall within CBA 2.

There are no Threatened Terrestrial Ecosystems within the Nxuba LM.

11.8.1.3 Plant Species

The proposed project site is located within 3226CB quarter degree square in terms of the 1:50 000 grid of South Africa. The South African National Biodiversity Institute (SANBI) uses this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. **Table 39** provides details on the Red Data plant species which have been recorded in the aforementioned grid cell. The definitions of the conservation status are provided in **Table 40**.

Table 39: Red data plant species recorded in grid cell 3226CB which could potentially occur in the study area

Family	Species	Threat status	SA Endemic	Growth forms
Cornaceae	*Curtisia dentata* (Burm.f.) C.A.Sm.	NT	No	Shrub
Iridaceae	*Watsonia amatolae* Goldblatt	Rare	No	Geophyte

***Note**: NT=Near Threatened;*

Table 40: Definitions of Red Data status (Raimondo *et al*, 1999)

Symbol	Status	Description
NT	Near Threatened	A taxon is Near Threatened when available evidence indicates that it is close to meeting any of the five International Union for Conservation of Nature (IUCN) criteria for Vulnerable and it is therefore likely to qualify for a threatened category in the near future.
	Rare	A taxon is rare when it does not meet any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to the five IUCN criteria.

Potential Impacts / Implications

Vegetation will be lost within the reservoir, as well as in areas that are to be cleared for the project infrastructure and the relocation of existing infrastructure (power line, canal, telephone line, roads). 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. This potential impact will need to be managed.

The establishment of trees within the pipeline servitude will not be allowed as roots may compromise the stability of the pipeline.

Specialist Study Triggered / Additional Investigations

The Terrestrial Ecological Impact Assessment in the EIA phase will assess the status of the sensitive ecological features. Areas to be affected by project activities and infrastructure will be surveyed to identify sensitive and significant floral species. Suitable mitigation measures to be identified and recommendations to be made to address impacts.

The compatibility of the project with the ECBCP (2007) and other environmental management and planning tools will be considered further during the EIA phase.

Mitigation measures will be established during the EIA phase to manage the potential impacts to vegetation, removal of protected trees and medicinal plants, encroachment by exotic species and to address the overall reinstatement and rehabilitation of the area affected within the construction domain (outside of the basin). A Search, Rescue and Relocation Management Plan for red data, protected and endangered flora will be developed for the project.

Permit(s) will be obtained under the National Forests Act (No. 84 of 1998) if protected trees are to be cut, disturbed, damaged, destroyed or removed. The final alignment of linear infrastructure will attempt to avoid protected trees, where possible.

Consideration will be given during the EIA phase 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 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.

11.8.2 Fauna

Status Quo

11.8.2.1 Mammals

According to the Animal Demography Unit (2015), the mammals listed in **Table 41** have been recorded in 3226CB. According to this list, one species of conservation importance, namely Blue Duiker could potentially occur in the proposed study area.

Table 41: Mammals recorded in 3226CB grid cell

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Bathyergidae	*Cryptomys*	*hottentotus*	Southern African Mole-rat	Least Concern	Yes
Bovidae	*Alcelaphus*	*buselaphus*	Hartebeest	Not listed	Yes
Bovidae	*Connochaetes*	*gnou*	Black Wildebeest	Least Concern	Yes
Bovidae	*Philantomba*	*monticola*	Blue Duiker	Vulnerable	Yes
Bovidae	*Tragelaphus*	*scriptus*	Bushbuck	Least Concern	Yes
Cercopithecidae	*Chlorocebus*	*pygerythrus*	Vervet Monkey	Not listed	Yes
Equidae	*Equus*	*quagga*	Plains Zebra	Not listed	Yes
Muridae	*Mus*	*minutoides*	Southern African Pygmy Mouse	Least Concern	Yes
Procaviidae	*Dendrohyrax*	*arboreus*	Southern Tree Hyrax	Not listed	Yes
Viverridae	*Genetta*	*tigrina*	Cape Genet	Least Concern	Yes

11.8.2.2 Reptiles

According to the Animal Demography Unit (2015), the reptiles that have been recorded in the 3226CB grid cell are listed in **Table 42**. According to this list, no reptile species of conservation importance is known to occur in the region.

Table 42: Reptiles recorded in 3226CB grid cell

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Least Concern (SARCA 2014)	
Colubridae	*Crotaphopeltis*	*hotamboeia*		Red-lipped Snake	Least Concern (SARCA 2014)	
Colubridae	*Duberria*	*lutrix*	*lutrix*	South African Slug-eater	Least Concern (SARCA 2014)	Yes
Colubridae	*Lycodonomorphus*	*laevissimus*		Dusky-bellied Water Snake	Least Concern (SARCA 2014)	Yes
Cordylidae	*Chamaesaura*	*anguina*	*anguina*	Cape Grass Lizard	Least Concern (SARCA 2014)	Yes
Cordylidae	*Pseudocordylus*	*melanotus*	*subviridis*	Drakensberg Crag Lizard	Least Concern (SARCA 2014)	Yes
Elapidae	*Hemachatus*	*haemachatus*		Rinkhals	Least Concern (SARCA 2014)	
Lacertidae	*Tropidosaura*	*montana*	*rangeri*	Ranger's Mountain Lizard	Not listed	
Scincidae	*Acontias*	*gracilicauda*		Thin-tailed Legless Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Acontias*	*meleagris*		Cape Legless Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Least Concern (SARCA 2014)	
Scincidae	*Trachylepis*	*homalocephala*		Red-sided Skink	Least Concern (SARCA 2014)	Yes
Scincidae	*Trachylepis*	*varia*		Variable Skink	Least Concern (SARCA 2014)	
Typhlopidae	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)	
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern (SARCA 2014)	
Viperidae	*Causus*	*rhombeatus*		Rhombic Night Adder	Least Concern (SARCA 2014)	

11.8.2.3 Amphibians

According to the Animal Demography Unit (2015), the amphibians that have been recorded in 3226CB grid cell are listed in **Table 43**. According to this list, no amphibian species of conservation importance is known to occur in the region.

Table 43: Amphibians recorded in 3226CB grid cell

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Bufonidae	*Amietophrynus*	*rangeri*	Raucous Toad	Least Concern	
Bufonidae	*Vandijkophrynus*	*gariepensis*	Karoo Toad	Least Concern	
Hyperoliidae	*Hyperolius*	*marmoratus*	Painted Reed Frog	Least Concern	
Hyperoliidae	*Kassina*	*senegalensis*	Bubbling Kassina	Least Concern	
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern	
Pyxicephalidae	*Amietia*	*quecketti*	Drakensberg River Frog	Least Concern	Yes
Pyxicephalidae	*Cacosternum*	*boettgeri*	Common Caco	Least Concern	
Pyxicephalidae	*Cacosternum*	*nanum*	Bronze Caco	Least Concern	
Pyxicephalidae	*Strongylopus*	*grayii*	Clicking Stream Frog	Least Concern	
Pyxicephalidae	*Tomopterna*	*tandyi*	Tandy's Sand Frog	Least Concern	

11.8.2.4 Avifauna

Table 44 indicates the Red data bird species (SABAP1) recorded in grid cell 3226CB.

Table 44: Red data bird species recorded in 3226CB grid cell

Species Code	Common Name	Conservation Status
84	Black Stork	NT
118	Secretarybird	NT
122	Cape Vulture (Griffon)	VU
140	Martial Eagle	VU
141	African Crowned (Crowned) Eagle	NT
168	Black Harrier	NT
172	Lanner Falcon	NT
208	Blue Crane	VU
231	Denham's (Stanley's) Bustard	VU
463	Southern Ground-Hornbill	VU
484	Knysna Woodpecker	NT

***Note**: NT=Near Threatened; VU = Vulnerable*

Important Bird Areas (IBAs) are classified on the basis of the following criteria:

- The site regularly holds significant numbers of a globally threatened species;
- The site is thought to hold, a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area; and
- The site is known or thought to hold a significant component of a group of species whose distributions are largely or wholly confined to one biome.

The following Important Bird Areas (IBAs) (Barnes, 1998), which are both partially protected, are situated to the east of the project area (see **Figure 68**):

- SA091 - Katberg-Readsdale Forest Complex (approximately 20 km to the east of the dam); and
- SA092 - Amatole Forest Complex (approximately 50 km to the east of the dam).

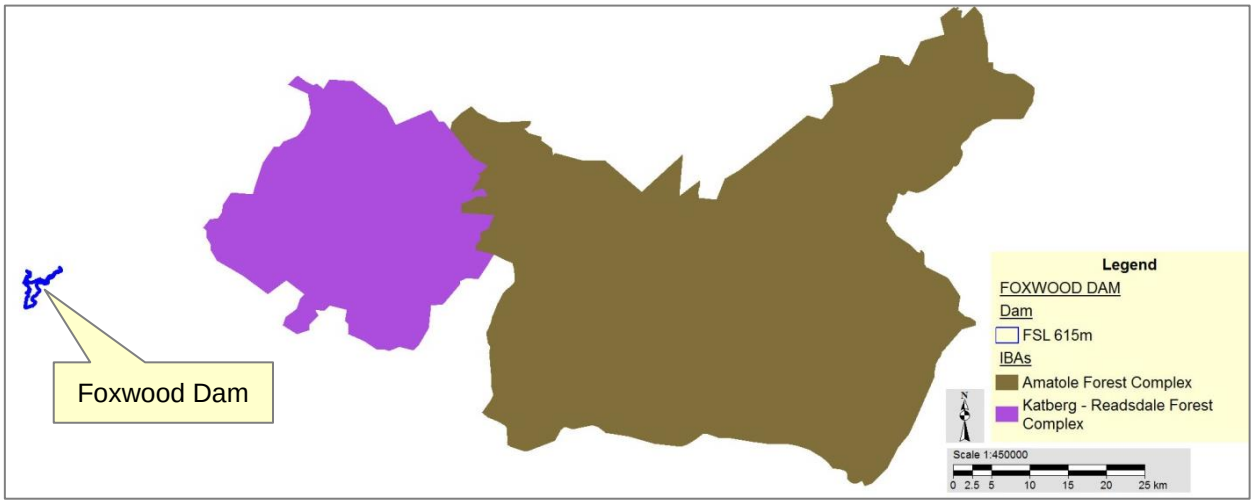

Figure 68: IBAs

Potential Impacts / Implications

- Permanent inundation caused by the reservoir will flood terrestrial habitat within the basin and the riparian zone. Further ecosystem disruption may occur where clearing is undertaken to allow for the construction of the project infrastructure and the deviation of infrastructure.
- Fauna could be adversely affected through construction-related activities (noise, illegal poaching, and habitat loss).

Specialist Study Triggered / Additional Investigations

Terrestrial Ecological Impact Assessment to be undertaken. Areas to be affected by project activities and infrastructure to be surveyed to identify sensitive and significant faunal species and associated habitat. Suitable mitigation measures to be identified as part of specialist study and recommendations to be made to address impacts.

The compatibility of the project with the ECBCP (2007) and other environmental management and planning tools will be considered further during the EIA phase.

A Search, Rescue and Relocation Management Plan for red data, protected and endangered fauna will be developed for the project.

11.9 Protected Areas

Status Quo

Protected areas in the greater region are shown in **Figure 69**.

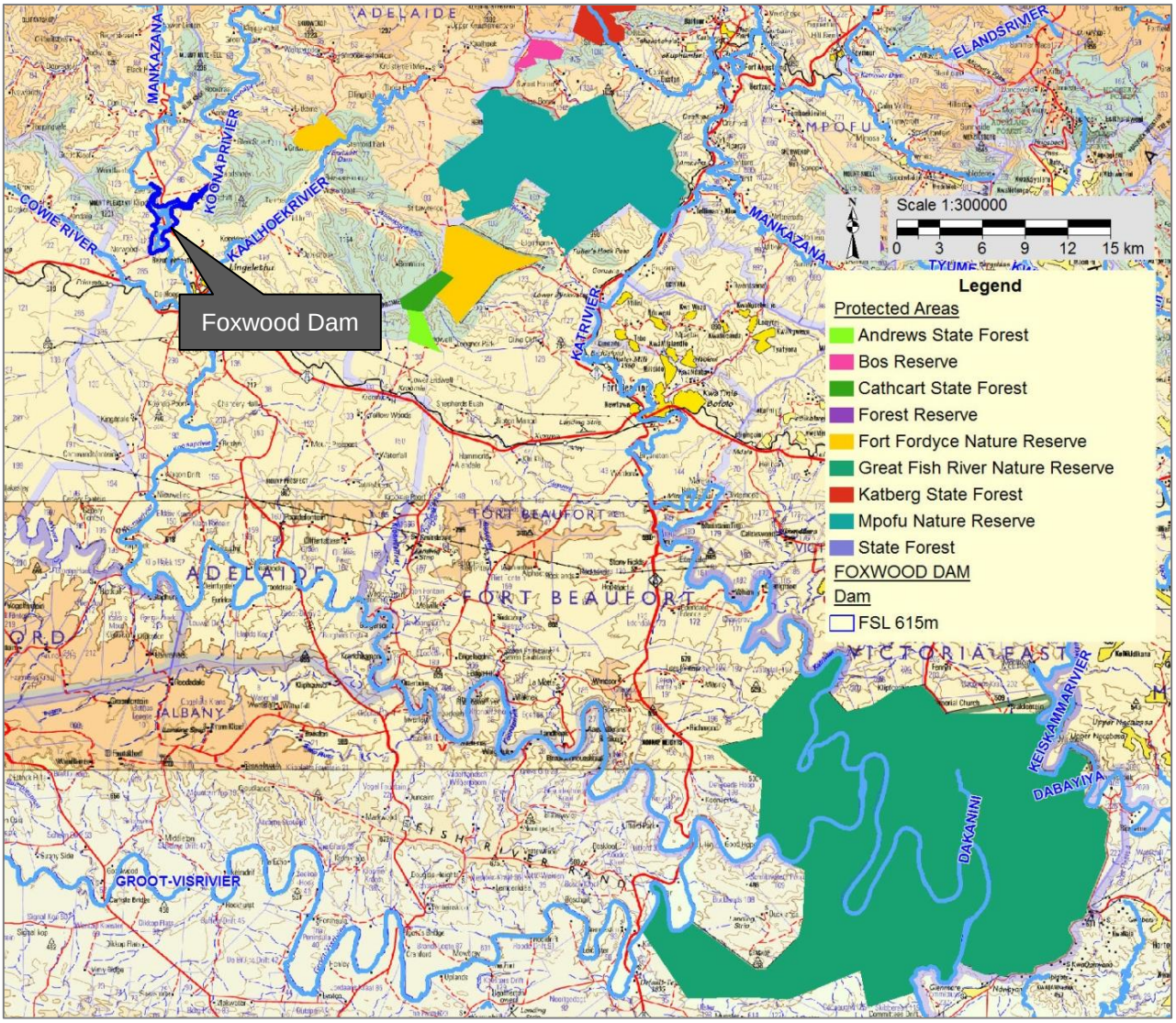

Figure 69: Protected Areas

The Fort Fordyce Nature Reserve, which is the nearest protected area to the dam (approximately 6 km to the north-east), is situated between Fort Beaufort and Adelaide, on the Amatola escarpment. The Great Fish River Nature Reserve is located downstream of the confluence of the Koonap River with the Great Fish River.

South Africa's protected area network currently falls far short of sustaining biodiversity and ecological processes. In this context, the goal of the National Protected Area Expansion Strategy (NPAES) is to achieve cost-effective protected area expansion for ecological sustainability and increased resilience to climate change (http://bgis.sanbi.org/protectedareas/NPAESinfo.asp). Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the NPAES. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems. The nearest NPAES focus area to the dam is Amathole Tarkastad, which is located less than 5 km to the west.

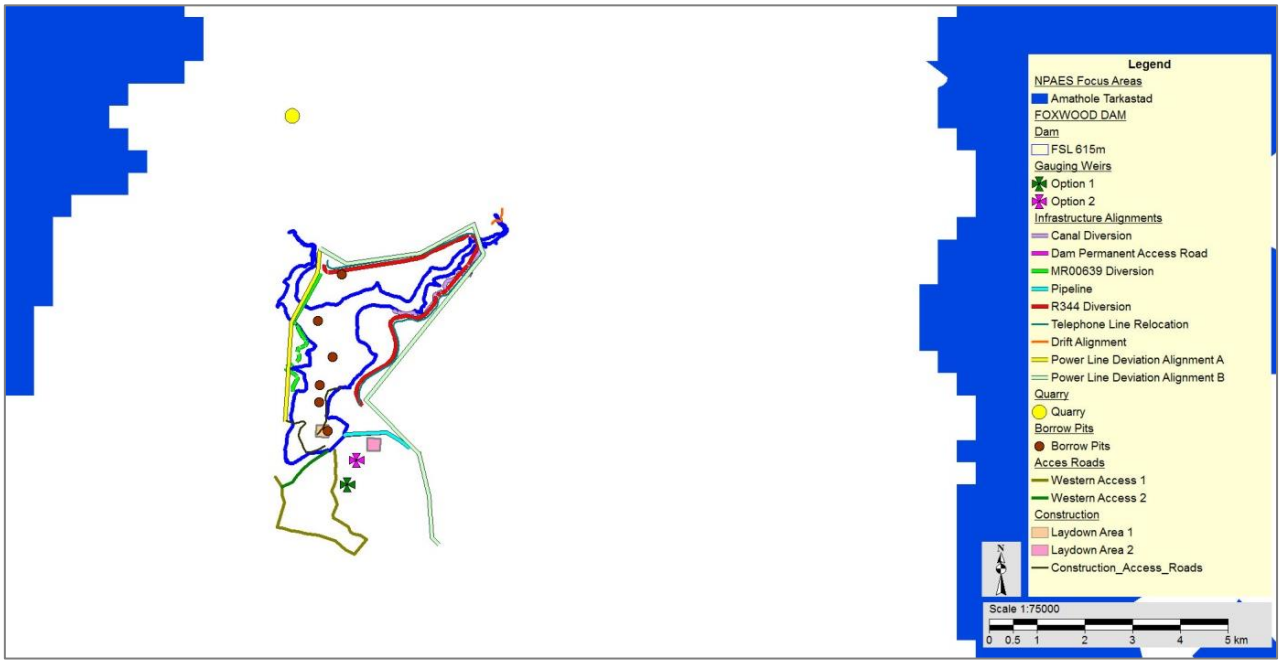

Figure 70: NPAES

Potential Impacts / Implications

Potential impacts caused by the damming of the Koonap River to the values and the sensitive environmental features associated with the Great Fish River within the downstream Great Fish River Nature Reserve.

Specialist Study Triggered / Additional Investigations

Ecological Reserve (EWR) to be satisfied by dam releases, which will include volume and quality of water required to sustain the values of the Great Fish River.

11.10 Socio-Economic Environment

Status Quo

11.10.1 General

The project infrastructure is mostly located on privately-owned properties that are primarily used for agricultural practices, except for the land in the south-eastern part of the project footprint which is owned by the municipality.

11.10.2 Socio-Economic Baseline for Nxuba LM

Nxuba LM falls under the Amathole DM. Its administrative seat is the town of Adelaide. The urban population is mainly located in the two small towns of Adelaide and Bedford.

The Nxuba LM is a product of the amalgamation of the now dis-established Adelaide TLC and Bedford TLC and surrounding farm areas. The municipality is approximately 230 km from Port Elizabeth and approximately 200 km from East London and represents an area of approximately 274,945.7956 hectares.

The key statistics for Nxuba LM are provided in **Table 45**.

Table 45: Key statistics for Nxuba LM (Stats SA)

Total population	24,264
Young (0-14)	30%
Working Age (15-64)	61,6%
Elderly (65+)	8,4%
Dependency ratio	62,4
Sex ratio	92,8
Growth rate	-0,23% (2001-2011)
Population density	9 persons/km2
Unemployment rate	42%
Youth unemployment rate	52,5%
No schooling aged 20+	6,3%
Higher education aged 20+	6,2%
Matric aged 20+	15,1%
Number of households	6,711
Number of Agricultural households	2,147
Average household size	3,5
Female headed households	45,3%
Formal dwellings	88,7%
Housing owned/paying off	53%
Flush toilet connected to sewerage	62,8%
Weekly refuse removal	68,6%
Piped water inside dwelling	43,2%
Electricity for lighting	92,2%

An Economic Impact Assessment (DWS, 2014) was conducted as part of the Technical Feasibility Study and an extract from this study follows.

The Gross Value Added (GVA) for a region is the level of economic activity which is recorded for the various economic sectors and over a period of time it provides a useful gauge of the expanding and declining sectors within a regional economy, as well as the dominant sectors within that economy.

The Global Insight data used indicates that for the year 2011 the GVA for Nxuba was R 272 million, with agriculture being the second largest sector after community services at R 37,2 million and 13.6% of the economy. Agriculture has declined by 2,2% over the past decade and the financial sector has shown the highest growth at 87%. This is indicated in the table to follow.

Table 46: Gross Value Added Per Economic Sector for Nxuba LM (Constant 2005 Prices)

GVA Per Economic Secor (R 1 000's)	2001	2011	% of Total	10Yr Growth
1 Agriculture	38 003	37 169	13.6%	-2.2%
2 Mining	0	0	0.0%	0.0%
3 Manufacturing	3 626	3 538	1.3%	-2.4%
4 Electricity	0	0	0.0%	0.0%
5 Construction	2 400	4 032	1.5%	68.0%
6 Trade	17 300	18 233	6.7%	5.4%
7 Transport	65	57	0.0%	-12.8%
8 Finance	17 070	31 941	11.7%	87.1%
9 Community services	113 301	151 523	55.6%	33.7%
Total Industries	191 766	246 492	90.4%	28.5%
Taxes less Subsidies on products	21 263	26 189	9.6%	23.2%
Total (Gross Domestic Product - GDP)	213 029	272 681	100.0%	28.0%

Source: Global Insight data supplied by ECSECC, November 2012.

The employment profile for Nxuba indicates that during 2011 there were 3 511 people employed of which 1 313 where employed in the agricultural sector, or 37,4% of all employees, a decline of 16,5% over the past decade, which tends to indicate a level of mechanization as the employment has decreased more substantially than the GVA. The largest real growth has occurred in the Community Services sector at 49% which indicates the success of the Governments employment policies. This is indicated in the table below.

Table 47: Employment Per Economic Sector for Nxuba LM

Employment Per Economic Secor	2001	2011	% of Total	10Yr Growth
1 Agriculture	1 572	1 313	37.4%	-16.5%
2 Mining	0	0	0.0%	0.0%
3 Manufacturing	36	26	0.7%	-27.4%
4 Electricity	0	0	0.0%	0.0%
5 Construction	101	107	3.1%	6.3%
6 Trade	334	284	8.1%	-14.8%
7 Transport	15	28	0.8%	87.4%
8 Finance	31	58	1.7%	87.7%
9 Community services	856	1 276	36.3%	49.0%
10 Households	335	418	11.9%	24.9%
Total	3 279	3 511	100.0%	7.1%

Source: Global Insight data supplied by ECSECC, November 2012.

The population for the town of Adelaide for the various residential areas including the non-urban areas has been sourced to Quantec Data courtesy of UrbanEcon for the year 2013. The main residential areas in the town of Adelaide are indicated in **Figure 71**.

A fifteen year population projection has been prepared based upon the assumption that it will take five years to approve and construct the Foxwood Dam and then a further ten years for the irrigated agriculture to reach full productive capacity and therefore attain its full employment and Gross Value Added (GVA) potential. The population projections for Adelaide are indicated in the table to follow. Although the census data indicates a negative population trend, a growth factor of 1% per annum has been assumed for the baseline to ensure a conservative analysis.

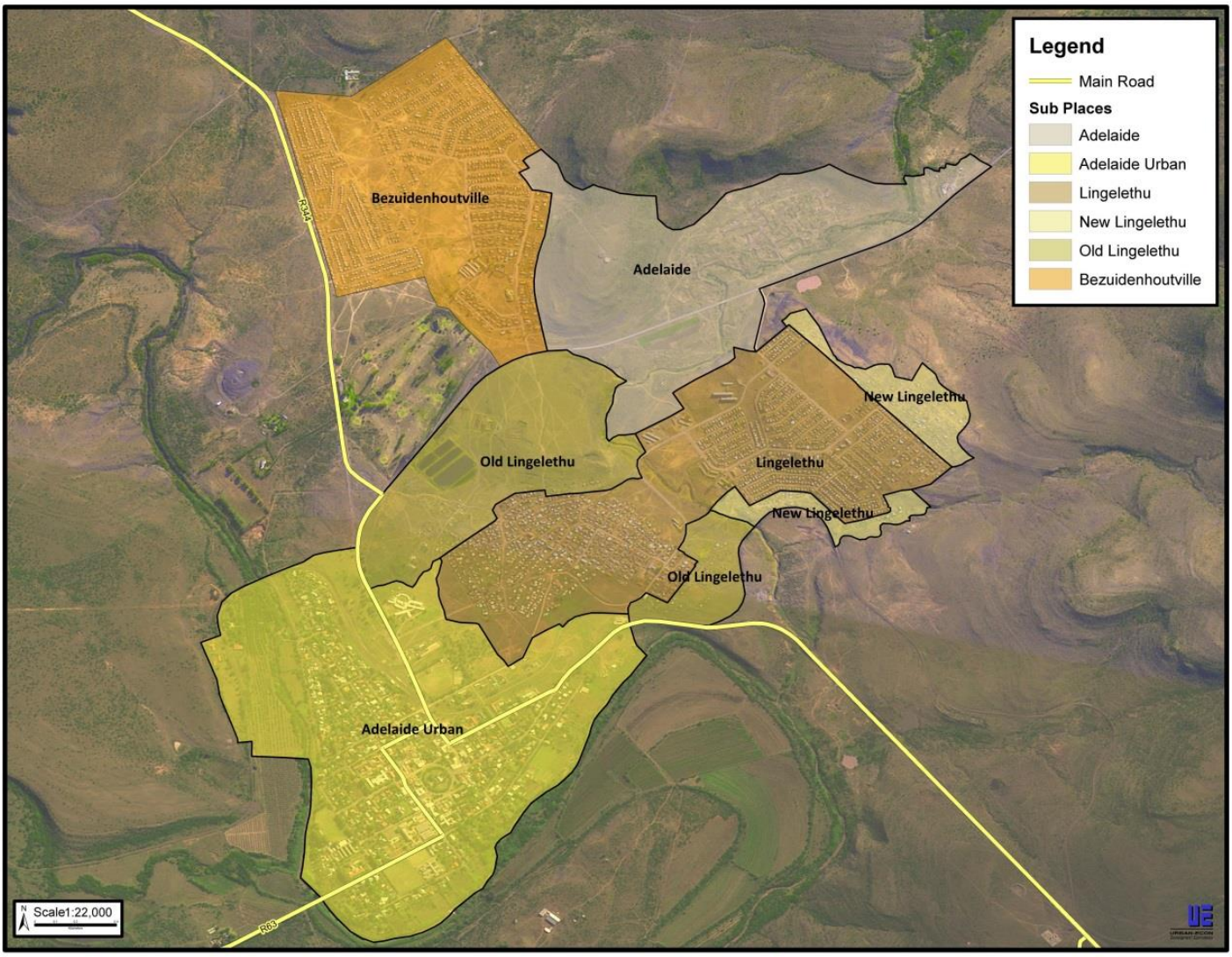

Figure 71: Adelaide Residential Areas

Table 48: Projected Population Growth for Nxuba LM

Year - Dam Project		-1	5	10	11	12	13	14
Year - Agriculture			1	6	7	8	9	10
Year - Calendar		2013	2019	2024	2025	2026	2027	2028
Adelaide (Urban)		1 303	1 342	1 411	1 425	1 439	1 454	1 468
Bezuidenhoutville		2 052	2 114	2 222	2 244	2 267	2 290	2 312
Lingelethu SP		5 941	6 121	6 434	6 498	6 563	6 628	6 695
New Lingelethu		673	693	729	736	743	751	758
Old Lingelethu		634	653	686	693	700	707	714
Adelaide (Non-Urban)		111	115	120	122	123	124	125
Totals		**10 714**	**11 039**	**11 602**	**11 718**	**11 835**	**11 953**	**12 073**
Growth Rate p.a.			1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Note: Although UrbanEcon have projected a negative population growth rate, it is anticipated that with the Foxwood Dam there will be a reversal of this trend over and above the irrigated agriculture potential.

11.10.3 Settlement Dynamics

Three distinctive areas are identified with these being the two urban nodes, rural hinterland and the high-lying hinterland.

Rural Hinterland

The rural hinterland forms part of the Nxuba Municipal area, where a relatively small proportion of the population reside. Most of the farming activities take place in the rural areas. Due to the fact that farming plays a major role in the economic growth of the Nxuba Municipal area, there is a need to promote diversification of the rural economy and to promote the policy of protecting the best quality agricultural land for development where ever possible.

High lying Hinterland

This area is mainly characterised by mountainous terrain and hills. The highest point occurs in the mountainous terrain to the west of Adelaide.

Urban nodes

The urban form is characterised by the promotion of the former separate development policies. An important spatial imperative of this urban form was the Group Areas Act, which required the provision of separate residential areas for the different population groups. The Nxuba LM SDF however seeks to promote integration rather that separation. The two urban areas are:

- Adelaide, including, Adelaide Town, Bezuidenhoutville, Lingelethu; and

- Bedford, including, Bedford Town, Goodwin Park, Nyarha.

11.10.4 Service Delivery – Water and Sanitation

This section provides a summary of water related services in the local municipality to provide context to the proposed significant development that would result from the proposed Foxwood Dam.

11.10.4.1 Water Supply and Infrastructure.

The Amathole DM is the Water Services Authority (WSA) and the Water Service Provider for the Nxuba LM area of jurisdiction and therefore responsible for the planning and provision of water and sanitation services.

Approximately 96% of the households have access to water within the standard set for RDP provision of which 15,6% consists of taps within a range of 200 m. Approximately 3,8% of the inhabitants use water from tankers, boreholes and other sources. Due to the dispersed farming settlement patterns it is concluded that the majority of inhabitants living in the rural hinterlands make use of boreholes, tanks and other water sources in the rural areas.

Table 49: Water Infrastructure in Nxuba LM (ECSECC Global Insight data for 2011)

Water infrastructure								
Number of households by level of access to Water								
	Piped Water Inside Dwelling	Piped Water In Yard	Communal Piped water < 200 m	Communal Piped water > 200 m	No formal Piped Water	Total	Piped Water Above RDP Level	backlog Households Below RDP
2001	1 518	2 478	1 041	1 121	505	6 663	75.6%	1 625
2002	1 498	2 446	1 130	1 229	551	6 854	74.0%	1 780
2003	1 475	2 524	1 081	1 380	576	7 035	72.2%	1 956
2004	1 611	2 550	1 083	1 399	547	7 190	72.9%	1 947
2005	1 850	2 454	1 053	1 476	522	7 355	72.8%	1 998
2006	2 230	2 368	1 055	1 398	496	7 547	74.9%	1 894
2007	2 637	2 401	1 022	1 264	436	7 760	78.1%	1 700
2008	2 874	2 487	1 048	1 136	358	7 902	81.1%	1 494
2009	3 017	2 477	1 177	1 020	326	8 017	83.2%	1 346
2010	3 269	2 373	1 256	912	317	8 127	84.9%	1 230
2011	3 675	2 147	1 289	815	315	8 241	86.3%	1 130
Change from 2001	2 157	-331	247	-305	-190	1 578		-495
% Change over 10 years	58.7%	-15.4%	19.2%	-37.4%		19.1%		-43.8%
% of Total:	44.6%	26.0%	15.6%	9.9%	3.8%	100.0%		

Water reticulation is only provided in the urban areas. In June 2009 Nxuba was declared a drought stricken area. Due to the seriousness of the drought and below-normal rainfall conditions, the district municipality embarked on a groundwater exploration study in Nxuba with funding received from DWS.

Adelaide Bulk Water

Adelaide bulk water supply comes from the weir in the Koonap River located 12 km west of the town which gravitates down to a treatment plant. The bulk water is usually insufficient due to the low rainfall in the catchment areas. There is a water reservoir located in Adelaide Town, Bezuidenhoutville and Lingelethu respectively. The reservoirs at Bezuidenhoutville and Lingelethu are often empty due to the ongoing dry conditions, and Amathole DM has been supplying both areas with water tankers during 2011.

The general layout of the Adelaide WTW is shown in **Figure 72**.

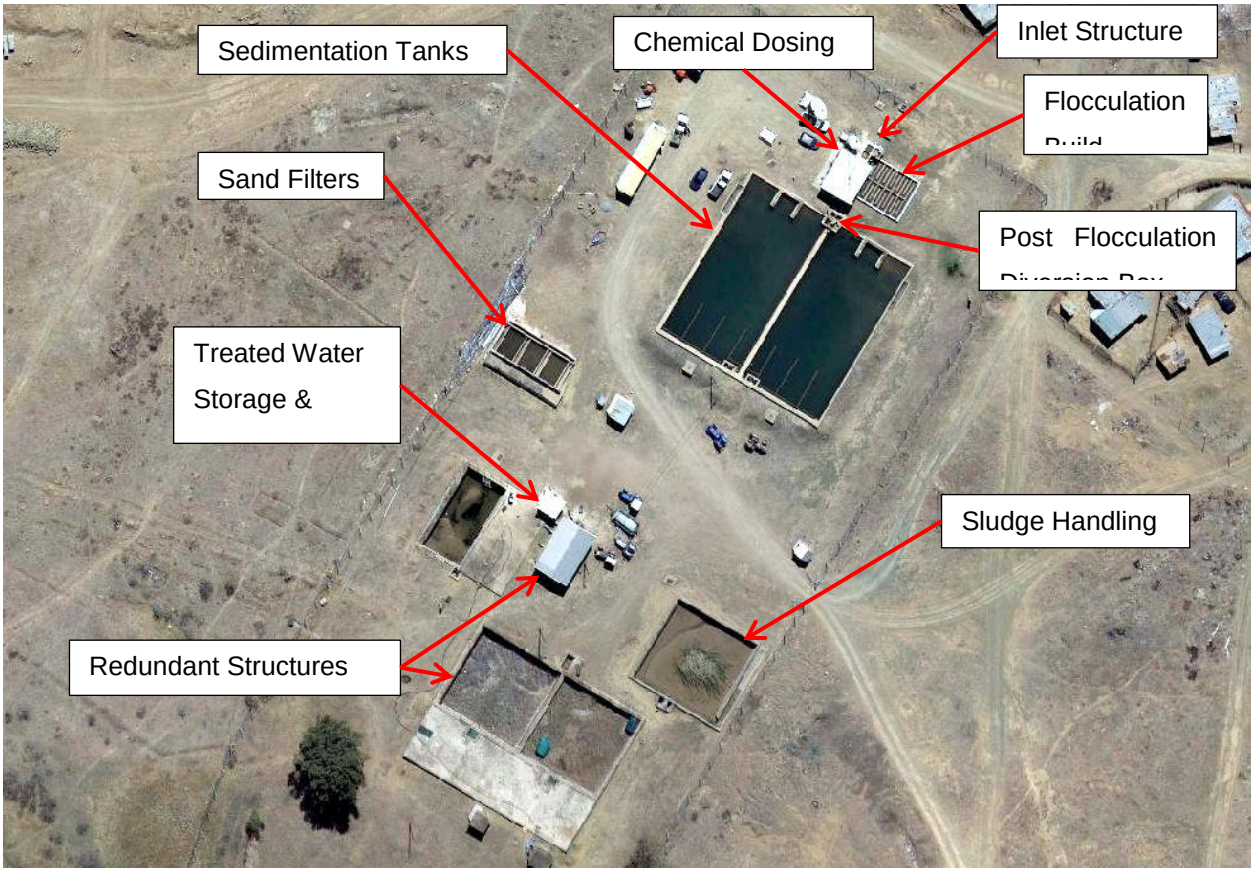

Figure 72: Adelaide WTW Layout (DWS, 2014b)

The existing Adelaide WTW was originally established in about 1957 and has been modified in at least 3 contracts since then. During January 2013 the works was inspected and observations made on the operation and performance of the current works as part of the Technical Feasibility Study. Current raw water inflows to the WTW suggest that the works is processing 850 000 m^3 per annum (equivalent to 2 330 m^3 per day or 97 m^3 per hour) of raw water. The existing works set up conforms to the general requirement to treat the raw water received at the works.

Bedford Bulk Water

Bedford's main supply of water is the Andrew Turpin Dam. The WTW has been upgraded with funding provided by the Amathole DM.

11.10.4.2 Sanitation Provision and Infrastructure.

The ECSECC data at 2011 reveals that a high number (10.6%) of the residents within Nxuba are using a bucket toilet system, 22,6% have no sanitation services and 17,4% uses pit latrines. Over the past ten years there has been a 47,7% increase in the provision of flush toilets, but the combined figure of 33,2% for no toilets and bucket system use is unacceptably high.

Table 50: Sanitation Infrastructure in Nxuba LM (ECSECC Global Insight data for 2011)

Sanitation								
Number of households by type of Toilet								
	Flush toilet	Ventilation Improv. Pit	Pit toilet	Bucket system	No toilet	Total	% Share Hygenic	Backlog: Non-Hygenic
2001	2 043	95	543	2 490	1 492	6 663	32.1%	4 525
2002	2 174	117	494	2 642	1 427	6 854	33.4%	4 563
2003	2 323	126	473	2 750	1 363	7 035	34.8%	4 586
2004	2 489	124	445	2 895	1 237	7 190	36.3%	4 577
2005	2 710	117	451	2 896	1 181	7 355	38.4%	4 528
2006	2 904	137	415	3 120	971	7 547	40.3%	4 506
2007	3 170	165	372	3 205	847	7 760	43.0%	4 424
2008	3 347	185	532	2 691	1 147	7 902	44.7%	4 370
2009	3 590	170	780	2 154	1 323	8 017	46.9%	4 257
2010	3 742	182	1 085	1 429	1 688	8 127	48.3%	4 203
2011	3 909	167	1 435	871	1 860	8 241	49.5%	4 165
Change from 2001	1 866	71	892	-1 619	368	1 578		-360
% Change over 10 years	47.7%	42.7%	62.2%	-186.0%		19.1%		-8.6%
% of Total:	47.4%	2.0%	17.4%	10.6%	22.6%	100.0%		

The sanitation constraints are mostly being experienced in Lingelethu (100% bucket system) and Nyarha (30% waterborne and 70% bucket system). It should, however be noted that the inadequate sanitation system has been upgraded but not connected to the waterborne sewerage system due to the severe shortage of water and limited capacity of the sewerage treatment plants. No formal sanitation service is offered for rural hinterlands, as these are privately owned farms.

Potential Impacts / Implications

- Possible impacts to the socio-economic environment during the construction phase include (amongst others):
  - Loss of land (including structures and cultivated areas) through inundation and project infrastructure (refer to land matters map compiled as part of the Technical Feasibility Study contained in **Figure 73**). Compensation measures will need to be evaluated in close consultation with the affected parties;
  - Risk to livestock as a result of construction related hazards;
  - Use of local road network;
  - Safety and security;
  - Impact to visual quality and sense of place;
  - Nuisance from dust and noise;
  - Light pollution;
  - 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).
  - On a positive note, employment opportunities will be created during the construction phase, with accompanying skills transfer. Where possible, goods and services will also be sourced locally during construction.
- The dependence of the local community on the reach of the Koonap and Mankazana Rivers that will be inundated, which may include obtaining water for domestic purposes, irrigation and stock watering, will need to be evaluated.
- The reservoir could become a breeding ground for disease vectors, such as mosquitoes and snails. If necessary, a monitoring plan will be considered as part of the EMPr.

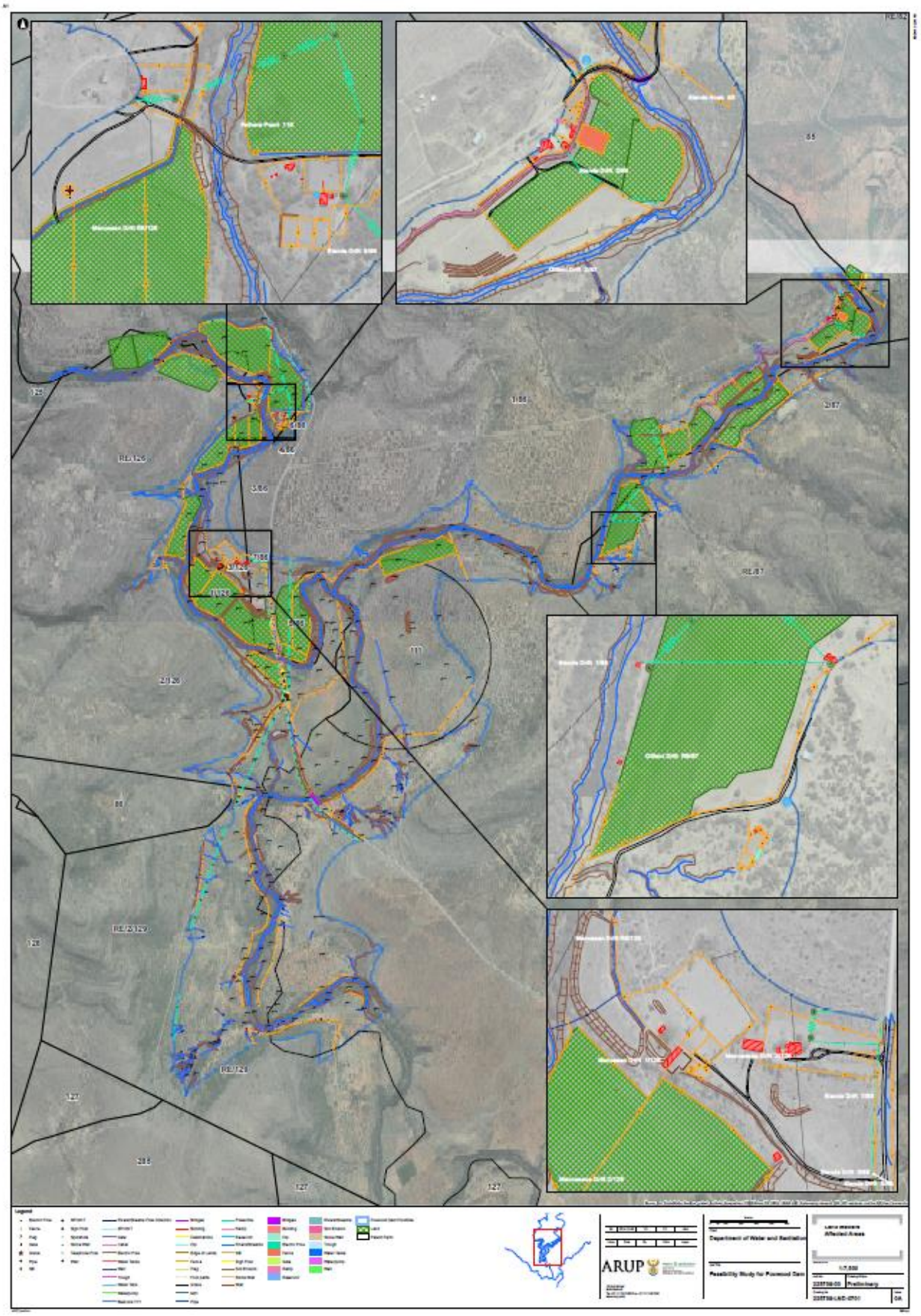

Figure 73: Land Matters Map

- The status of land claims needs to be assessed and resolved before the project can proceed.
- The development of the Foxwood Dam would provide additional, high assurance water supplies for domestic use, which would significantly improve the resilience of the limited supplies now available from the Koonap River without the benefit of storage, and would make water available to meet any increasing needs for domestic, municipal and industrial use.

Specialist Study Triggered / Additional Investigations

A Socio-economic Impact Assessment will be undertaken as part of the EIA phase, and mitigation measures will need to be identified to manage the impacts to the local social and economic environments.

Findings from the Economic Impact Assessment, which undertaken under the Technical Feasibility Study, will be incorporated into the EIA Report. The objectives of this assessment included to following:

- Substantiate whether there is a clear economic rationale for the project;
- Identify and quantify the economic consequences of all financial flows and other impacts of the project (Cost Benefit Analysis);
- Identify an appropriate 'no-project' scenario and calculate the associated economic flows, treating them as opportunity costs to the project;
- Detail the calculation for all inputs and outputs;
- Identify the economic benefits to BEE, and the opportunity costs to BEE of a 'no-project' scenario; and
- Provide a breakdown of the economic costs and benefits of the project into its financial costs and benefits and various externalities.

The energy requirements for Foxwood Dam and the capacity of existing electrical infrastructure to supply the energy requirements of the scheme will be confirmed in the EIA phase. Discussions are underway with Eskom in this regard.

All affected landowners and tenants will be engaged throughout the execution of the EIA.

11.11 Agriculture

Status Quo

Adelaide is predominantly a farming town, in a beef, mutton, wool and citrus farming district. According to the Reconciliation Strategy for Adelaide (DWA, 2010), approximately 2 700 ha of land near Adelaide is irrigated directly from the rivers or from farm dams.

The land areas affected by Foxwood Dam include natural bush grazing with some pastures, cultivated land and citrus orchards. Refer to the Land Matters Map in **Figure 73**, which shows cultivated areas affected by the proposed project. **Table 51** shows the land area affected by Foxwood Dam's purchase line.

Table 51: Projected extent of required land acquisition (DWS, 2015)

Land identification	Land type	Size (ha)
Eilands Hoek 85 Fort Beaufort RD PTN 0	Natural Grazing	5.70
Elands Drift 86 Fort Beaufort RD PTN 1	Natural Grazing	68.40
Elands Drift 86 Fort Beaufort RD PTN 2	Natural Grazing	20.00
	Citrus Orchards	5.00
Elands Drift 6 Bedford RD PTN 3	Natural Grazing	5.00
	Cultivated Land	1.00
Elands Drift 86 Fort Beaufort RD PTN 5	Natural Grazing	2.00
	Cultivated Land	12.00
Elands Drift 86 Fort Beaufort RD PTN 6	Natural Grazing	2.20
Elands Drift 86 Fort Beaufort RD PTN 7	Natural Grazing	4.50
Farm 111 Fort Beaufort RD	Natural Grazing	85.00
Fathers Poort 116 Bedford RD PTN 0	Natural Grazing	27.00
Leeuw hoek 129 Bedford RD PTN0	Natural Grazing	96.00
	Cultivated Land	1.80
Leeuw hoek 129 Bedford RD RE/2/PTN	Natural Grazing	0.10
Mancasana Drift 126 Bedford RD PTN 0	Natural Grazing	21.60
	Cultivated Land	16.00
Mancasana Drift 126 Bedford RD PTN 1	Natural Grazing	16.00
	Cultivated Land	12.00
Mancasana Drift 126 Bedford RD PTN2	Natural Grazing	52.00
	Cultivated Land	8.00
Mancasana Drift 126 Bedford RD PTN 3	Natural Grazing	12.00
Olifant Drift 87 Fort Beaufort RD PTN 0	Natural Grazing	24.00
	Cultivated Land	8.00
Olifant Drift 87 Fort Beaufort RD PTN2	Natural Grazing	10.00
	Citrus Orchards	8.00
Rooidam86 Bedford RD PTN0	Natural Grazing	0.20
Adelaide Town Planning	Natural Grazing	157.00
Sub-total (land costs)		681

Figure 74: Example of cultivated areas (Mankazana River)

Cultivated areas are situated alongside the gauging weir option 1 site (refer to **Figure 75**), on the Remainder of the Farm Leeuw Hoek 129. Access to this site will need to be considered from the west to minimise impacts to farming operations.

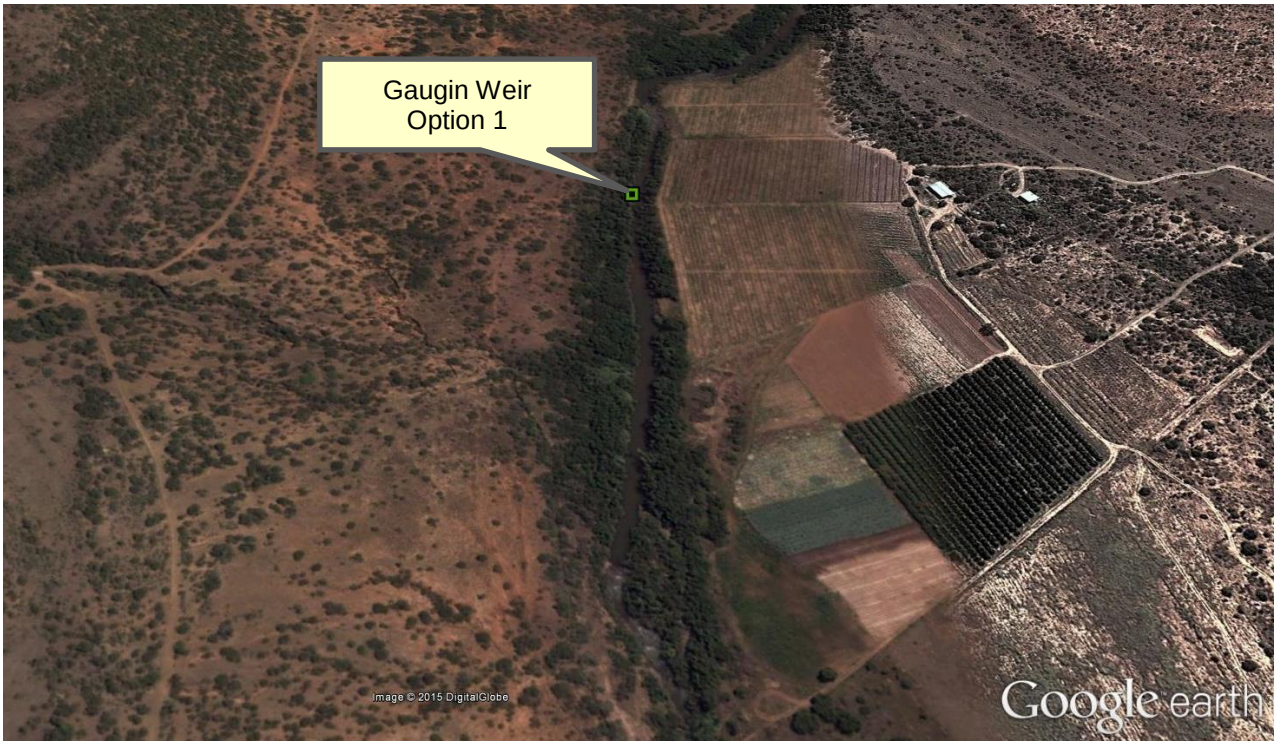

Figure 75: Cultivated land alongside gauging weir option 1

The relocated route of the telephone line passes through cultivated land on Portion 2 of the Farm Elands Drift 86 (see **Figure 76**).

Figure 76: Cultivated land affected by telephone line deviation

Potential Impacts / Implications

- The effective development of a major storage dam at the Foxwood site would regulate the variable runoff in the Koonap River to the extent that, after full provision is made for maintaining the Reserve to ensure the health and integrity of the resource itself, a significant quantity of water would be made available for irrigation development at an appropriate level of assurance. It is this resource that would be mobilized, together with land and human resources in the region, to provide a stimulus for socio-economic development. This vision is assessed in the context of agricultural development, land reform and rural development policies within the framework of the NDP.
- Loss of arable land and grazing land within the basin. This could place pressure on the remaining grazing resources.
- Loss of farm dams, water abstraction points (pump houses) and general agricultural infrastructure within the basin.
- Livestock currently have access to the Koonap and Mankazana Rivers for drinking purposes. Future access arrangements to the dam for livestock watering to be considered further.

- Agricultural areas affected by the deviation of existing infrastructure, including the canal, power line, telephone line, R344 and MR00639. Impacts during construction (clearing within the temporary servitude) and operational phase (permanent servitude restrictions) will need to be assessed. It is anticipated that agricultural practices will be able to proceed on top of the pipeline within the servitude, with certain limitations that need to be confirmed.
- Disruptions to farming operations as a result of construction-related use of access roads need to be clearly understood and mitigated.
- Impacts to existing water users that abstract from the river for agricultural use. As part of the Technical Feasibility Study 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 Koonap River, it is anticipated that a full review of water allocation would be carried out by DWS.
- During public participation an I&AP noted that he uses the MR00639 for the moving of sheep and cattle by foot to reach grazing areas (refer to Comments and Response Report contained in **Appendix O**). If this road is to be closed this matter will need to be considered further in terms of possible mitigation.

Specialist Study Triggered / Additional Investigations

The need for the project is rooted in the proposed Government Irrigation Scheme within the Koonap River valley downstream of the proposed Foxwood Dam, which needs to be taken forward by an appropriate Implementing Agent such as ECRDA. Although this scheme is excluded from the EIA, the Technical Feasibility Study (including associated engagements that took place with the relevant government departments and stakeholders) provided the necessary footing for this venture to be pursued further.

An Agricultural Impact Assessment will be conducted during the EIA phase. Amongst others, this will quantify the agricultural areas lost as a result of the proposed project and consider possible mitigation measures. It will also identify the preferred project options from an agricultural perspective.

The loss of cultivated land will need to be considered in terms of the impact to the current agricultural operations. Compensation measures will need to be evaluated in close consultation with the affected parties.

11.12 Air quality

Status Quo

Due to the predominantly rural nature of the study area, the air quality is regarded to be good. Localised impacts to air quality include burning of fossil fuels, 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 larger livestock.

In the greater area, air quality is influenced by anthropogenic activities in urbanised areas such as Adelaide and Bedford.

Sensitive receptors to dust and other air quality impacts in the study area include farm dwellings and the areas of Bezuidenhoutville and to a lesser extent the town of Adelaide.

Potential Impacts / Implications

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

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

Specialist Study Triggered / Additional Investigations

No specialist air quality study will be undertaken for the proposed project, as it is not deemed necessary for the type of activities associated with this project. Mitigation measures will be 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 will also include measures to control and minimize greenhouse gas emissions by optimizing the utilisation of construction resources.

11.13 Noise

Status Quo

The rural 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 mountainous terrain and undulating landscape serves as noise attenuation features, although the ambient noise levels are regarded as insignificant.

The following observations are made with regards to sensitive noise receptors in the study area (to be confirmed during the EIA phase and pre-construction):

- Dwellings on surrounding farms may be exposed to construction-related noise;
- A dwelling (status unknown) is located less than 400 m to the south of the dam wall. No other dwellings are situated closer than 500m from the dam wall, where major construction activities will take place;
- Bezuidenhoutville is located more than 1.5 km to the south-east of the dam wall; and
- No dwellings are located near the borrow pits and quarry, except on Portion 1 of the Farm Mancasana Drift 126 where a dwelling is situated approximately 300 m to the north-west of a borrow pit.

Refer to **Section 11.16** for further discussions on buildings affected by project infrastructure.

Potential Impacts / Implications

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

Specialist Study Triggered / Additional Investigations

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

11.14 Historical and Cultural Features

Status Quo

11.14.1 Adelaide's History

Some of Adelaide's history, as sourced from http://www.adelaidetourism.co.za /history.htm, follows and provides some context in terms of the historical significance of the general area.

Adelaide lies in a part of the EC that is rich in history due to the confluence of South Africa's three main population groups. The San ("Bushmen") were the original inhabitants of South Africa and far beyond. A hunter-gatherer way of life has meant that they have left little in the way of artifacts. They are best remembered for their natural record of wildlife in their so-called rock art of which there is a fine legacy in the district.

With the coming of the black Bantu speaking people from the east and the white Afrikaans speaking people from the west, the San were displaced northwards, never to return. When the British took over the Cape from the Dutch in the early 1800's during the wars with France, they established a military post on the southern bank of the Koonap River (a name derived from the San "Gonappe"). This is to-day the farm Haddon, just to the south of the town. The Dutch bequeathed to the British two problems in the EC. One

was the dissatisfaction of the trekboers with government from remote Cape Town. The other was friction between these migrant farmers and the migrating black peoples. In an attempt to stabilise the frontier, the British began to introduce settlers into the region; the well-known 1820 Settlers. Tension continued, however, and during much of the remainder of the century periodically broke out into open warfare, the Frontier Wars.

In 1834, a Captain Armstrong established a larger military encampment which he named Fort Adelaide after the wife of King William IV. The town subsequently grew up out of this.

In 1835 began the Great Trek in which numbers of Afrikaans speaking inhabitants left the area to migrate northwards in search of new lands to settle, free from government interference. This thinning-out of the population exacerbated the frontier problem and in 1836 a fort was built at Post Retief, north east of Adelaide which could serve as a refuge for farmers and their workers during raids.

Many Scottish settlers established themselves in the area, especially in the Mankanzana River valley. It was they who erected the first church in the district, at Glen Thorn.

11.14.2 General

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

- Due to the rich historical past of conflict, change, adaptation and interaction between different groups and individuals in the Adelaide region, evidence of historical remains (e.g. artefacts, structures, graves, etc.) may be identified within the project area;
- There is a large stone weir across the Koonap River which was built in 1901, as well as an old pump house on the Remainder of the Farm Leeuw Hoek 129 (see photographs in **Figure 77**);
- A small burial site was identified as part of the Technical Feasibly Study;
- It is noted that historical buildings are located within Adelaide that have been awarded provincial heritage status; and
- According to the Fossil Sensitivity Map, viewed on the South African Heritage Resources Information System (SAHRIS), the palaeontological sensitivity of the project area is regarded as very high.

Figure 77: Stone weir (top) and old pump house (bottom)

Potential Impacts / Implications

The project could impact on heritage and cultural features as follows:

- Destruction or damage of heritage resources through construction activities; and
- Inundation of heritage resources within the Foxwood Dam basin.

Specialist Study Triggered / Additional Investigations

A Phase 1 Heritage Impact Assessment, in accordance with the National Heritage Resources Act (Act No. 25 of 1999), will be conducted during the EIA phase and will be submitted to the EC Provincial Heritage Resources Authority for decision-making. The site will also be screened further against the Fossil Sensitivity Map on SAHRIS. In addition, an Application Form will also be completed and submitted to the EC Provincial

Heritage Resources Authority. All the relevant protocols need to be abided by and permits will need to be obtained with regard to heritage resources (where necessary).

A Search, Rescue and Relocation Management Plan for heritage resources and graves will be developed for the project. The heritage specialists should be assisted by the landowners and labourers with the identification of possible graves and other features of historical significance. All work will cease for chance finds of heritage resources during the construction phase and the EC Provincial Heritage Resources Authority will be notified. Additional mitigation measures will be included in the EMPr.

11.15 Planning

Status Quo

The project area is predominantly located in Wards 1 and 4 of the Nxuba LM, with a small section of the power line alignment B that is also situated in Ward 3 (see **Figure 78**).

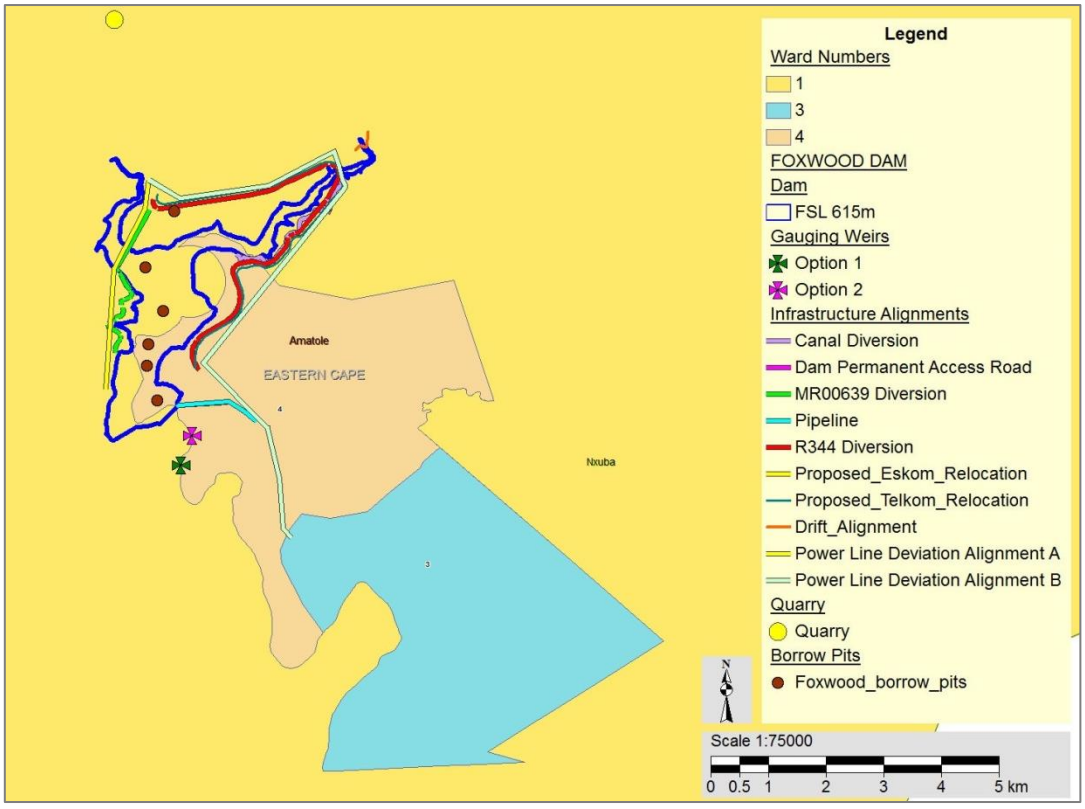

Figure 78: Project footprint in Nxuba LM

The SDF for the Amathole DM is provided in **Figure 79** and the Amathole DM Spatial Plan and Spatial Planning Elements Plan is shown in **Figure 80**. The SDF for Adelaide is provided in **Figure 81**.

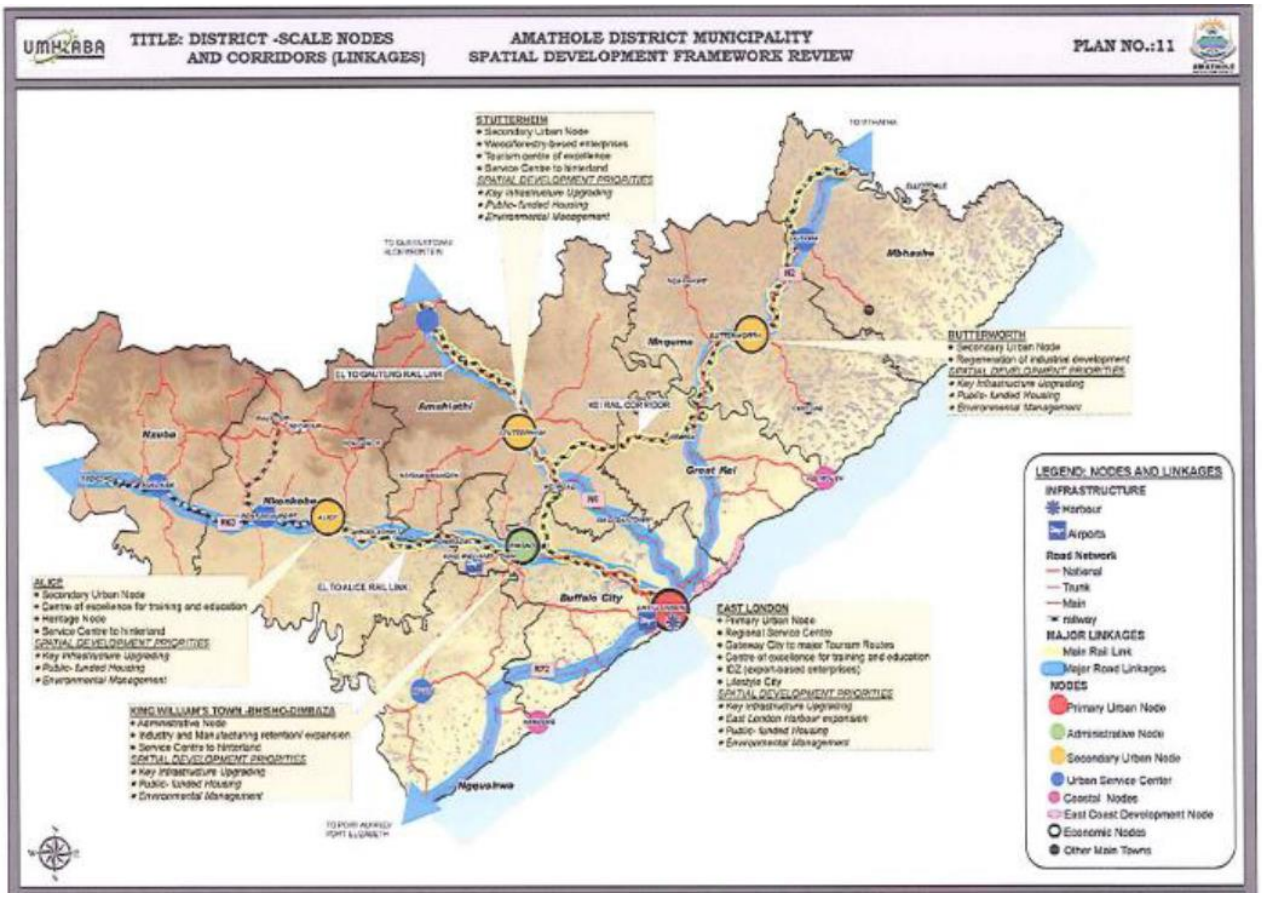

Figure 79: Amathole DM SDF (Nxuba LM, 2014)

According to the Nxuba LM IDP Review for 2014/2015, Adelaide is the Urban Service Centre in the municipality. This is seen as town that provides a higher order level of services to their surrounding hinterland areas. It is also recognized that these towns exhibit trends of population influx and require investment in order to accommodate these pressures.

According to the Amathole DM's SDF, the R63 is one of four corridors identified in the Corridor Programme led by ASPIRE (the Amatole DM's Economic Development Agency) identified for development and related investment initiatives.

The Nxuba LM IDP (2014) notes that the constructions of Foxwood dam will probably provide opportunities for tourism and water resources needed by investors.

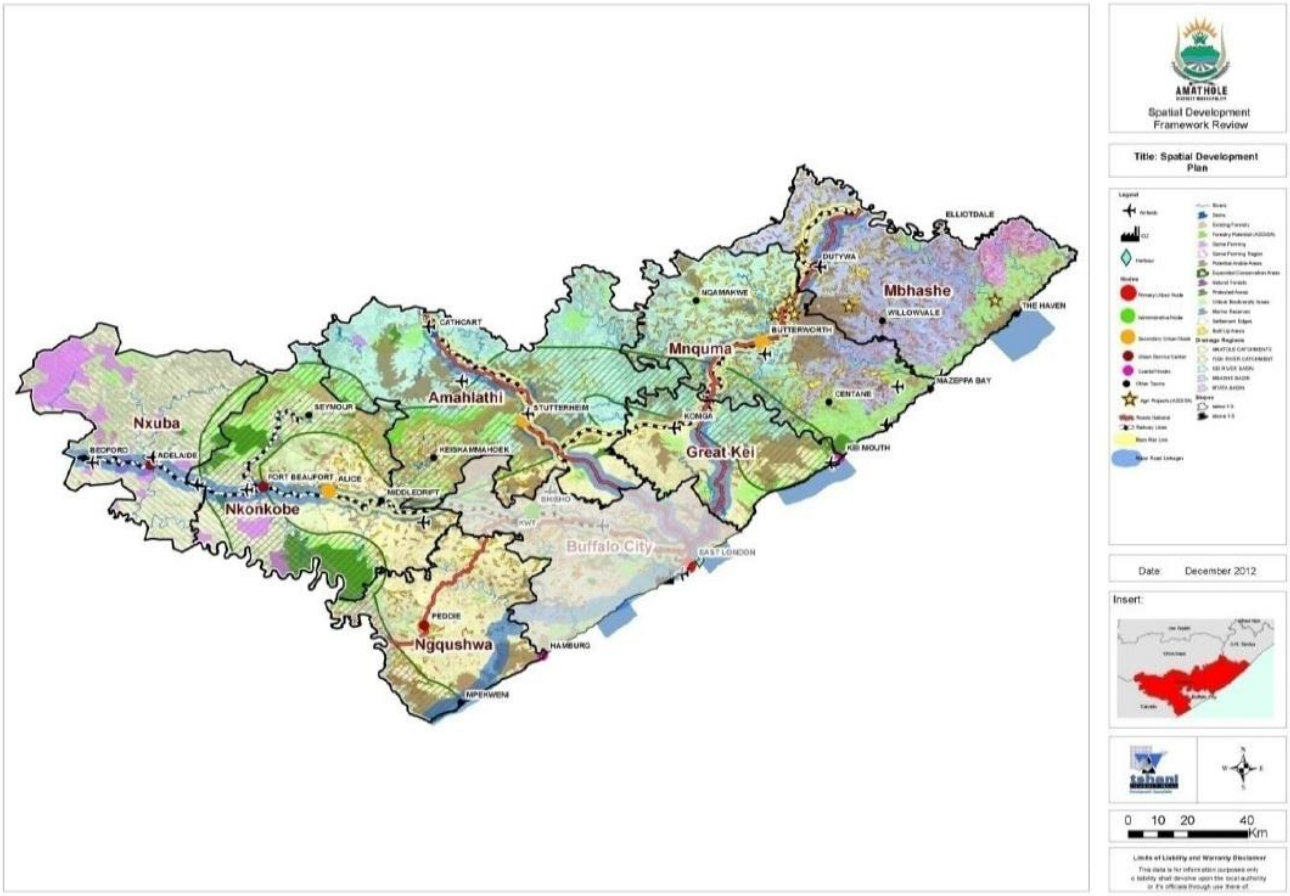

Figure 80: **Amathole DM Spatial Plan and Spatial Planning Elements Plan (Amathole DM, 2015)**

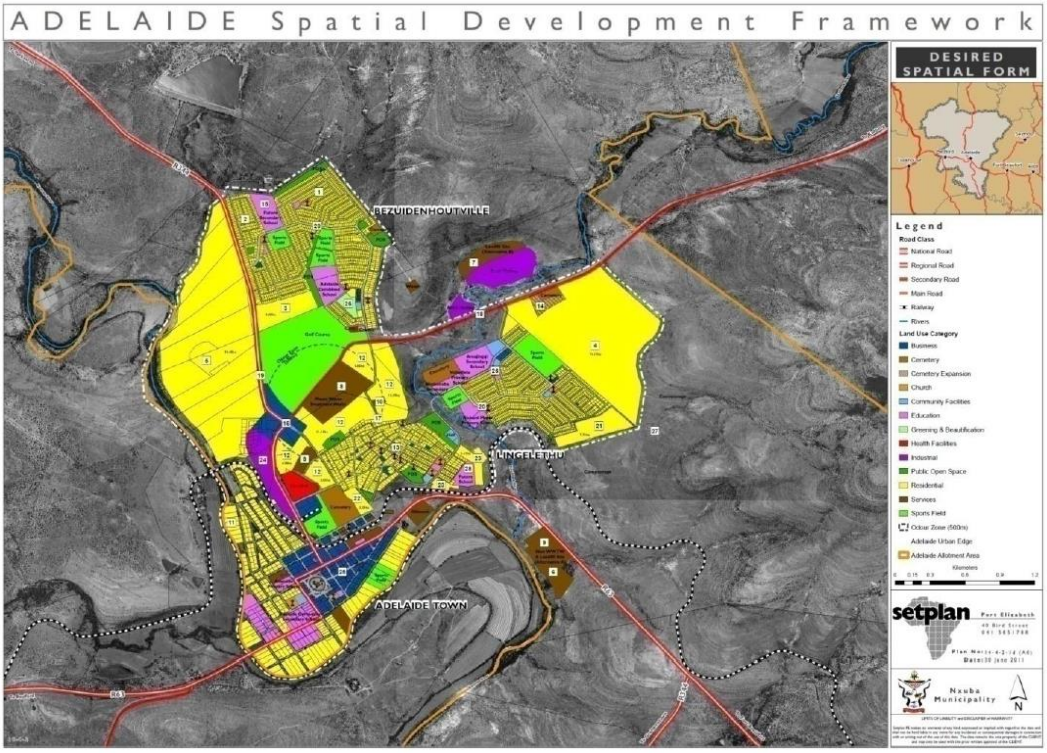

Figure 81: **Adelaide SDF (Nxuba LM, 2014)**

Potential Impacts / Implications

The land areas affected by Foxwood Dam generally consist of natural bush grazing with some pastures, cultivated land, mountain land and citrus orchards with some fixed improvements in the form of buildings.

The development of Foxwood Dam is not in direct conflict with the planning frameworks of the affected municipalities.

It is not anticipated that the project will adversely affect the rural nature of the project area.

Following a RMP process to determine the possibility of allowing recreational use at Foxwood Dam, coupled with the proximity of the dam to the Fort Fordyce Nature Reserve, tourism activities may increase in this area.

The dam may affect the sense of place of the receiving environment, however, mitigation measures will be investigated during the ensuing EIA phase.

Specialist Study Triggered / Additional Investigations

Tourism-related impacts will be assessed in the EIA phase. In this regard, a Visual Impact Assessment will also assist in understanding the potential implications to the aesthetic quality of the project area.

The influence of the proposed project to matters pertaining to planning and land use will also receive further attention in the EIA phase.

11.16 Existing Structures and Infrastructure

Status Quo

Table 52 summarises the structures affected by the proposed dam's purchase line. Refer to the Land Matters Map in **Figure 82**, which shows the locations of these structures.

Table 52: Loss of buildings (DWS, 2015)

Land identification	Land type	Size (m^2)
Mancasana Drift 126 Bedford RD PTN1	Fixed Improvements - buildings	270.00
Mancasana Drift 126 Bedford RD PTN2	Fixed Improvements - buildings	40.00
Mancasana Drift 126 Bedford RD PTN3	Fixed Improvements - buildings	1,000.00
Fathers Poort 116 Bedford RD PTN 0	Fixed Improvements - buildings	546.00
Fathers Poort 116 Bedford RD PTN 0	Fixed Improvements - tennis courts	3.00
Olifant Drift 87 Fort Beaufort RD PTN 0	Fixed Improvements - buildings	200.00
Elands Drift 86 Fort Beaufort RD PTN 2	Fixed Improvements - buildings	750.00
Sub-total (fixed improvements)		**2,809**

Figure 82: Examples of structure within the purchase line (top – Mankazana River, bottom – Koonap River)

Further observations with regards to the impacts of the project infrastructure on existing structures and buildings follows (list of affected structures not exhaustive):

- The power line alignment A crosses over structures associated with the Presbyterian Church Adelaide Primary School (Portion 4 of the Farm Elands Drift 86) as well as the tennis courts and clubhouse of the Adelaide Tennis Club (Portion 6 of the Farm Elands Drift 86). The last-mentioned features are also within the dam's purchase line;
- The power line alignment B crosses through the Adelaide Golf Course and Bezuidenhoutville;
- Power line alignment A and the deviation of the MR00639 cross over and pass nearby to farm buildings (Portions 1 and 3 of the Farm Mancasana Drift 126), which are also located within the dam's purchase line;
- A dwelling (status unknown) is located less than 400 m to the south of the dam wall;
- Relocated routes of the canal, R344 and telephone line pass near to existing farm buildings (Portion 2 and Remainder of the Farm Olifants Drift 87) (see **Figure 83**);
- Telephone line deviation crosses over a farm dam (Portion 2 of the Farm Olifants Drift 87) (see **Figure 83**).

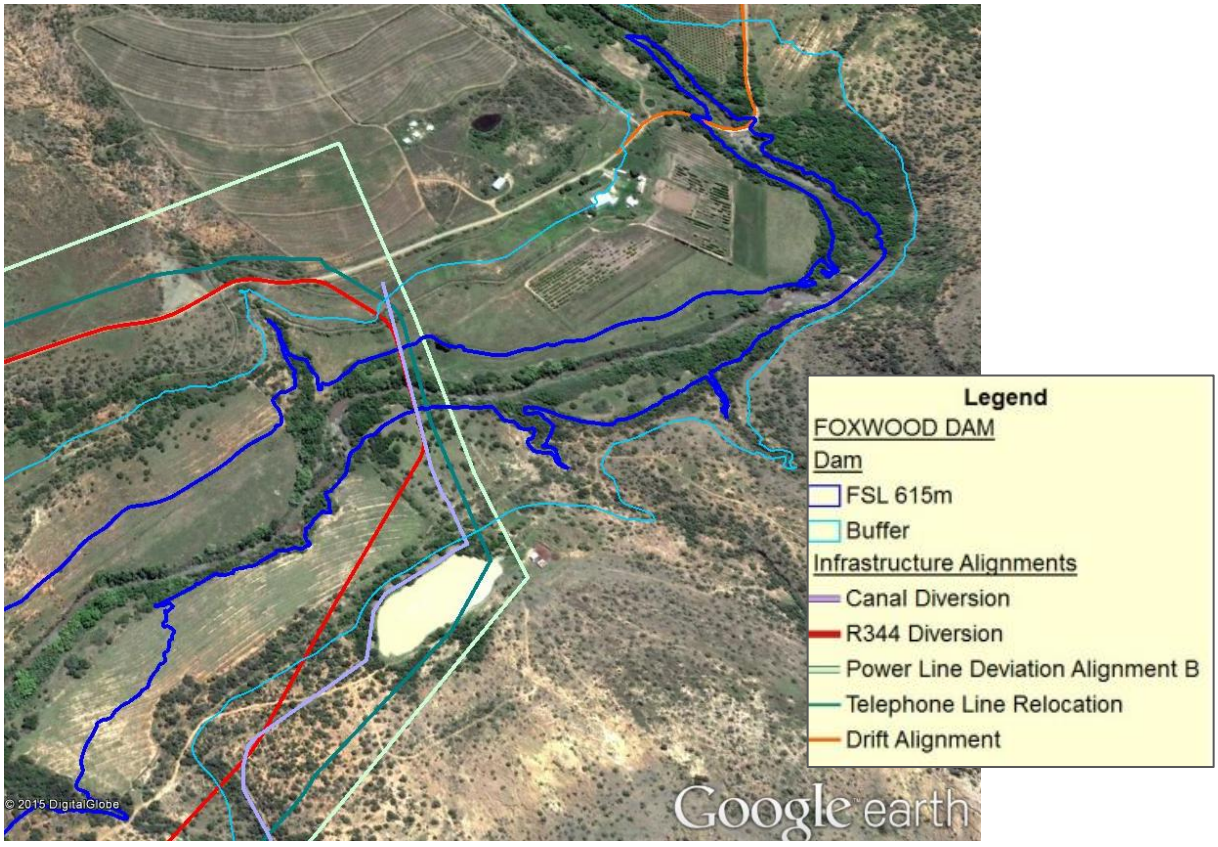

Figure 83: **Aerial view of some features affected by project components**

Potential Impacts / Implications

- The infrastructure (power line, telephone line, roads, canal) and structures affected by the proposed development will be relocated, as necessary. Alternatively, compensation will also be considered, where relevant.
- Disruptions to traffic on local road network during construction.
- Permanent access along the pipeline servitude will be required after construction.
- Pipeline markers (concrete posts) will be installed at changes in direction and at regular intervals along the pipeline route.
- Following the installation of the pipeline, the servitude can still be utilised by the landowner for certain types of land use, for examples grazing and planting of certain crops. However, the use of the land covering the servitude will be subject to certain restrictions. In this regard, certain activities will not be permitted such as the planting of trees, excavation over the pipeline, building of structures and installation of services.

Specialist Study Triggered / Additional Investigations

Provision made for relocation of a power line, telephone line, roads and canal that will be affected by the basin. Optimisation of routes to be considered in the EIA phase to avoid existing structures and buildings situated outside of the dam basin.

All structures and buildings that will be affected by the project will be identified and suitable compensation measures need to be established.

Mitigation measures to be identified during the EIA phase to safeguard or relocate existing structures and agricultural infrastructure on private farms or to compensate the owners.

11.17 Transportation

Status Quo

The transportation network in the study area is shown in **Figure 84**. The dam wall is best reached by taking the R344 off the R63 and travelling north-westwards until the proposed permanent access road located past Bezuidenhoutville.

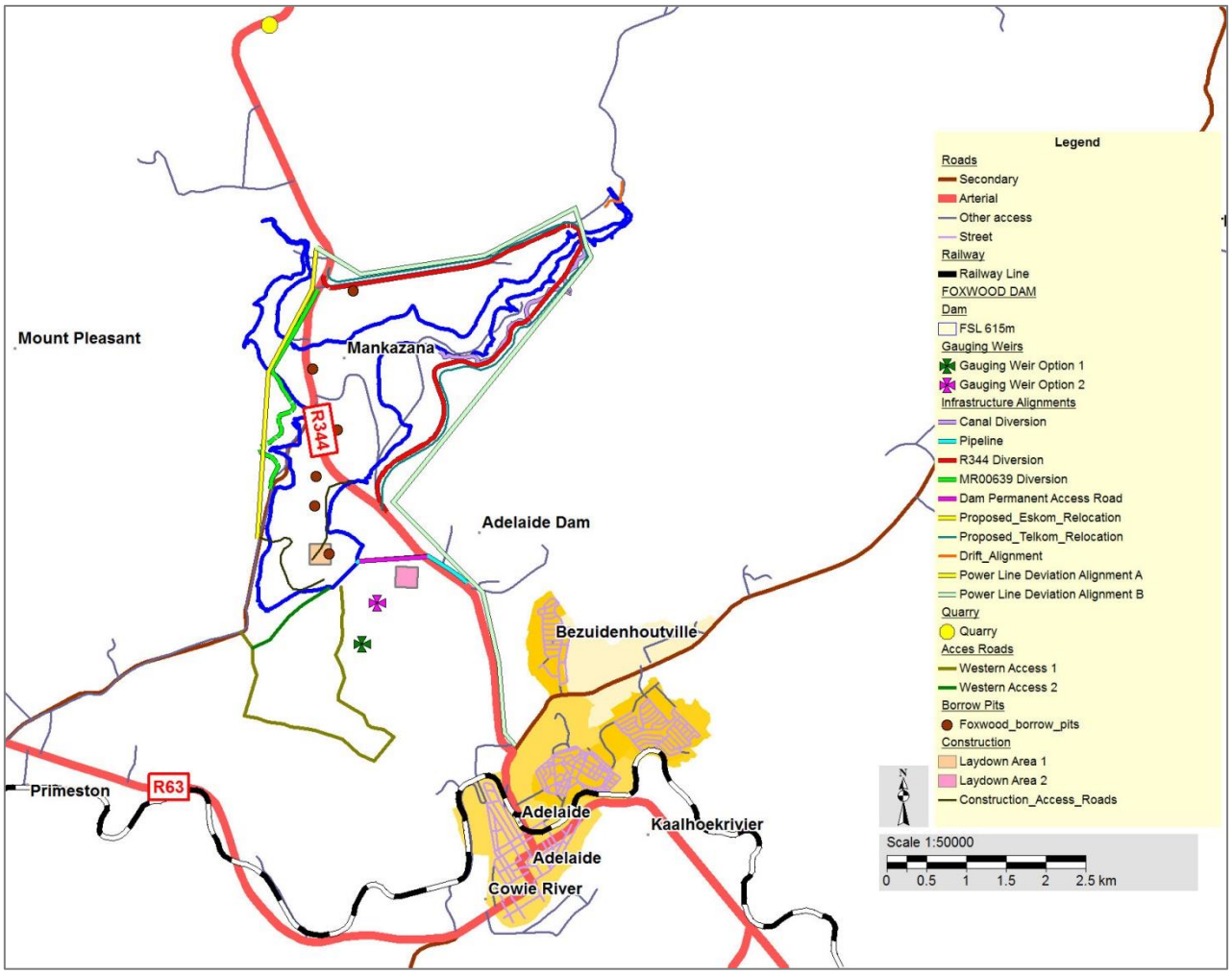

Figure 84: Transportation Network

Potential Impacts / Implications

The following two public roads will be inundated by the Foxwood Dam reservoir, for which route deviations are proposed (refer to **Section 9.5.5**):

- Approximately 2 km of the R344 (MR00638), which connects Adelaide and Tarkastad (including two bridges); and

- Approximately 1 km of the MR00639, which provides a connection from the R63 to the R344.

Permanent access roads will be required for the operational phase, whereas temporary access and haul roads will need to be created for construction purposes. Existing roads will be used, as far as possible. The proposed access roads for the project include the following:

- Permanent access roads –
  - Access road to dam wall (from R344);
  - Access road to right bank crest (from MR00639);
  - Access road to right bank earth embankment (from MR00639);
- Temporary access roads –
  - Access roads to construction laydown areas (from R344); and
  - Access road to right bank (from MR00639);

During the construction period there will be a significant increase in traffic on the local road networks, due to the delivery of plant and material, transportation of staff and normal construction-related traffic. This impact will be exacerbated if aggregate is to be obtained from a commercial source. Haul roads and access roads will also be created on site, within the construction domain.

As part of the construction phase measures will be implemented for the selective upgrade of the roads (if necessary) and to render these roads safe for other users (amongst others). Dust suppression on the access and hauls roads will also be addressed.

After the construction phase selected local roads will only need to be used for operation and maintenance purposes, and provision is made to create a permanent access road.

During public participation an I&AP noted that there used to be a landing strip between the R344 and Bezuidenhoutville, which subsequently made way for residential development (refer to Comments and Response Report contained in **Appendix O**). It was noted by the I&AP that the current absence of a landing strip has created a problem due to the increase in the number of international hunters that visit the area every year.

According to the I&AP, the proposed pipeline from the dam wall traverses the only area that is suitable for a landing strip for Adelaide. A deviation to the pipeline route was suggested by the I&AP, which will need to be investigated further from technical and environmental perspectives.

Specialist Study Triggered / Additional Investigations

Any disruptions to the transportation network must be mitigated, and will be discussed in the EIA Report. A Traffic Impact Assessment will be undertaken during the EIA phase.

Consultation regarding the potential relocation of the roads took place with the Eastern Cape Department of Roads and Public Works (ECDRPW) and the letter outlining the outcomes from this consultation is provided in **Appendix N**. The relocation of the MR00639 may not be justified, as it will be very expensive and is not often used. The traffic specialist will conduct traffic counts and provide a specialist opinion on the need to relocate this road.

11.18 Waste Disposal Facilities

Status Quo

According to the Nxuba LM IDP (2014), there are waste disposal sites in Adelaide and Bedford. The Bedford landfill site is permitted but it is not strictly managed according to the legislation and permit conditions. The Adelaide waste site is not registered and does not conform to DEA's standards and in addition the site is not zoned for waste disposal.

Potential Impacts / Implications

The project will directly or incidentally generate various types of solid waste during the construction phase, such as:

- Waste generated from site preparations (e.g. plant material);
- Domestic waste;
- Surplus and used building material; and
- Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags).

Wastewater will also be produced during construction from the sanitation facilities, washing of plant, operations at the batching plant, etc. Wastewater removed from site will be disposed of at the Adelaide Wastewater Treatment Works.

Excess spoil material (soil and rock) will be generated as part of the bulk earthworks associated with the construction phase of the project. This spoil material will be hauled and dumped at the borrow areas that will be created for the project, as part of rehabilitation.

Specialist Study Triggered / Additional Investigations

During construction a waste management area will be established at the camp where waste from site will be collected, sorted, weighed and placed in skips and recycling containers for removal to service providers and appropriate registered landfill sites (hazardous and general sites, as required).

Further provisions for waste and wastewater management will be attended to in the EMPr.

11.19 Aesthetic Qualities

Status Quo

The area around the proposed Foxwood Dam is afforded high aesthetic appeal through topographical features such as cliffs, valleys and watercourses, as well as the natural state of the basin's vegetative cover. A photograph of the upstream view of proposed basin from the left flank of the dam wall is provided in **Figure 85**.

The area's undeveloped, rural state further contributes to the visual quality encountered in the area. The sense of place is typical of rural EC, with agriculture as the dominant land use.

Figure 85: Upstream view of proposed basin from left flank of dam wall

Potential Impacts / Implications

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 Foxwood Dam wall will also be inundated.

One of the proposed borrow areas and the quarry will be situated outside of the basin. The remaining five borrow areas will be located within the basin, and will be inundated and will thus not pose a visual impact during the operational phase.

Foxwood Dam will replace the existing landscape from natural area to a water body. From the areas that are granted a view of the reservoir, 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.

Specialist Study Triggered / Additional Investigations

A Visual Impact Assessment will be undertaken during the EIA phase to assess the impacts to the aesthetics as a result of the proposed project activities and infrastructure. The assessment will also consider the sensitive receptors (e.g. residences) that could potentially be influenced by any visual impacts.

EMPr to include measures to manage visual impacts and to rehabilitate areas affected by construction activities that fall outside of the basin.

11.20 Tourism

Status Quo

Adelaide is situated in an eco-tourist centre, surrounded by countryside. It has a rich bird life, fine examples of rock art, a rich diversity of flora and fauna, and access to a number of game reserves and game farms.

According to the Nxuba LM (2014), tourism and heritage development remains a challenge for the Municipality but Amathole DM has committed to assist in the development of Nxuba Tourism Master Plan. Nxuba has a functioning Local Tourism Organisation which is partly funded by the municipality and supported by Amathole DM.

Tourist attractions in the Nxuba LM include (Nxuba LM, 2014):

- Spectacular scenery;
- Lingelethu, Bezuidenhoutville, Goodwin Park and Nyarha Parks;
- Heritage Sites;
- Fort Fordyce;
- Post Retief;
- Dutch Reformed Church;
- Glen Lynden;
- Glen Eden Church;
- War Memorial; and
- Heritage Museum (Adelaide).

The Nxuba LM IDP (2014) notes that the constructions of Foxwood dam will probably provide opportunities for tourism and water resources needed by investors.

Potential Impacts / Implications

The Foxwood Dam reservoir may be suitable for a variety of recreational activities (e.g. fishing, canoeing, camping, etc.), which will be established through the RMP process (explained in **Section 9.12**).

Visual impacts (see **Section 11.19**), particularly during the construction phase, may influence the tourism potential of the area.

Specialist Study Triggered / Additional Investigations

Visual Impact Assessment and Socio-economic Impact Assessment to be undertaken in EIA phase.

12 PUBLIC PARTICIPATION

The purpose of public participation includes:

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

The public participation process that was followed for the proposed development of Foxwood Dam is governed by NEMA and GN No. R. 982 (4 December 2014). **Figure 86** outlines the public participation process for the Scoping phase (current) and EIA phase (pending). Note that the dates may change due to the dynamic nature of the EIA process.

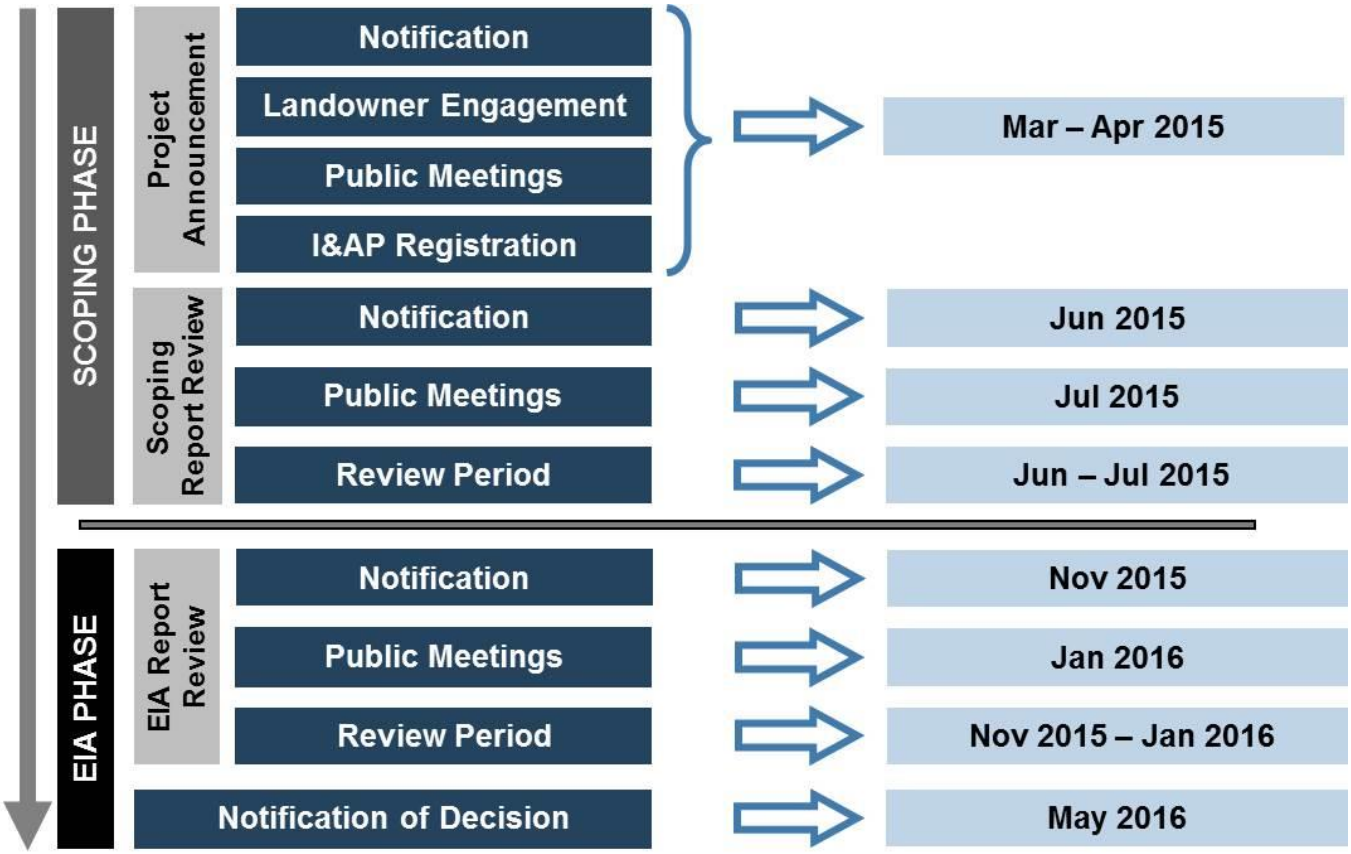

Figure 86: Outline of Public Participation Process

12.1 Public Engagement during the Technical Feasibility Study

Public participation was initiated as part of the Technical Feasibility Study for Foxwood Dam, which included targeted engagement with an Agricultural Technical Working Group (ATWG) and a Stakeholder Forum. Various meetings were held with the aforementioned parties to discuss the project.

There were a number of concerns and issues raised which were categorised as follows (DWS, 2014c):

- Institutional arrangements and responsibilities;
- Water resources management;
- Infrastructure;
- Agricultural (irrigation) opportunities;
- Social and environmental impacts; and
- Economic development opportunities.

The outcomes of the public participation during the Technical Feasibility Study fed into the EIA process.

12.2 Authorities Consultation

Note that authorities are regarded as government departments with jurisdiction pertaining to the activities associated with the proposed project or the receiving environment.

12.2.1 Pre-Application Consultation

A Pre-Application Consultation Meeting was convened with DEA on 18 March 2015 (refer to minutes contained in **Appendix D**). The purpose of the meeting included:

- To introduce the project to DEA;
- To seek clarification regarding certain matters that pertain to the EIA process;
- To determine DEA's requirements; and
- To confirm the process and timeframes.

12.2.2 Environmental Authorities' Meeting & Site Visit

An Environmental Authorities Meeting and site visit (see **Figure 87**) was held on 25 March 2015 (refer to **Appendix M** for a copy of the minutes of the meeting) and was attended by representatives from the following authorities:

- DEA;
- EC DEDEAT;
- DAFF;
- DWS EC Regional Office;
- EC Department of Rural Development and Agrarian Reform (DRDAR);
- Amathole DM; and
- Amatola Water.

Figure 87: Authorities Site Visit on 25 March 2015

12.3 Database of I&APs

A database of I&APs, which includes authorities, different spheres of government (national, provincial and local), parastatals, stakeholders, landowners, interest groups and members of the general public, was prepared for the project and is contained in **Appendix G**. This database will be maintained and updated as necessary during the course of the EIA.

12.4 Landowner Notification

The properties that are directly affected by the proposed development are shown in **Figure 7** and listed in **Table 2**. The details of the affected landowners are included in the I&AP database.

According to regulation 39(1) of GN No. R. 982 (4 December 2014), if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land. This requirement does not apply *inter alia* for linear developments (e.g. pipelines, power lines, roads) or if it is a SIP as contemplated in the Infrastructure Development Act, 2014. The proposed development of Foxwood Dam is a SIP and landowner consent is thus not required.

12.5 Project Announcement

12.5.1 Background Information Document

Background Information Documents (BIDs) and Reply Forms (refer to **Appendix H**), as well as Notification Letters, were prepared and forwarded to the I&APs contained in the database.

The BID provided the following information in a succinct format:

- Project background and overview;
- EIA process; and
- Details of the public participation process and where more information could be obtained.

The BID included a Reply Form, which granted the opportunity to register as an I&AP and to raise queries or concerns regarding the project. Copies of the completed Reply Forms and other correspondence received from I&APs are contained in **Appendix N**.

12.5.2 Onsite notices

Onsite notices (English, Afrikaans and Xhosa), which also served to announce the project, provided the details of the public meetings and explained how to register as an I&AP, were placed at strategic points within the project footprint (shown in **Figure 88**). Onsite notices were primarily placed in proximity to the project components, based on the availability of public access.

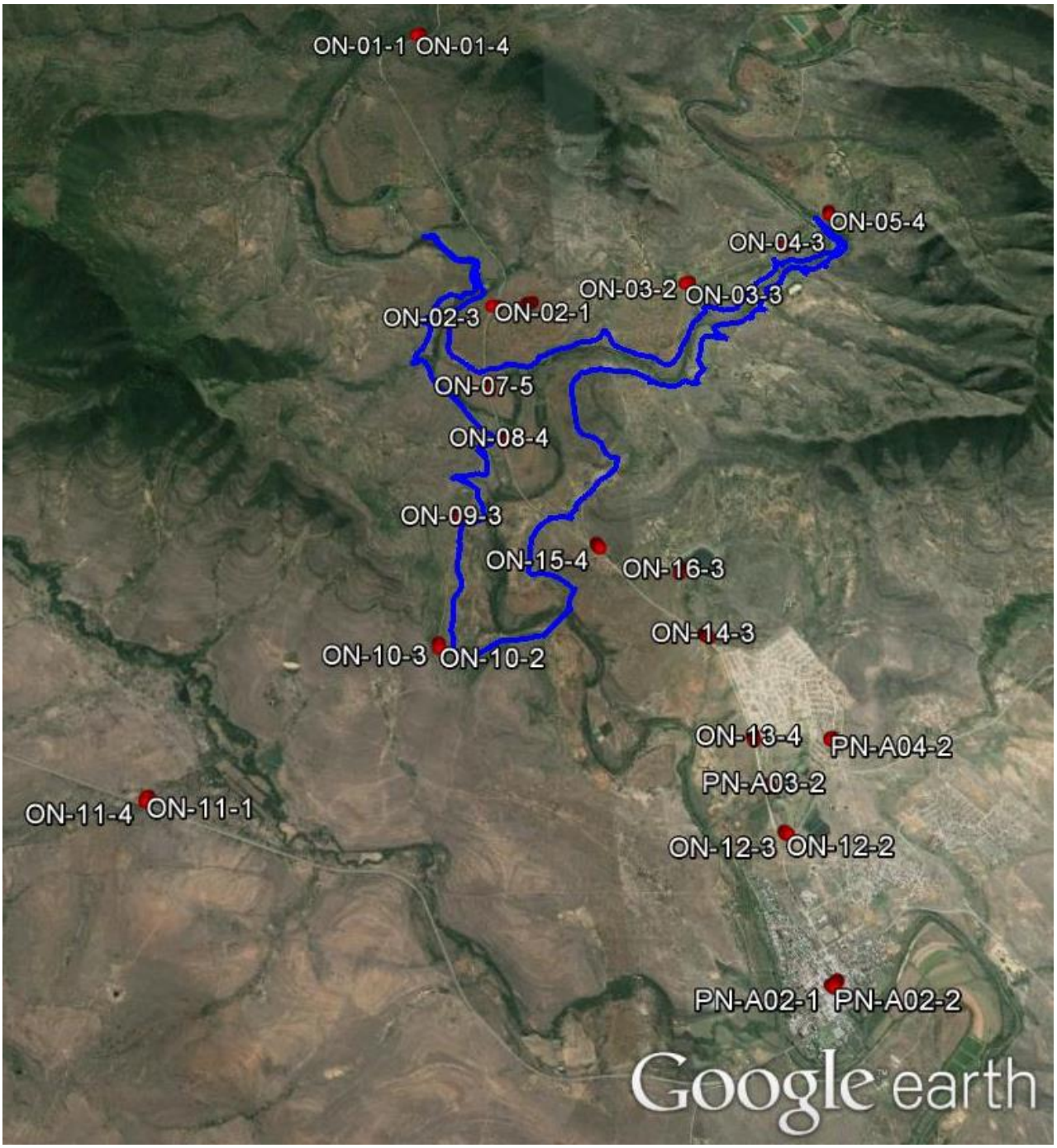

Figure 88: Locations of onsite notices during project announcement

In addition, public notices (same information as onsite notices) were also placed at the following locations:

- Municipal Office – Bedford;
- Library – Bedford;
- Golf Course – Bedford;
- Municipal Office – Adelaide;
- Library – Adelaide;
- Golf Course – Adelaide; and
- Library – Bezuidenhoutville.

Details of the locations of the onsite notices and accompanying photographs are contained in **Appendix I**.

12.5.3 Postal Inserts

A total of 600 postal inserts were placed at the following locations (see proof contained in **Appendix J**):

- Bedford Post Office;
- Adelaide Post Office;
- Bedford Municipal Office; and
- Adelaide Golf Course.

12.5.4 Newspaper Advertisements

Advertisements were placed in the following newspapers on 16 October 2013 (refer to copies of the newspaper advertisements contained in **Appendix K**) as notification of the project and the public meetings:

- Die Burger (05 March 2015);
- The Herald (06 March 2015); and
- Winterberg News (05 March 2015).

12.5.5 Public Meetings

A public meeting was held on 24 March 2015 (refer to minutes contained in **Appendix L**). Photographs of the meetings are included in **Figure 89**.

Figure 89: Pictures of public meeting held on 24 March 2015

The purpose of these meetings included the following:

- To introduce the project to the public;
- To provide an overview of the EIA process;
- To provide a platform for project-related discussions; and

- To obtain input into the Scoping Phase.

12.5.6 Comments Received

Copies of the comments received during the EIA announcement phase are included in **Appendix N** and were incorporated into the Comments and Response Report (**Appendix O**).

12.6 Review of Draft Scoping Report

12.6.1 Accessing the Draft Scoping Report

In accordance with Regulation 43(1) of GN No. R. 982 (4 December 2014), registered I&APs are granted an opportunity to review and comment on the Draft Scoping Report.

Copies of the document have been placed at the locations provided in **Table 53**. A 30-day review period (from 29 June - 29 July 2015) has been provided.

Table 53: Locations for review of Draft Scoping Report

Copy	Location	Address	Tel. No.
1.	Library – Adelaide	Market Square (next to Municipal Offices)	046 684 0034
2.	Library – Bedford	Cnr. Van Riebeeck & Donkin Street	046 685 0187
3.	Library – Bezuidenhoutville	Viljoen Street, Bezville Loc, Adelaide	046 684 0034
4.	Golf Course – Adelaide	Winterberg Lane, Adelaide	046 684 0489

Copies of the Draft Scoping Report were provided to the following parties, which include key regulatory and commentary authorities:

- DEA;
- EC DEDEAT;
- DAFF;
- DWS EC Regional Office;
- DMR EC Regional Office;
- Eastern Cape Department of Rural Development and Agrarian Reform (DRDAR);
- ECRDA;
- EC Department of Roads and Public Works;

- EC Provincial Heritage Resources Authority;
- Amathole DM;
- Nxuba LM; and
- Amatola Water.

The Draft Scoping Report can also be downloaded from the project website - https://www.dwa.gov.za/Projects/FoxwoodDam/.

12.6.2 Public Meetings to Present the Draft Scoping Report

The details of the public meetings scheduled during the review period of the Draft Scoping Report are provided in **Table 54**.

Table 54: Details of Public Meetings – Presentation of Draft Scoping Report

	Meeting 1	Meeting 2
Date:	08 July 2015	08 July 2015
Time:	14h00 – 16h30	17h30 – 19h30
Venue:	Adelaide Golf Club, Adelaide	Bezuidenhoutville Community Hall, Adelaide

12.6.3 Commenting on the Draft Scoping Report

For remarks on the Draft Scoping Report the reviewer can complete a Comment Sheet, which is included in **Appendix P** (attached to the hardcopies of the Draft Scoping Report). These completed Comment Sheets need to be forwarded to Nemai Consulting by **29 July 2015**.

Comments received from I&APs from the review of the Draft Scoping Report will be contained in a Comments and Response Report in the Final Scoping Report, which will be submitted to DEA>

12.7 Issues raised by I&APs

The Comments and Response Report, which summarises the salient issues raised by I&APs and the project team's response to these matters, is contained in **Appendix O**. The issues listed in the Comments and Response Report were identified from minutes of meetings, completed Reply Forms and other correspondence received to date.

The Scoping phase serves to identify and prioritise issues for further assessment during the EIA phase. Accordingly, the comments received from I&APs during public participation as part of Scoping will be afforded due consideration and further investigation during the pending EIA stage.

13 ENVIRONMENTAL ISSUES

In accordance with the purpose of the Scoping exercise as part of the overall environmental assessment, this section aims to identify potentially significant environmental issues for further consideration and prioritisation during the EIA stage. This allows for a more efficient and focused impact assessment in the ensuing EIA phase, where the analysis is largely limited to significant issues and reasonable alternatives.

13.1 Approach

13.1.1 Predicting Significant Environmental Issues

The potential environmental issues associated with the development of Foxwood Dam were identified during the Scoping phase through an appraisal of the following:

- Project-related components and infrastructure (see **Section 9.5**);
- Operation of the system (see **Section 9.7**);
- Activities associated with the project life-cycle (i.e. pre-construction, construction, operation and decommissioning) (see **Section 9.8**);
- Resources required for construction and operation (see **Section 9.10**);
- Proposed alternatives (see **Section 10**);
- Nature and profile of the receiving environment and potential sensitive environmental features and attributes (see **Section 11**), which included a desktop evaluation (via literature review, specialist input, GIS, topographical maps and aerial photography) and site investigations;
- Review of information from Technical Feasibility Study;
- Understanding of direct and indirect effects of the project as a whole;
- Input received during public participation from authorities and I&APs (see **Section 13.2**); and
- Legal and policy context (see **Section 5**).

Apart from explaining the receiving environment, **Section 11** succinctly discusses possible impacts during primarily the construction and operational phases of the project. The significant environmental issues were distilled from the aforementioned section and

are summarised in **Section 13.3**. Cumulative impacts are briefly explained in **Section 13.4**.

13.1.2 Mitigation of Impacts

During the EIA stage a detailed assessment will be conducted to evaluate all potential impacts (paying particular attention to the significant issues listed in the Scoping Report), with input from the project team, requisite specialist studies and I&APs and through the application of the impact assessment methodology contained in **Section 14**.

Suitable mitigation measures will be identified to manage the environmental impacts according to the following hierarchy:

1. Initial efforts will strive to **prevent** the occurrence of the impact;
2. If this is not possible, mitigation will include measures that reduce or **minimise** the significance of the impact to an acceptable level;
3. **Remediation** and **rehabilitation** will take place if measures cannot suitably prevent or reduce the impacts, or to address the residual impacts; and
4. As a last measure, **compensation** will be employed as a form of mitigating the impacts associated with a project.

The mitigation measures will be incorporated into the EMPr, which will form part of the EIA Report. This deliverable, together with the Environmental Authorisation, can act as a standalone document that can be used to *inter alia* monitor against compliance of the project with its pre-determined objectives, targets and management actions.

13.2 Issues raised by I&APs

The consolidated issues raised by I&APs during the Announcement and Scoping phases of the project, as contained in the Comments and Response Report (**Appendix O**), have been succinctly grouped into the following main categories (*Note: please refer to the Comments and Response Report for a comprehensive and accurate representation of the issues raised by I&APs*):

- Alternatives-

- Alternatives to dam option (e.g. Water Conservation and Water Demand Management, increase capacity of existing Adelaide Dam);
- Realignment of the pipeline from the dam;
- Motivation for the dam;

❖ Water use –

- Impacts to existing water users;
- Increase in cost of water;
- Impacts to existing extraction points and weirs;
- Water allocation process;
- Institutional arrangements;
- Use of Foxwood Dam for recreational purposes and the associated RMP process;
- Sizing of the dam;
- Relocation of existing canal;

❖ Socio-economic impacts –

- Benefits to local suppliers of construction material (e.g. local quarry site);
- The project may be a catalyst for development of Adelaide;
- Land acquisition process;
- Municipal revenue generation;
- Compensation;
- Tourism potential of the dam;

❖ Agriculture –

- Loss of agricultural land;
- Impacts to existing farming operations;
- Impacts to agricultural infrastructure (e.g. furrows);
- Impacts to viability of existing farms;
- Compensation;
- Movement of livestock;

❖ Terrestrial ecology –

- Impacts to sensitive species;
- Relocation of sensitive species;
- Rehabilitation of affected areas;

❖ Freshwater and estuarine ecology –

- Consideration of EWR;

❖ Proposed Irrigation Scheme –
- Timing;
- EIA process and lead authority;
- Institutional arrangements;
- Benefits to emerging farmers;
- Cumulative impacts;

❖ Traffic, road network and access –
- Impacts to existing roads used by local community;
- Air pollution of vehicles and traffic;
- Need for the relocation of the MR00639;

❖ Existing infrastructure –
- Impacts to existing infrastructure (power line, telephone line, roads);

❖ Historical and Cultural Features –
- Old weir structure on Koonap River;
- Recording of graves;

❖ Public participation –
- Involvement of the local community; and
- Suggestions for additional newspaper to be used.

❖ Electrical requirements –
- Electrical requirements of project; and
- Requirements of Eskom for the relocation of existing power lines.

The issues raised by I&APs will receive further attention during the investigations in the EIA phase. The Comments and Response Report will also be updated (as necessary) to elaborate on responses provided to date, as the understanding of the issues and the receiving environment evolve following the execution of the requisite specialist studies.

13.3 Summary of Environmental Issues

Pertinent environmental issues, which will receive specific attention during the EIA phase through a detailed quantitative assessment and relevant specialist studies (where deemed necessary), are listed in the tables to follow.

Table 55: Pertinent Issues (Construction Phase) for prioritisation during the EIA phase

Environmental Factor	Potential Issues / Impacts	Further Investigations / EIA Provisions
Land Use	Loss of land used for agriculture and game farming	❖ Agricultural Impact Assessment ❖ Socio-economic Impact Assessment ❖ EMPr
	Loss of natural areas	
	Servitude restrictions	
	Loss of cultivated land within construction domain	
Climate	Greenhouse gas emissions	❖ Climate change considerations ❖ EMPr
	Potential changes in the micro-climate of the area surrounding the reservoir	
Geology	Unsuitable geological conditions	❖ Reservoir Induced Seismicity Risk Appraisal (Technical Feasibility Study) ❖ Seismic Hazard Evaluation (Technical Feasibility Study) ❖ Geotechnical Study (Technical Feasibility Study) ❖ EMPr
	Sourcing of construction material	
	Blasting	
	Disposal of spoil material	
Topography	❖ Visual impact in river valleys ❖ Erosion of affected areas on steep slopes	❖ Visual Impact Assessment ❖ EMPr
Soil	Soil erosion	❖ EMPr
	Soil contamination	
Geohydrology	Groundwater pollution due to spillages and poor construction practices	❖ EMPr
Hydrology	Alteration of flow regimes	❖ Hydrological assessment (Technical Feasibility Study) ❖ Reserve determination (*conducted separately from EIA*) ❖ Technical Feasibility Study ❖ Aquatic Assessment
Water Quality	❖ Sedimentation from instream works ❖ Water quality impacts due to spillages and poor construction practices	❖ EMPr
Aquatic Ecology	Disruptions to aquatic biota community due to water contamination, alteration of flow, loss of instream habitat (dam) and disturbance to habitat during construction (watercourse crossings)	❖ Reserve determination (*conducted separately from EIA*) ❖ Aquatic Assessment ❖ Water Quality Assessment (Technical Feasibility Study) ❖ EMPr
Riparian Habitat	Loss of riparian and instream vegetation within construction domain	❖ Reserve determination (*conducted separately from EIA*) ❖ Aquatic Assessment ❖ EMPr
	Loss of fuelwood, medicinal and herbal plants,	❖ Socio-economic Impact Assessment

Environmental Factor	Potential Issues / Impacts	Further Investigations / EIA Provisions
	building material and raw products for handicrafts within construction domain	❖ Search, Rescue and Relocation Management Plan ❖ EMPr
Water use	Impacts to existing water users	❖ Socio-economic Impact Assessment ❖ EMPr
Wetlands	❖ Various wetlands are affected by the project, where some wetlands will be inundated by the Foxwood Dam and other wetlands are traversed by infrastructure. ❖ Impacts to wetland characteristics	❖ Wetland Assessment and Delineation Study ❖ EMPr
Estuary	❖ Impacts to the Great Fish Estuary in terms of flow alterations, sediment regime, habitat alteration, water quality and overall ecosystem health	❖ Estuarine Study (Technical Feasibility Study) ❖ EMPr
Terrestrial Ecology	❖ Impacts to sensitive terrestrial ecological features ❖ Potential loss of significant flora and fauna species ❖ Damage / clearance of habitat of conservation importance ❖ Proliferation of exotic vegetation ❖ Loss of medicinal plants	❖ Terrestrial Ecological Impact Assessment ❖ Search, Rescue and Relocation Management Plan ❖ EMPr
Socio-economic Environment	❖ Loss of land within construction domain ❖ Risk to livestock ❖ Nuisance from dust and noise ❖ 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) ❖ Land claims ❖ Safety and security ❖ Relocation of access roads ❖ Use of local road network ❖ Impact to visual quality and sense of place ❖ Light pollution	❖ Economic Impact Assessment (Technical Feasibility Study) ❖ Socio-economic Impact Assessment ❖ EMPr
Agriculture	❖ Loss of cultivated land within construction domain ❖ Loss of grazing land within construction domain ❖ Loss of stock watering points 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	❖ Agricultural Impact Assessment ❖ Socio-economic Impact Assessment ❖ EMPr
Air Quality	❖ Excessive dust levels ❖ Greenhouse gas emissions	❖ EMPr
Noise	❖ Localised increases in noise during construction	❖ EMPr
Historical and Cultural Features	❖ Destruction or damage of heritage resources through construction activities ❖ Relocation of graves	❖ Heritage Impact Assessment ❖ EMPr

Environmental Factor	Potential Issues / Impacts	Further Investigations / EIA Provisions
Existing Structures & Infrastructure	❖ Impoundment to affect the following – • R344 • MR00639 • Canal • Power line • Telephone line • Furrows • Various buildings • Farming-related infrastructure • Private access roads	❖ Relocation of affected infrastructure ❖ Compensation ❖ Satisfy requirements of infrastructure owners (including Amatola Water, Eskom, ECDRPW, Telkom)
Transportation	❖ Increase in traffic on the local road networks ❖ Re-alignment of R344 and MR00639 ❖ Develop temporary access roads	❖ Traffic Impact Assessment ❖ Re-alignment of affected roads ❖ EMPr
Solid Waste	❖ 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	❖ Rehabilitation of quarry and borrow area outside of basin ❖ EMPr
Aesthetics	❖ Visual quality and sense of place to be adversely affected by construction activities	❖ Visual Impact Assessment ❖ EMPr
Tourism	❖ Influence to tourism potential	❖ Visual Impact Assessment ❖ RMP process (*conducted separately from EIA*) ❖ EMPr

Table 56: Pertinent Issues (Operational Phase) for prioritisation during the EIA phase

Environmental Factor	Potential Issues / Impacts	Further Investigations / EIA Provisions
Land Use	Servitude restrictions Permanent loss of cultivated land and natural areas	❖ Agricultural Impact Assessment ❖ Socio-economic Impact Assessment ❖ EMPr
Geology	Unsuitable geological conditions	❖ Reservoir Induced Seismicity Risk Appraisal (Technical Feasibility Study) ❖ Seismic Hazard Evaluation (Technical Feasibility Study) ❖ Geotechnical Study (Technical Feasibility Study) ❖ EMPr
Topography	❖ Visual impact in river valleys ❖ Erosion of affected areas on steep slopes	❖ Visual Impact Assessment ❖ EMPr

Environmental Factor	Potential Issues / Impacts	Further Investigations / EIA Provisions
Geohydrology	❖ High groundwater inflows ❖ Lowering of the local water table ❖ Surface water and groundwater interactions	❖ Technical Feasibility Study ❖ Geotechnical Study (Technical Feasibility Study) ❖ EMPr
Hydrology	❖ Changes to seasonal flow patterns ❖ Alteration of flow regimes ❖ Quantity of water releases	❖ Hydrological assessment (Technical Feasibility Study) ❖ Reserve determination (*conducted separately from EIA*) ❖ Technical Feasibility Study ❖ Aquatic Assessment
Water Quality	❖ 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	❖ Water Quality Study (Technical Feasibility Study) ❖ Reserve determination (*conducted separately from EIA*) ❖ Aquatic Assessment ❖ Dam's Operating Rules
Aquatic Ecology	❖ Damming of a free-flowing river ❖ 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	❖ Reserve determination (*conducted separately from EIA*) ❖ Aquatic Assessment ❖ Water Quality Assessment (Technical Feasibility Study) ❖ Dam's Operating Rules ❖ EMPr
Riparian Habitat	Loss of riparian and instream vegetation	❖ Reserve determination (*conducted separately from EIA*) ❖ Aquatic Assessment ❖ EMPr
	Loss of fuelwood, medicinal and herbal plants, building material and raw products for handicrafts	❖ Socio-economic Impact Assessment ❖ Search, Rescue and Relocation Management Plan ❖ EMPr
Water use	With the damming of the Koonap River, the downstream water user requirements need to be safeguarded	❖ Reserve determination (*conducted separately from EIA*) ❖ Technical Feasibility Study
	Loss of existing access to Koonap River and Mankazana River for water abstraction or livestock watering points	❖ Socio-economic Impact Assessment ❖ Compensation ❖ EMPr ❖ RMP (*compiled separately from EIA*)
Wetlands	❖ Various wetlands are affected by the project, where some wetlands will be	❖ Wetland Assessment and Delineation Study

Environmental Factor	Potential Issues / Impacts	Further Investigations / EIA Provisions
	inundated by the Foxwood Dam and other wetlands are traversed by infrastructure. ❖ Impacts to wetland characteristics	❖ EMPr
Estuary	❖ Impacts to the Great Fish Estuary in terms of flow alterations, sediment regime, habitat alteration, water quality and overall ecosystem health	❖ Estuarine Study (Technical Feasibility Study) ❖ Dam's Operating Rules ❖ EMPr
Terrestrial Ecology	❖ Impacts to sensitive terrestrial ecological features ❖ Potential loss of significant flora and fauna species ❖ Proliferation of exotic vegetation ❖ Loss of medicinal plants	❖ Terrestrial Ecological Impact Assessment ❖ Search, Rescue and Relocation Management Plan ❖ EMPr
Socio-economic Environment	❖ Land claims ❖ Use of local road network for operation and maintenance purposes ❖ Impact to visual quality and sense of place ❖ Light pollution ❖ Inundation of buildings	❖ Socio-economic Impact Assessment ❖ Compensation ❖ EMPr
Agriculture	❖ Loss of grazing land. Could place additional pressure on the remaining grazing resources. ❖ Loss of stock watering points along the affected reaches of the Koonap River and Mankazana River. ❖ Permanent loss of cultivated land	❖ Agricultural Impact Assessment ❖ Socio-economic Impact Assessment ❖ EMPr ❖ RMP (*compiled separately from EIA*)
Historical and Cultural Features	❖ Inundation of heritage resources	❖ Heritage Impact Assessment ❖ EMPr
Existing Structures & Infrastructure	❖ Impoundment to affect the following – • R344 • MR00639 • Canal • Power line • Telephone line • Furrows • Various buildings • Farming-related infrastructure • Private access roads	❖ Relocation of affected infrastructure ❖ Compensation ❖ Satisfy requirements of infrastructure owners (including Amatola Water, Eskom, ECDRPW, Telkom)
Transportation	❖ Re-alignment of R344 and MR00639 ❖ Develop permanent access roads	❖ Traffic Impact Assessment ❖ Re-alignment of affected roads ❖ EMPr
Aesthetics	❖ Visual quality and sense of place could be adversely affected	❖ Visual Impact Assessment ❖ EMPr

Although impacts in the decommissioning phase are not included, it will nonetheless receive appropriate attention in the impact assessment during the EIA phase (where relevant).

13.4 Cumulative Impacts

Box 2:	What is a "Cumulative Impact"?
*According to GN No. R. 982 (4 December 2014), a **"cumulative impact"**, 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.*	

Cumulative impacts can be identified by combining the potential environmental implications of the proposed development of Foxwood 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 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 through a Traffic Impact Assessment.

Large-scale land clearing activities and other construction-related disturbances could lead to the proliferation of exotic vegetation. The associated cumulative impact in relation to other activities in the affected areas, such a livestock grazing and farming, will need to be considered further.

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 Terrestrial Ecological Impact Assessment will need to identify species of conservation significance that could be adversely affected by the project activities. This study will need to consider the existing local impacts to the biodiversity and the incremental loss of conservation-worthy species, within the context of the provincial conservation goals and targets.

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 irrigation scheme does not form part of the scope of this EIA, cumulative impacts related to this proposed development as well as Foxwood Dam will be evaluated on a desktop level in the EIA phase, which may include:

- Impacts to the viability of existing farming operations;
- Water quality impacts related to releases from the dam and diffuse pollution from the downstream cultivated areas; and
- Further fragmentation of river due to additional abstraction weirs for the irrigation scheme.

The project was initiated to meet the water demands in the Integrated Mgeni WSS. The water deficit in this system means that the water requirements of the supply area cannot be met. The proposed uMWP will cater for the water demands within this specific supply scheme on a sustained basis. In turn, this will have a positive impact on the macro socio-economic environment.

The development of the Foxwood 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. The last-mentioned aspect will need to be explored further through the RMP process for the dam.

14 METHODOLOGY TO ASSESS THE IDENTIFIED IMPACTS

The EIA quantitative impact assessment will further focus on the direct and indirect impacts associated with the project. All impacts will be analysed with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions and criteria apply:

Nature (/Status)
The project could have a positive, negative or neutral impact on the environment.

Extent
- 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.
- 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
- 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
- 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
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-
0 – Impact will not affect the environment. No mitigation necessary.
1 – No impact after mitigation.
2 – Residual impact after mitigation.
3 – Impact cannot be mitigated.

15 PLAN OF STUDY FOR EIA

This Plan of Study, which explains the approach to be adopted to conduct the EIA for the proposed development of Foxwood Dam, was prepared in accordance with Appendix 2 of GN No. R. 982 (4 December 2014).

15.1 Key Environmental Aspects and Issues identified during Scoping Phase

The Scoping exercise aimed to identify and qualitatively predict significant environmental issues for further consideration and prioritisation during the EIA stage. The issues raised by I&APs during Scoping (as contained in the Comments and Response Report) also determined and guided the identification of significant issues.

During the EIA stage a detailed quantitative impact assessment will be conducted via contributions from the project team and requisite specialist studies, and through the application of the impact assessment methodology contained in **Section 14**. Suitable mitigation measures will be identified to manage (i.e. prevent, reduce, rehabilitate and/or compensate) the environmental impacts, and will be included in an EMPr.

Pertinent environmental issues identified during Scoping, which will receive specific attention during the EIA phase are listed in **Table 55** (construction phase) and **Table 56** (operation phase).

15.2 Feasible Alternatives to be assessed during EIA Phase

The EIA phase will include a detailed comparative analysis of the project's feasible alternatives that emanate from the Scoping exercise, which will include environmental (with specialist input) and technical evaluations. This will ultimately result in the selection of a BPEO.

The following feasible alternatives will be assessed in the EIA phase:

- Major Storage Dam -

- Dam type;
- Dam capacity;

❖ Gauging weir -
- Location;

❖ Power line deviation -
- Route alignment.

15.3 Specialist Studies

15.3.1 Overview

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:

❖ Terrestrial Ecological Impact Assessment;
❖ Aquatic and Riverine Assessment;
❖ Wetland Assessment and Delineation;
❖ Agricultural Impact Assessment;
❖ Heritage Impact Assessment;
❖ Visual Impact Assessment;
❖ Socio-economic Impact Assessment; and
❖ Traffic Impact Assessment.

The Terms of Reference (ToR), both general and specific, for the abovementioned specialist studies follow in the sub-sections below. Amongst others, the *Guideline for determining the scope of specialist involvement in EIA processes* (Münster, 2005) was used in compiling the general Terms of Reference for the specialist studies. The following guidelines were also employed to prepare the specific ToR for the respective specialists (where appropriate):

❖ Guideline for involving biodiversity specialists in EIA processes (Brownlie, 2005);

- Guideline for involving visual and aesthetic specialists (Oberholzer, 2005);
- Guideline for involving heritage specialists in EIA processes (Winter & Baumann, 2005); and
- Guideline for involving social assessment specialists in EIA processes (Barbour, 2007).

In addition to the above guidelines, the relevant specialists need to satisfy specific requirements stipulated by the following key environmental authorities:

- DEA and EC DEDEAT;
- DWS;
- EC Provincial Heritage Resources Authority;
- DMR; and
- DAFF.

For the inclusion of the findings of the specialist studies into the EIA report, the following guideline will be used: *Guideline for the review of specialist input in EIA processes* (Keatimilwe & Ashton, 2005). Key considerations will include:

- Ensuring that the specialists have adequately addressed I&APs' issues and specific requirements prescribed by environmental authorities;
- 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.

15.3.2 Terms of Reference – General

The following general ToR apply to all the EIA specialist studies to be undertaken for the proposed development of Foxwood Dam:

1. Address all triggers for the specialist studies contained in the subsequent specific ToR.
2. Address issues raised by I&APs, as contained in the Comments and Response Report, and conduct an assessment of all potentially significant impacts. Additional issues that have not been identified during Scoping should also be highlighted to the EAP for further investigations.

3. Ensure that the requirements of the environmental authorities that have specific jurisdiction over the various disciplines and environmental features are satisfied.
4. Approach to include desktop study and site visits, as deemed necessary, to understand the affected environment and to adequately investigate and evaluate salient issues. Indigenous knowledge (i.e. targeted consultation) should also be regarded as a potential information resource.
5. Assess the impacts (direct, indirect and cumulative) in terms of their significance (using suitable evaluation criteria) and suggest suitable mitigation measures. In accordance with the mitigation hierarchy, negative impacts should be avoided, minimised, rehabilitated (or reinstated) or compensated for (i.e. offsets), whereas positive impacts should be enhanced. A risk-averse and cautious approach should be adopted under conditions of uncertainty.
6. Consider time boundaries, including short to long-term implications of impacts for project life-cycle (i.e. pre-construction, construction, operation and decommissioning).
7. Consider spatial boundaries, including:
    a. Broad context of the proposed project (i.e. beyond the boundaries of the specific site);
    b. Off-site impacts; and
    c. Local, regional, national or global context.
8. The provision of a statement of impact significance for each issue, which specifies whether or not a pre-determined threshold of significance (i.e. changes in effects to the environment which would change a significance rating) has been exceeded, and whether or not the impact presents a potential fatal flaw or not. This statement of significance should be provided for anticipated project impacts both before and after application of impact management actions.
9. Recommend a monitoring programme to implement mitigation measures and measure performance. List indicators to be used during monitoring.
10. Appraisal of alternatives (including the No-Go option) by identifying the BPEO with suitable justification.
11. Advise on the need for additional specialists to investigate specific components and the scope and extent of the information required from such studies.
12. Engage with other specialists whose studies may have bearing on your specific investigation.

13. Present findings and participate at public meetings, where EIA Report is to be presented to I&APs.
14. Information provided to the EAP needs to be signed off.
15. Review and sign off on EIA Report prior to submission to DEA to ensure that specialist information has been interpreted and integrated correctly into the report.
16. Sign a declaration stating independence.
17. The appointed specialists must take into account the policy framework and legislation relevant to their particular studies.
18. **All specialist reports must adhere to Appendix 6 of Government Notice No. R. 982 (4 December 2014)**.

15.3.3 Terms of Reference – Specific

15.3.3.1 Terrestrial Ecological Impact Assessment

Summary of Key Issues & Triggers Identified During Scoping

- I&AP issues –
  - Impacts to sensitive flora and fauna species and overall biodiversity.
  - Impacts to indigenous trees and/or protected trees under the National Forest Act (Act No. 84 of 1998).
- Species with a known conservation status occur in the project area.
- Potential loss of significant flora and fauna species (e.g. search-and-rescue, relocate, transplant).
- Impacts to sensitive terrestrial ecological features.
- Management actions for controlling exotic vegetation.

Approach

- Undertake baseline survey (reconnaissance) and describe affected environment within the project footprint from a biodiversity perspective.
- Take into consideration the provincial conservation goals and targets and identify existing and future planned conservation areas.
- Assess the current ecological status and the conservation priority within the project footprint and adjacent area (as deemed necessary). Provide a concise description of the importance of the affected area to biodiversity in terms of pattern and process, ecosystem goods and services, as appropriate.

- Undertake sensitivity study to identify protected and conservation-worthy species. Prepare a biodiversity sensitivity map with the use of GIS, based on the findings of the study.
- Assess impacts to fauna and flora, associated with the project. Consider cause-effect-impact pathways for assessing impacts to biodiversity related to the project.
- Identify potential fatal flaws associated with the project and its alternatives from a biodiversity perspective.
- Comply with specific requirements and guidelines of DEA and EC DEDEAT.
- Consider the following guidelines/Information sources (amongst others):
  - ECBCP (2007); and
  - Succulent Karoo Ecosystem Programme (SKEP).

Nominated Specialist

Organisation:	Nemai Consulting
Name:	Ronald Phamphe
Qualifications:	MSc – Botany
No. of years experience:	7
Affiliation (if applicable):	❖ 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)

15.3.3.2 Aquatic and Riverine Assessment & Wetland Assessment and Delineation Study

Summary of Key Issues & Triggers Identified During Scoping

- I&AP issues –
  - Maintaining EWR of Koonap River.
  - Water quality impacts.
- Impacts associated with instream works during construction in terms of Foxwood Dam, gauging weir and river crossings.
- Impacts associated with watercourse crossings by pipeline, canal deviation, major roads, access roads and other project infrastructure and activities.
- Downstream impacts to aquatic ecology due to reduction in water quality in

Foxwood 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 the Koonap River and Mankazana River.
- Loss of habitat for aquatic biota within the inundation zone.
- Loss of riparian habitat within inundated area.
- Proliferation of aquatic weeds
- Impacts to protected fauna and flora species (aquatic and riparian) and sensitive ecosystems.

Approach

- Undertake desktop study (literature review, topographical maps and aerial photographs) and baseline aquatic survey and describe affected aquatic environments/watercourses within the project footprint.
- Determine ecological status of the receiving aquatic environment, including the identification of endangered or protected species.
- Take into consideration the Reserve determination study (EWR).
- Delineate riparian habitat and all wetlands in accordance with the guideline: *A practical field procedure for identification and delineation of wetlands and riparian areas* (DWAF, 2005). This includes assessing terrain, soil form, soil wetness and vegetation unit indicators to delineate permanent, seasonal and temporary zones of the wetlands. Allocate conservation buffers from the outer edge of the temporary zones of the wetlands (provincial-specific).
- Provide a concise description of the importance of the affected aquatic environments/watercourses in terms of pattern and process, ecosystem goods and services, as appropriate.
- Assess impacts of proposed project to aquatic environments/watercourses, including:
  - Potential impacts on aquatic ecosystems within the dam basin;
  - Potential impacts on aquatic ecosystems downstream of the dam; and
  - Potential impacts of migration barriers (dam and gauging weir) to migratory fish species.
- Provide suitable mitigation measures to protect the aquatic ecosystems during project life-cycle.
- Provide input into timing and release strategy to mimic natural seasonal variability.
- Recommend monitoring programme and indicators for project life-cycle, where

findings from survey would serve as baseline data.

Nominated Specialist

Organisation:	Enviross Environmental Impact Studies CC
Name:	Mathew James Ross
Qualifications:	MSc – Aquatic Health (presently completing PhD)
No. of years experience:	8
Affiliation (if applicable):	South African Society for Aquatic Scientists (SASAqS)

15.3.3.3 Heritage Impact Assessment

Summary of Key Issues & Triggers Identified During Scoping

- I&AP issues –
  - Old weir structure and pump house on Koonap River.
  - Graves within basin.
- Potential occurrence of heritage resources, graves and structures older than 60 years within project footprint.

Approach

- Undertake a Heritage Impact Assessment in accordance with the South African Heritage Resources Act (No. 25 of 1999).
- The identification and mapping of all heritage resources in the area affected, as defined in Section 2 of the National Heritage Resources Act, 1999, including archaeological and palaeontological sites on or close (within 100 m) of the proposed developments.
- Undertake a desktop palaeontological assessment (evaluate site in terms of SAHRIS).
- The assessment of the significance of such resources in terms of the heritage assessment criteria as set out in the regulations.
- An assessment of the impact of development on such heritage resources.
- An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development.
- The identification of heritage resources that will be adversely affected by the

proposed development.

- Prepare a heritage sensitivity map (GIS-based), based on the findings of the study.
- Identify heritage resources to be monitored.
- Comply with specific requirements and guidelines of EC Provincial Heritage Resources Authority.

Nominated Specialist

Organisation:	Nemai Consulting
Name:	❖ Jean Beater (lead specialist) ❖ Frans Prins
Qualifications:	❖ Jean Beater – • MA (Heritage Studies) ❖ Frans Prins – • MA in Archaeology
No. of years experience:	❖ Jean Beater - 21 years ❖ Frans Prins - 20 years
Affiliation (if applicable):	❖ Jean Beater - • International Association of Impact Assessors (IAIA)(SA Branch) • Member: HIA Adjudication Committee for the Gauteng Provincial Heritage Resources Authority • Affiliate member - Association of Southern African Professional Archaeologists – member No. 349 ❖ Frans Prins – • Full member of the Association of Southern African Professional Archaeologists – Member No. 112

15.3.3.4 Agricultural Impact Assessment

Summary of Key Issues & Triggers Identified During Scoping

- I&AP issues –
  - Loss of agricultural land.
  - Viability of remaining farming operations.
- Loss of fertile soil, cultivated areas and grazing land in inundation area.
- Disruptions to farming practices during construction.
- Loss of farming-related infrastructure.

Approach

- Determine agricultural potential in project footprint.

- Determine impacts of project from an agricultural perspective.
- Suggest suitable mitigation measures to address the identified impacts.

Nominated Specialist

Name:	Dr Andries Gouws
Qualifications:	PhD Integrated Land Use Modelling
No. of years experience:	29
Affiliation (if applicable):	❖ Council of Natural Sciences.No:400036/93, Category: Agricultural sciences. ❖ Member of the Soil Science Society of South Africa

15.3.3.5 Visual Impact Assessment

Summary of Key Issues & Triggers Identified During Scoping

- Impacts to the visual quality and sense of place of the project area.

Approach

- Determine the visibility of the proposed project components. This analysis should also take into account the existing visual characteristics of the project area in relation to the surrounding areas as well as whether or not the project is compatible with the visual characteristics of the area.
- Determine the specific aesthetic implications of the project.
- Identify important viewpoints and view corridors, including sensitive receptors.
- Suggest suitable mitigation measures to address the identified impacts.

Nominated Specialist

Organisation:	Axis Landscape Architecture
Name:	Gerhard Griesel
Qualifications:	Masters Degree In Landscape Architecture
No. of years experience:	8
Affiliation (if applicable):	Member of the South African Council of Landscape Architects

15.3.3.6 Socio-Economic Impact Assessment

Summary of Key Issues & Triggers Identified During Scoping

- I&AP issues –
  - Compensation for loss of land, buildings and other structures affected by project.
- Loss of private property through inundation and project infrastructure.
- Resettlement of dwellings in dam basin.
- Construction-related impacts.
- 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).

Approach

- 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 cost-benefit analysis.
- Undertake a thorough review of the following:
  - 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.

Nominated Specialist

Organisation:	Nemai Consulting
Name:	❖ Ciaran Chidley ❖ Sameera Munshi
Qualifications:	❖ Ciaran Chidley • BA (Economics); BSc Eng (Civil); MBA ❖ Sameera Munshi • BA Hon (Econ)
No. of years experience:	Ciaran Chidley – 12 years
Affiliation (if applicable):	N/A

15.3.3.7 Traffic Impact Assessment

Summary of Key Issues & Triggers Identified During Scoping

- I&AP issues –
  - Requirements of the EC Department of Roads and Public Works.
  - Impacts to local roads due to use by construction plant and vehicles.
  - Impacts to local community as a result of the proposed access roads.
  - Justification for relocation of MR00639.
- Increase in traffic on the local road networks during the construction phase, including –
  - Delivery of construction material to site.
  - Use by construction plant and vehicles.
  - Possible delivery of aggregate to site.
- Assess re-alignment of R344 and MR00639.
- Access roads to the various sites (construction and operational phases).

Approach

- Assess the relocation of roads affected by the dam basin.
- Desktop and field study to understand regional and local traffic situation. Undertake traffic survey.
- The relocation of the MR00639 may not be justified, as it will be very expensive and is not often used. The specialist will need to conduct traffic counts and provide a specialist opinion on the need to relocate this road.
- Assess impacts and suggest suitable management measures to prevent or reduce traffic impacts associated with the project, taking into consideration the following –
  - During the construction period there will be an increase in traffic on the local road network due to the delivery of plant and material, transportation of staff and normal construction-related traffic.
  - Haul roads and access roads will be created on site, within the construction domain.
  - As part of the construction phase measures will be implemented for the selective upgrade of the roads (if necessary) and to render these roads safe for other users (amongst others).
  - After the construction phase the local roads will only need to be used for

operation and maintenance purposes.

- Assess traffic impacts on a desktop level associated with the hauling of aggregate from a commercial source that is located 6 km to the south of Adelaide (site location to be provided). Suggest best route(s) and suitable mitigation measures.
- Recommend monitoring programme for traffic management, which primarily focuses on the construction phase.
- Consider the following guidelines/Information sources (amongst others):
  - Manual of Traffic Impact Studies (RR93/635) published by the Department of Transport in 1995.
- The study will need to be conducted so as to satisfy the requirements of the EC Department of Roads and Public Works.
- Make recommendations on preferred options for the project infrastructure from a traffic impact perspective.

Nominated Specialist

Organisation:	Engineering Advice & Services (Pty) Ltd
Name:	Cary Grant Andrew Hastie
Qualifications:	Masters Diploma Technology (Civil) (Road Transportation)
No. of years experience:	31 years
Affiliation (if applicable):	Registered Professional Engineering Technologist, ECSA (200070122) Member, IPET (2390)

15.3.4 Technical Specialist Studies

A host of studies were conducted as part of the Foxwood Dam Technical Feasibility Study. Some of these studies that are of particular importance for the EIA, and will be reviewed further in the EIA phase, include the following:

- Water Quality Analysis;
- Geotechnical Investigation;
- Hydrological Assessment; and
- Economic Impact Assessment.

In addition, the outcomes of the Reserve determination as well as the assessment of the potential impacts of the Foxwood Dam on the Great Fish Estuary will also be incorporated into the EIA Report.

15.4 Public Participation – EIA Phase

15.4.1 Updating of I&AP Database

The I&AP database will be updated as and when necessary during the execution of the EIA.

15.4.2 Notification – Approval of Scoping Report and Review of EIA Report

Advertisements will be placed in the following newspapers as notification that the Scoping Report has been approved by DEA, as well as of the review of the EIA Report and the details of the public meeting:

- Die Burger;
- The Herald; and
- Winterberg News.

In addition, all I&APs will be notified o phase via fax, email or registered mail (as necessary).

15.4.3 Review of Draft EIA Report

A 30-day period will be provided to I&APs to review the Draft EIA Report, and copies of the document will be lodged for public review at the following venues:

Table 57: Locations for review of Draft EIA Report

Copy	Location	Address	Tel. No.
1.	Library – Adelaide	Market Square (next to Municipal Offices)	046 684 0034
2.	Library – Bedford	Cnr. Van Riebeeck & Donkin Street	046 685 0187
3.	Library – Bezuidenhoutville	Viljoen Street, Bezville Loc, Adelaide	046 684 0034
4.	Golf Course – Adelaide	Winterberg Lane, Adelaide	046 684 0489

Copies of the Draft EIA Report will be provided to the regulatory and commenting authorities listed in **Section 12.6**. The Draft EIA Report will also be placed on the project website - https://www.dwa.gov.za/Projects/FoxwoodDam/.

All parties on the I&APs database will be notified via email, fax or post of the opportunity to review the Draft EIA Report at the abovementioned locations, the review period and the process for submitting comments on the report. The public will also be notified of the aforementioned via advertisements in the newspapers (same as listed in **Section 15.4.2**).

All comments received from I&APs and the responses thereto will be included in the final EIA Report, which will be submitted to DEA.

15.4.4 Public Meeting

A public meeting will be held during the review period for the Draft EIA Report.

The aims of these meetings will be as follows:

- To present the project details;
- To present the findings of the specialist studies;
- To address key issues raised during the Scoping Phase;
- To elaborate on the potential environmental impacts (qualitative and quantitative), and the proposed mitigation of these impacts;
- To explain the EIA process; and
- To allow for queries and concerns to be raised, and for the project team to respond.

15.4.5 Comments and Response Report

A Comments and Response Report will be compiled and included in the EIA Report, which will record the date that issues were raised, a summary of each issue, and the response of the team to address the issue.

In addition, any unattended comments from the Scoping Phase or where the status of the previous responses has changed, will also be addressed in the Comments and Response Report for the EIA phase.

15.4.6 Notification of DEA Decision

All I&APs will be notified via email, fax or post after having received written notice from DEA on the final decision. Advertisements will also be placed in the newspapers listed in **Section 15.4.2**. These notifications will include the appeal procedure to the decision.

15.5 EIA Report

The EIA Report will contain the information that is necessary for DEA to consider and come to a decision on the application. As a minimum, the EIA Report will contain the information stipulated in Appendix 3 of GN No. R. 982 (4 December 2014).

The following critical components of the EIA Report are highlighted:

- A description of the policy and legislative context;
- A detailed description of the proposed development (full scope of activities);
- A detailed description of the proposed development site, which will include a plan that locates the proposed activities applied for as well as the associated structures and infrastructure;
- 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;
- The Comments and Response 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;
- A detailed assessment of all identified potential impacts;
- A list of the assumptions, uncertainties and gaps in knowledge;

- An environmental impact statement;
- 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;
- 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;
- An opinion by the consultant as to whether the development is suitable for approval within the proposed site;
- An EMPr that complies with Appendix 4 of GN No. R. 982 (4 December 2014);
- Copies of all specialist reports appended to the EIA report; and
- Any further information that will assist in decision making by the authorities.

15.6 Authority Consultation

The EIA will only commence once DEA has accepted the Scoping Report and the Plan of Study for the EIA. If relevant, the necessary revisions will be made to the aforementioned documents if requested by this Department.

An authorities meeting will be scheduled during the EIA public participation process to present salient findings. In addition, copies of the Draft EIA Report will be provided to the following key regulatory and commenting authorities:

- DEA;
- EC DEDEAT;
- DAFF;
- DWS EC Regional Office;
- DMR EC Regional Office;
- EC DRDAR;
- ECRDA;
- EC Department of Roads and Public Works;
- EC Provincial Heritage Resources Authority;
- Amathole DM;
- Nxuba LM; and
- Amatola Water.

The final EIA Report will be submitted to DEA. Any requested amendments will be discussed with the Department to ensure that their queries are adequately and timeously attended to.

For the remainder of the Scoping process and EIA the interaction with DEA will be as follows:

- Submission of the Scoping Report;
- Meet with designated DEA Environmental Officer to explain the project and arrange a site visit (if required by DEA);
- Address comments on Scoping Report;
- Arrange an authorities meeting during the EIA stage;
- Submit EIA Report;
- Address comments on EIA Report; and
- Obtain a decision.

15.7 EIA Timeframes

The table to follow presents the proposed timeframes for the EIA process. *Note that these dates are subject to change*.

Table 58: EIA Timeframes (dates may changes during the course of the EIA)

EIA Milestone	Start	Finish
I&APs Review of Draft Scoping Report	29/06/15	29/07/15
Submit Application Form and Draft Scoping Report to DEA		20/08/15
DEA Review and Decision	21/08/15	05/10/15
I&APs Review of Draft EIA Report	25/11/15	18/01/16
Submit Final EIA Report & EMPr to DEA		28/01/16
DEA Review and Decision	29/01/16	16/05/16
I&AP Notification Period	17/05/16	31/05/16

16 CONCLUSION

The scope of an environmental assessment is defined by the range of issues and alternatives it considers, the nature of the receiving environment, and the approach towards the assessment.

Key outcomes of the Scoping phase for the proposed development of Foxwood Dam are as follows:

- Stakeholders were effectively identified and were afforded adequate opportunity to participate in the scoping process;
- Alternatives for achieving the objectives of the proposed activity were duly considered.
- Significant issues pertaining specifically to the pre-construction, construction and operational phases of the project were identified;
- Sensitive elements of the environment to be affected by the project were identified;
- A Plan of Study was developed to explain the approach to executing the EIA phase, which also includes the Terms of Reference for the identified specialist studies; and
- The scoping exercise set the priorities for the ensuing EIA phase.

No fatal flaws were identified in terms of the proposed activities and the receiving environment that would prevent the environmental assessment from proceeding beyond the Scoping phase.

The need for the project is rooted in the proposed Government Irrigation Scheme within the Koonap River valley downstream of the proposed Foxwood Dam. This component needs to be taken forward by an appropriate Implementing Agent (e.g. ECRDA).

It is the opinion of the EIA team that Scoping was executed in an objective manner and that the process and report conform to the requirements of regulation 21 and Appendix 2 of GN No. R. 982 (4 December 2014), respectively. It is also believed that the Plan of Study for EIA is comprehensive and will be adequate to address the significant issues identified during Scoping, to select the BPEO, and to ultimately allow for informed decision-making.

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OATH OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

In accordance with Appendix 2 of Government Notice No. R. 982 (4 December 2014), this serves as an affirmation by the Environmental Assessment Practitioner (EAP) in relation to:

Section 2(j) -

1. *The correctness of the information provided in this report;*
2. *The inclusion of comments and inputs from stakeholders and interested and affected parties; and*
3. *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.*

Section 2(k) -

The level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment.

Dated this 24th *day of* June, *20*15.

Signature of EAP

APPENDICES