P WMA 12/T30/00/5212/14

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Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

DIRECTORATE: OPTIONS ANALYSIS

FEASIBILITY STUDY FOR THE MZIMVUBU WATER PROJECT

REGIONAL ECONOMICS

OCTOBER 2014

FEASIBILITY STUDY FOR THE MZIMVUBU WATER PROJECT APPROVAL

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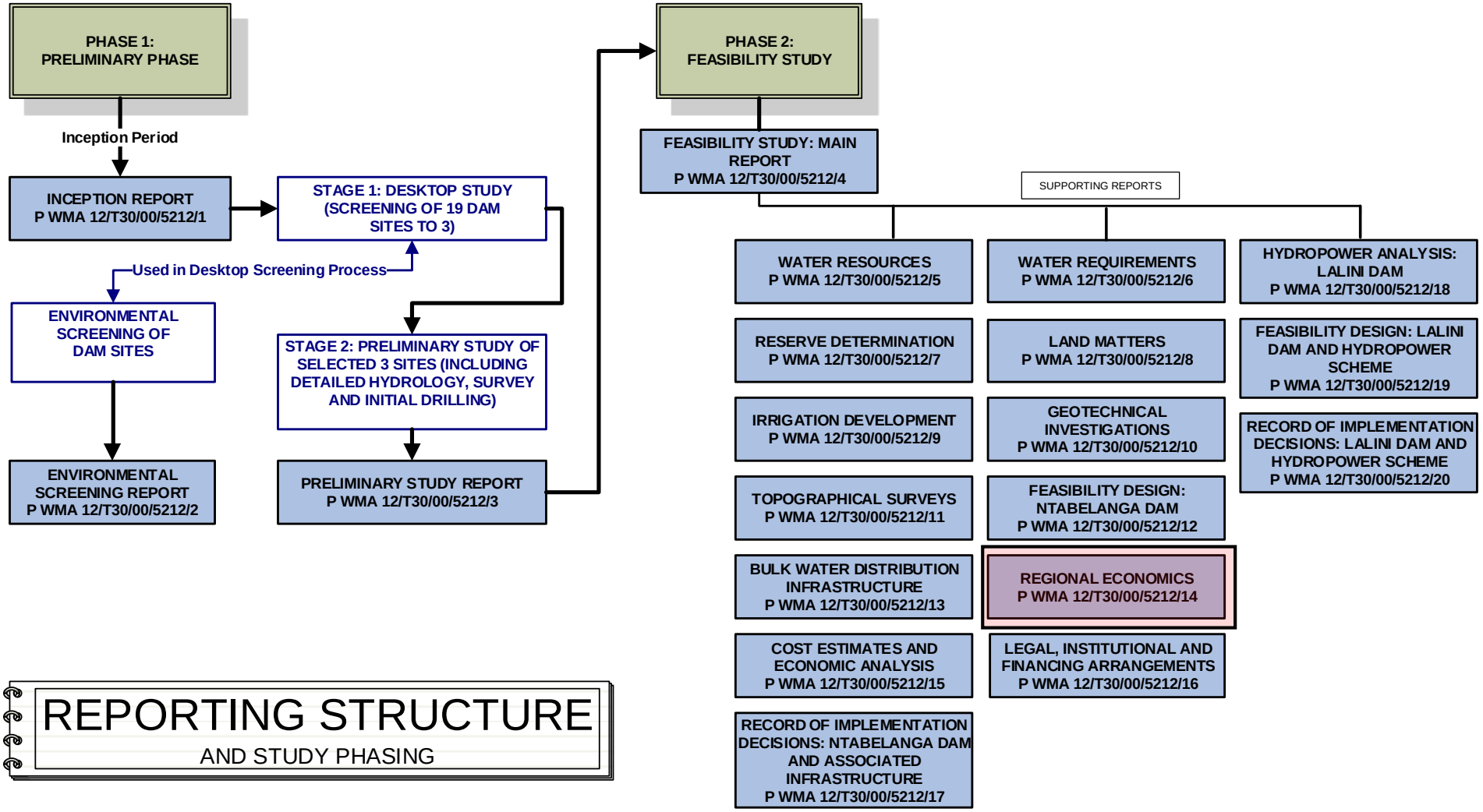
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REFERENCE

This report is to be referred to in bibliographies as:

Department of Water and Sanitation (2014). ***Feasibility Study for the Mzimvubu Water Project: Regional Economics***

DWS Report No: P WMA 12/T30/00/5212/14

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Note on Departmental Name Change:
In 2014, the Department of Water Affairs changed its name to the Department of Water and Sanitation, which happened during the course of this study. In some cases this was after some of the study reports had been finalized. The reader should therefore kindly note that references to the Department of Water Affairs and the Department of Water and Sanitation herein should be considered to be one and the same.

Note on Spelling of Laleni:
The settlement named Laleni on maps issued by the Surveyor General is locally known as Lalini and both names therefore refer to the same settlement.

EXECUTIVE SUMMARY

The Mzimvubu Catchment, one of the poorest regions in South Africa, possesses untapped economic potential in the form of its abundant water resources. The greater Transkei is the region in South Africa with the highest average rainfall and is host to the bulk of South Africa's untapped water, a rare commodity in an otherwise resource abundant nation.

The cost of constructing a dam is significant, requiring many decades of operation to recover the financial cost, if ever. Moreover, dams are criticised because of impacts such as flooding of large areas, and impacts on flow in aquatic and riparian ecosystems, disrupting livelihoods and destroying valuable, potentially arable, land.

However, dams provide many benefits. The primary benefit is in its supply of water for productive uses. Growth of populations, agricultural expansion and commercial and industrial economic activity relies heavily on South Africa's available water resources as a critical input into economic production. The availability of fresh water is increasingly an impediment to economic development. As such, the construction of the Ntabelanga Dam is foundational to the development of the Mzimvubu Catchment, and the large scale development associated with the dam can generate significant economic activity in the region.

Other benefits include hydroelectric power, recreation, flood control, water supply, waste management and navigation.

The construction of a second dam at Lalini downstream of the Ntabelanga Dam offers the opportunity to build a hydropower scheme able to produce up to 37.5 MW which, when used conjunctively with the Ntabelanga Dam, could supply some 202 million kWh into the regional grid, and generate significant revenue which could be used to the benefit of the overall scheme and region.

The above benefits are the tangible, medium term benefits associated with dams, and are relatively easy to measure. The most important benefits of dams however are in the long term economic benefits associated with the development of large infrastructure. There is a positive and statistically significant correlation between investment in infrastructure and economic performance at country level. Infrastructure investment not only increases quality of life, but, based on the time series evidence in the United States, infrastructure also has positive impact on both labour and economic productivity[1]. Examples of these benefits include the value of time saved by households in collecting water, the reduced burden of water-borne disease, tax revenue accruing to the fiscus and most importantly, the long-term economic impact resulting from the improvement in local infrastructure.

This report focuses only on the medium term economic benefits associated with construction, irrigation, water supply and hydropower generation of the Ntabelanga and Lalini Dams.

[1] *Aschauer, David Alan (1990). "Why is infrastructure important?" Federal Reserve Bank of Boston, New England Economic Review, January/February, pp. 21-48.*

The economic impact analysis considers two distinct phases over the lifetime of the project:

- *The construction phase; and*
- *The operational phase.*

The construction phase considers the economic impact of constructing the works over the prescribed implementation period, 2015 to 2021 inclusive. Over this 7-year period, the total expenditure in the construction sector will be R12 330 million on capital expenditure (including professional services, escalation and VAT).

Included in this are the following:

Ntabelanga Dam and Associated Infrastructure:	*R1 846 million*
Ntabelanga Water Treatment Works:	*R1 027 million*
Ntabelanga Bulk Potable Water Distribution (Primary, Secondary and Tertiary):	*R4 246 million*
Ntabelanga Bulk Irrigation Water Supply:	*R 795 million*
Ntabelanga In-Farm Investment Costs:	*R 180 million*
Lalini Dam, Hydropower Scheme and Associated Works:	*R3 686 million*
Catchment Management Programme being undertaken by DEA	*R 450 million*
Other allowances for Environmental and Social Offsets:	*R 100 million*

These expenditures will have a highly positive impact on the regional and national economies. These capital expenditures will generate economic activity which will contribute up to R2 566 million per year to regional and national GDP, and has the potential to create an average of 7 069 direct, indirect and induced jobs, during the construction period.

Other sectors indirectly benefitting from the construction phase include:

- *The Real Estate sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 4.13% (R2 016 million per year);*
- *The Wholesale and Retail Trade sectors, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 1.25% (R892 million per year);*
- *The Manufacturing sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 0.48% (R551 million per year); and*
- *The Transport sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 1.30% (R351 million per year).*

The operational phase considers the impact of post-construction economic activities in terms of a direct impact on agricultural development, water supply and hydroelectric power generation for the period 2020 – 2050. This phase will generate direct economic benefit in Agriculture, Water and Electricity industries which will contribute R778 million per year to regional and national GDP, and has the potential to create between 2 971 – 5 440 direct, indirect and induced jobs, depending to the level of labour-intensity applied in the irrigated agriculture activities.

The key sectors directly benefitting from the post-construction phase include:

- *The Agriculture sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 2.87% (R256 million per year);*
- *The Electricity sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 4.84% (R272 million per year); and*
- *The Water sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 12.26% (R216 million per year).*

Other sectors indirectly benefitting from the post-construction phase include:

- *The Manufacturing sector, would increase by 0.33% (R380 million per year);*
- *The Wholesale and Retail Trade sectors would increase by 0.19% (R133 million per year); and*
- *The Real Estate sector, which, for the total economic activity in the Eastern Cape province as a whole, would increase by 0.23% (R113 million per year).*

The project holds great potential to improve the livelihoods of local communities and entrepreneurs. A major challenge, especially during construction, will be to design the project to minimise income leakage (i.e. accrual of the project benefits outside the local and regional economies).

Employment in the Eastern Cape will:

- *Increase by 0.56% during construction. The additional economic activity resulting from dam construction will create approximately 7 069 full-time equivalent employment opportunities, which is equivalent to a total wage bill of R418 million per year, over the construction period.*
- *Increase by between 0.24% - 0.43% during post-construction. The additional economic activity resulting from post-construction activities will create between 2 971 and 5 440 full-time equivalent employment opportunities, and potentially another 1 350 seasonal jobs in agriculture. This is equivalent to a total wage bill of R240 million per year.*

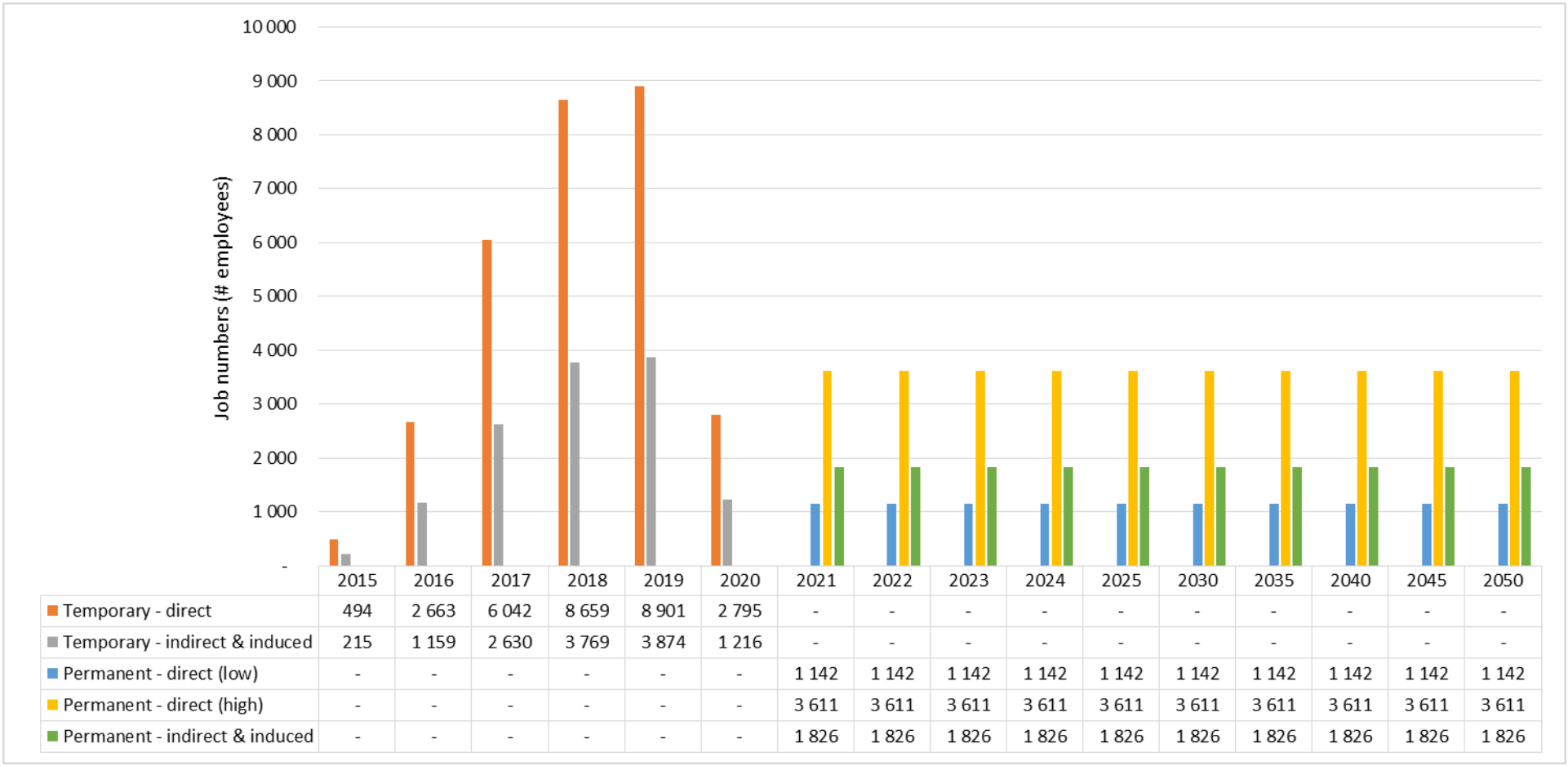
Employment in the local area adjacent to the Project will:

- *Increase by 17.7% during construction. (The challenge during the planning and implementation of the project will be to maximise local job creation and minimise income leakage to areas outside the local area.)*
- *Increase by between 7.5% - 13.7% during post-construction. (These will for the most part accrue within the local area. The sustainable local economic development opportunities created during post-construction will increase household income by R 579 million per year. This additional household income would have highly significant positive impact on local households. Assuming (for demonstration purposes only) that all the additional household income accrues in the Mhlontlo and King Sabata Dalindyebo LM's, this would increase the total household income in these LM's by 15.18%.*

Employment impacts in this study are broken down into direct as well as indirect and induced impacts. Direct employment impacts refer to the impact on employment arising due to the increase in the construction industry (during construction phase) and the increase in the agriculture, water and electricity industries (during post construction phase). On the other hand indirect and induced impacts refer to the impact on other industries that need to expand to support the construction industry (during construction phase) and the agriculture, water and electricity industries (during the post construction phase) as well as the effect that increase of wages will have on the local economy.

These direct and indirect employment opportunities will arise as demonstrated in the three table/figures below. It is important to note that the actual employment creation per year will vary from year to year within the two analysis periods – this annual variation can only be estimated through a detailed employment creation study and is not possible to estimate using the analysis methods specified for this study.

Table 1: Projected Job Creation Statistics: Ntabelanga-Lalini Conjunctive Scheme

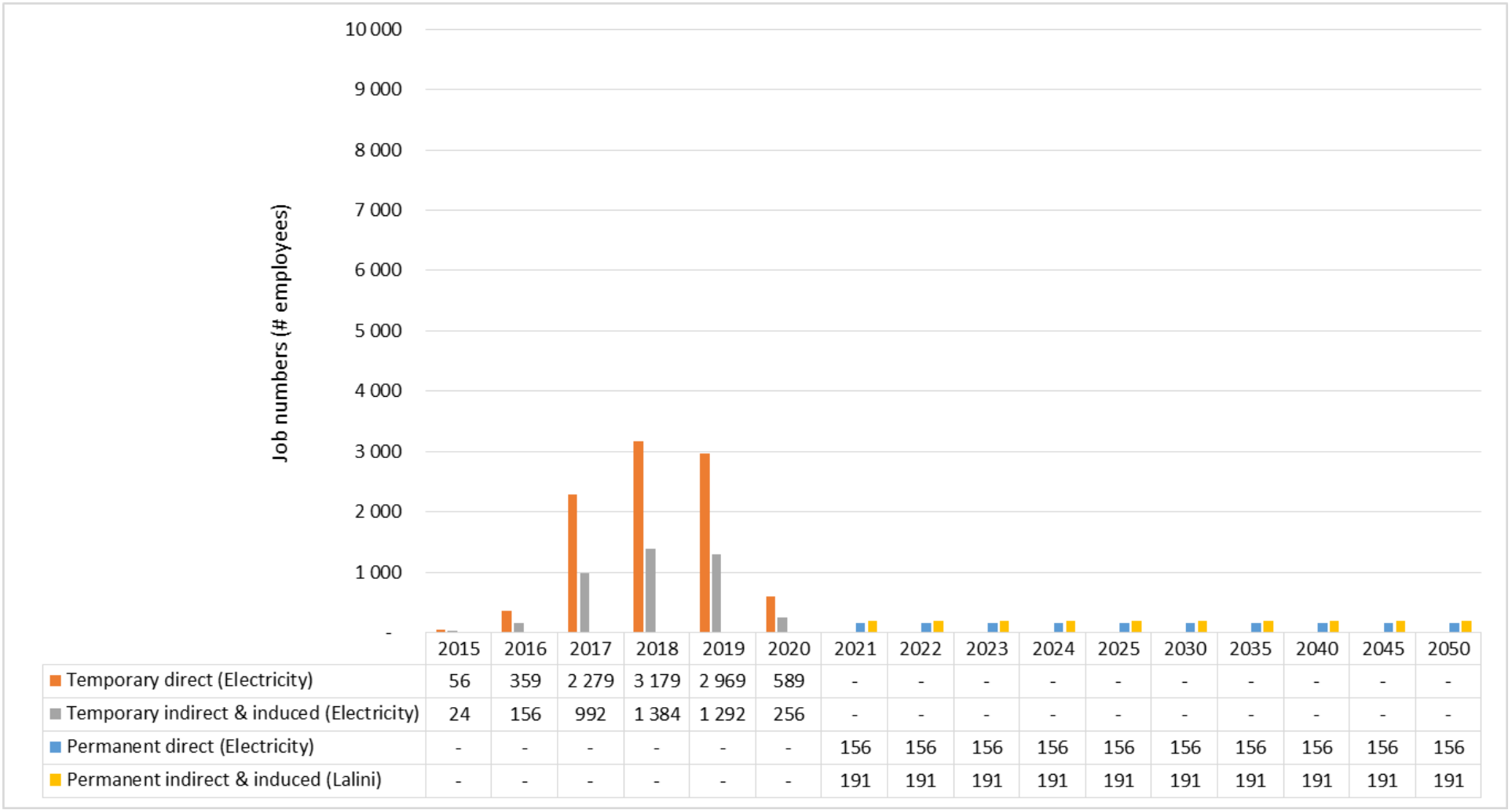


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050
Temporary - direct	494	2 663	6 042	8 659	8 901	2 795	-	-	-	-	-	-	-	-	-	-
Temporary - indirect & induced	215	1 159	2 630	3 769	3 874	1 216	-	-	-	-	-	-	-	-	-	-
Permanent - direct (low)	-	-	-	-	-	-	1 142	1 142	1 142	1 142	1 142	1 142	1 142	1 142	1 142	1 142
Permanent - direct (high)	-	-	-	-	-	-	3 611	3 611	3 611	3 611	3 611	3 611	3 611	3 611	3 611	3 611
Permanent - indirect & induced	-	-	-	-	-	-	1 826	1 826	1 826	1 826	1 826	1 826	1 826	1 826	1 826	1 826

Table 2: Projected Job Creation Statistics: Ntabelanga Water Supply and Agriculture

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050
Temporary direct (Agric & Water)	438	2 303	3 763	5 480	5 932	2 206	-	-	-	-	-	-	-	-	-	-
Temporary indirect & induced (Agric & Water)	191	1 003	1 638	2 385	2 582	960	-	-	-	-	-	-	-	-	-	-
Permanent direct (Agric & Water) - Low	-	-	-	-	-	-	987	987	987	987	987	987	987	987	987	987
Permanent direct (Agric & Water) - High	-	-	-	-	-	-	3 456	3 456	3 456	3 456	3 456	3 456	3 456	3 456	3 456	3 456
Permanent indirect & induced (Agric & Water)	-	-	-	-	-	-	1 637	1 637	1 637	1 637	1 637	1 637	1 637	1 637	1 637	1 637

Table 3: Projected Job Creation Statistics: Ntabelanga-Lalini Hydropower



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050
Temporary direct (Electricity)	56	359	2 279	3 179	2 969	589	-	-	-	-	-	-	-	-	-	-
Temporary indirect & induced (Electricity)	24	156	992	1 384	1 292	256	-	-	-	-	-	-	-	-	-	-
Permanent direct (Electricity)	-	-	-	-	-	-	156	156	156	156	156	156	156	156	156	156
Permanent indirect & induced (Lalini)	-	-	-	-	-	-	191	191	191	191	191	191	191	191	191	191

SOCIAL DISCOUNT RATE

The social discount rate (SDR) is directly analogous to concepts found in corporate finance such as the project appropriate discount rate; so the mathematics are identical. The benefit or cost per Rand can be calculated by:

$$(1/(1+r)^t)$$

where r equals the SDR and t equals time.

A higher SDR makes it less likely a social project will be funded. A higher SDR implies greater risks to the assumption that the benefits of the project will be reaped. A small increase in the social discount rate can matter enormously for benefits far into the future so it is very important to be as accurate as possible when choosing which rate to use.

There is a strong case for factoring in the equity issue when discounting benefits and costs of inter-generational projects such as this.

The social discount rate is a reflection of a society's relative valuation on today's well-being versus well-being in the future. The appropriate selection of a social discount rate is crucial for cost-benefit analysis, and has important implications for resource allocations.

The break even social discount rate of the project is attractive for a project of this nature. The return on investment to the economy can be estimated as the present value of project contribution to GDP against the capital cost of the project over the 2020 - 2050 operational planning horizon. The social discount rate is expected to be lower than financial discount rates. In this case the breakeven social discount rate is 6.54% per annum. This is a favourable discount rate for large infrastructure projects of this nature.

As the Lalini Dam and hydropower study was being completed, the EIA Professional Service Provider undertook a further economic assessment of the conjunctive scheme, which involved a critique of this report and some further analysis. The findings of this later study therefore complement this report and are given in DWS Report No. P WMA 12/T30/00/5314/8.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASGISA-EC	Accelerated and Shared Growth Initiative for South Africa – Eastern Cape
CAPEX	Capital Expenditure
CFRD	Concrete-faced rockfill dam
CMA	Catchment Management Agency
CTC	Cost to Company
CV	Coefficient of Variability
DAFF	Department of Agriculture, Forestry and Fisheries
DBSA	Development Bank of Southern Africa
DEA	Department of Environment Affairs
DM	District Municipality
DME	Department of Minerals and Energy
DoE	Department of Energy
DRDAR	Department of Rural Development and Agrarian Reform
DRDLR	Department of Rural Development and Land Reform
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Eastern Cape
ECRD	Earth core rockfill dam
EF	Earthfill (dam)
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPWP	Expanded Public Works Programme
ESIA	Environmental and Social Impact Assessment
EWR	Environmental Water Requirements
FSL	Full Supply Level
GDP	Gross Domestic Product
GDP-R	Gross Domestic Product of Region
GERCC	Grout enriched RCC
GN	Government Notices
GRDP	Gross Regional Domestic Product
GW	Gigawatt
GWh/a	Gigawatt hour per annum
IAPs	Invasive Alien Plants
IB	Irrigation Board
IFC	International Finance Corporation
IPP	Independent Power Producer
IRR	Internal Rate of Return
IVRCC	Internally vibrated RCC
ISO	International Standards Organisation
kW	Kilowatt

LM	Local Municipality
ℓ/s	Litres per second
MAR_{NAT}	Mean Annual Runoff (Naturalised Flows)
MAR_{PD}	Mean Annual Runoff (Present Day Flows)
MEC	Member of the Executive Council
MIG	Municipal Infrastructure Grant
million m^3	Million cubic metres
MW	Megawatt
NEMA	National Environmental Management Act
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act
NOCL	Non-overspill crest level
NWA	National Water Act
NWPR	National Water Policy Review
NWRMS	National Water Resources Management Strategy
O&M	Operations and Maintenance
OPEX	Operational Expenditure
PICC	Presidential Infrastructure Co-Ordinating Committee
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PSC	Project Steering Committee
PSP	Professional Services Provider
RBIG	Regional Bulk Infrastructure Grant
RCC	Roller-compacted concrete
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RWI	Regional Water Institution
RWU	Regional Water Utilities
SAM	Social Accounting Matrix
SEZ	Special Economic Zone
SIP	Strategic Integrated Project
SMC	Study Management Committee
SPV	Special Purpose Vehicle
StatsSA	Statistics South Africa
TCTA	Trans Caledon Tunnel Authority
ToR	Terms of Reference
UOS	Use of System
URV	Unit Reference Value
WEF	Water Energy Food
WMA	Water Management Area
WRYM	Water Resources Yield Model
WSA	Water Services Authority
WSP	Water Services Provider
WTE	Water Trade Entity
WUA	Water User Association

LIST OF UNITS

Description	Standard unit
Elevation	m a.s.l.
Height	m
Distance	m, km
Dimension	mm, m
Area	m^2 , ha or km^2
Volume (storage)	m^3
Yield, Mean Annual Runoff	m^3/a
Rotational speed	rpm
Head of Water	m
Pressure	Pa
Diameter	mm or m
Temperature	^oC

Description	Standard unit
Velocity, speed	m/s, km/hr
Discharge	m^3/s
Mass	kg, tonne
Force, weight	N
Gradient (V:H)	%
Slope (H:V) or (V:H)	1:5 (H:V) or 5:1 (V:H)
Volt	V
Power	W
Energy used	kWh
Acceleration	m/s^2
Density	kg/m^3
Frequency	Hz

1 BACKGROUND AND INTRODUCTION

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

Harnessing the water resources of the Mzimvubu River, the only major river in the country which is still largely unutilised, is considered by the Eastern Cape Provincial Government as offering one of the best opportunities in the Province to achieve such development. In 2007, a special-purpose vehicle (SPV) called ASGISA-Eastem Cape (Pty) Ltd (ASGISA-EC) was formed in terms of the Companies Act to initiate planning and to facilitate and drive the Mzimvubu River Water Resources Development.

The five pillars on which the Eastern Cape Provincial Government and ASGISA-EC proposed to model the Mzimvubu River Water Resources Development are:

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

The Department of Water and Sanitation (DWS) commissioned the Mzimvubu Water Project with the overarching aim of developing water resources schemes (dams) that can be multi-purpose reservoirs in order to provide benefits to the surrounding communities and to provide a stimulus for the regional economy, in terms of irrigation, forestry, domestic water supply and the potential for hydropower generation amongst others.

1.1 Study Locality

The Mzimvubu River Catchment is situated in the Eastern Cape (EC) Province of South Africa which consists of six District Municipalities (DM) and two Metropolitan Municipalities (Buffalo City and Nelson Mandela Bay). These include Cacadu DM in the west across to the Alfred Nzo DM in the east with the two Metropolitan Areas being located around the two major centres of the province, East London and Port Elizabeth, both of which border the Indian Ocean.

The Mzimvubu River Catchment is situated within three of the DM's namely the Joe Gqabi DM in the north west, the OR Tambo DM in the south and the Alfred Nzo DM in the east and north east. A locality map of the whole catchment area and its position in relation to the DM's in the area is provided in Figure 1-1.

1.2 Study Programme

The study commenced in January 2012 and was completed in October 2014 in three stages as follows:

- Inception ;
- Phase 1 – Preliminary Study; and
- Phase 2 – Feasibility Study.

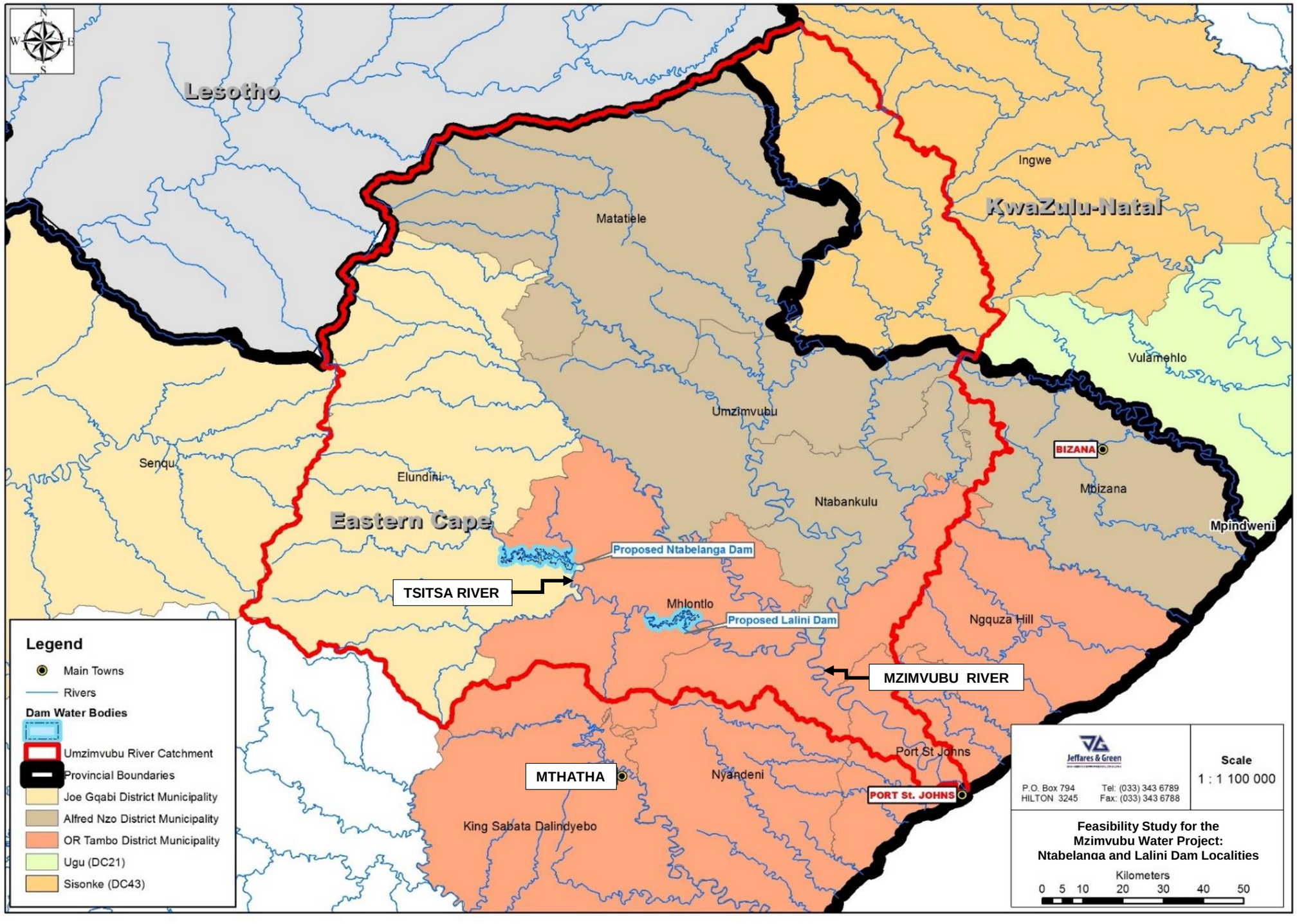


Figure 1-1: Locality of Ntabelanga and Lalini Dams Relative to Overall Mzimvubu Catchment Area

The purpose of the study was not to repeat or restate the research and analyses undertaken on the several key previous studies, but to make use of that information previously collected, to update and add to this information, and to undertake more focussed and detailed investigations and feasibility level analyses for the dam site options identified as being the most promising and cost beneficial.

1.2.1 Inception Phase

The aim of the inception phase was to finalise the Terms of Reference (TOR) as well as to include, *inter alia*, the following:

- A detailed review of all the data and information sources available for the assignment;
- A revised study methodology and scope of work;
- A detailed review of the proposed project schedule, work plan and work breakdown structure indicating major milestones;
- Provision of an updated organogram and human resources schedule; and
- Provision of an updated project budget and monthly cash flow projections.

The inception phase has been completed and culminated in the production of an inception report (DWS Report Number P WMA 12/T30/00/5212/1) which also constitutes the final TOR for the study.

1.2.2 Preliminary Study Phase

The preliminary report describes the activities undertaken during the preliminary study phase, summarizes the findings and conclusions, and provides recommendations for the way forward and scope of work to be undertaken during the feasibility study phase.

The Preliminary Study Phase was divided into two stages:

(1) Desktop Study; and
(2) Preliminary Study.

The aim of the desktop study was, through a process of desktop review, analyses of existing reports and data, and screening, to determine the three best development options from the pre-identified 19 development options (from the previous investigation).

The aim of the preliminary study was to gather more information with regard to the three selected development options as well as to involve the Eastern Cape Provincial Government and key stakeholders in the process of selecting the single best dam development option to be taken forward into Phase 2 of the study.

The main activities undertaken during the second stage of Phase 1 were as follows:

- Stakeholder involvement;
- Environmental screening;
- Water requirements investigations;
- Hydrological investigations;
- Geotechnical investigations;
- Topographical survey investigations, and
- Selection process.

1.2.3 Feasibility Study Phase

The preliminary study recommended a preferred dam site and scheme development to be taken forward to feasibility study level.

The key activities undertaken during the feasibility study were as follows:

- Detailed hydrology (over and above that undertaken during the Preliminary Study);
- Reserve determination;
- Water requirements investigation (including agricultural and domestic water supply investigations);
- Topographical survey (over and above that undertaken during the Preliminary Study);
- Geotechnical investigation (more detailed investigations than during the Preliminary Study);
- Dam design;
- Irrigation development;
- Bulk water distribution infrastructure;
- Hydropower analysis;
- Cost-Benefit Analysis;
- Land matters;
- Public participation;
- Regional economics; and
- Legal, institutional and financial arrangements.

An Environmental Impact Assessment was undertaken by an independent PSP in a separate study that ran in parallel to this one.

1.2.4 Additional Detailed Investigations for Lalini Dam and Hydropower Scheme

Following a variation order which extended the study programme to the end of October 2014, further detailed investigations were undertaken for a second dam on the Tsitsa at Lalini (just above the Tsitsa Falls) and its hydropower scheme, which would be operated conjunctively with the Ntabelanga Dam to generate significant hydropower for supply into the national grid.

1.3 Conjunctive Scheme Configuration

Following the completion of the above feasibility study stages it was agreed that the sizing and modus operandi of the Ntabelanga Dam and its associated works would take into account its multi-purpose role, namely:

i) To supply potable water to some 726 616 people and other water consumers in the region;
ii) To supply raw water for irrigation of some 2 868 ha of high potential agricultural land;
iii) To generate hydropower locally at the dam wall to reduce the cost of energy consumption when pumping water;
iv) To provide sufficient flow of water downstream of the Ntabelanga Dam to meet environmental water requirements for an ecological Class C; and
v) To provide additional balancing storage volume and consistent downstream flow releases to enable a second, smaller dam at Lalini (located on the Tistsa River some 3.5 km above the Tsitsa Falls) to generate significant hydropower for supply into the national grid.

The basis of approach listed in item v) was that the generating of hydropower could be used to cross-subsidize the significant energy costs required for pumping water for the irrigation and domestic water supply schemes proposed to be supplied from the Ntabelanga Dam. The agricultural water requirements proposed for the Tsolo area would require lifting the water more than 150 m, which would normally render such a scheme non-viable in terms of the pumping cost component of water supplied, unless hydropower is developed to reduce the net unit cost of water.

The purpose of this second dam and hydropower scheme at Lalini would thus be to generate significant revenue by selling energy into the ESKOM grid, thus generating a net positive income stream which would be used to subsidise the energy and operating costs of the main Ntabelanga water supply and irrigation scheme, thus providing self-sustainability.

1.4 Terms of Reference for Regional Economics

The terms of reference set out for the regional economics task sought to address the following objectives:

- To assess the current economic baseline in the Eastern Cape economy as a whole as well as within the specific study area impacted by the development;
- To describe the current status infrastructure and services available within the study area;
- To identify and describe the economic and social impacts that would likely occur as a result of the proposed development including, raw water provision and social water needs, stimulation of commercial agriculture, provision of hydroelectricity, as well as the indirect trickle down benefits that would occur as a result of the development. This includes assessment of potential employment opportunities and contributions to the primary and secondary economies.
- To develop quantifiable measures and qualitative indicators to be used to objectively evaluate the impact of the development; and
- Assess the impact of the project on the local community.

1.5 Purpose of this Report

This report provides a strategic assessment of the potential economic impacts of the proposed development. The report is founded on a macro-economic analysis of the Eastern Cape Province economy, detailing the scale of the impacts, both direct and indirect, on the various economic sectors.

Regional economics and demographics statistics provide a baseline point of departure, whilst a description of current infrastructure and services available in the study area provide context for the findings of the analysis.

The report seeks to detail quantifiable measures for economic performance, making use of key indicators including gross domestic product (GDP), gross regional domestic product, total economic output (disaggregated per sector), employment figures and household income.

1.6 Methodology

The TOR required that a macro-economic model be constructed which would then be able to report three distinct sets of results, namely:

- **The Direct effects:** The direct economic or employment impact is the change in economic activity or employment directly related to the dam construction scenario simulated.
- **Indirect effects:** Indirect effects are changes in inter-industry purchases in response to the change in demand from the sectors directly affected by dam construction. The indirect economic impact seeks to capture the knock-on benefits to the host economy. These indirect impacts, also known as the multiplier effects, include the re-spending within the local economy.
- **Induced effects:** Induced effects are changes from household spending due to changes in income that are caused by production changes.

The methodology used is based on the methodology and best practice recommended by the World Bank (2008), and the Water Research Commission (2000).

The full methodology is described in Appendix A.

1.7 Economic Indicators used to Evaluate Impact

Total Output – Total output is an estimate of the revenue flows within a specific economic sector. The change in total output generated by a certain stimulus, (e.g. a development project), is a useful measure for small business development.

Gross Domestic Product (GDP): GDP is a measure of all of the goods and services produced by a nation/region within a given year. The "Income Approach" is utilized in this project, which calculates GDP by summing up factor payments which include:

- Compensation of employees;
- Rent, the income of property owners;
- Interest income for supplying capital (borrowing/lending); and
- Proprietors' income and corporate profits, the income/profits derived from businesses, paid out to shareholders.

Gross Regional Domestic Product: Gross regional domestic product (GRDP), also known as gross domestic product of region (GDP-R), is a sub-national gross domestic product for measuring the size of that region's economy.

Employment Figures: The Social Accounting Matrix[2] (SAM) analysis method allows for the disaggregation of factor payment, including compensation of employees. Estimates of employment may be derived by analysing compensation paid to employees (factor payments to labour) in the context of salary levels within specific economic sectors.

Household Income: Household income is calculated as being a certain percentage of the factors payments to labour.

[2] *A Social Accounting Matrix (SAM) is a database (table) that reflects the structure of a given economy and is an important building block in the compilation of a SAM fixed-price model. The general, or partial equilibrium structure derived from a SAM, depicts the inter-relationship between the economic sectors and the various role-players (private sector, households, government, and where relevant, the rest of the world) in a particular economy. Based on these relationships, the SAMs serve as excellent tools for project impact analysis.*

The SAM analysis used to model the impact of the proposed development was based upon a social accounting matrix compiled by the Development Bank of Southern Africa for the Eastern Cape Province in 2006.

The matrix was augmented to account for economic growth, adjusting the prices to 2013 levels. No major changes in sector composition of the province were evident. However, in terms of the forecast values for economic stimulus, the addition of the Mzimvubu development itself could potentially alter the structure of the Province's economy, introducing a potential bias in the results.

Full-time equivalent (FTE) employment: is a unit that indicates the workload of an employed person in a way that makes workloads or class loads comparable across various contexts. FTE is often used to measure a worker's involvement in a project, or to track cost reductions in an organization. An FTE of 1.0 is equivalent to a full-time worker, while an FTE of 0.5 signals half of a full work load.

Also when defining FTE employment opportunities, these will vary per year as the project proceeds and the intensity of construction activities change. In general, the opportunities quoted herein relate to the FTE as defined above, and represent an average per year. Thus, an average of 1 000 FTE jobs per year over 4 years constitutes 1 000 employment opportunities in total and not 4 000 jobs *per se*. However, this does represent 4 000 man years of work income.

It should be noted that at the time this task was initiated, the main focus of the study was on the Ntabelanga Dam development, with the Lalini Dam and Hydropower scheme not yet taken to full feasibility study level. However, once the Lalini Dam and hydropower scheme feasibility design had been completed, its data, findings and recommendations were incorporated into this report.

As the Lalini Dam and Hydropower study was being completed, the EIA PSP undertook a further economic assessment of the conjunctive scheme, which involved a critique of this report and some further analysis. The findings of this later study therefore complement this report and are given in DWS Report No. P WMA 12/T30/00/5314/8.

2 A PERSPECTIVE ON THE NTABELANGA AND LALINI DAMS

2.1 Costs and Benefits of Dams

The cost of constructing a dam is significant, requiring many decades of operation to recoup the financial cost, if ever. Moreover, dams are criticised because of impacts such as flooding of large areas, and impacts on flow in aquatic and riparian ecosystems, both in the vicinity of the dam, as well as downstream of the dam wall. In some cases, the flooded area may also displace local inhabitants, disrupting livelihoods and destroying valuable, potentially arable, land.

On the other hand, dams also provide many benefits. The primary benefit is in the supply of water for productive uses. Growth of populations, agricultural expansion and commercial and industrial economic activity relies heavily on South Africa's available water resources as a critical input into economic production. The availability of fresh water is increasingly an impediment to economic development. As such, the construction of the Ntabelanga and Lalini Dams is foundational to the development of the Mzimvubu Catchment, and the large scale development associated with the two dams can generate significant economic activity in the region.

Other benefits include hydroelectric power, recreation, flood control, water supply, waste management, navigation and wildlife habitat.

Recreation benefits may include a variety of water sports and picnic areas. Moreover, evidence in South Africa exists of significantly increased property values in the vicinity of dams, both due to the benefits listed here, and the aesthetic value of improvements to the viewscape of dams. Dams can help prevent the loss of life and property caused by flooding. Flood control dams impound floodwaters and then either release them under control to the river below the dam or store or divert the water for other uses. In some instances, dams provide environmental protection, such as the retention of sedimentary materials.

The above benefits are the tangible, medium term benefits associated with dams, and are relatively easy to measure. The most important benefits of dams however are in the long term economic benefits associated with the development of large infrastructure. There is a positive and statistically significant correlation between investment in infrastructure and economic performance at country level. Infrastructure investment not only increases quality of life, but, based on the time series evidence in the United States, infrastructure also has positive impact on both labour and economic productivity[3].

This report focuses only on the medium term economic benefits associated with construction, irrigation, water supply and hydropower generation of the Ntabelanga and Lalini Dams.

[3] *Aschauer, David Alan (1990). "Why is infrastructure important?" Federal Reserve Bank of Boston, New England Economic Review, January/February, pp. 21-48.*

2.2 Mzimvubu Catchment in Perspective

The Mzimvubu Catchment, one of the poorest regions in South Africa, possesses untapped economic potential in the form of its abundant water resources. The Eastern Cape Province is the region in South Africa with the highest average rainfall and is host to the bulk of South Africa's untapped water resource potential. The rivers of the region, which include the Mzimvubu and its tributaries, among others, possess surpluses of this valuable resource (Richardson 2010).

The Mzimvubu Water Project purposes to harness this resource, through a multi-pronged approach that includes development of forestry, irrigated agriculture, hydroelectricity, water supply for domestic use as well as agriculture, and tourism (DWA.2013c). Water requirements for the Mzimvubu - Keiskamma Water Management Area (WMA) were estimated at 401 million m^3 per annum in 2012 (WRC.2009). Irrigated agriculture is the largest consumer of fresh water in the WMA, with domestic consumption coming in at a close second place.

Table 2-1: Water Consumption per Sector: Mzimvubu to Keiskamma WMA

WMA: MZIMVUBU TO KEISKAMMA		
Sector	**Water Consumption million m^3/a**	**Percentage of Total Consumption %**
Urban	106	26%
Rural	42	10%
Mining	0	0%
Power	0	0%
Afforestation	49	12%
Irrigation	204	51%
Total for WMA	**401**	**100%**

Source: WRC (2009)

The construction of the Ntabelanga Dam would harness this available resource and would add 490 million m^3 to the available reservoir capacity in the region (DWA. 2013d). The Ntabelanga Dam and the ancillary water resource development initiatives would provide a significant foothold for the development of the region, bringing increased economic opportunities, rural development, job creation, increased water supply, energy production, and associated indirect benefits.

The construction of the 232 million m^3 capacity Lalini Dam is solely for the purpose of balancing flow in the river to provide a reliable source of water to generate hydropower. The dam thus provides the headwater to supply the associated transfer conduit and hydroelectric plant. This dam does not provide potable water or water for irrigation, and water used by the hydropower plant is returned back to the river downstream of the plant.

Whilst the significant value of construction works will create jobs and associated increased economic opportunities, the main benefit of the Lalini Dam and hydropower scheme would be from the revenue generated from energy sales, which will be used to cross-subsidise the operation, maintenance and power costs of the proposed Ntabelanga potable water and irrigation schemes. This has the effect of reducing the unit cost of water supplied by the Ntabelanga scheme to levels which are considered to be sustainable and affordable, thus creating the opportunity for a viable operating entity to be established. Without this cross-subsidisation from energy sales revenue, it is unlikely that the Ntabelanga potable and irrigation schemes would be viable without significant ongoing state subsidy.

3 CURRENT ECONOMIC BASE AND ACTIVITIES

3.1 Regional Economic Summary

The Eastern Cape's contribution to national GDP (GDP-R) was measured at R 235 billion in 2013 (StatsSA. 2014). Total employment within the Eastern Cape stands at 30.8% of the region's population, a figure that has marginally increased from 30.4% in 2003 (StatsSA.2014).

Table 3-1 summarises the contribution per sector towards the GDP-R of the Eastern Cape. Economic growth within the province has been most evident within the "Wholesale and retail and motor trade; catering and accommodation" sector, however "General government services" comprise the biggest portion of the economic activity in the province. The other significant sectors of the Eastern Cape economy are the financial, real estate and business services and manufacturing sectors.

The Eastern Cape's economic capacity is centred in the manufacturing, specifically vehicle manufacturing, centres of East London and Port Elizabeth. These cities represent the hub of South Africa's motor industry. The province is host to deep water ports and four airports, and has well developed road and rail infrastructure. As such, the region has been earmarked for economic development. There are two industrial development zones; the West Bank in East London and Coega, which is located near Port Elizabeth.

The biggest contributor of employment in the region has been the vehicle manufacturing sector which has had an annual average growth rate of 6.9% since 1996. The sector employed around 175 000 people in 2009 (DEDEA.2010). Another significant contributor towards job creation has been the wholesale retail and trade sector, which has shown steady growth in both output and employment since 2000 (DEDEA. 2010). Financial and business services are a significant contributor to the province's economic capacity whilst the growing tourism market has made considerable contributions to employment through increases in both accommodation and catering.

The local economy is characterised by high levels of unemployment and low household income (Table 3-3). Many households are also still without electricity and water services (Table 3-4).

The region, which includes the former Transkei and Ciskei homelands, holds significant potential for economic development, as it holds a large proportion of South Africa's undeveloped water resources, a rare commodity in an otherwise resource abundant nation. The government of South Africa has highlighted the region for development to reduce levels of poverty in the region, and to bring a degree of prosperity to the rural regions which have not benefited significantly from the economic development in the urban centres of Port Elizabeth and East London.

The western interior of the province is mostly semi-arid Karoo bushveld, but the far south has a temperate and wet climate. This climate combined with the relatively hilly environment has meant that the area is one of the last remaining areas in South Africa with potential for large scale water supply infrastructure, i.e. dams.

The Ntabelanga and Lalini Dams will therefore have direct positive impacts on the following economic sectors:

- Construction, through the construction activities associated with the two dams and other infrastructure;
- Agriculture, through the water made available for irrigation schemes;
- Electricity, through the hydropower to be generated; and
- Water, through the water supply to rural and urban consumers.

The indirect impact of the development initiative will ripple into the various sectors of the region's economy. Tourism will be stimulated in the region, both through business tourism during construction of the dam as well as recreational tourism associated with the dam water body once it has been constructed. Real estate prices will be positively affected by the presence of the dam, through the creation of waterfront property.

In addition, the revenue injection into the region's economy in the context of the increased demand for goods and services generated by the construction and operation of the dam and associated developments will impact the broader economy, stimulating manufacturing, transport, communication, wholesale and retail trade, as well as finance and business services.

3.2 Regional Household Statistics and Current Infrastructure and Services

The Eastern Cape, a province which remains one of the country's most severely impoverished regions, is steadily instituting programmes and initiatives to address the slow development and high levels of unemployment in the region (DEDEA.2010).

Demographic statistics for the study area, obtained from StatsSA (Census 2011), have been analysed and summarized for illustration in this report.

In the study area, programmes to provide access to services have shown success with close to 64 805 households having access to piped water within 1 km of the household, and with 47 646 households having access to water within 200 m of the household. Unfortunately a significant backlog remains, with almost 48 620, mostly rural households not having any access to piped water.

Table 3-1: Household Access to Water Statistics: Mzimvubu Study Area

ACCESS TO PIPED WATER	HOUSEHOLDS	
Piped (tap) water inside dwelling/institution	5 007	4.30%
Piped (tap) water inside yard	9 060	7.80%
Piped (tap) water on community stand: distance less than 200 m from dwelling/institution	33 579	28.90%
Piped (tap) water on community stand: distance between 200 m and 500 m from dwelling/institution	12 502	10.80%
Piped (tap) water on community stand: distance between 500 m and 1000 m (1 km) from dwelling/institution	4 657	4.00%
Piped (tap) water on community stand: distance greater than 1000 m (1 km) from dwelling/institution	2 835	2.40%
No access to piped (tap) water	48 620	41.80%

Note: (StatsSA Census 2011)

Table 3-2: Eastern Cape Economy

SECTOR	GDP-R per SECTOR (Current Prices – R' million)					
	2010	**%**	**2011**	**%**	**2012**	**%**
Agriculture, forestry and fishing	2 994	1.6%	3 400	1.7%	3 845	1.8%
Mining and quarrying	472	0.3%	474	0.2%	540	0.3%
Manufacturing	27 358	14.8%	26 391	13.5%	26 863	12.8%
Electricity and Water	2 474	1.3%	2 750	1.4%	3 204	1.5%
Construction	5 458	3.0%	4 555	2.3%	4 969	2.4%
Wholesale and retail and motor trade; Catering and accommodation	29 597	16.0%	32 532	16.7%	37 773	17.9%
Transport storage and communication	15 944	8.6%	17 488	9.0%	18 404	8.7%
Finance real estate and business services	37 101	20.1%	39 826	20.4%	41 929	19.9%
General government services	43 893	23.7%	47 387	24.3%	51 119	24.3%
Personal services	19 641	10.6%	20 197	10.4%	21 925	10.4%
Taxes less subsidies on products	19 143	10.4%	22 054	11.3%	23 965	11.4%
Total for Eastern Cape	**184 932**	**100.0%**	**195 000**	**100.0%**	**210 571**	**100%**

Table 3-3: Household Income and Employment for Local Economy

Local Administration Area	Population	Households	HH with No Income	Annual Household Income R'million	Employed Population	Unemployed Population	Discouraged Work-seekers
P2D04: Joe Gqabi (DC14)	**349 768**	**97 776**	**13 868**	**4 610**	**51 889**	**28 212**	**16 070**
P2D04M01: Elundini (EC141)	138 143	37 854	5 997	1 402	14 313	11 438	5 453
P2D04M02: Senqu (EC142)	134 149	38 048	5 694	1 507	18 576	9 919	7 544
P2D04M03: Maletswai (EC143)	43 802	12 104	1 336	1 010	10 630	4 073	1 527
P2D04M04: Gariep (EC144)	33 674	9 770	841	691	8 370	2 782	1 546
P2D05: O.R.Tambo (DC15)	**1 364 946**	**298 230**	**48 072**	**13 575**	**122 265**	**95 470**	**68 296**
P2D05M03: Ngquza Hill (EC153)	278 481	56 212	9 236	2 196	18 622	19 594	15 618
P2D05M04: Port St Johns (EC154)	156 135	31 715	5 984	1 019	8 178	8 390	10 071
P2D05M05: Nyandeni (EC155)	290 394	61 647	9 854	2 248	20 935	16 877	12 753
P2D05M06: Mhlontlo (EC156)	188 223	43 414	6 238	1 570	15 052	14 118	9 793
P2D05M07: King Sabata Dalindyebo (EC157	451 713	105 242	16 760	6 542	59 478	36 491	20 061
P2D06: Alfred Nzo (DC44)	**801 344**	**169 261**	**25 595**	**6 507**	**69 652**	**52 955**	**41 342**
P2D06M01: Umzimvubu (EC442)	191 622	46 893	7 068	1 866	18 809	15 439	11 069
P2D06M02: Matatiele (EC441)	203 840	49 524	7 799	2 052	24 508	15 219	8 032
P2D06M03: Mbizana (EC443)	281 906	48 446	7 067	1 801	19 502	15 158	14 879
P2D06M04: Ntabankulu (EC444)	123 976	24 398	3 661	788	6 833	7 139	7 362
Total for Local Economy	**2 516 058**	**565 267**	**87 535**	**24 692**	**243 806**	**176 637**	**125 708**

Note: (StatsSA Census 2011)

Table 3-4: Household Water and Electricity Services for Local Economy

Local Administration Area	HH using Electricity for lighting		HH with Flush toilet (connected to sewerage system)		HH with Access to piped water: Inside dwelling/ institution		HH with Access to piped water: Inside yard	
Units	**# HH**	**% of Mun. Total # HH**	**# HH**	**% of Mun. Total # HH**	**# HH**	**% of Mun. Total # HH**	**# HH**	**% of Mun. Total # HH**
P2D04: Joe Gqabi (DC14)	**67 676**	**69.2%**	**23 221**	**23.7%**	**17 201**	**17.6%**	**24 120**	**24.7%**
P2D04M01: Elundini (EC141)	17 569	46.4%	3 037	8.0%	3 904	10.3%	2 785	7.4%
P2D04M02: Senqu (EC142)	31 036	81.6%	4 445	11.7%	3 331	8.8%	12 289	32.3%
P2D04M03: Maletswai (EC143)	10 205	84.3%	8 487	70.1%	5 968	49.3%	3 758	31.0%
P2D04M04: Gariep (EC144)	8 866	90.7%	7 252	74.2%	3 998	40.9%	5 288	54.1%
P2D05: O.R.Tambo (DC15)	**210 136**	**70.5%**	**31 702**	**10.6%**	**26 559**	**8.9%**	**30 593**	**10.3%**
P2D05M03: Ngquza Hill (EC153)	35 519	63.2%	1 335	2.4%	2 079	3.7%	2 636	4.7%
P2D05M04: Port St Johns (EC154)	21 577	68.0%	586	1.8%	886	2.8%	1 499	4.7%
P2D05M05: Nyandeni (EC155)	43 983	71.3%	1 002	1.6%	1 766	2.9%	2 239	3.6%
P2D05M06: Mhlontlo (EC156)	31 652	72.9%	1 253	2.9%	1 771	4.1%	3 953	9.1%
P2D05M07: King Sabata Dalindyebo (EC157)	77 405	73.5%	27 526	26.2%	20 057	19.1%	20 266	19.3%
P2D06: Alfred Nzo (DC44)	**78 672**	**46.5%**	**8 775**	**5.2%**	**9 814**	**5.8%**	**17 291**	**10.2%**
P2D06M01: Umzimvubu (EC442)	21 419	45.7%	2 484	5.3%	2 072	4.4%	6 061	12.9%
P2D06M02: Matatiele (EC441)	22 353	45.1%	5 147	10.4%	6 018	12.2%	7 651	15.4%
P2D06M03: Mbizana (EC443)	29 188	60.2%	587	1.2%	1 079	2.2%	2 292	4.7%
P2D06M04: Ntabankulu (EC444)	5 712	23.4%	557	2.3%	645	2.6%	1 287	5.3%
Total for Local Economy	**356 484**	**63.1%**	**63 698**	**11.3%**	**53 574**	**9.5%**	**72 004**	**12.7%**

Note: (StatsSA Census 2011)

The Ntabelanga Dam and the supporting reticulation and treatment infrastructure will be able to supply some 110 133 households in the Alfred Nzo, OR Tambo and Joe Gqabi District Municipalities in 2020, rising to some 148 443 by 2050. Thus the development of this infrastructure will have a major positive impact in terms of reducing the backlog in access to piped water.

The energy statistics, detailed in Table 3-5 illustrate a comparable context for energy consumption and access to electricity. Fifty-eight percent (58%) of households have access to electricity for lighting, 36% have access to electricity for cooking. Whilst these figures show promise and improvement, there remains a significant backlog in terms of providing access to electricity. Wood remains the most significant source of fuel in the province, with 41% to 58% of houses utilizing wood for heating and cooking (StatsSA. 2011).

The proposed infrastructure development configuration for hydropower consists of the Lalini Dam, downstream of the Ntabelanga Dam, which is to be used exclusively for hydropower generation. The inclusion of the hydropower facility will improve the financial viability of the scheme through the provision of an additional income stream (DWA.2013b).

Table 3-5: Household Energy Statistics, Mzimvubu Study Area

Purpose	Energy Source	Households	Percent
Energy for Cooking	Electricity	41 405	35.60%
	Gas	7 309	6.30%
	Paraffin	15 559	13.40%
	Wood	47 859	41.20%
	Coal	189	0.20%
	Animal Dung	3 204	2.80%
	Solar	117	0.10%
	Other	265	0.20%
	Not classified	332	0.30%
Energy for Heating	Electricity	14 769	12.70%
	Gas	1 677	1.40%
	Paraffin	25 268	21.70%
	Wood	66 463	57.20%
	Coal	481	0.40%
	Animal Dung	1 903	1.60%
	Solar	115	0.10%
	Other	71	0.10%
	Not classified	5 496	4.70%
Energy for Lighting	Electricity	67 403	58.00%
	Gas	343	0.30%
	Paraffin	6 129	5.30%
	Candles *(not a valid option)	41 390	35.60%
	Solar	368	0.30%
	Not classified	617	0.50%

Note: (StatsSA Census 2011)

The challenges faced by the province revolve primarily around the provision of electricity, water and sanitation infrastructure. Government has made significant budgetary allocations for the development of healthcare, roads and logistics infrastructure and education, but the issue of rural economic development remains an impediment to poverty reduction. As the province is richly endowed with farmland, agricultural expansion has been earmarked as a significant part of the strategy to address this issue (StatsSA. 2012).

The primary overarching economic objective for the region is to achieve economic growth that is matched by job creation. However the region has been plagued by slow job growth during economic upturns and rapid job losses during the downturn, which has left the province in a state of jobless growth.

The provincial unemployment rate currently stands at 30.8% of the economically active population. The figures for the study area, which is to be directly impacted by the development, paint a somewhat more desperate picture. A mere 39% of prospective job seekers have secured employment, whilst a staggering 61% of economically active individuals are listed either as unemployed or as being discouraged work seekers.

Table 3-6: Population Employment Profile: Mzimvubu Study Area

Employment Status	%	% (cumulative)
Employed	39.0%	39.0%
Unemployed	35.9%	74.9%
Discouraged Work Seekers	25.1%	100.0%
Total	**100.0%**	**-**

Note: (StatsSA Census 2011)

The income profile for households within the study area indicates that 86% of households in the area survive on an income of R38 200 per annum or less. This figure, when compared to the employment figures, alludes to the high degree of welfare dependence in these communities.

Table 3-7: Household Income Profile: Mzimvubu Study Area

Income Band	%	% (cumulative)
No income	16.00%	16.00%
R1 – R4 800	7.30%	23.30%
R4 801 – R9 600	13.70%	37.00%
R9 601 – R19 600	27.00%	64.00%
R19 601 – R38 200	22.00%	86.00%
R38 201 – R76 400	6.90%	92.90%
R76 401 – R153 800	3.70%	96.60%
R153 801 – R307 600	2.20%	98.80%
R307 601 – R614 400	0.90%	99.70%
R614 401 – R1 228 800	0.10%	99.80%
R1 228 801 – R2 457 600	0.10%	99.90%
R2 457 601 or more	0.10%	100.00%

Note: (StatsSA Census 2011)

Increased employment opportunities, generated by the Mzimvubu Water Project would introduce considerable economic prospects to this area.

Low skilled construction sector employment would draw upon the local supply of labour, bringing much needed income to marginalised communities.

The provision of infrastructure to these communities, along with the on-going labour demand for operation and maintenance jobs would ensure a lasting economic impact to the area.

The transport and logistics networks generated through the construction of the dam, will increase labour mobility and help the local economy develop stronger ties with the urban-centric formal economic centres of the province.

4 SOCIO-ECONOMIC IMPACT PHASES ANALYSED IN THIS REPORT

The economic impact analysis considers two distinct phases over the lifetime of the project:

- The construction phase; and
- The operational phase.

Each phase is assessed in terms of both the direct and indirect economic impacts of the proposed development.

The construction phase considers the economic impact of constructing the Ntabelanga and Lalini Dams over the expected implementation period, 2015 to June 2021.

The operational phase considers the impact of post-construction economic activities, specifically the agricultural development, hydroelectricity generation and raw water provision.

The operational period of the project envisions a direct impact on agricultural development, water supply and hydroelectric power generation for the period 2020 to 2050.

5 SOCIO-ECONOMIC IMPACT OF THE CONSTRUCTION PHASE

The construction activities of the Ntabelanga and Lalini Dams would proceed as described elsewhere in project documents. During this period, construction will directly generate economic activity in the construction sector, over the period 2015 – 2021.

Over this 6-year period, the total expenditure in the construction sector will be R12 330 million on capital expenditure, as set out in Table 5-1. This capital expenditure increases the sectorial output of the Eastern Cape economy which in turn generates Gross Values Added (GVA, measured as GDP-R in this report) and stimulates job creation.

These expenditures will have a highly positive impact on the national and regional economies. These capital expenditures will generate economic activity which will increase the national GDP by up to R2 566 million per year during the construction period. This GDP impact includes all direct, indirect and induced effects. The largest direct impact associated with construction would be in the building and construction sector.

Not all of this GDP will accrue in the municipalities adjacent to the dam. This is because specialised labour, equipment and building material would likely be sourced from outside this area. A particular challenge during the construction phase would be to maximise the local impact of construction activities to minimise inevitable income leakage from the local municipalities.

Other sectors indirectly benefitting from the construction phase include:

- The Real Estate sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 4.13% (R2 016 million per year);
- The Wholesale and Retail Trade sectors, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 1.25% (R892 million per year);
- The Manufacturing sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 0.48% (R551 million per year); and
- The Transport sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 1.30% (R351 million per year).

Further economic sectors, including electricity, water, accommodation, communication, insurance and business services will all increase their economic output and GDP contribution (refer to Table 5-2 for more detail).

The additional economic activity resulting from dam construction will create up to 7 069 full-time equivalent employment opportunities, of which 4 926 are direct jobs and the balance indirect and induced (Table 5-3). This is equivalent to a total wage bill of R418 million per year, over the construction period. This estimate is based on average employment rates and wages in the Eastern Cape Province, as reported by Statistics South Africa and the Development Bank of Southern Africa.

The majority of these opportunities will be created in the construction sector, with a large number of indirect job opportunities also created in the other economic sectors (refer to Table 5-3).

The multiplier effect for the construction phase is 2.00. This means that for every Rand of GDP generated in the agriculture, electricity and water sectors, an additional R1.00 of GDP is generated in the rest of the economy.

Table 5-1: Overall Conjunctive Scheme Cost Estimate and Cashflow Projection

COST ESTIMATES		ANNUAL EXPENDITURES R'MILLION									
COMPONENT	**R' million**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Ntabelanga dam and associated works	1 075		81	322	215	215	215	27			
Ntabelanga dam hydropower works	88				9	35	35	9			
Ntabelanga land compensation/mitigation costs	18		1	4	4	4	4	1			
Ntabelanga power transmission	29		3	23	3						
Sub-Total Ntabelanga Dam and Associated Works	*1 209*		*85*	*349*	*231*	*254*	*254*	*37*			
Engineering and EMP Costs (12%)	*145*		*10*	*42*	*28*	*30*	*30*	*4*			
Sub-Total Ntabelanga Dam and Associated Works incl Eng & EMP	*1 354*		*95*	*391*	*259*	*284*	*284*	*41*			
* Escalation in Each Year @ 5.5% p.a.	265		5	44	45	68	87	16			
Sub-Total Ntabelanga Dam and Associated Works incl Eng, EMP & ESC	*1 619*		*100*	*435*	*304*	*352*	*371*	*57*			
VAT (14%)	227		14	61	43	49	52	8			
Add in R 22 million per year for catchment management (no esc)	220	22	22	22	22	22	22	22	22	22	22
Allowance for other offset activities (50% of R 100 million)	50				10	15	15	10			
Total Ntabelanga Dam and Associated Works (incl Esc + VAT)	**2 116**	**22**	**136**	**518**	**378**	**438**	**460**	**97**	**22**	**22**	**22**
COMPONENT	**R' million**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Ntabelanga water treatment works	643		32	32	193	193	129	64			
Ntabelanga primary & secondary bulk treated water distribution system	1 234			123	247	370	370	123			
Ntabelanga tertiary bulk treated water distribution system (DM's)	1 425			143	285	428	428	143			
Ntabelanga bulk irrigation water supply system	497				50	149	199	75	25		
Sub-Total Ntabelanga WTW and Bulk Water Systems	*3 799*		*32*	*298*	*774*	*1 140*	*1 125*	*405*	*25*		
Engineering and EMP Costs (12%)	*456*		*4*	*36*	*93*	*137*	*135*	*49*	*3*		
Sub-Total Ntabelanga WTW and Bulk Water Systems incl Eng & EMP	*4 255*		*36*	*334*	*867*	*1 277*	*1 260*	*453*	*28*		
* Escalation in Each Year @ 5.5% p.a.	1 067		2	38	151	305	387	172	13		

COST ESTIMATES		ANNUAL EXPENDITURES R'MILLION									
COMPONENT	**R' million**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Sub-Total Ntabelanga WTW and Bulk Water Systems incl Eng, EMP & ESC	*5 322*		*38*	*372*	*1 019*	*1 581*	*1 647*	*625*	*40*		
VAT (14%)	745		5	52	143	221	231	88	6		
Total Ntabelanga WTW and Bulk Water Systems (incl Esc + VAT)	**6 068**		**43**	**424**	**1 161**	**1 803**	**1 878**	**713**	**46**		
COMPONENT	**R' million**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
In-farm irrigation investment costs	105						53	53			
Engineering and EMP Costs (12%)	*13*						*6*	*6*			
Sub-Total in-farm irrigation investment costs incl Eng & EMP	*118*						*59*	*59*			
* Escalation in Each Year @ 5.5% p.a.	40						18	22			
Sub-Total in-farm irrigation investment costs incl Eng, EMP & ESC	*158*						*77*	*81*			
VAT (14%)	22						11	11			
Total in-farm irrigation investment costs (incl Esc + VAT)	**180**						**88**	**92**			
COMPONENT	**R' million**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Lalini dam and associated works	802				267	267	267				
Lalini Access Roads and Bridges	487			73	195	195	24				
Lalini land compensation/mitigation costs	50				17	17	17				
Lalini water delivery tunnel, shafts and penstocks	756				113	302	302	38			
Lalini hydropower E&M equipment	175					26	79	61	9		
Lalini hydropower civil works	49						24	24			
Lalini power transmission lines to grid	29			14	14						
Sub-Total Lalini Dam and HEP	*2 347*			*87*	*607*	*807*	*714*	*124*	*9*		

COST ESTIMATES		ANNUAL EXPENDITURES R'MILLION									
COMPONENT	**R' million**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Engineering and EMP Costs (12%)	*282*			*10*	*73*	*97*	*86*	*15*	*1*		
Sub-Total Lalini Dam and HEP incl Eng and EMP	*2 629*			*98*	*679*	*904*	*799*	*138*	*10*		
* Escalation in Each Year @ 5.5% p.a.	648			11	118	216	245	52	4		
Sub-Total Lalini Dam and HEP incl Eng, EMP and Esc	*3 277*			*109*	*798*	*1 120*	*1 045*	*191*	*14*		
VAT (14%)	459			15	112	157	146	27	2		
Add in R 22 million per year for catchment management (no esc)	230	23	23	23	23	23	23	23	23	23	23
Allowance for other offset activities (50% 0f R 100 million)	50				10	15	15	10			
Total Lalini Dam and HEP (incl Esc + VAT)	**3 966**	**23**	**23**	**147**	**932**	**1 300**	**1 214**	**241**	**39**	**23**	**23**
		2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
GRAND TOTAL ALL COMPONENTS (R'MILLION INCL ESC AND VAT)	**12 330**	45	203	1 089	2 472	3 541	3 640	1 143	107	45	45

** Note: The effective escalation rate is calculated at the given annual rate compounded from the 2014 base year to the actual year that the expenditure is made.*

Table 5-2: Construction Phase Economic Impact: Average Annual Impact (R'million)

Sector	Baseline output (2014) (R'million/a)	Direct impact on economic output (R'million/a)	Indirect impact on economic output (R'million/a)	Induced impact on economic output (R'million/a)
Agriculture	8 947	12 131	35	28
Mining	1 055	-	2	16
Manufacturing	113 737	-	318	234
Electricity	5 620	-	131	118
Water	1 764	-	10	4
Building and Construction	27 737	-	1 950	537
Trade	71 349	-	444	448
Accommodation	9 625	-	59	23
Transport	27 009	-	210	141
Communication	19 394	-	70	48
Insurance	26 704	-	79	175
Real Estate	48 805	-	1 400	616
Business Services	12 438	-	11	58
Regional GDP (R'million/a)				**2 566**

Note: (Own Analysis) This Regional GDP is not the total of the three columns but is a result from the modelling undertaken. There is a difference between total output and GDP.

Table 5-3: Construction Phase Job Creation: Averaged Annual Impact

Sector	Direct Job Creation	Indirect Job Creation	Induced Job Creation
Agriculture	-	20	16
Mining	-	0	2
Manufacturing	-	38	28
Electricity	-	13	11
Water	-	1	0
Building and Construction	4 926	792	218
Trade	-	269	272
Accommodation	-	20	8
Transport	-	44	30
Communication	-	15	10
Insurance	-	22	48
Real Estate	-	170	75
Business Services	-	4	19
Total Job Impact	4 926	1 407	737

Note: (Own Analysis)

6 SOCIO-ECONOMIC IMPACT OF THE POST-CONSTRUCTION PHASE

6.1 Direct Socio-Economic Impacts

The post-construction period of the project extends from 2020 through to 2050. During this period, the additional economic activity generated by the implementation of the Ntabelanga and Lalini Dams will impact directly on the following economic sectors:

- The Agriculture sector , through the water made available for irrigation schemes;
- The Electricity sector, through the hydropower to be generated; and
- The Water sector, through the water supply to rural and urban consumers.

6.1.1 Irrigation Agriculture

The Ntabelanga Dam will supply raw water for irrigation. The resulting agricultural development in areas identified around the Ntabelanga Dam will likely comprise 2 868 ha in areas around the dam and near Tsolo (refer to Figure 6-1). Assuming a water requirement of 8 800 m^3/ha per year, and depending on what crop mix is planted in each farming unit, the water demand from the dam is expected to be between a minimum of 17.8 million m^3/a and a maximum of 32.7 million m^3/a, giving an average annual irrigation raw water requirement of 27.8 million m^3/a.

A feasibility study has been conducted for the development of this irrigated land (DWA.2013c) as part of this project. This study envisages the transformation of what is currently non-commercial, non-irrigated and communally managed land to commercial irrigation farming.

The irrigation area is proposed to be sub-divided into 45 farming units of between 40 and 90 ha each. The proposed crops comprise vegetables, row crops and forage/fodder crops. On average, each farm would generate a gross margin at R580 734 per 60 ha (typical) farming unit. In agricultural economics, gross margin is a useful indicator of farm profitability.

The gross margin is the difference between crop production costs (including seeds/seedlings, irrigation, fertiliser, pesticides, herbicides, field prep, harvest costs, labour costs, transport costs) and the gross selling price (i.e. farm turnover or total output) (refer to Table 6-1).

The total output is likely to be between R3.0 million and R5.0 million per year. The total output for the full scheme of 2 868 ha can be estimated through using a reference crop analysis method. This method shows that the ratio of gross margin to total output is 11%, and thus this development would generate R256 million in total output (i.e. total scheme revenue) for the Agriculture sector per year.

The GDP and job creation impacts of these irrigation activities are discussed below.

Table 6-1: Summary of Gross Margins: Farming Unit of 60 ha

Cropped area (ha)	Crop 1	Crop 2	GMA crop 1 (R/ha)	GMA crop 2 (R/ha)	Annual GM (R)
1	Green beans		R32 174		R 88 014
		Carrot		R55 840	
1	Lettuce		R29 560		R 59 120
		Lettuce		R29 560	
2	Potatoes		R11 741		R 50 060
		Cabbage		R13 289	
10	Lucerne		R13 138		R131 380
5	Oats		R 7 953		R 39 765
1	Spinach		R30 825		R 42 952
		Onion		R12 127	
4	Soybean		R 4 742		R 18 968
5	Ryegrass		R 2 525		R 12 625
1	Tomatoes		R16 820		R 16 820
30	Maize		R 4 034		R121 030
60					**R580 734**

Note: (DWA 2013c)

6.1.2 Water Supply

The Ntabelanga Dam will supply water for domestic consumption. Water supply planning will be synchronised with the three relevant District Municipalities' (Alfred Nzo, Joe Gqabi, OR Tambo) master plans implemented by Amatola Water. The water supply scenario analysed here will include raw water supply, bulk water treatment, primary and secondary distribution and tertiary supply to households.

Consequently, it is estimated that the Ntabelanga Dam and associated works would have the capacity to supply potable water to 539 094 people in 2020 rising to 726 616 people by year 2050. This comprises a rural domestic water demand of 60 litres per person per day and an urban domestic water demand of 125 litres per person per day, and includes provision for potential commercial and industrial water requirements.

Domestic water consumption, intended to be supplied by the development, is initially expected to supply 110 133 homes per year in 2020 and this is forecasted to expand to 148 433 households by 2050. The scheme will thus supply 23 million m^3 water (2020) growing to 31 million m^3 in 2050.

Total water supplied by the scheme will thus be an estimated 32.4 million m^3 per annum. At an estimated price of R6.36 per m^3 (benchmarked against Amatola Water Board sales prices) this will generate R206 million of revenue for the water sector per year. The price is a weighted average price of Amatola Water and it internalises free basic water supplied.

The GDP and job creation impacts of these irrigation activities are discussed below.

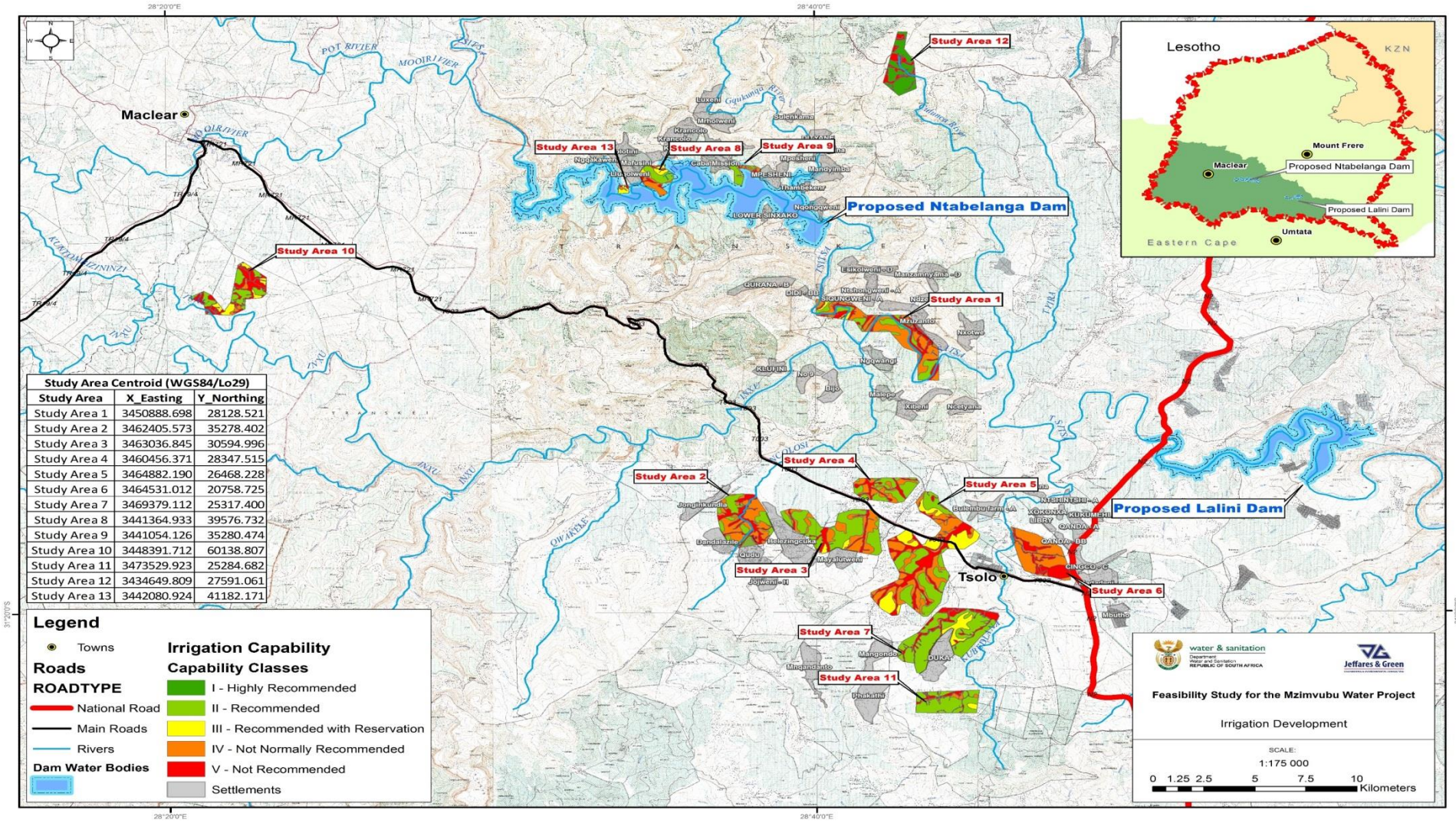


Figure 6-1: Proposed Irrigation Development Zones: Ntabelanga Dam (DWA. 2013c)

6.1.3 *Hydropower Generation*

The conjunctive Ntabelanga and Lalini Dams will provide water for generating hydropower.

The power generation facilities to be constructed at Lalini will have the capacity to generate up to 37.5 MW of hydroelectric power. Both dams will also have mini-hydropower plants just downstream of the dam walls, each able to generate up to 5 MW.

The conjunctive scheme will generate 202 million kWh (an average equivalent to 23.06 MW continuous output) electricity each year. At a future likely price of (say) 135c/kWh, this would generate R272 million in revenue each year for the operator.

6.1.4 *Tourism*

It is possible that a recreational tourism industry could develop around the Ntabelanga and Lalini Dams. Using the Loskop Dam in Mpumalanga as a benchmark, such an industry could generate at least R8 million per annum in tourism revenue for local tourism sector entrepreneurs. This estimate is based on an assumption that the dams could attract at least 6 000 visitors per year between the two of them, each spending on average R1 349 per trip (Statistics SA).

6.2 Contributions to GDP and GDP-R

The contributions to GDP are estimated by measuring the direct and indirect effects of the increased outputs in the agriculture, water supply and electricity sectors through the Social Accounting Matrix, as summarised in the methodology section.

The Eastern Cape GDP in 2012 was R234 536 million (Stats SA). Using this GDP as a baseline, the project construction phase will add R2 566 million in GDP in total over the 6-year construction period. During the post-construction period, the project will add R778 million per year through development and growth in the Agriculture, Electricity and Water services sectors and their indirect impacts

The economic activity generated by the development of these sectors will have an impact varying between 0.2% - 0.3% per annum of the Eastern Cape's GDP. The figure below demonstrates the positive impact on the GDP-R (regional GDP) of the Eastern Cape. The figure presents growth in the GDP-R contribution index of the Eastern Cape to the economy of South Africa.

The baseline is 1.0, and this value indicates that the contribution of the Eastern Cape GDP to national GDP is the same as the projected contribution without the project. Therefore anything above 1.0 can be interpreted that the Eastern Cape economy has grown faster than the rest of SA and that the Eastern Cape economy is contributing a larger share to national GDP. The graph therefore demonstrates the positive impact on GDP-R's contribution throughout the project period up to 2050.

This covers the analysis period to 2050.

The key sectors directly benefitting from the post-construction phase include:

- The Agriculture sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 2.87% (R256 million per year);
- The Electricity sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 4.84% (R272 million per year); and
- The Water sector, which, for the total economic activity in the Eastern Cape Province as a whole, would increase by 12.26% (R213 million per year).

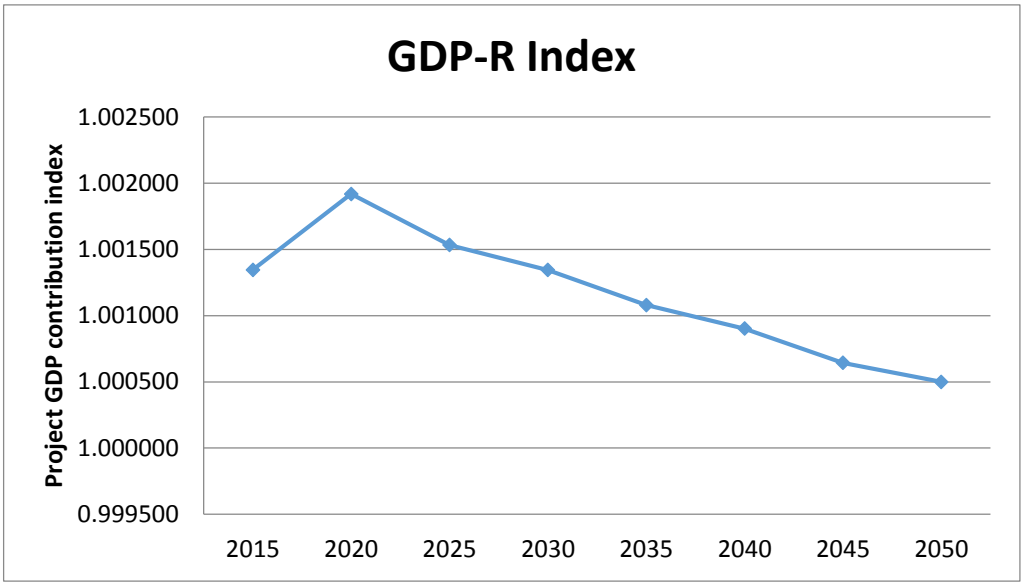


Figure 6-2: Impact on Regional GDP

A large proportion of this GDP will accrue in the municipalities adjacent to the dam. In the case of the Agriculture and Water sectors, income leakage is likely to be small and most value adding activities will be locally based, either in the adjacent municipalities or in the Eastern Cape itself. The income leakage from the Electricity sector may be higher. The scenario simulated here assumes that the power is fed into the national electricity grid. Thus some of the economic activity generated by the hydropower scheme may take place outside the municipalities immediately adjacent to the dam. As in the case of the construction phase, it is recommended that the post-construction phase should strive to maximise the local impact of project activities to minimise income leakage from the local municipalities.

Other sectors indirectly benefitting from the post-construction phase include:

- The Manufacturing sector, would increase by 0.33% (R380 million per year);
- The Wholesale and Retail Trade sectors would increase by 0.19% (R133 million per year); and
- The Real Estate sector, which, for the total economic activity in the Eastern Cape province as a whole, would increase by 0.23% (R113 million per year).

Other economic sectors, including Accommodation, Transport and other sectors will all increase their economic output and GDP contribution (refer to Table 6-2 for more detail).

The multiplier effect for these post-construction economic activities is 3.12. This means that for every Rand of GDP generated in the Agriculture, Electricity and Water Sectors, and additional R 2.12 of GDP is generated in the rest of the economy.

Table 6-2: Post-Construction Phase Economic Impact Summary: Averaged Annual Impact

Sector	Baseline output (2014) (R'million/a)	Direct impact on economic output (R'million/a)	Indirect impact on economic output (R'million/a)	Induced impact on economic output (R'million/a)
Agriculture	8 947	256	14	11
Mining	1 055	-	1	2
Manufacturing	113 737	-	219	161
Electricity	5 620	272	10	9
Water	1 764	213	32	14
Building and Construction	27 737	-	31	9
Trade	71 349	-	66	67
Accommodation	9 625	-	40	16
Transport	27 009	-	33	22
Communication	19 394	-	22	15
Insurance	26 704	-	13	28
Real Estate	48 805	-	79	35
Business Services	12 438	-	3	15
Gross Value Added (GVA)	**R778 million per annum**			

Note: (Own Analysis) This GVA is not the total of the columns but is a result from the modelling undertaken.

6.3 Employment Opportunities in the Primary and Secondary Economies

The additional economic activity resulting from post-construction activities will create between 2 971 and 5 440 full-time equivalent employment opportunities per year, which is equivalent to a total wage bill of between R240 and R325 million per year. This estimate is based on average employment rates and wages in the Eastern Cape, as reported by Statistics South Africa and the Development Bank of Southern Africa.

The majority of these opportunities will be created in the agriculture sector, and to a lesser extent in the electricity and water sectors. The agriculture sector employment opportunities may vary, depending on the agricultural development model applied. In the worst case, using a technology intensive model, 906 jobs may be created. On the other hand, the agriculture economics study completed as part of the Ntabelanga Dam investigation estimates that, in the best case, 3 375 permanent jobs would be created and up to 1 350 seasonal workers would be employed.

Large numbers of indirect job opportunities will also be created in the other economic sectors (refer to Table 6-4). This is especially evident in the trade and manufacturing sectors, as well as the accommodation and building and construction sectors.

Table 6-3 below summarises the expected job creation figures for the post-construction phase of the development, according to expected salary.

Table 6-3: Job Creation Relative to Expected Salary: Post-construction Phase

Salary Range			Number of Jobs
> R180 000			352
R120 000	to	R180 000	550
R60 000	to	R120 000	146
R0.00	to	R60 000	1 936
Total Jobs			**2 984**

Table 6-4: Post-Construction Phase Job Creation: Averaged Annual Impact

	Direct job creation (lower estimate)	Direct job creation (higher estimate)	Indirect job creation	Induced job creation
Agriculture	906	3 375	14	11
Mining	-	-	1	2
Manufacturing	-	-	219	161
Electricity	156	156	10	9
Water	81	81	32	14
Building and Construction	-	-	31	9
Trade	-	-	66	67
Accommodation	-	-	40	16
Transport	-	-	33	22
Communication	-	-	22	15
Insurance	-	-	13	28
Real Estate	-	-	79	35
Business Services	-	-	3	15
Total	1 143	3 612	563	1 265

Note: (Own Analysis)

6.4 Impact on Local Communities

The project holds great potential to improve the livelihoods of local communities and entrepreneurs. A major challenge, especially during construction, will be to design the project to minimise income leakage (i.e. accrual of the project benefits outside the local and regional economies).

Employment in the Eastern Cape will:

- Increase by 0.56% during construction and
- Increase by 0.24% - 0.43% during post-construction.

Employment in local area adjacent to the Project will:

- Increase by 17.7% during construction. (The challenge during project design will be to maximise local job creation and minimise income leakage to areas outside the local area.)
- Increase by between 7.5% - 13.7% during post-construction. (These will for the most part accrue within the local area.)

The sustainable economic opportunities created during post-construction will increase household income by R579 million per year. Table 6-5 demonstrates that this additional household income could have highly significant positive impact on local households. Assuming (for demonstration purposes only) that all the additional household income accrues in the Mhlontlo and King Sabata Dalindyebo LM's, this would increase the total household income in these two LM's by 15.19% (see Table 6-5).

In addition, local business profits (after subtraction of labour and all other costs) is estimated at R204 million per year.

Table 6-5: Potential Local Household Impact (demonstration only)

	Baseline household income (Mhlontlo and King Sabata Dalindyebo)	**Household income in Mhlontlo and King Sabata Dalindyebo Post Construction**
	R'million/a	**R'million/a**
Total Household Income earned	3 818	4 398
Impact on local household income		+15.19%

7 CONCLUSION

7.1 Social Cost-Benefit Analysis

Energy, water and transport are essential ingredients for the success of a competitive modern economy. Well-designed infrastructure investments have long-term economic benefits; they can raise economic growth, productivity, and land values, while providing significant positive spillovers. These spill-overs result from a change in the structure of the economy, which is very difficult to estimate. However, investing adequately in infrastructure is critically important as over-investment may lead to projects that are inefficiently large.

The Ntabelanga and Lalini Dam conjunctive scheme will have a large beneficial impact on the regional economy of the Eastern Cape, as well as a large beneficial impact on the local economy surrounding the study area.

All salient economic indicators will be positively affected. Moreover, the economic development and growth starts from a very low baseline.

The breakeven social discount rate of the project is attractive for a project of this nature. The return on investment to the economy can be estimated as the present value of project GDP against the capital cost of the project over the 2015 - 2050 time horizon. The social discount rate is expected to be lower than commercial financial discount rates. In this case the breakeven social discount rate is 6.01% per annum. This is a favourable discount rate for large infrastructure projects of this nature.

Table 7-1: Social Discount Rate for the Project

Discount rate	Net present value
4.00%	R2 494
6.00%	R7
6.01%	R0
8.00%	R-1 485

7.2 Job Creation

This estimate is based on average employment rates and wages in the Eastern Cape, as reported by Statistics South Africa and the Development Bank of Southern Africa.

The construction and operation of the two Dams will create different types of jobs during the construction and post-construction phases.

Based on StatsSA and DBSA economic statistics, the economic activity resulting from both dams' construction will generate a total wage bill of R418 million per year. This is 3.4% of the total construction cost (R 12 330 million). When averaged over the construction period of June 2014 – June 2020, this wage bill constitutes approximately 4 926 full-time equivalent direct employment opportunities per year in the Construction sector. The DBSA Social Accounting Matrix (SAM) for the Eastern Cape indicates that dam construction will generate approximately another 1 134 full-time equivalent employment opportunities in other economic sectors (indirect and induced effects) (refer to Table 5-3).

Based on StatsSA and DBSA economic statistics, the economic activity resulting from post-construction economic activity will generate a total wage bill of R240 million per year. When averaged over the post-construction period of 2020-2050, and depending on different business models that may be available, this wage bill could result in between 2 971 and 5 440 full-time equivalent employment opportunities per year. The majority of these opportunities will be created in the agriculture sector, and to a lesser extent in the electricity and water sectors.

The agriculture sector employment opportunities may vary, depending on the agricultural development model applied. In the worst case, using a technology intensive model, 906 jobs may be created. On the other hand, the agriculture economics study completed as part of the Ntabelanga Dam investigation estimates that, in the best case, 3 375 permanent jobs would be created and up to 1 350 seasonal workers would be employed. According to the DBSA SAM, approximately 1 828 indirect job opportunities will also be created in the other economic sectors (refer to Table 6-2).

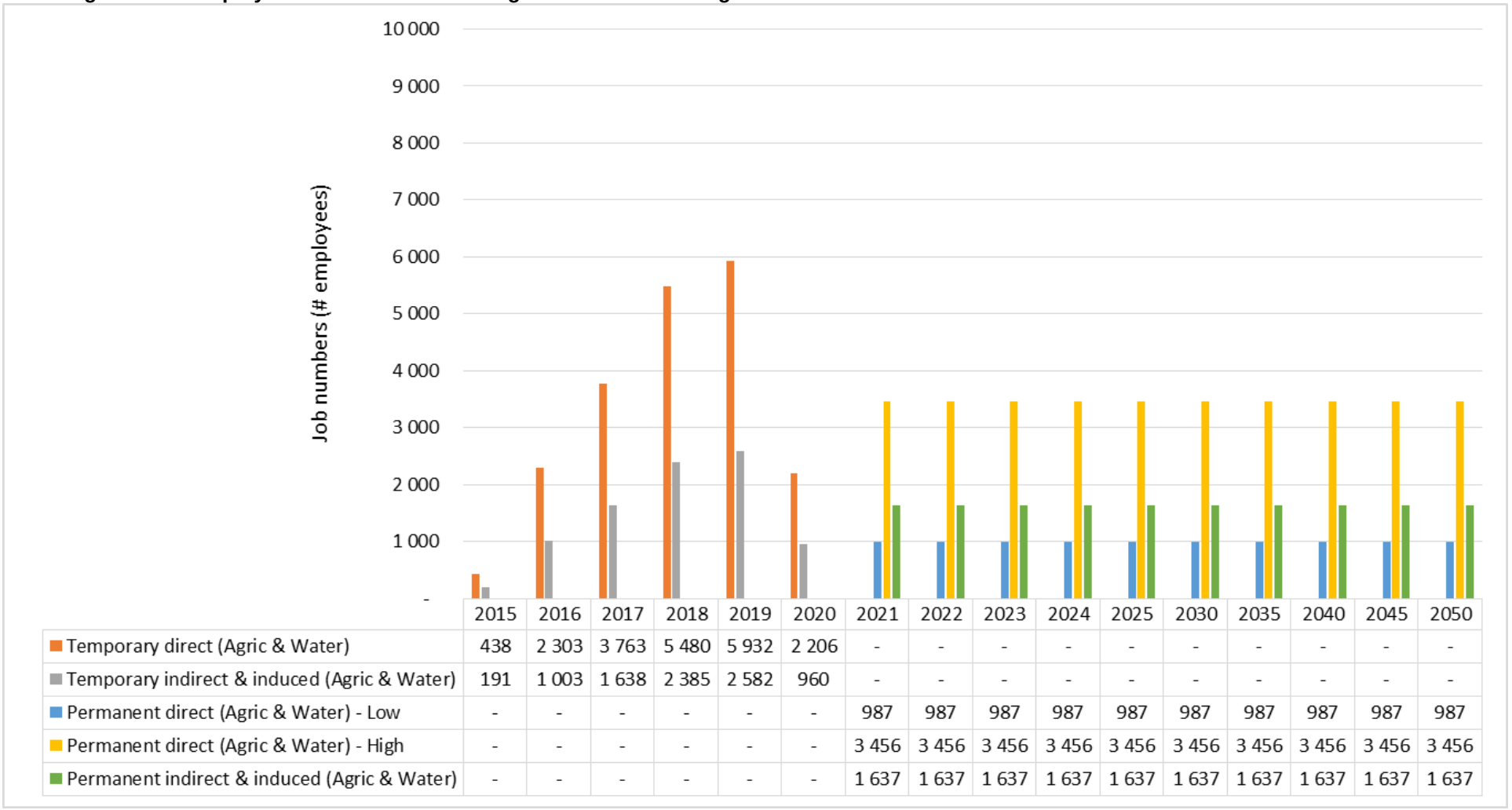
These direct and indirect employment opportunities will arise as demonstrated in Tables 7-2 to 7-4 below. It is important to note that the actual employment creation per year will vary from year to year within the two analysis periods – this annual variation can only be estimated through a detailed employment creation study and is not possible to estimate using the analysis methods specified for this study. The sectoral breakdown of these employment opportunities are presented in Table 5-3 and Table 6-4.

Table/Figure 7-2: Employment Creation: Ntabelanga-Lalini Conjunctive Scheme

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050
Temporary - direct	494	2 663	6 042	8 659	8 901	2 795	-	-	-	-	-	-	-	-	-	-
Temporary - indirect & induced	215	1 159	2 630	3 769	3 874	1 216	-	-	-	-	-	-	-	-	-	-
Permanent - direct (low)	-	-	-	-	-	-	1 143	1 143	1 143	1 143	1 143	1 143	1 143	1 143	1 143	1 143
Permanent - direct (high)	-	-	-	-	-	-	3 612	3 612	3 612	3 612	3 612	3 612	3 612	3 612	3 612	3 612
Permanent - indirect & induced	-	-	-	-	-	-	1 828	1 828	1 828	1 828	1 828	1 828	1 828	1 828	1 828	1 828

NB: Temporary: Construction phase, Permanent: Post-construction phase
NB: Direct effects are impacts in the industries directly affected by the project, i.e. during construction phase it will be the construction industry and during post-construction phase this will be in the agriculture, electricity and water industries. Indirect and induced effects are for the local economy as a whole, i.e. employment created in all other industries.

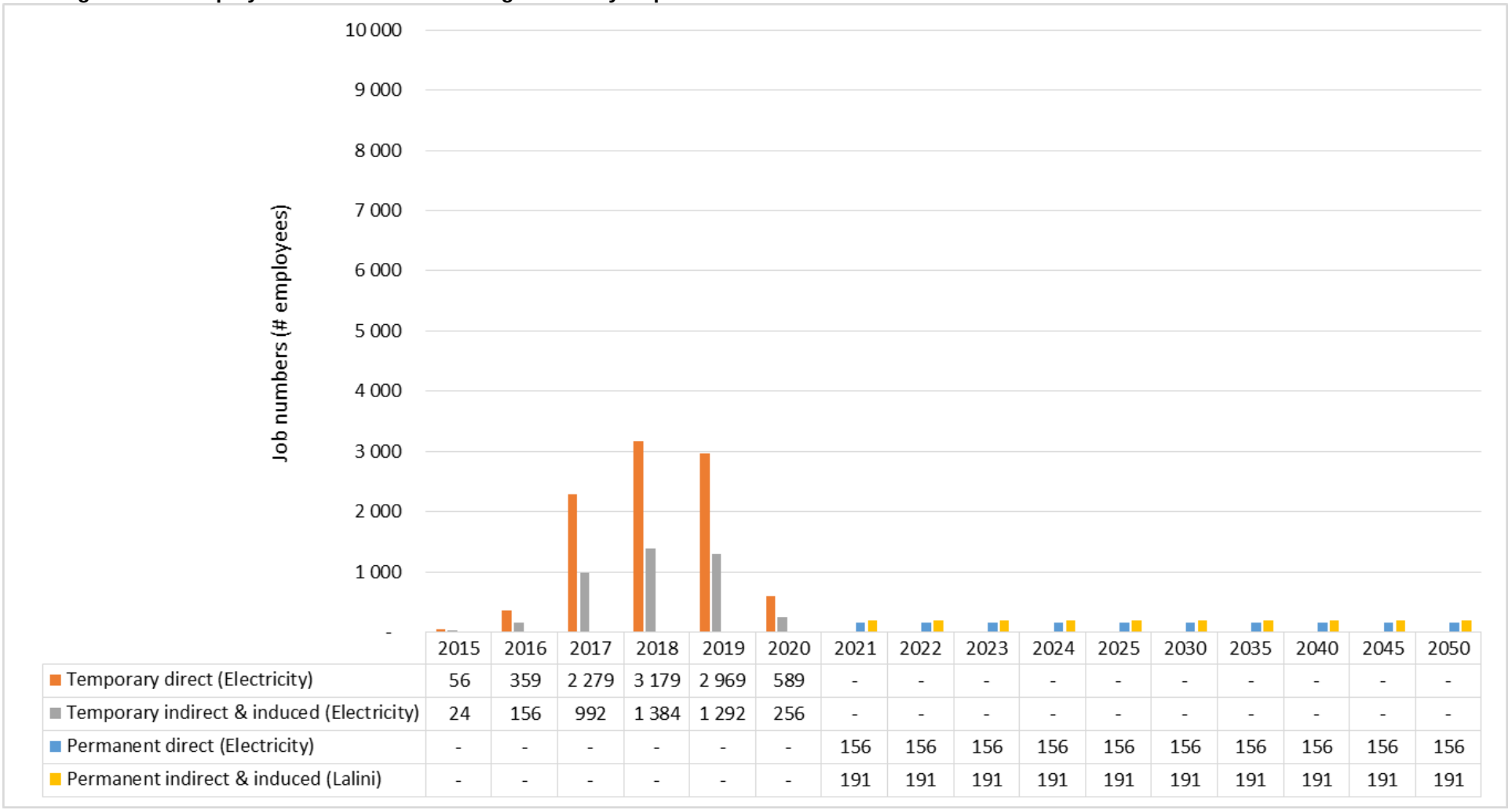
Table/Figure 7-3: Employment Creation: Ntabelanga Dam: Water and Agriculture



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050
Temporary direct (Agric & Water)	438	2 303	3 763	5 480	5 932	2 206	-	-	-	-	-	-	-	-	-	-
Temporary indirect & induced (Agric & Water)	191	1 003	1 638	2 385	2 582	960	-	-	-	-	-	-	-	-	-	-
Permanent direct (Agric & Water) - Low	-	-	-	-	-	-	987	987	987	987	987	987	987	987	987	987
Permanent direct (Agric & Water) - High	-	-	-	-	-	-	3 456	3 456	3 456	3 456	3 456	3 456	3 456	3 456	3 456	3 456
Permanent indirect & induced (Agric & Water)	-	-	-	-	-	-	1 637	1 637	1 637	1 637	1 637	1 637	1 637	1 637	1 637	1 637

NB: Ntabelanga-Lalini conjunctive agriculture and water sector associated, direct, indirect and induced employment

Table/Figure 7-4: Employment Creation: Ntabelanga-Lalini Hydropower Schemes



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050
Temporary direct (Electricity)	56	359	2 279	3 179	2 969	589	-	-	-	-	-	-	-	-	-	-
Temporary indirect & induced (Electricity)	24	156	992	1 384	1 292	256	-	-	-	-	-	-	-	-	-	-
Permanent direct (Electricity)	-	-	-	-	-	-	156	156	156	156	156	156	156	156	156	156
Permanent indirect & induced (Lalini)	-	-	-	-	-	-	191	191	191	191	191	191	191	191	191	191

NB: Electricity sector relates to Ntabelanga-Lalini conjunctive hydropower scheme, and includes direct, indirect and induced employment creation.

7.3 Assumptions, Limitations and Exclusions

The above analysis has been confined to the macro-economic impacts of the Ntabelanga and Lalini Dams on indicators of GDP and jobs in the regional and local economies. It is notoriously difficult to measure the full socio-economic benefits of dam development, mainly because it tends to be approached in terms of relatively simple equations responding to the direct impacts of the project.

Several key assumptions were made in this study:

- Structure of the economy is as per DBSA Eastern Cape SAM;
- Total domestic water demand by 2050 = 32.4 million m^3/a;
- Population growth: 1% per annum:
- Weighted average domestic water price to final consumer: R6.36/ m^3;
- Total agricultural water demand: Max. 27.8 million m^3/a;
- Weighted average irrigation water price to final consumer: R0.40/ m^3;
- Gross farm income: R580 734/unit;
- Total electricity sales: 202 GWh/a: and
- Weighted average sales price of electricity: R1.35/kWh.

Any other studies that may follow this would have to make the same assumptions for comparable results.

There are however other benefits, not evaluated in this study, such as the value of time saved by households in collecting water, the reduced burden of water-borne disease, tax revenue accruing to the fiscus and most importantly, the long-term economic impact resulting from the improvement in local infrastructure. In spite of these study limitations and exclusions, the Ntabelanga and Lalini Dams project shows highly attractive socio-economic returns.

This study has assumed that sufficient Government funds are available for the project, and that funding is not a project constraint. Investment in infrastructure requires suitable government intervention. This is because, unlike other types of investment, infrastructure investment has a high-risk, long-term, capital intensive nature. However, where funding constraints exist, additional analyses may be required to evaluate various project scenarios as well as the opportunity costs of the investment.

The estimates made here are based on average economic output, GDP and employment rates and wages in the Eastern Cape, as reported by Statistics South Africa and the Development Bank of Southern Africa. Estimates can be improved only through additional analysis using discounted cash flow (DCF) methodology and detailed construction and operational plans.

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APPENDIX A

METHODOLOGY

METHODOLOGY

The methods utilized in the study are as follows:

- Cost Benefit Analysis (CBA) Framework, as prescribed by the World Bank (2008) and WRC (2000)
- Social Accounting Matrix (SAM) Analysis
  - Determining the scale of the direct and indirect economic impacts of the proposed investment
  - Identifying affected sectors, stimulated by the proposed investment
  - Calculating factor payments for capital and labour, etc.

Cost Benefit Analysis Method

The World Bank prescribes an international standard for analysing economic impacts of large scale infrastructure projects. The link to this guide is listed here:

Guide to Cost Benefit Analysis of Investment Projects
- [http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf]

This guide outlines a set of generally accepted methodological rules about how to identify, analyse and present economic information as a basis to make choices between investment options.

It is important to note that while CBA is a useful framework for analysing and contrasting investment decisions, it should not be seen as providing all the information for a decision. Other criteria also need to be taken into account when making a decision. It might be the case that decisions need to be based around political, legal, cultural, and other not easily quantifiable reasons.

In the South African context, there exist key strategic objectives for the development of water resources and river basin management (WRC. 2000). The strategic objectives are outlined in the Raw Water Pricing Strategy (2007) and may be listed as:

- Social Equity:
  - Redressing inequitable access to basic water services and water for productive use purposes

- Ecological Sustainability
  - Safeguarding of the environment, management of the catchment

- Financial Sustainability
  - Generating adequate revenue to cover costs

- Economic Efficiency
  - Promoting the efficient allocation and beneficial use of water

Nevertheless, the CBA method is a powerful tool that provides a useful point of departure.

Economic Model Input Assumptions

The economic analysis presented in this report takes into account a certain number of assumptions to estimate the economic impacts. These assumptions are listed in Table A-1 below.

Table A-1: Economic Model Input Assumptions per Sector

Construction Sector:	▪ Grand Total incl escalation = R12 330 million, incl: ▪ Tertiary distribution system = R1 425 million ▪ Irrigation developments = R795 million ▪ Tsitsa catchment management = R450 million ▪ Period: 6 years (2015- 2021) ▪ Data sources: JGI study outputs, DBSA
Agriculture Sector:	▪ Irrigated area = 2,868 ha ▪ Water use = 27.8 million m^3/a ▪ Total Gross Margin/60ha = R580 000/a ▪ Period: 2020-2050 ▪ Data sources : Feasibility Study Outputs; DAFF Abstract of Agriculture Statistics 2012, DBSA
Water Sector:	▪ Water use = 32.4 million m^3/a ▪ Income (assumption) = R206 million/a ▪ Period: 2020-2050 ▪ Data sources: Feasibility Study Outputs ; National Treasury , DBSA
Energy Sector:	▪ 25 MW ▪ Period: 2020-2050 ▪ Data sources: Feasibility Study Outputs, Eskom , DBSA

Social Accounting Matrix Economic Analysis:

The social accounting matrix analysis method used comprises a 3 step process outlined as follows:

(1) The project costs were estimated in terms of the capital expenditure that will be required to build the two dams and hydro power facility.

(a) The project cost includes the initial capital investment needed for the construction of the dams and hydro power facility as well as the operating and maintenance cost over the lifetime of the dams and hydro power facility.

(2) These figures were assimilated into a social accounting matrix for Eastern Cape in order to assess both the direct economic effect of the construction of the proposed infrastructure as well as the indirect economic effects that will be induced through the expenditure in the region.

(a) The Social Accounting Matrix (SAM) Model is, in simple terms, a matrix representation of flows of funds from one sector in the economy to another.

(3) The outputs of the augmented social accounting matrix were used to estimate the medium and long term economic impact on the region.

(a) The outputs given by the model show the immediate effect the construction of the dams will have on the different sectors of the economy.

(b) Forecasts for 2050 are done to estimate the long run impact that the project will have.

(c) Using the outputs a regional economic impact study was done where it can be seen how this project will change the structure of the regional economy and how this change in structure will influence the demographics of the region.

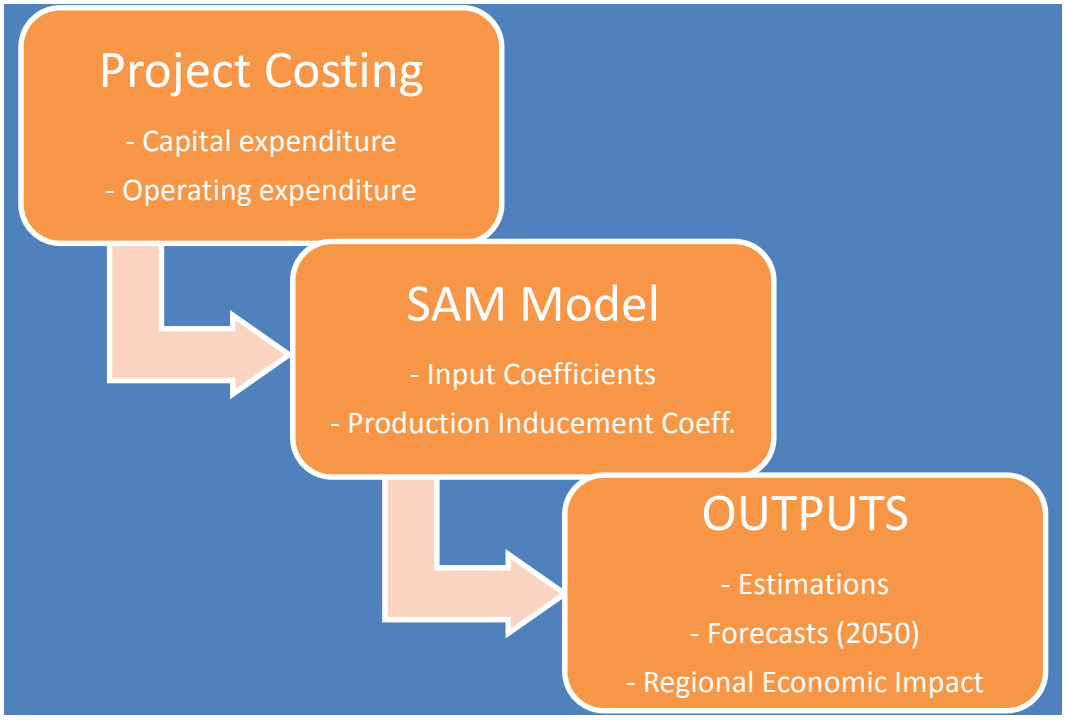

Figure A-1: Analysis Method Overview

What is a Social Accounting Matrix?

A social accounting matrix (SAM) represents all of the flows of all of the economic transactions that take place within an economy. The specific economy in question may be constructed at various scales such as, provincial, national, or otherwise. SAM's are regularly used as a matrix representation of the National Accounts of a given country.

SAM provides information on interactions between production activities (by sectors), factors of production (capital and labour), institutions (households by occupations, local government), capital accounts, and the rest of the world (imports, exports).

The core components of a SAM are arranged in a symmetric matrix (a matrix with equal number of rows and columns), as in the highlighted grey section in Table A-2. Each row of the SAM gives receipts of an account while the columns give the expenditure. An entry in row i and column j represents the receipts of account i from account j. The total of each row is supposed to be equal to the total of each corresponding column.

Table A-2: Basic Structure of a Social Accounting Matrix

		PRODUCERS AS CONSUMERS								Final Demand			
		Agric.	Mining	Const.	Manuf.	Trade	Transp.	Services	Other	Personal Consumption Expenditure	Gross Private Domestic expenditures	Govt. Purchases of Good and Services	Net Exports of Goods and Services
PRODUCERS	Agric.												
	Mining												
	Const.												
	Manuf.												
	Trade												
	Transp.												
	Services												
	Other												
VALUE ADDED	Employees	Employee Compensation								GROSS DOMESTIC PRODUCT			
	Business Owners and Capital	Profit-type income and capital consumption allowances											
	Government	Indirect business taxes											