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Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Post Feasibility Bridging Study for the Proposed Bulk Conveyance Infrastructure from the Raised Clanwilliam Dam (WP0485)

# Right Bank Canal Cost Analysis Sub-Report


**June 2021**

**Department of Water and Sanitation**
**Directorate: Water Resource Development Planning**

# POST FEASIBILITY BRIDGING STUDY FOR THE PROPOSED BULK CONVEYANCE INFRASTRUCTURE FROM THE RAISED CLANWILLIAM DAM

## APPROVAL

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**STUDY TEAM**

**Approved for Zutari (Pty) Ltd:**

.......................................
***E VAN DER BERG***
***Technical Director***

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**DEPARTMENT OF WATER AND SANITATION**
Directorate Water Resource Development Planning

**Approved for Department of Water and Sanitation:**

| | |
|---|---|
| ....................................... | ....................................... |
| ***M MUGUMO*** | ***C FOURIE*** |
| ***CHIEF ENGINEER: WRDP (South)*** | ***DIRECTOR: WRDP*** |

# Document control record


Document prepared by:

**Mosaka Economic Consultant cc. t/a Conningarth Economists**
2000/058454/23
Meiring Naudé Avenue
CSIR, Building 4E
Brummeria, Pretoria,
0184
South Africa

**T** +27 83 448 2882/+27 12 349 1915
**E** Williamm@conningarth.co.za or wjmullins@worldonline.co.za
**W** conningarth.co.za

Document verified and approved by:

**Zutari (Pty) Ltd**
1977/003711/07
Zutari Centre, 1 Century City Drive
Waterford Precinct, Century City
Cape Town, 7441
PO Box 494, Cape Town,
8000
South Africa

**T** +27 21 526 9400
**F** +27 21 526 9500
**E** capetown@zutari.com
**W** zutari.com


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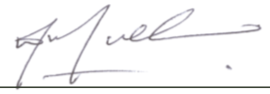
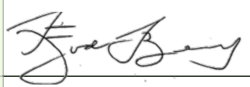
| Author signature |  | Approver signature |  |
| Name | William Mullins | Name | Erik van der Berg |
| Title | Economist | Title | Technical Director |

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Directorate: Water Resource Development Planning

## Post Feasibility Bridging Study for the Proposed Bulk Conveyance Infrastructure from the Raised Clanwilliam Dam

# Right Bank Canal Cost Analysis Sub-Report

**Final: June 2021**

*Prepared by:* Zutari (Pty) Ltd
P O Box 494
Cape Town, 8000
South Africa

Tel: 021 526 5790
Fax: 086 526 9500
E-mail: erik.vanderberg@zutari.com

*Prepared for:* Director: Water Resource Development Planning
Department of Water and Sanitation
Private Bag X313
Pretoria 0001
South Africa

Mr Menard Mugumo (CE: WRDP, South)
Tel: 012 336 6838
E-mail: mugumom@dws.gov.za

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# Post Feasibility Bridging Study for the Proposed Bulk Conveyance Infrastructure from the Raised Clanwilliam Dam

Reports produced as part of this project are indicated below.

**Bold** type indicates this report.

| Report Index | Report Number | Report Title |
|---|---|---|
| 1 | | Inception Report |
| 2 | P WMA 09/E10/00/0417/2 | Capacity Building & Training Year 1 |
| 3 | P WMA 09/E10/00/0417/3 | Capacity Building & Training Year 2 |
| 4 | P WMA 09/E10/00/0417/4 | Water Requirements Assessment |
| 5 | P WMA 09/E10/00/0417/5 | Distribution of Additional Available Water |
| 6 | | Existing Infrastructure and Current Agricultural Development Sub-Report |
| 7 | P WMA 09/E10/00/0417/6 | Existing Conveyance Infrastructure and Irrigated Land |
| 8 | | Suitable Agricultural Areas and Land Ownership Report |
| 9 | | Evaluation of Development Options Sub-Report |
| 10 | P WMA 09/E10/00/0417/10 | Suitable Areas for Agricultural Development |
| 11 | | Right Bank Canal Design Sub-Report |
| 12 | | Conceptual Design Sub-Report |
| 13 | | Environmental Screening Sub-Report |
| 14 | | Jan Dissels and Ebenhaeser Schemes Design Sub-Report |
| 15 | P WMA 09/E10/00/0417/13 | Feasibility Design |
| 16 | P WMA 09/E10/00/0417/7 | Topographical Surveys |
| 17 | P WMA 09/E10/00/0417/8 | Geotechnical Investigations |
| 18 | P WMA 09/E10/00/0417/9 | Soil Survey |
| 19 | | Financial Viability of Irrigation Farming Sub-Report |
| 20 | P WMA 09/E10/00/0417/11 | Agricultural Production and Farm Development |
| **21** | | **Right Bank Canal Cost Analysis Sub-Report** |
| 22 | | Socio-Economic Impact Analysis Sub-Report |
| 23 | P WMA 09/E10/00/0417/12 | Socio-Economic Impact Analysis |
| 24 | P WMA 09/E10/00/0417/14 | Record of Implementation Decisions Report |
| 25 | P WMA 09/E10/00/0417/1 | Main Report |
| 26 | P WMA 09/E10/00/0417/15 | Historically Disadvantaged Farmers Report |

**Concise Description of the Content of Study Reports**

| Report Index | Report Number | Report Title and Description of Content |
|---|---|---|
| 1 | | Inception<br>The report forms part of the contract and stipulates the scope of work for the study, the contract amount and the contract period. It contains a detailed description of tasks and methodology, a study programme, human resource schedule, budget and deliverables. The Capacity Building and Training Plan has been included. |
| 2 | P WMA 09/E10/00/0417/2 | Capacity Building & Training Year 1<br>Describes the range of capacity building and training activities planned for the study, and the activities undertaken during the first year of the study, including field-based training, training workshop 1 and mentorship of DWS interns through secondment. |
| 3 | P WMA 09/E10/00/0417/3 | Capacity Building & Training Year 2<br>Describes the range of capacity building and training activities planned for the study, and the activities undertaken during the second year of the study, including field-based training, training workshop 2 and mentorship of DWS interns through secondment. |
| 4 | P WMA 09/E10/00/0417/4 | Water Requirements Assessment<br>Provides an analysis of the existing water use and current water allocations in the study area, and addresses ecological water requirements, water use for irrigated agriculture and projections for future use, current domestic and industrial water use and projections for future use, water use for hydropower and<br>water losses in the water supply system. |
| 5 | P WMA 09/E10/00/0417/5 | Distribution of Additional Available Water<br>Confirms the volume of additional water available for development, after water has been reserved for the current water uses, as well as making recommendations on how the additional yield should be distributed among water use sectors and water users. |
| 6 | | Existing Infrastructure and Current Agricultural Development Sub-Report<br>Provides an overview of the extent and general condition of the current bulk water storage and conveyance infrastructure. This report also provides an overview of the locality and extent of the existing agricultural areas determined by reviewing Geographic Information System (GIS) data obtained from various sources. |
| 7 | P WMA 09/E10/00/0417/6 | Existing Conveyance Infrastructure and Irrigated Land<br>An update of the Sub-Report, providing a refinement of the current agricultural water requirements following evaluation of the current crop types, an assessment of the desirability of diverting releases for downstream irrigators via the Clanwilliam Canal and Jan Dissels River, to meet the summer ecological flows in the lower Jan Dissels River, and presents an Implementation Action Plan with costs. |

| Report Index | Report Number | Report Title and Description of Content |
|---|---|---|
| 8 | | Suitable Agricultural Areas and Land Ownership Sub-Report<br>Description of the collection of information and the preparation undertaken for the analysis of options, which includes a summary of existing irrigated areas and water use, cadastral information, land ownership, environmental sensitivity, soils suitability, water quality considerations and constraints, and the initiation of the process to identify additional areas suitable for irrigation. |
| 9 | | Evaluation of Development Options Sub-Report<br>Describes the salient features, costs and impacts of identified potential irrigation development options for new irrigation development in the lower Olifants River. This provides the background and an introduction to the discussions at the Options Screening Workshop held in December 2018. |
| 10 | P WMA 09/E10/00/0417/10 | Suitable Areas for Agricultural Development<br>Describes the supporting information, process followed and the salient features, costs and impacts of identified potential irrigation development options for new irrigation development in the lower Olifants River. Recommends the preferred options to be evaluated at feasibility level. |
| 11 | | Right Bank Canal Feasibility Design Sub-Report<br>Describes the Design Criteria Memorandum, based on best practice in engineering and complying with recognised codes and standards. Description of route alignments and salient features of the new Right Bank canal. Feasibility-level design of bulk infrastructure, including evaluation of capacities, hydraulic conditions, canal design, surface flow considerations, canal structures, power supply and access roads. Operational considerations and recommendations. |
| 12 | | Conceptual Design Sub-Report<br>Describes the scheme layouts at a conceptual level and infrastructure components to be designed, alternatives to consider or sub-options, and affected land and infrastructure, as well as the updated recommended schemes for new irrigation development. |
| 13 | | Environmental Screening Sub-Report<br>Describes and illustrates the opportunities and constraints, and potential ecological risks/impacts and recommendations for the short-listed bulk infrastructure development options at reconnaissance level. Describes relevant legislation that applies to the proposed irrigation developments. |

| Report Index | Report Number | Report Title and Description of Content |
|---|---|---|
| 14 | | Jan Dissels and Ebenhaeser Schemes Feasibility Design Sub-Report<br>Describes the Design Criteria Memorandum, based on best practice in engineering and complying with recognised codes and standards. Description of route alignments and salient features of the Jan Dissels and Ebenhaeser schemes. Feasibility-level design of bulk infrastructure, including evaluation of capacities, hydraulic conditions, intake structures, balancing dams and reservoirs, rising mains and gravity pipelines and trunk mains where relevant, power supply and access roads. Operational considerations and recommendations. |
| 15 | P WMA 09/E10/00/0417/13 | Feasibility Design<br>Description of the approach to and design of selected bulk infrastructure at feasibility level, with supporting plans and implementation recommendations. |
| 16 | P WMA 09/E10/00/0417/7 | Topographical Surveys<br>Describes the contour surveys for the proposed identified bulk infrastructure conveyance routes and development areas, the surveying approach, inputs and accuracy, as well as providing the survey information. |
| 17 | P WMA 09/E10/00/0417/8 | Geotechnical Investigations<br>Presents the findings of geotechnical investigations of the various identified sites, as well as the approach followed, field investigations and testing, laboratory testing, interpretation of findings and geotechnical recommendations. |
| 18 | P WMA 09/E10/00/0417/9 | Soil Survey<br>Describes the soil types, soil suitability and amelioration measures of the additional area covering about 10 300 ha of land lying between 60 to 100 m above river level, between the upper inundation of the raised Clanwilliam Dam and Klawer. |
| 19 | | Financial Viability of Irrigation Farming Sub-Report<br>Describes the findings of an evaluation of the financial viability of pre-identified crop-mixes, within study sub-regions, and advises on the desirability of specific crops to be grown in these sub-regions. It includes an evaluation of the financial viability of existing irrigation farming or expanding irrigation farming, as well as the identification of factors that may be obstructive for new entrants from historically disadvantaged communities. |
| 20 | P WMA 09/E10/00/0417/11 | Agricultural Production and Farm Development<br>This report will focus on policy, institutional arrangements, available legal and administrative mechanisms as well as the proposed classes of water users and the needs of each. This would include identifying opportunities for emerging farmers, including grant and other types of Government and private support, and a recommendation on the various options and opportunities that exist to ensure that land reform and water allocation reform will take place through the project implementation. |

| Report Index | Report Number | Report Title and Description of Content |
|---|---|---|
| 21 | | Right Bank Canal Cost Analysis Sub-Report<br>Provides an economic modelling approach to quantify the risk of the failure of the existing main canal and the determination of the economic viability of the construction of the new right bank canal to reduce the risk of water supply failure. |
| 22 | | Socio-Economic Impact Analysis Sub-Report<br>Describes the socio-economic impact analysis undertaken for the implementation of the new irrigation development schemes, for both the construction and operational phases. This includes a description of the social and economic contributions, the return on capital investment, as well as the findings of a fiscal impact analysis. |
| 23 | P WMA 09/E10/00/0417/12 | Socio-Economic Impact Analysis<br>Synthesis of agricultural economic and socio-economic analyses undertaken, providing an integrated description of agricultural production and farm development and socio-economic impact analysis, as well as the analysis of the right bank canal costs and benefits. |
| 24 | P WMA 09/E10/00/0417/14 | Record of Implementation Decisions<br>Describes the scope of the project, the specific configuration of the schemes to be implemented, the required implementation timelines, required institutional arrangements and the required environmental and other approval requirements and mitigation measures, to ensure that the project is ready for implementation. |
| 25 | P WMA 09/E10/00/0417/1 | Main Report<br>Provides a synthesis of approaches, results and findings from the supporting study tasks and interpretation thereof, culminating in the study recommendations. Provides information in support of the project funding motivation to be provided to National Treasury. |
| 26 | P WMA 09/E10/00/0417/15 | Historically Disadvantaged Farmers Report<br>Describes the activities undertaken by an independent consultant to evaluate existing HDI Farmers policies and legislative context, identify, map and analyse prospective HDI farmers and potential land for new irrigation, as well as propose a mechanism for the identification and screening of HDI farmers. |

# Glossary

**Cost Benefit Analysis (CBA):** A Cost Benefit Analysis is used to calculate the micro-economic feasibility of the project by comparing the costs and benefits and thereby establish the financial and economic viability of the project.

**Benefit Cost Ratio (BCR):** Is calculated within the construct of the following formula: Benefits/Cost.

**Discount Rate:** Is the rate used to convert current Rand values of costs which occur in a future year to a present value in the base year. The recommended inflation free rate is *r*. To convert an amount which will be paid *n* years in the future to a present value, divide the future value by $(1+r)^{n}$. Discount rates can be reflected in real or nominal terms where 'real' indicates that the effects of general inflation have been removed. The discount rate used depends on the type of Rands to be adjusted. Discounting translates projected cash flows into present value terms using specified discount factors.

**Internal Rate of Return (IRR):** Is the discount rate that sets the net present value of the programme or project to zero. While the internal rate of return does not generally provide an acceptable decision criterion, it does provide useful information, particularly when budgets are constrained or there is uncertainty about the appropriate discount rate.

**Net Present Value (NPV):** Is defined as the difference between the present value of benefits and the present value of costs. The benefits referred to in this calculation must be quantified in monetary terms in order to be included.

**Social Accounting Matrix (SAM):** A SAM is a comprehensive, economy-wide database that contains information about the flow of resources that take place between the different economic agents that exist within an economy. The SAM forms the basis of the model to calculate socio-economic impacts of the project.

**Partial Equilibrium:** Partial equilibrium is a condition of economic equilibrium that takes into consideration only a part of the market (assuming all other parts of the market remain constant) to attain equilibrium.

**Gross Domestic Product (GDP):** A monetary measure of the market value of all the final goods and services produced in a specific time period, often annually, within a specific country.

**Intermediate Costs:** Intermediate costs constitute the total monetary value of goods and services consumed or used up as inputs in production by enterprises, including raw materials, components, services, and various other operating expenses.

**Permanent Equivalents:** Direct labour on the farm is expressed in "permanent equivalents" in the case of temporary labour, i.e., if a worker is temporarily employed for 3 months per annum, (s)he is classified as 0.25 permanent equivalent.

**Capital Formation:** Capital formation is a crucial element for economic growth. Capital formation increases investment, which stimulates economic development.

**Balance of Payments:** The balance of payments (BOP) is a statement of all transactions made between entities in one country and the rest of the world over a defined period of time.

**Direct Impact:** Impact created in the project area where the capital is spent or production is generated.

**Indirect Impact:** Impact created by input service providers, and could occur in the project area or outside as part of the marketing of the products.

**Induced Impact:** Impact generated by the salaries and wages paid and the spending of this income.

**Crop Budget:** Crop Budget is a term used by the Department of Agriculture and all producer organisations like Grain SA, SAWIS, SATI, Potato SA, etc. The main objective of compiling a crop budget for a specific crop is to use them as the basis of determining **Net Income** for a reperesentative farm or specific crop. This variable is an important parameter in determining the value of irrigated land as well as the economic value of irrigation water. The structure of a crop budget is as follows:

| **Gross Revenue** | |
|---|---|
| *Less* | • Variable Costs<br>• Marketing Costs<br>• Fertiliser<br>• Microelements<br>• Pesticides and Herbicides<br>• Irrigation Equipment<br>• Land Prparations.Plant Material<br>• Interest on working capital |
| **Equals : GROSS MARGIN.** | |

Source: WRC Report No 989/1/08.

# List of Acronyms

| Acronym | Definition |
|---|---|
| BCR | Benefit Cost Ratio |
| CBA | Cost-Benefit Analysis |
| CLM | Cederberg Local Municipality |
| CPI | Consumer Price Index |
| DCF | Discounted Cash flow |
| DWS | Department of Water and Sanitation |
| ECBA | Economic Cost Benefit Analysis |
| FCBA | Financial Cost Benefit Analysis |
| GDP | Gross Domestic Product |
| HD | Historical Disadvantaged |
| IRR | Internal Rate of Return |
| MEIA | Macro-economic Impacts Assessment |
| MLM | Matzikama Local Municipality |
| NPV | Net Present Value |
| PGE | Partial General Equilibrium |
| PV | Present Value |
| SAM | Social Accounting matrix |
| SATI | South African Table Grape Industry |
| SAWIS | South African Wine Industry Statistics |
| ToR | Terms of Reference |
| WRC | Water Research Commission |

# List of Publications

The following is a list of the publications used in compiling the report:

a) Western Cape – Social Economic Profile of Matzikama Local Municipality – 2020;
b) Western Cape – Social Economic Profile of Cederberg Local Municipality – 2020;
c) Matzikama LM Annual Report – 2018-2019;
d) Cederberg LM Annual Report – 2018-2019;
e) SAWIS - SA Wine Industry 2019 Statistics – NR 44;
f) SATI – Statistics of Table Grapes in South Africa 2019;
g) Water Research Commission – A Manual for Cost Benefit Analysis in South Africa with Specific Reference to Water Resource Development – Third Edition;
h) Department of Agriculture, Forestry and Fisheries – Abstract of Agricultural Statistics 2019;
i) Western Cape Provincial Government – Lower Olifants River: Economic Impact Assessment of the 2017/2018 Drought – August 2018;
j) Task 8 - Financial Viability of Irrigation Farming Sub-Report;
k) Mechanization Guide 2020 – compiled by JP, ME and CF le Roux;
l) AECOM – 2020 Building Costs.

# Executive Summary

## Project Background

The Clanwilliam Dam is situated in the Olifants River near the town of Clanwilliam in the Olifants/Doorn River Catchment Management Area in the Western Cape. The dam requires remedial work for safety reasons, which in turn presented the opportunity to raise the dam wall, thus enlarging its storage capacity and increasing its yield. Water use in the region is predominantly for irrigated agriculture.

A feasibility study was completed in 2008, which concluded that the raising of the Clanwilliam Dam and further associated projected agricultural development is economically viable and socially desirable. The feasibility study recommended the raising of the full supply level of the existing Clanwilliam Dam by 13 m to augment the water supplied to the existing scheduled irrigation area, towns and for industrial use; as well as to provide additional water for new irrigation areas to be established by historically-disadvantaged farmers, as well as to supply other local water users.

This particular report provides the results of an economic modelling exercise that quantified the risk of failure of the existing left bank main canal up to Verdeling, and the determination of the economic viability of the proposed new right bank canal, which underpins the betterment of the existing canal to reduce the risk of failure.

The approach is to quantify the macro- and micro-economic impact associated with the mitigation of the risk of the failure of the existing main canal (Trawal section) of the Lower Olifants River GWS by constructing a right bank canal (the Right Bank Canal Scheme) to replace the existing main canal from Bulshoek Weir to Verdeling.

The analysis considers the proposed construction of two alternative development scenarios:

- **Scenario 1: Right Bank Canal:** Construction of a Right Bank Canal to serve the four recommended Trawal irrigation areas, existing irrigators and other future water users; and
- **Scenario 2: Alternative - Left Bank Canal:** Two small bulk water schemes to serve the four recommended Trawal irrigation areas and existing users, and refurbishment of the remainder of the existing left bank main canal.

This report describes the approach and methodology followed to determine the financial and economic viability of the recommended Trawal irrigation areas separately. Then the two alternative scenarios are compared.

A Cost Benefit Analysis (CBA) approach is used to calculate the micro-economic feasibility of the project by comparing the costs versus the benefits and, thereby, establish the financial and economic feasibility of the project.

The CBA section consists of two separate analyses:

Firstly, the analysis of the possible schemes and betterment works, that can supply the four identified irrigation areas at Trawal, to determine the financial and economic feasibility of the system for the scenarios.

Secondly, the financial and economic feasibility of Scenario 1 and Scenario 2 are compared to support a recommendation in terms of financial and economic terms.

A Social Accounting Matrix (SAM) based econometric model is applied to estimate the social and macro-economic impacts of the Trawal section, as well as the impact of the recommended scenario on a local, regional, and national level.

# Project Description

**Chapter 2** provides a detailed description of the history of the canal system below the Bulshoek Weir. The Report provides an economic modelling approach to quantifying the risk of failure of the existing main canal. The analysis includes determination of the economic viability of the new right bank canal versus the betterment of the left bank existing canal, to reduce the risk of failure and delivering of the higher water volume that will be available. By reducing the risk, the total benefits that are available from the additional available water have been assessed, including the establishment of historically disadvantaged farmers.

The detailed development scenarios are discussed as well as the estimated construction costs for these developments.

**Table E1** presents the estimated costs of the two small schemes to supply water to the four Trawal identified areas as part of Scenario 2.

**Table E1: Costs of two small schemes (2020 prices, excl. VAT)**

| Capital Cost Components | Costs (R million) |
|---|---|
| New high-level canal | 122.7 |
| Pump stations | 153.04 |
| Pipelines + syphon | 83.86 |
| Farm Dams | 27.42 |
| Canal raising: 8km of existing main canal | 3.92 |

| Capital Cost Components | Costs (R million) |
|---|---|
| Cost of lining: 8km of existing main canal | 45.61 |
| Land purchase cost | 66.32 |
| Consulting fees | 70.29 |
| **Total cost** | **R 573.16** |

The estimated capital construction cost to develop the two small bulk water development schemes to provide water to the Trawal irrigation areas is R 573.16 million, expressed in 2020 prices.

The development and betterment costs for the two alternative scenarios to extend the water supply to Verdeling (Scenario1 and 2) are presented in **Table E2**.

**Table E2: Development and Betterment costs of Scenario 1 and 2 (R million, 2020 Prices, excl. VAT)**

| Main canal long-term alternative | Development Component | Betterment Component | Total Cost | Production Period |
|---|---|---|---|---|
| Two small schemes and upgrading of left bank main canal | R 573.16 | R 1 436.41 | R 2 009.57 | 18 years |
| Right Bank Canal Scheme | R 573.16 | R 1 421.50 | R 1 994.66 | 4 Years |

It is estimated that the right bank canal will be constructed over a 4-year period (Scenario 1). The two small schemes will be constructed over 3 years and the betterment of the remainder of the main left bank canal will be implemented over a 15-year period (Scenario 2).

The capital proposed for the Alternate left bank canal Scenario is R 819.66 million, if expressed as Present Value, while the Present Value of the right bank canal is R 1 177.05 million. From this it appears that the left bank canal scenario is the preferable scenario. However, this does not take the contribution of the possible significant benefits and the extended negative impact of the canal breaks and water supply restrictions into consideration. Also, the additional water available from the raised Clanwilliam Dam will only be properly utilised after 18 to 20 years for the alternate left bank canal scenario compared to the 8 to 10 year period of the right bank canal scenario.

# Impact of Restricted Water Supply and Canal Breaks

**Chapter 3** provides an analysis of the current crops produced in the lower Olifants River valley and the production budgets, expressed in 2020 prices, which are included in the Annexures. An analysis is also provided of the impact of the water restrictions during the latest drought period, as well as the estimated losses suffered during canal breaks.

**Table E3** provides the estimated losses suffered during the recent drought period for grape based products. The estimation is shown to provide an estimation of the financial impact on the producers, farm labour and urban areas. It is accepted that the improvement of the canal system, to provide the additional water from Clanwilliam Dam, will probably reduce the impact. The proposed right bank canal will substantially reduce the impact and the left bank canal (once it has been refurbished) will also reduce the impact, but to a lesser extent.

**Table E3: Losses by producers during recent drought period**

| Crops | Baseline | Drought Year | | Post Drought | | | |
|---|---|---|---|---|---|---|---|
| | 2016/17 | 2017/18 | | 2018/19 | | 2019/20 | |
| | Yield | Yield | % Change | Yield | % Change | Yield | % Change |
| Wine grapes (t/ha) | 22.6 | 19.8 | -12% | 17.2 | -24% | 23.7 | 5% |
| Raisins (total tonnes) | 7 800 | 5 800 | -26% | 6 500 | -17% | 11 000 | 41% |
| Table grapes (total 4,5kg export ctns) | 3 968 073 | 2 802 436 | -29% | 2 366 503 | -40% | 3 319 516 | -16% |

**Table E4** presents the estimated loss that would be suffered by producers due to a 30 day and a 3 month water break caused by canal failures.

**Table E4: Losses by producers during different canal failure periods**

| Duration of break | Wine Grapes & Raisins | | Table Grapes | |
|---|---|---|---|---|
| | Year 1 loss | Year 2 loss | Year 1 loss | Year 2 loss |
| 30 day water break | 50% | 20% | 55% | 25% |
| 3 month water break | 60% | 40% | 65% | 45% |

From **Table E3** and **Table E4** it is obvious that the drought restriction has a very negative impact on the grape-based crop production, not only in physical yields but also financial. As all three grape-based crops are also large export products, the country also suffers due to a drop in the Balance of Payments.

In the specific chapter the impact on Summer and Winter vegetable production is also discussed.

# Social and Economic Conditions in Local Municipalities

A detailed analysis is provided of the current social and economic conditions in the two local municipalities. The latest available data show the dependence of these two local municipalities on irrigation agriculture. In the case of Cederberg LM, 42.6% of the people employed are active in the agriculture sector and for Matzikama LM the number is 39.7%.

Both municipalities have large numbers of indigent households, and unemployment is relatively high with large numbers of part-time employees.

The main conclusion from the analysis is that the future growth of the economy of the two municipalities will depend on increased irrigation.

# Financial & Economic Viability & Macro-Economic Impact

To determine the financial and economic feasibility of the total project, a comprehensive CBA econometric modelling approach was used, with the following three models being developed:

- Constant Price Financial CBA Model with an 8% discount rate and constant prices;
- Current Price Financial CBA Model with an 11.28% discount rate and nominal prices at 4.5% annual inflation; and
- Constant Price Economic CBA Model with an 8% discount rate and market (shadow) prices.

The three indicators used to interpret the results of the analysis are:

- Net Present Value (NPV) >0;
- Internal Rate of Return (IRR) > Discount Rate; and
- Benefit Cost Ratio (BCR) >1.

A project must satisfy all three indicators to be recommended for implementation.

The macro-economic impacts were determined with a partial equilibrium model based on the Western Cape Provincial Social Accounting Matrix (SAM) to estimate the macro-economic impact contribution of a specific scenario.

# Current Production and Future Assumptions

A detailed analysis was performed to identify the current crops being produced, the profitability of these crops, and the future outlook for a selection of specific crops. All of the crops currently produced require intensive management and have high input costs. The availability of effective marketing channels also plays an important role in selection of the specific crops.

**Table E5** presents the existing production, but it must be kept in mind that the situation is very dynamic and continuous changes are taking place. According to information received from

SAWIS, the area under wine grapes declines by about 130 hectares per annum and is mostly replaced by table grapes and raisin varieties.

**Table E5: Production below Bulshoek Weir by Crop Type**

| Crop type | Sub-Area 4 and 5-Bulshoek Weir to Lutzville (hectares) | Percentage |
|---|---|---|
| Peaches | 100 | 0.80% |
| Table grapes | 880 | 7.04% |
| Wine grapes | 8 389 | 67.11% |
| Dry Grapes (Raisins) | 1 300 | 10.40% |
| Summer Vegetables | 811 | 6.49% |
| Tomatoes Industrial | 350 | 2.80% |
| Tomatoes Fresh | 186 | 1.49% |
| Winter Vegetables | 485 | 3.88% |
| **Total** | **12 501** | **100.00%** |

After considering the different scenarios, some changes in the crop composition were assumed based on the current and future price structures. **Table E6** presents the existing crop structure and the one used in the analysis.

**Table E6: Existing crops vs. crops analysed**

| Crop type | Current Percentage | Adapted Percentage Used |
|---|---|---|
| Peaches | 0.80% | 0.00% |
| Table grapes | 7.04% | 11.17% |
| Wine grapes | 67.11% | 44.66% |
| Dry Grapes (Raisins) | 10.40% | 20.10% |
| Summer Vegetables | 6.49% | 6.70% |
| Tomatoes Industrial | 2.80% | 8.04% |
| Tomatoes Fresh | 1.49% | 6.70% |
| Winter Vegetables | 3.88% | 2.64% |
| **Total** | **100.00%** | **100%** |

Peaches were removed and Wine Grapes reduced in line with the current financial and marketing problems. Table Grapes, Raisins and Tomatoes were increased as the market for all three products appears to be strong in the coming years.

# Financial and Economic Viability of Proposed Trawal Irrigation

The four identified irrigation areas were analysed against the background that the 2 339 hectares is reserved for the establishment of Historically Disadvantaged Farmers. A second issue analysed is the fact that these farmers will need additional financial and other support, which an existing commercial farmer will not require.

The development is set to take place over a four-year construction period, with the development of the first irrigation area during the second year of construction.

- The latest projections are that, if construction starts in Year 1, the irrigation areas can become available as follows:
- Year 2: Zypherfontein 1 - 669 hectares.
- Year 3: Zypherfontein 2 - 661 hectares.
- Year 5: Trawal - 554 hectares.
- Year 5: Melkboom - 455 hectares.

Farm establishment costs were estimated using the *Financial Viability of Irrigation Farming Sub-Report* together with the *Mechanization Guide 2020,* published by JP and ME le Roux, and the building costs from the *2020 Building Cost AECOM* publication.
**Table E7** presents the total estimated farm development costs.

**Table E7: Trawal - Farm Unit establishment costs (R million, 2020 Prices, excl. VAT)**

| Year | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|
| Sheds | 12.36 | 10.75 | 5.81 | 12.20 | 41.13 |
| Raisin Slabs | 0.15 | 0.15 | 0.15 | 0.15 | 0.600 |
| Pack Houses | 6.00 | 6.00 | 6.00 | 6.00 | 24.00 |
| Irrigation and Bulk Water | 95.07 | 82.73 | 44.69 | 93.89 | 316.38 |
| Tractors/ Implements, Etc | 41.49 | 36.11 | 19.50 | 40.98 | 138.08 |
| **Total** | **R 155.07** | **R 135.74** | **R 76.15** | **R 153.22** | **R 520.18** |

The operational costs were calculated in line with ‘Budgets’ as presented in the Annexures of this report. **Table E8** presents the results of the three CBA models.

**Table E8: Results from the three CBA Models for Trawal Irrigation Areas**

| Model | Constant Price - Financial | Current Price - Financial | Economic Price |
|---|---|---|---|
| **Discount Rate** | **8%** | **11.28%** | **8%** |
| Present Value - Benefits (Rand million) | R 6 169.1 | R 7 599.6 | R 6 169.1 |
| Present Value - Costs (Rand million) | R 4 665.1 | R 5 518.2 | R 4 592.5 |
| Net Present Value (NPV) (Rand million) | R 1 504.02 | R 2 081.46 | R 1 576.67 |
| Benefit Cost Ratio (BCR) | 1.32 | 1.38 | 1.34 |
| Internal Rate of Return (IRR) | 16.8% | 22.2% | 17.34% |

**Table E8** shows positive, financially viable results for all three baseline models. A detailed risk analysis was performed making provision for the following cost increases:

- A capital costs that can increase up to 40% for both the canal system and the farm development costs;
- A 20% annual increase in electricity costs; and
- A 10% annual wage increase.

For all three models of the analysis the results remain positive and it can therefore be stated that this section of the project is financially viable.

The macro-economic analysis shows that in total, 2 705 jobs will be directly created, mostly on the farms, of which 84 will be skilled, 281 semi-skilled, and 2 899 unskilled. A large percentage of the unskilled ‘direct’ labour will be part time, while the skilled and semi-skilled will be permanent employees.

The indirect employment opportunities created are estimated at a total of 234, and the induced employment at a total of 444.

The total annual amount paid to households is estimated at R 417 million, expressed in 2020 prices. The low-income household share is R 44 million, which is 10.5%, per annum, expressed in 2020 prices.

The total annual taxes paid are estimated at R 154 million, with R 108 million paid to National Government.

The annual estimated Impact on the Balance of Payment is R 259 million, expressed in 2020 prices. It is mostly made up of the export of table grapes and raisins, with a small percentage contribution from wine production.

From the above analysis it is possible to state that the proposed Trawal irrigation is financially and economically viable, and can be recommended for implementation.

## Comparison of the Right Bank Canal & the Alternative Left Bank Canal scenarios

The data used in the different models to determine the financial and economic feasibility of the two development scenarios is presented. Scenario 1, which is the construction of the proposed new right bank canal, is compared to Scenario 2, namely the construction of the two small schemes and the refurbishment of the left bank canal.

The right bank canal will have a 4-year construction period, while the two small schemes will have a 3-year construction period and the left bank main canal betterment works will have a 15-year construction period thereafter.

The total new area that can be developed if the right bank canal scenario is selected is 3 639 hectares. This area comprises 2 339 hectares in the Trawal area and an additional 1300 hectares, which is made up as follows:

- Klawer Phase 1 - 412 hectares.
- Klawer Phase 2 - 438 hectares.
- Coastal flow-restricted - 89 hectares.
- Ebenhaeser - 361 hectares.

If the alternate left bank canal scenario is implemented, the Klawer Phase 2 Scheme might not be developed due to lack of canal flow capacity. The additional area is then reduced to 888 hectares, if it is assumed that canal losses remain at 20%. However, as the canal is lined, the losses will decrease, eventually to the extent that adequate flow capacity can potentially be available to also implement the Klawer Phase 2 Scheme, although this would not be advisable.

Klawer Phase 2 can also be developed as the last phased scheme if the right bank canal scenario is selected, and additional funds become available for an upgrade or replacement of the Klawer canal section to service the area.

The estimated development of irrigation areas per year, if the right bank canal scenario is selected, is as follows:

- Year 2: Zypherfontein 1 - 669 hectares.
- Year 2: Klawer Phase 1 - 412 hectares.
- Year 3: Zypherfontein 2 - 661 hectares.
- Year 3: Ebenhaeser Restitution and CPA augmentation - 361 hectares.
- Year 5: Trawal - 554 hectares.

- Year 5: Melkboom - 455 hectares.
- Year 5: Coastal flow restricted - 89 hectares.
- Year 7: Klawer Phase 2[1] - 438 hectares.

The following development estimation was followed, and populated in the model, for the alternate left bank canal scenario:

- Year 2: Zypherfontein 1 - 669 hectares.
- Year 2: Klawer Phase 1 - 412 hectares.
- Year 2: Trawal - 554 hectares.
- Year 3: Zypherfontein 2 - 661 hectares.
- Year 3: Ebenhaeser - 361 hectares.
- Year 4: Melkboom - 455 hectares.
- Year 5: Coastal flow restricted - 89 hectares.
- Year 13: Klawer[2] Phase 2 - 438 hectares.

The farm development costs were also estimated for the settlement of historically disadvantaged farmers and for application in the CBA models.

The farm developmental costs are presented in **Table E9**.

**Table E9: Right Bank Production Unit Development Costs (R million, 2020 prices, excl. VAT))**

| Year | 2 | 3 | 4 | 5 | 6 | 7 | Total |
|---|---|---|---|---|---|---|---|
| Hectares developed per Year | 1 081 | 1 022 | 0 | 1 098 | 0 | 438 | 3 639 |
| Percentage per Annum | 29.7% | 28.1% | 0.0% | 30.2% | 0.0% | 12.0% | 100.0% |
| Sheds, Etc. | R 31.80 | R 30.06 | R 0.00 | R 32.30 | R 0.00 | R 12.88 | R 107.05 |
| Irrigation and Bulk Water | R 229.08 | R 216.57 | R 0.00 | R 232.8 | R 0.00 | R 92.82 | R 771.15 |
| Tractors/ Implements, etc. | R 128.43 | R 121.42 | R 0.00 | R 130.45 | R 0.00 | R 52.04 | R 432.34 |
| **Total** | **R 389.31** | **R 368.06** | **R 0.00** | **R 395.43** | **R 0.00** | **R 157.74** | **R 1 310.53** |

The total farm development costs of R 1 310.53 million, expressed in 2020 prices, are the same for both scenarios, but the application of the funds is phased in the relevant CBA models according to the two different development scenarios.

[1] This will be soonest that Klawer Phase 2 could be implemented.
[2] This will only be possible once the left bank canal has been refurbished,

The production costs are based on the budgets and phased according to the proposed area development. The same applies for the income generated by the development of the new irrigation areas. **Table E10** presents the CBA results of the right bank canal scenario.

**Table E10: CBA results of the Right Bank Canal scenario**

| Parameters | FCBA[3] Constant Price | FCBA Current Price 4.5% Annual Inflation | ECBA Constant Price |
|---|---|---|---|
| Discount Rate | 8% | 11.28% | 8% |
| Benefit - Present Values (R million) | R 8 597.85 | R 12 418.23 | R 8 142.66 |
| Total Costs - Present Values (R million) | R 8 316.36 | R 9 998.77 | R 5 396.88 |
| Net Present Value (NPV) (R million) | R 281.49 | R 2 419.46 | R 2 745.78 |
| Benefit Cost Ratio (BCR) | 1.03 | 1.24 | 1.51 |
| Internal Rate of Return (IRR) | 8.8% | 13.71% | 16.2% |

The results of the baseline model (**Table E10)** present a very positive financially viable result. A sensitivity analysis was performed to show the effect if no additional benefits are realised from the existing producers. Different production levels were analysed, should the new farmers experience problems to reach expected production levels in the first 7 years. This analysis also shows a very positive set of results.

**Table E11: Right Bank Canal Scenario Sensitivity Analysis results**

| Parameters | No Additional Benefits from Existing Area | New Production 10% Short | New Production 15% Short | New Production 20% Short |
|---|---|---|---|---|
| NPV (R million) | R 2 055.59 | R 2 390.8 | R 1 788.3 | R – 476.65 |
| BCR | 1.26 | 1.24 | 1.18 | 0.98 |
| IRR | 12.2% | 11.3% | 9.9% | 6.52% |

The right bank canal scenario is financially viable for the first two risk sensitivity factors, but not if the production yields shortfall increases above 15%.

**Table E12** presents the CBA results of the alternate left bank scenario.

[3] FCBA – Financial Cost Benefit Analysis

**Table E12: CBA Results - Alternate Left Bank Canal scenario (Klawer Phase 2 Included)**

| Parameters | FCBA[4] Constant Price | FCBA Current Price 4.5% Annual Inflation | ECBA Constant Price |
|---|---|---|---|
| Discount Rate | 8% | 11.28% | 8% |
| Benefits - Present Value (R million) | R 7 973.00 | R 10 118.06 | R 7 973.00 |
| Total Costs - Present Value (R million) | R 7 949.32 | R 9 380.47 | R 7 848.45 |
| Net Present Value (NPV) (R million) | R 2 368 | R 737.59 | R 124.55 |
| Benefit Cost Ratio (BCR) | 1.01 | 1.08 | 1.03 |
| Internal Rate of Return (IRR) | 8.1% | 14.0% | 8.4% |

The results in **Table E12** indicate a financially viable scenario. **Table E13** shows the sensitivity results for the same set of risks applied to the right bank canal scenario.

**Table E13: Alternate Left Bank Canal Scenario Sensitivity Analysis results**

| Parameters | No Additional Benefits from Existing Area | New Production 5%short | New Production 10% short |
|---|---|---|---|
| NPV (R million) | R 482.00 | R 244.47 | R – 248.65 |
| BCR | 1.05 | 1.03 | 0.97 |
| IRR | 13.2% | 12.2% | 10.3% |

The results in **Table E13** for the alternate left bank canal scenario show much more sensitivity than the results for the right bank canal scenario.

The results show that both scenarios are financially viable in terms of the CBA results, with Scenario 1 providing much stronger results.

The sensitivity analysis also does not support Scenario 2 in terms of the different risk factors.

**Table E14** shows a comparison of the baseline results from the financial and economic CBA models of both scenarios, indicating the stronger Scenario 1.

[4] FCBA – Financial Cost Benefit Analysis

**Table E14**: **Result Comparison of the Right Bank and Left Bank Scenarios**

| Parameters | FCBA Current Price 4.5% Annual Inflation | FCBA Current Price 4.5% Annual Inflation | Economic CBA Constant Market Prices | Economic CBA Constant Market |
|---|---|---|---|---|
| | Scenario 1 | Scenario 2 | Scenario 1 | Scenario 2 |
| Discount Rate | 11.28% | 11.28% | 8% | 8% |
| Benefit - Present Values (R mil.) | R 13 590.76 | R 10 118.06 | R 8 142.66 | R 7 973.00 |
| Total Costs - Present Values (R mil.) | R 9 998.76 | R 9 380.46 | R 5 396.88 | R 7 848.44 |
| Net Present Value (NPV) (R mil.) | R 3 592.00 | R 737.60 | R 2 745.78 | R 124.56 |
| Benefit Cost Ratio (BCR) | 1.36 | 1.08 | 1.51 | 1.01 |
| Internal Rate of Return (IRR) | 16.2% | 14.0% | 16.2% | 8.4% |

The macro-economic impact analysis show that total, 7 686 job opportunities can be created and supported, of which 6 160 in the direct category will be in the area and on the farms. It can also be accepted that a percentage of the other two categories will also occur in the feeder area.

The analysis indicates that at least 6 160 jobs will be created in the Cederberg and Matzikama LM service areas, where social conditions are currently not very encouraging. The proposed irrigation activities can therefore add to the improvement of the situation.

**Table E15** shows the number of jobs that can be created and supported at different skill levels by the proposed right bank canal scenario and new irrigation development.

**Table E 15: Jobs created by the Right Bank Canal Scenario**

| Impact on employment | Numbers |
|---|---|
| Skilled | 484 |
| Semi-skilled | 1 257 |
| Unskilled | 5 945 |
| **Total** | 7 686 |

**Table E15** shows that 484 of the employment opportunities to be created will be in the skilled category, with 1 257 semi-skilled and 5 945 unskilled.

One of the crucial aspects of any socio-economic impact assessment is poverty alleviation. The extent to which poverty alleviation is achieved is measured by the impact on household income, specifically, the extent to which low-income households will be affected by the successful execution of the project. **Table E16** shows the total annual impact of the expected wages to be paid to households, with a total of R 818 million annually, expressed in 2020 prices.

**Table E16: Impact on expected household wages**

| Impact on Households | Total Impact Rand Million |
|---|---|
| Low Income | 103 |
| Medium Income | 253 |
| High Income | 623 |
| **Total** | 979 |

As a large percentage of the table grapes, raisins and wine grape products are exported, a very positive impact is realised on the Balance of Payments of Treasury, namely R 584 million annually, expressed in 2020 prices.

## Summary

The report describes the approach and methodology followed to determine the financial and economic viability of the Trawal identified irrigation areas separately. Then the following two alternative options are compared:

- Scenario 1 - The construction of the new right bank canal up to Verdeling to serve the Trawal area, other future water users and the rest of the system; and
- Scenario 2 - The construction of two small bulk water supply schemes to serve the Trawal area and the betterment of the current left bank main canal up to Verdeling.

The different possible scenarios are evaluated against the ‘Do Nothing’ option, which could be the following:

- After the Clanwilliam Dam wall has been raised and the additional water is available, only the new irrigation schemes that make use of the existing spare canal flow capacity can be developed. These are the following schemes:
  - Year 2: Klawer Phase 1 - 412 hectares.
  - Year 3: Ebenhaeser Restitution and CPA augmentation - 361 hectares.
  - Year 7: Coastal flow-restricted - 89 hectares.
- Attempt to maintain the current canal system with all its weaknesses of leakages and breakages.

The results of the 'do nothing' option would then be:

- Restricted economic development in the lower Olifants River valley as the current left bank canal will not be able to accommodate the new water volumes.
- The available additional water is not properly used.
- Only at schemes that make use of the spare capacity in the existing canals would historical disadvantaged farmers be established and the opportunity to establish or support them on the other areas will not take place.

# Trawal Irrigation Areas

The financial and economic feasibility of developing the four recommended Trawal irrigation areas were established separately. The financial feasibility was established by applying the Cost Benefit Analysis approach. A Cash Flow Model was used to determine if the HD Farmers will be able to repay any production and farm development loans. The economic feasibility was determined by using a Macro-economic Impact Model (MEIA).

A detailed investigation was performed to identify the current crops produced, the profitability of these crops, and the future outlook of specific crops. Based on this analysis, a specific crop composition was used in the analysis.

The future income of the new areas was phased in the modelling exercise. The capital costs and the production costs were also phased in the models.

The results are positive for the CBA analysis as well as the Cash Flow, in which it is estimated that newly established HD Farmers should be able to repay their loans within a period of 10 years. The MEIA also shows very positive results and the construction of the right bank canal makes a very positive contribution to economic growth of the two local municipalities

**Table E17** presents the results of the CBA results for the Trawal area, which indicates financial viability.

**Table E17: CBA Results for the Trawal Area**

| Model | Constant Price - Financial | Current Price - Financial | Economic Price |
|---|---|---|---|
| **Discount Rate** | **8%** | **11.28%** | **8%** |
| Present Value - Benefits (Rand million) | R 6 169.1 | R 7 599.6 | R 6 169.1 |
| Present Value - Costs (Rand million) | R 4 665.1 | R 5 518.2 | R 4 592.5 |
| Net Present Value (NPV) (Rand million) | R 1 504.02 | R 2 081.46 | R 1 576.67 |
| Benefit Cost Ratio (BCR) | 1.32 | 1.38 | 1.34 |
| Internal Rate of Return (IRR) | 16.8% | 22.2% | 17.34% |

**Table E17** indicates a very positive set of results, showing that the development will be positive. The sensitivity analysis undertaken supports the very positive results.

## Comparison of the Two Canal Scenarios

The detail analysis of the two canal scenarios is presented in **Chapter 7**. The following presents a summary of the CBA results for the current price and market price models of the two scenarios.

**Table E18** shows that Scenario 1 is preferable in terms of the baseline CBA results, although both show viable results.

**Table E18: Comparative CBA results for the two canal scenarios**

| Parameters | FCBA Current Price 4.5% Annual Inflation | FCBA Current Price 4.5% Annual Inflation | Economic CBA Constant Market Prices | Economic CBA Constant Market |
|---|---|---|---|---|
| | Scenario 1 | Scenario 2 | Scenario 1 | Scenario 2 |
| Discount Rate | 11.28% | 11,28% | 8% | 8% |
| Benefit - Present Values (R mil.) | R 13 590.76 | R 10 118.06 | R 8 142.66 | R 7 973.00 |
| Total Costs - Present Values (R mil.) | R 9 998,76 | R 9 380.46 | R 5 396.88 | R 7 848.44 |
| Net Present Value (NPV) (R mil.) | R 3 592.00 | R 737.60 | R 2 745.78 | R 124.56 |
| Benefit Cost Ratio (BCR) | 1.36 | 1.08 | 1.51 | 1.01 |
| Internal Rate of Return (IRR) | 16.2% | 14.0% | 16.2% | 8.4% |

**Table E18** shows that Scenario 1 presents the stronger financial and economic results, especially in the case of the Economic Cost Benefit Analysis.

A detailed risk and sensitivity analysis was also performed with some of the cost items that might increase faster than the projected inflation rate, as well as the possibility that projected income levels may not be attained. **Table E19** shows the results of the risk and sensitivity analysis.

**Table E19: Comparative Sensitivity Analysis for the two canal scenarios**

| Scenarios | Scenario 1 | Scenario 2 | Scenario 1 | Scenario 2 |
|---|---|---|---|---|
| Parameters | No Additional Production Existing Areas | No Additional Production Existing Areas | Production 10% Short | Production 10% Short |
| NPV (Rand million) | R 2 055.59 | R 482.00 | R 2 390.8 | R – 248.65 |
| BCR | 1.26 | 1.05 | 1.24 | 0.97 |
| IRR | 12.2% | 13.2% | 11.3% | 10.3% |

The results in **Table E19** show that both scenarios provided positive answers, if no impact of the existing areas are taken into consideration, but the results of Scenario 2 are considerably lower than the results from Scenario 1 (right bank canal).

The second comparison set shows that if the financial results are lower than 15% of the expected results, then Scenario 2 is not viable.

The Macro-Economic Impact Analysis shows that the execution of Scenario 1 will introduce considerable positive results in terms of the growth potential of the economy of the Lower Olifants River valley, in an area where economic growth is currently very low. It will also make a large contribution to poverty alleviation in the region by the number of new jobs created and salary payments to households.

Scenario 1 will also produce economic impacts in the lower Olifants River region after 8 to 9 years, while Scenario 2 will probably reach the same level of positive impacts after 18 to 20 years.

In **Chapter 2** the following technical reasons are provided to support Scenario 1, the right bank canal scenario, as the preferable option:

- The Right Bank Canal will be more secure against failure than the relined left bank canal. In addition, this security will be achieved earlier.
- The Right Bank Canal will present an opportunity for a subsequent upgrade of the system downstream, extending the benefit of greater flexibility and additional capacity. This in turn, along with the slightly increased capacity, will allow irrigators to plant a higher percentage of permanent crops with associated significant socio-economic benefits. The improved assurance of supply will also lead to changes in crop patterns, but this will benefit existing irrigators in any case, whether the Right Bank Canal or the Alternative is constructed.
- There is greater confidence in the estimation of the Right Bank Canal's construction costs and programme. For the upgrading of the left bank canal, the requirement to keep water flowing

while construction takes place makes it a complex exercise, beset with operational difficulties and unforeseen issues that can increase costs and are likely to lead delays.

- The Right Bank Canal Scheme makes provision to meet the future water requirements for towns, industries and mines (initially only up to Verdeling, until further canals are upgraded), which the Alternative does not do. The Alternative also does not have the potential to eventually increase the supply capacity up to Vredendal.
- Should the left bank canal be relined, new irrigation schemes that rely on the construction of the Right Bank Canal cannot be developed, such as the Klawer Scheme Phase 2.
- There will be significant water savings because of reduced water losses, should the Right Bank Canal be constructed. For the Alternative these savings will take time as the entire left bank main canal needs to be relined. Even then, the integrity of the Right Bank Canal will be better than that of a relined left bank canal.

The financial and economic viability analysis results show that the right bank canal scenario is viable and supports the technical evaluation. It is therefore possible to recommend the right bank canal as the preferable scenario.

The right bank canal scenario also makes it possible to establish a number of Historical Disadvantaged Farmers and contributes to the distribution of high value land.

The construction and development of the Right Bank Canal Scheme will contribute to poverty alleviation and economic growth in the two local municipalities.

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# 1 Introduction

## 1.1 Project Background

The Clanwilliam Dam is situated in the Olifants River near the town of Clanwilliam in the Olifants/Doorn River Catchment Management Area in the Western Cape. The dam requires remedial work for safety reasons, which in turn presented the opportunity to raise the dam wall, thus enlarging its storage capacity and increasing its yield. Water use in the region is predominantly for irrigated agriculture.

A feasibility study was completed in 2008, which concluded that the raising of the Clanwilliam Dam and further associated projected agricultural development is economically viable and socially desirable. The feasibility study recommended the raising of the full supply level of the existing Clanwilliam Dam by 13 m to augment the water supplied to the existing scheduled irrigation area, towns and for industrial use; as well as to provide additional water for new irrigation areas to be established by historically-disadvantaged farmers, as well as to supply other local water users.

The environmental authorisation for the raising of the Clanwilliam Dam has been effective from February 2010 and the project was approved by the then Minister of Water and Environmental Affairs as a Government Water Works in August 2010. The implementation of this project is currently in the construction phase, which commenced in October 2018, after a significant delay due to budgetary constraints.

## 1.2 Study Objective

The objective of this Post Feasibility Bridging Study for the Proposed Bulk Conveyance Infrastructure from the Raised Clanwilliam Dam is to provide recommendations regarding the bulk conveyance infrastructure required for the equitable distribution of the existing and additional water from the raised Clanwilliam Dam. The additional water will be used to meet the ecological water requirements of the Olifants River, provide irrigation water to existing and new irrigators at a higher Assurance of Supply, and, most importantly, support historically disadvantaged farming projects and other broad-based black economic empowerment opportunities.

## 1.3 Objective of This Report

This particular report provides the results of an economic modelling exercise that quantified the risk of failure of the existing left bank main canal up to Verdeling, and the determination of the economic viability of the proposed new right bank canal, which underpins the betterment of the existing left bank main canal, to reduce the risk of failure.

The approach is to quantify the macro- and micro-economic impact associated with the mitigation of the risk of failure of the main canal (Trawal section) of the Lower Olifants River GWS by constructing a right bank canal to replace the existing main canal from Bulshoek to Verdeling.

Two proposed construction development scenarios were evaluated, namely:

- **Scenario 1 Right Bank Canal**: The construction of a right bank canal (the Right Bank Canal Scheme) to serve existing irrigators, the recommended new four Trawal irrigation areas and other future water users; and
- **Scenario 2 Alternative - Left Bank Canal**: The construction of two small irrigation schemes (one of which includes refurbishment of a section of the existing main canal) to serve the four recommended new Trawal irrigable areas and refurbishment of the remainder of the left bank main canal up to Verdeling.

The report also describes the approach and methodology followed to determine the financial and economic viability of the Trawal identified irrigation areas separately. Then the two alternative development scenarios are compared.

A Cost Benefit Analysis (CBA) approach is used to calculate the micro-economic feasibility of the project by comparing the costs versus the benefits and, thereby, establish the financial and economic feasibility of the Trawal option separately, and comparing the two scenarios.

The CBA section consists of two separate analyses: firstly, the analysis of the alternative left bank canal scenario to determine the financial and economic feasibility of the development. The financial and economic feasibility of the two scenarios is then compared to support a recommendation based on this evaluation.

A Social Accounting Matrix (SAM) based econometric model is applied to estimate the social and macro-economic impacts of the Trawal section as well as the impact of the recommended development option on a local, regional and national level.

## 1.4 Structure of the Report

**Chapter 1: Introduction** (this Chapter): Introduces and provides background to the study and task objectives.

**Chapter 2: Overview of the Scheme**: Describes the development of the scheme, the current bulk water infrastructure and planned irrigation development, the institutional framework, risks and opportunities, the state of infrastructure and maintenance and betterment planning and costs.

**Chapter 3: Approach and Methodology**: Describes the modelling approach to be followed, including the construction of the two econometric models used in the analysis, the CBA models used, and the difference between a financial and an economic CBA in terms of a Government Capital Investment project.

**Chapter 4: Product Budgets and Impact of Canal Breaks**: describes the different irrigation crops produced in the area and the projected makeup of the crop distribution in the newly available area, as well as the project cost and income budgets of the different crops. An analysis is presented of the historical breaks and the estimation of the cost to the producers at a farm level.

**Chapter 5: Social and Economic Conditions in the Lower Olifants River Area:** The current social and economic situation in the Matzikama and Cederberg Local Municipalities are discussed in this chapter.

**Chapter 6: Financial and Economic Analysis of the Trawal Irrigation Areas**: This chapter provides financial and economic analysis of the development of the two alternative small irrigation schemes to supply the new Trawal irrigation areas, and also focuses on the establishment cost of the historically disadvantaged farmers, as well as possible government support.

**Chapter 7: Financial and Economic Feasibility of the Right Bank Canal**: The results of the CBA and Macro-economic Models, as well as other comparative costs and benefits are discussed, to compare the Right Bank Canal with the Alternative.

**Chapter 8: Summary**: A short summary of the approach and methodology followed is provided, and the results are discussed.

# 2 Overview of the Scheme

## 2.1 Location and Climate

The Olifants River catchment is located on the west coast of South Africa. The catchment is characterised by a Mediterranean climate (winter rainfall) from mid-May through to the end of August. The summer months, November to February, are very warm and dry, and are characterised by extremely high evaporation losses. Climate variation is extreme as a result of the variation in topography, with summer temperatures reaching 45° in the Vredendal/Koekenaap area. The mean annual precipitation is up to 1 500 mm in the south-west in the Cederberg mountains, decreasing sharply to about 200 mm to the north, east and west thereof, and to less than 100 mm in the far north.

The focus of the area in this report is on the semi-desert area in the north-west and coastal area of the catchment.

## 2.2 Historical Perspective of the Scheme’s Development

The first farm in the Olifants River valley was awarded in 1732, and by the late eighteenth century small-scale irrigation was well established. Originally, farmers planted crops in the fine alluvial deposits on the banks of the Olifants River. These crops would be irrigated every time the river overflowed. However, vast destruction of riparian vegetation caused the river’s banks to widen and deepen, until it rarely overflowed. By 1860, around 120 people were living around the irrigable portion of the Olifants River and farmers started their own irrigation initiatives.

With the intention of providing perennial irrigation, construction of the Bulshoek Weir and 80 km of unlined distribution canals began in 1913, which was significantly disrupted by the First World War and the Spanish Influenza. By 1920, the weir was mostly completed and the entire scheme was eventually completed in 1924.

Despite the construction of Bulshoek Weir, water demand soon again outstripped supply, especially during the hot summer months. In 1927, a start was made to line the canals with concrete.

The need for additional storage was identified and a dam site was identified in the Olifants River near the town of Clanwilliam, with the intention that this new dam would store enough water for the existing irrigation scheme, and also allow for the expansion of agricultural activities. The

Clanwilliam Dam was originally constructed in 1935 with a capacity of 69.86 million $m^3$. By 1962 the Olifants River valley was inhabited by about 13 000 people. The ever increasing need for water resulted in the dam being raised between 1962 and 1964 to increase the capacity to 128 million m3 and the wall height to 43 m. Despite the dam being raised, curtailments were experienced quite often as the extent of irrigation increased.

About 40 000 people in the various towns supplied are now dependent on the scheme. Besides the rain-fed irrigation in the area, the total scheduled water entitlements from the scheme are 11 500 ha at 12 200 $m^3$/ha/a. Because of improved irrigation technology, less water per hectare is now used to irrigate crops, and a much larger area is irrigated. Many industries and mines are also dependent on water from the scheme.

Without the development of Bulshoek Weir and the Clanwilliam Dam and the canals below Bulshoek Weir, the towns, significant irrigation development and associated industries would not exist. It is therefore essential to keep this critical bulk water infrastructure effectively operating to ensure the future of the regional economy.

Following a dam safety inspection, the DWS Dam safety office became concerned about the risks associated with the Clanwilliam Dam as raised for extreme events, and by about 2000 DWS started to investigate the best way to improve its safety. It recommended the construction of a concrete gravity wall against the downstream side of the current dam wall. **Figure 2-1** shows the Lower Olifants Canal at different locations.

**Figure 2-1: The Lower Olifants Canal near Bulshoek Weir (left) and downstream**

The current scheme infrastructure of the Lower Olifants River Government Water Scheme (LORGWS) is shown in **Figure 2-2.**

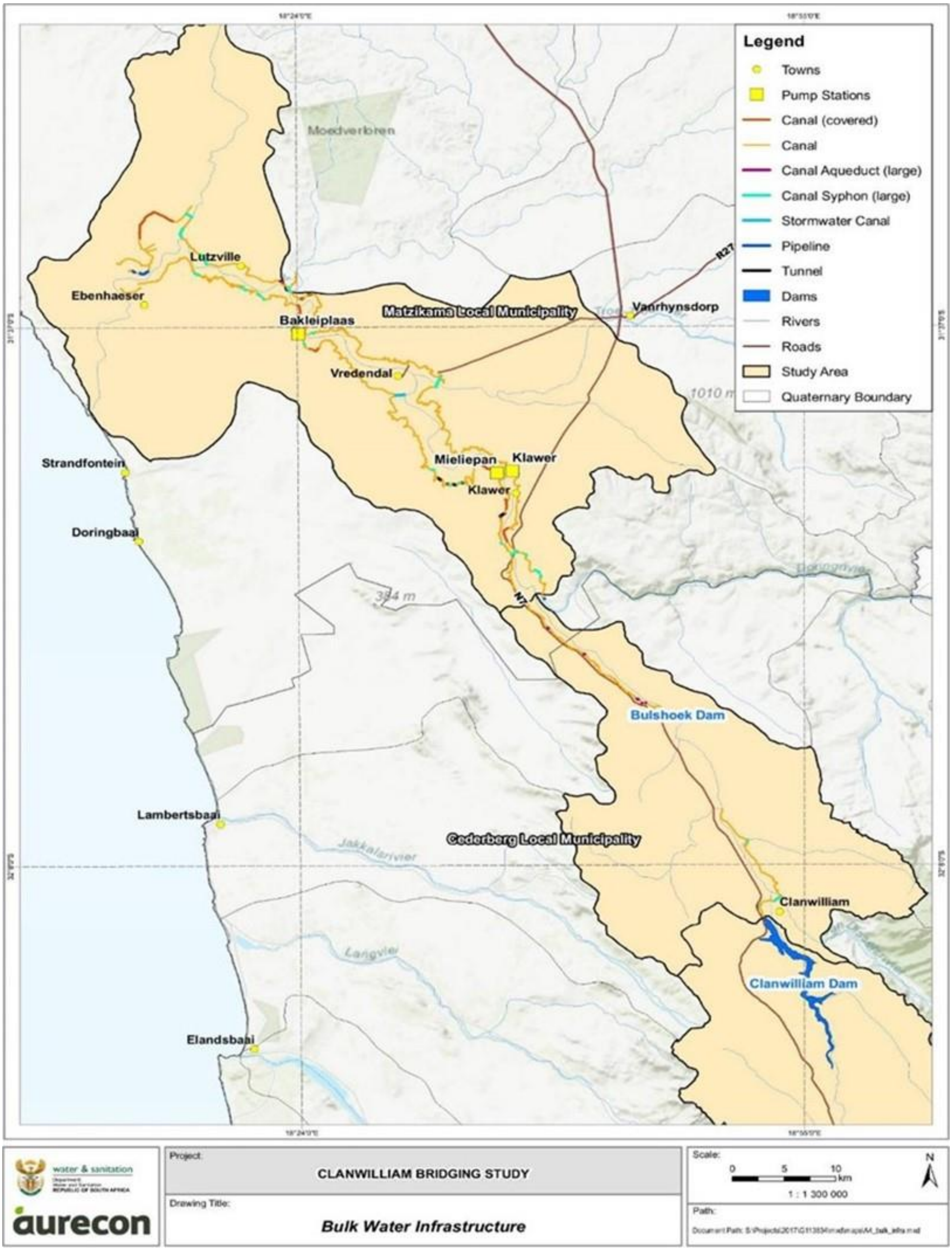


**Figure 2-2: The Current Scheme Infrastructure of the Lower Olifants River Government Water Scheme (LORGWS)**

## 2.3 Future Plans

### 2.3.1 Raising the Clanwilliam Dam

Due to proposed betterments to improve the safety of the Clanwilliam Dam wall, the opportunity to simultaneously raise the dam wall was investigated.

The Feasibility Study, concluded in 2008, found that a 13 m dam raising would be economically viable and socially desirable. A substantial increase in supply from the raised dam could be achieved, thereby increasing the dam's storage volume to 344 million $m^3$ and providing an additional 82 million $m^3$ per year for use, at appropriate levels of assurance of supply to current and future water users. The dam raising would aim to stabilise the current irrigation development and provide an opportunity to establish historically disadvantaged farmers to promote food security and decent employment through inclusive economic growth. 75% of the additional water is earmarked for the development of new irrigation for historically disadvantaged farmers and 25% to provide a more secure supply to existing farmers. The project has the potential to create significant jobs in a poor region and provide tax revenue. In addition to the raising of the dam, the existing conveyance infrastructure needs to be improved and new conveyance infrastructure needs to be provided for land to be allocated to historically disadvantaged farmers.

The environmental authorisation for the raising of Clanwilliam Dam was issued, effective from February 2010, and the project was approved for implementation by the Minister of Water Affairs and Forestry as a government water works in August 2010. The implementation of this project commenced in October 2018.

The water supply in this arid area is highly vulnerable as a result of the extremely old and poor state of the bulk water supply infrastructure. The canal system is a single, very long, artery supporting life in the region. If it fails, there are likely to be very serious problems and negative economic and social consequences. Canal failures occur with increasing regularity and threatens the lifeline of the region. A new opportunity has arisen to address this problem as new infrastructure will be required to expand the irrigation area as more water will come available from a raised Clanwilliam Dam. The combining of long-planned and delayed canal betterments with new infrastructure development means that canal improvements could be done at significantly reduced cost.

### 2.3.2 Proposed Irrigation Development and Conveyance Infrastructure

The identification and evaluation of new irrigation development options were incorporated into the Post Feasibility Bridging Study for the Proposed Bulk Conveyance Infrastructure from the Raised

Clanwilliam Dam (this study). Following screening and refinement, and also taking into account the most significant betterment needs, the following schemes have been recommended for implementation:

- **Schemes located upstream of Bulshoek Weir:**
  - **Jan Dissels Scheme** located near Clanwilliam Town, to receive a pumped supply from the Clanwilliam Dam.
  - **Transfer of scheduled** allocations, which entails moving identified existing allocations of irrigators in the lower Jan Dissels River to the Olifants River, to relieve over-allocation and improve the ecological condition of the lower section of the Jan Dissels River.
  - **Clanwilliam Scheme**, pumping from the lake of the raised Clanwilliam Dam.
  - **Zandrug Scheme**, pumping from the Olifants River below the raised Clanwilliam Dam and upstream of Bulshoek Weir.
  - **Bulshoek Scheme**, pumping from the Olifants River and the lake of Bulshoek Weir.
- **Schemes located downstream of Bulshoek Weir:**
  - **Right Bank Canal Scheme**, consisting of the construction of a new main canal section on the right bank of the Olifants River to replace the existing main canal section on the left bank, and to supply four proposed irrigation development areas near Trawal, namely the Zypherfontein1, Trawal, Zypherfontein 2 and Melkboom irrigation areas. This scheme will overcome the current flow restriction up to the bifurcation of the canal and significantly reduce the risk of supply failure.
  - **Klawer Phase 1 Scheme**, using spare capacity in canal section/s to supply the first phase of the Klawer irrigation area close to Vredendal, on the right bank of the Olifants River, after passing through the right bank canal flows intended for the Ebenhaeser Scheme.
  - **Klawer Phase 2 Partial Development Scheme**, developing a portion of the remaining Klawer irrigation area, following the completion of the new Right Bank main canal and the upgrading of the Klawer canal section.
  - **Coastal 1 Scheme**, using spare capacity in existing canal section/s, located on the left bank of the Olifants River near Vredendal, after passing through the left bank canal flows intended for the Ebenhaeser Scheme, to irrigate a small portion of the Coastal 1 irrigation area.
  - **Ebenhaeser Scheme**, using spare capacity in existing canal section/s to provide water to restitution farms and to augment the supply to the existing community at Ebenhaeser.

The development of the recommended schemes will:

- Broaden the ownership base of the economy to HD Farmers through new development,
- Mostly focus on high-value and export crops, whilst planning for some subsistence-plus farming,
- Sustainably create jobs and alleviate poverty in a poor region, and
- Improve utilisation of existing infrastructure and resources by combining planned new development with overdue and long-delayed betterment works.

The recommended schemes entail both the development of new land for irrigation as well as the replacement of lower-value crops of existing irrigation with higher-value crops.

**Table 2-1: Comparison of Recommended Schemes**

| Scheme | Irrigable Area (ha) | Incr. Req + Losses ($Mm^3/a$)* | Scheme Loss % | Capital Cost (R million) | Total NPV Cost (R million) | URV ($R/m^3$) | Environ-mental impact | Implementation Risks | Opportunity for smallholders / restitution |
|---|---|---|---|---|---|---|---|---|---|
| Jan Dissels | 462 | 4.26 | 0% | 83.2 | 100.2 | 2.03 | High | Environmental opposition | Yes |
| Clanwilliam | 298 | 2.46 | 0% | 34.5 | 58.6 | 1.84 | Medium | Limited area of existing irrigation & land ownership | Yes |
| Transfer of lower Jan Dissels River allocations | 0 | 1.00 | 0% | 0.0 | 0.0 | 0.00 | Low | Low but irrigators may potentially oppose it | - |
| Zandrug | 1 209 | 9.15 | 5% | 117.8 | 196.8 | 1.52 | High | Interest of land owners to switch existing irrigation to higher-value crops & land ownership | Partial |
| Bulshoek | 266 | 2.25 | 5% | 25.9 | 44.4 | 1.56 | Medium | Interest of land owners to switch existing irrigation to higher-value crops & land ownership | No |
| Right Bank canal (incl. 4 Trawal irrigation areas) | 2 339 | 25.65 | 15% | 573.2 | 782.3 | 3.05 | Medium | Funding of betterments & land ownership | No |
| Klawer Phase 1 (flow- restricted) | 412 | 5.09 | 22% | 77.1 | 108.5 | 2.25 | Low | Canal structural integrity, land ownership, operational complexity | Yes |
| Klawer Phase 2 (partial development) | 438 | 5.32 | 20% | 158.0 | 192.2 | 1.71 | Low | Funding of betterments & land ownership | Yes |
| Coastal 1 (flow-restricted) | 89 | 1.21 | 34% | 41.6 | 51.5 | 4.92 | Low | Canal structural integrity, high cost, operational complexity | Yes |
| Ebenhaeser | 361 | 4.66 | 28% | 512.9 | 536.7 | 12.77 | Low | Canal structural integrity, high cost, operational complexity | Yes |
| **TOTALS** | **5 874** | **61.05** | | **1624.3** | **2071.2** | | | | |

** In addition to existing allocations*

### 2.3.3 Betterment Infrastructure Works

A betterment implies an improvement of existing (hard) water resource infrastructure, resulting in an increased functional performance and/or increased capital value thereof. A distinction is made between types of expenditures on existing works during their working lives (maintenance, refurbishment, betterment, etc.). This also determines how certain charges will be levied, and who will take responsibility for its undertaking. This can consist of small improvements which are typically part of maintenance, to refurbishment, such as smaller works. Maintenance and refurbishment are often funded from operational budgets, while more significant betterments need to be budgeted for and approved by management.

Betterment works for the scheme have long been planned for by the owner of the scheme, DWS, as well as the operators of components of the scheme, LORWUA and the Clanwilliam WUA, as described in Section 2.9.3, and costed. Financial constraints have significantly delayed the implementation of the more significant betterment works that are needed.

In terms of the Raw Water Pricing Policy, a depreciation charge should be levied on hard infrastructure of Government schemes, to be used for the replacement of infrastructure when it reaches the end of its useful life. In terms of the lifetime of the scheme, the Raw Water Pricing Policy has only fairly recently been implemented, and depreciation charges have not been levied. There is therefore no mechanism to replace the infrastructure that has already reached the end of its useful life.

The development of conveyance infrastructure to convey additional water made available by the raising of Clanwilliam Dam to the proposed irrigation areas, provides a unique opportunity to combine betterment works more cost-effectively with new development infrastructure.

### 2.3.4 Phasing of Recommended Irrigation Schemes

The phasing of the preferred schemes has been recommended in three phases, namely Phases A, B and C. Alternate phasing has also been identified. A summary of the proposed phasing is shown in **Table 2 2**.

**Table 2-2: Proposed Phasing of Recommended Schemes**

| Scheme | Zone | Incremental requirement + losses ($Mm^3/a$) | Phase A | Phase B | Phase C |
|---|---|---|---|---|---|
| Jan Dissels | | 4.26 | ● | | |
| Clanwilliam | | 2.46 | ● | ⊙ | ⊙ |
| Transfer of lower Jan Dissels irrigators | 2 | 1.00 | ● | | |
| Zandrug | | 9.15 | ● | ⊙ | ⊙ |
| Bulshoek | | 2.25 | ● | ⊙ | ⊙ |

| Scheme | Zone | Incremental requirement + losses (Mm³/a) | Phase A | Phase B | Phase C |
|---|---|---|---|---|---|
| Right Bank canal & 4 Trawal irrigation areas | 4 | 25.65 | | ● | ⊙ |
| Klawer Phase 1 | 5 | 5.09 | ● | | |
| Klawer Phase 2 partial development | | 5.32 | | | ● |
| Coastal 1 flow-restricted | | 1.21 | | | ● |
| Ebenhaeser | | 4.65 | ● | | |

| | | | | |
|---|---|---|---|---|
| **Incremental Water Requirements + Losses** | 61.05 | 29.44 | 25.08 | 6.53 |
| **Water Loss %** | 12.5% | 10.8% | 12.4% | 22.3% |
| **Hectares of new irrigation** | 5 874 | 3 008 | 2 339 | 527 |

The options located closest to the Clanwilliam Dam, especially those options located upstream of the Bulshoek Weir, are the most attractive options, as water can be provided for irrigation at low cost, with limited losses.

Several of the preferred schemes provide opportunities for the development of smallholder plots (assumed 7.5 ha), being located reasonably close to towns. These options also provide the opportunity to support a restitution scheme or an existing HDI scheme (Ebenhaeser).

## 2.4 Water Users Dependent on the Scheme

Besides supplying irrigation water (including to the Ebenhaeser community irrigation project), the lower Olifants River canals also supply water for domestic use to towns within the Matzikama Municipality, various industries and mines. Untreated water is also supplied for household purposes to farmers and their workers on the scheme, for domestic use or irrigation of gardens on farms.

The annual allocation below Bulshoek Weir to the various water use categories is summarised in **Table 2-3**.

**Table 2-3: Water Allocations below Bulshoek Weir**

| Water Use Category | Area (ha) | Scheduled Allocation (m³/ha) | Annual Allocation (m³) |
|---|---|---|---|
| Scheduled irrigation | 9 013 | 12 200 | 109 958 600 |
| Ebenhaeser small farmers | 257 | 12 200 | 3 135 400 |
| Emerging farmers | 240 | 12 200 | 2 928 000 |
| Matzikama Municipality | - | - | 5 151 000 |
| Industries | - | - | 3 200 000 |
| **Total** | **9 510** | | **124 373 000** |

*Source: (R Nieuwoudt 2018, personal communication, 15 June)*

The canal system supplies irrigation, industrial, and domestic water to the Matzikama Municipality for the following towns and communities: Vredendal, Klawer, Lutzville, Koekenaap, Ebenhaeser, Papendorp, Strandfontein, Doring Bay and Vanrhynsdorp.

The major crop cultivated is wine grapes. The remainder is export table grapes, raisins, and tomatoes, as well as a variety of smaller crop types. Industries in the Study area consist mainly of wine cellars as well as a tomato processing industry. There are a number of wine cellars in the Lower Olifants River valley (e.g., Stellar Wines) and cellars in Vredendal, Klawer, Spruitdrift, Trawal and Lutzville. The wine cellars of Vredendal, Lutzville and Spruitdrift are the three largest wine cellars in the country. The wine industry in the lower Olifants River valley contributes approximately 15% of the total South African wine industry production.

Mining operations supplied are the Cape Lime plant and the Namakwa Sands (Tronox) heavy mineral mining at Brand-se-Baai and its smelter near Koekenaap.

It is evident that the lower Olifants River valley and community is almost exclusively dependent on the sustainability and longevity of the LORGWS. The scheme has brought livelihoods and prosperity to a poor region of the country. Without the scheme, economic activities would have been very limited in this arid region.

## 2.5 Scheme Description

### 2.5.1 Clanwilliam Dam

The Dam basin currently has a live storage capacity of 122 million $m^3$. The dam currently supplies approximately 11 000 ha of scheduled water downstream of the dam. There are 318 ha scheduled water allocations from the dam basin.

### 2.5.2 Clanwilliam Canal and Olifants River

The Clanwilliam Canal, approximately 18 km in length, originates at the Clanwilliam Dam wall, passes through Clanwilliam town and crosses the Jan Dissels River. The canal, which was built during 1940, supplies water for irrigation. There are 564 ha of scheduled allocations from the Clanwilliam Canal and 665 ha allocated from the Olifants River for Clanwilliam WUA irrigators.

### 2.5.3 Bulshoek Weir

The Bulshoek Weir (**Figure 2-3**), a stone-masonry gravity structure was constructed across the Olifants River about 26 km downstream of Clanwilliam town, and has a current capacity of 4.2 million $m^{3.}$ The weir’s catchment area is 2 679 $km^2$ in extent. A series of connected arches and buttresses supporting a bridge deck and a gantry for the spillway gate hoists make up the dam wall. Sixteen gates are positioned between the buttresses on top of the ogee-shaped crests.

**Figure 2-3: Concrete masonry Bulshoek Weir**

### 2.5.4 Olifants River (Vanrhynsdorp) Government Water Scheme

The Olifants River (Vanrhynsdorp) Government Water Scheme (ORWGS) consists of the canal system fed from Bulshoek Weir with water released from the Clanwilliam Dam. Downstream of the Bulshoek Weir, water is diverted into the Lower Olifants Canal which is the main conveyance system in the Olifants River (Vanrhynsdorp) Government Water Scheme (GWS).

The canal runs on the left bank (western side) of the Olifants River for approximately 21 km (the so-called main canal / Trawal canal section), before it bifurcates and the river is crossed with a syphon, whence it runs on both sides of the river, with a small section of the canal running upstream along the right bank. The canals continue towards Lutzville, gradually becoming smaller downstream. Water is abstracted at numerous points along the canal (approximately 529 off-takes). Secondary canals distribute water from near Lutzville towards the coast. The lead time for water to travel in the canal from the Bulshoek Weir to the last point at Ebenhaeser is about three days. The total length of the canal system is some 237 km.

The canal system below Bulshoek Weir is shown in **Figure 2-4**.

## 2.6 Institutional and Legal Framework

### 2.6.1 Ownership and Control

Ownership and control of Clanwilliam Dam and Bulshoek Weir will remain with the State, until the future of that ownership and control has been decided upon, and transfer of those rights to some water management institution such as a national or regional water utility, occurs.  The WUA will not pay operation and management (O&M) and depreciation charges for the canal systems, but only O&M and depreciation in respect of the major dams supplying the canal systems.

As the owner of the infrastructure, the State retains responsibility for major betterment works, upgrading and refurbishment, including repairs of major breaks.

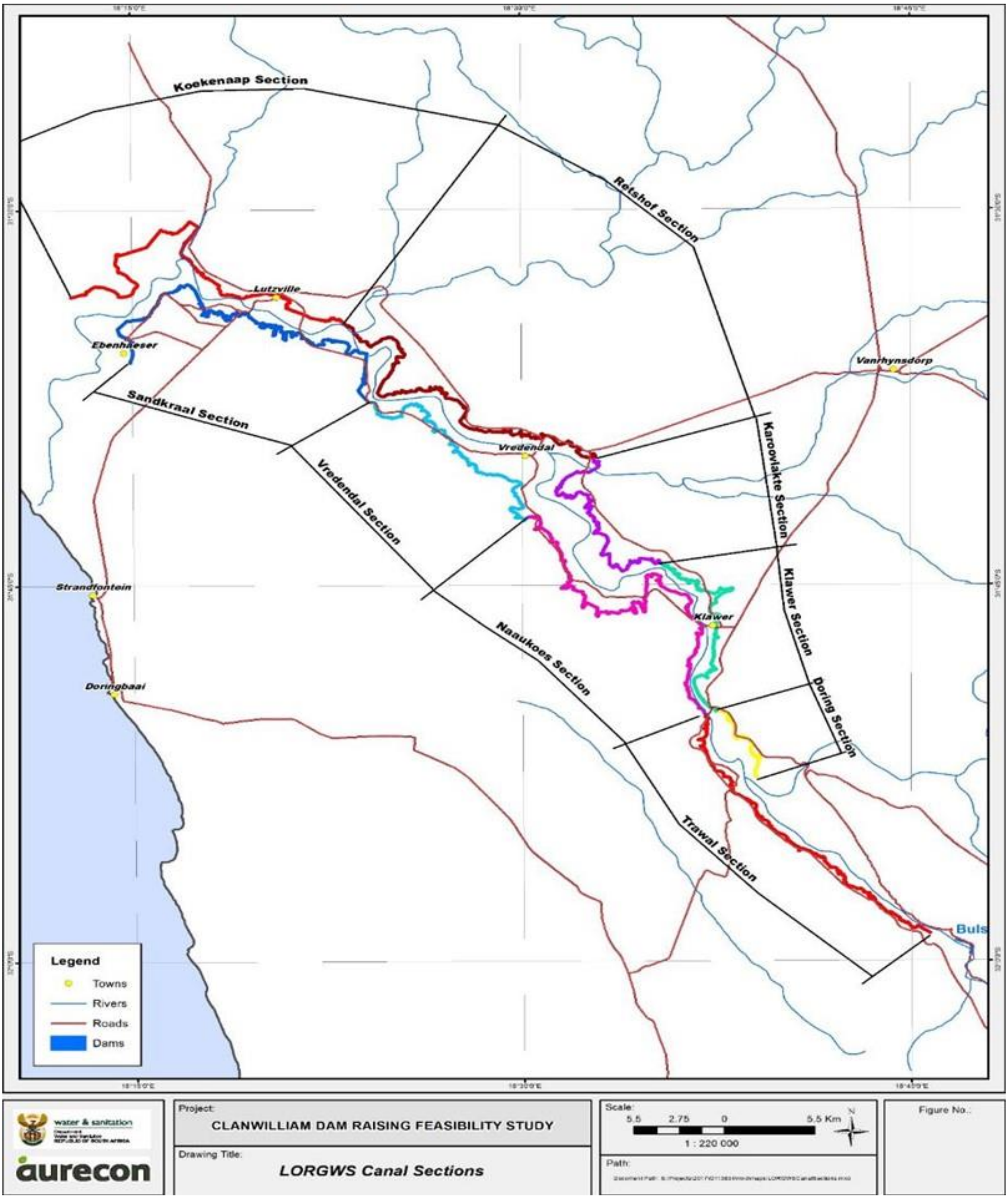


**Figure 2-4: The Lower Olifants Canals**

### 2.6.2 Background to transfer of O&M on canal schemes

On 6 July 2000, the then Minister of Water Affairs and Forestry approved a policy for outsourcing the operations, maintenance and refurbishment of canal irrigation schemes, by transferring the functions and relevant staff to water management institutions to be established in terms of the National Water Act (NWA), 1998.

The operating, maintenance and betterment costs of State Irrigation Schemes had been highly subsidised before the currently applied tariff agreement was concluded with the then South African Agricultural Union in 1995.

The operating and maintenance (O&M) costs of schemes consisting of canal distribution structures were for various reasons relatively high, the main reasons being the high canal maintenance costs and functional support costs derived from regional and area offices.

The Department`s Raw Water Pricing Strategy, which was promulgated on 12 November 1999, determines that irrigators on State Irrigation Schemes must pay the full O&M costs, plus a depreciation charge for future rehabilitation of the scheme (betterments), plus the relevant water resource management charge. In view of the affordability problems mentioned above, it will not be possible to recover the additional charges to be levied in future, related to water resource management and depreciation, unless the O&M costs can be considerably reduced.

There are good reasons for the transfer of the O&M of Government irrigation schemes to WUAs. Investigations conducted on schemes already transferred in the past to irrigation boards, show that O&M costs can be reduced significantly following such transfers, also due to lower overhead costs. Risks in relation to canal breaks or flood damages are also transferred, thus reducing the risk and costs for the Department.

### 2.6.3 Clanwilliam WUA

The Clanwilliam WUA manages abstractions from the Clanwilliam Dam catchment, the Clanwilliam Canal and the Olifants River up to the Bulshoek Weir. The Jan Dissels River Catchment also forms part of the Clanwilliam WUA.

### 2.6.4 Transfer of O&M to LORWUA

LORWUA was established with the purpose of taking over the operation and maintenance of the Bulshoek Weir and canal distribution system of the scheme.

On 9 June 2001 the then Minister of Water Affairs and Forestry approved the transfer of the full operation and maintenance functions of the Olifants River (Vanrhynsdorp) GWS to LORWUA. The Business Plan for LORWUA was also approved. The LORWUA operates and maintains the canal system up to the Ebenhaeser balancing dam and reservoir. From the balancing dam, there is also a canal to the Ebenhaeser community, which is operated and maintained by the community.

Due to various reasons the transfer of the departmental staff to LORWUA and the signing of the O&M agreement were never finalised.

The Department and LORWUA have reached an agreement in terms of which the Department will fund LORWUA for certain outstanding refurbishment works on existing siphons in the main water supply system to bring the scheme to a reasonable standard, subject to the terms and conditions as stipulated in the Memorandum of Understanding (MOA). This MOA was signed during September 2008.

### 2.6.5 Draft pro-forma template for MOA

The Chief Directorate: Operations and Maintenance of the DWS has conducted an audit investigation on all agreements previously entered into by the DWS and Water User Associations, Irrigation Boards and Water Boards. The audit investigation revealed that:

- The agreements are outdated/ have lapsed and may not be applicable in current projects; and
- The outdated /lapsed agreements have shortcomings/ defects and as such cannot be applied for the current project/s.

DWS Legal Services have vetted the pro-forma template for the updated MOU during November 2019. The DWS are now in the process of compiling new O&M agreements for all the GWSs where transfers are applicable. This agreement spells out the difference between refurbishment/ rehabilitation, replacement or betterments.

## 2.7 Operating Rules

The LORWUA is responsible for the operation and maintenance of the water conveyance system from Bulshoek Weir to Ebenhaeser and Koekenaap. Their responsibility includes the existing waterworks infrastructure at Bulshoek Weir but excludes management of some of the internal distribution system of the Ebenhaeser small-scale farmers. The Lower Olifants Canal operates for between 38 and 42 weeks during the year, and the remainder of the 52 weeks of the year is reserved for maintenance on the canal.

The existing system allows abstractions from the canal as requested by irrigators, i.e., a demand system. The 529 $m^3$ or so off-takes are set on a weekly basis. Irrigators must apply for a specific volume of water for the next week as well as the period in which the water must be supplied to his/her property.

The water level in the canal varies continuously, and surplus and deficit flow conditions can occur frequently. The variation increases with further progression down the canal, which can lead to considerable operational water losses if not managed properly. Irrigators compensate for this variation by building their own small balancing dams.

Two quotas are in effect, viz. an annual allocation of 12 200 $m^3$/ha/a and a weekly quota (or maximum extraction rate) of 325 $m^3$/ha/week. During years of drought, which historically occurred very regularly in this region, both quotas are reduced, and restrictions are imposed on water users. If the quota for the next year is uncertain, farmers become more conservative in irrigation development. If there is insufficient water to meet full irrigation requirements, the existing use is reduced by a percentage, according to the water available. The quota is based on an assessment of the state of the Clanwilliam Dam after the rainy season each year during the latter half of September, which considers factors such as the rainfall in the catchment, inflow and extent of snow during winter in the catchment.

## 2.8 Risks and Opportunities

The very poor state of canal infrastructure poses a high risk to the regional community and economy. The Bulshoek Weir and canal system infrastructure is about 90 years old and is deteriorating.

The region has experienced regular droughts, some severe and, as a result, regular water restrictions have been implemented. The situation will be improved once Clanwilliam Dam has been raised and existing irrigators will receive an improved assured supply, with the raised dam storing surplus water to be used for defined drought situations.

The flow capacity of the canals is restrictive and often cannot meet the peak demand, especially during the very hot, peak summer period. During the summer season from 1 October to 30 April, the water allocation released to the LORWUA canal is capped at 8 400 $m^3$/ha/a, due to the capacity constraint of the canal. This is equivalent to 325 $m^3$/ha/week and the canal is designed for 290 $m^3$/ha/week. The current water supply system is thus ‘over committed’. The rest of the allocation is released during the remaining months of the year, if water is available, but farmers often cannot then fully use their allocations.

The Bulshoek Weir has had a history of leakage problems through the foundation of the dam since its completion. Remedial work undertaken from 2003 to 2005 with the main objective to protect the weir from structural failure has not reduced leakage. It is envisaged that a grouting programme is needed to reduce the leakage.

There is excessive conveyance water losses and leakage from the canals, estimated to be up to 30% by DWS, due to the age and poor condition of the canals, which represent very ineffective use of available water in a dry region.

Canal breakages (**Figure 2-5**) represents a significant risk, due to the disruption, periods of non-supply (including supply to towns, industries and mines), and associated commercial and cost implications. The frequency and severity of these breakages seems to be worsening. Breakages on the current main canal poses the biggest risk, as all downstream water users, which represents most scheme users, are affected.

Water is the driving force underpinning the livelihood of the region. Therefore, the Right Bank Canal Scheme, to replace the old main canal, is being investigated as a means to ensure a secured future water supply to sustain existing development in the region, as well as to supply new irrigators.

**Figure 2-5: Lower Olifants Canal break in 2015**

The 2015 break was as a result of a 180 m long failure in the soil supporting the dry concrete packed lining near Klawer. The canal collapse cost the agriculture sector an estimated R100 million (Creamer Media, 2017).

Water is the driving force underpinning the livelihood of the region. Therefore, the Right Bank Canal Scheme, to replace the old main canal, is being investigated as a means to ensure a secured future water supply to sustain existing development in the region, as well as to supply new irrigators and other future water uses.

A more recent break of the canal is shown in **Figure 2-6**.

**Figure 2-6: Failure in 2019 of the Lower Olifants Canal along the existing main canal**

The canal systems have been in use for significantly longer than its design life. Design standards looked at the typical useful economic "life" of canals as 45 years - the canals are now twice that old. There is a big difference in engineering standards to which this infrastructure was built, as opposed to current accepted standards. Construction standards were not up to today's standards and lining of the canal e.g., mostly consisted of hessian cloth plastered over by hand. The age of the infrastructure, plus the inadequate standards (e.g., lack of service roads and cross-drainage) are reasons why revamping/replacing of the infrastructure is overdue.

The responsibility for the funding of betterment works needs to be better defined and agreed. It is perceived to be a government responsibility.

The raising of Clanwilliam Dam, with the associated development of new irrigation and conveyance infrastructure, provides a significant and probably unique opportunity to cost-effectively undertake combined irrigation development and betterment works. The replacement of the current left-bank main canal from Bulshoek Weir, up to the bifurcation of the canal with a proposed right bank canal is an opportunity to significantly reduce the risk of canal breakage and supply interruptions to water users, lower water losses and lower the risk of damage to the regional economy.

The option to enlarge and reline the current main canal was also evaluated and compared as part of the options analysis. This option however presents many obstacles to implementation, the most significant being the need to still continually supply the irrigators with water for irrigation while construction is underway and the main canal, or sections thereof, closed. The measures to overcome this problem are costly and will impact on the Olifants River from an environmental perspective. Further challenges are the lack of good access in some sections and likely impacts on farming activities.

A further example is the proposed provision of 150 000 $m^3$ balancing storage for operational purposes of the more downstream parts of the canals, that has been provided for as part of the proposed Ebenhaeser Scheme balancing dam, at a significantly reduced cost when compared with a stand-alone scheme.

## 2.9 State of Infrastructure

### 2.9.1 Canal Breaks

After more than 90 years of usage, the concrete lining has become frail and prone to damage, which results in canal breaks occurring frequently.

Several major breaks have been experienced along the Lower Olifants Canal due to ageing infrastructure. The largest break happened in January 2015 with a repair cost of R 11.5 million. The LORWUA reported (J Matthee 2018, personal communication, 12 February) that it spends approximately R 4.2 million per annum on normal maintenance with its own teams, and contracts out approximately R 5.8 million per annum on more serious repairs.

### 2.9.2 Estimated Costs to Refurbish, Improve and Maintain the Current Left Bank Main Canal

Planned Maintenance and Betterments in the 'Existing Conveyance Infrastructure and Irrigated Land' Report of this study, a review was done of the two condition assessments of the lower Olifants canals, which was carried out by Element Consulting (LORWUA, 2004), and by LTE Consulting and Pula Strategic Resource Management (DWS, 2016) respectively. The DWS (2016) condition assessment accounts for any maintenance, rehabilitation and repairs undertaken by the LORWUA since the LORWUA (2004) study was first conducted.

An explanation for the significantly higher DWS (2016) estimated costs is that the LORWUA (2004) costs have not yet been escalated, as well as likely further deterioration of the conveyance infrastructure during the 12-year period between the two condition assessments.

Following the review of the two condition assessments, an 'Implementation Action Plan' was proposed based on information obtained from the DWS (2016) report. This describes the maintenance, repairs and betterments that will need to be undertaken to keep the system functioning, in the short-term, medium term and long-term respectively, as well as the associated costs. As time progresses, it is expected that the costs to keep the system functioning will increase. These costs represent required expenditure to be used in the financial and socio-economic calculations.

The Implementation Action Plan focused on the short- and medium-term actions required for the lining of the canals, and includes:

- Short-term actions for the canal lining comprising canal repairs such as earthwork repairs crack repairs, surface finishes, expansion joint and sealing repairs, and panel repairs.
- Medium-term actions for the canal lining comprise replacement/renewal of the lining.

'Long-term' actions involved infrastructure upgrades such as new canal balancing dams, or a new main canal on the right bank of the Olifants River. These long-term actions were investigated as part of this study, to recommend bringing these proposed 'long-term' actions forward to the medium-term.

#### 2.9.2.1 Short-term Actions

The short-term actions considered were related to the repair of components of the canal system that were identified as being in a 'Poor' or worse condition in the DWS (2016) condition assessment. The estimated cost for the short-term actions is R 260 million (incl. VAT) (refer to **Table 2 4**) for all the canal and R 50 million (incl. VAT) for the existing main canal.

**Table 2-4: Estimated 2018 cost for short-term actions (excluding VAT)**

| Activity | Cost (R) for all canals | Cost (R) for existing main canal |
|---|---|---|
| **Earthworks** | | |
| - Repair berm | R 52 200 000 | R 7 200 000 |
| - Repair shoulder gaps | R 4 300 000 | R 600 000 |
| - Repair shoulder level | R 14 100 000 | R 1 900 000 |
| **Concrete Works** | | |
| - Crack repairs to concrete lining | R 8 800 000 | R 2 000 000 |
| - Resurfacing / rescreeding | R 41 900 000 | R 12 900 000 |
| - Expansion joints and resealing | R 6 400 000 | R 700 000 |
| - Repair broken panels | R 8 900 000 | R 1 200 000 |
| **Sub-total (excl. P&Gs, fees, contingencies & VAT)** | **R 136 600 000** | **R 26 500 000** |
| **Total (incl. 25% P&Gs, 15% engineering fees, 15% contingencies, 15% VAT)** | **R 260 000 000** | **R 50 400 000** |

#### 2.9.2.2 Medium-term Actions

The canal sections which the LORWUA considered to be in critical condition were compared to the canal lining sections identified in the DWS (2016) report. 'Priority 1', i.e., highest priority, and 'Priority 2' sections were identified and total approximately 40 km and 114 km respectively.

The practicality of implementing actions in relation to the downtime/maintenance schedule (approximately 17 weeks, in cycles of two-weeks standing periods) was evaluated. Where possible, the medium-term actions of replacing the existing canal lining should be implemented during the downtime of the canal system. However, where it is necessary to undertake construction outside of the 'dry' weeks, it may be necessary to construct diversion works such as a temporary pipeline bypass (water to be pumped if necessary).

Because canal replacement rates are too low, it is infeasible to undertake the canal lining replacement during the LORWUA's scheduled downtime. It is therefore recommended that temporary diversion works, consisting of a 600 m temporary pipeline bypass, be constructed to allow for replacement of the canal lining without interrupting the water supply to farmers. Other measures could include construction work done on different sections - at the same time using different teams; or placement of precast interlocking elements while the water is flowing, followed by final adjusting if necessary and joint sealing of significant lengths during a 'dry' period.

The estimated cost required to replace the concrete lining, including diversion works, for the Priority 1 sections for an approximate total length of 40 km for all the canals is R740 million (incl. VAT) and R 393 million (incl. VAT) for the existing main canal. The estimated cost for the Priority 2 sections for an approximate total length of 114 km is R1 699 million (incl. VAT) and R ?100 (incl. VAT) for the existing main canal. Refer to Figure 2-9 for a summary of the canal lining replacement costs. Note that some of the cost items in this estimate may potentially be an order of magnitude out as much of the data was extracted from the DWS (2016c) report and a more definitive evaluation of actions required would need to be done.

**Table 2-5: Estimated 2018 cost for canal lining replacement (medium-term action)**

| Activity | Cost (R) for all canals | Cost (R) for existing main canal |
|---|---|---|
| | (incl. 25% P&Gs, 15% engineering fees, 15% contingencies, 15% VAT) | |
| **Priority 1 sections (± 40 km)** | | |
| - Replace concrete lining (various canal sections) | R 422 900 000 | R 230 700 000 |
| - Diversion works - temporarily pumping / diverting water | R 317 400 000 | R 162 000 000 |
| **Priority 1 sections: Subtotal** | **R 740 300 000** | **R 392 700 000** |

| Activity | Cost (R) for all canals | Cost (R) for existing main canal |
|---|---|---|
| | (incl. 25% P&Gs, 15% engineering fees, 15% contingencies, 15% VAT) | |
| **Priority 2 (less critical) sections (± 114 km)** | | |
| - Replace concrete lining (various canal sections) | R 883 000 000 | R 65 500 000 |
| - Diversion works - temporarily pumping / diverting water | R 815 900 000 | R 34 500 000 |
| **Priority 2 sections: Subtotal** | **R 1 698 900 000** | **R 100 000 000** |
| **Total** | **R 2 439 200 000** | **R 492 700 000** |

### 2.9.3 A New Right Bank Main Canal to Replace the Current Left Bank Main Canal

The long-term action of implementing a new main canal on the right bank of the Olifants River was investigated in this study at feasibility level. The proposed Right Bank Canal Scheme will use the existing outlet works from the Bulshoek Weir, cross the Olifants River 3 km further downriver, and continue along the right bank of the Olifants River up to the canal bifurcation at 'Verdeling', where the canal splits into a left bank and a right bank canal. The scheme consists of the following components:

- Using the existing intake works to the canal system, i.e., the outlet works at the Bulshoek Weir,
- Upgrading of a portion of the existing left bank canal to accommodate the design flow,
- A new syphon and pipe bridge across the Olifants River,
- A new right bank canal from the syphon to the right bank (current) outlet of the existing syphon at Verdeling,
- A combination of two concrete culvert syphons and a short canal reach to cross the Doring River, and
- Modifications to the existing syphon outlet at Verdeling to increase the head of the syphon.

This Right Bank Canal will supply the four proposed new irrigation areas in the Trawal area and can potentially be considered for the development of a Government Water Scheme (GWS). **Figure 2-7** shows the Right Bank Canal Scheme and the four irrigation areas that will be supplied by it.

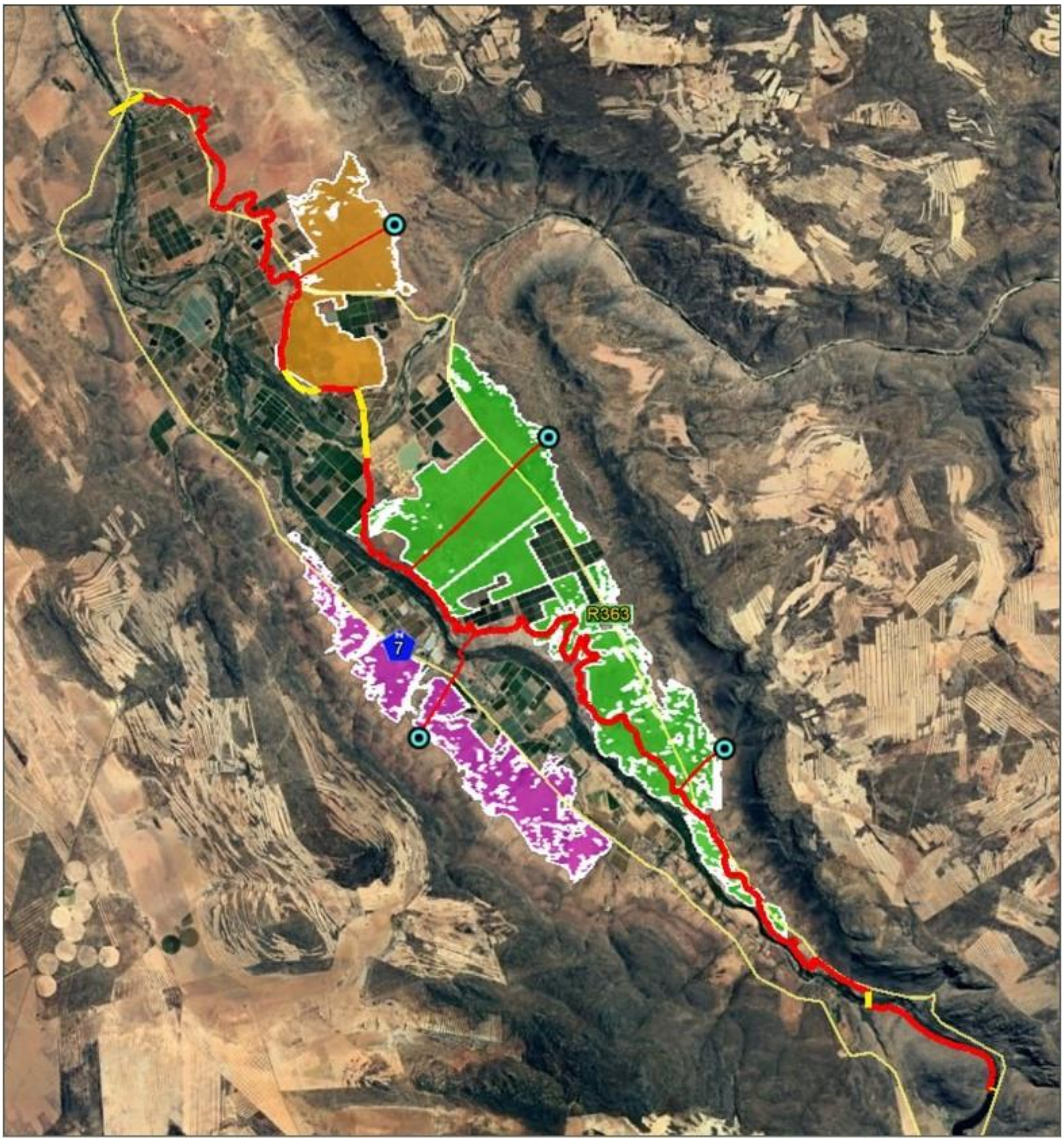


**Figure 2-7: Layout of the Right Bank Canal Scheme**

### 2.9.4 Alternative small schemes to only serve new irrigation in the Trawal area

Should a new Right Bank main canal not be constructed, the four planned irrigation areas (**Figure 2-7)** could then be supplied by two smaller new bulk water infrastructure schemes, as follows:

1) Release water from Bulshoek Weir down the Olifants River, and pump it from the river to the new Trawal irrigation area on the left bank. This scheme will have much higher water losses.

2) Supply water from Bulshoek Weir to the Zypherfontein1, Zypherfontein 2 and Melkboom irrigation areas, via an 8 km lined/raised section of the existing left bank main canal, a syphon crossing the Olifants River, and a new small high-level canal supplying the three irrigation areas under gravity, with a syphon through the Doring River.

These small schemes are shown in **Figure 2-8** and **Figure 2-9** respectively.

**Figure 2-8: Layout of the small scheme to supply the new Trawal irrigation area**


**Figure 2-9: Layout of the small scheme to supply 3 irrigation areas**

### 2.9.5 Capital Costs

#### 2.9.5.1 Two Small Schemes

The capital cost of the two small schemes to supply the four Trawal irrigation areas, that were evaluated at reconnaissance (desktop) level, and as explained in **Paragraph 2.9.4**, is regarded as the attributable Development capital cost component of the Right Bank Canal Scheme. The combined estimated 2020 capital cost of the two small schemes is R 573 million, excluding VAT.

#### 2.9.5.2 Right Bank Canal Scheme

The full 2020 cost of the Right Bank Canal Scheme is R 1 994.66 million, excluding VAT.

The difference between the development cost of the two small schemes and the full cost of the Right Bank Canal Scheme is deemed the Betterment cost, as this is for the benefit of existing water users, mainly for irrigation. The betterment cost component of the scheme is therefore R 1 421 million, excluding VAT, as shown in **Table 2-6**.

**Table 2-6: 2020 Right Bank Canal Scheme Capital Costs in R million, (excl. VAT)**

| Scheme infrastructure component | Total Cost R million | Development R million | Betterment R million |
|---|---|---|---|
| Lining/raising portion of existing main canal & small high-level canal | - | 172.24 | - |
| Right Bank Canal | 1 434.32 | - | 1 262.08 |
| Pump stations | 153.04 | 153.04 | - |
| Pipelines & syphons | 83.86 | 83.86 | - |
| Farm Dams | 27.42 | 27.42 | - |
| Land | 82.30 | 66.32 | 15.98 |
| Prof design & support | 213.72 | 70.29 | 143.43 |
| **Total cost** | **1 994.66** | **573.16** | **1 421.50** |

#### 2.9.5.3 Alternative upgrade of the existing left bank main canal

This long-term alternative to the Right Bank Canal Scheme assumes that two small bulk water schemes are built to supply the four irrigation areas in the vicinity of Trawal, and that as part of one of these schemes, the first 8 km of the existing left bank canal is lined/raised.

To reduce the risk of severe water disruptions due to a failure in the remainder of the left bank main canal (up to Verdeling - 24.6 km), structural improvements will be required within the limitations of access difficulties, the fact that water needs to flow almost continuously and, of course, available budget. This will entail relining the remainder of the left bank main canal at an estimated cost of R 1 436.41 million in 2020 prices. This would provide an alternative to the implementation of the Right Bank Canal Scheme in the long-term.

The capacity of the remainder of the canal will stay as current. It is assumed the consideration of risks to the Lower Olifants River supply area will lead to a decision to upgrade the rest of the left bank canal, but that implementation will take place over a period of 15 years for practical reasons. Undertaking of the canal lining replacement during LORWUA's scheduled downtime is not feasible. It is thus recommended that temporary diversion works, consisting of a 600 m temporary pipeline bypass, be constructed to allow for replacement of the canal lining without interrupting the water supply to farmers. Other measures may include construction work done on different sections at the same time using different teams.

### 2.9.6 Comparison of the two long-term main canal alternatives

#### 2.9.6.1 Comparing Costs

The resulting capital cost of the two developmental scenarios, i.e., two small schemes plus refurbishment of the remainder of the existing left bank main canal versus building a new Right Bank Canal Scheme are as shown in **Table 2-7**.

**Table 2-7: Comparative Capital Costs (R million, 2020 prices, excl. VAT)**

| Main canal long-term alternative | Development Component | Betterment Component | Total Cost |
|---|---|---|---|
| 2 small schemes & upgrading remainder of left bank main canal | R 573.16 | R 1 436.41 | **R 2 009.57** |
| Right Bank Canal Scheme | R 573.16 | R 1 421.50 | **R 1 994.66** |

Purely from a capital cost point of view the Right Bank canal is more cost-effective. However, if it is assumed that, in practice, the rest of the left bank main canal will be upgraded over time, say over 15 years (or longer), whereas the Right Bank Canal Scheme will have to be built over an envisaged 4-year construction period then, on the basis of an economic 8% p.a. discount rate, the Present Value comparison of the "betterment components" is as follows:

**Table 2-8: Present Values of Comparative Costs (R million, 2020 prices, excl. VAT)**

| Main canal long-term alternative | Present Value |
|---|---|
| Right Bank Canal Scheme | R 1 177.05 |
| 2 small schemes and upgrading remainder of left bank main canal | R 819.66 |
| **Difference** | **R 357.39** |

The incremental Present Value cost of implementing the Right Bank Canal Scheme is R 357.4 million. Note that this calculation did not take into consideration additional maintenance costs over the additional fourteen-year period for the left bank canal. Maintenance costs would entail identified short-term and medium-term maintenance of the canal, phased out as the lining/raising or lining of the left bank canal progresses, and lowered maintenance costs thereafter, similar to that of the new right bank canal.

#### 2.9.6.2 Comparing Benefits

An example of what the right bank canal could look like is indicated in **Figure 2-10**.

**Figure 2-10: Vlakfontein Canal example of a new canal**

Compared to additional cost, the significant benefits of implementing the Right Bank Canal Scheme are as follows:

a) The Right Bank Canal will be built to current construction standards, with proper freeboard and additional capacity that allows for intra-month flexibility to meet water requirements and therefore improve production. While this, at first, will only be of immediate benefit for water users up to Verdeling, this presents the opportunity for the rest of the system to benefit later when the secondary canals are upgraded.

b) The Right Bank Canal will be more secure against failure than the re-lined left bank canal. In addition, this security will be achieved earlier.

c) The Right Bank Canal will present an opportunity for a subsequent upgrade of the system downstream, extending the benefit of greater flexibility and additional capacity. This in turn, along with the slightly increased capacity, will allow irrigators to plant a higher percentage of permanent crops, especially during the high summer period, with associated socio-economic benefits.

d) There is greater confidence in the estimation of the Right Bank Canal's construction costs and programme. For the upgrading of the left bank canal, the requirement to keep water flowing while construction takes place makes it a complex exercise, beset with operational difficulties and unforeseen issues that can increase costs and are likely to cause delays.

e) The Right Bank Canal Scheme makes provision to meet the future water requirements such as towns, industries and mines (initially only up to Verdeling, until further canals are upgraded). Upgrading the existing left bank canal does not make provision to meet the future water requirements, especially the potential to eventually increase the supply capacity up to Vredendal.

f) Should the left bank canal be re-lined, new irrigation schemes that rely on the construction of the Right Bank Canal cannot be developed, such as the Klawer Scheme Phase 2, which can be done if the Right Bank Canal Scheme is implemented.

g) There will be significant water savings should the Right Bank Canal be constructed, compared to re-lining the entire left bank main canal. The integrity of the Right Bank Canal will also be better than that of a re-lined left bank canal.

Whilst it is not possible to directly compare all the incremental benefits, which cannot be monetised, with the incremental costs, a strong argument can be made for implementing the Right Bank Canal Scheme. The benefits are described above, but in addition the opportunity to piggy-back on to the project to supply the new development areas is a once-off. If missed, that opportunity will be gone forever.

# 3 Approach and Methodology

## 3.1 Approach

The proposed new right bank canal or alternative left bank canal scenario is a partnership involving the investment of Government funds and commercial investments from private individuals and banks. The project is also aimed at establishing a number of "historically disadvantaged farmers" (HD Farmers) in the proposed new irrigation areas, which can be achieved if the project is introduced.

In the broad approach, the micro- and macro-economic impacts of the proposed construction development and the projected agricultural production are calculated. The approach used is as follows:

- The economic and financial feasibility of the proposed 4 Trawal irrigation areas are separately determined, assuming that the two small supply schemes are constructed and the historically disadvantaged farmers are established. The detailed approach and methodology are discussed in **Chapter 6**.
- The economic and financial feasibility of the new right bank canal will be established.
- The economic and financial feasibility of the alternative left bank canal scenario (2 small schemes and betterment of the current left bank canal) will be established.
- Other costs and benefits of the alternatives will be quantified or described.
- The two scenarios will be compared and a recommendation formulated and explained.

Firstly, a Cost Benefit Analysis (CBA) is used to calculate the micro-economic feasibility of the specific project by comparing the costs with the benefits in order to establish the financial and economic viability of a proposed project. The costs identified are the following:

- Construction Costs:
  - Construction Costs of the Trawal irrigation development;
  - Construction Costs for both the scenarios for the proposed betterment.
- On "farm" development costs – Irrigation equipment, buildings, tractors, etc.;
- LORWUA – Maintenance Costs for both options;
- LORWUA – Operational Costs for both options;
- Social Costs if any resettlement is necessary for any of the scenarios;

- Environmental costs; and
- Canal Break Costs for Urban and Irrigation users.

The benefits are the Net Farm Income of the new recommended areas (Gross Income – (Operational Costs + Fixed Costs + Losses suffered by canal breaks and droughts)). The benefit includes increases in the long-term production yield of existing areas due to the higher assurance of uninterrupted supply of water in the increased capacity right bank canal.

Secondly, a Social Accounting Matrix (SAM) based partial general econometric model is applied to estimate the social and macro-economic impacts of the construction phase and the operational phase. The projected positive social impacts will mostly take place in the two local municipalities, namely, Cederberg and Matzikama, such as job creation and household income. The negative impact on urban users due to canal breaks will also be reduced for the Matzikama local municipality. The positive economic impacts will be shared by the local municipalities, the West Coast District Municipality, and the National Government by additional Fiscal income and improvement of the Balance of Payments resulting from the estimated increased exports.

## 3.2 Economic Models

The two economic models used in the analysis are presented in the following two sections.

### 3.2.1 Cost Benefit Analysis

The Cost Benefit Analysis (CBA) approach is used to determine the financial and economic feasibility of the proposed new right bank canal option and the betterment of the existing canal.

The **Financial CBA** is performed in two models: firstly, as a constant 2020 price model, and secondly as a current price model that incorporates a projection of the future inflation rate. Financial viability is measured in terms of the following parameters and decision criteria:

- Net Present Value (NPV) >0, with the relevant discount rates that differ for the two models.
- Internal Rate of Return (IRR) > Discount Rate; and
- Benefit Cost Ratio (BCR) >1.

The **Economic CBA** is performed with constant prices using economic[5] “prices” that eliminate market price distortions. These economic prices are often referred to as “shadow prices”. The same parameters and decision criteria are used as in the Financial CBA to determine economic feasibility.

[5] Economic Prices – also called Market or Shadow prices.

### 3.2.2 Socio-Economic Impact Analysis

A SAM is a comprehensive, economy-wide database that contains information about the flow of resources that takes place between the different economic agents that exist within an economy (i.e., business enterprises, households, government, etc.) during a given period of time – usually one calendar year. Thus, a SAM is a matrix that incorporates the inter-relationships that exist between the various economic agents in the economy, including the distribution of income and expenditure amongst household groups.

The development of the SAM is very significant as it provides a framework in which the activities of all economic agents are accentuated and prominently distinguished. By combining these agents into meaningful groups, the SAM makes it possible to distinguish clearly between groups, to research the effects of interaction between groups, and to measure the economic welfare of each group.

Because of its fine disaggregation of private household expenditure into relatively homogenous socio-economic categories that are recognizable for policy purposes, the SAM, has been used to explore issues related to income distribution.

## 3.3 Methodology

The following sections discuss the methodology to be followed in the two economic models.

### 3.3.1 Cost Benefit Analysis

CBA appraisal of a project must indicate the extent to which a project is viable in its totality. Where a project is identified as not being viable, there is a significant possibility that it will not be sustainable in the long run.

CBA forms the basis of the investment appraisal process and is considered to be the most acceptable tool for ascertaining the financial and economic viability of **public sector** and **public/private** sector projects. The CBA method provides a logical framework by means of which development programmes can be evaluated, serving as an aid in the decision-making process.

CBA differs from cash-flow analysis in that cash-flow analysis looks at the availability of cash to repay a specific loan, whereas CBA looks at the lifespan of the project. Furthermore, it is also important to note that a CBA is done in financial values, as well as in terms of economic values. The Financial CBA looks at the viability of the project from its owners' and investors' perspective; whereas the Economic CBA looks at the viability of the project from the perspective of the community at large where it takes into account externalities such as pollution, noise, congestion, environment, etc.

Economic CBA evaluates projects at prices that reflect the relative scarcity of inputs and outputs, known as shadow prices. This economic analysis follows the analysis of the source and application of productive funds, which is done at market prices. In the economic analysis, prices represent opportunity costs, and reflect the actual economic value of inputs and outputs. The opportunity cost is the value of the best alternative application of an input or an output of the project.

The principle of CBA can be described as the comparison of costs and benefits over time. In the case of the construction of the right bank canal and possible option of the 'betterment' project, the time period is 30-years. The only factor that complicates the technique is the discounting of costs and benefits back to present values. The following standard CBA criteria were used in the evaluation:

- Net present value (NPV);
- Internal rate of rate (IRR); and
- Benefit cost ratio (BCR).

#### 3.3.1.1 Parameters

The detailed definition of these standard evaluation criteria is explained in the following sections.

##### 3.3.1.1.1 Net Present Value (NPV)

According to this method, the difference between the benefits and costs (the net benefit) in a specified future year is discounted to the present using the appropriate discount rate. The discounted sum of all these net benefits over the economic life of a project is defined as the net present value (NPV).

The following explains the choice of discount rates:

- Constant price Financial CBA = 8%. This is the accepted real discount rate in South Africa[6].
- Current price Financial CBA = 11.28 %. The current price includes the impact of inflation over time on prices. The nominal discount rate of 11.54% is made up of the current average prime[7] lending rate of 7% and the risk premium rate of 4%, making provision for future interest rate increases. It is calculated as follows (((1+0.07) x (1+0.04))-1) x100 = 11.28%. Obviously, the rate will not always be constant as it depends on prime lending rate as well as associated risk of the specific project.
- Economic CBA = 8%. Accepted rate in South Africa.

[6] Water Research Commission: A Manual for Cost Benefit Analysis in South Africa with Specific Reference to Water Resource Development Third Edition – TT598/14 – Page 72.
[7] The RSA prime lending rate during 2020 was 7.25%, but in 2021 it changed to the present 7%.

The discounted sum of all these net benefits over the economic life of a project is defined as the net present value (NPV). In terms of the terminology set out above the NPV is equal to the value calculated according to the following method:

$$\sum_{t=1}^{N}\left(\frac{b_t}{(1+i)^t}-\frac{c_t}{(1+i)^t}\right)$$

where $b_t$ = benefit in year $t$

$c_t$ = cost in year $t$

$i$ = discount rate

The criterion for the acceptance of a project is that the NPV must be positive; in other words, funds will be voted for a project only if the analysis produces a positive net present value. Where a choice has to be made between mutually exclusive projects, the project with the highest NPV will be chosen, since it maximises the net benefit to the community.

#### 3.3.1.1.2 Internal Rate of Return (IRR)

The internal rate of return (IRR) is the discount rate at which the present values of costs and benefits are equal. It is therefore the value of the discount rate that satisfies the following equation:

$$\sum_{t=1}^{N}\left(\frac{b_t}{(1+i)^t}-\frac{c_t}{(1+i)^t}\right)=0$$

where $b_t$ = benefit in year $t$

$c_t$ = cost in year $t$

Only projects with an IRR higher than the applicable discount rate, which forms a lower limit, will be considered for funding. The IRR must be carefully handled because there are situations in which the mathematical solution of the above equation is not unique. This happens when the stream of net benefits over the assessment period changes its sign (positive or negative) more than once.

#### 3.3.1.1.3 Benefit Cost Ratio (BCR)

The discounted benefit-cost ratio (BCR) is the ratio of the present value of the benefits relative to the present value of the costs, as indicated in the following equation:

$$BCR = \frac{\sum_{t=1}^{N} \frac{b_t}{(1+i)^t}}{\sum_{t=1}^{N} \frac{c_t}{(1+i)^t}}$$

where $b_t =$ benefit in year $t$

$c_t =$ cost in year $t$

$i =$ discount rate

A project is potentially worthwhile if it's BCR is greater than 1. This means that the present value (PV) of benefits exceeds the PV of costs. In applying this decision rule, if alternatives are mutually exclusive, the alternative with the highest BCR would be chosen.

The NPV, IRR and BCR criteria are not the only discounting approaches used in CBA. There is also the net discounted end value, the net benefit-investment ratio and the yearly value methods. The first three are, however, theoretically well founded and are the ones most commonly used in practice. As such, these three criteria are applied in respect of every section of the project analysed.

### 3.3.2 Historical Disadvantaged Farmers Establishment Cash Flow

The four new irrigation areas in Trawal have been identified as locations for the establishment of historically disadvantaged farmers. However, the Trawal area is not the only new area that will benefit if the new canal option is selected and it is accepted that the other identified areas will also be utilised for the establishment of new historically disadvantaged farmers. Experienced commercial farmers will be able to source capital from commercial banks and other institutions; however, these new farmers will not have access to these institutions, and it will be necessary to determine the capital necessary for their establishment.

The estimated capital necessary will be calculated by constructing a "Cash Flow" model that will determine the estimated annual support required over a period of time. The model will be based on the structure of the current price Financial Cost Benefit Analysis model. However, certain additional costs will be added that are not part of a CBA model, such as interest on outstanding loans and other cash support.

### 3.3.3 Socio-Economic Impact Analysis

The partial general econometric model used to calculate the socio-economic impacts of the construction and operational phases are based on the multipliers obtained from the Western Cape Provincial SAM[8]. The development of a SAM is very significant as it provides a framework in which the activities of all economic agents are accentuated and prominently distinguished. By combining these agents into meaningful groups, the SAM makes it possible to distinguish clearly between groups, to research the effects of interaction between groups, and to measure the economic welfare of each group.

There are two key reasons for compiling a SAM:

- Firstly, a SAM provides a framework for organizing information about the economic and social structure of a particular geographical entity (i.e., a country, region or province) for a particular time period (usually one calendar year); and
- Secondly, it provides a database that can be used by any one of a number of different macro-economic modelling tools for evaluating the impact of different economic decisions and/or economic development programmes.

Since a SAM is a comprehensive, disaggregated, consistent, and complete data system of economic entities that captures the interdependence that exists within a socio-economic system, it can be used as a conceptual framework for exploring the impact of exogenous changes in variables such as exports, certain categories of government expenditure, and investment on the entire interdependent socio-economic system.

#### 3.3.3.1 Impacts of the proposed construction and agricultural development

During both the construction and production phases, the investment of capital will have an impact on the economy. In the case of the construction phase, the socio-economic impact will be for a limited period of time as the proposed construction period is relative short. For the proposed investment project, capital spending during the construction phase has two elements, namely, the spending by the Government on the canal system, and the spending on new farms in terms of buildings, irrigation equipment and farming implements by both the HD Farmer and commercial farmers.

In the case of the operational phase, the production of agricultural produce will take place over a long period of time. In the case of this study the period of the operational phase is set at 30 years.

[8] The Western Cape SAM was constructed in 2016, based on 2015 prices. It is currently being updated to 2020 structures and prices.

##### 3.3.3.1.1 Direct Impacts

The "direct impacts" refer to the economic impacts that are realized from the improvement in the availability of water on the economic efficiency of the future production of the different products and operational activities (enhanced handling of greater tonnages of various commodities).

##### 3.3.3.1.2 Indirect Impacts

"Indirect impacts" refer to the effects of the project on all other industries that supply inputs during the construction and operational phases. In terms of the construction phase, such inputs include cement, bricks, steel, electrical and mechanical components, etc. With regard to the operational phase, inputs include products such as electricity, fuel, fertilizer and chemicals. It is important to note that indirect impacts also include the materials, which other firms would have to supply to the industries that supply products and services directly to the project.

##### 3.3.3.1.3 Induced Impacts

The induced impacts are the effects of paying salaries and wages to people who are employed in the first instance by the company responsible for the construction of the project; and, secondly, the salaries and wages paid by the input suppliers. These additional salaries and wages create a multiplier effect through their increase in the demand for consumable goods that need to be supplied by various economic sectors throughout the economy.

#### 3.3.3.2 Social and Macro-economic Indicators

This section presents information regarding the standard indicators used to measure the macro-economic and social impacts of the various aspects of the construction of the canal and future produce production. These indicators include:

- Gross Domestic Production (GDP) - value added to the national economy;
- Capital utilization (procurement of machinery, transport equipment, buildings and other social and economic infrastructure);
- Fiscal Impact (contributions to Government Revenue);
- Improvement of the Balance of Payments because of the positive impact of exports; and
- Effectiveness Criteria (the GDP/Capital ratio and the Labour/Capital ratio), where effectiveness indicators of projects are measured and compared to national and sectoral effectiveness indicators to demonstrate how efficiently a particular project employs the factors of production to arrive at a certain output.

The following socio-economic indicators are also measured:

- Employment creation (creation of new jobs for skilled, semi-skilled, and unskilled workers);

- Income generated for low-, medium-, and high-income households; where incremental income available to low-income households is used as a specific measure of poverty alleviation; and
- Social Impact of Fiscal Payments.

## 3.4 Construction of the Models

This section explains the overall process used in the construction and application of the CBA and Macro-economic Impact Assessment (MEIA) modelling systems to evaluate the economic and financial viability of the project, as well as estimating the socio-economic impacts of construction and operational phases.

### 3.4.1 Construction of the CBA model

The three CBA models applied, to evaluate the feasibility of the new Trawal irrigation areas with the two development scenarios, were constructed in both financial and economic terms, where the CBA model consists of the following sections:

A. Costs Sections with the following sub-sections:
   a) Canal Construction Costs.
   b) On farm establishment costs for the new farmers in both options, including irrigation systems, tractors and machinery, and buildings.
   c) On farm production costs.
   d) Canal Maintenance Costs by Government and LORWUA for both options, based on accepted annual percentage of the capital expenditure.
   e) LORWUA Operational Costs for both options.
   f) Social Costs, if resettlement costs are an issue.
   g) Environmental Costs.

B. Benefit Section:
   a) Two small schemes in the Trawal Area.
   b) Right Bank Canal with all the additional new irrigation areas, as well as benefits accrued to existing irrigators from the increase in Assurance of Supply of water.
   c) The betterment of the Left Bank Canal and the additional new irrigation areas.

### 3.4.2 Financial CBA

The financial CBA is constructed in two formats namely:

- Constant Price CBA with a discount rate of 8%; and

- Current (Real or Nominal) Price CBA with a discount rate of 11.28% and an inflation rate of 4.5%, within the 3% to 6% variable rate used by the South African Reserve Bank.

The real discount rate of 11.28% is made up of the current prime lending rate of 7% and the risk premium rate of 4%. The following formula was used for the calculation of the real nominal discount rate:

- Real Nominal discount rate calculation: (((1+0.07) *(1+0.04)-1) x100) = 11.28%

The CBA model has also been adapted to accommodate the reduced projected impact of a long drought as experienced in the recent past, the impact of a canal break if necessary, and the possibility of specific production cost items, such as electricity experiencing price increases above the assumed 4.5% inflation rate.

The construction phase for the two small schemes is estimated to be a 3-year period and for the right bank canal a 4-year period. For the betterment section of the left bank canal a 15-year period is assumed and is phased in as such in all models.

### 3.4.3 Economic CBA

In the case of the economic CBA, the different cost items are converted to economic prices. In the literature on CBA, the term "Shadow or Market Prices" is also applied for certain economic prices.

Market Prices are those prices at which products and services trade, irrespective of the level of interference in the market. In theory market prices are indeed manifestations of the willingness to pay the asking price for a product or service. On the other hand, shadow prices are the opportunity costs of products and services when the market price, for whatever reason, does not reflect these costs in full. An example is a shadow wage for labour where the minimum wage is fixed, and market forces are unable to lower wages below this fixed minimum.

The publication "*A Manual for Cost Benefit Analysis in South Africa with Specific Reference to Water Resource Development TT598/14*" published by the Water Research Commission contains a list with the appropriate multipliers to convert the market prices to "Shadow Prices". In this study, all of the necessary items were converted to shadow prices by applying the applicable multiplier found in this publication.

## 3.5 Populating the Model

**Table 3-1** presents the individual items used in the CBA models for both scenarios.

### Table 3-1: Detail Items Accommodated in the CBA Models

| No | Cost type | Items |
|---|---|---|
| **1** | **Capital Expenditure – RB Canal and System Betterment** | |
| | • Pipelines | • Data provided by Zutari |
| | • Pump Stations | |
| | • Balancing Reservoirs | |
| | • Canal | |
| | • Farm Dams | |
| | • Prof. Design and Support | |
| | **Capital Expenditure – Establishing New Farmers** | |
| | • Irrigation Equipment and Supply of Bulk Water | • This an estimation of the capital invested on the irrigated areas |
| | • Farming Equipment | • With an addition of either 2 239 (Trawal areas) or 3 640 hectares (all areas below Bulshoek Weir) to be irrigated, a number of new implements will be necessary |
| | • Buildings | • As new farms will be established new buildings will be necessary |
| | **Total Capital Expenditure** | |
| | | |
| **2** | **Operating Expenditure** | |
| | • Agriculture | • Seed, grape plants, etc. |
| | • Mining | |
| | • Fuel | • Diesel and petroleum as estimated |
| | • Fertilizer | • Estimation of the annual fertilizer costs |
| | • Pharmaceuticals | • Weed and insect control |
| | • Other | |
| | • Electricity | |
| | • Water | |
| | • Construction | • Any annual construction and maintenance costs |
| | • Trade and accommodation | |
| | • Transport and communication | • Transport and telephonic costs |
| | • Financial and business services | • Banking, insurance and accounting costs |
| | • Community services | |
| | • Salaries and wages: Skilled | |
| | • Salaries and wages: Semi-Skilled | |
| | • Salaries and wages: Unskilled | |
| | **Total Operating Expenditure** | |
| | | |

| No | Cost type | Items |
|---|---|---|
| 3 | **LORWUA[9] Costs - Operational and Maintenance Costs** | |
| | | |
| 4 | **Externalities** | • Any costs that are not directly involved with the farming activities |
| | | |
| 5 | **Social Costs** | • Possible relocation costs and other social costs because of the construction of the canal or the 'betterment' process. |
| | | |
| 6 | **Environmental Costs** | • In the Financial CBA only direct costs (such as salaries) are included. In the Economic Model values such as those representing Biodiversity costs should be included. |
| | | |
| | **TOTAL COSTS** | |
| | | |
| | **BENEFITS** | |
| | | |
| | • New Production Areas | • Estimation annual income |
| | • Existing Production | • Production – Improvement in yields due to increased Assurance of Reliable Water Supply by limiting the restrictions because of inadequate storage in Clanwilliam Dam or restrictive canal flow capacity. |
| 7 | **Revenue from Agriculture Production** | |

## 3.6 Construction of the Socio-Economic Model

A partial general macro-economic equilibrium analysis model has been constructed to quantify the socio-economic impacts of the different sections of the canal project. The 2015 SAM for the Western Cape Province compiled by Conningarth Economists, which is based on National Accounts figures supplied by Reserve Bank, Statistics South Africa and the World Bank, provides the basis for this partial general economic equilibrium analysis.

For the purposes of conducting the partial general macro-economic equilibrium analysis, the SAM has been converted into a Macro-economic Impact Assessment Model (MEIAM). This is a

[9] LORWUA – Lower Olifants River Water User Association

detailed econometric model that is generally used for purposes of measuring the macro-economic and social impacts resulting from a specific project.

**Figure 3-1** indicates graphically the direct, indirect and induced macro-economic impacts stemming from the construction and operation of the proposed canal construction.

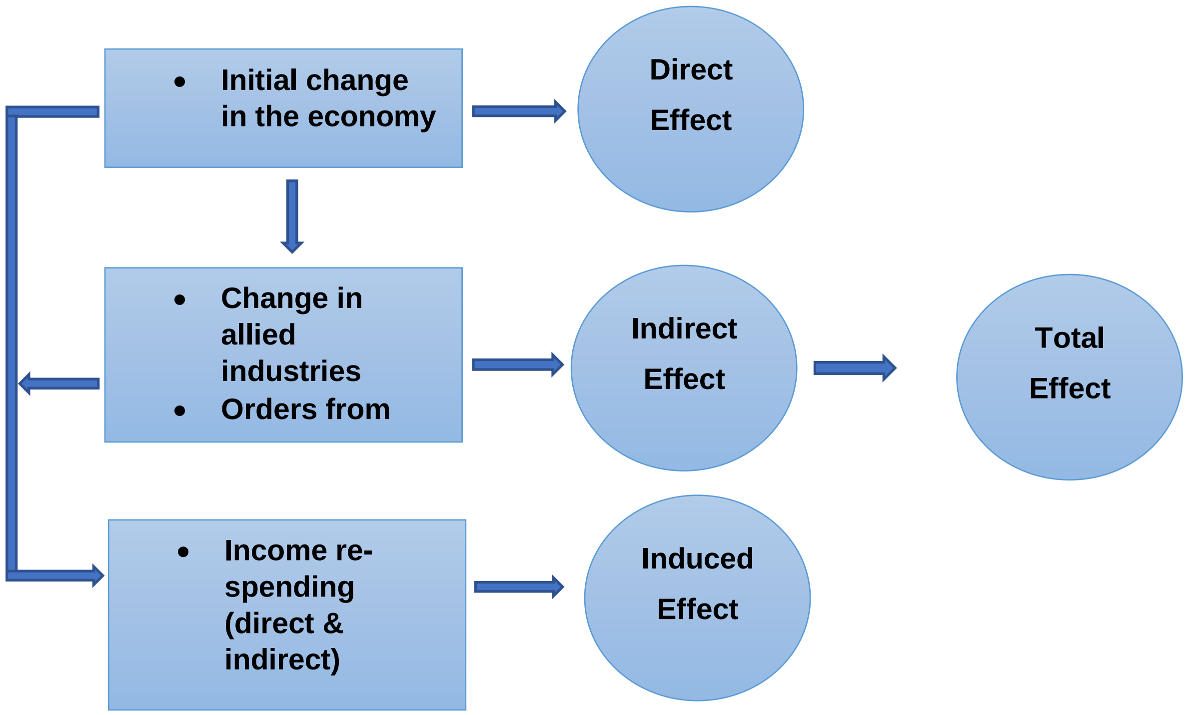


**Figure 3-1: Illustration of Macro-Economic Model**

# 4 Product Budgets and the Impact of Canal Breaks

This section of the report serves to estimate the potential financial and economic impact of breakages of the main canal resulting in a disruption of water supply to users in the LORWUA scheme. The possible impact on the urban and non-agricultural water users from the canal is discussed in **Chapter 5**.

## 4.1 Methodology and Approach

### 4.1.1 Background to Canal Breaks

The first aspect of this exercise involved the establishment of possible canal break scenarios. Information in this regard was gathered primarily from Zutari and LORWUA. The scenarios were developed taking into consideration historic breakages and LORWUA's knowledge and experience of the canal and known risks. The historic canal breaks of the main canal between the Bulshoek Weir and Verdeling, where the canal splits, are detailed in **Table 4-1**.

**Table 4-1: Historic Canal Breaks**

| Date of break | Date flow restored | Days to restore flow |
|---|---|---|
| 18 Jan 2017 | 2 Feb 2017 | 15 days |
| 31 Dec 2019 | 3 Jan 2020 | 3 days |

*Source: LORWUA*

The period of peak flow is mid-November to mid-February and the risk and likelihood of canal breaks are greatest during this period, which also coincides with the historic breaks of this section of the canal detailed above. Further to this, the likelihood of canal breaks and the potential severity of breaks will increase over time if the old left bank canal is not replaced, as the condition of the canal continues to deteriorate. Key factors which influence the length of time taken to repair a break are the accessibility of the broken stretch of canal and the length of canal affected. Many sections of the old left bank canal are not accessible by road and if one of these sections were to break, an access road to reach the broken section of canal would need to be built before repair of the canal can commence. LORWUA estimates that a large canal break in an inaccessible area, could take up to 3 months to repair and restore water flow.

Based on input from LORWUA, two scenarios have been modelled in this exercise, the first being a 30-day disruption in water supply, which is considered a likely scenario if the canal is not rebuilt, and a worst case scenario of a 3 month disruption in water supply due to a large break in an inaccessible area. It must be noted that a break in water supply of the main canal between the Bulshoek Weir and the Verdeling split will result in a break in water supply to the entire LORWUA scheme, as this section of canal supplies all the irrigators in the area. It must be noted that in the case of a canal break, irrigating directly from the Olifants River is not a viable alternative during the summer as the water is not suitable for irrigation due to high salinity and can only be used if desalinated or mixed with canal water.

### 4.1.2 Potential Impact on Agricultural Production

The crops grown in the LORWUA area are summarised in **Table 4-2** below.

**Table 4-2: Crop Production Distribution in the Lower Olifants River**

| Crop | | Hectares |
|---|---|---|
| Grapes | Wine | 8 489 |
| | Raisins | 1 300 |
| | Table grapes | 880 |
| Tomatoes | Factory | 350 |
| | Market | 166 |
| | Tunnels | 20 |
| Vegetables | Open | 615 |
| | Under cover | 70 |
| Seed | | 105 |
| Peaches | | 50 |
| Pecan nuts | | 50 |
| Other | | 406 |
| **Total** | | **12 501** |

The 'official' irrigation area is about 9 500 hectares, but because of improved management and modern irrigation technology it was possible for the farmers to expand the irrigation area to an average of 12 501[10] hectares. This number of hectares also differs from year to year depending

[10] Different sources provide different hectares between 10 000 and 14 000.

on the availability of the water, which again depends on possible restrictions that can be introduced.

Nearly 85% of the LORWUA area is planted with grapes (mostly wine grapes, followed by raisins and table grapes). The next biggest crops by planted area are vegetables (5.5%) and tomatoes (4.3%). The seed production is mainly brassicas grown in the winter for Syngenta.

The potential economic impact of water breaks at farm level were estimated based on input from experienced viticulturists and industry players in the area. The analysis and estimates were based on a percentage loss of income due to the effect of a break in irrigation on both the yield and quality. It must be noted that the estimated losses were not determined by scientific research, which would be a significant undertaking not provided for under the scope and timelines of this study, but rather through high level estimates provide by experienced industry players.

However, the 2017/18 drought, where the initial LORWUA water quota was only 1 700 $m^3$/ha, as opposed to the preceding 10-year average of 6 460 $m^3$/ha, provided a valuable data set with respect to the impact of reduced irrigation on crop yields. It must however be noted that the impact of a significant, unscheduled water cut is likely to be significantly greater than the impact of the drought, as the farmers were able to plan ahead in the drought to make optimal use of the limited water available, which would not be the case during a complete water cut resulting from a canal break.

The yield/harvest losses on the key perennial crops resulting from the 2017 drought are illustrated in **Table 4-3** against 2016 as a baseline.

**Table 4-3: Estimated Impact of the recent drought on production**

| Crops | Baseline | Drought Year | | Post Drought | | | |
|---|---|---|---|---|---|---|---|
| | 2016/17 | 2017/18 | | 2018/19 | | 2019/20 | |
| | Yield | Yield | % Change | Yield | % Change | Yield | % Change |
| Wine grapes (t/ha) | 22.6 | 19.8 | -12% | 17.2 | -24% | 23.7 | 5% |
| Raisins (total tonnes) | 7 800 | 5 800 | -26% | 6 500 | -17% | 11 000 | 41% |
| Table grapes (total 4,5kg export ctns) | 3 968 073 | 2 802 436 | -29% | 2 366 503 | -40% | 3 319 516 | -16% |

*Source: Wine cellar, Raisins SA and SATI*

What is clear from the above is that the drought resulted in a drop in yield for the two consecutive seasons. In the case of wine grapes and table grapes, the yield reduction in the year following the drought was greater than the loss of yield during the drought year. The key reason for this is that during the second half of the summer, deciduous crops translocate carbohydrates from the leaves to the roots prior to dormancy to serve as an energy store, which is vital for initial growth the following season.

### 4.1.3 Impact of Water Restrictions and Canal Breaks on Grapes

The impact of a cut in the water quota will differ depending on when the cut occurs during the season. Key phases of a grape vine development are flowering and fruit set, which takes place in October and November, followed by fruit growth and then colour formation. The harvest of table grapes commences towards the end of December, while the wine grape harvest starts in January and is completed around early April. As mentioned, the mostly likely period for a canal break is during the canals peak flow period from mid-November to mid-February. The impact of a canal break on the vines during this period would have a dramatic impact on the crops. The majority of farmers in the LORWUA scheme do not have large storage dams and the small farm balancing dams only contain sufficient water for a few days' irrigation. Nearly 100% of the moisture held in the soil will be depleted within 3 to 8 days during mid-summer, depending on the soil type. The plants will therefore start showing severe water stress for any cut in water supply, lasting longer than a week. Depending on the plant's development phase, severe water stress will result in a combination of the following symptoms:

- Flower drop;
- Fruit drop;
- Small fruit;
- Low sugar content;
- Leaf drop;
- Sunburn on fruit;
- Dry stems on bunches (not suitable for export markets on table grapes);
- Loose berries (not suitable for export on table grapes); and
- Low energy reserves stored in roots prior to dormancy.

Three viticulturists from the area were consulted regarding the potential impact of a 30 day and 3 month water cut respectively starting between November and February and their range of answers is presented in **Table 4-4**.

**Table 4-4: Estimate Percentage Yield Loss due to Canal Breaks**

| Break period | Year 1 loss | Year 2 loss |
|---|---|---|
| 30 day water break | 50-100% | 20-35% |
| 3 month water break | 50-100% | 35-40% |

The impact on table grapes will be more severe than on wine grapes and raisins due to the more stringent quality requirements for table grapes. Based on the above input from viticulturists, the following assumptions (**Table 4-5**), erring on the conservative side, were used to estimate the potential economic impact of a canal break.

**Table 4-5: Estimated Yield Loss for Grape Products due to Canal Breaks**

| Break period | Wine Grapes & Raisins | | Table Grapes | |
|---|---|---|---|---|
| | Year 1 loss | Year 2 loss | Year 1 loss | Year 2 loss |
| 30 day water break | 50% | 20% | 55% | 25% |
| 3 month water break | 60% | 40% | 65% | 45% |

For the purpose of analysis, in the case of a water cut, certain elements of the production cost are considered sunk costs, while other costs such as labour for harvesting and packing costs, have been reduced accordingly. The income, cost and yield figures were gathered from Vinpro, cellars, Raisins SA and SATI, and the respective crop budgets are attached as **Annexure A**.

### 4.1.4 Impact of a Water Break on Annual Crops

Given that it is assumed that a canal break is most likely during the period of peak flow in summer, it is assumed for the analysis that it will not impact annual crops grown in winter, which includes the seed production (mainly brassicas). For any summer crop, which is already planted and where harvest has not yet begun, both a 30 day and 3 month water break will result in the crop dying resulting in a 100% yield loss. Given that the bulk of the tomatoes are planted between October and January (processing Oct-Nov and fresh Oct-Jan) and that they take 14-15 weeks to come into production, any break in water of 30 days or longer between November and mid-January will lead to a 100% crop loss, as the entire crop will die before harvest commences. In the case of a break at the tail end of the period of peak canal flow from mid-January to mid-February, harvest will have commenced on the earliest October plantings. However, for the purpose of this analysis it is assumed that the canal break takes place between November and mid-January resulting in a total crop loss.

An earlier study in the LORWUA area indicated that common summer vegetable crops grown in the area include potatoes, sweet corn, winter melons, watermelons, sweet potatoes and butternut, with the main planting season running from October to December. For the purpose of this exercise, a generic summer vegetable crop budget was used based on the average income and production costs of butternut, potato, sweet potato and watermelons. Given that some of these crops come into production quicker than tomatoes, it was assumed that October plantings would suffer 100% loss in the case of a water cut during the peak flow period, whereas all plantings after November would suffer 93% loss.

As with grapes, in the case of tomatoes and other vegetable crops it was considered that some of the production costs are sunk costs and other costs, such as harvest and packing costs, have been reduced or removed accordingly. The crop budgets for annual vegetable crops were obtained from the Western Cape Department of Agriculture and growers in the area, and the respective budgets are included as **Annexure A**.

## 4.2 Summary of Losses at Farm Level

The summarised estimates of the potential financial losses at farm level resulting from canal breaks are presented in **Table 4-6**. It is estimated that the total loss of income at farm level over two years, resulting from a canal break, could be in the region of R 1.2 billion for a 30 day water cut and R 1.5 billion for a 3 month water cut. At earnings before interest, tax, depreciations and amortization (EBITDA) level, the losses are estimated at R 674 million and R 865 million respectively.

These losses are incorporated into the relevant CBA models by lower than average crop yields and the accompanying financial impact on the farmers.

## Table 4-6: Estimated Potential Losses in Case of Water Breaks

**Potential Losses Resulting from Canal Breaks Between Bulshoek Weir and the Canal Split**

| | Wine Grapes | Raisins | Table Grapes | Tomatoes - Processing | Tomatoes - Fresh | Vegetables/other - summer | Vegetables/other - winter | Total |
|---|---|---|---|---|---|---|---|---|
| Total Area (ha) | 8,489 | 1,300 | 880 | 350 | 186 | 1,054 | 242 | **12,501** |
| **Baseline** | | | | | | | | |
| Farm gate income | 464,687,860 | 168,844,000 | 383,240,000 | 58,852,500 | 81,840,000 | 152,524,999 | 32,477,846 | **1,342,467,205** |
| Cash expenses | 273,914,563 | 68,803,443 | 326,100,720 | 40,999,014 | 65,325,968 | 119,739,151 | 21,145,959 | **916,028,817** |
| EBITDA margin | 190,773,297 | 100,040,557 | 57,139,280 | 17,853,486 | 16,514,032 | 32,785,848 | 11,331,887 | **426,438,387** |
| **30 day water break** | | | | | | | | |
| Year 1 | -50% | -50% | -55% | -100% | -100% | -93% | N/A | |
| Farm gate income | 232,343,930 | 84,422,000 | 172,458,000 | - | - | 11,439,375 | | **500,663,305** |
| Cash expenses | 231,753,945 | 55,714,807 | 208,676,543 | 26,896,070 | 23,633,233 | 83,465,546 | | **630,140,143** |
| EBITDA margin | 589,986 | 28,707,193 | - 36,218,543 | (26,896,070) | - 23,633,233 | - 72,026,171 | - | **129,476,838** |
| Year 2 | -20% | -20% | -25% | N/A | N/A | N/A | N/A | |
| Farm gate income | 371,750,288 | 135,075,200 | 287,430,000 | | | | | **794,255,488** |
| Cash expenses | 257,050,316 | 63,567,989 | 272,726,094 | | | | | **593,344,398** |
| EBITDA margin | 114,699,972 | 71,507,211 | 14,703,906 | | | | | **200,911,090** |
| **3 month water break** | | | | | | | | |
| Year 1 | -60% | -60% | -65% | -100% | -100% | -100% | N/A | |
| Farm gate income | 185,875,144 | 67,537,600 | 134,134,000 | - | - | 11,439,375 | | **398,986,119** |
| Cash expenses | 223,321,821 | 53,097,080 | 187,326,692 | 10,642,323 | 23,633,233 | 83,118,432 | | **581,139,581** |
| EBITDA margin | - 37,446,677 | 14,440,520 | - 53,192,692 | - 10,642,323 | - 23,633,233 | - 71,679,057 | - | **182,153,462** |
| Year 2 | -40% | -40% | -45% | N/A | N/A | N/A | N/A | |
| Farm gate income | 278,812,716 | 101,306,400 | 210,782,000 | | | | | **590,901,116** |
| Cash expenses | 240,186,068 | 58,332,535 | 230,026,393 | | | | | **528,544,996** |
| EBITDA margin | 38,626,648 | 42,973,865 | - 19,244,393 | | | | | **62,356,120** |
| **Total variance between baseline and water break scenarios (year 1 & 2 losses combined - opportunity cost at farm level of not building the new canal)** | | | | | | | | |
| 30 day water break | | | | | | | | |
| Farm gate income | (325,281,502) | (118,190,800) | (306,592,000) | (117,705,000) | | (293,610,623) | (64,955,692) | **(1,226,335,616)** |
| EBITDA margin | (266,256,636) | (99,866,710) | (135,793,196) | (44,749,556) | | (104,812,019) | (22,663,774) | **(674,141,892)** |
| 3 month water break | | | | | | | | |
| Farm gate income | (464,687,860) | (168,844,000) | (421,564,000) | (117,705,000) | | (293,610,623) | (64,955,692) | **(1,531,367,174)** |
| EBITDA margin | (380,366,623) | (142,666,729) | (186,715,645) | (28,495,809) | | (104,464,905) | (22,663,774) | **(865,373,486)** |

# 5 Social and Economic Conditions in the Lower Olifants River Area

The proposed construction work and the possible future expansion of irrigation agricultural production will all take place within the domains of the Matzikama Local Municipality (MLM) and the Cederberg Local Municipality (CLM), which are both part of the West Coast District Municipality, and each of which consists of a very large area, including a number of towns and villages.

The economic impact of the two development scenarios, including betterment of the existing main canal will not take place in a vacuum, but will create opportunities in the area. The purpose of this section is to establish the level of social and economic development of the area, and to highlight the need for development in the area. A further purpose is to highlight the impact of canal breaks, which not only impact on farmers, but can also lead to water shortages in the towns, and reduced spending by the producers and workers. A large number of the farm workers are “temporary” and they only receive wages if they work. Therefore, if there are any canal breaks it can be accepted that they will not receive any payments and the commercial sector will experience a decline in spending.

## 5.1 Cederberg Local Municipality

**Table 5-1** presents the number of towns and villages in the Cederberg Local Municipality (CLM), as well as the estimated 2020 population, which is based on a CLM Socio-economic Profile 2018, as published by the Western Cape Provincial Government and updated by Conningarth Economists. The publication provides an estimated population growth up until 2020.

**Table 5-1: Estimated 2020 Inland Population of the Cederberg Local Municipality**

| Town or Village | 2020 Estimated Population |
|---|---|
| Citrusdal (Rural Area) | 11 869 |
| Citrusdal (Town) | 8 737 |
| Clanwilliam | 9 431 |
| Graafwater | 10 414 |
| Wupperthal | 8 931 |
| **Total** | **49 382** |

*Source: Statistics South Africa and updated by Conningarth Economists*

It should be noted that the total in **Table 5-1** excludes the small coastal towns of Elands Bay, Lamberts Bay and Leipoldtville, which have a total estimated population of less than 10 000.

The Clanwilliam town and surrounding area will not benefit a lot from the proposed two development scenarios evaluated, as the construction will be below the Bulshoek Weir and only a small area will be developed in the domain of the CLM. No urban water use below the Bulshoek Weir will be in the domain of CLM.

### 5.1.1 Social Environment

The aim of this section is to provide a summary of the current social environment in the area where the proposed construction will take place and the reduction of the impact of the canal breaks.

In terms of employment, the economic sectors that contributed the most to Cederberg's employment are; agriculture, forestry and fishing (42.54%); the wholesale and retail trade, catering and accommodation (15.08 %); and the community, social and personal services (10.01%). Overall, between 2005 and 2020, all sectors contributed to growth in job creation, except for the mining and quarrying sector, the agriculture sector, and the forestry and fishing sector, which jointly shed 80 jobs over the period.

Employment needs within the agriculture sector are volatile due to constant changes in minimum wages and labour legislation, as well as production volumes and producer prices. The main agricultural activities are irrigation, "rooibos" tea, and livestock. This sector is characterised by seasonal (temporary) labour needs that make job creation in some years unsustainable. As the agriculture sector contributes the most to employment in the CLM, many households are dependent on this sector, which highlights the importance of sustainable job creation within this sector.

**Table 5-2** presents the fulltime job distribution throughout the district. It is based on 2018 numbers determined in a 2019 research exercise undertaken by Quantec. There are no more recent numbers available.

**Table 5-2: Contribution of the different Economic Sectors to Permanent Employment in Cederberg Local Municipality**

| Labour | Percentage | 2018 Numbers |
|---|---|---|
| **Primary Sector** | **42.57%** | **11 407** |
| Agriculture | 42.54% | 11 397 |
| Mining | 0.04% | 10 |
| **Secondary Sector** | **12.98%** | **3 477** |
| Manufacturing | 8.51% | 2 280 |
| Electricity, Gas and Water | 0.22% | 59 |
| Construction | 4.25% | 1 138 |
| **Tertiary Sector** | **44.45%** | **11 909** |
| Wholesale, Retail Trade and Catering | 15.08% | 4 040 |
| Transport, Storage and Communication | 3.63% | 972 |
| Finance, Insurance, etc | 7.80% | 2 090 |
| General Government | 7.93% | 2 126 |
| Community, Social and Personal Services | 10.01% | 2 681 |
| **Total** | **100%** | **26 793** |

*Source: Quantec Research, 2019*

It is evident from **Table 5-2** that the Tertiary Sector provides the most permanent jobs, followed by agriculture in the Primary Sector. The agricultural sector also supports a large number of temporary workers who are only employed during the planting and harvesting seasons, increasing the number of employees dependent on agriculture to 42.5%.

A detailed analysis was performed of the irrigation crops grown in the Matzikama Local Municipality (MLM) area from which it was possible to estimate the total number of people employed by irrigation agriculture, including the estimated number of temporary workers. This level of detail is not available for the CLM, so it was necessary to estimate the numbers based on different crop products.

The following was the results for the two municipal areas combined:

- Permanent Employees - 11 407.
- Part Time Employees - 3 990.
- Estimated Total - 15 397.

The estimated total of 15 397 is a better representation of the job creation by irrigation agriculture. The unemployment is estimated at 7.9%, if all the temporary and informal workers are included as "employed".

According to the Quantec Research the skill levels are estimated as follows:

- Skilled - 12,1% with a positive growth rate of 2.9% over the 5 year period/
- Semi-skilled - 35,9% with a positive growth rate of 3% over the 5 year period.
- Unskilled - 52% with a small positive growth rate of 0.8% over the 5 year period.

In 2017 most municipalities classified an "**indigent household"**[11] as a family earning a combined income of less than R 3 200 per month. According to the CLM 2019 Annual Report there was a total of 14 158 households on 31 March 2019. However, the 2020 Western Cape Cederberg Socio-Economic Profile reported the number of households at 16 488. According to the CLM Annual Report the number of formal residential properties connected to the municipal electrical infrastructure network (credit and prepaid electrical metering, excluding Eskom areas) and billed for service, as of 30 June 2018, was 7 515. It appears as if roughly 39 000 people are living in Clanwilliam and the other towns, which provides an estimated number of 10 540 households at an average household size of 3.7 as published in the Socio-Economic Profile.

The difference between the actual number of households billed and the estimated number is roughly 3 000. The Cederberg LM Annual Report does not provide a reason for some households not being billed for electricity supply. Roughly the same number shows up for the provision of water. Both these issues support a conclusion that a sizeable number of households are "very poor" and could possibly be classified as "indigent".

### 5.1.2 Cederberg Economic Basis

**Table 5-3** presents the GDP contribution of the different sectors to the economic makeup of the CLM in 2018.

**Table 5-3: Gross Domestic Product of the Cederberg LM Economic Activities**

| Economic | Percentage | 2018 Rand million |
|---|---|---|
| **Primary Sector** | **21.94%** | **854.60** |
| Agriculture | 21.73% | 846.50 |
| Mining | 0.21% | 8.10 |

[11] Indigent Policy: Allow municipalities to target the delivery of essential services to citizens who experience a lower quality of life.

| Economic | Percentage | 2018 Rand million |
|---|---|---|
| **Secondary Sector** | **28.35%** | **1 104.10** |
| Manufacturing | 21.29% | 829.20 |
| Electricity, Gas and Water | 2.15% | 83.90 |
| Construction | 4.90% | 191.00 |
| **Tertiary Sector** | **49.71%** | **1 936.40** |
| Wholesale, Retail Trade and Catering | 13.90% | 541.50 |
| Transport, Storage and Communication | 12.22% | 476.10 |
| Finance, Insurance, etc | 9.88% | 384.80 |
| General Government | 8,54% | 332.70 |
| Community, Social and Personal Services | 5,17% | 201.30 |
| **Total** | **100%** | **3 895.10** |

*Source: Cederberg Socio-Economic Profile - 2020*

It is evident from **Table 5-3** that the Tertiary Sector at 49.7% is the largest entity, followed by the Secondary Sector at 28.3%, and then agriculture at 21.9%, where agriculture is made up of irrigation agriculture and livestock farming. It appears that the livestock division is fully stocked and no real growth in production is expected. It is interesting to note that, although agriculture supports 42% of the employment in the municipality domain, it is the smallest of the three economic sectors.

### 5.1.3 Cederberg LM Summary

The above analysis shows that the municipality is not experiencing any dynamic growth at present, and is a relatively poor area with a high number of households identified as being poor.

As the Clanwilliam Dam wall will be raised, additional areas situated above the Bulshoek Weir have been identified for irrigation purposes. **Table 5-4** shows these areas, along with their identified hectares.

**Table 5-4: Areas Identified above the Bulshoek Weir for Irrigation Development**

| Scheme/Area Name | Irrigable Area (ha) |
|---|---|
| Jan Dissels | 462 |
| Clanwilliam | 298 |
| Transfer of lower Jan Dissels irrigators | 0 |
| Zandrug | 1 209 |
| Bulshoek | 266 |
| **Total** | **2 235** |

*Source: Zutari*

Areas below the Bulshoek Weir have also been identified for development, as part of the right bank canal construction project. It is estimated that close to 50% of the new identified Trawal areas will fall within the CLM if developed. These areas are the full Zypherfontein 1 irrigation area, a larger portion of the Trawal irrigation area, and a smaller portion of the Zypherfontein 2 irrigation area, all of which fall within the CLM. The numbers in **Table 5-5** are based on measurements by Conningarth Economists using Google Earth and slides received from Zutari.

**Table 5-5: The proposed Schemes which fall within Cederberg Local Municipality**

| Scheme | Total Hectares | Hectares in Cederberg Municipality |
|---|---|---|
| Zypherfontein 1 | 669 | 669 |
| Trawal | 554 | 324 |
| Zypherfontein 2 | 661 | 132 |
| Melkboom | 455 | 0 |
| **Total** | **2 339** | **1 125** |

Portions of the development infrastructure will fall within the CLM if either of the two development scenarios is implemented, whether it is e.g., new infrastructure such as the new right bank canal or the alternative two small schemes, or betterment of the existing main canal.

If the Clanwilliam Dam wall is raised and the additional water becomes available, the proposed construction and establishment will not take place in a vacuum, but will contribute to social and economic growth that will be generated in the CLM. Specifically, the additional jobs created and the positive impact on the household income will have a socially desirable impact and contribute to poverty alleviation.

## 5.2 Matzikama Local Municipality

**Table 5-6** presents the number of towns and villages in the MLM and the estimated 2020 population, based on the MLM Socio-Economic Profile 2017, published by the Western Cape Provincial Government and updated by Conningarth Economists. The publication provides an estimated population growth up until 2020. The list excludes the small holiday resorts on the coast.

**Table 5-6: Estimated 2020 Population of the Matzikama Local Municipality**

| Town or Village | 2020 Estimated Population |
|---|---|
| Vredendal | 19 924 |
| | |
| Vanrhynsdorp | 6 877 |
| Klawer | 6 836 |
| Lutzville | 5 737 |
| Koekenaap | 1 701 |
| Ebenhaeser | 1 431 |
| Nuwerus | 713 |
| Bitterfontein | 1 081 |
| Kliprand | 225 |
| All non-urban areas | 26 186 |
| **Total** | **70 710** |

*Source: Statistics South Africa and updated by Conningarth Economists*

The item “non-urban areas” is only identified as “people not living in towns”. It has been assumed that the majority of these people will be living on farms.

Vanrhynsdorp is the oldest town in the area and was established around 1661, with Vredendal being the largest town with a population approaching 20 000.

**Table 5-7** provides an indication of the water demand for the different towns in the MLM.

**Table 5-7: Water demand by individual Towns in MLM (2018)**

| Town | 2018 (million $m^3$) |
|---|---|
| Vredendal | 2.97 |
| Klawer | 0.57 |
| Lutzville | 0.58 |
| Koekenaap | 0.11 |
| Ebenhaeser | 0.56 |
| Household use - LORWUA canal | 1.98 |
| **Total** | **6.77** |

*Source: Water Requirements Assessment Report*

It is evident from **Table 5-7** that the total volume of water is relatively small, but is still a very important element of the social and economic wellbeing of the urban areas. Regular canal breaks put the community, including the commercial and industrial sectors, under pressure. Additional water sources are then utilised at high cost, which places further pressure on the local municipality to provide water in cases where the break extends over a four week period, as tankers are often used.

The water use by the industrial and mining activities in the Local Municipality is presented in **Table 5-8**.

**Table 5-8: Water Use in the Mining and Industrial Sections**

| Sector | Sub-sector | Water use (million $m^3/a$) | | | |
|---|---|---|---|---|---|
| | | 2014 | 2015 | 2016 | Average |
| Mining | Namakwa Sands | 2.10 | 1.79 | 1.54 | 1.81 |
| | Cape Lime | 0.01 | 0.05 | 0.06 | 0.07 |
| Industries | Wine Cellars | 0.43 | 0.43 | 0.44 | 0.43 |
| | Tiger Brand | 0.09 | 0.10 | 0.09 | 0.09 |
| **Total** | | **2.72** | **2.38** | **2.13** | **2.41** |

*Source: Zutari - Water Requirements Assessment Report*

It is obvious from **Table 5-8** that the only two relatively large industrial activities are both agriculturally based. In the case of the wine industry, it is 430 000 $m^3$ per annum, which is necessary to produce about 15% of the South African wine!

### 5.2.1 Social Environment

The aim of this section is to provide a summary of the current social environment in the area where the proposed construction will take place.

In terms of employment, the sectors that contribute the most to Matzikama's employment are agriculture, forestry and fishing (36.3%); the wholesale and retail trade, catering and accommodation (19.3%); and the community, social and personal services (11.7%). Overall, between 2005 and 2020, all sectors contributed to growth in job creation, except for the mining and quarrying and the agriculture, forestry and fishing sectors, which jointly shed 1 420 jobs over the period.

Employment needs within the agriculture, forestry and fishing sector are volatile due to constant changes in minimum wages and labour legislation, as well as production volumes and producer prices. This sector is characterised by seasonal (temporary) labour needs that make job creation in some years unsustainable. As the agriculture, forestry and fishing sector contributes the most to employment in the MLM District, many households are dependent on this sector, which highlights the importance of sustainable job creation within this sector.

**Table 5-9** presents the fulltime job distribution throughout the district. It is based on 2018 numbers determined in a 2019 research exercise. There are no more recent numbers available.

**Table 5-9: Contribution of the different Economic Sectors to Permanent Employment**

| Labour | Percentage | 2018 Numbers |
|---|---|---|
| **Primary Sector** | **40.72%** | **11 661** |
| Agriculture | 39.66% | 11 357 |
| Mining | 1.06% | 304 |
| **Secondary Sector** | **10.65%** | **3 049** |
| Manufacturing | 6.35% | 1 818 |
| Electricity, Gas and Water | 0.33% | 95 |
| Construction | 3.97% | 1 136 |
| **Tertiary Sector** | **48.63%** | **13 925** |
| Wholesale, Retail Trade and Catering | 18.12% | 5 189 |
| Transport, Storage and Communication | 2.30% | 658 |
| Finance, Insurance, etc | 7.30% | 2 089 |
| General Government | 9.86% | 2 822 |
| Community, Social and Personal Services | 11.06% | 3 167 |
| **Total** | 100% | **28 635** |

*Source: Quantec Research, 2019*

It is evident from **Table 5-9** that agriculture is the largest permanent employment provider; however, the numbers do not reflect the total figure as far as agriculture is concerned. According to calculations based on work done by Agrifusion and Conningarth for this study, **Table 5-10** presents the permanent and temporary workers in the irrigation sector, excluding any workers operating in the livestock or game operations sectors.

**Table 5-10: Estimated Total Employment in Irrigation Agriculture in MLM**

| Labour Agriculture - Irrigation | Number/ha | Estimated Hectares | Number of Labourers |
|---|---|---|---|
| Wine Grapes | 1.54 | 8 489 | 13 073 |
| Table Grapes | 2.54 | 880 | 2 235 |
| Raisins | 2.00 | 1 300 | 2 603 |
| Deciduous Fruit | 0.54 | 100 | 54 |
| Industrial Tomatoes | 0.16 | 350 | 57 |
| Fresh Tomatoes | 0.75 | 186 | 139 |

| Labour Agriculture - Irrigation | Number/ha | Estimated Hectares | Number of Labourers |
|---|---|---|---|
| Summer Vegetables | 0.64 | 811 | 519 |
| Winter Vegetables | 0.36 | 485 | 177 |
| **Total** | | **12 501** | **18 858** |

*Source: Agrifusion and Conningarth Economists*

The total number of those permanently employed in agriculture provided in **Table 5-10** is much greater than the 11 357 presented in T**able 5-9**, and is an indication of the large number of individuals and households dependent on irrigation agriculture.

The manufacturing sector employs around 1 818 persons, of which the majority is employed by the All Gold Tomato Sauce manufacturing unit and the three[12] producer wine cellars in the area.

According to the Quantec Research, only 13.4% of the workers in the MLM can be classified as skilled, 32.1% as semi-skilled and 54.6% as unskilled. Projections indicate that, if the situation carries on as present, the skilled group can grow by 1% over a 5 year period.

In 2017 most municipalities classified an '**indigent household**'[13] as a family earning a combined income of less than R 3 200 per month. In 2016, there were 2 926 households classified as indigent, with a previous growth rate of 9% per annum. If this growth rate continues to apply, the number of households would be around 4 100. However, according to the MLM 2018-2019 Annual Report, the number of in Indigent Households amount to the following on 30 June 2019:

- Receiving free water - 3 291.
- Receiving free electricity - 3 084.
- Receiving free sanitation - 3 223.
- Receiving free refuse removal - 3 071.

After contacting the municipality, we were unable to ascertain the reason for the difference in these numbers, except that the households are situated in different towns. We could not get permission to name the official as we were trying to obtain the 30 June 2020 numbers. However, it appears as if the annual growth rate has declined from the previous 9% per annum. Currently, the number of 'Indigent Households' represent between 15% and 16% of the total number of households.

[12] South African Wine Industry Statistics - 2019
[13] Indigent Policy: Allow municipalities to target the delivery of essential services to citizens who experience a lower quality of life.

When counting the temporary workers as employed, the official unemployment rate was 17.7% in 2018.

From the above analysis it appears that, overall, the population is poor and they will benefit from the proposed construction and additional irrigation activities throughout the municipal area.

### 5.2.2 Matzikama Economic Activities

**Table 5-11** presents the GDP contribution of the different sectors to the MLM economic make up in 2018.

**Table 5-11: Gross Domestic Product contribution of the Different Sectors (2018 prices)**

| Sector | Contribution to GDP | GDP (R million) |
|---|---|---|
| **Primary Sector** | **27.30%** | **1 203.7** |
| Agriculture | 22.66% | 999.0 |
| Mining | 4.64% | 204.7 |
| **Secondary Sector** | **21.42%** | **944.6** |
| Manufacturing | 13.82% | 609.4 |
| Electricity, Gas and Water | 2.86% | 126.3 |
| Construction | 4.74% | 208.8 |
| **Tertiary Sector** | **51.28%** | **2 261.1** |
| Wholesale, Retail Trade and Catering | 16.81% | 741.0 |
| Transport, Storage and Communication | 7.29% | 321.6 |
| Finance, Insurance, etc | 9.61% | 423.6 |
| General Government | 11.06% | 487.7 |
| Community, Social and Personal Services | 6.51% | 287.2 |
| **Total** | | **4 409.40** |

*Source: Quantec Research, 2019*

**Table 5-11** shows that agriculture is the largest single entity, followed by the manufacturing sector, which is mostly based on the beneficiation of agricultural products, as is a significant portion of the transport sector. Agriculture is made up of irrigation agriculture and livestock farming products. It appears that the livestock division is fully stocked and no real growth in production is expected. **Table 5-12** presents the annual turnover numbers of the irrigation production expressed in 2020 numbers.

**Table 5-12: Estimated Irrigation Production Turnover (2020 Prices)**

| Labour Agriculture - Irrigation | Hectares | Turnover Rand per hectare | Total Annual Turnover 2020 prices - (R million) |
|---|---|---|---|
| Wine Grapes | 8 489 | R 74 385 | R 631.45 |
| Table Grapes | 880 | R 588 407 | R 517.80 |
| Raisins | 1 300 | R 294 785 | R 383.22 |
| Deciduous Fruit | 100 | R 156 277 | R 15.63 |
| Industrial Tomatoes | 350 | R 232 400 | R 81.34 |
| Fresh Tomatoes | 186 | R 666 900 | R 124.04 |
| Summer Vegetables | 711 | R 189 486 | R 153.67 |
| Winter Vegetables | 485 | R 217 357 | R 105.42 |
| **Total** | **12 501** | | **R 2 012.57** |

*Source: Agrifusion and Conningarth Economists*

**Table 5-12** above shows that Wine grapes provides the largest contribution to the total at 31.4%, followed by Table grapes with 25.7%, and then Raisins with 19%. This amounts to a total of 76.1% for the different grape varieties. According to Vinpro, wine grapes is reduced by about 120 hectares annually, mostly replaced by raisins and table grapes, keeping the number of grape orchard hectares constant.

The manufacturing sector, with a 13.82% GDP contribution, also adds to the total impact of agriculture turnover with an estimated annual turnover of R 1.3 billion, which is based on the wine cellars and tomato sauce producing units.

According to SAWIS, data for the Olifants River production area contributes around 14.6% of South African wine production from 11.7% of total South African wine grape hectares, which provides an indication of how important local wine production is to the wine sector.

These production levels are reached with an 80% Water Assurance, leaking and breaking canals and regular drought-induced restrictions. It is generally accepted that close to 30% of the water in the present old canal system on average does not reach wine producers, with losses in the main canal estimated at 20%.

### 5.2.3 Summary for Matzikama Local Municipality

The estimate for 2019 indicates that MLM had a GDP of R 4.5 billion, and employed 28 609 people. The economic growth rate of less than 1% per annum indicates that the economy of the municipal area contracted in real terms, resulting in job losses in the MLM area. The main contributor to GDP in the MLM area in 2018 was the agriculture, forestry and fishing sector, with a contribution of 22.7%, whereas the electricity, gas and water sector was the smallest, contributing 2.9% to GDP in the municipal area. Other prominent contributors to GDP in the MLM area include the wholesale and retail trade, catering and accommodation sector, and the manufacturing sector, contributing 16.8% and 13.8% respectively. The agriculture, forestry and fishing sector are also the largest source of employment, contributing 39.7% to total employment. The significant contribution of the agriculture, forestry and fishing sector indicates that this sector is labour-intensive. Another important source of employment in the municipal area is the wholesale and retail trade, catering and accommodation sector, which contributed 18.1% to total employment in the municipal area

From the above analysis of the social and economic situation it appears that it will be very difficult to generate future growth. The opportunities to grow can only come from increased agricultural production and, perhaps, increased mining and tourism.

When the Clanwilliam Dam wall is raised and the additional water becomes available, the proposed construction and establishment will not take place in a vacuum, but will contribute to social and economic growth that will be generated in the MLM area. Table 5-13 shows the proposed new irrigation areas that fall within the Matzikama LM boundary.

**Table 5-13: New Irrigation Areas that fall within the Matzikama Local Municipality**

| Scheme | Total Hectares | Hectares in Matzikama Municipality |
|---|---|---|
| Zypherfontein 1 | 710 | 0 |
| Trawal | 554 | 230 |
| Zypherfontein 2 | 661 | 529 |
| Melkboom | 455 | 455 |
| Klawer Phase 2 | 438 | 438 |
| Ebenhaeser | 361 | 361 |
| Coastal 1 Flow Restricted | 89 | 89 |
| **Total** | **3 268** | **2 102** |

The rest of the irrigation area falls within the Cederberg Local Municipality.

In the next sections the investigation of the economic viability of the schemes is presented as well as the socio-economic contribution of the construction and operational phases.

## 5.3 Social and Economic Summary

The economic and social analysis shows that both local municipalities serve relatively poor communities and depend largely on agricultural production for employment and economic growth. An objective analysis of the potential sources of further growth in the inland areas will depend on an increase in agriculture production, mining and tourism. The dryland production areas are fully occupied and very little if any increase can take place in 'Rooibos Tea' production. The only real increase in production can take place if additional irrigation areas are developed that will create employment and generate economic growth

Regular canal breaks put the community and the commercial and industrial sectors of Matzikama Local Municipality under pressure whilst no urban areas of Cederberg are impacted. Additional sources are then utilised, which again puts pressure on this municipality to provide water, often in tankers, at additional cost.

An estimation of the wages lost by the temporary workers in the MLM during a 30 day canal break is estimated[14] at R 19 million, expressed in 2020 wages. During the recent significant drought period wages lost are estimated at between R 100 and R 120 million. This is money that is not spent locally for basic needs, so the loss is for the commercial enterprises.

[14] Estimation by Conningarth Economists

# 6 Financial and Economic Analysis of the Trawal Irrigation Areas

## 6.1 Background

Four areas below the Bulshoek Weir in the vicinity of Trawal have been identified as recommended irrigation areas that will be developed to settle HD Farmers. This chapter analyses the financial and economic feasibility of the four irrigation areas if the two smaller schemes are constructed to supply these areas, instead of the right bank canal, as explained in **Chapter 2**.

The purpose of this chapter is therefore to determine the economic and financial feasibility of the defined irrigation area, as well as the financial support that will be required to establish these new farmers on the identified area. The motivation for the estimation of the 'financial' support for the Historically Disadvantaged (HD) farmers in the area is based on the fact that they will be dependent on support from Government sources, which is not the case for established commercial farmers, who would be able to find funding sources.

## 6.2 Approach and Methodology

### 6.2.1 Approach

The approach to determining the financial and economic feasibility of the proposed development scenario is to apply a CBA and a Socio-Economic Impact assessment of the development. Calculating the support required to establish the new HD Farmers involves constructing a financial cash flow that includes all cash support that is not accommodated in a CBA. The social and macro-economic impact analysis will provide an indication of the economic impacts in the area.

### 6.2.2 Methodology

The methodology followed was to construct the following CBA models:

- A constant price Financial CBA with Discount Rate of 8% and Parameters of NPV, IRR and BCR.

- A current price Financial CBA with Discount Rate of 11.28% and Parameters of NPV, IRR and BCR.
- An economic 'shadow' price model with Discount Rate of 8% to determine 'Shadow' Prices using Parameters of NPV, IRR and BCR.

Simultaneously with the CBA models, a Macro-economic Model, based on the Western Province Social Accounting Model (SAM) was constructed, and the following parameters were measured:

- Regional Gross Domestic Product generated (RGDP).
- Employment created, including direct, indirect and induced employment.
- Payments to Households; specifically low-income households.
- New Capital Generation.

Once the above models were completed, the Cash Flow of the new HD Farmers was constructed and accommodated in the model. The following assumptions were taken into consideration:

i. In the CBA, it is assumed that the HD Farmers will produce the same high value crops as the existing commercial farmers, and they will ultimately become successful commercial farmers. The result will be that a large number of vineyards will be planted, which will only reach full production in the 5$^{th}$ year after planting. Provision was made for a household income amount. The detail is explained in the relevant section.
ii. Houses for employees: The housing for employees on the farms was classified as a local government function and not taken into consideration.
iii. Houses for the new owners were allocated to the 'Cash Flow' model.
iv. Sheds per farm to accommodate tractors, implements, vehicles, seed and fertiliser, as necessary, have been included.
v. An estimation of the necessary implements, tractors and vehicles per farm has been included.
vi. As the four areas are relatively small, it was decided that the following cost items would be applied on an area basis instead of being provided by each farm:
    a. A central table grape pack house per area; and
    b. A central packing facility per area for fresh tomatoes and other vegetables destined for the markets.

The motivation for this assumption is that there is no certainty of which crops would be produced per new unit, although a detailed sub-study[15] was performed as part of the total study, and the establishment cost per 50 or 60 hectare unit was calculated. Some of the data in the report was used in the calculation of establishment costs of the new farms in the four areas.

[15] Financial Viability of Irrigation Farming Sub-Report

## 6.3 Data Applied

The following sections present and discuss the data used in the different econometric models.

### 6.3.1 Cost Data – Cost Benefit Analysis and Macro-economic Analysis

In this section the different data sources and values are presented as applied in the CBA and MEIA.

### 6.3.2 Small Irrigation Schemes Construction Costs

As explained, two small irrigation schemes, instead of the new right bank main canal could be constructed to serve the four new Trawal irrigation areas where the new HD Farmers will be established. **Table 6-1** presents the estimated small scheme costs. The schemes will have a combined three-year construction period.

**Table 6-1: Estimated 2020 Small Schemes Construction Costs (R million, 2020 prices, excl. VAT)**

| Capital Cost Components | Scheme 1 (14b Dev[16]) | Scheme 2 (10 Dev) | Total (10+14b Dev) |
|---|---|---|---|
| New high-level canal | 122.7 | 0 | 122.7 |
| Pump stations | 113.53 | 39.51 | 153.04 |
| Pipelines + syphon | 67.7 | 16.16 | 83.86 |
| Farm Dams | 25.83 | 1.59 | 27.42 |
| Canal raising: 8km of existing main canal | 3.92 | 0 | 3.92 |
| Cost of lining: 8km of existing main canal | 45.61 | 0 | 45.61 |
| Land purchase cost | 53.15 | 13.16 | 66.32 |
| Consulting fees | 55.84 | 14.45 | 70.29 |
| **Total cost** | **R 488.29** | **R 84.87** | **R 573.16** |

*Source: Zutari*

These costs are used in the Cash Flow model. Although it is for the establishment of the HD Farmers, the Western Cape Department of Agriculture's policy is that they will be responsible for the repayment, but at a reasonable interest rate.

[16] 14b and 10 Dev refers to the two small irrigation schemes, with small scheme 14b supplying three areas and small scheme 10 supplying one area.

#### 6.3.2.1 Farming Unit Development Costs

The cost per item of developing the farm infrastructure is presented in this section. The different annual amounts are repeated in the CBA model to make provision for depreciation and replacement after a number of years. The following time periods are used for the replacement structure:

- Buildings - 40 years.
- Irrigation Equipment[17] - 12 years. This is a very difficult item as the technology used differs considerably, i.e., in the case of fresh tomatoes, producers using drip technology that they tend to replace after two crops, whereas in the case of other vegetable types, it is a bit longer. For orchards it can be up to 20 years, depending on a number of factors.
- Tractors, vehicles and other equipment - 12 years.

##### 6.3.2.1.1 Sheds

As part of the development of the farms, one shed was added to the cash flow per farm, calculated as follows:

- 47 units x 250 $m^2$ x R 3 500[18] $m^2$ = R 41,125 million spread over four years expressed in 2020 prices. This amount is included in the CBA and Cash Flow as part of farm development costs.

##### 6.3.2.1.2 Table Grape, Fresh Tomatoes and Vegetable Pack Houses

Provision is made for two pack houses per Trawal irrigation unit. The cost of the pack houses is calculated as follows:

- 8 pack houses x 500 $m^2$ x R 6 000[19] $m^2$ = R 24 million spread over 4 years, expressed in 2020 prices. This amount is included in the CBA and Cash Flow as part of farm development costs.

##### 6.3.2.1.3 Raisins

As 233 hectares are projected to be converted to raisin production, it was decided to provide one drying slab per unit. The cost is calculated as follows:

- 4 slabs at R 150 000 per slab = R 600 000 over four years, expressed in 2020 prices.[20]

[17] Source: Agrico Irrigation Systems
[18] Source: AECOM 2020 Building Costs
[19] Source: AECOM 2020 Building Cost
[20] Source: SA Raisin Producers

#### 6.3.2.1.4 Total Farm Development Costs

**Table 6-2** presents the estimated total amount needed to develop the different farming units. These values are presented in the CBA models, as well as in the Cash Flow analysis.

It must be kept in mind that the development costs are based on an assumed crop planting structure and is not representative of a specific farm unit, i.e., a table grape unit will differ considerably from a vegetable or tomato farming unit, as the irrigation system and trellising will be much more expensive.

It was decided to spread the farm development and production period over a four year period, starting in year 2 up till year 5.

**Table 6-2: Trawal - Estimated Farm Units Development Costs - (R million, 2020 prices, excl. VAT)**

| Year | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|
| Sheds | 12.36 | 10.75 | 5.81 | 12.20 | 41.13 |
| Raisin Slabs | 0.15 | 0.15 | 0.15 | 0.15 | 0.60 |
| Pack Houses | 6.00 | 6.00 | 6.00 | 6.00 | 24.00 |
| Irrigation and Bulk Water | 95.07 | 82.73 | 44.69 | 93.89 | 316.38 |
| Tractors/ Implements, etc. | 41.49 | 36.11 | 19.50 | 40.98 | 138.08 |
| **Total** | **R 155.07** | **R 135.74** | **R 76.15** | **R 153.22** | **R 520.18** |

*Source: Conningarth Economists*

A total amount of R 520.18 million will be required to develop the individual farming units, as shown in **Table 6-2**. These costs will change (as they are in constant 2020 prices) when the actual development of the farms is initiated and detailed planning has taken place and inflation is taken into consideration.

#### 6.3.2.2 Small Schemes Maintenance Costs

**Table 6-3** presents the estimated annual maintenance costs of the new canal as applied in the CBA model from year 5 up to year 30.

**Table 6-3: Small Schemes Annual Maintenance Costs (2020 prices, excl. VAT)**

| Cost Item | Construction Costs (R million) | Rate | Amount (R million) |
|---|---|---|---|
| Civil | 172.24 | 0.50% | 0.86 |
| Mechanical | 236.9 | 4.00% | 9.48 |
| Dams | 27.42 | 0.25% | 0.07 |
| **Total** | **R 436.56** | | **R 10.41** |

*Source: Conningarth Calculations*

Land purchase and consulting fees are not used in the calculation of the maintenance costs, as these cost items are not used in the Cash Flow analysis, because they are not for the account of the new HD Farmers.

#### 6.3.2.3 LORWUA Operational Costs

The LORWUA operational cost is based on the 2019/2020 tariffs as provided and presented in **Table 6-4**.

**Table 6-4: LORWUA Operational Costs (excl. VAT)**

| Year | Tariff per ha | Number of hectares | Total Annual Costs |
|---|---|---|---|
| 2019/2020 | R 2 937.92 | 2 339 | R 6 871 795 |

*Source: Conningarth Calculations based on LORWUA data.*

This cost item is included in the CBA models but is not part of the Cash Flow as it is a transferred amount.

#### 6.3.2.4 Social Costs

No social costs have been identified.

#### 6.3.2.5 Environmental Costs

The Environmental Screening Sub-Report reflects a number of possible environmental impacts but no actual costs are provided.

As the main impact will be along the construction of the small right bank canal, the following values are used to represent a possible environmental impact cost.

- A permanent environmental officer at a salary of R 15 000 per month and a projected environmental impact of R 370 683 per annum.

This amount is calculated at R 120[21] per hectare multiplied with the estimated impacted area along the canal of 2 339 hectares. The environmental officer's salary is used in the financial CBA, whilst the total cost including the environmental impact is used in the economic CBA.

#### 6.3.2.6 Data – Crop Production

The following sections present the assumptions regarding crops used in the calculations, as well as the different operational costs used.

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[21] Amount based on values calculated for Iliso Consulting: Environmental Impact Assessment for the Mzimvubu Water Project Phase 1

#### 6.3.2.7 Crops Used

Currently, a certain crop mixture is planted and produced in the LORWUA irrigation area and a well-developed marketing structure exists. Over 80% of the area is based on grapes, including wine grapes, raisins and table grapes. The other crops produced are fresh tomatoes, industrial tomatoes, and summer and winter vegetables.

Three large wine distillers are operating in the area, along with a tomato sauce production unit, and packing facilities for the table grapes destined for export. Over 90% of the South African table grape and raisin production is exported, and, according to information collected, this also applies to the Olifants River production. The vegetable groups and fresh tomatoes are marketed in Cape Town and surrounding areas.

It was assumed that the new HD farmer development will be in line with current production, but taking possible future realities into consideration. As part of the Clanwilliam Bridging Study the "*Financial Viability of Irrigation Farming Sub-Report*" was completed. The report provided a detailed discussion on the establishment of different farm units that vary in size for the different crops, from a 64 hectare raisin to a 10 ha fresh tomato unit, and the projected profitability of the different crops.

In the crop division applied in the specific Trawal CBA and the Macro-Economic Impact Analysis a number of factors were taken in to consideration, as follows:

- Available crop management expertise in the area and level of crop management required;
- Marketing channels availability;
- Present and future price projections;
- Level of crop management required; and
- Any obvious changes in the composition of the crop production mixture.

The South African Wine Industry Information and Systems (SAWIS) reports that an average of 130 hectares of wine grapes are annually removed and mostly replaced with Table Grapes and Raisin Grape varieties. They quote the reason as being the low price of wine and the availability of orchard management expertise and positive prices from the export market for table grapes and raisins.

There also appears to be a steady growth in fresh tomatoes and summer vegetable production, and seed production. The industrial tomatoes have an available market facility in the area while vegetables and fresh tomatoes are marketed in the Cape Town Metro. It appears as if most of the seed production is produced under contract for seed companies.

The additional criteria used for selecting crops to evaluate in terms of the economic evaluation also include the following:

- Crops which are well suited to the climate and soils enabling high yields and good quality to be produced; and
- Crops which are tried and tested in the area and already grown on a large scale commercially.

In the final decision on a structure for the crop production for the CBA calculation, the following was decided:

- Make no provision for deciduous fruit.
- Reduce wine plantings considerably.
- Increase the table grapes, raisins and tomato production.

**Table 6-5** presents the current crop distribution and the adapted distribution for the Trawal irrigation area.

**Table 6-5: Crop Recommendation for Production in the Trawal Irrigation Development**

| Crop type | Sub-Area 4 and 5-Bulshoek Weir to Lutzville (hectares) | Current Percentage | Trawal hectares used in the Models | Estimated Percentage |
|---|---|---|---|---|
| Peaches | 100 | 0.80% | - | 0.00% |
| Table grapes | 880 | 7.04% | 250 | 11.17% |
| Wine grapes | 8 389 | 67.11% | 1 000 | 44.66% |
| Dry Grapes (Raisins) | 1 300 | 10.40% | 450 | 20.10% |
| Summer Vegetables | 811 | 6.49% | 150 | 6.70% |
| Tomatoes Industrial | 350 | 2.80% | 180 | 8.04% |
| Tomatoes Fresh | 186 | 1.49% | 150 | 6.70% |
| Winter Vegetables | 485 | 3.88% | 59 | 2.64% |
| **Total** | **12 501** | **100.00%** | **2 239** | **100.00%** |

*Source: Sub Areas 4 and 5 – Agrifusion; Trawal Conningarth*

It is evident from **Table 6-5** that wine grapes represent 44.67% of the area with the total grape production area being over 75.9%. It must be emphasised that there is no guarantee that this would be the actual mix for the proposed Trawal development as irrigation agriculture is very dynamic with regular changes, but the areas in **Table 6-5** were used in the calculations.

**Table 6-6** presents the Estimated Net Farm Income and Long-Term Marketing Projections.

**Table 6-6: Estimated Net Farm Income and Long-Term Marketing Projections (2020 prices)**

| Crop type | Estimated Net Farm Income (NFI) R/ha | Some Comments about Long Term Marketing Projections |
|---|---|---|
| Table grapes | R 71 123 | Currently very profitable, over 90% exported and long-term outlook very positive. |
| Raisins | R 55 144 | Currently very profitable, over 90% exported and long-term outlook very positive. |
| Wine grapes | R 11 204 | Worldwide over-production, the same in South Africa and presently not very profitable, but an improvement expected in the medium term. |
| Tomatoes - Industry | R 41 033 | Appears to be static in the producing area and profit margins are relatively low, but the market is available. |
| Tomatoes - Fresh | R 126 709 | This appears to be experiencing growth in the producing area, margins are good. The fresh market price varies seasonally considerably. |
| Winter Vegetables | R 26 219 | Stable, without any major growth. |
| Summer Vegetables | R 41 429 | Experiencing growth in the production area. The fresh market prices vary considerably. |

*Source: Agrifusion – Budgets; Comments Conningarth Economists*

*Table notes:*

- *The Net Farm Income (NFI) is calculated before any interest yield on investment capital or management fees are taken into consideration.*

**Table 6-6** shows that the NFI of Table Grapes is the highest, with Wine Grape production the lowest at present.

#### 6.3.2.8 Crop Yields

The assumption made in the estimation of the four new irrigation areas is that the new canal will not experience any long-term canal failures, and that the raised Clanwilliam Dam will provide the water at a much improved Assurance of Supply.

**Table 6-7** presents the crop yields used.

**Table 6-7: Crop Yield used In Calculations**

| Crop type | Tons per Hectare |
|---|---|
| Table grapes | 15.5 |
| Raisins | 7.6 |
| Wine grapes | 26 |
| Tomatoes - Industry | 95 |

| Crop type | Tons per Hectare |
|---|---|
| Tomatoes – Fresh | 90 |
| Winter Vegetables | 18.5 |
| Summer Vegetables | 39.2 |

*Source: Agrifusion – Wine yield adapted by Conningarth after contact with SAWIS.*

#### 6.3.2.9 Product Prices

In the constant price financial and economic CBA models, the prices determined during the data collection period and used in the analysis, are kept constant over the 30-year analysis period. In the case of the current price financial CBA, the price is changed over time, by applying the annual inflation rate increase of 4.5%, in line with Reserve Bank projections.

The following discussion explains the background to the decisions taken with regard to the product prices as applied in the two financial Cost Benefit Analysis models.

For vegetables and fresh tomato production, which is marketed in local markets, the annual price increase applied over the 30-year period is in line with the South African Reserve Bank policy, to keep the inflation rate between 3% and 6% annually. The results are presented for a 4.5% inflation rates per annum over the 30-year period.

In the case of table grapes and raisins, where over 90% of the annual South African production is exported, exchange rate fluctuations will impact either negatively or positively on the export price, as overseas markets have an inflation rate of below 2% per annum and economic policy decisions also impact on the exchange rate. Therefore, the future price, which the South African farmers receive, will be influenced by the movement of the exchange rate.

The question then arises, which of the major exchange rates must be used. In the past, the exchange rate was mostly impacted by the movement in the US dollar, as most of the prices were quoted in this currency. However, more recently, some export prices are quoted in British pounds or Euros. At present, the largest buyers of the table grapes and raisins are the Netherlands, United Kingdom and Germany, with more than 64% of the total production exported to these three countries.

As such, the decision was made to link the future RSA export price to the movement of the Euro. The inflation rate in the European Union averaged 1.88% from 2000 until 2020, reaching an all-time high of 4.50% in July of 2008 and a record low of -0.60% in January of 2015. Historical analysis indicates that South Africa experiences an average inflation rate of around 5%, while the Reserve Bank is attempting to keep it between 3% and 6%. The South African average inflation rate is about 2.7% higher than EU countries, in addition to which South Africa has a 1% lower productivity rate then the three specified EU countries. As such, it appears that the Rand is likely to experience an annual +- (2.7%+1%) = 3.7% weakening against the Euro. This percentage has been used in the calculations over the 30-year period.

In the following table the base income per ton per product as used in the first year of production. The Assurance of Supply of the "new" water will be 90% instead of 80%.

**Table 6-8** presents the product prices as collected from the producers and producer organizations in the survey undertaken by Agrifusion as part of this study.

**Table 6-8: Product Prices – 2019/2020**

| Crop type | Current Farm Gate Price per Ton |
|---|---|
| Table grapes | R 32 500 |
| Raisins | R 17 000 |
| Wine grapes | R 2 750 |
| Deciduous Fruit | R 6 035 |
| Tomatoes - Industry | R 2 124 |
| Tomatoes – Fresh | R 6 610 |
| Winter Vegetables | R 11 749 |
| Summer Vegetables | R 4 303 |

*Source: Agrifusion*

The farm gate prices for wine grapes is problematic as a result of the impact of the Covid-19 restrictions on the sales of alcohol products, which has led to an unsold surplus of between 250 and 300 million liters of wine. This has impacted dramatically on the price paid to farmers for wine grapes. The following average prices[22] were paid to farmers in the study area between 2017 and 2020:

- 2017 production year - R 4 054 per ton of grapes.
- 2018 production year - R 5 063 per ton of grapes.
- 2019 production year - R 5 044 per ton of grapes.
- 2020 production year - R 2 380 per ton of grapes.

The price in the 2021 production year is uncertain, as no surety has been provided as yet. As the CBA model is constructed for a 30-year period, and hopefully the situation will normalize again

[22] SAWIS

soon, it was decided to use the 2019 price of R 5 044 per ton as the base price that will grow over time.

The long- and short-term profitability of each crop, together with the availability of an effective marketing channel, was identified and discussed. The reason for this is that a very profitable crop like table grapes involves a high establishment cost of around R 500 000 per hectare presently with an orchard lifetime of 30 years. Currently, effective packing facilities and marketing channels are in place.

The production of raisins also demands a long-term commitment, but the management demands are less than in the case of table grapes.

#### 6.3.2.10 Crop Production Budget Structure

This section presents the crop budget structures that are used in the Economic CBA to determine the applicable shadow prices. This budget structure is also used in the MEIA model where different multipliers operate for the different elements of the budget. **Table** 6-9 presents the budget structure for summer crops.

**Table 6-9: Summer Vegetables Production Budget Structure - (2020 prices, excl. VAT)**

| Current Situation (per hectare) | Average Annual Budget - Production - Irrigation |
|---|---|
| **Gross Income per hectare** | **R 189 486** |
| | |
| **Variable Costs** | **R 137 891** |
| - Marketing Costs | *R 23 686* |
| - Pre-Harvest Costs | *R 64 466* |
| - Harvest Cost | *R 49 739* |
| **Interest on Working Capital** | ***R 1 128*** |
| Gross Margin | **R 50 467** |
| **Fixed Costs** | **R 4 735** |
| *- Depreciation* | *R 1 795* |
| - Labour | *R 680* |
| - Insurance | *R 531* |
| - Repairs & Maintenance | *R 549* |
| - Administration Costs | *R 840* |
| - Fuel & Electricity | *R 270* |
| - Sundry | *R 70* |
| **Net Farm Income (NFI)** | **R 45 732** |

*Source: Agrifusion and Conningarth Economists*

The above structure presents the final summary used to estimate Net Farm Income. As this is not a 'Cash Flow' model the above structure makes no provision for yield on capital to repay any loans or for possible drawing of income by the producer.

In the case of an orchard crop, the initial structure makes provision for the following detail in a model constructed over a 30-year period:

- Year 1 - Establishment Costs.
- Year 2 - 0% of the crop with the detailed different production costs.
- Year 3 - 30% of the crop with the different production costs.
- Year 4 - 70% of the crop with the different production costs.
- Year 5 - 100% crop with the different production crops.

**Table 6-10** provides the detail structure (without costs) required for the formation of the production budget of the model, which is then prepared for a 30-year period in the case of orchard crops. It presents the detail for the different sections of the budget namely, Marketing Costs, Pre-Harvest Costs and Harvesting Costs, which will be used to calculate the 'shadow prices' applied in economic CBA models.

**Table 6-10: Detailed Structure of the Production Budget**

| Pre-harvest and Planting Costs | Costs |
|---|---|
| Planting Material | |
| Land Preparation & Trellising | |
| Fertilizer | |
| Disease and Pest | |
| Fuel | |
| Repairs & Maintenance - Tractor & Implements | |
| Irrigation Electricity & Water | |
| Labour | |
| General | |
| **Total Pre-harvest Cost** | |
| **Harvest Costs** | |
| Transport Costs | |
| Packing Material | |
| Repairs & Maintenance - Tractor & Implements | |
| Labour | |
| Fuel | |
| **Total Variable Cost** | |

| Pre-harvest and Planting Costs | Costs |
|---|---|
| **Fixed Cost** | |
| Labour | |
| Repairs & Maintenance - Fixed | |
| Administration Costs | |
| Depreciation | |
| Sundry | |
| Fuel and Electricity | |
| **Total Fixed Cost** | |

The above detailed structure data is then used to calculate the percentages of the total cost to be used in the MEIA. The budget structure presented in **Table 6-11** is an example of the Summer Vegetable Budget.

**Table 6-11: Budget as Applied in the MEIA Calculations with Costs**

| Intermediate inputs and labour requirements | Percentages of total cost | Costs Rands |
|---|---|---|
| Agriculture | 16,65% | 23 942.14 |
| Mining | 0,00% | - |
| Manufacturing | 0,00% | - |
| * Fuel | 0,52% | 742.56 |
| * Fertilizer | 7,55% | 10 853.72 |
| * Pharmaceuticals | 3,19% | 4 590.58 |
| * Other | 18,14% | 26 083.79 |
| Electricity | 4,56% | 6 551.76 |
| Water | 0,62% | 893.36 |
| Construction | 3,51% | 5 041.68 |
| Trade and accommodation | 0,00% | - |
| Transport and communication | 8,54% | 12 281.57 |
| Financial and business services | 19,69% | 28 309.66 |
| Community services | 0,00% | - |
| Salaries and wages: Skilled | 3,96% | 5 686.25 |
| Salaries and wages: Semi-Skilled | 8,71% | 12 522.43 |
| Salaries and wages: Unskilled | 4,35% | 6 254.73 |
| **Total Costs** | **100,00**% | **R 143 754,23** |

*Source: Conningarth Economists*

#### 6.3.2.11 Phasing of the Trawal Irrigation Area

After studying the available maps, the latest projections are that, if construction of the conveyance infrastructure starts in Year 1, the irrigation areas can become available as follows:

- Year 2: Zypherfontein 1 - 669 hectares.
- Year 3: Zypherfontein 2 - 661 hectares.
- Year 5: Trawal - 554 hectares.
- Year 5: Melkboom - 455 hectares.

**Table 6-12** presents the area (hectares) per crop per year as planting takes place according to the available areas and assumed crop plantings.

**Table 6-12: Estimated Area Planted at end of Construction Year**

| Crop Production | Percentage | Hectares | Hectares | Hectares | Hectares | Hectares |
|---|---|---|---|---|---|---|
| | | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
| Peaches | 0.00% | - | - | - | - | - |
| Table Grapes | 11.17% | 75 | 140 | 176 | 250 | 250 |
| Dry Grapes (Raisins) | 20.10% | 135 | 253 | 316 | 450 | 450 |
| Wine Grapes | 44.66% | 301 | 562 | 703 | 1 000 | 1 000 |
| Tomatoes - Fresh | 6.70% | 45 | 84 | 105 | 150 | 150 |
| Tomatoes - Industrial | 8.04% | 54 | 101 | 127 | 180 | 180 |
| Winter Vegetables | 2.64% | 18 | 33 | 41 | 59 | 59 |
| Summer Vegetables | 6.70% | 45 | 84 | 105 | 150 | 150 |
| **Total** | 100.00% | **673** | **1 258** | **1 574** | **2 239** | **2 239** |

*Source: Conningarth Economists*

It is evident from **Table 6-12** that, according to the assumptions used, the total area will be planted in Year 5.

**Table 6-13** provides an indication of the total estimated production costs as applied in the different financial and economic CBA models. The expenditure is based on the expected number of hectares that become available per annum, and the expected crops planted per annum, as presented in **Table 6-12**.

**Table 6-13: Estimated Production Costs per Annum – 2020 prices**

| Item | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|
| **Total Production Costs** | **Rand mil.** | **Rand mil.** | **Rand mil.** | **Rand mil.** | **Rand mil.** |
| Agriculture | 4.20 | 7.86 | 9.84 | 13.99 | 13.99 |
| Manufacturing | - | - | - | - | - |
| * Fuel | 5.35 | 10.01 | 12.53 | 17.82 | 17.82 |
| * Fertilizer | 7.17 | 13.42 | 16.79 | 23.88 | 23.88 |
| * Pharmaceuticals | 7.38 | 13.81 | 17.28 | 24.57 | 24.57 |
| * Other | 18.68 | 34.94 | 43.72 | 62.17 | 62.17 |
| Electricity | 6.34 | 11.86 | 14.84 | 21.11 | 21.11 |
| Water | 0.97 | 1.81 | 2.26 | 3.22 | 3.22 |
| Construction | 3.72 | 6.96 | 8.71 | 12.39 | 12.39 |
| Transport and communication | 2.59 | 4.85 | 6.06 | 8.62 | 8.62 |
| Financial and business services | 10.35 | 19.35 | 24.22 | 34.44 | 34.44 |
| Salaries and wages: Skilled | 10.80 | 20.20 | 25.27 | 35.94 | 35.94 |
| Salaries and wages: Semi-Skilled | 11.04 | 20.64 | 25.83 | 36.73 | 36.73 |
| Salaries and wages: Unskilled | 10.69 | 19.98 | 25.01 | 35.56 | 35.56 |
| **Total** | **R 99.29** | **R 185.70** | **R 232.37** | **R 330.42** | **R 330.42** |

*Source: Conningarth Economists*

It is evident from **Table 6-13** that the maximum estimated annual production costs will be around R 330 million per annum expressed in 2020 prices, which equates to about R 148 000 per hectare.

These numbers are used in the CBA, MEIA and “Cash Flow” models. The reason they are used in the cash flow model is that the HD Farmers will not have these large monetary amounts available and some assistance will have to be provided. The detail used in the cash flow is discussed in the relevant section below.

### 6.3.2.12 Estimated Income

This section presents the estimated income expected per annum, based on the above cultivated areas, product yields, and applicable product prices. The estimated income per annum is presented in **Table** 6-14 and is based on the crops as planted in the specific year and the average prices as discussed.

The possibility exists that the yields in the first couple of years will not be reached because of developmental and management problems. A detailed sensitivity analysis is therefore performed and the baseline and sensitivity results are reported in **Table 6-17**.

**Table 6-14: Expected Income per Annum (R million, 2020 prices)**

| Years that areas become available | Production Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 |
| Second Year | 0.0 | 55.8 | 55.8 | 96.2 | 150.2 | 190.6 | 190.6 | 190.6 | 190.6 |
| Third Year | 0.0 | 0.0 | 48.5 | 63.3 | 103.4 | 145.4 | 165.9 | 165.9 | 165.9 |
| Fourth Year | 0.0 | 0.0 | 0.0 | 48.5 | 48.5 | 83.7 | 130.7 | 165.9 | 165.9 |
| Fifth Year | 0.0 | 0.0 | 0.0 | 0.0 | 55.1 | 55.1 | 95.0 | 148.3 | 188.3 |
| **Total** | **R 0.0** | **R 55.8** | **R 104.3** | **R 208.0** | **R 357.2** | **R 474.9** | **R 582.3** | **R 670.7** | **R 710.7** |

*Source: Conningarth Economists*

The income in the second and third years are from summer and winter vegetables and tomatoes only. Although grapes have already been planted, it is expected that production will only begin in Year 5, with a yield between 15% and 30% of the total. It is expected that the different grape production crops will be in full production in Year 9. The projected maximum income will be R 710.7 million in Year 9 and beyond, expressed in 2020 prices.

**Table 6-15** presents the surplus or shortfall between income and direct production costs.

**Table 6-15: The Estimated Surplus and Shortfall between Income and Production Costs (R million, 2020 prices)**

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Income | 0.00 | 55.8 | 104.3 | 208.0 | 357.2 | 474.9 | 582.3 | 670.7 | 710.7 |
| Production Costs | 0.00 | 99.3 | 185.7 | 232.4 | 330.4 | 330.4 | 330.4 | 330.4 | 330.4 |
| **Surplus/ Shortfall** | **R 0.00** | **-R 43.5** | **-R 81.4** | **-R 24.4** | **R 26.8** | **R 144.5** | **R 251.9** | **R 340.3** | **R 380.3** |

*Source: Conningarth Economists*

**Table 6-15** shows that, from Year 2 to Year 4, an income shortfall will be experienced, after which a surplus will be generated. It should be noted that this is not a net farm surplus as many developmental costs form part of the models and is taken into consideration in the CBA and Cash Flow Model.

### 6.3.3 Additional Data – Cash Flow

Given that a number of HD Farmers will be established on the identified undeveloped land near Trawal, it is necessary that the development cost be taken into consideration in the construction of the irrigation units and incorporated in the Cost Benefit Analysis.

In this section the different costs involved are identified and estimated, as well as costs that are 'transferred' to a specific Government department. However, it must be kept in mind that this is not a planning document and that the values used are in most cases based on values in the *Financial Viability of Irrigation Farming Sub-Report*.

#### 6.3.3.1 Cost of Living

The prospective HD Farmers will have to receive a 'cost of living' grant or loan during the first number of years to pay for household costs. The amount is an estimated amount of R 25 000[23] per month per farmer, expressed in 2020 values, for at least the first 12 years. It is estimated that at least 50 new farming units will be developed and that an initial amount of R 15.1 million, expressed in 2020 prices, will be necessary. The amount of R 15.1 million is then used for the first year and then inflated in the model at 4.5% per annum.

#### 6.3.3.2 Farm Development Costs

The main farm developmental costs are in the CBA models. This section refers to cost items not presented in the CBA models, but which are part of the developmental costs.

##### 6.3.3.2.1 Housing

Two housing facility setups are at stake, namely housing for the farmer, and housing for permanent labour. It is assumed that basic housing for the farmer must be provided and that provision must be made for funding as follows:

- The area of individual farms is estimated at 50 hectares per farm, which equates to a total of: (2339 ha/50) = 47 units.
- The size of a house is assumed to be 200 $m^2$, at the current building costs of R 5 000 per square metre, which amounts to a total of R 1 million per unit[24].
- The total of housing amounts to R 47 million spread over four years, expressed in 2020 prices, which equates to R 11.75 million per year over the four year period.

This cost of housing was not part of the CBA farm development cost.

[23] Based on South African Average Household Income – Statistics SA
[24] AECOM – 2020 Building Costs

The recommendation for the housing of permanent employees is that this is the responsibility of the housing section of the local authority, and not part of the cash flow programme. Where the housing will be established must be decided. The recommendation is that it is not on the farms, but at the nearest village to the specific development.

## 6.4 Results

The results of the Cost Benefit Analysis (CBA), Macro-economic Impact Analysis (MEIA), the determination of the required support that the new farmers will require, and the Cash Flow Model that will provide an indication whether the loan capital can be repaid, are discussed below.

### 6.4.1 Cost Benefit Results – Trawal Development

The results of the three CBA models (financial constant price, financial current price and economic 'shadow price' models) are presented in **Table 6-16**. The results are obtained for a period of 30-years with the 2020 prices as the base price. For the Current Price model, the annual inflation is set at 4.5%.

No provision is made in calculation of the crops produced for any canal, pipeline or pump breakages, as the two small schemes will be new infrastructure. Drought restrictions are regarded as if this will very seldom happen after the raising of Clanwilliam Dam when the Assurance of Supply is estimated as 91%.

It is also accepted that Table Grapes and Raisins will maintain their exports at 90% of annual production, and that the Rand will maintain its position against the Euro.

**Table 6-16: Trawal Area - Cost Benefit Analysis Results**

| Model | Constant Price - Financial | Current Price - Financial | Economic Price |
|---|---|---|---|
| **Discount Rate** | **8%** | **11.28%** | **8%** |
| Present Value Benefits (Rand million) | R 6 169.1 | R 7 599.6 | R 6 169.1 |
| Present Value – Costs (Rand million | R 4 665.1 | R 5 518.2 | R 4 592.5 |
| Net Present Value (NPV) (Rand million) | R 1 504.02 | R 2 081.4 | R 1 576.67 |
| Benefit Cost Ratio (BCR) | 1.32 | 1.38 | 1.34 |
| Internal Rate of Return (IRR) | 16.8% | 22.2% | 17.34% |

It is evident from **Table 6-16** that in all three models the results indicate:

- NPV > 0.
- BCR > I.
- IRR > Discount Rate.

The interpretation is that, for the two small schemes, the Trawal irrigation project is financially and economically feasible. However, it is necessary that a Sensitivity Analysis be performed, which introduces a number of factors that might follow a rate of increase higher than the inflation rate. **Table 6-17** presents the results of the sensitivity analysis using the Current Price model.

**Table 6-17: Trawal - Sensitivity Analysis applying Current Price Model (4.5% inflation)**

| **Item** | Percentage Increase | Net Present Value (NPV) (Rand mil). | Benefit Cost Ratio (BCR) | Internal Rate of Return (IRR) | Results |
|---|---|---|---|---|---|
| Construction Costs | 40% | R 464.23 | 1.08 | 13.9% | Positive |
| Electricity | 20% | R 983,7 | 1.20 | 17.5% | Positive |
| Wages | 10% | R 959.8 | 1.19 | 17.4% | Positive |
| Product Income | -5% | R 767,2 | 1.16 | 16.4% | Positive |
| Product Income | -10% | R 467.7 | 1.09 | 14.6% | Positive |
| Product Income | -15% | R 166.4 | 1.03 | 12.7% | Positive |
| Product Income | -20% | R 133.9 | 0.97 | 10.6% | Negative |

The results in **Table 6-17** show that the results remain positive for the change in production cost items. However, when negative impacts on product prices and/or yields are taken into consideration, the results are much more drastic. Another factor that contributes to the possibility of crop decline is the reality that this will be new farmers starting a farming enterprise. A sensitivity analysis for a 5% to 20% decline in income was calculated. A 20% decline in income produces a negative result. This decline is a possibility if the price of the export products does not grow as expected. This result supports the argument that good financial and practical management will be crucial for the success of the Trawal irrigation schemes and the construction of the two new smaller schemes.

### 6.4.2 Cash Flow of New Farmers

As mentioned, the new HD Farmers will need financial support in a number of instances to assist them in becoming successful commercial farmers who contribute to the economic and social development in the area.

**Table 6-18** presents the breakdown of the financial loan support necessary at an 8% interest rate. The different cost items included are:

- Farm Development Capital;
- Operational Capital;
- Farm Owner Housing;
- Cost of Living Allowance;
- Service Costs consisting of Environmental and Operational Costs; and
- Interest.

The following cost items are not included as the assumption is that they are a transfer cost between Government departments:

- Farm land costs; and
- Irrigation Water Capital and Operational Water Costs.

**Table 6-18: Projected Cash Flow of the new Trawal Farmers based on 2020 prices and 4.5% Annual Increase**

| Financial Year | Outflow of Funds | | | | | | | | Inflow of Funds | Outstanding Loan |
|---|---|---|---|---|---|---|---|---|---|---|
| | Water Supply Develop-ment | Farm develop-ment capital | Farm Owner Housing | Crop Production costs | Cost of Living Allowance | Service Costs | Interest @8% per annum | **Total Annual cash outflow** | Crop Income | |
| | R mil | R mil. | R mil. | R mil. | R mil. | R mil. | R mil | R mil. | R mil. | R mil. |
| Year 1 | 208.64 | - | | - | 15.1 | 8.5 | 0 | 232.24 | 0 | **-R 232.24** |
| Year 2 | 218.02 | 198.62 | 13.41 | 120.71 | 15.70 | - | 18.58 | 585.04 | 54.11 | **-R 763.17** |
| Year 3 | 227.83 | 181.57 | 14.01 | 235.91 | 16.40 | 11.20 | 61.05 | 747.98 | 105.74 | **-R 1 405.41** |
| Year 4 | | 106.01 | 14.64 | 308.49 | 17.10 | 13.70 | 112.43 | 572.37 | 229.20 | **-R 1 748.58** |
| Year 5 | | 223.94 | 15.30 | 458.41 | 17.90 | 15.50 | 139.89 | 870.93 | 424.93 | **-R 2 194.57** |
| Year 6 | | - | | 479.03 | 18.70 | 18.30 | 175.57 | 691.60 | 609.42 | **-R 2 276.76** |
| Year 7 | | - | | 500.59 | 19.60 | 19.10 | 182.14 | 721.43 | 797.05 | **-R 2 201.14** |
| Year 8 | | - | | 523.12 | 20.40 | 19.90 | 176.09 | 739.51 | 967.70 | **-R 1 972.95** |
| Year 9 | | - | | 546.66 | 21.40 | 20.80 | 157.84 | 746.69 | 1 074.86 | **-R 1 644.79** |
| Year 10 | | - | | 571.26 | 22.30 | 21.80 | 131.58 | 746.94 | 1 123.22 | **-R 1 268.50** |

| Financial Year | Outflow of Funds | | | | | | | | Inflow of Funds | Outstanding Loan |
|---|---|---|---|---|---|---|---|---|---|---|
| | Water Supply Develop-ment | Farm develop-ment capital | Farm Owner Housing | Crop Production costs | Cost of Living Allowance | Service Costs | Interest @8% per annum | **Total Annual cash outflow** | Crop Income | |
| | R mil | R mil. | R mil. | R mil. | R mil. | R mil. | R mil | R mil. | R mil. | R mil. |
| Year 11 | | - | | 596.96 | 23.30 | 22.80 | 101.48 | 744.54 | 1 173.77 | **-R 839.28** |
| Year 12 | | - | | 623.83 | 24.40 | 23.80 | 67.14 | 739.17 | 1 226.59 | **-R 351.86** |
| Year 13 | | | | 651.90 | 25.50 | 24.871 | 28.15 | 730.42 | 1 281.79 | **R 199.51** |
| Year 14 | | | | 681.24 | | 25.99 | - | 707.23 | 1 339.47 | **R 831.75** |

*Source: Conningarth Economists*

**Table 6-18** shows that, in **Year 7,** the projected income will be higher than the expected funds needed, and that the loans could be repaid around **Year 13 to Year 14**. It is accepted that the baseline model is applying current good product prices and good yields, but sensitivity analysis shows that with a 15% reduction in income, a positive answer is attained only after 18 to 19 years. Land Bank farm loans are for a 20 year period and the above cash flow model shows that the farming enterprises can be profitable if high standard management practises are in place.

### 6.4.3 Socio- and Macro-economic Impact Results

The proposed development of the Trawal irrigation will have a social and economic impact on the immediate area, as well as on the Matzikama and Cederberg Local municipalities, as the construction and eventual production materialises.

Only an analysis of the maximum production is done, as the construction period is projected to be only 3 years and the capital amount is relatively low. **Table 6-19** presents the macro-economic results of the operational phase at maximum production, which is based on the crop division as presented in **Table 6-5**. However, there is no guarantee that this is the final make up after planting.

**Table 6-19: Macro-economic Impact of the Operational Phase of the proposed Trawal development**

| Impact Parameter | Direct Impact | Indirect Impact | Induced Impact | Total Impact |
|---|---|---|---|---|
| Impact on Gross Domestic Product (GDP) [R million] | 244 | 125 | 177 | **546** |
| Impact on capital formation [R million] | 146 | 445 | 499 | **1 090** |

| Impact Parameter | Direct Impact | Indirect Impact | Induced Impact | Total Impact |
|---|---|---|---|---|
| **Impact on employment [number of job opportunities]** | 2 705 | 234 | 444 | **3 383** |
| - Skilled impact on employment [number of job opportunities] | 69 | 49 | 96 | 214 |
| - Semi-skilled impact on employment [number of job opportunities] | 233 | 107 | 206 | 546 |
| - Unskilled impact on employment [number of job opportunities] | 2 403 | 78 | 142 | 2 623 |
| **Impact on Households [R million]** | | | | **417** |
| - Low Income Households [R million] | | | | 44 |
| - Medium Income Households [R million] | | | | 108 |
| - High Income Households [R million] | | | | 265 |
| **Fiscal Impact [R million]** | | | | **154** |
| -National Government [R million] | | | | 108 |
| -Provincial Government (Rm) | | | | 4 |
| -Local Government (Rm) | | | | 42 |
| **Impact on the Balance of Payments [R million]** | | | | **259** |

### 6.4.3.1 Regional Gross Domestic Product

**Table 6-19** shows that, at maximum production, a total of R 546 million (expressed in 2020 prices) will be added to the economy, of which R 244 million will be directly linked to the production of the crops and take place within the area of the two local municipalities.

### 6.4.3.2 Capital Formation

The formation of new capital that can be reinvested is a necessary element for economic grow. In total R 1 090 million will be generated with R 146 million having a direct impact.

### 6.4.3.3 Employment Creation

In total, 2 705 jobs will be directly created, mostly on the farms, of which 84 will be skilled, 281 semi-skilled, and 2 899 unskilled. A large percentage of the unskilled "direct" labour will be part time, while the skilled and semi-skilled will be permanent employees.

The indirect employment created is estimated at a total of 234, and the induced employment at a total of 444.

#### 6.4.3.4 Payment to Households

The total annual amount paid to households is estimated at R 417 million, expressed in 2020 prices. The share for low-income households is R 44 million, which is 10.1%, per annum expressed in 2020 prices.

#### 6.4.3.5 Payments to Fiscus

The total annual taxes paid is estimated at R 154 million with R 108 million paid to National Government.

### 6.4.4 Impact on Balance of Payments

The annual estimated Impact on the Balance of Payment is R 259 million, expressed in 2020 prices. It Is mostly made up of the export of table grapes and raisins, with a small percentage contribution from wine production.

## 6.5 Summary of the Analysis of the Irrigation Development of the Trawal Irrigation Areas

The Cost Benefit Analysis indicates a financially and economically feasible project for all three of the models. The sensitivity analysis, which includes possible additional construction cost increases and below par crop yields and/or lower crop prices, also indicates a feasible project.

The projected Cash Flow of the proposed new HD Farmers indicates that they will be able to repay loans in less than 12 years. It is interesting to note that the average repayment period for bonds on farms by the Land Bank and Commercial Banks is 20 years.

The Macro-economic Impact Analysis shows that the operational phase of the irrigation development will have a very positive impact on the social and economic circumstances of the project area and the two local municipalities.

The conclusion is that the scenario of developing the two small bulk water schemes and the four Trawal irrigation areas is viable and, with the necessary support, could make an important contribution to the socio-economic improvement of the local communities.

# 7 Financial and Economic Feasibility of the Right Bank Canal

## 7.1 Background

In addition to the irrigation of the Trawal areas, which has already been established as economically and financially viable, it is necessary that a recommendation be formulated regarding the preferred development scenario. The Trawal irrigation areas are part of both development scenarios in terms of how the additional water from the Clanwilliam Dam will be provided to the additional new irrigation areas.

This chapter presents the data used in the different models to determine the financial and economic feasibility of the proposed new right bank canal, compared with the alternative left bank canal development scenario (two small bulk water schemes and refurbishment of the remainder of the left bank main canal). The detail of the two scenarios is explained in **Chapter 2**.

The additional new irrigation areas that could be developed after the Trawal areas, is presented in **Table 7-1** for both scenarios.

**Table 7-1: Additional New Areas in the Lower Olifants valley below Trawal**

| New Irrigation Areas | Hectares |
|---|---|
| Klawer Phase 1 | 412 |
| Klawer Phase 2 (partial development) | 438 |
| Coastal 1 flow-restricted | 89 |
| Ebenhaeser restitution & augmentation | 361 |
| **Total** | **1 300** |

*Source: Zutari*

## 7.2 Approach

The proposed new development below Bulshoek Weir consist of the Trawal (2 339 hectares) and a further 1 300 hectares, giving a total of 3 639 hectares. The approach followed to determine financial and economic feasibility is that the crop yield will be the projected potential yield, with fewer negative impacts resulting from water restrictions due to inadequate dam storage, canal breaks or restrictive canal capacity. This approach is used as there will be additional water available from the Clanwilliam Dam and less canal breaks will take place for a new canal or an improved canal.

It was assumed that the 1 300 hectares is also totally reserved for the settlement of HD Farmers and that the same guidelines will apply as used in the Trawal analysis.

The assumption is also made that the existing 12 501 hectares irrigated below Bulshoek Weir will benefit from the higher Assurance of Supply of water from the Clanwilliam Dam and that water failures due to canal breaks will be a minimum.

Improved water supply would also have a very positive impact on the towns and villages in the Matzikama Local Municipality.

*Note: In this chapter only, the data will pe presented without the reasoning behind it, as it is available in Chapter 6.*

## 7.3 Construction and Related Capital

### 7.3.1 Construction Capital

The Present Value (PV) construction costs for the two possible development and betterment scenarios are presented in **Table 7-2**, which is the same data as **Table 2-8** in **Chapter 2**.

**Table 7-2: Present Values of Comparative Costs (R million, 2020 prices)**

| Main canal long-term alternative | Present Value |
|---|---|
| 2 small schemes and upgrading of remainder of left bank main canal | R 819.66 |
| Right Bank Canal Scheme | R 1 177.05 |
| **Difference** | **R 357.4** |

*Source: Zutari*

The incremental Present Value cost of implementing the Right Bank Canal Scheme is R 357.4 million, which appears to be the more costly scenario from a cost perspective. It is however necessary to evaluate the capital cost and proposed construction time of both options, and the eventual impact on the benefits accrued from the additional water and increased assurance of supply.

**Table 7-3: Construction Costs of 2 Small Schemes and Betterment of the Left Bank Canal (2020 price, excl. VAT)**

| Total Cost R mil. | Development Component R mil. | Betterment Component R mil. | Assume betterment takes place over 15 years: annual cost R mil. | PV of Betterment @ 8% p.a. R mil. |
|---|---|---|---|---|
| **R 2 009.57** | R 573.16 | R 1 436.41 | R 95.76 | **R 819.66** |

*Source: Zutari*

**Table 7-3** reflects a betterment period of 15 years, with a relatively small annual cost of R 95.76 million expressed in 2020 prices. However, although the cost appears attractive, it does not take the benefits of a shorter construction period, if practically possible, into consideration. This cost excludes the maintenance costs for the left bank canal (pre- and post-betterment) and the two small schemes to serve the Trawal irrigation area.

Other questions that arise include the year in which each section is upgraded, and who will benefit from the year-on-year construction, as it is impossible to bring the benefits derived from the betterment works into consideration. **Table 7-4** presents the development and betterment costs of the right bank canal scenario.

**Table 7-4: Development and Betterment Costs of the Right Bank Canal (2020 prices, excl. VAT)**

| Total Cost R mil. | Development Component R mil. | Betterment Component R mil. | Assume betterment takes place over 4 years: annual cost R mil. | PV of Betterment @ 8% p.a. R mil. |
|---|---|---|---|---|
| **R 1 994.66** | R 573.16 | R 1 421.50 | R 355.58 | **R 1 177.05** |

*Source - Zutari*

**Table 7-4** results are based on a period of four years for the total construction to be completed.

## 7.4 Scenario 1 - Right Bank Canal Feasibility Analysis

The data used in the right bank canal scenario are presented In the following paragraphs.

### 7.4.1 Construction Costs

**Table 7-5** presents the construction costs of the right bank canal, with the "Development" column presenting the costs associated with construction of the alternative two small bulk water schemes.

**Table 7-5: Development and Betterment Costs for the Right Bank Canal Scenario (2020 prices, excl. VAT))**

| Scheme infrastructure component | Development (Rand mil.) | Betterment (Rand mil.) | Total Cost (Rand mil.) |
|---|---|---|---|
| Lining/raising development portion of existing main canal & new small high-level canal | 172.24 | - | 1 434.32 |
| Right Bank Canal | - | 1 262.08 | |
| Pump stations | 153.04 | - | 153.04 |
| Pipelines & syphons | 83.86 | - | 83.86 |
| Farm Dams | 27.42 | - | 27.42 |
| Land | 66.32 | 15.98 | 82.30 |
| Prof design & support | 70.29 | 143.43 | 213.72 |
| **Total Cost** | **573.16** | **1 421.50** | **1 994.66** |

*Source: Zutari*

### 7.4.2 Maintenance Costs

The annual maintenance cost is included in the CBA models from year 5, after the completion of the construction work. It is presented in 2020 prices in **Table 7-6**.

**Table 7-6:Calculation of Annual Maintenance Costs (2020 prices, excl. VAT)**

| Construction Component | Percentage | Capital R mil. | Maintenance R mil. |
|---|---|---|---|
| Civil Construction | 0.50% | 1 434.32 | 7.17 |
| Mechanical | 4.00% | 236.9 | 9.48 |
| Dams | 0.25% | 27.42 | 0.07 |
| **Total** | | | **16.72** |

*Source: Zutari Values and Percentages with Conningarth the Calculations*

The annual amount of R 16.72 million is used in the constant finance price model and R 21.77 million in year 5 in the current financial priced model, with an annual 4.5% inflation factor applied per annum thereafter.

### 7.4.3 Benefits

In deciding on which irrigation areas will be used in the calculation of the benefits, the following additional options are available:

a) Must the total new area of 3 639 hectares, located below Bulshoek Weir be used, which include the Trawal areas.
b) Only the 1 304 hectares that become additionally available if the right bank canal scheme is constructed.
c) Are the projected benefits that the existing farmers will experience qualifying for application in the CBA?

The 2 339 hectares of new irrigation in the Trawal section was proved economically and financially viable in the **Chapter 6** analysis. If this area is not included in the analysis, the R 573 million development cost must also be excluded from the capital costs used in the CBA, and then only the 'Betterment' costs of R 1 421.50 million must be used.

It is economically not logical to ignore the Trawal irrigation areas in the analysis, as the Right Bank Canal is a standalone project and must be analysed in its totality.

The existing irrigation farmers will also benefit from the right bank canal as the canal breaks will be less than on the left bank canal, where improvement will take place over a number of years. The additional regular supply of water during drought periods will also have a positive impact on crop yields.

The yields of the existing irrigation areas are based on the following:

- The assurance of water supply from Clanwilliam Dam will increase from 80% to 91%, with an associated design allowance for increased (and more regular) flows in the right bank canal.
- Reductions in crop yields because of canal breaks will also reduce.

### 7.4.4 Product Prices and Crop Yields

**Table 7-7** presents the potential crop yields and crop prices used in the new irrigation areas, at an assurance of water supply of 91%.

**Table 7-7: Crops used in the models**

| Crop type | Price per Ton | Ton per Hectare |
|---|---|---|
| Table grapes | R 32 500 | 15.5 |
| Raisins | R 17 000 | 7.6 |
| Wine grapes | R 5 040 | 26 |
| Tomatoes - Industry | R 2 124 | 95 |
| Tomatoes – Fresh | R 6 610 | 90 |
| Winter Vegetables | R 11 749 | 18.5 |
| Summer Vegetables | R 4 303 | 39.2 |

*Source: Agrifusion and Conningarth Economists*

### 7.4.5 Water Restrictions Discussion

Any restriction in irrigation water results in a decline in production yield and a fall in Net Farm Income associated with this lost production.

The proposed estimated increase in production for the current 12 501 hectares is based on the following assumptions:

- The increase in assurance of the water supply from 80% to 91% will lower the occurrence of the current regular (typically annual) water restrictions.
- Less ‘Canal Breaks’ during the summer if the ‘Betterment’ work is completed.

It is necessary to highlight the fact that the cost of the raised Clanwilliam Dam is a sunken cost, and that the increase in assurance of water supply is already discounted. However, due to the very poor condition of the current canal system below the Bulshoek Weir, the benefit will not be fully experienced by the producers. A number of reasons are responsible for this:

- The leakage of water in the entire canal system is estimated at close to 30% of the volume released from Bulshoek Weir by LORWUA, and 20% for the main canal.
- The irregular breaking of the canals from time to time and the impact on the production, and eventually the financial losses suffered by the producers.

Two quotas are in effect for the producers, i.e., an annual allocation of 12 200 $m^3$/ha/a, and a weekly quota (or maximum extraction rate) of 325 $m^3$/ha/week. During years of prolonged drought or short-term restrictions, both quotas are reduced, and restrictions are imposed on water users. The quota is based on an assessment of the state of the Clanwilliam Dam after the rainy season, during the latter half of September. This assessment considers factors such as the rainfall in the catchment, inflow and extent of snow during winter in the catchment. According to LORWUA, the situation would change for the positive if the raising of the Clanwilliam Dam is completed and the canal situation has been improved.

It is important to estimate the reaction of the farmers to the longer-term water restrictions, the financial impact on them, and the economic impact. In the Orange and Letaba Rivers the reaction by the farmers can be summarised as follows:

- They first stop planting any short-term crops.
- Then they restrict water supply to the orchards and accept the loss in yield over a period of at least 2 to 3 years.
- In the case of forecasted long-term droughts, they start taking out orchards that are at the end of their productive life and replant. The reason being that the replanted orchards will need much less water than an orchard in full production. It is important to note that we could not obtain any information that this was actually taking place in the irrigation area below the Clanwilliam Dam.

It appears as if the farmers in the study area planted less vegetables and restricted water supply to the vineyards, with a negative impact on yields.

In the case of canal breaks, the loss is mostly for summer vegetable crops that are either destroyed or the yield is considerably lower, while the orchards will experience varying losses in reduced yields. In the case of summer vegetable production, the producers tend to spread the planting area over a period of time to manage the marketing process. Therefore, a short water break will not result in a total crop loss, depending on the length of the water break.

It is accepted that the new right bank canal and the increased water supply from the raised Clanwilliam Dam will improve the supply of water. The result of this is that imposed restrictions will be reduced.

### 7.4.6 Improvement of Yields – Current Production

Currently 12 501[25] hectares are in production below Bulshoek Weir and the expectation is that a Higher Assurance of Water supply can have a positive impact on the crop yields over a period of time. Currently regular water restrictions are implemented or canal breaks occur.

[25] The hectares vary from year to year and also the different sources used. The 12501 hectares are the number provided by Agrifusion

**Table 7-8** shows the estimated wine grape loss per annum during the recent year-long drought period.

**Table 7-8: Estimated Wine Grape Losses during the 2017 to 2019 period (2020 Prices)**

| Production Year | Average Production Ton/ha | Loss Ton/ha | Total Yield Loss Tons | Financial Rand mil. |
|---|---|---|---|---|
| Long term Average | 22.6 | - | | |
| 2017/18 | 19.8 | -2.8 | -23 769.2 | -96.27 |
| 2018/19 | 17.2 | -5.4 | -45 840.6 | -185.65 |
| 2019/20 - Recovery | 23.7 | | | |
| **Total** | | | **-69 609.8** | **-281.92** |

*Source: Agrifusion and Conningarth Economists*

**Table 7-8** shows estimated losses suffered by the farmers of 69 609 tons with a monetary value of R 281.92 million over the two-year period. It must also be emphasised that the wine cellars in the area also experienced a financial loss, because of the lower volume of grapes delivered. Not only was a decline in output experienced, but also a decline in profitability.

Similar calculations can be performed for table grapes and raisins. According to the data collected by Agrifusion, raisins suffered an average loss of 23% in the two-year period, and table grapes 21% per annum.

**Table 7-8** also shows that the long-term average production for wine grapes is 22.6 tons per hectare, and that, in the first year after the drought, an average of 23.7 tons per hectare was obtained. According to the SAWIS 2020 data, 9 405 hectares are producing wine grapes in the Olifants River catchment, with 8 489 hectares situated below the Bulshoek Weir. The total production for the Lower Olifants River valley is projected to reach 220 700 tons, which is nearly 26 tons per hectare, if the total potential is reached, as compared to the 201 200 tons produced in 2019/20. A number of reasons can be presented for not reaching the maximum potential, namely:

- Long periods of restriction because of major droughts from time-to-time.
- Short term restrictions because of the Clanwilliam Dam running low before the rainy season starts.
- Canal breaks at crucial periods in the production cycle.
- According to the SAWIS statistics, 70.8% of the wine grape vineyards in the Lower Olifants River valley are older than 10 years and the production area is not yet fully representative of the new cultivars that are available, which reach maximum production earlier and also have the potential to produce higher yields.

The first three reasons above are water-related and will be very much reduced if the new right bank canal is constructed, because of the specific allowance for increased flow for existing irrigators.

From the time that the orchard is established, the grape crop yield increases over time to reach a maximum yield in year 4 or 5, depending on the variety. The yield then remains stable for a number years depending on the availability of the water. As the orchard gets older the yield starts declining, until the point is reached where the orchard has to be removed and replanted. The yield provided by the farmer is the average crop yield for all the orchards, regardless off the age, over the production period, which in this case was 22.6 tons per hectare. The projected possible increase in the yield is calculated as follows: a 6% average yield increase from 22.6 tons to 23.96 tons per hectare was selected because of the higher assurance of water supply and the replacement of orchards with the newer varieties. The only additional cost is harvesting, labour, packing material and transport cost items, which were adapted.

**Table 7-9** shows the impact of the water restriction during the long drought period on Table Grape production in the Lower Olifants River production area.

**Table 7-9: Table Grape Production during the recent Drought**

| Production Period | Number of 4.5kg cartons | Percentage Loss |
|---|---|---|
| Long Term Average | 3 324 000 | |
| 2017/2018 | 2 802 436 | -15.7% |
| 2018/2019 | 2 366 503 | -28.8% |
| 2019/2020 | 339 516 | -0.1% |

*Source: SATI*

The long-term average yield of 3.324 million cartons is still 5.03% lower than the accepted average potential of 3.5 million for the area. This long term lower-than-expected yield is blamed on the irregular water supply, the delivery bottleneck that exist in the current canal and the restrictions in place in times of drought as discussed above.

The production yield in both the new areas as well as the existing area was established at 16 ton per hectare in a full producing orchard, which converts to 14.72 tons per hectare over the 30-year period, taking into consideration the period from planting to full production. Only additional harvesting costs, packaging, transport and labour were increased.

The average long term raisin production is around 6.5 tons dry grapes per hectare for a 30-year period, but producers claim that new varieties, with no water restrictions, can produce around 8.2 tons per hectare. After contact with the Raisin Producers Organisation, it was decided to use 7.5 tons per hectare in the current and new producing areas. In the case of vegetables, where a total loss in production could occur during the production period, **Table 7-10** presents the estimated loss in yields in the case of canal breaks.

**Table 7-10: Negative Impact of Canal Breaks on Vegetable production**

| Crop | One month break | | Three months break | |
|---|---|---|---|---|
| | October to | January | October to | January |
| Fresh Tomatoes | 25% | 25% | 75% | 75% |
| Industrial Tomatoes | 100% | 100% | 100% | 100% |
| Summer Vegetables | 70% | 100% | 70% | 100% |
| Winter Vegetables | It is assumed that no breaks will occur in Winter | | | |

*Source: Agrifusion*

No detailed data could be collected about the long-term average of any of the popular vegetable types, and it was decided to use the 6% increase in yield for the existing producing areas, because it is assumed that larger volumes of water will be supplied from the raised Clanwilliam Dam.

### 7.4.7 Irrigated Crop Budget Structure

Refer to **Table 6-9** for the crop budget structure, which is discussed in Chapter 6.

Refer to **Table 6-10** for the detailed budget structure.

Refer to **Table 6-11** for the Production Cost Sub-division to be used in the SAM model for the Average Summer Vegetables.

### 7.4.8 Different Crop Combinations

In the current irrigation production system, a specific number of crops are produced. It was necessary to revisit this crop split and make a decision on the possible crops that might be produced in the new production area. **Table 7-11** presents a summary of the current production situation, with some comments about applicability to the new available irrigation area.

**Table 7-11: Current Production in Study Area (2020 prices)**

| Crop type | Sub-Area 4 and 5-Bulshoek Weir to Lutzville | Estimated Net Farm Income (NFI) R/ha | Some Comments about Long Term Marketing Projections |
|---|---|---|---|
| Table grapes | 880 | R 71 123 | Currently very profitable, over 90% exported and long-term outlook very positive |
| Raisins | 1 300 | R 55 144 | Currently very profitable, over 90% exported and long-term outlook very positive |
| Wine grapes | 8 389 | R 11 204 | Worldwide over-production, the same in South Africa and presently not profitable, but an improvement expected in the medium term |
| Deciduous Fruit | 100 | R 28 808 | Not really increasing. A lot of interest in different nut production options |
| Tomatoes - Industry | 350 | R 41 033 | Appears to be static in the producing area, but profit margins are relatively low, and the market is available. |
| Tomatoes – Fresh | 186 | R 126 709 | This appears to be experiencing growth in the producing area, margins are good. The fresh market price varies considerably. |
| Winter Vegetables | 485 | R 26 219 | Stable, without any major growth |
| Summer Vegetables | 811 | R 41 429 | Experiencing growth in the production area. The fresh market prices vary considerably. |
| **Total** | **12 501** | | |

*Source: Agrifusion and adaption by Conningarth*

*Table notes:*

- *It is accepted that the table does not represent the detailed situation, as it is a very productive farming area, but we nonetheless believe that it is representative of the area.*
- *Deciduous fruit includes peaches and pekan nut production together. The different dry nut varieties are experiencing high growth rates in many of the irrigation areas as the export price is doing very well. There is no surety at this time that it would also expand considerably in the Lower Olifants Area.*
- *The Net Farm Income (NFI) is calculated before any interest yield on investment capital or management fee is taken into consideration.*

**Table 7-11** above shows that the NFI of Table Grapes is the highest, with Wine Grape production being the lowest at present. In making a decision on the crops to be used in the CBA, a number of issues were taken into consideration. The successful implementation of the project will imply that new areas be developed for the establishment of HD Farmers.

After considering all the relevant factors, it was decided to use the existing crop division in the lower Olifants River as the base scenario, with minor adaptions and include wine grape production as a reality check. **Table 7-12** presents the data used in the analysis. No provision is made for any percentage of double cropping of the winter and summer crops.

**Table 7-12** provides the estimated crop division breakdown of the recommended 3 638 hectare irrigation area, which is based on the assumptions discussed in the Trawal analysis and includes the Trawal irrigation area.

**Table 7-12: Division of New Irrigation Area Crops below Bulshoek Weir**

| Crop type | New Area Proposed Crops – % | New Area Proposed Crops Including Trawal - hectares |
|---|---|---|
| Table grapes | 7.04% | 406 |
| Raisins | 67.11% | 731 |
| Wine grapes | 10.40% | 1 625 |
| Tomatoes - Industry | 6.49% | 292 |
| Tomatoes – Fresh | 2.80% | 244 |
| Winter Vegetables | 1.49% | 244 |
| Summer Vegetables | 3.88% | 96 |
| **Total** | | **3 638** |

*Source: Conningarth Economists*

It must be emphasised that there is no guarantee that this crop composition will actually be implemented, but it is still representative of what is actually produced in the area presently.

The crop types in **Table 7-12** make provision for immediate income from the tomato and summer and winter vegetable allocation, whilst awaiting the production of the three grape-based products.

### 7.4.9 Phasing of New Production Area

**Table 7-13** illustrates the different areas that become available after the construction of the right bank canal and the improved distribution from the canal system.

### Table 7-13: New Identified Irrigation Areas

| New Areas | Hectares |
|---|---|
| New Right Bank canal (incl. 4 Trawal irrigation areas) | 2 339 |
| Klawer Phase 1 | 412 |
| Klawer Phase 2 (partial development) | 438 |
| Coastal 1 flow-restricted | 89 |
| Ebenhaeser (restitution & augmentation) | 361 |
| **Total** | **3 638** |

*Source: Zutari*

The Klawer Phase 2 Scheme area will only become available once the Klawer canal section is either increased or replaced with a canal of increased flow capacity, as part of the implementation of the scheme.

If the alternate left bank canal scenario is implemented, the Klawer Phase 2 Scheme cannot be developed due to lack of canal flow capacity, and the additional hectares are reduced to 888 hectares, if it is assumed that the extent of canal losses remains at 20%. However, as the canal is lined, the losses will progressively decrease, eventually to the extent that adequate flow capacity will be available to also potentially implement the Klawer Phase 2 Scheme, although this is not recommended.

Klawer Phase 2 can also be developed as the last phased scheme if the right bank canal scenario is selected and additional funds become available for an upgrade or replacement of the Klawer canal section to service the area.

After studying the available maps, the latest projections are that, if construction starts in Year 1, the following areas can become available:

- Year 2: Zypherfontein 1 - 669 hectares.
- Year 2: Klawer Phase 1- 412 hectares.
- Year 3: Zypherfontein 2 - 661 hectares.
- Year 3: Ebenhaeser - 361 hectares.
- Year 5: Trawal - 554 hectares.
- Year 5: Melkboom - 455 hectares.
- Year 5: Coastal flow restricted - 89 hectares.
- Year 7: Klawer Phase 2 - 438 hectares.

**Table 7-14** presents the new irrigation areas (hectares) developed as applied in the CBA model, with the Klawer Phase 2 included. It must however be mentioned that this projected planting process could change as it is based on projected construction. It is important to emphasize that the planting process will be determined by the actual construction as it takes place over time.

**Table 7-14: Projection of areas (hectares) becoming available**

| Construction Year | Schemes | Hectares |
|---|---|---|
| Year 1 | | 0 |
| Year 2 | Zypherfontein 1, Klawer Phase 1 | 1 082 |
| Year 3 | Zypherfontein 2, Ebenhaeser | 1 022 |
| Year 4 | | 0 |
| Year 5 | Trawal, Melkboom | 1 098 |
| Year 6 | | 0 |
| Year 7 | Coastal flow restricted, Klawer Phase 2 | 438 |
| **Total** | | **3 639** |

*Source: Zutari and Conningarth Economists*

The division of the area per crop is in line with the main crops in the area, with the assumption that vegetable production will start immediately, followed by vineyards. The following production pattern is envisaged for the vineyards:

- Year 1 - Establishment.
- Year 2 - 0% Production.
- Year 3 - 30% production.
- Year 4 - 70% production.
- Year 5 - 100% production.
- Orchard's lifetime - 30-years.

**Table 7-15** presents the structure of the planting process using the schemes according to **Table** 7-12 and the crops according to **Table 7-13** as basis, indicating the number of hectares planted.

### Table 7-15: Irrigation Area (hectares) developed per Year

| Years that areas become available | Production Years - hectares | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Year 2 | 1082 | 1082 | 1082 | 1082 | 1082 | 1082 | 1082 | 1082 | 1082 |
| Year 3 | 0 | 1022 | 1022 | 1022 | 1022 | 1022 | 1022 | 1022 | 1022 |
| Year 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Year 5 | | | | 1098 | 1098 | 1098 | 1098 | 1098 | 1098 |
| Year 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Year 7 | | | | | | 438 | 438 | 738 | 438 |
| **Total in Production** | **1082** | **2104** | **2104** | **3202** | **3202** | **3639** | **3639** | **3939** | **3639** |

Although 1 082 hectares are e.g. developed in Year 2 and put under production, it will only be the vegetables and tomatoes that will deliver an income. The vineyards will only start producing 30% of potential in year 3 after establishment and will only realise full production in year 5 after establishment. A similar pattern of establishment of crops and income is followed as the other irrigation areas are phased in.

In **Table 7-16** the estimated income is presented for the example of 1 082 hectares established and produced over the next number of years.

### Table 7-16: Estimated Income for the 1 082 hectares established in year 2

| Crop Type | Estimated Income (Rand/ha) | Crop production in R million | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Table Grapes | 750 885 | 0 | 0 | 0 | 27.2 | 63.4 | 90.6 | 90.6 |
| Dry Grapes (Raisins) | 296 033 | 0 | 0 | 0 | 19.3 | 45.0 | 64.3 | 64.3 |
| Wine Grapes | 127 891 | 0 | 0 | 0 | 18.5 | 43.2 | 61.7 | 61.7 |
| Tomatoes - Fresh | 666 900 | 0 | 48.3 | 48.3 | 48.3 | 48.3 | 48.3 | 48.3 |
| Tomatoes - Industrial | 232 400 | 0 | 20.2 | 20.2 | 20.2 | 20.2 | 20.2 | 20.2 |
| Winter Vegetables | 217 357 | 0 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 |
| Summer Vegetables | 189 486 | 0 | 13.7 | 13.7 | 13.7 | 13 .7 | 13.7 | 13.7 |
| | | **R 0** | **R 88.4** | **R 88.40** | **R 153.4** | **R 240.1** | **R 305.1** | **R 305.1** |

**Table 7-16** shows that the income increases from R 88.4 million per year in the first two years of production (vegetables) up to a total of R 305.1 million per year, as the vineyards start to come into production,.

The projected production income for the first number of years is provided in **Table 7-177**, as phased in the CBA model.

### Table 7-17: Projected Income per Year in Constant 2020 Prices (R million, excl. VAT)

| Years that areas become available | Production Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 |
| Second Year | 88.4 | 88.4 | 153.4 | 240.1 | 305.1 | 305.1 | 305.1 | 305.1 | 305.1 | 305.1 |
| Third Year | 0.00 | 83.5 | 83.5 | 145.0 | 226.9 | 288.4 | 288.4 | 288.4 | 288.4 | 288.4 |
| Fifth Year | 0.00 | 0.0 | 0.0 | 89.8 | 89.8 | 155.8 | 243.8 | 309.9 | 309.9 | 309.9 |
| Seventh Year | 0.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 35.8 | 62.1 | 97.2 | 123.6 |
| **Total** | **R 88.41** | **R 171.9** | **R 237.0** | **R 474.9** | **R 621.8** | **R 749.3** | **R 873.2** | **R 965.6** | **R 1 000.7** | **R 1 027.1** |

**In Table 7-17** the interpretation of the income in a specific year is presented in the specific row for scheme areas coming available. The table for example indicates that in the Second Year (of start of production) row the Zypherfontein 1 and Klawer Phase 1 areas were brought into production. The production then increases gradually as the orchards start producing up to a maximum of R 305.1 million per year, which then continues up to year 30, expressed in constant prices. **Table 7-15** includes the Klawer Phase 2 area. A sensitivity analysis (as described later) is performed without the Klawer Phase 2 area included.

**Table 7-17** shows that the total annual income will start in Year 2 at R 88.41 million and increase to R 1 027.1 million in Year 11 if expressed in constant prices. The amount of R 1 027.1 million is the amount used in the model up to the 30$^{th}$ year (because of the 30-year evaluation period), based on the assumption that the vineyards will have a full production period of at least 25 years from year 5 after planting.

In the case of the alternate left bank canal scenario, the following development estimation was followed, and as such populated in the model, with Klawer Phase 2 included:

- Year 2: Zypherfontein 1 - 669 hectares.
- Year 2: Klawer Phase 1 - 412 hectares.
- Year 2: Trawal - 554 hectares.
- Year 3: Zypherfontein 2 - 661 hectares.
- Year 3: Ebenhaeser - 361 hectares.
- Year 4: Melkboom - 455 hectares.
- Year 5: Coastal flow restricted - 89 hectares.
- Year 13: Klawer Phase 2 - 438 hectares.

The approach of the alternate left bank scenario is discussed in the appropriate section.

### 7.4.10 On the Farm Capital Expenditure

On the farm capital expenditure will also be necessary in terms of irrigation equipment, and farming implements such as tractors, trailers and soil working implements. An assumption is also made that some sheds will have to be constructed for the implements and packing of vegetables.

The estimation of buildings is based on an average of a 50-hectare production unit farm. The actual size of the units has not yet been determined, and this value can change depending on the number of units and the determination of the actual number of buildings/sheds per farming unit.

The irrigation and bulk water capital costs is based on modern technology as the water is a valuable source and it must be used as efficiently as possible. Tractors and implements are based on the projected need per crop during the planting process.

In the case of the Trawal area, provision was made for pack houses, which is not repeated as most of the additional areas are close to current facilities. The numbers as applied in the CBA model are presented in **Table 7-18**.

**Table 7-18: Projected Capital Expenditure on the New Irrigation Units (2020 prices, excl. VAT))**

| Year | 2 | 3 | 4 | 5 | 6 | 7 | Total |
|---|---|---|---|---|---|---|---|
| Hectares Developed per Year | 1 081 | 1 022 | 0 | 1 098 | 0 | 438 | 3 639 |
| Percentage per Annum | 29.7% | 28.1% | 0.0% | 30.2% | 0.0% | 12.0% | 100.0% |
| Sheds, Etc. (R million) | R 31.80 | R 30.06 | R 0.00 | R 32.30 | R 0.00 | R 12.88 | R 107.05 |
| Irrigation and Bulk Water (R million) | R 229.08 | R 216.57 | R 0.00 | R 232.68 | R 0.00 | R 92.82 | R 771.15 |
| Tractors/ Implements, etc. (R million) | R 128.43 | R 121.42 | R 0.00 | R 130.45 | R 0.00 | R 52.04 | R 432.34 |
| **Total (R million)** | **R 389.31** | **R 368.06** | **R 0.00** | **R 395.43** | **R 0.00** | **R 157.74** | **R 1 310.53** |

The total investment is estimated in 2020 prices at:

- Buildings: R 107.05 million.
- Irrigation: R 771.15 million.
- Tractors and implements: R 432.34 million.
- **Total: R 1 310.53 million**.

The different annual amounts are repeated in the model to make provision for depreciation and replacement after a number of years. The following periods are used in the replacement structure:

- Buildings - 40 years.

- Irrigation Equipment - 12 years. This is a very difficult item to quantify as the technology used differs considerably, i.e., in the case of fresh tomatoes, producers using drip technology tend to replace after two crops, whilst, in the case of other vegetable types, it is a bit longer. For orchards it can be up to 20 years depending on a number of factors.
- Tractors, vehicles and other spray equipment - 12 years.

#### 7.4.10.1 Environmental Impact

The *Environmental Screening Sub-Report* mentions a number of possible environmental impacts, but no actual potential costs are provided. As the main impact will be along the route of the right bank canal during construction, the following values are used to represent a possible impact cost.

- A permanent environmental officer at a salary of R 15 000.00 per month, and a projected environmental impact of R 370 683.00 per annum.

This amount is calculated at R 120 per hectare multiplied by the estimated impact area along the canal of 15 139 hectares. The environmental officer's salary is used in the financial CBA, whilst the total costs including the environmental impact, are used in the economic CBA.

#### 7.4.10.2 Right Bank Canal Scenario - Total Area Analysis Results

The results of the financial and economic analysis are discussed in terms of the Cost Benefit Analysis (CBA) with the Financial CBA models (constant prices and nominal prices) and the Economic CBA.

The following sections present and discuss the results of the CBA for the total area. The total area is defined as the current production area, the Trawal identified area, and the rest of the new areas in the lower Olifants River.

In assessing both the micro-economic and the macro-economic impacts of the construction of the new right bank canal project, a 4-year construction period is used. The following scenarios form the basis of the financial and economic assessment:

- 'Do Nothing' Scenario;
- 'Do' Scenario; and
- Sensitivity Analysis

The CBA provides the overall financial and economic viability of the right bank canal scenario by comparing the different cost elements against the benefits generated by the additional water available from the Clanwilliam Dam. The analysis includes the additional new identified irrigation areas, as well as the production increase in the current production area due to the increase in the Assurance of Supply of water.

The socio- and macro-economic results are discussed in detail and, where possible, are allocated to the relevant local municipality, keeping in mind that all of the development will take place in the West Coast District Municipality, and where necessary, the macro-economic results are allocated to the National Government. The results are presented for the construction period, as well as the operational phase.

### 7.4.11 Right Bank Canal - Cost Benefit Analysis Results

#### 7.4.11.1 The Do-Nothing Scenario

The definition of the 'do-nothing' option is that no capital is spent on any of the canal scenarios. Although additional water will be available, the results can be summarised as follows:

- After the Clanwilliam Dam wall has been raised and the additional water is available, only the new irrigation schemes that make use of the existing spare canal flow capacity can be developed. In other words, the right bank canal or alternatively the two small bulk water supply schemes are not constructed. The following schemes can be developed for the 'do nothing' scenario:
  - Year 2: Klawer Phase 1 - 412 hectares.
  - Year 3: Ebenhaeser Restitution and CPA augmentation - 361 hectares.
  - Year 5: Coastal flow-restricted - 89 hectares.
- Attempt to maintain the current canal system with all its weaknesses of leakages and breaks.

The results of the ‘Do Nothing’ scenario would then be:

- Restriction of economic development in the lower Olifants River as the current left bank canal will not be able to accommodate the new water volumes.
- The available additional water will not be properly used, unless used above Bulshoek Weir.
- Only at schemes that make use of the spare capacity in the existing canals would historical disadvantaged farmers be established and the opportunity to establish or support them on the other areas will not take place.

As far as the existing farmers are concerned, their damages might increase over time as the existing canal degenerates further and more canal breaks occur. The following results are from **Table 4-6**:

- The losses estimated for a 30-day water break are as follows:
  - Year 1 - R 500.67 million.
  - Year 2 - R 794.26 million.
- The losses estimated for a 3-month water break are as follows:
  - Year 1 - R 398.99 million.
  - Year 2 - R 590.9 million.

The above values will also depend on the time of the break, especially in the grape orchard producing period. Another issue is the impact on the urban population, which often receives water from tankers at additional cost.

One positive point is that if the Clanwilliam Dam wall is raised, regular restrictions resulting from droughts will decline.

A second positive result would be less canal breaks if the canal system is improved.

#### 7.4.11.2 Results of Right Bank Canal Analysis

The following tables present and discuss the results of the three CBA models:

- **Table 7-19** presents the NPV, IRR and BCR values; and
- **Table 7-20** presents the results of the sensitivity analysis.

**Table 7-19 Cost Benefit Results of the Right Bank Canal Scenario (2020 prices)**

| Parameters | FCBA[26] Constant Price | FCBA Current Price 4.5% Annual Inflation | ECBA Constant Price |
|---|---|---|---|
| Discount Rate | 8% | 11.28% | 8% |
| Benefit - Present Values (R mil.) | R 8 597.85 | R 12 418.23 | R 8 142.66 |
| Total Costs – Present Values (R mil.) | R 8 316.36 | R 9 998.77 | R 5 396.88 |
| Net Present Value (NPV) (R mil.) | R 281.49 | R 2 419.46 | R 2 745.78 |
| Benefit Cost Ratio (BCR) | 1.03 | 1.24 | 1.51 |
| Internal Rate of Return (IRR) | 8.8% | 13.71% | 16.2% |

**Table 7-19** shows that, for all three models, the outcomes of the decision criteria are strongly positive, indicating a very viable financial project if the new right bank canal is completed:

- Net Present Value (NPV) > 0 (Positive).
- Internal Rate of Return (IRR) > Discount rates.
- Benefit Cost Ratio (BCR) > 1.

**Table 7-19** also shows that very positive results were obtained when using market prices in the ECBA model, indicating a very viable economic project.

The economic CBA model also indicates that a full recovery of the capital investment will be obtained in a period of 10 years.

#### 7.4.11.3 Sensitivity and Risk Analysis

The current economic environment indicates that certain of the input costs are likely to increase faster than the expected inflation rate. It was therefore necessary to run some of these items through the financial current price CBA model to estimate possible impacts on the outcome of the analysis. The following three inputs were evaluated with increases over time at growth rates much higher than the estimated annual inflation rate:

- Electricity tariffs, which are currently increasing at about 20% above annual inflation.
- Farm labour, who are receiving increases about 10% above annual inflation.
- Capital Cost and developmental costs, where a number of increases were run, with a maximum 40% increase.

**Table 7-20** presents the results of the above three sets of combinations.

[26] FCBA – Financial Cost Benefit Analysis

**Table 7-20: Right Bank Canal - Results of the Sensitivity Analysis, applying the Current Price Model with Discount Rate 11.28%**

| Parameters | Electricity Annual Increase 20% | Wages Annual Increase 10% | Capital Cost 40% |
|---|---|---|---|
| NPV (R million) | R 2 285.57 | R 2 179.05 | R 897.34 |
| BCR | 1.23 | 1.21 | 1.08 |
| IRR | 13.5% | 13.2% | 12.2% |

All three scenarios show positive results, providing strong financial and economic grounds for expressing support for the implementation of the recommended project. The possible higher than expected increase in capital cost poses the highest risk for the project. The possible higher than inflation increases for electricity and wages is at a lower risk level. The evaluation indicates that an increase of up to 40% in construction costs still provides a positive answer.

A second set of risks are that the new irrigation areas will not be able to reach maximum production over the first 5 years, due to management, production and financing problems. Secondly, the estimated increase in existing irrigated areas might not materialise, and therefore only experience less restrictions, but no production increase in terms of a higher assurance of water supply. **Table 7-21** represents the results of a number of risk analyses.

**Table 7-21: Right Bank Canal- Results of Production Shortfalls over the first 7 years using the Current Price Model**

| Parameters | No Additional Benefits from Existing Area | New Production 10% Short | New Production 15% Short | New Production 20% Short |
|---|---|---|---|---|
| NPV (R million) | R 2 055.59 | R 2 390.8 | R 1 788.3 | R – 476.65 |
| BCR | 1.26 | 1.24 | 1.18 | 0.98 |
| IRR | 12.2% | 11.3% | 9.9% | 6.52% |

**Table 7-21** shows that, if no additional benefits are obtained by the existing producers, the new production areas will still be financially viable.

The table shows that a positive set of results are obtained if the output is 10% below the base line expectations for up to 7 years. The 15% shortfall is border line between feasibility and non-feasibility.

The above results were obtained with the Klawer Phase 2 development taking place in Year 7. However, if this scheme is implemented at a later stage, the results become more risk sensitive, The CBA results together with the Risk analysis indicate a viable project in terms of financial and economic indicators.

## 7.5 Scenario 2 - Two Small Schemes and Left Bank Betterment: Cost Benefit Analysis

This section explains the determination of the financial and economic viability of the construction of the two small schemes and the betterment of the remainder of the existing left bank main canal. The same three CBA modelling structures used for the right bank canal option, is used in this analysis:

- Financial CBA (FCBA) with constant prices at 8% discount rate;
- Financial CBA (FCBA) with nominal (current) prices at 4.5% annual inflation and 11.28% discount rate; and
- Economic CBA (ECBA) with constant market (shadow) prices at 8% discount rate.

The new irrigation area that will eventually be developed is the same as for the right bank canal scenario, but the timeline for development will differ. In the case of the Trawal area, it was accepted that it will be developed in the same order as applied in **Chapter 6**.

### 7.5.1 Construction Capital

**Table 7-22** presents the costs of the development component constructed over a 3-year period (two small schemes) and the betterment component over a 15-year period (left bank canal betterment).

**Table 7-22: Construction Costs of the Two Small Schemes and the Betterment of the Left Bank Canal (2020 prices)**

| Total Cost (R million) | Development Component (R million) | Betterment Component (R million) | Assume betterment takes place over 15 years: annual cost (R million) |
|---|---|---|---|
| **R 2 009.57** | R 573.16 | R 1 436.41 | R 95.76 |

*Source: Zutari*

The R 95.76 million annual cost, expressed in 2020 prices, is inflated by 4.5% per annum over 18 years to R 219 million, which is used in the current price model.

### 7.5.2 Farm Developmental Costs

The farm development costs are linked to the projected new area development assumed with the development pattern below.

The following development estimation was followed and as such populated in the model, with Klawer Phase 2 included:

- Year 2: Zypherfontein 1 - 669 hectares.
- Year 2: Klawer Phase 1 - 412 hectares.
- Year 2: Trawal - 554 hectares.
- Year 3: Zypherfontein 2 - 661 hectares.
- Year 3: Ebenhaeser - 361 hectares.
- Year 4: Melkboom - 455 hectares.
- Year 5: Coastal flow restricted - 89 hectares.
- Year 13: Klawer Phase 2 - 438 hectares.

**Table 7-23** presents the estimated development costs per annum as used in the CBA models.

**Table 7-23: Left Bank Farm Development Costs (R million, 2020 prices, excl. VAT)**

| Year | 2 | 3 | 4 | 5 | 13 | Total |
|---|---|---|---|---|---|---|
| Hectares Developed per Year | 1 635 | 1 022 | 455 | 89 | 438 | 36 390 |
| Percentage per Annum | 44.9% | 28.1% | 12.5% | 2.4% | 12.0% | 100% |
| Sheds, etc. | R 48.10 | R 30.06 | R 13.39 | R 2.62 | R 12.88 | R 107.05 |
| Irrigation and Bulk Water | R 346.47 | R 216.57 | R 96.42 | R 18.86 | R 92.82 | R 771.15 |
| Tractors/ Implements, etc. | R 194.25 | R 121.42 | R 54.06 | R 10.57 | R 52.04 | R 432.34 |
| **Total (R million)** | **R 588.82** | **R 368.06** | **R 163.86** | **R 32.05** | R 157.74 | R1 310.53 |

*Source: Conningarth Economists*

### 7.5.3 Benefits

For the division of the crops, the same percentages are used as in the right bank canal scenario, which are presented in **Table 7-12**.

It is also accepted that once the left bank canal has been refurbished the canal will be able to let through increased flow, as there will be fewer canal breaks and losses should decrease to the accepted 10%.

Possible increased production by existing farmers can only materialise after the completion of the refurbishment when water restriction periods caused by long droughts and canal breaks will be reduced. Therefore, the possible increased production was only applied in years 18 to 30.

In the base CBA model, it was assumed for a number of reasons that a 6% increase in crop yield will be possible over years 6 to 30. In this case it is obvious that the full 6% will only be realised from year 18 to year 30, once the betterment is completed. The increase of 6% is therefore added in the model from years 18 to 30.

#### 7.5.4 Scenario 2 - Cost Benefit Analysis Results

**Table 7-24** presents the results of the CBA for the three models used.

**Table 7-24: Results - Cost Benefit Analysis Left Bank Canal Betterment - Klawer Phase 2 Included**

| Parameters | FCBA[27] Constant Price | FCBA Current Price 4.5% Annual Inflation | ECBA Constant Price |
|---|---|---|---|
| Discount Rate | 8% | 11.28% | 8% |
| Benefits – Present Value (R million) | R 7 973.00 | R 10 118.06 | R 7 973.00 |
| Total Costs – Present Value (R million) | R 7 949.32 | R 9 380.47 | R 7 848.45 |
| Net Present Value (NPV) (R million) | R 23.68 | R 737.59 | R 124.55 |
| Benefit Cost Ratio (BCR) | 1.01 | 1.08 | 1.03 |
| Internal Rate of Return (IRR) | 8.1% | 14.0% | 8.4% |

The results in **Table 7-24** indicate a financially and economically viable project, based on the discussed assumptions for the two small schemes with associated Trawal irrigation development and the left bank canal betterment.

**Table 7-25** presents the results of the FCBA and ECBA models, with Klawer Phase 2 included and excluded.

[27] FCBA – Financial Cost Benefit Analysis

**Table 7-25: Comparison of Impact of Including Klawer Phase 2 in the Left Bank Betterment**

| Parameters | FCBA Current Price – Klawer Phase 2 included | FCBA Current Price – Klawer Phase 2 excluded | ECBA – Klawer Phase 2 Included | ECBA – Klawer Phase 2 Excluded |
|---|---|---|---|---|
| Discount Rate | 11.28% | 11.28% | 8% | 8% |
| Benefits – Present Value (R million) | R 10 118.06 | R 9 597.31 | R 7 973.00 | R 7 602.15 |
| Total Costs – Present Value (R million) | R 9 380.47 | R 9 180.00 | R 7 848.45 | R 7 561.58 |
| Net Present Value (NPV) (R million) | R 737.59 | R 409.31 | R 124.55 | R 40.53 |
| Benefit Cost Ratio (BCR) | 1.08 | 1.04 | 1.03 | 1.01 |
| Internal Rate of Return (IRR) | 14.0% | 13.1% | 8.4% | 8.2% |

**Table 7-25** indicates that exclusion of the development of the Klawer Phase 2 area results in the financial and economic viability of the Left Bank Canal Scenario 2 becoming very marginal.

In the following paragraph the results of the Risk analysis are presented.

### 7.5.5 Sensitivity and Risk Analysis

As previously explained, the current economic environment indicates that certain of the input costs are likely to increase faster than the expected inflation rate. It was therefore necessary to run some of these items through the financial current price CBA model to estimate possible impacts on the outcome of the analysis. The following are the three inputs evaluated and increased over time at growth rates much higher than the estimated annual inflation rate:

- Electricity tariffs, which are currently increasing at about 20% above annual inflation.
- Farm labour, who are receiving wage increases of about 10% above annual inflation.
- Capital Cost and developmental costs with a maximum 40% increase.

**Table** 7-26 presents the results of the above three different combinations of increases.

**Table 7-26: Results of the Sensitivity Analysis applying the Current Price Model – Discount Rate 11.28%**

| Parameters | Electricity Annual Increase 20% | Wages Annual Increase 10% | Capital Cost Increase 40% |
|---|---|---|---|
| NPV (R mil.) | R 648.14 | R 540.85 | R – 540.72 |
| BCR | 1.07 | 1.06 | 0.95 |
| IRR | 13.7% | 13.3% | 9.5% |

The results (Table 7-26) of two of the three scenarios show positive results with the increased capital cost resulting in a negative answer. This provides a sense of alarm for financial and economic grounds for expressing unconditional support for the implementation of the development scenario. The possible increase in capital cost indicates the highest risk, with only a 15% capital cost increase providing a positive value, with the possible electricity and wage increases at a much lower risk level.

A second set of risks are that the new irrigation areas will not be able to reach maximum production over the first 7 years of production, due to management and production finance problems. Secondly, the estimated increase in existing irrigated areas might not materialise, and therefore only experience less restrictions, but no production increase in terms of a higher Assurance of Supply of irrigation water. **Table 7-27** represents the results of a number of risk analyses.

**Table 7-27: Results of Production Shortfalls over the first 7 years - Alternative Left Bank Canal Scenario**

| Parameters | No Additional Benefits from Existing Area | New Production 5%short | New Production 10% short |
|---|---|---|---|
| NPV (R million) | R 482.00 | R 244.47 | - R 248.65 |
| BCR | 1.05 | 1.03 | 0.97 |
| IRR | 13.2% | 12.2% | 10.3% |

The results in **Table 7-27** show that the alternative left bank scenario (2 small schemes and refurbishment of the remainder of the left bank main canal) provides positive answers if no contribution from the existing producers is introduced. However, the results show a high level of sensitivity regarding shortfalls in production in the first seven years, which is not the case for the right bank canal scenario.

## 7.6 Scenario 1 compared to Scenario 2

The results of the various evaluations show that both scenarios are financially viable in terms of the CBA results with Scenario 1, the Right Bank Canal Scenario, providing much stronger results.

The Sensitivity analysis also does not support Scenario 2 in terms of the different risk factors regarding possible construction cost increases, not reaching maximum production levels and possible product prices not keeping up with the cost of production inflation.

The Macro-Economic Impact Analysis shows that the implementation of Scenario 1 will introduce considerable positive results in terms of the growth potential of the economy of the Lower Olifants River, which is an area where economic growth is currently very low. It will also make a large contribution to poverty alleviation in the region by the number of new jobs created and salary payments to households.

It therefore appears that Scenario I is the best financial and economic scenario.

## 7.7 Economic Analysis: Macro- Economic Impact Results

The Cost Benefit Analysis results in terms of the micro-impact analysis show that the Trawal irrigation development together with the right bank canal is the better of the two scenarios, as discussed in **Chapter 7.6**.

However, the CBA results provide no indication of the Social and Economic impacts in the two local municipalities. The preferred scheme would be constructed over a relative short period of four years, whereas the production period is over a 30 year period and will have an annual social and economic impact.

To calculate the social and economic impacts, a partial general input-output model was used based on the Social Accounting Matrix (SAM) of the Western Cape, updated to 2020 prices for the provincial government.

- The results of the Socio-Economic Impact Assessment of the project are discussed below. These results are measured in terms of macro- and socio-economic performance indicators such as:
- GDP (value added to the provincial economy);
- Employment creation (creation of new jobs for skilled, semi-skilled, and unskilled workers);
- Capital utilization (investments in machinery, transport equipment, buildings, and other social and economic infrastructure);
- Income generated for low-income households (incremental income available to low-income households) as a specific measure of poverty alleviation;
- Fiscal Impact (contributions to Government Revenue); and
- Social Indicators (i.e., the number of additional educators; the number of additional beds serviced at hospitals; the number of additional doctors; the number of additional low-cost houses that can be built; etc.).

The results of the construction phase are presented first, followed by the benefits obtained during the operational phase of the new irrigation developments. There are also additional benefits in the existing irrigation as a result of the improved Assurance of Supply of irrigation water.

It is important to evaluate the results of the construction and the operational phases in terms of the possible impact in the West Coast District Municipality, and the two very rural Cedarberg and Matzikama Local Municipality service areas.

The construction phase will impact positively on both municipalities as sections of the construction will take place in both.

### 7.7.1 Results of the Construction Phase of Scenario 1: Right Bank Canal

**Table 7-28** provides the results of the proposed capital investment in the construction of the right bank canal to serve the new identified production areas. The results are reported as the direct impact (on site), the indirect impact (ripple effect of on-site activities on other sectors of the regional economy) and the induced impact. The latter measures the impact on the economy of wages and salaries associated with the additional economic activities created by the capital investment aspects of the project. The total impact is calculated as the sum of the three component impacts. The direct impacts are in the two local municipality domains, whilst a percentage of the indirect impact and induced impacts will also be local. Additional salaries paid to the labour force working in the area will spend a percentage of the money locally, which will stimulate local trading.

**Table 7-28: Socio-economic Results of the Capital Investment by Government (2020 prices)**

| Impact parameter | Direct Impact | Indirect Impact | Induced Impact | Total Impact |
|---|---|---|---|---|
| Impact on Gross Domestic Product (GDP) [R million] | 497 | 132 | 297 | 926 |
| Impact on capital formation [R million] | 1 100 | 375 | 835 | 2 310 |
| Impact on employment [number of job opportunities] | 1 548 | 322 | 745 | 2 614 |
| - Skilled impact on employment [number of job opportunities] | 251 | 80 | 164 | 495 |
| - Semi-skilled impact on employment [number of job opportunities] | 968 | 159 | 346 | 1 473 |
| - Unskilled impact on employment [number of job opportunities] | 329 | 83 | 235 | 646 |
| Impact on Households [R million] | | | | 706 |
| - Low Income Households [R million] | | | | 66 |
| - Medium Income Households [R million] | | | | 153 |
| - High Income Households [R million] | | | | 487 |

| Impact parameter | Direct Impact | Indirect Impact | Induced Impact | Total Impact |
|---|---|---|---|---|
| Fiscal Impact [R million] | | | | 239 |
| - National Government [R million] | | | | 161 |
| - Provincial Government (R million) | | | | 7 |
| - Local Government (R million) | | | | 71 |

The results in **Table 7-28** are presented on the assumption that the construction period will be completed in four years, and the capital used is converted to annual amounts.

Although these benefits will only be for a four-year period, the results of the investment will stimulate agricultural and business production for a very long period.

The socio-economic impacts are as follows:

- The construction period will provide an estimated 2 614 jobs, of which 1 100 will be direct on site employment opportunities, including 646 unskilled people.
- The estimated wages paid per annum expressed in 2020 prices is R706 million, of which R66 million will be for low-income households.

The macro-economic impacts are as follows:

- The total GDP per annum during the four year construction period is estimated at R 926 million.
- The total taxes to be paid in 2020 prices will be R 239 million per annum, with the two local government entities receiving R 71 million in taxes.

The total taxes to be paid, in 2020 prices, will be R 239 million per annum.

### 7.7.2 Results of the Operational Phase of Scenario 1

**Table 7-29** presents the socio-economic results of one year at maximum production of the operational phase of Scenario 1. It should be remembered that the life time of the project is assumed to be 30-years. These results will however depend on future changes in crops produced, as well as the introduction of modern technology.

**Table 7-29: Socio- and Macro-economic Impact Results of the Production Phase (2020 prices)**

| Impact Parameter | Direct Impact | Indirect Impact | Induced Impact | Total Impact |
|---|---|---|---|---|
| Impact on Gross Domestic Product (GDP) [R million] | 604 | 264 | 413 | 1281 |
| Impact on capital formation [R million] | 1 311 | 964 | 1 168 | 3 443 |
| Impact on employment [number of job opportunities] | 6 160 | 484 | 1 042 | 7 686 |
| - Skilled impact on employment [number of job opportunities] | 159 | 101 | 225 | 484 |
| - Unskilled impact on employment [number of job opportunities] | 5 448 | 163 | 334 | 5 945 |
| Impact on Households [R million] | | | | 979 |
| - Low Income Households [R million] | | | | 103 |
| - Medium Income Households [R million] | | | | 253 |
| - High Income Households [R million] | | | | 623 |
| Fiscal Impact [R million] | | | | 355 |
| -National Government [R million] | | | | 249 |
| -Provincial Government (Rm) | | | | 9 |
| -Local Government (Rm) | | | | 97 |
| Impact on the Balance of Payments [R million] | | | | 584 |

Allocating a percentage of the results in **Table 7-29** to one of the two local municipalities is not a straightforward issue. Although 1 166 hectares out of the total 3 668 ha of the new irrigation area falls within the Cederberg LM, the balance (2 102 hectares) is in Matzikama LM, and the types of crops might not be uniform throughout the area.

Additional to the above aspects, the expected crop yield increase by the existing farmers will only take place in the MLM area.

#### 7.7.2.1 Gross Domestic Product

Previously, in South Africa the term Gross Geographical Product (GGP) was used to describe local or regional increase in 'Domestic Product'. The term is not used anymore and 'Regional' or 'Provincial' GDP is rather referred to where necessary.

The definition of GDP states that it is 'a monetary measure of the market value of all the final goods and services produced in a specific time period for a country, region or local economy, often annually'. In this specific situation it presents the projected value when the production stemming from the project is fully developed.

The total projected GDP is estimated to be around R 1 281 million per annum, expressed in 2020 prices, with the direct component being estimated at R 604 million, the indirect component at R 264 million, and the induced effect at R 413 million.

**Figure 7.1** shows the percentage distribution of the GDP between the three different components. It is also necessary to keep in mind that the products will nearly all be transported to Cape Town for either marketing or export purposes. The accompanying economic impacts are included in the results.

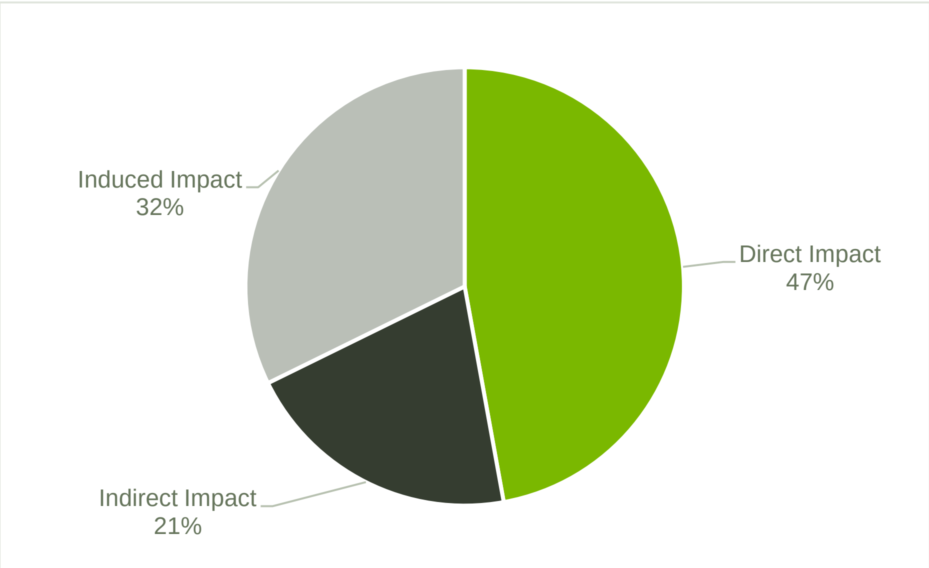


**Figure 7-1: Distribution of Gross Domestic Product**

#### 7.7.2.2 Capital Creation

Capital formation is a crucial element for economic growth. New capital formation increases investment, which stimulates economic development in two ways:

- Firstly, it increases the per capita income and enhances purchasing power, which in turn creates more effective demand.
- Secondly, investment leads to an increase in production.

The following capital is created in the different segments per annum:

- Direct - R 1 311 million.
- Indirect - R 964 million.
- Induced - R 1 168.
- A total of R 3 443 million annually.

It is necessary that 'new capital' be generated each year to fund the new production year.

#### 7.7.2.3 Employment Creation

The number of employment opportunities created as a result of the project are presented as direct, indirect, induced and also as skilled, semi-skilled and unskilled. **Table 7-30** presents the estimated new employment opportunities.

**Table 7-30: Employment Creation**

| Impacts | Number of Jobs |
|---|---|
| Direct Impact | 6 160 |
| Indirect Impact | 484 |
| Induced Impact | 1 042 |
| **Total Impact** | **7 686** |

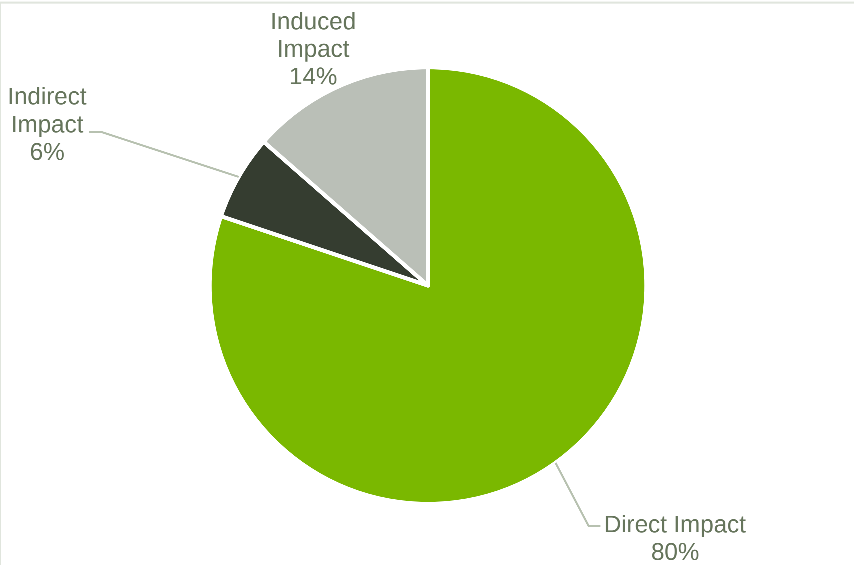


**Figure 7-2: The potential job opportunities per category**

**Figure 7-2** shows that over 80% of job opportunities created are in the direct category, with much smaller percentages in the other two categories. In total, 7 686 job opportunities can be created and supported. The 6 160, which are in the direct category, will be in the area and on the farms. It can also be accepted that a percentage of the other two categories will also occur in the feeder area.

The 6 160 jobs will be created in the Cederberg and Matzikama LM service areas, where social conditions are currently not very encouraging and irrigation activities can add to the improvement of the situation.

**Table 7-31** shows the number of jobs that can be created and supported at different skill levels by the proposed new irrigation development.

**Table 7-31: Impact on Employment Skills**

| Impact on employment | Numbers |
|---|---|
| Skilled | 484 |
| Semi-skilled | 1 257 |
| Unskilled | 5 945 |
| **Total** | 7 686 |

It is evident from **Table 7-31** that 484 of the job opportunities will be in the skilled category, with 1 257 semi-skilled and 5 945 unskilled. **Figure 7-3** provides an illustration of the skill categories of the number of jobs created.

**Table 7-31** also shows that Scenario 1, the right bank canal, can create 5 945 unskilled jobs in the production area within 8 - 9 years after construction has started. The majority of these jobs will be in the Matzikama Local Municipality area.

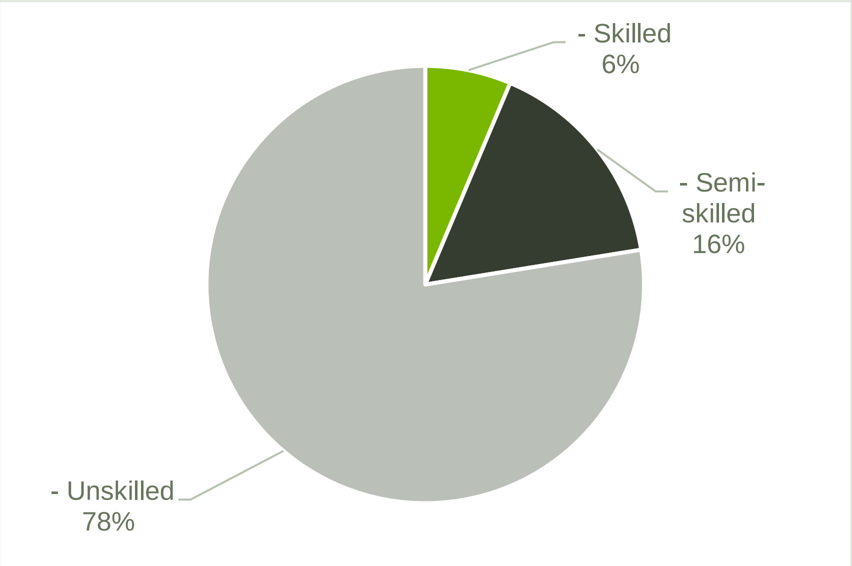


**Figure 7-3: Presentation of Skills Development**

**Figure 7-3** indicates that only 6% of the potential jobs will be in the skilled category, with 16% being semi-skilled and 78% unskilled.

#### 7.7.2.4 Fiscus Payment – Social Impact

The total revenue generated by the project to the Fiscus, in terms of different forms of tax at current rates, is estimated at R 355 million per annum at 2020 prices. The individual tax elements are the National Government, Provincial Government and Local Government.

To provide an estimation of what the National Tax of R 355 million is worth in economic terms, it is expressed in social values. The data below provides an indication of the extent to which the social services of South Africa can be improved by the additional government income emanating from taxes due to the project. These figures are calculated by assuming that a sizeable portion of this additional government income will be allocated to social services. It should be noted that the social services indicators depicted below are not mutually exclusive, but should be considered together.

National Government income will increase, on average, by R 211 million per annum expressed in 2020 prices. If this amount is translated into social services, by using the social expenditure portion of the current national budget, it can support the following increases in social services in one year:

- Additional educators: 150.
- Additional hospital beds serviced: 33.
- Additional doctors: 7.
- Additional low-cost houses built: 49 per annum, which accumulates to over 980 over a 20 year period.

When undertaking projections of this kind, it is important to note that the total cost to government to employ, for example, one teacher, must be taken into account. It is not only the educator's remuneration package, but also all of the other costs related to supporting the educator standing in front of a class, namely furniture, school buildings, administrative support, etc. Thus, total government expenditure on education is divided between the total number of educators employed. The figures reflected above thus make provision for all direct and indirect costs associated with each of the social indicators investigated.

The local government entities, represented by West Coast District Municipality and the two local municipalities, will receive an additional R 82 million per annum, expressed in 2020 prices. The provincial government will receive R 8 million per annum.

### 7.7.3 Impact on Households

One of the crucial aspects of any socio-economic impact assessment is poverty alleviation. The extent to which poverty alleviation is achieved is measured by the impact on household income, specifically, the extent to which low-income households will be affected by the successful execution of the project. **Table 7-32** shows the total annual impact of the expected wages to be paid to households, with a total of R 818 million annually, expressed in 2020 prices.

**Table 7-32: Annual Payments to Households (2020 Prices)**

| Impact on Households | Total Impact (Rand Million) |
|---|---|
| Low Income | 103 |
| Medium Income | 253 |
| High Income | 623 |
| **Total** | **979** |

It is estimated that 10.5% of the total household income generated will flow to low-income households. Households represent an important agent of the economy, due to their Income and Expenditure patterns. It is important to note that people, as economic agents, are classified as households in terms of national accounts. This is shown in **Figure 7-4**.

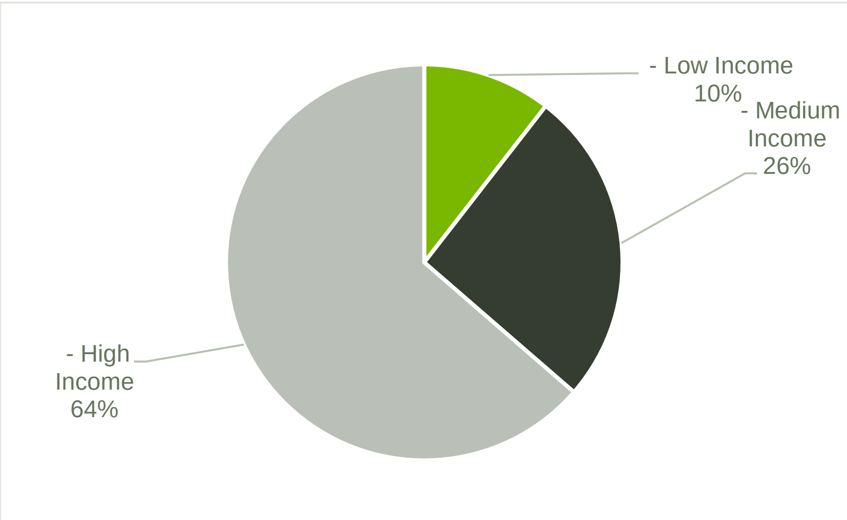


**Figure 7-4: Percentage Division of Income to Households**

### 7.7.4 Impact on Balance of Payments

As a large percentage of the table grapes, raisins and wine grape products are exported, a very positive impact is realised on the Balance of Payments of the Treasury, namely R 584 million annually, expressed in 2020 prices.

# 8 Summary

The approach followed during this evaluation was to quantify the macro- and micro-economic impact associated with the mitigation of the risk of failure of the main canal (Trawal section) of the Lower Olifants River GWS. The risk is mitigated by constructing a right bank canal to replace the existing main canal from Bulshoek to Verdeling and the development of the Trawal four irrigation areas.

The report also describes the approach and methodology followed to determine the financial and economic viability of the Trawal identified irrigation areas separately. Then the two alternative development scenarios are compared, which are as follows:

- Scenario 1 - The construction of the new Right Bank Canal up to Verdeling to serve the new Trawal irrigation areas and the rest of the system; and
- Scenario 2 - The alternative schemes to serve the new Trawal irrigation areas and the betterment of the current left bank canal up to Verdeling.

A further possible scenario is evaluated, namely the 'Do Nothing' scenario, which could be the following:

- After the raised Clanwilliam Dam wall and the additional water is available, only the three schemes (Ebenhaeser, Trawal Phase 1 and Coastal 1 flow-restricted) that use spare capacity in the existing canal system, will be developed; and
- Attempt to maintain the current canal system with all its weaknesses of leakages and breakages.

The results of the 'do nothing' scenario would then be:

- Restriction of economic development in the lower Olifants River;
- The available additional water will not be properly used; and
- Only for three schemes would HD Farmers be established and the opportunity to establish or support them on the other areas will not take place.

## 8.1 Trawal Irrigation Development

The financial and economic feasibility of developing the four identified Trawal areas were established separately. The financial feasibility was established by applying the Cost Benefit Analysis approach (CBA) and a Cash Flow Model, to determine if this development will be able to repay any production and farm development loans. The economic feasibility was determined by using a Macro-economic Impact Model (MEIA).

A detailed investigation was performed to identify the current crops produced, the profitability of these crops, and the future outlook of specific crops. Based on this analysis, a specific crop composition was used in the analysis.

The future income of the new areas was phased into the modelling exercise. The capital costs, as well as the production costs, were phased into the models.

The results are positive for the CBA analysis, as well as the Cash Flow, in which it is estimated that newly established HD farmers should be able to repay their loans within a period of 10 years.

**Table 8-1** presents the CBA results, which indicates financial viability.

**Table 8-1: Cost Benefit Analysis Results of the four new Trawal irrigation Areas (2020 prices)**

| Model | Constant Price - Financial | Current Price - Financial | Economic Price |
|---|---|---|---|
| **Discount Rate** | **8%** | **11.54%** | **8%** |
| Present Value Benefits (R million) | R 6 169.1 | R 7 599.6 | R 6 169.1 |
| Present Value – Costs (R million | R 4 665.1 | R 5 518.2 | R 4 592.5 |
| Net Present Value (NPV) (R million) | R 1 504.02 | R 2 081.46 | R 1 576.67 |
| Benefit Cost Ratio (BCR) | 1.32 | 1.38 | 1.34 |
| Internal Rate of Return (IRR) | 16.8% | 22.2% | 17.34% |

The results in **Table 8-1** indicate a very positive set of results and that the development will be viable. The sensitivity analysis in **Chapter 6** supports these very positive results.

The MEIA also shows very positive results for the operational phase of the four Trawal areas. A maximum GDP production total of R 546 million, expressed in 2020 prices, will be added to the economy, of which R 244 million will be directly linked to the production of the crops and take place within the area of the two local municipalities.

In total 2 705 jobs will be directly created, mostly on the farms, of which 84 will be skilled, 281 will be semi-skilled, and 2 899 unskilled. A large percentage of the unskilled; direct' labour will be part time, whilst the skilled and semi-skilled will be permanent employees. The indirect employment opportunities created is estimated at a total of 234 and the induced employment at a total of 444.

The total annual amount paid to households is estimated at R 417 million, expressed in 2020 prices. The share of the low-income households is R 44 million, which is 10.5% per annum.

## 8.2 Scenario Development up to Verdeling

The analysis of the two scenarios for new irrigation development for the water conveyance from Bulshoek Weir to Verdeling was investigated and compared:

- Scenario 1 - Development of the new Trawal irrigation area and the construction of a Right Bank Canal up to Verdeling in a four year construction period; and
- Scenario 2 - Development of the new Trawal irrigation area and the construction of two small schemes in a three year period, and the betterment of the remainder of the existing left bank canal over a 15 year period.

The detail of the Analysis is presented in **Chapter 7**. **Table 8-2** presents a summary of the CBA results for the current price model.

**Table 8-2: Current Price CBA Results for both scenarios**

| Parameters | FCBA Current Price 4.5% Annual Inflation | FCBA Current Price 4.5% Annual Inflation | Economic CBA Constant Market Prices | Economic CBA Constant Market |
|---|---|---|---|---|
| | Scenario 1 | Scenario 2 | Scenario 1 | Scenario 2 |
| Discount Rate | 11.28% | 11.28% | 8% | 8% |
| Benefit - Present Values (R mil.) | R 13 590.76 | R 10 118.06 | R 8 142.66 | R 7 973.00 |
| Total Costs – Present Values (R mil.) | R 9 998.76 | R 9 380.46 | R 5 396.88 | R 7 848.44 |
| Net Present Value (NPV) (R mil.) | R 3 592.00 | R 737.60 | R 2 745.78 | R 124.56 |
| Benefit Cost Ratio (BCR) | 1.36 | 1.08 | 1.51 | 1.01 |
| Internal Rate of Return (IRR) | 16.2% | 14.0% | 16.2% | 8.4% |

**Table 8-2** shows that Scenario 1 is the preferable option in terms of the baseline financial CBA results, although both show viable results. The same applies for the economic CBA results where Scenario 2 shows the higher risk results.

A detailed risk and sensitivity analysis was also performed with some the cost items that might increase faster than the projected inflation rate, as well as the possibility that projected income levels may not be attained. Some of the results are presented in **Table 8-3** below.

**Table 8-3: Comparison of some of the Sensitivity Analysis Results**

| Scenarios | Scenario 1 | Scenario 2 | Scenario 1 | Scenario 2 |
|---|---|---|---|---|
| **Parameters** | **No Additional Production Existing Areas** | **No Additional Production Existing Areas** | **Production 10% Short** | **Production 10% Short** |
| NPV (R million) | R 2 055.59 | R 482.00 | R 2 390.8 | R – 248.65 |
| BCR | 1.26 | 1.05 | 1.24 | 0.97 |
| IRR | 12.2% | 13.2% | 11.3% | 10.3% |

The results in **Table 8-3** show that both scenarios provided positive answers if no impact of the existing areas is taken into consideration, but the results of Scenario 2 are considerably lower than the results from Scenario 1.

The second comparative set show that, if the financial results are lower than 10% of the expected values, then Scenario 2 is not viable.

Scenario 1 will also produce economic impacts in the Lower Olifants River region after 8 to 9 years, while Scenario 2 will probably reach the same level of positive impacts after 18 to 20 years.

The MEIA also shows very positive results for the operational phase of the production areas once the right bank canal is operational. A maximum GDP production total of R 1 281 million, expressed in 2020 prices, will be added to the economy, of which R 644 million will be directly linked to the production of the crops and take place within the area of the two local municipalities.

In total 6 160 jobs will be directly created, mostly on the farms, of which 159 will be skilled, 553 will be semi-skilled, and 5 448 unskilled. A large percentage of the unskilled 'direct' labour will be part time, whilst the skilled and semi-skilled will be permanent employees. The indirect employment created is estimated at a total of 484 and the induced employment at a total of 1 168.

The total annual amount paid to households is estimated at R 979 million, expressed in 2020 prices. The share of the low-income households is R 103 million, which is 10.5% per annum.

From the above employment creation numbers and wages paid, it can be deducted that the two local municipalities will benefit from the implementation of Scenario1.

The annual contribution to the National Balance of Payments is estimated to be R 584 million in 2020 prices.

In **Chapter 2** the following technical reasons are provided, supporting Scenario 1 as the preferable option (the right bank canal scenario):

- The Right Bank Canal will be more secure against failure than the relined left bank canal. In addition, this security will be achieved earlier.
- The Right Bank Canal will present an opportunity for a subsequent upgrade of the system downstream, extending the benefit of greater flexibility and additional capacity. This will allow irrigators to plant a higher percentage of permanent crops with associated significant socio-economic benefits. The improved assurance of supply will also lead to changes in crop patterns, but this will benefit existing irrigators in any case, whether the Right Bank Canal or the Alternative is constructed.
- There is greater confidence in the estimation of the Right Bank Canal's construction costs and programme. For upgrading of the left bank canal, the requirement to keep water flowing while construction takes place makes it a complex exercise, beset with operational difficulties and unforeseen issues that can increase costs and are likely to lead delays.
- The Right Bank Canal Scheme makes provision to meet the future water requirements for towns, industries and mines (initially only up to Verdeling, until further canals are upgraded), which the Alternative does not. The Alternative also does not have the potential to eventually increase the supply capacity up to Vredendal.
- Should the left bank canal be relined, new irrigation schemes that rely on the construction of the Right Bank Canal cannot be developed, such as the Klawer Scheme Phase 2.
- There will be significant water savings because of reduced water losses, should the Right Bank Canal be constructed. The reduction of water losses for the Alternative will take considerable time, as the entire left bank main canal has to be relined. Even then, the integrity of the Right Bank Canal will be better than that of a relined left bank canal.

The financial and economic viability analysis results show that the Right Bank Canal scenario is viable and supports the technical evaluation. The Right Bank Canal is therefore recommended as the preferable scenario.

The Right Bank Canal scenario also makes it possible to establish a number of Historical Disadvantaged Farmers and contribute to the distribution of high value land.

The construction and development of the Right Bank Canal Scheme will contribute to poverty alleviation and economic growth in the two local municipalities.

# Annexure A

The following project crop budget tables were used in the CBA and Socio-Economic models.

## Wine Production

| **Baseline** | |
|---|---|
| Cash-flow budget | |
| 10 year average yield @ 2020 values | |
| Wine Grapes: Key Assumptions | Per ha |
| Avg yield in tonnes | 23 |
| Avg Price per / tonne (delivered cellar) | 2 380 |
| **Income at full production** | **54 740** |
| **Total Direct costs** | **30 907** |
| Fertiliser & organic material | 3 123 |
| Pesticides & Herbicides | 2 143 |
| Seed | 27 |
| Repair trellising | 232 |
| Permanent labour | 6 057 |
| Seasonal labour | 2 106 |
| Supervision | 1 348 |
| Hired transport | 208 |
| Fuel, oil, R&M | 7 619 |
| Fixed improvements R&M + Ins | 1 287 |
| Electricity | 4 359 |
| Water | 2 398 |
| **Gross margin at full production** | **23 833** |
| Gross margin percentage | 44% |
| Overhead expenses | 1 360 |
| **Net operating cashflow** | **22 473** |
| | 41% |

*Source: Vinpro 2020*

## Raisin Production

| Baseline | |
|---|---|
| Cash-flow budget | |
| Baseline: 2020 Yield | |
| Raisins: Key Assumptions | Per ha |
| Avg yield in tonnes (dry) | 7.6 |
| Avg Price per / tonne (delivered to depot) | 17 000 |
| **Income at full production** | **129 880** |
| **Total Direct costs** | **51 566** |
| Fertiliser & organic material | 3 123 |
| Pesticides & Herbicides | 2 143 |
| Seed | 27 |
| Repair trellising | 232 |
| Permanent labour | 16 512 |
| Seasonal labour | 10 503 |
| Supervision | 1 348 |
| Hired transport | 256 |
| Fuel, oil, R&M | 9 377 |
| Fixed improvements R&M + Ins | 1 287 |
| Electricity | 4 359 |
| Water | 2 398 |
| **Gross margin at full production** | **78 314** |
| Gross margin percentage | 60% |
| Overhead expenses | 1 360 |
| **Net operating cashflow** | **76 954** |
| | 59% |
| *Source: Vinpro 2020* | |
| Lower Olifants River total income | 168 844 000 |
| Lower Olifants River total cash expenses | 68 803 443 |
| Lower Olifants River net return | 100 040 557 |

## Table Grape Production

| Baseline | |
|---|---|
| Cash-flow budget | |
| | |
| **Table Grapes: Key Assumptions** | **Per ha** |
| Avg yield in 4.5kg cartons | 3 350 |
| Avg Price / carton (delivered to cold store) | 130 |
| **Income at full production** | **435 500** |
| **Total Direct costs** | **330 196** |
| Fertiliser & organic material | 21 455 |
| Pesticides & Herbicides | 20 732 |
| Seed | 27 |
| Repair trellising | 232 |
| Labour (perm, seasonal & supervisory) | 127 200 |
| Hired transport | 3 982 |
| Fuel, oil, R&M | 20 000 |
| Fixed improvements R&M + Ins | 2 823 |
| Electricity | 20 471 |
| Water | 2 022 |
| Packaging and marketing | 111 252 |
| **Gross margin at full production** | **105 304** |
| Gross margin percentage | 24% |
| Overhead expenses | 40 373 |
| **Net operating cashflow** | **64 931** |
| | 15% |
| Source: SATI 2020 | |
| Lower Olifants river total income | 383 240 000 |
| Lower Olifants river total cash expenses | 326 100 720 |
| Lower Olifants river net return | 57 139 280 |
| Financial loss compared to baseline | |
| | |
| **Establishment Costs** | **524 216** |
| Planting | 424 707 |
| Irrigation | 99 509 |

## Tomatoes Processing

| Baseline | |
|---|---|
| | |
| Cash-flow budget | |
| Baseline: | |
| **Tomatoes: Key Assumptions** | **Per ha** |
| Avg yield in tonnes | 95.0 |
| Avg Price / ton (delivered to factory) | 1 770 |
| **Income at full production** | **168 150** |
| **Total Direct costs** | **108 094** |
| Soil prep | 9 578 |
| Seed | 22 138 |
| Fertiliser | 12 772 |
| Chemicals | 16 731 |
| Fuel and Oil | 5 300 |
| Repairs and maintenance | 4 277 |
| Electricity & Water | 4 440 |
| Wages | 32 858 |
| **Gross margin at full production** | **60 056** |
| Gross margin percentage | 36% |
| Overhead expenses | 9 046 |
| **Net operating cashflow** | **51 010** |
| | 30% |

*Source: WC Dept. of Agriculture Elsenburg 2020*

## Tomatoes Fresh

| **Baseline** | |
|---|---|
| | |
| Cash-flow budget | |
| Baseline: | |
| **Tomatoes: Key Assumptions** | **Per ha** |
| Avg yield in tonnes | 80,0 |
| Avg Price / ton (delivered to market/customer) | 5 500 |
| **Income at full production** | **440 000** |
| **Total Direct costs** | **342 169** |
| Soil prep | 4 480 |
| Seed | 13 560 |
| Basal fertiliser | 7 899 |
| Fertigation and foliar feed | 36 369 |
| Chemicals | 55 040 |
| Trellising | 11 820 |
| Fuel and Oil | 6 602 |
| Electricity & Water | 31 018 |
| Wages | 37 320 |
| Transport | 9 261 |
| Packing and packaging | 128 800 |
| **Gross margin at full production** | **97 831** |
| Gross margin percentage | 22% |
| Overhead expenses | 9 046 |
| **Net operating cashflow** | **88 785** |
| | 20% |

*Source: Tiger Brands and producers*

## Summer Vegetables

| Baseline | |
|---|---|
| | |
| Cash-flow budget | |
| Baseline: | |
| **Tomatoes: Key Assumptions** | **Per ha** |
| Avg yield in tonnes | 34.2 |
| Avg Price / ton (delivered to market/cuts) | 4 238 |
| **Income at full production** | **144 711** |
| **Total Direct costs** | **104 559** |
| Soil prep | 1 740 |
| Seedlings/seed | 20 672 |
| Fertilizer & Compost | 9 403 |
| Weed control | 494 |
| Pest & Disease Control | 3 483 |
| Seasonal labour | 27 518 |
| Fuel | 4 566 |
| R&M | 3 316 |
| Irrigation and water | 6 450 |
| Harvest fuel | 6 142 |
| Packaging | 20 774 |
| **Gross margin at full production** | **40 152** |
| Gross margin percentage | 28% |
| Overhead expenses | 9 046 |
| **Net operating cashflow** | **31 106** |
| | 21% |

*Source: Tiger Brands and producers*

## Winter Vegetables

| Baseline | |
|---|---|
| | |
| Cash-flow budget | |
| Baseline: | |
| **Tomatoes: Key Assumptions** | **Per ha** |
| Avg yield in kg | 13.6 |
| Avg Price / ton (delivered to market/cuts) | 9 905 |
| **Income at full production** | **134 206** |
| **Total Direct costs** | **78 334** |
| Soil prep | 1 246 |
| Seedlings/seed | 29 430 |
| Fertilizer & Compost | 10 721 |
| Weed control | 3 469 |
| Pest & Disease Control | 12 913 |
| Seasonal labour | 12 889 |
| Fuel | 1 305 |
| R&M | 951 |
| Irrigation and water | 4 400 |
| Harvest fuel | 1 010 |
| **Gross margin at full production** | **55 872** |
| Gross margin percentage | 42% |
| Overhead expenses | 9 046 |
| **Net operating cashflow** | **46 826** |
| | 35% |

*Source: Tiger Brands and producers*

**Zutari (Pty) Ltd**
1977/003711/07
Zutari Centre
1 Century City Drive
Waterford Precinct
Century City
Cape Town
7441
PO Box 494
Cape Town
8000
South Africa
**T** +27 21 526 9400
**F** +27 21 526 9500
**E** capetown@zutari.com
**W** zutari.com