



Botswana | Lesotho | Namibia | South Africa

The Orange-Senqu River Commission (ORASECOM)

Sharing the Water Resources of the Orange-Senqu River Basin

Contract No.: P-Z1-EAZ-048/CS/01

# Preparation of Climate Resilient Water Resources Investment Strategy & Plan and Lesotho-Botswana Water Transfer Multipurpose Transboundary Project

## ROADMAP FOR IWRMP OPERATIONALIZATION

Component II

Appendix C : Core Scenario : Concept Notes



August 2024  
FINAL REPORT

Report number: ORASECOM 012C/2019

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**PREPARATION OF CLIMATE RESILIENT WATER  
RESOURCES INVESTMENT STRATEGY & PLAN AND  
LESOTHO-BOTSWANA WATER TRANSFER  
MULTIPURPOSE TRANSBOUNDARY PROJECT**

**COMPONENTS I AND II**

**ROADMAP SUPPORTING REPORT**

**APPENDIX C**

**CORE SCENARIO : CONCEPT NOTES**



Orange-Senqu River Commission (ORASECOM)

Von Willich LN, C nr Von Willich LN & Lenchen Avenue, Corporate 66 Office Park, Block A

**Prepared by**



in association with



**Knight Piésold**  
CONSULTING

**INGEROP**  
*Investing for tomorrow*

**GWC**



**Water Resources Consultants**



**PREPARATION OF CLIMATE RESILIENT WATER  
RESOURCES INVESTMENT STRATEGY & PLAN AND  
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COMPONENTS I AND II**

**ROADMAP SUPPORTING REPORT**

**APPENDIX C**

**CORE SCENARIO : CONCEPT NOTES**

<b>ORASECOM Document No.</b>	ORASECOM 013/2019
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**APPROVALS**

For the Consultants: \_\_\_\_\_  
**RS McKenzie:** Study Team Leader

\_\_\_\_\_  
**C Muir:** Deputy Study Team Leader

For ORASECOM: \_\_\_\_\_  
**C Molosiwa**  
**Executive Secretary: ORASECOM Secretariat**

## TABLE OF REPORTS

Reports submitted	ORASECOM Report No. <sup>1</sup>
<b>Inception Report</b> Components I and II	ORASECOM 010/2018
<b>Inception Report</b> Components III and IV	ORASECOM 011/2018
<b>Preparation of climate resilient water resources investment strategy &amp; plan Component I</b>	
<b>Core Scenario Update Report</b> Component I	ORASECOM 003/2019
<b>Core Scenario Supporting Report: Water Requirements and Return flows</b> Component I	ORASECOM 004/2019
<b>Core Scenario Supporting Report: Water Conservation, Water Demand management and Re-use Report</b> Component I	ORASECOM 005/2019
<b>Core Scenario Supporting Report: Ground Water Report</b> Component I	ORASECOM 006/2019
<b>Climate Change Report</b> Component I	ORASECOM 007/2019
<b>Review and assessment of existing policies, institutional arrangements and structures</b> Component I	ORASECOM 008/2019
<b>Optimized IWRMP Core Scenario economic approach Report</b> Component I	ORASECOM 009/2019
<b>Climate Resilient Water Resources Investment Plan Report</b> Component I	ORASECOM 010/2019
<b>System analysis Report</b> Component I	ORASECOM 011/2019
<b>Preparation of climate resilient water resources investment strategy &amp; plan Component II</b>	
<b>Roadmap for IWRMP Operationalization Report</b> Component II	ORASECOM 012/2019
<b>Roadmap for IWRMP Operationalization Executive Summary</b>	ORASECOM 012A/2019
<b>Roadmap for IWRMP Operationalization: Appendix B Strategic Actions Concept Notes</b>	ORASECOM 012B/2019
<b>Roadmap for IWRMP Operationalization: Appendix C Core Scenario Concept Notes</b>	ORASECOM 012C/2019
<b>Climate Resilience Investment Plan (Brochure)</b>	ORASECOM 012D/2019
<b>Roadmap supporting Report: Strategic actions and TORs (Appendix A to Roadmap Report)</b>	ORASECOM 013/2019
<b>Lesotho-Botswana water transfer multipurpose transboundary project Component III Pre-feasibility Phase</b>	
<b>Pre-feasibility report Phase 1 Report</b> Component III	ORASECOM 014/2019
<b>Pre-feasibility report Phase 2 Report</b> Component III	ORASECOM 015/2019
<b>Lesotho-Botswana water transfer multipurpose transboundary project Component IV - Feasibility Phase</b>	

<sup>1</sup> Note: For any report not prepared and completed within 2019 revert back for revised numbering.

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<b>Reports submitted</b>	<b>ORASECOM Report No.<sup>1</sup></b>
<b>Feasibility Study Interim Report</b> Component IV	ORASECOM 016/2019
<b>Feasibility Study Report</b> Component IV	ORASECOM 017/2019

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER  
TRANSFER PROJECT**

Cluster

**1**

Orange River Project + Noordoewer/Vioolsdrift Dam Cluster related development Projects

**Development Options Core Scenario**

The Basin Wide Investment Plan and the Core Scenario development options comprises projects that had already been identified by the basin states, and which had been subject to various levels of planning. The projects were grouped into clusters based on the larger schemes or sub-systems of which they formed one of the key components. The following Clusters were considered:

**1) Orange River Project (ORP) + Noordoewer/Vioolsdrift Dam future improvements.**

- 2) Lesotho Botswana Water Transfer Scheme.
- 3) Lesotho Lowlands Water Project
- 4) Integrated Vaal River System Intervention Options.
- 5) Caledon to Greater Bloemfontein transfer.
- 6) Greater Bloemfontein internal resource improvements
- 7) Gariep to Greater Bloemfontein Transfer.
- 8) Neckartal Dam Scheme
- 9) Integrated Water management actions.

**Projects forming part of the Orange River Project Cluster.**

**1a) Utilise the Lower Level Storage in Vanderkloof Dam:**

Vanderkloof Dam is an existing dam with its current minimum operating level (m.o.l.) at about 40 m above the riverbed level, which equates to a dead storage capacity of 1 015 million m<sup>3</sup>. This high m.o.l. was fixed by the outlet into the Vanderkloof main canal for irrigation supply purposes as well as the outlets used for hydro-power generation by Eskom. This m.o.l. could be lowered to reduce the dead storage capacity to 165 million m<sup>3</sup>. By utilizing that additional live storage, the historic firm yield from Vanderkloof Dam could be increased by 137 million m<sup>3</sup>/a. For that option, it would be required to install a pumping system with 15 m<sup>3</sup>/s capacity, in order to lift the water from the dam into the Vanderkloof Main Canal. The capital cost of such a modification is estimated at R180 million and the cost of operating the dam is estimated to increase by about R10 million per annum based on 2018 prices. RSA DWS will most probably install this option once Polihali Dam started to inundate water and the ORP system is moving into a dry cycle.

**1b) Real-time monitoring and modelling Orange River:**

This option already forms part of one of [key strategic action 2](#). Thus no need to provide details here.

**1c) Building of the Verbeedingskraal Dam upstream of the Gariep Dam**

The Verbeedingskraal Dam is a proposed new dam to be built upstream of the Gariep Dam in the Orange River and just upstream of the Aliwal North Town. The initial planning is to construct a 67m high dam (FSL) with a storage of 1 363 million m<sup>3</sup>. The dam will increase the net yield of the system by 200 million m<sup>3</sup>/a. The purpose of this dam is to augment the ORP to be able to supply the final agreed EWR or ecological Reserve, increasing urban and mining demands, as well as to restore the ORP water balance impacted due to negative yield impacts on the ORP at the time when the Polihali Dam and its transfer system to support the IVRS, is in place. The construction cost of the dam is estimated at R4.0 billion and the annual operating cost at R12 million at 2018 prices.

**1d) Orange River agreed EWRs (Ecological Reserve)**

This project was selected as one of the Strategic actions ([Strategic Action 1](#)) and will not be discussed here.

**1e) Noordoewer-Vioolsdrift Dam**

The Noordoewer/Vioolsdrift Dam is a proposed new dam that will be built in the Lower Orange River across the border of South Africa and Namibia. This dam will be a combined Namibia/RSA project to increase the ORP yield, reduce the current high system operating requirements, and control EWR releases, mainly for the Orange River mouth. A feasibility study has already been completed and at the time of writing this report the decision on confirming the dam size had yet to be taken (between 400 and 2800 mil m<sup>3</sup>). A bridging study will soon start with the main aim to determine and agree on the size of the dam, bearing in mind the EWR impacts.

**1f) Development of 12 000 ha for resource-poor farmers in the RSA from the ORP**

These developments are almost completed and is driven by DWS RSA.

**1g) Polihali Dam (Lesotho Highlands Water Project (LHWP) Phase II and connecting tunnel to Katse Dam; using new operating rule**

The construction of this scheme started in 2023

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 1a**

**Utilize the lower-level storage in Vanderkloof Dam**

**Project Description**

Vanderkloof Dam is an existing dam with its current minimum operating level (m.o.l.) at about 40 m above the riverbed level, which equates to a dead storage capacity of 1 015 million m<sup>3</sup>. This high m.o.l. was fixed by the outlet into the Vanderkloof main canal for irrigation supply purposes as well as the outlets used for hydro-power generation by Eskom. This m.o.l. could be lowered to reduce the dead storage capacity to 165 million m<sup>3</sup>. The impact of sedimentation on the reduced dead storage capacity in Vanderkloof Dam is minimal as most of the sediment is captured in Gariep Dam. The estimated reduction in storage in Vanderkloof Dam by 2040 due to sedimentation is only 40 million m<sup>3</sup>(ORASECOM,2014). That would increase the live storage from the current 2 173 million m<sup>3</sup> to 3 023 million m<sup>3</sup>, with the gross storage of the dam being 3 188 million m<sup>3</sup>.

By utilizing that additional live storage, the historic firm yield from Vanderkloof Dam could be increased by 137 million m<sup>3</sup>/a. For that option, it would be required to install a pumping system with 15 m<sup>3</sup>/s capacity, in order to lift the water from the dam into the Vanderkloof Main Canal. The capital cost of such a modification is estimated at **\$9.47 million** and the cost of operating the dam is estimated to increase by about **\$0.53 million per annum** based on 2018 prices.

This intervention would also result in a loss of power generated specifically during severe drought periods when the water level in Vanderkloof Dam drops below the current m.o.l. The quantification of the loss of generated power was complex and depended on the volume of water released to supply downstream water requirements, as well as the water level in the dam. The water level in the dam is further highly dependent on the operating rule used.

Based on the analysis and related results carried out in the Orange River Reconciliation Strategy Study (DWS, 2015 ) it was stated that the economic benefits or disbenefits on the effect of hydro-power generation for the option were considered too uncertain to be estimated as part of the Reconciliation Strategy Study, but it was not expected to be significant. The Reconciliation Strategy Study, therefore, recommended that during the pre-feasibility study of this component, Eskom should be part of the evaluation and recommendations relating to this component. Eskom is fully aware of this option and participated in the Orange Reconciliation Strategy Study.

This is a quick win project in that construction can commence almost immediately. In reality, this option will most probably only be implemented once a severe drought is experienced with expected low water levels in Vanderkloof Dam. It is thus foreseen that this option will only be put in place after the inundation and construction of Polihali Dam.

**STRATEGIC ACTION**

Strategic action being supported	Specific action

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	RSA
Supporting 1	Namibia
Supporting 2	
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	X
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 1a**

**Utilize the lower-level storage in Vanderkloof Dam**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input checked="" type="checkbox"/>
Limited	<input checked="" type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Small	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input type="checkbox"/>	6 to 20 Years	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input checked="" type="checkbox"/>	Positive	<input checked="" type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input checked="" type="checkbox"/>
Medium	<input type="checkbox"/>	Neutral	<input type="checkbox"/>
Low	<input checked="" type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input checked="" type="checkbox"/>
Small contribution	<input type="checkbox"/>	Low contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 1c**

**Building of the Verbeedingskraal Dam upstream of the Gariep Dam**

**Project Description**

The Verbeedingskraal Dam is a proposed new dam to be built upstream of the Gariep Dam in the Orange River, located wholly in South Africa as recommended by the Orange Reconciliation Strategy study (DWS, 2015). There is however the possibility, if agreed with Lesotho, that the dam can be built higher which will then inundate some area in Lesotho. This will have the advantage of a larger storage capacity and increased yield available from the dam. There is a high possibility that Lesotho, Botswana and RSA will look at an intervention option to re-balance the ORP after the construction of Makhaleng Dam. Verbeedingskraal Dam might then be a good option to conder to re-balance the ORP due to the impacts of both Polihali and Makhaleng dams.

The dam site is located in the Orange River just upstream of the Aliwal North Town. Only a low level reconaiceance level study was carried out untilnow. Pre-feasibility and feasibility studies still need to take place. This should include to also look at possible other dam sites as well as the raising of Gariep Dam.

As recommended in the Orange Reconciliation Strategy study (if not inundating part of Lesotho) the dam will have a maximum wall height of 67 m at full supply level and storage of 1 363 million m<sup>3</sup>. The dam will increase the net yield of the system by 200 million m<sup>3</sup>/a. The purpose of this dam is to augment the ORP to be able to supply the final agreed EWR or ecological Reserve, increasing urban and mining demands, as well as to restore the ORP water balance impacted by some of the negative yield impacts on the ORP at the time when the Polihali Dam and its transfer system to support the IVRS, is in place. The water will be held back as long as possible before it is released to the Gariep Dam so that the high evaporation losses from the Gariep Dam can be reduced.

The construction cost of this dam is estimated at **\$210.5 million** and the annual operating cost at **\$0.63 million/a** at 2018 prices.

**STRATEGIC ACTION**

Strategic action being supported	Specific action
Valuable input from SA3 & SA4	

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	RSA
Supporting 1	Namibia
Supporting 2	Possibly Lesotho
Supporting 3	Possibly Botswana
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	X
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER**

**Project 1c**

**Building of the Verbeeldingskraal Dam upstream of the Gariep Dam**

**1: Involvement of ORASECOM**

High	<input checked="" type="checkbox"/>
Significant	<input checked="" type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Limited	<input type="checkbox"/>

**2: Countries involved**

Botswana	<input checked="" type="checkbox"/>
Lesotho	<input checked="" type="checkbox"/>
Namibia	<input checked="" type="checkbox"/>
South Africa	<input checked="" type="checkbox"/>

**3: Priority**

High Priority	<input checked="" type="checkbox"/>
Medium Priority	<input type="checkbox"/>
Low Priority	<input type="checkbox"/>

**4: Impact on Climate Resilience**

High	<input checked="" type="checkbox"/>
Medium	<input type="checkbox"/>
Small	<input type="checkbox"/>

**5:Type of Funding Required**

Normal Loan	<input checked="" type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>

**6: Likley Loan Period**

1 to 5 Years	<input type="checkbox"/>
6 to 20 Years	<input type="checkbox"/>
More than 20 Years	<input checked="" type="checkbox"/>

**7: Job Creation**

Long term jobs	<input checked="" type="checkbox"/>
During construction	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>

**8: Impact on possible Conflicts Between Basin States**

Positive	<input checked="" type="checkbox"/>
Neutral	<input type="checkbox"/>
Negative	<input type="checkbox"/>

**9: Socio economic influence**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**10: Influence on local communities**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**11: Yield contribution**

Significant contribution	<input checked="" type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Small contribution	<input type="checkbox"/>

**12: Contribution to alleviating water scarcity**

Significant contribution	<input checked="" type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Small contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project**

**1e**

**Noordoewer-Vioolsdrift Dam**

**Project Description**

The Noordoewer/Vioolsdrift Dam is a proposed new dam that will be built in the Lower Orange River across the border of South Africa and Namibia. This dam will be a combined Namibia/RSA project to increase the ORP yield, reduce the current high system operating requirements, and control EWR releases, mainly for the Orange River mouth.

The final dam size is still to be determined and will be between 400 mil m3 and 2800mil m3.

A feasibility study was already completed. Due to EWR impacts agreement on the size of the dam could not be obtained. A bridging study will soon start with the main aim to determine and agree on the size of the dam, bearing in mind the EWR ipmacts. The dam will re-regulate water to the Orange River mouth and provide water for the EWRs, irrigators, mining and urban users downstream of the dam. This will reduce the load on the Gariep and the Vanderkloof dams.

It is expected that the Noordoewer/Vioolsdrift Dam yield may also be used to supply water to new additional irrigation developments in Namibia downstream of the dam, although it might still contribute to part of the ORP yield loss replacement. Two options for the NVD were thus considered.

1) One where the NVD is purely used as a yield replacement dam to restore the water balance, due to the negative impact of the Polihali Dam on the ORP yield.

2) Secondly when NVD is used as a new resource, using its net yield mainly to support existing and new users.

The capital cost of the dam is estimated at \$231.6 million and the annual operating cost at \$0.68 million/a although the costs will change and depend upon the final size of dam selected.

**STRATEGIC ACTION**

Strategic action being supported	Specific action
Valuable input from SA3 & SA4	

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	Namibia
Supporting 1	RSA
Supporting 2	
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	X
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER**

**Project 1e**

**Noordoewer-Vioolsdrift Dam**

**1: Involvement of ORASECOM**

High	<input checked="" type="checkbox"/>
Significant	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Limited	<input type="checkbox"/>

**2: Countries involved**

Botswana	<input type="checkbox"/>
Lesotho	<input type="checkbox"/>
Namibia	<input checked="" type="checkbox"/>
South Africa	<input checked="" type="checkbox"/>

**3: Priority**

High Priority	<input checked="" type="checkbox"/>
Medium Priority	<input type="checkbox"/>
Low Priority	<input type="checkbox"/>

**4: Impact on Climate Resilience**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Small	<input type="checkbox"/>

**5:Type of Funding Required**

Normal Loan	<input checked="" type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>

**6: Likley Loan Period**

1 to 5 Years	<input type="checkbox"/>
6 to 20 Years	<input type="checkbox"/>
More than 20 Years	<input checked="" type="checkbox"/>

**7: Job Creation**

Long term jobs	<input checked="" type="checkbox"/>
During construction	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>

**8: Impact on possible Conflicts Between Basin States**

Positive	<input checked="" type="checkbox"/>
Neutral	<input type="checkbox"/>
Negative	<input type="checkbox"/>

**9: Socio economic influence**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**10: Influence on local communities**

Positive	<input checked="" type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**11: Yield contribution**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Small contribution	<input type="checkbox"/>

**12: Contribution to alleviating water scarcity**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Small contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER  
TRANSFER PROJECT**

**Cluster**

**2**

**Lesotho Botswana Water Transfer Scheme**

**Development Options Core Scenario**

The Basin Wide Investment Plan and the Core Scenario development options comprises projects that had already been identified by the basin states, and which had been subject to various levels of planning. The projects were grouped into clusters based on the larger schemes or sub-systems of which they formed one of the key components. The following Clusters were considered:

- 1) Orange River Project (ORP) Scheme future improvements.
- 2) Lesotho Botswana Water Transfer Scheme.**
- 3) Lesotho Lowlands Water Project
- 4) Integrated Vaal River System Intervention Options.
- 5) Caledon to Greater Bloemfontein transfer.
- 6) Greater Bloemfontein internal resource improvements
- 7) Gariep to Greater Bloemfontein Transfer.
- 8) Neckartal Dam Scheme
- 9) Integrated Water management actions.

**Projects forming part of the Lesotho Botswana Water Transfer Scheme**

**2a) Future Dam on the Makhaleng River in Lesotho :**

Based on the results from the Phase II Pre-feasibility Study (Feasibility study is already in process) the dam will have a wall height of about 126 m at full supply level and storage of 1 133 million m<sup>3</sup> (3 MAR dam). The gross yield from a 3 MAR Makhaleng Dam at the N1A site was determined as 334 million m<sup>3</sup>/a. The capital cost of the dam is estimated at R4.1 billion for the Arch dam option.

**2b) L-BWTS Conveyance System**

The recommended pipeline route is the Central Route and was proposed to be a fully piped option that will transport raw water from a proposed weir located just downstream of the proposed dam site on the Makhaleng River in Lesotho, to a proposed outfall upstream of Nnywane Dam in Botswana over 688 km away. Following pre-feasibility level hydraulic analysis, steel pipe with diameters ranging from 2 200 mm to 1 100 mm are required. The capital cost of the pipeline is estimated at R48 billion and the annual operating and pumping cost at the full supply capacity of the transfer system at R838 million/a.

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 2a**

**Proposed Future Dam on the Makhaleng River**

**Project Description**

Based on the results from the Phase II Pre-feasibility Study (Feasibility study is already in process) the dam will have a wall height of about 126 m at full supply level and storage of 1 133 million m<sup>3</sup> (3 MAR dam). The gross yield from a 3 MAR Makhaleng Dam at the N1A site was determined as 334 million m<sup>3</sup>/a. Utilizing this gross yield in full for the Lesotho-Botswana transfer system would result in a decrease in the downstream system yield by approximately 200 million m<sup>3</sup>/a which would need to be compensated for. It was recommended that a separate Reconciliation Strategy type of study must be initiated to look at the imbalance in the Upper Orange and Senqu catchments due to all the future developmenst such as Makhaleng, Polihali, Lesotho Lowland dams etc. It was assumed that the gross yield from Makhaleng Dam will be available for the L-BWT Scheme including developments within Lesotho and also possible other developments within the RSA. The capital cost of the dam is estimated at \$216 million and the annual operating cost at \$1.1 million/a for the Arch dam option.

**STRATEGIC ACTION**

**Strategic action being supported**  
SA3 & SA 4 will provide important inputs

**Specific action**

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	Lesotho
Supporting 1	Botswana
Supporting 2	RSA
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	X
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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Date 30 Oct 2023

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 2a**

**Proposed Future Dam on the Makhaleng River**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input checked="" type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input checked="" type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input checked="" type="checkbox"/>
Limited	<input type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Small	<input type="checkbox"/>
<b>5: Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input checked="" type="checkbox"/>
<b>7: Type of Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input checked="" type="checkbox"/>	Positive	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input checked="" type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input checked="" type="checkbox"/>
Small contribution	<input type="checkbox"/>	Small contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 2b**

**LBWT Conveyance System**

**Project Description**

The recommended pipeline route is the Central Route and was proposed to be a fully piped option that will transport raw water from a proposed weir located just downstream of the proposed dam site on the Makhaleng River in Lesotho, to a proposed outfall upstream of Nnywane Dam in Botswana over 688 km away. Following pre-feasibility level hydraulic analysis, steel pipe with diameters ranging from 200 mm to 1 100 mm are required to deliver the required design flows ranging from 8 731 l/s to 2 735 l/s resulting in pipe velocities between 1.3 m/s and 2.9 m/s. As a result of the total dynamic head requirement at the discharge in Botswana, a combination of high lift pump stations, booster pump stations and break-pressure tanks will be required. The capital cost of the pipeline is estimated at **\$2.53 billion** and the annual operating and pumping cost at the full supply capacity of the transfer system at **\$44.1 million/a**. While dependent on the final agreed water allocations, it is currently foreseen that the dam and the pipeline will supply users in the different countries as follows:

- Directly from dam: Lesotho for irrigation purposes - 0 to 78 million m<sup>3</sup>/a, still depending on the final agreed water allocations and can be higher for specific options.
- Dam via main transfer Pipeline : Lesotho urban ±22 million m<sup>3</sup>/a. Lesotho urban ±22 million m<sup>3</sup>/a Botswana urban 156 million m<sup>3</sup>/a.

**STRATEGIC ACTION**

Strategic action being supported	Specific action
SA3 & SA 4 will provide important inputs	

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	Lesotho
Supporting 1	Botswana
Supporting 2	RSA
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**




More than 1 billion USD	X
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER**

**Project 2b**

**LBWT Conveyance System**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High		Botswana	<input checked="" type="checkbox"/>
Significant		Lesotho	<input checked="" type="checkbox"/>
Medium		Namibia	<input type="checkbox"/>
Limited	<input type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input checked="" type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Small	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input checked="" type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input checked="" type="checkbox"/>	Positive	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input checked="" type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input checked="" type="checkbox"/>	Positive	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input checked="" type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input checked="" type="checkbox"/>
Small contribution	<input type="checkbox"/>	Small contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER  
TRANSFER PROJECT**

**Cluster**

**3**

**Lesotho Lowlands Water Project**

**Development Options Core Scenario**

The Basin Wide Investment Plan and the Core Scenario development options comprises projects that had already been identified by the basin states, and which had been subject to various levels of planning. The projects were grouped into clusters based on the larger schemes or sub-systems of which they formed one of the key components. The following Clusters were considered:

- 1) Orange River Project (ORP) Scheme future improvements.
- 2) Lesotho Botswana Water Transfer Scheme.
- 3) Lesotho Lowlands Water Project**
- 4) Integrated Vaal River System Intervention Options.
- 5) Caledon to Greater Bloemfontein transfer.
- 6) Greater Bloemfontein internal resource improvements
- 7) Gariep to Greater Bloemfontein Transfer.
- 8) Neckartal Dam Scheme
- 9) Integrated Water management actions.

**Projects forming part of the Lesotho Lowlands Water Supply Schemes**

**3a) Future Hlotse Dam in Lesotho :**

The Hlotse Dam is located in the Hlotse River, a tributary of the Mohokare/Caledon River with an expected total demand of 66.3 million m<sup>3</sup>/a. This demand includes the urban/rural (about 30%) and irrigation developments (about 70%).

**3b) Future Ngoajane Dam in Lesotho**

The Ngoajane Dam is located just north of Hlotse Dam in the Hololo River a tributary of the larger Mohokare/Caledon River. The dam will be used to mainly supply urban/rural water requirements (80%) and some irrigation with a total combined water requirement estimated at 29 million m<sup>3</sup>/a.

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 3a**

**Proposed Future Dam on the Hlotse River**

**Project Description**

The Hlotse Dam is located in the Hlotse River, a tributary of the Mohokare/Caledon River with an expected total demand of 66.3 million m<sup>3</sup>/a to be imposed on the dam by 2050. This demand includes the urban/rural (about 30%) and irrigation developments (about 70%). The Hlotse Dam has a gross storage of 105 million m<sup>3</sup> and a wall height of about 51 m at full supply level with an estimated net yield of 54 million m<sup>3</sup>/a (gross yield 85 million m<sup>3</sup>/a). The large difference between the net and gross yield is due to the significant reduction in supply to existing downstream users when the Hlotse Dam is introduced. This means that some of the yield generated by the dam needs to be released to mitigate the loss of the existing system yield for the existing downstream users. The construction cost is estimated at **\$50 million** and the operating annual cost at **\$0.16 million/a** at 2018 development level costs.

**STRATEGIC ACTION**

**Strategic action being supported**  
SA3 & SA4 will provide important input

**Specific action**

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

**LEAD** Lesotho

Supporting 1

Supporting 2

Supporting 3

Supporting 4

**BUDGET REQUIREMENTS**

More than 1 billion USD

Between 50 million USD and 1 billion USD

Between 1 million USD and 50 million USD **X**

Less than 1 million USD

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 3a**

**Proposed Future Dam on the Hlotse River**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input checked="" type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input checked="" type="checkbox"/>
Limited	<input checked="" type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Small	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input checked="" type="checkbox"/>	Positive	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input checked="" type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input checked="" type="checkbox"/>
Little or no contribution	<input type="checkbox"/>	Little or no contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 3b**

**Proposed Future Ngoajane Dam on the Hololo River**

**Project Description**

The Ngoajane Dam is located just north of Hlotse Dam in the Hololo River a tributary of the larger Mohokare/Caledon River. The dam will be used to mainly supply urban/rural water requirements (80%) and some irrigation with a total combined water requirement estimated at 29 million m<sup>3</sup>/a, by 2050. The gross storage of the dam is 36 million m<sup>3</sup>/a with a wall height of 47.5 m at the full supply level. The net yield of the system is estimated as 10.6 million m<sup>3</sup>/a, with a gross yield of 30.8 million m<sup>3</sup>/a. As in the case of the Hlotse Dam, the large difference in the gross and net yield is a result of the significant reduction of existing system yield for existing downstream users.

The construction cost is estimated at **\$26.2 million** and the annual operating cost at **\$0.16 million/a**

**STRATEGIC ACTION**

Strategic action being supported	Specific action
SA3 & SA4 will provide important input	

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	Lesotho
Supporting 1	
Supporting 2	
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	X
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER**

**Project 3b**

**Proposed Future Ngoajane Dam on the Hololo River**

**1: Involvement of ORASECOM**

High	<input checked="" type="checkbox"/>
Significant	<input checked="" type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Limited	<input type="checkbox"/>

**2: Countries involved**

Botswana	<input type="checkbox"/>
Lesotho	<input checked="" type="checkbox"/>
Namibia	<input checked="" type="checkbox"/>
South Africa	<input checked="" type="checkbox"/>

**3: Priority**

High Priority	<input type="checkbox"/>
Medium Priority	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>

**4: Impact on Climate Resilience**

High	<input type="checkbox"/>
Medium	<input type="checkbox"/>
Small	<input checked="" type="checkbox"/>

**5:Type of Funding Required**

Normal Loan	<input checked="" type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>

**6: Likley Loan Period**

1 to 5 Years	<input type="checkbox"/>
6 to 20 Years	<input checked="" type="checkbox"/>
More than 20 Years	<input type="checkbox"/>

**7: Type of Job Creation**

Long term jobs	<input checked="" type="checkbox"/>
During construction	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>

**8: Impact on possible Conflicts Between Basin States**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input checked="" type="checkbox"/>

**9: Socio economic influence**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**10: Influence on local communities**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**11: Yield contribution**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input type="checkbox"/>
Small contribution	<input checked="" type="checkbox"/>

**12: Contribution to alleviating water scarcity**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input type="checkbox"/>
Small	<input checked="" type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER  
TRANSFER PROJECT**

<b>Cluster</b>	<b>4</b>
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**Integrated Vaal River System Intervention Options**

**Development Options Core Scenario**

The Basin Wide Investment Plan and the Core Scenario development options comprises projects that had already been identified by the basin states, and which had been subject to various levels of planning. The projects were grouped into clusters based on the larger schemes or sub-systems of which they formed one of the key components. The following Clusters were considered:

- 1) Orange River Project (ORP) Scheme future improvements.
- 2) Lesotho Botswana Water Transfer Scheme.
- 3) Lesotho Lowlands Water Project
- 4) Integrated Vaal River System Intervention Options.**
- 5) Caledon to Greater Bloemfontein transfer.
- 6) Greater Bloemfontein internal resource improvements
- 7) Gariep to Greater Bloemfontein Transfer.
- 8) Neckartal Dam Scheme
- 9) Integrated Water management actions.

**Projects forming part of the Integrated Vaal River System Intervention Options.**

**4a) Utilise Crocodile River Return flows:** The Vaal River System Reconciliation Strategy (DWAF, 2009) identified the re-use of return flows in the Upper Crocodile (West) River as one of the important intervention options for the IVRS. By re-using these return flows, the demand of the Northern Gauteng area, of which most is supplied from the IVRS, will be reduced.

**4b) The proposed further phases of the Thukela River Water Transfer:** The proposed further phases of the Thukela River Water Transfer comprise two new dams at Jana on the main stem of the Thukela River and the Mielietuin Dam on the Bushmans River (a tributary of the Thukela River) with new pipelines and pump stations linking these dams to the existing Thukela Water Transfer Scheme.

**4c) The desalination and re-use of acid mine drainage** The desalination and re-use of acid mine drainage (AMD) were listed as one of the most important intervention options from the Vaal River System Reconciliation Strategy (DWAF, 2009) as it significantly improves both water quality and water quantity. The implementation of this intervention option is forming part of the continuation of the IVRS Reconciliation Strategy Phase 2. In the IVRS, the desalination of AMD will ensure a reduction in the release of water from the Vaal Dam for dilution purposes; it will also reduce demand through reclamation and direct re-use, as well as improve the salinity levels in the Vaal River system, and the Orange-Senqu River Basin, by eliminating or substantially reducing the discharge of saline AMD.

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 4a**

**Utilise Crocodile River Return flows**

**Project Description**

The Vaal River System Reconciliation Strategy (DWAF, 2009) identified the re-use of return flows in the Upper Crocodile (West) River as one of the important intervention options for the IVRS. These return flows are generated from the Vaal River water, transferred over the water shed from the Vaal River Catchment into the Upper Crocodile River Catchment by Rand Water, to supply water to urban and industrial areas within the Northern Gauteng Province. By re-using these return flows, the demand of the Northern Gauteng area, of which most is supplied from the IVRS, will be reduced.

This strategy was further taken up in the City of Tshwane Water Resource Masterplan (Tshwane, 2014). The City of Tshwane Metropolitan Municipality (MM) is planning a re-use plant at Rietvlei Dam with a capacity of 100 MI/d. Water transferred from the Olifants WWTW will also be treated at the Rietvlei Plant. The second re-use plant of 50 MI/d is planned at the Roodeplaat Dam, utilizing water from the Zeekoegat WWTW extension, which is flowing into the Roodeplaat Dam. These two treatment plants will further treat the Tshwane return flows to a potable standard to re-use that water in the Tshwane Municipality. Key information on the re-use schemes includes the following:

- The potential savings in Tshwane’s demand supplied from the Vaal River System is estimated to be in the order of 56 million m<sup>3</sup>/a, as a result of the re-use;
- The capital cost to implement this further treatment capacity is estimated at **\$77.6 million**, at the 2018 price level;
- The annual operation costs are estimated to be **\$6.68 million/a** (2018); and
- This intervention option is expected to be in place by 2025

**STRATEGIC ACTION**

Strategic action being supported	Specific action
SA2 Can provide useful input	

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	RSA
Supporting 1	
Supporting 2	
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	X
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 4a**

**Utilise Crocodile River Return flows**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input type="checkbox"/>
Limited	<input checked="" type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Low	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input checked="" type="checkbox"/>	Positive	<input checked="" type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input checked="" type="checkbox"/>
Medium	<input type="checkbox"/>	Neutral	<input type="checkbox"/>
Low	<input checked="" type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>	Low contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 4b**

**The proposed further phases of the Thukela River Water Transfer.**

**Project Description**

The proposed further phases of the Thukela River Water Transfer comprise two new dams at Jana on the main stem of the Thukela River and the Mielietuin Dam on the Bushmans River (a tributary of the Thukela River) with new pipelines and pump stations linking these dams to the existing Thukela Water Transfer Scheme.

The proposed further phases will increase the yield of the Vaal River system, by approximately 522 million m<sup>3</sup>/a. This represents the net yield from the two dams after provisions were made for required yield loss mitigation releases for existing downstream users.

Key information on this water transfer scheme includes:

- The Jana Dam with the net yield of 396 million m<sup>3</sup>/a and the Mielietuin Dam with the net yield of 126 million m<sup>3</sup>/a
- The Jana Dam with a gross storage of 2 652 million m<sup>3</sup> and the Mielietuin Dam with a gross storage of 467 million m<sup>3</sup>;
- The dam wall height at full supply level for the Jana Dam is 186 m and for the Mielietuin Dam is 95 m;
- The total pumping head is high at about 580 m, requiring substantial electrical energy;
- The construction cost for the total scheme is estimated at **\$1 184 million** and the annual operations cost at **\$9.1 million/a**, at the 2018 development level; and
- Construction of the further phases is scheduled to commence in 2032 and it is estimated to be completed by 2036

**STRATEGIC ACTION**

**Strategic action being supported**

**Specific action**

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD

Supporting 1

Supporting 2

Supporting 3

Supporting 4

**BUDGET REQUIREMENTS**

More than 1 billion USD

Between 50 million USD and 1 billion USD

Between 1 million USD and 50 million USD

Less than 1 million USD

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER**

**Project 4b**

**The proposed further phases of the Thukela River Water Transfer.**

**1: Involvement of ORASECOM**

High	<input checked="" type="checkbox"/>
Significant	<input checked="" type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Limited	<input type="checkbox"/>

**2: Countries involved**

Botswana	<input type="checkbox"/>
Lesotho	<input type="checkbox"/>
Namibia	<input type="checkbox"/>
South Africa	<input checked="" type="checkbox"/>

**3: Priority**

High Priority	<input type="checkbox"/>
Medium Priority	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>

**4: Impact on Climate Resilience**

High	<input checked="" type="checkbox"/>
Medium	<input type="checkbox"/>
Low	<input type="checkbox"/>

**5:Type of Funding Required**

Normal Loan	<input checked="" type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>

**6: Likley Loan Period**

1 to 5 Years	<input type="checkbox"/>
6 to 20 Years	<input type="checkbox"/>
More than 20 Years	<input type="checkbox"/>

**7: Job Creation**

Long term jobs	<input checked="" type="checkbox"/>
During construction	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>

**8: Impact on possible Conflicts Between Basin States**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**9: Socio economic influence**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**10: Influence on local communities**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**11: Yield contribution**

Significant contribution	<input checked="" type="checkbox"/>
Moderate contribution	<input type="checkbox"/>
Low contribution	<input type="checkbox"/>

**12: Contribution to alleviating water scarcity**

Significant contribution	<input checked="" type="checkbox"/>
Moderate contribution	<input type="checkbox"/>
Low contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER  
TRANSFER PROJECT**

**Project 4c**

**The desalination and re-use of acid mine drainage**

**Project Description**

The desalination and re-use of acid mine drainage (AMD) were listed as one of the most important intervention options from the Vaal River System Reconciliation Strategy (DWAF, 2009) as it significantly improves both water quality and water quantity. The implementation of this intervention option is forming part of the continuation of the IVRS Reconciliation Strategy Phase 2 (DWS, 2018). In the IVRS, the desalination of AMD will ensure a reduction in the release of water from the Vaal Dam for dilution purposes; it will also reduce demand through reclamation and direct re-use, as well as improve the salinity levels in the Vaal River system, and the Orange-Senqu River Basin, by eliminating or substantially reducing the discharge of saline AMD.

The AMD mainly occurs in the Middle Vaal catchment downstream of the Vaal Dam. The Short-Term Intervention (STI) of the project is currently maintained. The STI consists of pumping and treatment infrastructure which reduces the concentration of metals and neutralizes the acidity before releasing the water into the natural water courses.

Initial estimations indicated a positive quantity contribution to the IVRS of 500 million m<sup>3</sup>/a. Current indications are that this might be less. RSA DWS is in the process to carry out further detailed studies in this regard, and a final updated quantity contribution is thus not yet available.

The pumping and treatment processes introduced through the immediate and short-term solution only neutralize AMD's high acidity and address the metals (notably iron) carried in the water. In the medium, to long term, the option of neutralizing will not be sustainable, as it could result in excessive salt loads in the surface water of the receiving catchments. For the long-term, the desalination and selling the pumped mine water to users should be investigated. During 2014/15 the proposed long-term solution for AMD was put on hold due to further requested investigations. In April 2019 a detailed dilution assessment was undertaken as part of the investigation for the pre-feasibility study on the long-term solutions for the AMD problem. The results from the investigation recommended a full recalibration of the Vaal Barrage catchment hydrology and water quality modules before proceeding with the implementation of the Long-term Solution. The water quality recalibration study has not yet been initiated and details on what the Long-term solution would entail is thus not yet available.

The long-term solution work was estimated to start in 2021 with full implementation by 2025. These dates will change depending on the findings from the proposed recalibration study which has not yet started.

Initial estimations indicated a positive quantity contribution to the IVRS of 500 million m<sup>3</sup>/a. Current indications are that this might be less. RSA DWS is in the process to carry out further detailed studies in this regard, and a final updated quantity contribution is thus not yet available. This is an expensive intervention option with total capital expenditure at 2018 price levels estimated at **\$0.463 billion** and operational costs at **\$68 million/a**

**STRATEGIC ACTION**

Strategic action being supported	Specific action
SA 2 will provide usefull input	

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	RSA
Supporting 1	
Supporting 2	
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	X
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER**

**Project 4c**

**The desalination and re-use of acid mine drainage**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input type="checkbox"/>
Limited	<input checked="" type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Low	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input checked="" type="checkbox"/>	Positive	<input checked="" type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input checked="" type="checkbox"/>
Medium	<input type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
Low	<input checked="" type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input checked="" type="checkbox"/>	Significant contribution	<input checked="" type="checkbox"/>
Moderate contribution	<input type="checkbox"/>	Moderate contribution	<input type="checkbox"/>
Low contribution	<input type="checkbox"/>	Low contribution	<input type="checkbox"/>

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
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TRANSFER PROJECT**

<b>Cluster</b>	<b>5</b>
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**Caledon to Greater Bloemfontein transfer Cluster**

**Development Options Core Scenario**

The Basin Wide Investment Plan and the Core Scenario development options comprises projects that had already been identified by the basin states, and which had been subject to various levels of planning. The projects were grouped into clusters based on the larger schemes or sub-systems of which they formed one of the key components. The following Clusters were considered:

- 1) Orange River Project (ORP) Scheme future improvements.
- 2) Lesotho Botswana Water Transfer Scheme.
- 3) Lesotho Lowlands Water Project
- 4) Integrated Vaal River System Intervention Options.
- 5) **Caledon to Greater Bloemfontein transfer.**
- 6) Greater Bloemfontein internal resource improvements
- 7) Gariep to Greater Bloemfontein Transfer.
- 8) Neckartal Dam Scheme
- 9) Integrated Water management actions.

**Projects forming part of the Caledon to Bloemfontein transfers**

**5a) Increase Tienfontein Pumping capacity to 3.87 m<sup>3</sup>/s :**

This was already completed .

**5b) Tienfontein pump station capacity increase to 7 m<sup>3</sup>/s**

This phased project is primarily a regional project augmenting the water supply to the City of Mangaung (Bloemfontein) but may have on-route offtakes. The Tienfontein infrastructure belongs to DWS RSA. There is some possibility of future links with Lesotho via compensation releases from Lesotho Lowland dams and or support from the LHWP.

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TRANSFER PROJECT**

**Project 5b**

**Tienfontein pump station capacity increase to 7 m<sup>3</sup>/s**

**Project Description**

This phased project is primarily a regional project augmenting the water supply to the City of Mangaung (Bloemfontein) but may have on-route offtakes. The Tienfontein infrastructure belongs to DWS RSA. There is some possibility of future links with Lesotho via compensation releases from Lesotho Lowland dams and or support from the LHWP.

- oThis option is expected to increase the system yield by 13.7 million m<sup>3</sup>/a;
- oThe capital cost for this option is estimated at **\$ 9.5 million** (2018 )
- oThe operational cost is estimated at **\$0.37 million/a** (2018)

**STRATEGIC ACTION**

**Strategic action being supported**  
SA3 possible inputs

Specific action

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD

Supporting 1

Supporting 2

Supporting 3

Supporting 4

**BUDGET REQUIREMENTS**

More than 1 billion USD

Between 50 million USD and 1 billion USD

Between 1 million USD and 50 million USD

Less than 1 million USD

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**Project 5b**

**Tienfontein pump station capacity increase to 7 m<sup>3</sup>/s**

**1: Involvement of ORASECOM**

High	<input checked="" type="checkbox"/>
Significant	<input checked="" type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Limited	<input checked="" type="checkbox"/>

**2: Countries involved**

Botswana	<input type="checkbox"/>
Lesotho	<input checked="" type="checkbox"/>
Namibia	<input type="checkbox"/>
South Africa	<input checked="" type="checkbox"/>

**3: Priority**

High Priority	<input type="checkbox"/>
Medium Priority	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>

**4: Impact on Climate Resilience**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**5:Type of Funding Required**

Normal Loan	<input checked="" type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>

**6: Likley Loan Period**

1 to 5 Years	<input type="checkbox"/>
6 to 20 Years	<input type="checkbox"/>
More than 20 Years	<input type="checkbox"/>

**7: Job Creation**

Long term jobs	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>

**8: Impact on possible Conflicts Between Basin States**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**9: Socio economic influence**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**10: Influence on local communities**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**11: Yield contribution**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>

**12: Contribution to alleviating water scarcity**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>

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TRANSFER PROJECT**

Cluster

**6**

**Greater Bloemfontein Internal Resource Improvements**

**Development Options Core Scenario**

The Basin Wide Investment Plan and the Core Scenario development options comprises projects that had already been identified by the basin states, and which had been subject to various levels of planning. The projects were grouped into clusters based on the larger schemes or sub-systems of which they formed one of the key components. The following Clusters were considered:

- 1) Orange River Project (ORP) Scheme future improvements.
- 2) Lesotho Botswana Water Transfer Scheme.
- 3) Lesotho Lowlands Water Project
- 4) Integrated Vaal River System Intervention Options.
- 5) Caledon to Greater Bloemfontein transfer.
- 6) Greater Bloemfontein internal resource improvements**
- 7) Gariep to Greater Bloemfontein Transfer.
- 8) Neckartal Dam Scheme
- 9) Integrated Water management actions.

**Projects forming part of the Greater Bloemfontein Internal Resource Improvements**

**6a) Raise Mockes Dam :**

This component is included mainly to capture and store return flows for indirect re-use purposes, and to minimise spills from the dam. The yield benefit from the raising of the Mockes Dam on its own is very small.

**6b) Increase the Maselspoort WTW capacity :**

Maselspoort WTW capacity increase to 130 Ml/d to be able to accommodate the increased volumes due to indirect re-use. This will include the upgrading of the plant to treat the lower water quality from the re-use return flows, to potable standards .

**6c) Indirect re-use of 16 million m<sup>3</sup>/a from the Bloemspruit WWTW to be captured in Mockes Dam.**

**6d) Direct re-use of 11 million m<sup>3</sup>/a to be fed directly into the water supply system at the Maselspoort WTW downstream of the Mockes Dam**

**Comined System:**

The total system yield is increased by 30 million m<sup>3</sup>/a due to the combination of all improvements

The total capital cost for all components combined is **\$ 86.2 million**

The combined operational cost for all components was estimated at **\$ 9.2 million/a**

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
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**Project 6a**

**Raise Mockes Dam**

**Project Description**

This component is included mainly to capture and store return flows for indirect re-use purposes, and to minimise spills from the dam. The yield benefit from the raising of the Mockes Dam on its own is very small.

**STRATEGIC ACTION**

<b>Strategic action being supported</b>

<b>Specific action</b>

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

<b>LEAD</b>	RSA
Supporting 1	
Supporting 2	
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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**Project 6a**

**Raise Mockes Dam**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input type="checkbox"/>
Limited	<input checked="" type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Low	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input type="checkbox"/>	Positive	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input type="checkbox"/>
Low contribution	<input type="checkbox"/>	Low contribution	<input checked="" type="checkbox"/>

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**Project 6b**

**Increase the Maselspoort WTW capacity :**

**Project Description**

Maselspoort WTW capacity increase to 130 Ml/d to be able to accommodate the increased volumes due to indirect re-use. This will include the upgrading of the plant to treat the lower water quality from the re-use return flows, to potable standards .

**STRATEGIC ACTION**

**Strategic action being supported**

**Specific action**

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD

Supporting 1

Supporting 2

Supporting 3

Supporting 4

**BUDGET REQUIREMENTS**

More than 1 billion USD

Between 50 million USD and 1 billion USD

Between 1 million USD and 50 million USD

Less than 1 million USD

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**Project 6b**

**Increase the Maselspoort WTW capacity :**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input type="checkbox"/>
Limited	<input checked="" type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Low	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input type="checkbox"/>	Positive	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>	Low contribution	<input type="checkbox"/>

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**Project 6c**

**Indirect re-use**

**Project Description**

Indirect re-use of 16 million m<sup>3</sup>/a from the Bloemspruit WWTW to be captured in Mockes Dam.

**STRATEGIC ACTION**

Strategic action being supported

Specific action

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD 

RSA
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Supporting 1 

--

Supporting 2 

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Supporting 3 

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Supporting 4 

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**BUDGET REQUIREMENTS**

More than 1 billion USD 

--

Between 50 million USD and 1 billion USD 

--

Between 1 million USD and 50 million USD 

--

Less than 1 million USD 

--

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**Project 6c**

**Indirect re-use**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input type="checkbox"/>
Limited	<input checked="" type="checkbox"/>	South Africa	<input checked="" type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input checked="" type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Low	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input type="checkbox"/>	Positive	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>	Low contribution	<input type="checkbox"/>

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
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**Project 6d**

**Direct re-use**

**Project Description**

Direct re-use of 11 million m<sup>3</sup>/a to be fed directly into the water supply system at the Maselspoort WTW downstream of the Mockes Dam

**STRATEGIC ACTION**

Strategic action being supported

Specific action

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD RSA

Supporting 1

Supporting 2

Supporting 3

Supporting 4

**BUDGET REQUIREMENTS**

More than 1 billion USD

Between 50 million USD and 1 billion USD

Between 1 million USD and 50 million USD

Less than 1 million USD

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**Project 6d**

**Direct re-use**

**1: Involvement of ORASECOM**

High	<input checked="" type="checkbox"/>
Significant	<input checked="" type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Limited	<input checked="" type="checkbox"/>

**2: Countries involved**

Botswana	<input type="checkbox"/>
Lesotho	<input type="checkbox"/>
Namibia	<input type="checkbox"/>
South Africa	<input checked="" type="checkbox"/>

**3: Priority**

High Priority	<input type="checkbox"/>
Medium Priority	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>

**4: Impact on Climate Resilience**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**5:Type of Funding Required**

Normal Loan	<input checked="" type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>

**6: Likley Loan Period**

1 to 5 Years	<input type="checkbox"/>
6 to 20 Years	<input type="checkbox"/>
More than 20 Years	<input type="checkbox"/>

**7: Job Creation**

Long term jobs	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>

**8: Impact on possible Conflicts Between Basin States**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**9: Socio economic influence**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**10: Influence on local communities**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**11: Yield contribution**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>

**12: Contribution to alleviating water scarcity**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>

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TRANSFER PROJECT**

**Cluster**

**7**

**Gariep to Greater Bloemfontein Transfer**

**Development Options Core Scenario**

The Basin Wide Investment Plan and the Core Scenario development options comprises projects that had already been identified by the basin states, and which had been subject to various levels of planning. The projects were grouped into clusters based on the larger schemes or sub-systems of which they formed one of the key components. The following Clusters were considered:

- 1) Orange River Project (ORP) Scheme future improvements.
- 2) Lesotho Botswana Water Transfer Scheme.
- 3) Lesotho Lowlands Water Project
- 4) Integrated Vaal River System Intervention Options.
- 5) Caledon to Greater Bloemfontein transfer.
- 6) Greater Bloemfontein internal resource improvements
- 7) Gariep to Greater Bloemfontein Transfer.**
- 8) Neckartal Dam Scheme
- 9) Integrated Water management actions.

**Projects forming part of the Gariep to Greater Bloemfontein Transfer**

**7a) Gariep to Greater Bloemfontein Transfer :**

Cluster 7 will focus on the future transfer from the existing Gariep Dam to the Greater Bloemfontein Water Supply system. This option was recommended from both studies, the Greater Bloemfontein Reconciliation Strategy (DWS, 2012) and the Mangaung Gariep Augmentation Project (Mangaung, 2018). However, DWS has advised that that the best option from a national perspective must still be confirmed through an independent study that is currently in process through DWS RSA.

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 7a**

**Gariep to Greater Bloemfontein Transfer**

**Project Description**

Cluster 7 will focus on the future transfer from the existing Gariep Dam to the Greater Bloemfontein Water Supply system. This option was recommended from both studies, the Greater Bloemfontein Reconciliation Strategy (DWS, 2012) and the Mangaung Gariep Augmentation Project (Mangaung, 2018). However, DWS has advised that that the best option from a national perspective must still be confirmed through an independent study that is currently in process through DWS RSA.

There are several possible route options for the transfer pipeline from Gariep Dam. For the purpose of this report, only one of the pipeline route options was selected, namely the clear water pipeline from Gariep Dam to a point near Bloemfontein. Based on the latter study, the transfer scheme will be constructed in two phases:

Phase 1: Transfer capacity of 32 million m<sup>3</sup>/a by means of a pump station and pipeline;

Phase 2: Inclusion of a booster pump station increasing the transfer capacity by another 11 million m<sup>3</sup>/a, to a total transfer capacity of 43 million m<sup>3</sup>/a.

Phase 1 capital cost estimated at \$ 200 million.

Phase 1 operational cost estimated at \$ 9 million/a

Phase 2 capital cost estimated at \$ 26.3 million

Phase 2 operational expenditure estimated at \$ 3.1 million/a

**STRATEGIC ACTION**

Strategic action being supported	Specific action
Valuable input from SA 3	

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	RSA
Supporting 1	
Supporting 2	
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	X
Between 1 million USD and 50 million USD	
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER  
TRANSFER PROJECT**

**Project 7a**

**Gariiep to Greater Bloemfontein Transfer**

**1: Involvement of ORASECOM**

High	<input checked="" type="checkbox"/>
Significant	<input checked="" type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Limited	<input checked="" type="checkbox"/>

**2: Countries involved**

Botswana	<input type="checkbox"/>
Lesotho	<input checked="" type="checkbox"/>
Namibia	<input type="checkbox"/>
South Africa	<input checked="" type="checkbox"/>

**3: Priority**

High Priority	<input checked="" type="checkbox"/>
Medium Priority	<input type="checkbox"/>
Low Priority	<input type="checkbox"/>

**4: Impact on Climate Resilience**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**5:Type of Funding Required**

Normal Loan	<input checked="" type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>
Donor Only	<input type="checkbox"/>

**6: Likley Loan Period**

1 to 5 Years	<input type="checkbox"/>
6 to 20 Years	<input type="checkbox"/>
More than 20 Years	<input type="checkbox"/>

**7: Job Creation**

Long term jobs	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>

**8: Impact on possible Conflicts Between Basin States**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**9: Socio economic influence**

High	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>

**10: Influence on local communities**

Positive	<input type="checkbox"/>
Neutral	<input checked="" type="checkbox"/>
Negative	<input type="checkbox"/>

**11: Yield contribution**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>

**12: Contribution to alleviating water scarcity**

Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER  
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**Cluster**

**8**

**Neckartal Water Supply Scheme**

**Development Options Core Scenario**

The Basin Wide Investment Plan and the Core Scenario development options comprises projects that had already been identified by the basin states, and which had been subject to various levels of planning. The projects were grouped into clusters based on the larger schemes or sub-systems of which they formed one of the key components. The following Clusters were considered:

- 1) Orange River Project (ORP) Scheme future improvements.
- 2) Lesotho Botswana Water Transfer Scheme.
- 3) Lesotho Lowlands Water Project
- 4) Integrated Vaal River System Intervention Options.
- 5) Caledon to Greater Bloemfontein transfer.
- 6) Greater Bloemfontein internal resource improvements
- 7) Gariep to Greater Bloemfontein Transfer.

**8) Neckartal Dam Scheme**

- 9) Integrated Water management actions.

**Projects forming part of the Neckartal Water Supply Scheme**

**8a) Neckartal Scheme:** It is important to note that the construction of the Neckartal Dam located in the lower Fish River in Namibia was recently completed and the dam started to store water already in 2018. The main purpose of this dam is to supply water to a new irrigation development.

**ORASECOM:CLIMATE RESILIENT WATER RESOURCES  
INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER  
TRANSFER PROJECT**

**Project 8a**

**Neckartal Water Supply Scheme**

**Project Description**

It is important to note that the construction of the Neckartal Dam located in the lower Fish River in Namibia was recently completed and the dam started to store water already in 2018. The main purpose of this dam is to supply water to a new irrigation development. Water will be released from the dam directly into the river and abstracted downstream from a diversion weir into a canal system, used to distribute the water to the irrigators. The releases from the dam into the river will take place via hydro-power turbines, which were already installed.

The planning of the irrigation scheme is currently behind schedule, and at the time of writing this report (June 2024) it was confirmed that the Namibian Government had acquired 4 farms measuring 19 137 Ha. The total irrigation requirement was estimated at 90 million m<sup>3</sup>/a. Based on the installed turbine capacities the volume that can be released through the turbines was determined as 100 million m<sup>3</sup>/a. The difference of 10 million m<sup>3</sup>/a will most probably be used to support the EWR downstream of the diversion weir.

In the meantime, water is expected to be released for power generation purposes from Neckartal Dam. Depending on the amount of losses between the dam and the Orange River mouth (expected to be high) it can be considered to utilize these flows to supply the river mouth environmental requirements or part thereof and thereby reducing the demand on Gariep and Vanderkloof dams. The saved water in the ORP system can then be utilized for other purposes such as the increasing water requirements on the Lower Orange River for Namibia and the RSA. This is an option that should be further investigated.

The yield from the dam at 98% assurance is estimated at 108 million m<sup>3</sup>/a  
 Installed capacity of the hydro-power turbines is 2.7 MW  
 The planned irrigation scheme to cover approximately 5 000 ha  
 The capital cost for the irrigation scheme was estimated at \$ 26.3 million (2018);  
 The operational costs for the irrigation scheme were estimated at \$ 0.79 /a (2018)

**STRATEGIC ACTION**

Strategic action being supported	Specific action
SA 1 might provide usefull input on EWRs	

**LEAD AND SUPPORTING ORGANISATIONS OR COUNTRIES**

LEAD	Namibia
Supporting 1	
Supporting 2	
Supporting 3	
Supporting 4	

**BUDGET REQUIREMENTS**

More than 1 billion USD	
Between 50 million USD and 1 billion USD	
Between 1 million USD and 50 million USD	X
Less than 1 million USD	

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**ORASECOM:CLIMATE RESILIENT WATER RESOURCES INVESTMENT PLAN & LESOTHO TO BOTSWANA WATER TRANSFER PROJECT**

**Project 8a**

**Neckartal Water Supply Scheme**

<b>1: Involvement of ORASECOM</b>		<b>2: Countries involved</b>	
High	<input checked="" type="checkbox"/>	Botswana	<input type="checkbox"/>
Significant	<input checked="" type="checkbox"/>	Lesotho	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Namibia	<input checked="" type="checkbox"/>
Limited	<input checked="" type="checkbox"/>	South Africa	<input type="checkbox"/>
<b>3: Priority</b>		<b>4: Impact on Climate Resilience</b>	
High Priority	<input type="checkbox"/>	High	<input type="checkbox"/>
Medium Priority	<input checked="" type="checkbox"/>	Medium	<input checked="" type="checkbox"/>
Low Priority	<input type="checkbox"/>	Low	<input type="checkbox"/>
<b>5:Type of Funding Required</b>		<b>6: Likley Loan Period</b>	
Normal Loan	<input checked="" type="checkbox"/>	1 to 5 Years	<input type="checkbox"/>
Loan and Donor	<input checked="" type="checkbox"/>	6 to 20 Years	<input type="checkbox"/>
Donor Only	<input type="checkbox"/>	More than 20 Years	<input type="checkbox"/>
<b>7: Job Creation</b>		<b>8: Impact on possible Conflicts Between Basin States</b>	
Long term jobs	<input type="checkbox"/>	Positive	<input type="checkbox"/>
During construction	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
None	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>9: Socio economic influence</b>		<b>10: Influence on local communities</b>	
High	<input type="checkbox"/>	Positive	<input type="checkbox"/>
Medium	<input checked="" type="checkbox"/>	Neutral	<input checked="" type="checkbox"/>
Low	<input type="checkbox"/>	Negative	<input type="checkbox"/>
<b>11: Yield contribution</b>		<b>12: Contribution to alleviating water scarcity</b>	
Significant contribution	<input type="checkbox"/>	Significant contribution	<input type="checkbox"/>
Moderate contribution	<input checked="" type="checkbox"/>	Moderate contribution	<input checked="" type="checkbox"/>
Low contribution	<input type="checkbox"/>	Low contribution	<input type="checkbox"/>

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