



Western Cape
Government

BETTER TOGETHER.

A Berg River Improvement Plan - 2012

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***A Water Stewardship Programme in the Berg River Catchment:
Changing the lives of communities, farmers and industry...***

SUMMARY

1. INTRODUCTION

Water is the most critical natural resource in the economic sector, with communities and industry deriving goods and services from river systems in their catchment areas. The Berg River catchment is home to cultivated agricultural land, mainly vineyards, fruit trees and wheat fields. About 75% of the crop produced in the catchment is exported to the European Union and the United Kingdom (UK).

Pollution in the Berg River catchment, however, is a cause of great concern especially to communities, farmers and industry in the various municipalities of the West Coast and Cape Winelands regions. Various stakeholders have implemented initiatives to address the pollution concerns raised.

On 24 February 2009, a Berg River Water Quality Task Team was established to investigate and propose interventions to improve the water quality of the Berg River system. A report, finalised by the Western Cape Government in April 2009, made recommendations to address the water quality concerns in the Berg River system. However, as there are no quick-fix solutions, a focused effort by all stakeholders is required to successfully address water quality concerns in the Berg River system.

The Western Cape Government has, on 06 September 2012, undertaken to develop this Berg River Improvement Plan to address the current water quality concerns in the Berg River. The Improvement Plan highlights the current status of sources of pollution and the various interventions that have been or are currently being undertaken by municipalities and sector Departments in the Western Cape. It identifies short (≤ 5 years) and long term (5 – 30 years) interventions, and its financial implications.

The ultimate aim of the Improvement Plan is to have a **Water Stewardship Programme for the Berg River catchment** to change the lives of people through the implementation of simple interventions. The outcome will be a Berg River, where its value for ecosystem services is recognised, and its natural resource state as it relates to water quality and quantity returns, while promoting sustainable growth and development towards a green economy in the Western Cape.

This Berg River Improvement Plan is also intended to complement the Business Plan that is currently being drafted by CASIDRA, on behalf of the Department of Water Affairs – DWA (DWA, 2012), as well as link with the Berg River Water Quality Task Team, as managed by DWA.

2. CATCHMENT OVERVIEW

Overview

For the purposes in this Improvement Plan, the Berg River catchment was divided into three sub-areas, based on quaternary catchments and geomorphological zones:

- Upper Berg River (G10A-B): Including the Berg, Franschhoek, Wemmershoek and Dwars Rivers.
- Middle Berg River (G10C-D): Including the Berg, Hugos, Krom, and Kompanjies rivers.
- Lower Berg River (G10E-G10M) Including the Klein Berg, Vier-en-Twintig, Sandspruit, Matjies, Moorreesburgspruit, Boesmans, Doring, Sand, Drieheuwels, Platkloof and Sout rivers.

Biophysical Characteristics

- **Geology:** The Upper Berg River basin is underlain by Table Mountain Sandstone (TMS). Malmesbury Shale dominates the Berg River downstream of Paarl
- **Groundwater:** The groundwater system of the Berg River catchment comprises the Table Mountain Group Aquifer (TMGA), the Cape Granite Suite Aquifer (CGSA), the Malmesbury Group Aquifer (MGA), the Klipheuwel Group Aquifer (KGA) and Primary Aquifers (PA). Groundwater quality in the Berg River catchment is generally poor, particularly in areas underlain by rocks of the MGA, while good quality groundwater is found in the upper parts of the catchment.
- **Hydrology:** The Berg River has 19 major tributaries, with a total natural runoff from its catchment amounting to ca. 931 Mm³/a (DWA, 2007).
- **Land-Use and Socio-Economic Profile:** The Berg River is a main source of domestic water supply and is also important for agricultural, industrial and environmental purposes. The land-use in the Berg River catchment is mainly agricultural crop production with approximately 600 farm units providing employment.

The Berg estuary is one of the largest of South Africa's 279 estuaries, from a conservation perspective. Economic activities associated with the estuary have historically been fisheries-based and also includes tourism and recreation.

- **Demographic Profile and Socio-Economic Information:** The Berg River population in the Cape Winelands District Municipality and West Coast District Municipality has been described as moderate; while the population density reduces in smaller towns. It was predicted that the population in the towns of Paarl, Wellington, Stellenbosch and Malmesbury will grow at a rate of between 1% and 1.5% per annum.

3. WATER QUALITY GUIDELINES, STANDARDS AND CURRENT MONITORING

- **South African Water Quality Guidelines:** The DWA is the custodian of South Africa's water resources, and the South African Water Quality Guidelines (Volumes 1 – 8) sets out the Target Water Quality Ranges (TWQRs) for the various water uses.
- **General and Special Standards for the purification of wastewater or effluent:** The DWA has issued General and Special Standards (DWA, 2004) for the purification of wastewater or effluent that is discharged to a water resource that must be adhered to.
- **Current Monitoring: Present Ecological Status** The DWA prescribes a method for the categorisation of the Present Ecological Status (PES) of a river. The PES defines the river's ecological integrity, condition or degree of "naturalness", i.e. the river's "Ecstatus. Currently, water quality monitoring is undertaken by various institutions along the length of the Berg River, albeit at varying degrees.
 - **Faecal coliforms: *Escherichia coli*:** Faecal coliforms such as *E. coli* are used as bacterial indicators of faecal pollution. The *E. coli* results collected by the various institutions were difficult to compare. As such, the percentage of its compliance to the Drinking Water Quality Standards (SANS 241: 2006) and it meeting the Target Water Quality Range (TWQR) of the South African Water Quality Guidelines for *E. coli* was calculated.

- **Physico-chemical parameters: Nitrates and Phosphates:** Nitrates in irrigation water are primarily of concern because it has the potential to leach and contaminate groundwater sources, and it has a stimulatory effect on nuisance growth of algae and aquatic plants in irrigation. Water samples collected as part of the DWA Hydrological / Water Quality Monitoring Programme indicate that phosphates and nitrates in the Berg River are a concern. Surface runoff of both nitrates and phosphates from the surrounding catchment are likely the major inflow source to surface waters. In summary, water quality in the Berg River catchment is of concern for domestic, agricultural and recreational use.

4. SOURCES OF POLLUTION THAT IMPACT ON WATER QUALITY OF THE BERG RIVER

- **Wastewater Treatment Works (microbiological):** The Berg River catchment has a total of 35 wastewater treatment works (WWTWs), with ca. 20 impacting directly or indirectly on the water quality of the river contributing high microbiological loads. Current upgrading of the WWTWs is at various stages of completion or planning. A new Regional WWTW to serve the Franschoek and Wemmershoek area is planned for completion by end 2013.
- **Informal settlements (microbiological):** There are 35 informal settlements that impact directly or indirectly on the Berg River catchment (G10A-M). The Department of Housing estimated that there are ca. 7 483 structures, and ca. 34 125 people living in these informal settlements. Although water and sanitation, as well as bulk services are available in most of the informal settlements, these services are limited and have led to the disposal of waste into the Berg River and stormwater drains.
- **Agriculture (nutrients, pesticides, sediment / erosion):** The agricultural zoned area in the Berg River catchment comprise an estimated ca. 7073 farm portions, totalling ca. 477 833 ha (cultivated) of which ca. 36 770 ha are potentially irrigated. Irrigation return flows and run-off contributes to the pollution load.
- **Natural impacts (salinity / mean annual precipitation and evaporation):** The impacts include climate change and the natural geology of the area.
- **Industrial wastewater:** While the specific impact of industrial effluent on water quality in the Berg River has not been quantified, it is likely that the industries in the catchment impact on the water quality of the river.
- **Cost of pollution in the Berg River**
 - **Agricultural export industry:** The deciduous fruit industry in the Berg River catchment is estimated to have a value of R1 billion, with 70% of the fruits exported to the European Union. During 2004/2005, the export markets in the Berg River catchment were at risk of having their fruit exports from the region cancelled due to pollution from informal settlements close to the river. Water pollution in the Berg River catchment will impact on unemployment and social services.
 - **Risk of disease:** Pollution in the river water may lead to waterborne and endemic diseases such as cholera and diarrhoea.

- **Loss of revenue in Municipalities that trade water from the Berg River:** The WCDM and Berg River Local Municipality both generate revenue from trading water sourced from the Berg River. Deterioration of the quality of water due to pollution is projected to reduce the revenue generated at both municipalities.
- **Impact on the Berg River estuary and the economic goods produced:** The pollution of the Berg River and the reduction in the quantity and quality of freshwater flowing to the estuary is a threat to the economic goods and services produced by the estuary.

5. IMPLEMENTING THE IMPROVEMENT PLAN

An overarching *Water Stewardship Programme for the Berg River catchment* is proposed for integrating the Tasks identified in the Berg River Improvement Plan. All Tasks are proposed for completion within a 5-30 year time frame. The Improvement Plan is to be reviewed and updated every 5 years.

- **Vision:** Berg River water of acceptable quality and quantity for sustainable farming, industrial development, human consumption and recreation, as well as ecological health.
- **Aims and Objectives:** The aim is to have a *Water Stewardship Programme for the Berg River catchment* to change the lives of the communities, farmers and industry by implementing simple green interventions. The outcome will be a Berg River where its value for ecosystem services is recognised, its natural resource state as it relates to water quality and quantity returns, while promoting sustainable growth and development in a green economy in the Western Cape.

The objectives of the Berg River Improvement Plan are to:

- Reduce the *negative impact from Municipal urban areas*, particularly informal settlements and wastewater treatment works;
- Reduce the *negative impact of agriculture* on the Berg River's water quality to acceptable levels;
- Ensure *sustainable resource use efficiency and ecological integrity*.

- **Tasks and Responsibilities**

A Water Stewardship Programme for the Berg River is proposed that incorporates the following tasks towards meeting the identified objectives:

- Task 1: Establish a Berg River Water Quality Monitoring Programme
- Task 2: Upgrade Wastewater Treatment Works and Train Process Controllers
- Task 3: Upgrade Informal Settlements
- Task 4: Advocate Best Practice in Agricultural, Industrial and Domestic Land-use
- Task 5: Riparian Zone Rehabilitation and Management (Buffer Zone)
- Task 6: Pricing Water Management in the Berg River Catchment

The key actions and funding requirements to support the targets identified in each Task are provided below. The timeframes and budgets assigned to each Task are proposed, and require revision when the Improvement Plan is adopted for implementation. The order of the Tasks identified does not denote the level of importance.

- **Communication Strategy and Communication Platform:** Communication is key to successfully implementing the Improvement Plan, and to ensure that relevant and appropriate messages are delivered to the public. Therefore, an effective Communication Strategy and Communication Platform must be developed that links all government Departments and key stakeholders. A service provider will be appointed to develop and drive the Communication Strategy and Communication Platform.
- **Monitoring and Evaluating the Improvement Plan:** A Monitoring and Evaluation System is integral to evaluating the success of implementing the Berg River Improvement Plan.

6. INSTITUTIONAL FRAMEWORK

- **Human Resources:** A Project Manager will be appointed to manage a Specialist Team, comprising of 5 team members and 1-2 persons per municipality. One Task Manager is to be appointed for each of the tasks identified. Further, the project will aim to create "green" jobs, via the existing EPWP or Jobs Fund mechanisms.
- **Partnerships:** The DWA, Provincial Departments and Local Government has already completed and is currently implementing a range of successful water quality improvement projects in collaboration with industry and farmers in the Berg River catchment. A formal Partnership, comprising of all three spheres of Government, industry, farmers and the communities, is proposed to monitor the progress of the Improvement Plan.

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Berg River Improvement Plan

1. INTRODUCTION

Water is the most critical natural resource in the economic sector, with communities and industry deriving goods and services from river systems in their catchment areas. The Berg River catchment is home to cultivated agricultural land, mainly vineyards, fruit trees and wheat fields. About 75% of the crop produced in the catchment is exported to the European Union and the United Kingdom (UK).

Pollution in the Berg River catchment, however, is a cause of great concern especially to communities, farmers and industry in the various municipalities of the West Coast and Cape Winelands regions. Various stakeholders have implemented initiatives to address the pollution concerns raised.

On 24 February 2009, a Berg River Water Quality Task Team was established to investigate and propose interventions to improve the water quality of the Berg River system. A report, finalised by the Western Cape Government in April 2009, made recommendations to address the water quality concerns in the Berg River system. However, as there are no quick-fix solutions, a focused effort by all stakeholders is required in order to successfully address the water quality concerns in the Berg River system.

The Western Cape Government has, on 06 September 2012, undertaken to develop this Berg River Improvement Plan to address the current water quality concerns in the Berg River. The Improvement Plan highlights the current status of sources of pollution and the various interventions that have been or are currently being undertaken by municipalities and sector Departments in the Western Cape. It identifies short (≤ 5 years) and long term (5 – 30 years) interventions, as well as the financial implications thereof.

The ultimate aim of the Improvement Plan is to have a **Water Stewardship Programme for the Berg River catchment** to change the lives of people through the implementation of simple interventions. The outcome will be a Berg River, where its value for ecosystem services is recognised, and its natural resource state as it relates to water quality and quantity returns, while promoting sustainable growth and development towards a green economy in the Western Cape.

This Berg River Improvement Plan is also intended to complement the Business Plan that is currently being drafted by CASIDRA, on behalf of the Department of Water Affairs – DWA (DWA, 2012).

2. THE IMPROVEMENT PLAN

The overview and contextual analysis established the foundations upon which the Improvement Plan was developed and proposes interventions towards achieving the vision and objectives identified.

An overarching Water Stewardship Programme for the Berg River catchment is proposed for integrating the Tasks identified in the Berg River Improvement Plan. All Tasks are proposed for

completion within a 5-30 year time frame. The Improvement Plan is to be reviewed and updated every 5 years.

2.1 Vision

Berg River water of acceptable quality and quantity for sustainable farming, industrial development, human consumption and recreation, as well as ecological health.

2.2 Aims and Objectives

The aim is to have a *Water Stewardship Programme for the Berg River catchment* to change the lives of the communities, farmers and industry by implementing simple interventions. The outcome will be a Berg River where its value for ecosystem services is recognised and its natural resource state as it relates to water quality and quantity returns, while promoting sustainable growth and development towards a green economy in the Western Cape.

The objectives of the Berg River Improvement Plan are to:

- i. Reduce the *negative impact from Municipal urban areas*, particularly informal settlements and wastewater treatment works;
- ii. Reduce the *negative impact of agriculture* on the Berg River's water quality to acceptable levels;
- iii. Ensure *sustainable resource use efficiency and ecological integrity*.

2.3 Tasks and Responsibilities

A Water Stewardship Programme for the Berg River catchment is proposed that incorporates the following tasks towards meeting the identified objectives:

- Task 1: Establish a Berg River Water Quality Monitoring Programme
- Task 2: Upgrade Wastewater Treatment Works and Train Process Controllers
- Task 3: Upgrade Informal Settlements
- Task 4: Advocate Best Practice in Agricultural, Industrial and Domestic Land-use
- Task 5: Riparian Zone Rehabilitation and Management (Buffer Zone)
- Task 6: Pricing Water Management in the Berg catchment

The key actions and funding requirements to support the targets identified in each Task are provided below. The timeframes and budgets assigned to each Task are proposed, and require revision when the Improvement Plan is adopted for implementation. The order of the Tasks identified does not denote the level of importance.

2.3.1 Task 1: Establish a Berg River Water Quality Monitoring Programme

Resource Condition Target (5-30 yrs)	<ul style="list-style-type: none"> ▪ <i>E. coli</i>, suspended sediment and nutrient (dissolved inorganic nitrogen – DIN; phosphates) levels in receiving waters meet the TWQRs of the SA Water Quality Guidelines, by 2042 (modelled annual load compared to current).
Resource Condition Target (Interim Target)	<ul style="list-style-type: none"> ▪ <i>E. coli</i>, suspended sediment and nutrient (dissolved inorganic nitrogen – DIN; phosphates) levels in receiving waters meet the TWQRs of the SA Water Quality Guidelines, by 2017 (modelled annual load compared to current).
Resource Condition Target (Interim Target: 1-4 yrs)	<ul style="list-style-type: none"> ▪ Establish baseline levels of <i>E. coli</i>, suspended sediment and nutrient (dissolved inorganic nitrogen – DIN; phosphates) in receiving waters, by 2016.
Management Action Target	<ul style="list-style-type: none"> ▪ Municipalities and private-owners to upgrade their WWTWs to comply with the relevant General or Special Standards (Annexure 1), by 2017. ▪ Informal settlements are upgraded, by 2020. ▪ Industrial & domestic land use best practices adopted, by 2017. ▪ Farmers adopt agricultural best practice to reduce runoff and improve groundcover and riparian vegetation (to reduce agricultural runoff), by 2017.
<p><i>Key actions to support targets:</i> <i>Lead Department: DEADP</i></p> <ul style="list-style-type: none"> • Appoint a Task Manager to oversee and manage the Programme. • Appoint a Specialist Team to assist with Task 1. • Develop an integrated Berg River Water Quality Monitoring Programme that: <ul style="list-style-type: none"> - focuses on monitoring the impacts of agricultural runoff and microbiological loads from informal settlements, industry, WWTWs, sewer pipes and manholes in the area. - Monitors pollutant loads in surface waters, plumes and receiving waters during events to support improved modelling capacity and develop methods to assess change in loads and reduction in impact of pollutants. - Identifies the key strategic goals and objectives of the Programme. - Includes a water quality monitoring sampling plan that: <ul style="list-style-type: none"> ▪ Identifies downstream users most negatively affected by poor water quality in the Berg River. ▪ Identifies the concentrated waste streams / source of bacteriological pollution e.g. informal settlements, piggeries, cattle farms etc. and other pollution sources. ▪ Integrates all existing Berg River monitoring sites (i.e. DWA National Microbial Monitoring Programme, DWA Hydrological/Water Quality Monitoring Programme, Bergrivier Irrigation Board, Local Municipalities and District Municipalities, etc.). ▪ Identifies additional water quality monitoring sites, to supplement existing sites. ▪ Identifies the water quality parameters (physico-chemical and microbiological) to be monitored at each site. ▪ Identifies the sampling frequency for each water quality monitoring site. ▪ Ensures that officials are trained on correct sampling protocols to be followed ▪ Establishes standard operating procedures for sample collection (e.g. SANS). ▪ Ensures that all water quality analyses are undertaken at accredited laboratories. ▪ Ensures QA/QC mechanisms in all sampling and analytical procedures. ▪ Addresses key knowledge gaps and refine prioritisation using catchment models (relative contribution of hill slope, gully and bank erosion; estimates of groundcover; location of gullies; trapping efficiency of dams; other sources of pollution; and pollutant tracing to validate models). ▪ Includes a receiving waters model to better understand the concentrations of pollutants in receiving waters. ▪ Addresses key knowledge gaps on risk and hazard assessment for pollutants (including understanding of surface and groundwater pathways of pollutant export) and refine prioritisation using models. 	

- Reports and communicates the water quality monitoring information in terms of the three Berg River sub-areas (i.e. Upper Berg River, Middle Berg River, Lower Berg River).
- Includes a Monitoring and Evaluation System to assess the programme on a regular basis.
- Identify EPWP employment opportunities that link to the interventions and create opportunities for small businesses.
- Communicate progress, as outlined in the Communication Strategy (Section 5.4).

2.3.2 Task 2: Upgrade Wastewater Treatment Works & Train Process Controllers

Resource Condition Target (5-30 yrs)	<ul style="list-style-type: none"> ▪ <i>E. coli</i> and nutrient levels meet the TWQRs of the SA Water Quality Guidelines, by 2042 (modelled annual load compared to current).
Resource Condition Target (Interim Target)	<ul style="list-style-type: none"> ▪ <i>E. coli</i> and nutrient levels meet the TWQRs of the SA Water Quality Guidelines, by 2017 (modelled annual load compared to current). ▪ WWTW effluent discharged directly or indirectly to the Berg River complies with the relevant General or Special Standards (Annexure 1), by 2017.
Management Action Target	<ul style="list-style-type: none"> ▪ Municipalities and private-owners upgrade their WWTWs to comply with the relevant General or Special Standards (Annexure 1), by 2017. ▪ All WWTWs have Green Drop status, by 2017. ▪ Process controllers of WWTWs at Municipalities are trained and accredited, by 2017.

Key actions to support targets:

Lead Department: DLG

- Appoint a Task Manager to oversee and manage the upgrading of WWTWs, as planned.
- Appoint a Specialist Team to train process controllers at Municipalities and assist with Task 2.
- Establish the number of industrial, Municipal and privately-owned WWTWs in the Berg River catchment that potentially impact on water quality.
- Develop risk abatement plans in all Municipalities that discharge directly or indirectly to the Berg River.
- Engage with all Municipalities on appropriate rectification/upgrading work, with the aim to reach Green Drop status at all WWTWs.
- Engage with privately-owned WWTWs on appropriate rectification/upgrading work, with the aim to reach Green Drop status. Link to the Stewardship Programme on Water (see Task 4).
- Train and accredit process controllers at all WWTWs that discharge directly or indirectly into the Berg River.
- Re-evaluate estimated costs for resultant projects and possible sources of funding.
- Fast-track the upgrading of the WWTWs.
- Identify and assess the potential of wastewater effluent re-use at all WWTWs, as part of the Municipality's WC/WDM plans.
- Develop a web-based early warning system that reports on spillages from WWTWs and pump stations (e.g. EMANTI).
- Track all cost estimates and possible grants on a dedicated Berg River database.
- Assess the annual Green Drop Status reports and address shortcomings by communicating with Municipalities and provide feedback into Task 1.
- Identify EPWP employment opportunities that link to the interventions and create opportunities for small businesses.
- Communicate progress made, as outlined in the Communication Strategy (Section 5.4).

2.3.3 Task 3: Upgrade Informal Settlements

Resource Condition Target (5-30 yrs)	<ul style="list-style-type: none"> ▪ Reduction in <i>E. coli</i> and waste loads to receiving waters, by 2042 (modelled annual load compared to current).
Resource Condition Target (Interim Target)	<ul style="list-style-type: none"> ▪ Reduction in <i>E. coli</i> and waste loads to receiving waters, by 2017 (modelled annual load compared to current).
Management Action Target	<ul style="list-style-type: none"> ▪ Langrug and Klein Mooiwater informal settlements are upgraded, by 2017. ▪ Paarl and Wellington informal settlements are upgraded, by 2020.

Key actions to support targets:

Lead Department: DHS

- Appoint a Task Manager to oversee and manage the upgrading of informal settlements, as planned.
- Appoint a Specialist Team to assist municipalities with the process and Task 3.
- Consult with the relevant municipalities and Departments to identify relevant solutions to address impacts of informal settlements on water quality.
- Upgrade the informal settlements in the Berg River catchment, with reference to the interventions as prioritised by the Department of Human Settlements, in its assessment of the informal settlements.
- Re-evaluate estimated costs and dates for resultant projects and possible sources of funding.
- Integrate discussions on the alignment of bulk services, planning and development with relevant Departments (e.g. Local Government, Environmental Affairs and Development Planning).
- Explore options to develop informal settlements that focus on reconfiguring the water, sanitation and energy systems are sustainable and promote resource-efficient consumption patterns (e.g. off-the-grid solutions).
- Include key stakeholders (e.g. Developers, Informal Settlement Network, Informal Housing Community Organisations / Steering Committees, I-Shack Living) in informal settlement upgrading at the planning phase.
- Greening of low cost housing and practices (e.g. cooking - Wonderbag, solar water heaters etc.)
- Prioritise "emergency projects" in the informal settlements that include the following:
 - temporary toilets, grid inlet upgrade; gulleys; river embankment cleaning; standpipes;
 - upgrade or add sewers, where required; install flow gauging weirs in main stormwater channels, where required; divert summer/low flow via canals to WWTWs or other receptacles.
- Identify "long term projects" in the informal settlements, inclusive of the following:
 - sustainable provision of basic water and sanitation services; treatment of stormwater prior to discharge to Berg River; upgrade of sewer pump stations, pipes and manholes.
- Identify available public land for future construction of diversion canals for low flows (e.g. an off-channel wetland / canal to WWTWs).
- Identify EPWP employment opportunities that link to the interventions and create opportunities for small businesses.
- Communicate progress made, as outlined in the Communication Strategy (Section 5.4).

2.3.4 Task 4: Advocate Best Practice in Agricultural, Industrial and Domestic Land-Use

Resource Condition Target (5-30 yrs)	<ul style="list-style-type: none"> ▪ Reduction in <i>E. coli</i>, suspended sediment and nutrient (dissolved inorganic nitrogen – DIN; phosphates) loads in receiving waters, by 2042 (modelled annual load compared to current).
Resource Condition Target (Interim Target)	<ul style="list-style-type: none"> ▪ Reduction in <i>E. coli</i>, suspended sediment and nutrient (dissolved inorganic nitrogen – DIN; phosphates) loads in receiving waters, by 2017 (modelled annual load compared to current). ▪ Water is used efficiently in the Berg River catchment, by 2017.
Management Action Target (5-30 yrs)	<ul style="list-style-type: none"> ▪ Stewardship Programme on Land-use rolled out successfully in the Berg River catchment, by 2042. ▪ All farmers adopted agricultural best practice to improve groundcover and riparian vegetation (to reduce agricultural runoff), by 2042.
Management Action Target (Interim Target)	<ul style="list-style-type: none"> ▪ Best practice in agricultural, industrial and domestic land-use advocated via a Stewardship Programme, by 2017. ▪ Farmers adopted agricultural best practice to improve groundcover and riparian vegetation (to reduce agricultural runoff), by 2017.
<p><i>Key actions to support targets:</i> <i>Lead Department: DoA</i></p> <ul style="list-style-type: none"> • Appoint a Task Manager to oversee and manage agricultural best practice advocacy. • Appoint a Specialist Team to assist with Task 4. • Advocate best practice as part of the Stewardship Programme in agricultural, industrial and domestic land-use in the Berg River catchment by: <ul style="list-style-type: none"> - Identifying key strategic goals and objectives for the Programme. - Encouraging best practice and resource use efficiency in industrial and domestic land-use, linked to the green economy. - Collating agricultural best practice into a guideline. - Encourage the agricultural industry to follow the best practice guideline on agricultural farming, including participation in platforms such as the Biodiversity and Wine Initiative, etc. - Ensuring that agricultural and industrial water is used as an economic advantage by ensuring that traders do not procure products from their suppliers that pollute or waste the Berg River's water. - Developing and implement advisory and support services that ensure farmers or industry understand what can be done to comply with water quality guidelines and agricultural and industrial best practices. - Providing incentives and extension programmes to accelerate the adoption of best practice agricultural, industrial and domestic land-use. - Benchmarking current agricultural, industrial and domestic land-use management practices and monitor adoption of such best practices (e.g. soil, irrigation and drainage management practices; water use efficiency, etc.) - Developing planning and extension tools and approaches to support improved nutrient and pesticide management for farmers (such as a six-easy-steps equivalent for pesticides etc.) - Measuring the effectiveness of the recommended land-use management practices in achieving water quality and quantity benefits in surface water and groundwater (link to Task 1). - Identifying key threats to the filtering capacity of catchment landscapes (riparian vegetation, farming systems) and implement additional actions to address these (e.g. protection of high quality riparian vegetation, management of stock access to riparian areas, etc.) • Investigate the feasibility for establishing integrated River Maintenance and 	

Management Plans (RMMP) for demarcated sections over the length of the Berg River system, with the aim to formalise the methodology, functioning and institutional alignment of stakeholders to enable and facilitate:

- Riparian landowners to conduct normal and recurring activities within setback lines to best management practises.
- The management and prevention of soil erosion through coordinated and accepted measures.
- The management of sedimentation and associated risks.
- The establishment of applicable NWA and NEMA General Authorisations for the area.
- The rehabilitation of riparian buffer zones and wetlands (link to Task 5).
- The enhancement of ecological status of the river (link to Task 1).
- Appoint and train officials to perform compliance and enforcement monitoring of agricultural land-use practices and wastewater discharge licenses.
- Identify EPWP employment opportunities that link to the interventions and create opportunities for small businesses.
- Communicate progress made, as outlined in the Communication Strategy (Section 5.4).

2.3.5 Task 5: Riparian Zone Rehabilitation and Management (Buffer Zone)

Resource Condition Target (5-30 yrs)	<ul style="list-style-type: none"> Reduction in <i>E. coli</i>, suspended sediment, nutrients (dissolved inorganic nitrogen – DIN) and pesticide loads to receiving waters, by 2042 (modelled annual load compared to current).
Resource Condition Target (Interim Target)	<ul style="list-style-type: none"> Reduction in <i>E. coli</i>, suspended sediment, nutrients (dissolved inorganic nitrogen – DIN) and pesticide loads to receiving waters, by 2017 (modelled annual load compared to current).
Management Action Target (5-30 yrs)	<ul style="list-style-type: none"> Riparian zone rehabilitation rolled out successfully, by 2042.
Management Action Target (Interim Target)	<ul style="list-style-type: none"> Riparian zone rehabilitation to improve groundcover and riparian vegetation (to reduce agricultural runoff), by 2017. Farmers adopt agricultural best practice to improve groundcover and riparian vegetation (to reduce agricultural runoff), by 2017.

Key actions to support targets:

Lead Department: DEADP

- Appoint a Task Manager to oversee and manage riparian zone rehabilitation.
- Appoint a Specialist Team to assist with Task 5.
- Identify and evaluate viable interventions/actions that focus on reducing the impacts of agricultural, industrial and domestic on the water quality and quantity of the Berg River.
- Identify degraded buffer and riparian zones where modification and/or re-vegetation can provide a cost effective action to remove pollutants and improve flow attenuation, and develop actions to facilitate this.
- Determine the intervention(s) to be implemented using, amongst others, the following criteria:
 - Explore options that include, but are not limited to, constructed wetlands, floating wetlands, compost berms and restoration of riparian vegetation.
 - Identify the National Freshwater Ecosystem Priority Areas and determine their status in the Berg River catchment.
 - Ensure that the intervention(s) fit with existing technological solutions (e.g. proximity to divert first 20mm of rain to existing infrastructure).
 - Establish if water licenses/environmental authorizations will be required in order to implement the interventions.
- Explore the opportunity of using RMMPs, as a vehicle for environmental authorisations, to recycle waste and alien vegetation management (e.g. charcoal production and composting).
- Establish links with the target community and farmers to determine the social dynamics (i.e. supportive or opposed to proposed intervention), if needed.
- Identify suitable sites for the intervention(s) to capture and treat polluted water that enter the Berg River, with the optimal beneficial impact on downstream users and National Freshwater Priority Areas.
- Identify EPWP employment opportunities that link to the interventions and create opportunities for small businesses.
- Communicate progress made, as outlined in the Communication Strategy (Section 5.4).

2.3.6 Task 6: Price Water Quality, Quantity and Ecosystem Services in the catchment

Resource Condition Target	<ul style="list-style-type: none"> ▪ Reduction in <i>E. coli</i>, suspended sediment, nutrients (dissolved inorganic nitrogen – DIN) and pesticide loads to receiving waters, by 2042 (modelled annual load compared to current).
Management Action Target	<ul style="list-style-type: none"> ▪ Reduction in the cost of pollution in the Berg River catchment. ▪ Increased GDP in the Berg River catchment.
<p><i>Key actions to support targets:</i> <i>Lead Department: DEDAT</i></p> <ul style="list-style-type: none"> • Appoint a Task Manager to oversee and manage riparian zone rehabilitation. • Appoint a Specialist Team to assist with Task 5. • Price water quality and quantity in the Berg River catchment as it relates to: <ul style="list-style-type: none"> - various scenarios (e.g. cost of pollution to the export market; business-as-usual; implementing the Improvement Plan – upgrading etc.) in terms of water quality impacts on crop production, domestic and recreational use. - upgrades to the informal settlements and WWTWs - best practices in agricultural, industrial and domestic land-use - improved water quality and quantity • Compare the cost of pollution / no action in the Berg River catchment vs. implementing the Improvement Plan. • Assess the socio-economic status of people in the Berg River catchment. • Assess the value of the export market, following key actions taken in Tasks 1 – 5 and various scenarios identified. • Assess GDP in the Berg River catchment. • Communicate progress made, as outlined in the Communication Strategy (Section 5.4). 	

2.4 Communication Strategy and Communication Platform

Communication is key to successfully implementing the Improvement Plan, and to ensure that relevant and appropriate messages are delivered to the public. Therefore, an effective Communication Strategy and Communication Platform will be developed that links all government Departments and key stakeholders. Therefore, a Communication Strategy must be developed that focuses on:

- Achieving alignment and pre-empting misinformation, and communicating material;
- Raising awareness on the key aspects of the Improvement Plan, and its progress in terms of implementation, in an appropriate format and media identified (i.e. multi-media platforms), while taking cognisance of export market sensitivities;
- Establishing partnerships between key and relevant stakeholders: DWA, Western Cape Government Departments, Irrigation Boards, District Municipalities, Local Municipalities, and Communities.
- Ensuring that Task 1 – 6 are integrated across Sector Departments and communicated in an integrated manner.
- Establishing a dedicated call centre/communication hub for the Berg River (e.g. sms, email, web-based).
- Establishing a platform for communicating the water quality results and progress on WWTWs upgrades, informal area upgrades and agricultural best practice, to key and relevant stakeholders Committee.

Appropriately skilled marketing, communication and community liaison capacity is required to develop and implement the Communication Strategy.

Experienced communication specialists are required to inform the general public and the various interested and affected parties of the proposed Improvement Plan.

2.5 Adopting of the Improvement Plan

The Improvement Plan will result in the following:

- Further the Western Cape Government's 110% Green initiative, as it relates to water and the green economy
- Increased collaboration between the three spheres of Government, industry, farmers and the community
- Upgrade of informal settlements and increased access to related water and sanitation services
- Upgrade of all WWTWs and achievement of Green Drop Status (both Municipal and privately-owned) at all WWTWs in the catchment
- Facilitate and assist farmers to develop agricultural best practices and target key stakeholders (e.g. Landcare groups, farmers) are interested in sustainable farming
- Increased job creation for the youth and unemployed in the region, linking to the Western Cape Government's 110% Green Initiative and the green economy
- Reduced risk of crop production loss and its associated export prospects
- Reduced risk of waterborne pathogens and related disease

2.6 Monitoring and Evaluating the Improvement Plan

A Monitoring and Evaluation System is integral to evaluating the success of implementing the Berg River Improvement Plan and its Water Stewardship Programme. The Improvement Plan is proposed to be updated every 5 years.

3. INSTITUTIONAL FRAMEWORK

3.1 Human Resources

A Project Manager must be appointed to over and manage all Task as identified in the Berg River Improvement Plan, to ensure its successful delivery.

A Specialist Team, consisting of the following, is proposed for each Task, as identified:

- 1 Task Manager
- 4 Team Members
- 1-2 Municipal officials from each Municipality (seconded)

People with low or limited skills and the youth are to be appointed in green jobs as part of the Extended Public Works Programme.

A service provider will be appointed to develop and drive the Communication Strategy and Communication Platform.

3.2 Partnerships

The DWA, Provincial Departments and Local Government has already completed and is currently implementing a range of successful initiatives in the Berg River catchment in collaboration with industry and farmers (e.g. Bergrivier Irrigation Board, Deciduous Fruit Industry, Remgro, etc.). This must be continued and strengthened, while new partnerships are required in terms making the Berg River catchment sustainable at all fronts. Partnerships with institutions such as I-Shack Living, Informal Settlement Network, CSIR, The Sustainability Institute, etc. need to be explored and formed where necessary in the Berg River catchment.

A formal Partnership, comprising of all three spheres of Government, industry, farmers, the respective communities and institutions, is proposed to monitor the progress of the Improvement Plan.

The Partnership must develop a Terms of Reference to work together and meet regularly, as required.

4. REFERENCES

Dallas HF and Day JA (2004). The effect of water quality variable on aquatic ecosystems: A Review. Water Research Commission Report No. TT224/04, ISBN No. 1-77005-131-7.

Dallas H (1992). Western Cape System Analysis. Berg River Invertebrate Study. Department of Water Affairs and Forestry, Report No. PG 000/00/1392.

Department of Human Settlements – DHS (2010). Provincial Government of the Western Cape. Municipal Informal Settlement Profile. Drakenstein.

Department of Water Affairs and Forestry – DWAF (1996a). South African Water Quality Guidelines (second edition). Volume 1: Domestic Use. Pretoria, South Africa.

Department of Water Affairs and Forestry – DWAF (1996b). South African Water Quality Guidelines (second edition), Volume 2: Recreational Use. Pretoria, South Africa.

Department of Water Affairs and Forestry - DWAF (1996c). South African Water Quality Guidelines (second edition), Volume 3: Industrial Use. Pretoria, South Africa.

Department of Water Affairs and Forestry - DWAF (1996d). South African Water Quality Guidelines (second edition). Volume 4: Agricultural Use: Irrigation. Pretoria, South Africa.

Department of Water Affairs and Forestry – DWAF (1996e). South African Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering. Pretoria, South Africa.

Department of Water Affairs and Forestry – DWAF (1996f). South African Water Quality Guidelines (second edition). Volume 6: Agricultural Water Use: Aquaculture. Pretoria, South Africa.

Department of Water Affairs and Forestry - DWAF (1996g). South African Water Quality Guidelines. (second edition) Volume 7: Aquatic Ecosystems. Pretoria, South Africa.

Department of Water Affairs and Forestry - DWAF (1996h). South African Water Quality Guidelines (first edition). Volume 8: Field Guide. Pretoria, South Africa.

Department of Water Affairs and Forestry - DWAF (2002). National Microbial Monitoring Programme for Surface Water. Implementation Manual. Pretoria, South Africa.

Department of Water Affairs – DWAF (2004). General Authorizations in terms of section 39 of the National Water Act, 1998 (Act No. 36 of 1998) published in Gazette No. 26187, Government Notice No 399, 2004. Pretoria, South Africa.

Department of Water Affairs and Forestry - DWAF (2007a). Berg River Baseline Monitoring Programme. Final Report – Volume 5: Synthesis. Pretoria, South Africa.

Department of Water Affairs and Forestry - DWAF (2007b). Proposal for the Establishment of the Berg Catchment Management Agency. Pretoria, South Africa.

Department of Water Affairs and Forestry – DWAF (2008). River Management Strategy for the Berg Water Management Area of the Western Cape: Scoping Report. DWAF Project No. 2006-462.

Department of Water Affairs - DWA (2012). Memorandum of Agreement between Department of Water Affairs and Casidra. Pretoria, South Africa.

Department of Water Affairs – DWA (2012). Green Drop Progress Report. Pretoria, South Africa.

Erasmus E and Silberbauer M (2012). Resource Quality Services. Department of Water Affairs, Hydrological Water Quality Data Base. Personal Communication.

Faasen N and Titus G (2012). West Coast District Municipality. Personal Communication.

Fillipi M (2011). Lyners Consulting Engineers and Project Managers, Drakenstein Municipality, Interventions and Actions taken by Drakenstein Municipality to Reduce Pollution on the Berg River from Informal and High Density Areas. Personal Communication.

Fourie JM and Görgens AHM (1977). Mineralization studies of the Berg River (1974 – 1976). Report, National Institute for Water Research, CSIR, to the Provincial Administration of the Cape of Good Hope. CSIR Research Report No. 334.

Louw DB (2005). Possible impact of water pollution in the Berg River irrigation region for the Upper Berg River Irrigation Board. Department of Agricultural Economics, University of Free State and Director of Optimal Agricultural Business Systems. Report No. KM24.

Paulse C (2012). Drakenstein Local Municipality. Personal Communication.

Phillips A, Brito N, Allie H, Mlangeni M, Marinus T and Prinsloo P (2012). Western Cape Provincial Treasury, Current Impacts and Future Implications of the Berg River Pollution on some West Coast and Cape Winelands Municipalities.

Rowntree KM and Wadeson RA (1999). A hierarchical geomorphological model for the classification of selected South African Rivers. Water Research Commission Report No. 497/1/99. ISBN No. 1 86845 527 0.

Snaddon CD and Davies BR (2000). An assessment of the ecological effects of the Inter-Basin Water Transfer Schemes (IBT) in dryland environments. Water Research Commission Report No. 665/1/100, ISBN No. 186845 584 X.

South African Bureau of Standards Division. South African National Standard – SANS 241: 2006 (2006). Drinking Water: Application of SANS 241: 2006.

Visser A (2012). Bergriver Irrigation Board. Personal Communication.

