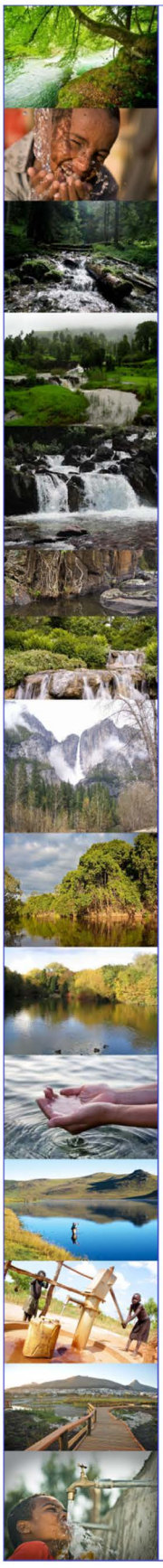

SIP 19: Ecological Infrastructure for Water Security

An overview of a proposed Strategic Integrated Project (SIP) aimed at improving South Africa's water resources and other environmental goods and services through the conservation, protection, restoration, rehabilitation and/or maintenance of key ecological infrastructure

Minister's Approved Draft for Submission to the Presidential Infrastructure Coordinating Commission

Revision 6.1, Friday 31 October 2014

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EXECUTIVE SUMMARY

The Strategic Integrated Project known as SIP 19: Ecological Infrastructure for Water Security is the proposed second water-related SIP and provides a framework for the integration of a number of impactful water-related ecological infrastructure investments and interventions into a coordinated, coherent and focussed project specifically aimed at improving South Africa's water resource quality and quantity. Thus, the purpose of SIP 19 is to make a significant contribution to the overall goal of ensuring a sustainable supply of fresh, healthy water to equitably meet South Africa's social, economic and environmental water needs for current and future generations through the integrated implementation of projects within identified priority water catchments.

Although, the concept of ecological infrastructure is not very well known in traditional infrastructure sectors, the essential life-supporting and life-enhancing ecosystem goods and services that are generated by this infrastructure are universally experienced (e.g. nutrient dispersal and cycling; seed dispersal; food (e.g. seafood, fresh-water fish and game); crops; wild foods; spices; water; minerals; medicinal plants; pharmaceuticals; bio-chemicals; industrial products; energy (hydropower, biomass fuels); carbon sequestration and climate regulation; waste decomposition and detoxification; purification of water and air; crop pollination; pest and disease control; cultural, intellectual and spiritual inspiration; recreational experiences (including ecotourism) and scientific discovery).

Thus, as infrastructure is often broadly defined as the substructure or underlying foundation on which the continuance or growth of a community or state depends, similarly, ecological infrastructure is the networks of natural lands, working landscapes and other open spaces that are the substructure or underlying foundation on which the continuance or growth of ecosystem goods and services depends.

As a water-poor country where water is an acknowledged challenge in respect to the country's growth and development, in line with the National Water Resource Strategy, SIP 19 compliments SIP 18 in addressing this challenge. As illustrated in Figure 1, SIP 19's "upstream" interventions add value, utility and cost-effective benefits to water quantity and quality in general, and to SIP 18 in particular.

As with the majority of other SIPs, SIP 19's geographical focussing into priority areas is based on a detailed mapping exercise that considered water-related threats and vulnerability, levels of service delivery and poverty and potential alignment with other SIPs. This exercise resulted in the following SIP 19 priority areas being identified: (I) Quaternary catchment/s associated with the Orange-Vaal-Thukela and/or uMngeni-Mooi-Thukela Strategic Water Source Areas; (II) Olifants-Doring-Berg and/or Berg-Breede; (III) Langeberg-Gouritz and/or Gouritz and/or Kromme-Gouritz and/or Gamtoos-Gouritz and/or Tsitsikamma; (IV) Vaal-Thukela-Phongola and/or Inkomati-Phongola-Usutu and/or Crocodile-Olifants; and (V) Quaternary catchment/s associated with the remaining Strategic Water Source Areas including: Letaba-Olifants and/or Luvubu-Mutale and/or Mfolozi-Phongola and/or Zululand Coast and/or Great Kei-Great Fish and/or Mzimvubu-Orange and/or Pondoland Coast.

As summarised in Table 1, SIP 19 components comprise well defined ecological infrastructure interventions that are broadly grouped into specific intervention focus areas or categories. The current components of SIP 19 comprise over 140 short-, medium- and long-term

projects/interventions implementing over 360 activities valued at over R2 billion. There are over 88 national and provincial government departments, municipalities, state-owned enterprises, non-governmental and community-based organisations, private sector entities and international partners directly involved in the implementation of the various SIP 19 components.

In terms of the standard desired positive impacts associated with the SIP approach, SIP 19 is likely to have significant positive impacts in respect of job creation, addressing spatial imbalances, promoting rural development, the economic performance of the poorest provinces, greening the economy and regional integration.

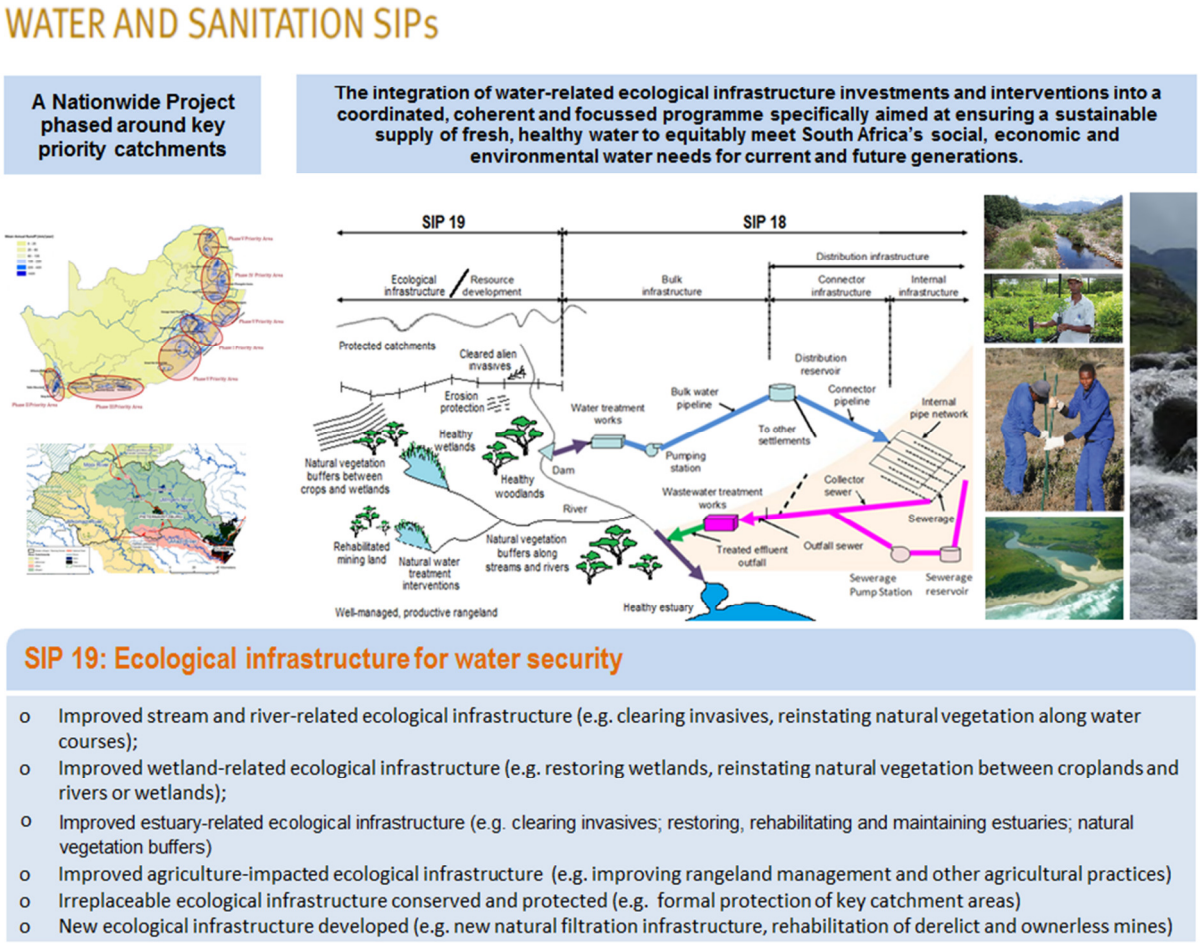

Figure 1: SIP 19 at a glance

In terms of governance and management, the SIP 19 Inter-Governmental Forum (IGF) will be chaired by the Minister of Water and Environmental Affairs. The IGF will coordinate and align across all spheres of government and different government departments. The South African National Biodiversity Institute (SANBI) will be the SIP 19 Coordinator responsible for the technical coordination of the implementation of the SIP under the guidance of the IGF and reporting regularly to the IGF, Presidential Infrastructure Coordinating Committee (PICC) Secretariat and PICC Manco. Finally, the SIP 19 Steering Committee that guides all phases of the implementation of SIP 19 will comprise representatives of all key SIP 19 stakeholders.

As with all the other SIPs, and as the fundamental justification for why the project described in this document should be a SIP, is the fact that, although the various SIP 19 components are all

going projects at various stages of development and implementation, their positive impacts can be substantially increased, fast-tracked, replicated, duplicated and generally made more immediately impactful through efficient and effective integration. This integration includes the key general SIP focus of governance integration (e.g. aligned, coordinated, coherent and consistent authorisation processes) as well as the integration of traditional sector-based initiatives (e.g. land management, conservation, human settlements, rural development, town planning, eco-tourism, agriculture, water, mining, etc.).

Table 1: Summary of SIP 19 Components/Projects per Priority Area

SIP 19 Intervention		SIP 19 Priority Area					Total
		I	II	III	IV	V	
A.	**Improved stream and river-related ecological infrastructure –**	**26**	**29**	**28**	**17**	**42**	**142**
A.1	Clearing invasive alien plant infestations, especially in mountain catchments and riparian areas	20	25	23	13	32	113
A.2	The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation along streams and rivers	6	4	5	4	10	29
B.	**Improved wetland-related ecological infrastructure –**	**13**	**9**	**8**	**11**	**18**	**59**
B.1	The restoration, rehabilitation and/or maintenance of wetlands	6	5	5	7	8	31
B.2	The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation between agricultural crops and rivers or wetlands	7	4	3	4	10	28
C.	**Improved estuary-related ecological infrastructure –**	**6**	**0**	**0**	**0**	**3**	**9**
C.1	Clearing invasive alien plant infestations	2	0	0	0	1	3
C.2	The restoration, rehabilitation and/or maintenance of estuaries	2	0	0	0	1	3
C.3	The reinstatement, restoration, rehabilitation, establishment and/or maintenance of buffers of natural vegetation along estuaries	2	0	0	0	1	3
D.	**Improved agriculture-impacted ecological infrastructure –**	**14**	**6**	**5**	**6**	**11**	**42**
D.1	The improvement in rangeland management practices (e.g. grazing regime and improved fire management)	8	3	3	3	6	23
D.2	The improvement of agricultural practices (e.g. improved tillage, contour ploughing, organic agriculture, etc.)	6	3	2	3	5	19
E.	**The conservation and protection of irreplaceable ecological infrastructure –**	**26**	**12**	**9**	**12**	**19**	**78**
E.1	The formal protection of key catchment areas as part of the expansion of South Africa's conservation estate	10	4	3	5	6	28
E.2	The reinstatement, restoration, rehabilitation and/or maintenance of grass- and wood-lands, especially in upper-catchment areas	8	4	2	4	10	28
E.3	Clearing invasive alien plant infestations in protected catchment areas	8	4	4	3	3	22
F.	**The reinstatement and/or development of new ecological infrastructure –**	**2**	**2**	**0**	**3**	**3**	**10**
F.1	The establishment of natural filtration infrastructure, i.e. built wetlands, to purify various small sources of polluted inflows into streams and rivers (e.g. acid mine drainage (AMD) from old mining works, livestock farms, waste dumps, etc.)	2	2	0	2	2	8
F.2	The rehabilitation of land affected by derelict and ownerless mines	0	0	0	1	1	2
G.	**Ecological infrastructure for water security research and development**	**6**	**4**	**1**	**3**	**6**	**20**
Totals		**93**	**62**	**51**	**52**	**102**	**360**

1. BACKGROUND

Government has adopted an Infrastructure Plan that is intended to transform the economic landscape of South Africa, create a significant numbers of new jobs, strengthen the delivery of basic services to the people of South Africa and support the integration of African economies.

To this end, Cabinet established a body to integrate and coordinate the long term infrastructure build, namely the Presidential Infrastructure Coordinating Commission (PICC), along with its various supporting management structures.

The PICC assessed South Africa's infrastructure gaps through a spatial mapping exercise which analysed future population growth, projected economic growth and areas of the country which are not served with water, electricity, roads, sanitation and communication. Based on this work, a number of Strategic Integrated Projects (SIPs) were developed and approved to support economic development and address service delivery in the poorest provinces.

Each SIP comprises of a large number of specific infrastructure components and programmes.

In formulating the National Infrastructure Plan, the New Growth Path (NGP) was taken as a starting point. In this regard, although the NGP sets a goal of 5 million new jobs by 2020, it also identifies structural problems in the economy that need to be overcome and also points to opportunities in specific sectors and markets (the so-called "jobs drivers").

Significantly, infrastructure is identified in the NGP as the 1st jobs driver by laying the basis for higher growth, inclusivity and job creation. However, it was also recognised that the pace of infrastructure development and spending on infrastructure was projected to fall from 9,1% of GDP in 2012 to 8,1% in 2013.

With this, there was also the recognition that there were various infrastructure development blockages including weak implementation capacity in parts of the state (with unspent monies) and poor project development planning. The fact that projects are not always strategic, integrated or aligned with national priorities was also acknowledged as was poor coordination that slowed projects and limited their impact.

In response, the PICC is supposed to address these challenges through coordination, integration and accelerated implementation. A single common Infrastructure Plan was developed that is being monitored and centrally driven. The PICC has identified who is responsible for implementing the various

Figure 2: Summary of the Terms of Reference of the Presidential Infrastructure Coordinating Commission (PICC)

components of the plan and will hold them to account. The plan provides a twenty-year planning framework which takes it beyond one administration to avoid stop-start patterns.

The PICC's mandate is to ensure the systematic selection, planning and monitoring of large projects and its Terms of Reference are summarised as follows (see Figure 2) –

- Identify 5 year priorities
- Develop a 20 year project pipeline
- Development Objectives: skills, localisation, empowerment, research & development
- Expand maintenance: new and existing infrastructure
- Improve infrastructure links: rural areas and poorest provinces
- Address capacity constraints and improve coordination and integration
- Scale up investment in infrastructure
- Address impact of prices
- Support African development and integration

In this regard, infrastructure is regarded as being critical to:

- Promoting balanced economic development
- Unlocking economic opportunities
- Promoting mineral extraction and beneficiation
- Addressing socio-economic needs
- Promoting job creation
- Helping to integrate human settlements and economic development

An Infrastructure Book has been compiled, which contains more than 645 infrastructure projects across the country and the Infrastructure Plan with identified Strategic Integrated Projects (SIPs) has been developed and adopted by Cabinet and the PICC.

As noted above, in order to inform the plan, the PICC undertook a "mapping exercise" to identify infrastructure gaps, population movement and economic performance and placed these in a spatial framework in order to develop the required Strategic Integrated Projects.

20 mapping exercises were performed that set out the key 'corridors' of infrastructure development and provided an overview of the SIPs.

The current list of SIPS include –

- SIP 1: Unlocking the northern mineral belt with Waterberg as the catalyst
- SIP 2: Durban-Free State-Gauteng logistics and industrial corridor
- SIP 3: South-Eastern node & corridor development
- SIP 4: Unlocking the economic opportunities in North West Province
- SIP 5: Saldanha-Northern Cape development corridor
- SIP 6: Integrated municipal infrastructure project
- SIP 7: Integrated urban space and public transport programme
- SIP 8: Green energy in support of the South African economy
- SIP 9: Electricity generation to support socioeconomic Development

- SIP 10: Electricity transmission and distribution for all
- SIP 11: Agri-logistics and rural Infrastructure
- SIP 12: Revitalisation of public hospitals and other health facilities
- SIP 13: National school build programme
- SIP 14: Higher education infrastructure
- SIP 15: Expanding access to communication Technology
- SIP 16: SKA & Meerkat
- SIP 17: Regional integration for African cooperation and development
- SIP 18: Water and sanitation infrastructure

2. INTRODUCTION

Sip 19, the Ecological Infrastructure for Water Security SIP, is a proposed Strategic Integrated Project aimed at improving South Africa's water resources and other environmental goods and services through the conservation, protection, restoration, rehabilitation and/or maintenance of key ecological infrastructure.

Water is a critical strategic natural resource[1]. It is essential for growth and development, the environment, as well as the health and well-being of the people of South Africa. Although this principle is generally accepted, it is not always well understood or appreciated. Despite the fact that South Africa is a naturally water stressed country, further challenged by the need to support growth and development as well as potential climate change impacts, the resource is not receiving the priority status and attention it deserves. This situation is reflected in the manner by which this scarce resource is wasted (more than 37% water losses), polluted, degraded, inadequately financed and inappropriately strategically positioned. Paradoxically South Africa has a fairly well developed water management and infrastructure framework which has resulted in a perceived sense of water security (particularly in urban and growth areas), as well as a lack of appreciation and respect for a critical strategic resource.

South Africa is facing a number of water challenges and concerns, including security of supply, environmental degradation and resource pollution. The sustainability of our fresh water resources has reached a critical point and its associated management is now at a crossroads. It is now of paramount importance that the status of South Africa's water is elevated to the core of the public agenda and that advanced management practices are applied and implemented to address an increasingly complex business. It is also becoming increasingly recognised that water crises are not only about water, but are interconnected with other social, political, economic and environmental factors. More integrated and sophisticated approaches are therefore required than simply concentrating on supply-side solutions, as has frequently been the case historically in water sectors across the world.

[1] This section is taken from the Executive Statement in the 2012 National Water Resource Strategy to ensure full and unambiguous alignment between this strategy and SIP 19.

3. ECOLOGICAL INFRASTRUCTURE

Infrastructure is often broadly defined as the substructure or underlying foundation on which the continuance or growth of a community or state depends. Similarly, ecological infrastructure is the networks of natural lands, working landscapes and other open spaces that are the substructure or underlying foundation on which the continuance or growth of essential life-supporting and life-enhancing ecosystem goods and services depends.

Ecological infrastructure refers to naturally functioning ecosystems that deliver valuable services to people, such as fresh water, climate regulation, soil formation and disaster risk reduction. It is the nature-based equivalent of built or hard infrastructure, and may be just as important for providing services and underpinning socio-economic development. Ecological infrastructure includes, for instance, healthy mountain catchments, rivers, wetlands, coastal dunes, and nodes and corridors of natural habitat, which together form a network of interconnected structural elements in the landscape.

3.1 Ecosystem services

Ecosystem services include:

- ***Supporting services*** like nutrient dispersal and cycling, seed dispersal and primary production;
- ***Provisioning services*** like food (e.g. seafood, fresh-water fish and game), crops, wild foods, spices, water, minerals (including diatomite), medicinal plants, pharmaceuticals, bio-chemicals, industrial products, energy (hydropower, biomass fuels);
- ***Regulating services*** like carbon sequestration and climate regulation, waste decomposition and detoxification, purification of water and air, crop pollination, pest and disease control; and
- ***Cultural services*** like cultural, intellectual and spiritual inspiration, recreational experiences (including ecotourism) and scientific discovery.

Globally, it is estimated that ecological infrastructure underpins the delivery of ecosystem services worth between US$21-72 trillion a year as compared to the 2008 World Gross National Income of US$58 trillion.

3.2 Watershed services

With respect to SIP 19, the focus is specifically on the ecological infrastructure that underpins water-related ecosystem services commonly known as watershed services.

In essence, the sound ecological infrastructure that underpins healthy watersheds does much the same work as a water treatment plant and other built water quality infrastructure, but without the expensive equipment and associated operating costs and with added benefits like protection of wildlife habitats and carbon sequestration.

Watershed-related ecological infrastructure can filter out water pollution, regulate stream flows, recharge aquifers, and absorb flooding. These benefits are collectively known as "watershed services," and society can't do without them[2].

[2] See more at: http://www.watershedconnect.com/pages/primer#sthash.yRPHOWB7.dpuf

Watershed services provided by, for example, mountain grasslands, fynbos, indigenous forest and woodland ecological infrastructure, include –

- ***Water Quality***: Intact natural vegetation such as healthy grasslands, fynbos, woodlands and forests act as natural filters and can provide high water quality supplies that have low levels of both nutrients and chemicals.
- ***Flow Regulation***: Healthy natural vegetation cover helps regulate surface and groundwater flow, providing a natural buffer to flooding and landslides often linked to heavily degraded land.
- ***Water Supply***: Healthy natural vegetation acts as a regulator of water during both dry and wet seasons, leading to an increase in minimum flows during the dry seasons.
- ***Aquatic Productivity***: The quality of fisheries is closely linked to the conditions of adjacent upstream watersheds

Because these are effectively "free services", we tend to take these benefits for granted. Indeed, few, if any, water authorities or utilities list watersheds as assets anywhere on their books, and landowners aren't rewarded for good management practices that result in downstream users receiving clean, ample water.

Fortunately this is beginning to change. Leaders and communities around the world are moving to recognise the ways in which we depend on natural systems and how we need to incorporate those values into our economic decisions.

Watershed-related ecological infrastructure investments aimed at improving and/or maintaining watershed services put this concept into action through interventions that have the potential to produce a range of benefits, including:

- lengthening the lifespan of existing built infrastructure, thereby reducing or delaying the need for additional built infrastructure – often with significant cost savings;
- buffering human settlements and built infrastructure against extreme events like floods and drought, thus playing a crucial and cost effective role in disaster risk reduction;
- creating new employment opportunities for the maintenance and rehabilitation of ecological infrastructure, which usually entails labour-intensive activities;
- supporting rural development by diversifying rural livelihood options, on one hand through direct job creation (since key elements of ecological infrastructure are located in rural areas), and on the other by strengthening economic sectors such as sustainable farming and ecotourism; and
- providing opportunities for adapting to the negative impacts of climate change.

This approach is thus also a powerful tool for funding conservation and is often more cost-effective than traditional large engineering solutions to water problems, and can provide new revenue streams to rural and often poor communities in resource-rich areas around the world.

4. PROBLEM ANALYSIS

4.1 Water and water security[3]

South Africa has low levels of rainfall relative to the world average with high variability as well as high levels of evaporation due to the hot climate, and increasing challenges from water pollution. All of these pose constraints on the amount and quality of water available for use.

Although the regulatory framework and the institutional arrangements have changed since the advent of democracy, one aspect remains constant: water scarcity – whether quantitative, qualitative or both – which originates as much from inefficient use and poor management as from real physical limits. South Africa is the 30th driest country in the world and has less water per person than countries widely considered to be much drier, such as Namibia and Botswana.

Water run-off is highly variable and unevenly spread in space and time. High variability of water flow is the norm, and the base flow varies from very low to zero. At present, there is a well-developed infrastructure, with more than 4 395 registered dams in South Africa, of which 2 528 are water supply related. However, in many parts of the country we have either reached or are fast approaching the point at which all of our financially viable freshwater resources are fully utilised.

Despite the good infrastructure, the occurrence of floods and droughts are part of the "normal" water cycle and water restrictions and flood management are a critical part of the water business. And despite the good infrastructure, the poor and marginalised experience water scarcity most intensely, particularly in under-developed rural areas and areas such as the former homelands.

In many parts of the country, we are fast approaching the point at which all of our easily accessible freshwater resources are fully utilised. All South Africans must recognise this situation so that necessary steps are taken to assess current and future demands for water. In this regard it must be acknowledged that, although restoring and maintaining intact watersheds may not solve all the water demand challenges it does make a significant contribution to securing a sustainable supply of clean water. Watershed services can be seen as the upper end of the water value chain that includes watersheds, storage schemes, distribution, purification, reticulation and sanitation (treatment of return flows).

Although dealing with our current water predicament will not be an easy task, with the necessary resolve to plan and implement the required interventions, a secure water future can be achieved.

It is important to recognise, however, that there are very different experiences of water scarcity for different groups in South Africa. In particular, water scarcity is experienced on a daily basis by the rural poor, many of whom still do not have access to potable water supply, and who also do not have access to reliable water supply for productive purposes. These communities are also the most vulnerable to droughts and floods. When dealing with water scarcity, therefore, the plight of those who experience water scarcity most intensely must take priority. It is also these communities who are often directly reliant on ecological infrastructure for goods and

[3] Based on, or extracted from the 2012 National Water Resource Strategy, Chapter 2, Section 2.3 – Facts about South African Water.

services, for example by drawing their drinking water directly from rivers, and tend to be most immediately and severely affected when ecosystems become degraded.

The present water supply situation has created a false sense of water security within the privileged sectors of South African society. Marginalised and poor communities have, on the other hand, always experienced high levels of water insecurity.

It must be noted that, as at 2012, South Africa has had 16 consecutive years of above average rainfall in the majority of summer rainfall areas and in these areas the last major drought was more than two decades ago. This trend is unlikely to continue. Other areas such as the Western Cape and parts of the Eastern Cape suffered from drought. The potential for drought in other areas and the impacts of climate change place a particular imperative on the effective management of water resources.

4.1.1 Water quantity

The South African water situation is characterised by highly variable rainfall, erratic runoff, high levels of evaporation due to high temperatures and shallow dam basins as well as sedimentation problems and large-scale inter-basin water transfers.

South Africa's first National Water Resource Strategy (NWRS-1) in 2004 showed that the majority of the water management areas (WMA) have water deficits (i.e. the water requirements exceed availability with current infrastructure) despite significant transfers from other catchments. Only a few selected WMAs such as parts of the Eastern Cape had surplus water. There were, already, concerns that more WMAs would have fresh water deficits by the year 2025.

There are a number of options for reconciling water requirements and availability, which are dealt with in the technical strategies detailed in the 2012 National Water Resource Strategy (NWRS-2), including improved water use efficiency, development of new infrastructure, re-use and recycling, desalination, and the removal of water hungry alien invasive plants.

However, although the removal of alien invasive plants is an extremely important ecological infrastructure intervention, it is only one of many such interventions that can have a positive impact on both water quantity and quality. For example, recent studies and anecdotal evidence have shown that desertification has significant negative impacts on utilizable water. For one it increases high flows as a result of water not infiltrating the soil which leads to faster runoff and increased flooding. This leads to reduced dry season flows which are critical for, especially, rural communities. If streams dry up during the dry season alternative options for access to water must be created which, more often than not, means additional infrastructure. It is however not only dry season flows that are being negatively impacted upon but also existing water storage infrastructure. The same studies have shown that the rates of sedimentation are exponentially higher in degraded catchments than intact catchments.

4.1.2 Surface water

For the purpose of water planning, the Department of Water Affairs and Sanitation (DWAS) plans with 'available water' and uses a 98% assurance of supply. This means that water can be abstracted at the determined 'yield', 98 out of 100 years on average. There is about 10 000 million cubic metres per year available with this level of assurance. In most areas where there are water deficits or where the system is considered 'in balance', the probability is that water

shortages are experienced more than 2 out of 100 years. Water shortages have become part of life in South Africa.

Approximately 25% of the mean annual runoff (MAR) of 49 000 million cubic meters per annum needs to remain in the rivers and estuaries to support the ecological functioning of the catchments, depending on the specific river systems. In many water management areas the ecological portion of the Reserve is not yet fully implemented.

Most of the economically available yield from surface water resources over large parts of the country has been fully developed and utilised. More than two thirds of the country's MAR is already stored in dams. Where additional water is still available, such as in the uThukela, Mzimvubu and Pongola basins, it is located in relatively remote areas far from existing centres of demand. Opportunities for economically viable new dams are few and far between, and the costs of transfer of water per cubic metre to locations where water is needed are also rising with longer distances.

Surface water from dams and direct abstraction from rivers, accounted for 9 500 million cubic metres per annum, with a significant volume of the surface water yield (3 000 million cubic metres per annum) moved via inter-basin transfers to areas in the country where requirements exceed supply. An example is the Lesotho Highlands Water Scheme which supplies water to Gauteng through transfers from Katse and Mohale Dams in Lesotho to the Vaal WMA.

Many dams and associated water resources infrastructure were built more than 40 years ago. While the main structures may have an extremely long life, spillways, gates, pumps, pipelines and canals and associated infrastructure, need regular maintenance and occasional major rehabilitation to extend the lifespan of these assets for which funding is required.

There are also considerable backlogs in the rehabilitation of water infrastructure owned by the municipalities.

4.1.3 Groundwater

Groundwater is a significant resource in many parts of the country although local yields are usually quite low. The most recent estimate of sustainable potential yield of groundwater resources at high assurance is 7 500 million cubic metres per annum, while current groundwater use is estimated at around 2 000 million cubic metres per annum. Allowing for an underestimation on groundwater use, potentially about 3 500 million cubic metres per annum is available for further development. This resource is, however, sparsely distributed and often not readily available at points of demand. This is exacerbated by the levels of knowledge and information on the groundwater resource.

Some of the most favourable areas/aquifers regarding groundwater availability include: the Dolomites of the West and Far West Rand; Table Mountain Group Aquifers of the Western and Eastern Cape; Coastal sand aquifers in the Western and Eastern Cape, and northern KwaZulu-Natal. Other high yielding aquifers include basement granites in the Polokwane-Dendron-Coetzerdam area, alluvial deposits along sections of major rivers such as the Limpopo, and parts of the Karoo Sequence associated with dolerite dykes and ring structures.

4.1.4 Water resource quality

There are significant water quality challenges in South Africa. The main contributors to water quality problems are mining (acidity and increased metals content); urban development

(salinity, nutrients, microbiological); industries (chemicals, toxins); and agriculture (sediment, nutrients, agro-chemicals, salinity through irrigation return flows). Rural communities in parts of the country that are dependent on ground water are negatively affected because of the natural mineral content exceeding recommended levels. Untreated or poorly treated waste water is severely affecting the quality of water in many areas.

Water resource quality and water quantity issues and solutions are interrelated and need to be addressed in an integrated manner. Although it is technically possible to treat water of poor quality to a potable standard, this can be very costly and usually results in concentration of hazardous waste requiring containment. Water of bad quality also impacts negatively on farming, recreation, ecosystems and the economy. One single intervention will never address all water quality challenges. By arguing that more and more water purification plants need to be built is not only unaffordable but also impractical. Water purification infrastructure can to some extent address point source pollution but will never be able to deal with non-point source pollution. To deal with the latter, land use practices need to change and wetland and riparian zones need to be restored in order to improve the quality of return flows into our river systems. This can be seen as the contribution that investments in watershed services can make at the lower end of the water value chain.

4.1.5 Shared water resources

South Africa shares four major river systems with six neighbouring states (Zimbabwe, Botswana, Mozambique, Swaziland, Lesotho and Namibia). Trans-boundary institutional structures for all of the shared basins are in place to deal with water matters and international agreements on water sharing are in place in two of these river basins, namely the Inkomati and Maputo basins, in line with the Revised SADC Protocol on Shared Watercourses. These shared river basins raise the importance of water in the regional integration agenda in SADC.

South Africa's policy and legislation recognises international obligations in allocation protocol.

4.1.6 Are we facing a water crisis?

The NWRS-2 notes that there are, in principle, two answers to the question of whether South Africa is facing a water crisis or not. In terms of "crisis" being defined as a disaster, a catastrophe, or an emergency, there is no immediate water crisis. However, in terms of "crisis" meaning a situation having a negative impact on economic, political, societal or environmental goals, there is a potential crisis.

In terms of water resource availability, there is no crisis. There are theoretically sufficient water resources available to meet our demands, especially if we include the sea.

The challenge and risk lies in:

- the water resource choice, its location and the associated cost, technology and effort to develop it;
- the ability to ensure timeous access to these resources;
- the ability to ensure functionality and sustainability of the water delivery systems;
- the ability to secure life cycle financing, from planning to implementation, to operations & maintenance;
- the viability of schemes and associated services in terms of sector related affordability;

- the ability to protect the water resource in terms of quality and habitat for sustained use and re-use;
- the spatial context within the physical, economic and hydrological environment; and,
- The potential skill shortage as well as the capacity and ability to manage the various water challenges.

In the short- to medium-term, a potential water crisis will not be the result of water resources *per se*, but rather due to a lack of appropriate institutional arrangements, skills and capacity, financing and financial management, effective water management and poor governance. In selected areas the reality of water resource challenges, the present economic climate as well as potential climate variation, will dictate the possibility of water crisis.

This notwithstanding, the following provides a quick reality check on the likelihood, or otherwise, of a water crisis in the short- to medium-term –

- Poor functionality of existing water supply infrastructure and inadequate management thereof due to a lack of investment in and focus on operation and maintenance, is a current reality;
- Fresh water deficits already occur in the majority of water management areas, and water allocation challenges are a reality;
- All existing water reconciliation studies, with associated development proposals, are based on the principle (and assumption) that water conservation and demand management (WCDM) will effectively be implemented. Failing to implement WCDM will result in local and regional water crises. This is already a reality in the Western Cape, the KwaZulu-Natal metropolitan area and the Upper-Vaal system;
- Deteriorating water quality with associated socio-economic impacts is already evident in key river catchments such as the Vaal River, Crocodile River and Upper-Olifants River. This situation, together with the failure to address poor wastewater treatment, mine water pollution and poor land use management effectively, is already a major risk area;
- Although the investment framework for new infrastructure development is well advanced, a delay in its timeous implementation will result in potential water crises. With present funding levels less than 50% of what is required, delays of some projects are imminent;
- Societal and political expectations from intended economic development and job creation programmes, which depend on water availability, may not be realized. In many cases, water may not be readily available due to high development costs, with associated implications.

4.2 The impact of climate change on South Africa's water[4]

Government's Long-Term Adaptation Scenario Research Flagship Programme (LTAS) aims to respond to the South African National Climate Change Response White Paper (NCCRP, paragraph 8.8) by developing national and sub-national adaptation scenarios for South Africa under plausible future climate conditions and development pathways. This is a complex task which requires the projection of climate change impacts for key sectors and an evaluation of their socio-economic implications, in the context of development needs and aspirations of these

[4] The following section is an edited extract from the draft Summary for Policy-Makers of government's Long-Term Adaptation Scenarios (LTAS), Phase I, dated 06/08/2013.

sectors. This process is being followed in two major phases to build a sub-national and national 'scenarioscape' within which adaptation to climate change will occur.

During its first phase which was concluded in June 2013, summarized here, the LTAS process developed a consensus view of climate change trends and projections, summarized key impacts and identified potential response options in so-called primary sectors as defined by the NCCRP and stakeholders, namely water, agriculture and forestry, human health, marine fisheries, and biodiversity.

4.2.1 Climate Trends and Scenarios for South Africa

The LTAS climate scenario technical work determined the range of potential future climatic conditions that plausibly could occur in South Africa over three time frames (2015 – 2030, 2040 – 2060, and 2080 – 2100). Climate scenarios were developed in response to two emissions pathways – an unconstrained emissions pathway and a constrained (also referred to as mitigated) emissions pathway. Observed climate trends (1960 – 2012) were analysed and related to modelled trends for the same period in order to assess the possible strengths and weaknesses of modelled projections.

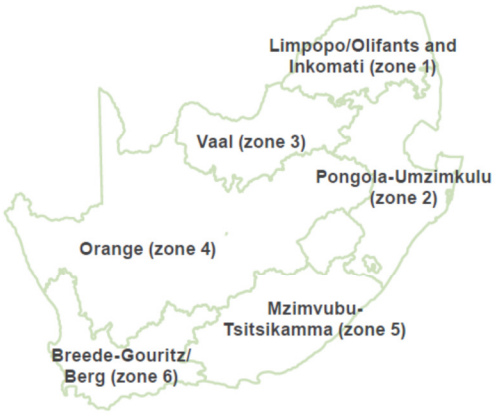

Figure 3: LTAS aims to provide national and sub-national adaptation scenarios for South Africa under future climates. At sub-national level the LTAS process covers the six hydrological zones in South Africa developed for use by the National Water Adaptation Strategy process.

Observed Climate Trends for South Africa (1960-2012)

Over the last five decades the following climate trends have been observed in South Africa.

- Mean annual temperatures have increased by approximately double the observed global average of 0.7°C reported by the *4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).*
- Mean and maximum temperatures have been increasing less strongly, and some decreases in minimum temperatures have been observed in the central interior.
- There have been significant overall increases in hot extremes and decreases in cold extremes particularly in the western and northern interior of the country.
- Rainfall seasonality has shifted and rainfall intensity has increased.
- In almost all hydrological zones there has been a reduction in rainfall for the autumn months. Annual rainfall has not changed significantly, but, an overall reduction in the number of rainy days implies an increase in the intensity of rainfall events and increased dry spell duration.

Strengths and weaknesses of modelled projections (1960-2012)

Modelled climate data were compared with observed climate trends (1960 – 2010) to explore how well climate models have simulated observed trends. Findings suggest that some key climatic processes relevant for South Africa are not yet adequately represented by either or both the General Circulation Models or the downscaling methods currently in use.

- Observed temperature trends are more closely matched by modelled simulations than are rainfall trends.
- Observed trends since 2000 have not increased as steeply as projected by model simulations.
- The observed reductions in autumn rainfall are not reproduced by the models, and the models tend to show opposite trends.
- In spring, where observed trends are weak, models show a tendency for reduced rainfall projections in all hydrological zones.

Projected rainfall and temperature changes for South Africa (to 2050 and beyond)

Climate projections were simulated over southern Africa using both statistical and dynamic downscaling of various future energy pathways modelled by the Intergovernmental Panel on Climate Change (IPCC) and models such as those developed by the Massachusetts Institute of Technology (MIT) Integrated Global System Model.

From this work, climate change projections for South Africa up to 2050 and beyond under unmitigated emission scenarios include:

- All modelling approaches project warming trends until the end of this century, but most approaches project the possibility of both drying and wetting trends in almost all parts of South Africa.
- Very significant warming, as high as 5–8°C, over the South African interior by the end of this century. Warming would be somewhat reduced over coastal zones.
- A general pattern of a risk of drier conditions to the west and south of the country and a risk of wetter conditions over the east of the country.
- Many of the projected changes are within the range of historical natural variability, and uncertainty in the projections is high.
- Effective global mitigation action is projected to reduce the risk of extreme warming trends, and to reduce the likelihood of extreme wetting and drying outcomes by at least mid-century.
- High resolution regional modelling suggests even larger benefits of effective global mitigation by the end of this century, when regional warming of 5–8°C could be more than halved to 2.5–3°C.
- Overall, there is far greater certainty in temperature than in rainfall projections.

Projected climate futures for South Africa (2015–2035, 2040–2060 and 2070–2090)

Four broad climate scenarios could usefully represent plausible climate outcomes over the coming century given the two main groups of emissions scenarios namely unmitigated (unconstrained) and mitigated (constrained) future energy pathways.

South Africa's climate future from 2025 and beyond can be described using four broad climate scenarios at national scale, with different degrees of change and likelihood that capture the results of global mitigation action and the passing of time:

- 1. ***warmer (<3°C above 1961–2000) and wetter***, with greater frequency of extreme rainfall events.

- 2. ***warmer (<3°C above 1961–2000) and drier***, with an increase in the frequency of drought events and somewhat greater frequency of extreme rainfall events.
- 3. ***hotter (>3°C above 1961–2000) and wetter***, with substantially greater frequency of extreme rainfall events.
- 4. ***hotter (>3°C above 1961–2000) and drier***, with a substantial increase in the frequency of drought events and greater frequency of extreme rainfall events.

The effect of strong international mitigation responses would be to reduce the likelihood of scenarios 3 (hotter/wetter) and 4 (hotter/drier), and increase the likelihood of scenarios 1 (warmer/wetter) and 2 (warmer/drier) during the course of this century. These scenarios can be further elaborated in terms of rainfall projections at sub-national level for the six hydrological zones as shown in Table 2 below.

Table 2: Climate Change scenario impact on rainfall projections for each of the six hydrological zones considered in the LTAS

Scenario	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
	Limpopo / Olifants / Inkomati	Pongol-Umzimkulu	Vaal	Orange	Mzimvubu-Tsitsikamma	Breede-Gouritz / Berg
1 – warmer /wetter	Increased spring and summer	Increased spring	Increased spring and summer	Increased in all seasons	Increased in all seasons	Reduced autumn, increased winter and spring
2 – warmer /drier	Reduced summer, spring and autumn	Reduced spring and strongly reduced summer and autumn	Reduced summer and spring and strongly reduced autumn	Reduced summer, autumn and spring	Reduced all seasons, strongly in summer and autumn	Reduced all seasons, strongly in the west
3 – hotter /wetter	Strongly increased spring and summer	Strongly increased spring	Increased spring and summer	Increased in all seasons	Strongly increased in all seasons	Reduced autumn, increased winter and spring
4 – hotter /drier	Strongly reduced summer, spring and autumn	Reduced spring and strongly reduced summer and autumn	Reduced summer and spring and strongly reduced autumn	Reduced summer, autumn and spring	Reduced all seasons, strongly in summer and autumn	Reduced all seasons, strongly in the west

4.2.2 Implications for the Water Sector

Climate change impacts

- Climate change impacts on South Africa are likely to be felt primarily via effects on water resources. Projected impacts are due to changes in rainfall and evaporation rate, but hydrological modelling approaches are essential for translating these into potential water resource impacts.
- Preliminary projections for national runoff range from a 20% reduction to a 60% increase by as early as mid-century based on an unmitigated emissions pathway. Across the country, this ranges from increases along the eastern seaboard and central interior to decreases in much of the Western and Northern Cape. If global emissions are constrained to stabilise at

450 ppm CO_2, these changes are projected to lie between a 5% decrease and a 20% increase in annual runoff.

- Under all four future climate scenarios, a higher frequency of flooding and drought extremes is projected, with the range of extremes exacerbated significantly under the unconstrained global emissions scenario. Under a wetter future climate scenario, significant increases in runoff would result in increased flooding, human health risks, ecosystem disturbance and aesthetic impacts. Drier future climate scenarios would result in reduced surface water availability, but would not exclude the risk of extreme flooding events.
- Areas showing highest risks in extreme runoff related events (and flooding conditions) include KwaZulu-Natal, parts of southern Mpumalanga and the Eastern Cape. Specific areas at risk to increased evaporation, decreased rainfall and decreased runoff include the south-west and western regions, and to some extent the central region and the extreme north-east.

Adaptation Responses and Research Requirements

- Because of the critical importance of water in the South African economy, the country has a sophisticated water resources technical and planning capacity which has been founded on a good understanding of the rainfall variability. This capacity is a key capability for adaptation planning going forward.
- At present, specific provisions for climate change adaptation have been made in very few of the water resources planning tools. There are some early attempts that have simulated simple scenarios of changed surface water supply in reconciliation studies.
- Development aspirations in South Africa will likely be influenced by opportunities and constraints that arise from climate change impacts on the water sector. Key decisions would benefit from considering the implications of a range of possible climate-water futures facing South Africa. This is because the current modelling of future climate is uncertain with respect to rainfall variability and seasonality change, but more certain with regard to warming projections.
- A scenario-based approach is therefore a viable way forward with respect to exploring adaptation options for the water sector. Given the substantial uncertainty over rainfall scenarios neither drier nor wetter scenarios can be excluded.
- Under a wetter future scenario, trade-offs in water allocation between sectors are likely to be less restrictive, providing greater scope for urban-industrial economic growth and water provision for an intensive agricultural production model.
- Under a drier future scenario, significant trade-offs are likely to occur between developmental aspirations, particularly in terms of the allocation between agricultural and urban/industrial water use, linked to the marginal costs of enhancing water supply. These constraints are most likely to be experienced in central, northern and south-western parts of South Africa, with significant social, economic and ecological consequences through restricting the range of viable national development pathways.
- Adaptation response strategies for the water sector could be usefully identified at distinct governance levels. At national scale the development of a strategic intent and an enabling framework for adaptation would help to ensure a coherent national response. At sub-national or system scale key institutions could usefully engage in prioritising and allocating resources to interventions that take cognisance of adaptation imperatives. At sub-catchment

or municipal scale the design of local implementation actions would be facilitated by responding to local challenges, resources and capacities.

- The following priority functions would be beneficial to the Department of Water Affairs and Sanitation (own emphasis):
  - policy review for enabling flexible frameworks;
  - flexible and robust infrastructure planning;
  - resources directed at maintaining critical ecological infrastructure in vulnerable systems;
  - institutional oversight to ensure water related institutions build adaptive management capacity;
  - effective information management and maintenance of monitoring and evaluation systems; and
  - sustainable and locally accessible financial management.

- Research and focused monitoring would be valuable for:
  - supporting the development of tools, approaches and case studies of the way in which water planning may consider long-term climate change;
  - understanding the way in which climate driven changes in water resources availability or demand may constrain or enable different development pathways in different parts of South Africa, particularly for agricultural production and energy generation; and
  - exploring the implications of long-term hydrological change on the ecological reserve (including the appropriate definition of the reserve) and associated issues of catchment management approaches that are needed to maintain the ecological reserves in different systems so that it continues to provide clean water and other ecosystem services to society.

4.3 The destruction and/or degradation of ecological infrastructure

As mentioned above, although ecological infrastructure underpins the delivery of life-giving ecological services, our global stocks of natural capital, including our ecological infrastructure, is being drastically depleted and is in urgent need of restoration.

In 2010, nearly two-thirds of the globe's ecosystems were considered degraded as a result of damage, mismanagement and a failure to invest and reinvest in their productivity, health and sustainability.

In this regard, water-related ecosystems are of particular importance to water-poor South Africa and, thus, water ecosystems are regarded as a priority performance area by the Department of Water Affairs and Sanitation. This indivisibility of water is a cornerstone of the National Water Policy, to the extent that water ecosystems are not seen as users of water in competition with other users, but as the base from which the resource is derived, without which, growth and development cannot be sustainable. This is legislated in the National Water Act through Resource Directed Measures, which include the Ecological Reserve, Water Resource Classification and Resource Quality Objectives.

South Africa's ecosystems range from sub-tropical in the north-eastern part of the country, to semi-arid and arid in the interior, to the cool and temperate rivers of the fynbos. This diversity is a result of a geologically and climatically complex country, giving rise to a diverse range of ecosystems. Keeping an adequate number of these river and wetland ecosystems in a good

condition (so-called A or B ecological category) helps to support the ecological functioning of catchments and the sustainable development of water resources.

The recent National Biodiversity Assessment 2011[5] identified 223 river ecosystem types that are representative of the diversity of rivers in South Africa, based on soil, geology, vegetation, climate, flow and the slope of the river channel. In addition, 792 wetland ecosystem types were identified in a similar manner to describe wetland diversity across the country.

Consistent with global trends, this assessment found that freshwater ecosystems in South Africa are highly threatened, much more so than terrestrial ecosystems. Almost 60% of river ecosystem types are threatened, with 25% of these critically endangered. Wetland ecosystem types are of even more concern with 65% identified as threatened, including a staggering 48% critically endangered. This is of enormous concern given the crucial role of wetlands in delivering ecosystem services such as water purification, flood regulation and drought mitigation.

High levels of threat are also documented for freshwater fauna: 31% of freshwater fish indigenous to South Africa are threatened, and a recent southern African study on the conservation status of major freshwater-dependent taxonomic groups (fishes, molluscs, dragonflies, crabs and vascular plants) reported far higher levels of threat in South Africa than in the rest of the region.

South Africa's system of protected areas shows significant gaps in conserving freshwater ecosystems, and less than 15% of the river ecosystems assessed can be considered moderately- to well-represented within protected areas. Moreover, inclusion in protected areas does not guarantee conservation: almost half of the large river systems that are incorporated into protected areas have been degraded by upstream human activities before entering the protected area. Despite these deficiencies in protection levels, rivers inside protected areas are in better condition compared to those outside, emphasizing the positive role protected areas can have through appropriate land management strategies.

[5] Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. and Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs. Pretoria

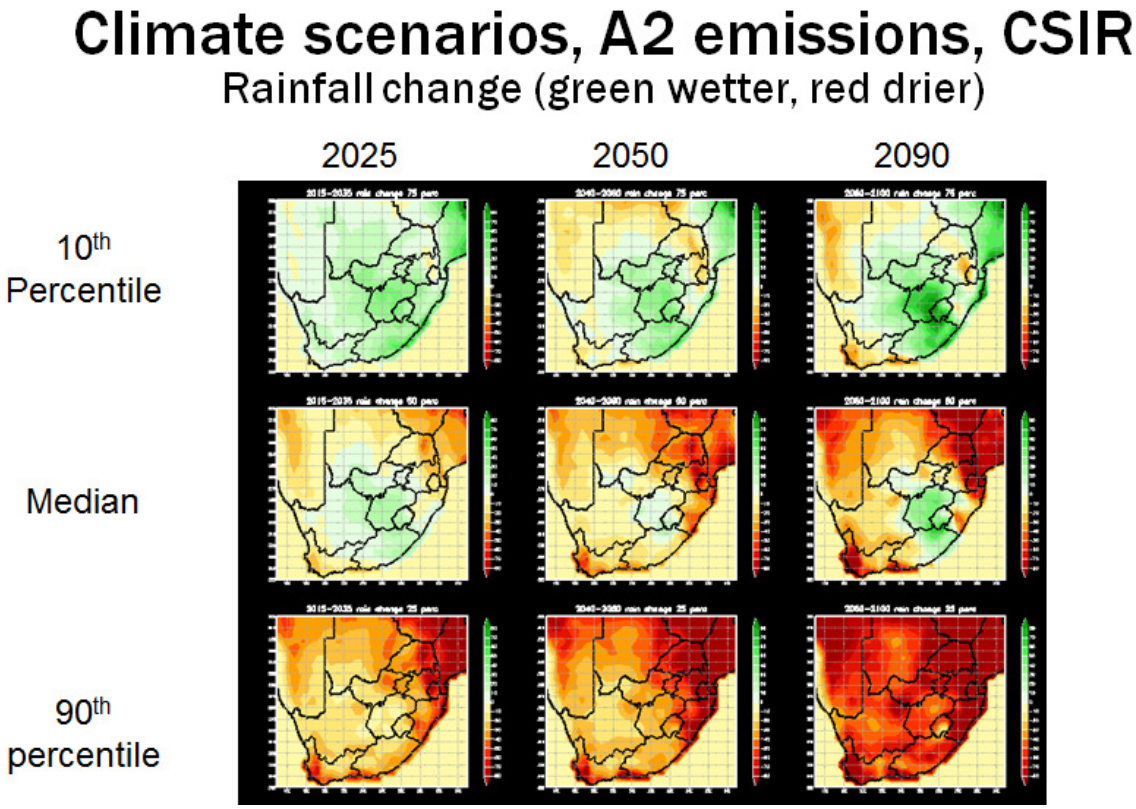

Figure 4: Recent rainfall modelling results should current levels of greenhouse gas emissions persist

Key pressures on freshwater ecosystems are expected to be exacerbated by climate change and include:

- Over-abstraction of water especially in the dry months of the year (this is exacerbated by invasive alien plants and desertification);
- Water quality problems (associated with non-point-source pollution from fertilizers, as well as point-source pollution from mining and failed waste water treatment works);
- Habitat destruction, especially from bulldozing in riparian zones, sand-winning from river beds, mining development, urbanisation and agricultural cultivation;
- Of particular concern is the impact of development on water generating capability (e.g. river sources) and its associated impacts on water availability, groundwater recharge and down-stream water quality;
- Development in estuarine functional zone; and,
- Impacts of invasive alien fish species.

Urgent attention is needed to ensure that we conserve adequate quantities of the different ecosystems that make up the natural heritage of this country. A strategic approach to freshwater ecosystem conservation and management is needed to focus efforts where they will have the greatest impact. To this end, Freshwater Ecosystem Priority Areas ("FEPAs") have been identified across South Africa, providing strategic spatial priorities for conserving South Africa's freshwater ecosystems and associated biodiversity. These products represent the biodiversity sector's input into water resource protection, specifically targeting Resource-

Directed Measures tools (Water Resource Classification, Reserve Determination and setting and monitoring of Resource Quality Objectives).

Climate change scenarios predict that the south western and eastern parts of the country will become drier and the central parts marginally wetter (see Figure 4). Climate change and assumed economic growth will increase the pressure on water resources, especially for water-intensive activities such as mining and power generation.

The limits on water are likely to be a major constraint on future economic growth.

Figure 5 provides a simplified graphical representation of the various cause and effect relationships contributing to the destruction and/or degradation of water-related ecological infrastructure in the form of a "Problem Tree".

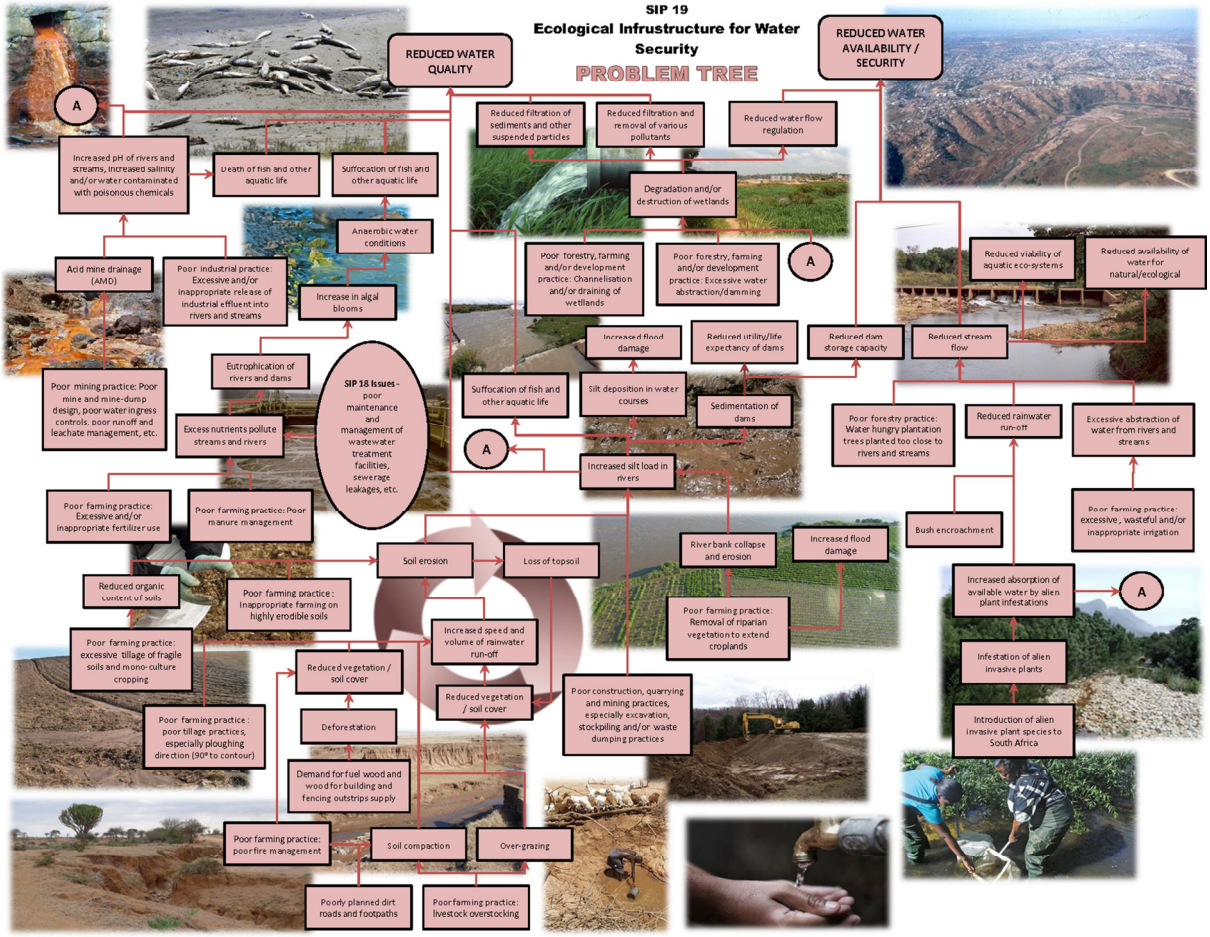

Figure 5: The SIP 19 Problem Tree - the problem cause and effect relationships that SIP 19 is designed to address to some degree.

4.3.1 Soil Erosion

As can be seen from the SIP 19 Problem Tree (see extract provided in Figure 6), soil erosion is a direct form of water-related ecological infrastructure destruction and/or degradation that results in both negative water quality and quantity impacts. Soil erosion does not only lead to the loss of top soil and the productive potential of land but silts up water supply infrastructure reducing its yield and economic lifespan, as well as increasing the costs of both maintaining this infrastructure and purifying water for human use.

Poor Farming Practice

The following poor farming practices contribute to soil erosion –

- ***Livestock overstocking*** – exceeding the land's livestock carrying capacity leads to overgrazing and the compaction of the soil. Both of these effects then result in reduced vegetation or soil cover which results in the increased speed and volume of rainwater run-off. This, in turn, erodes the soil.
- ***Poorly planned roads and footpaths*** – the construction and use of roads and paths that do not take account of storm-water flow (e.g. follow a line that is at right-angles to steep slopes), often results in soil compaction as well as the increased speed and volume of rainwater run-off. This, in turn, erodes the soil.
- ***Poor fire management*** – having too frequent veld fire or having veld fires during the wrong season combined with unsustainable grazing regimes leads to the compaction of the soil and reduced vegetation or soil cover which results in the increased speed and volume of rainwater run-off. This, in turn, erodes the soil.
- ***Exhausting the soil*** – excessive tillage of fragile soils, tillage of highly erodible soils and continuous mono-culture cropping without crop rotation reduces the organic content of soils which make them more erodible. This again results in the increased speed and volume of rainwater run-off. This, in turn, erodes the soil.

Demand for natural products exceeding supply

In relatively dense, often poor, rural communities, the demand for "free" natural fuel, building and fencing materials in the form of indigenous wood from natural woodlands often exceeds the supply of these resources. This leads to deforestation which may result in reduced vegetation or soil cover which results in the increased speed and volume of rainwater run-off. This, in turn, erodes the soil.

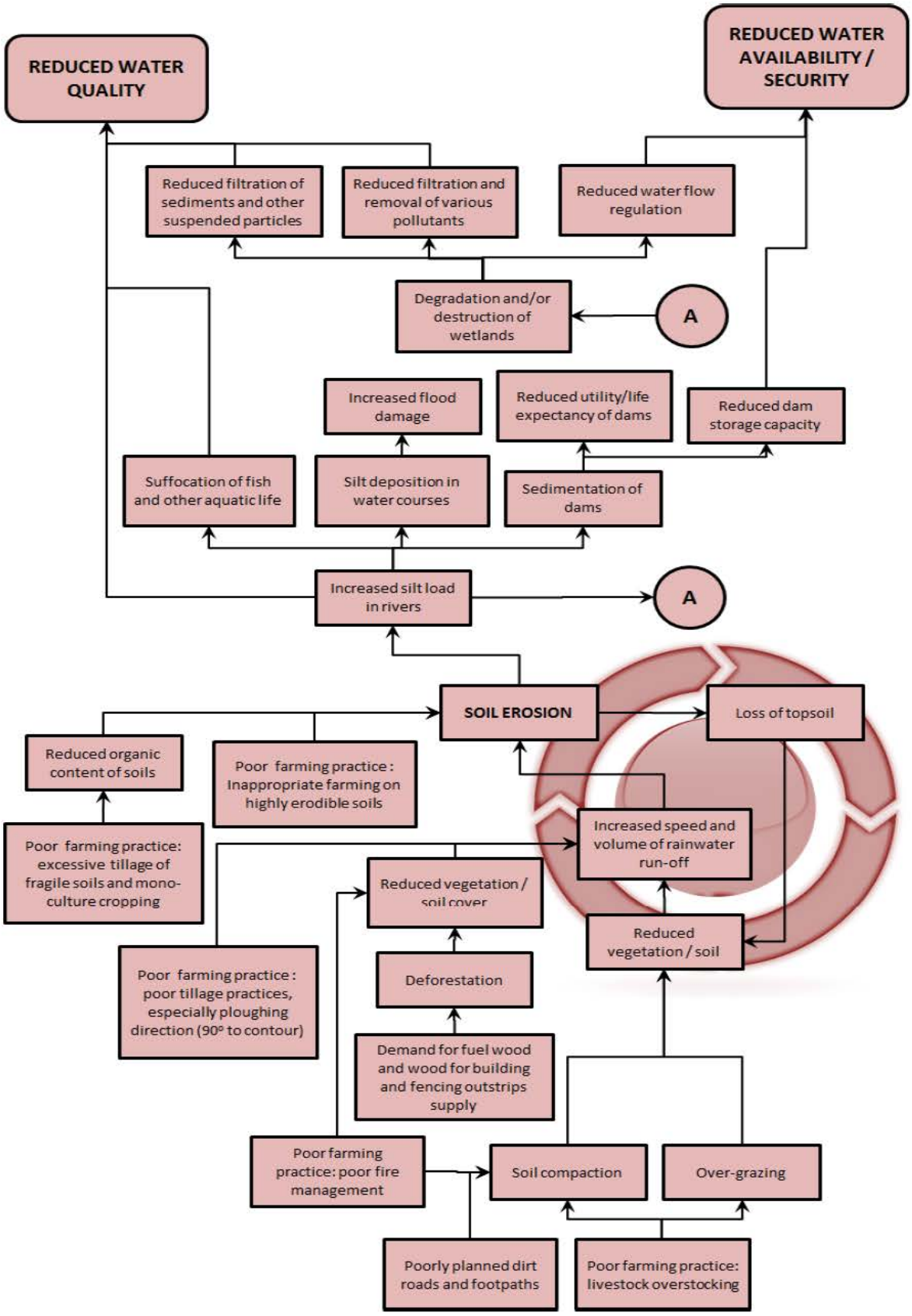

Figure 6: Simplified Problem Tree in respect of soil erosion

Gully-erosion – the vicious cycle

As illustrated in Figure 6, once soil erosion reaches a stage when all the available topsoil is washed away, no plants can grow in the eroded area and so a vicious cycle of erosion starts that gouges deep gulleys into the landscape making the land completely unproductive.

Impact on Water

Apart from severely reducing the productivity of the affected land, soil erosion increases the silt load in rainwater run-off, streams and rivers. This silt clogs up and suffocates wetlands, leads to the sedimentation of dams and water courses, damages hydropower clean energy generation facilities and suffocates fish and other aquatic life. These impacts then have the knock-on effects of wetland degradation and destruction (see 4.3.3), increased flood damage reduced dam utility, storage capacity and life expectancy. The extra silt directly impacts water quality, which in turn results in higher costs in treating the water to the required standard for human consumption. Ultimately these costs are passed on to consumers. The abrasive effect of water-borne silt also reduces the lifespan of components such as valves, pumps and turbines, thereby increasing maintenance costs. These impacts on dams thus directly affect water availability and water security. In 2010, the average cost to create one cubic meter of storage space was in the order of R20. If allowed to silt up, it will cost a further R8 per cubic meter to dredge this clogged up storage space.

4.3.2 Invasive Alien Plant Infestations

There is a strong relationship between invasive alien infestations and reduced aquatic ecosystem integrity and hydrological yield, including:

- Reduction in mean annual runoff and particularly dry season low flows;
- Reduction in utilisable yield from dams;
- Alteration of the key hydrological cues that define the nature of stream biota;
- Increases in catchment sediment supply, through the effects of “hot fires” and bank erosion;
- Reach- and biome-specific alteration in geomorphological processes, with resulting effects on channel geometry and in-stream habitat quality;
- Reduction in riparian and wetland plant and invertebrate (for example dragon flies) biodiversity, through competitive displacement, shading and changes in fire regime;
- Changes in the supply and timing of food sources, water chemistry and fire regime in aquatic ecosystems; and
- Threats to aquatic fauna and biodiversity through the combined effects of the above on the extent, distribution and quality of micro- and macro-habitats comprising freshwater ecosystems.
- Increase in the intensity of fires and exacerbation of environmental damage due to increased fuel loads.

4.3.3 Wetlands

Wetlands (vleis, bogs, swamps, sponges and/or marshes) are vital ecosystems, which have been described as some of the most productive ecosystems in the world. Apart from wetlands providing habitat for a variety of plant and animal species, wetlands are important elements of ecological infrastructure that provide key watershed services including the moderation of water flow and the regulation of water quality. They may act as sponges during wet periods, thereby

attenuating the destructive energy of floodwaters and maintaining streamflow during dry periods. They slow down the flow of water, causing suspended matter (e.g. silt) to settle out or to be absorbed by wetland plants. The ability of wetlands to transform, sequester or remove certain pollutants, especially nutrients originating from sewage or fertiliser, heavy metals and sediment, is well known, to the extent that constructed wetlands that mimic these natural processes are increasingly being employed as passive water treatment systems. Wetland plants are specifically adapted to flourish in areas of higher than average concentrations of certain elements.

Despite providing these benefits, wetlands were identified by the 2011 National Biodiversity Assessment as the most threatened ecosystem type in South Africa. Although no systematic national survey of wetland loss has been undertaken, studies in several major catchments have revealed that between 35% and 60% of the wetlands, and the benefits they provide, have been lost or severely degraded. It is likely that the extent of wetland loss for the country as a whole lies within this range.

Threats to wetlands include human activities, such as channelization, drainage, crop production, effluent disposal and water abstraction. Loss of wetlands leads to a reduction or loss in biodiversity, as the plants and animals that are adapted to wetland habitats are often unable to adapt to new environmental conditions, or to move to more suitable ones. Loss of harvestable resources also occurs when wetlands are lost. For example reeds and grasses are important materials in traditional construction, and reduction in these resources creates a dependence on other materials such as wood, plastics, and metals, which have negative environmental impacts. Loss of water quality and flow regulation is a further consequence of loss of wetlands, and may result in greater extent or severity of flooding. Consequences of wetland loss thus include reduced food security, desertification, lost livelihoods, diminished water security, increased vulnerability to floods and droughts and reduction in biodiversity. It is also important not to overlook the connection between poverty and environmental degradation – poverty is a consequence as well as a driver of environmental degradation.

The national wetland inventory maintained by SANBI has to date mapped in excess of 100,000 wetlands that together cover 2,9 million hectares, or 2,4% of South Africa's surface area. The vast majority of these are found outside formal protected areas. The National Biodiversity Assessment found that Only 11% of wetland ecosystem types are well protected, with 71% not protected at all, reflecting the fact that wetlands have not been systematically taken into account in establishing and expanding land-based protected areas.

South Africa currently has 21 wetlands designated as Wetlands of International Importance in accordance with the Ramsar Convention.

5. STRATEGY ANALYSIS[6]

Water planners have recognized the importance of preserving key watershed[7] lands for some time. For example, when the United States Congress formally authorised the creation of national forests in their Organic Administration Act of 1897, although they naturally hoped that national forests would provide a "continuous supply of timber for the use and necessities" of the nation, their first purpose envisaged for national forests was "securing favourable conditions of water flows." When U.S. cities began to import water in the 19th and early 20th centuries, they frequently, and for good reason, chose areas that were protected from logging and other forms of development (e.g. San Francisco's choice of the Hetch Hetchy Valley in Yosemite National Park as the site of its major water reservoir) or took active steps to protect the land (e.g. creating the Adirondacks "forever wild" preserve in New York).

Watershed preservation remains of importance today to both water quantity and water quality. On the water quantity front, watershed preservation can help ensure a steadier, and thus more readily captured and stored, supply of water in surface waterways. Conversely, watershed degradation can increase sedimentation that in turn can reduce the storage capacity of existing surface reservoirs.

Recent years have seen growing interest in the importance of watershed preservation for water quality. When land in the vicinity of a surface waterway is developed, the uses to which the land is put frequently add contaminants to the waterway. Non-point pollution, in the form of runoff from agriculture, livestock operations, construction sites, mines, parking lots, roads, and other uses, as well as

Kenya, Uganda and Tanzania's Ecological Infrastructure Investments for Water Security

For the last couple of years Kenyan flower growers along the shore of Lake Naivasha have been paying upstream farmers in the hills 40 kilometres away to adopt sustainable agriculture practices aimed at improving water quality and quantity to the lake. This investment in ecological infrastructure for watershed services is not only improving the quality of the lake and the livelihoods of the flower growers, but is also helping farmers lift themselves out of poverty (see *www.ecosystemmarketplace.com.)*

Figure 7: Excavation of terraces in Tanzania

In Tanzania's Mfizigo River sub-catchment, the industrial water supply and sewerage corporation (DAWASCO) and Coca Cola have entered into a deal with the farmers of the Lukenge, Kibungo, Lanzi, Dimilo and Nyingwa villages in which the farmers receive payment for the adoption of agricultural practices aimed at controlling runoff and soil erosion, while improving their crop production.

Figure 8: Beans being grown on Fanya juu terraces

A combined approach is being implemented that includes structural interventions (bench terraces and, so-called fanya juu terraces), ecological infrastructure interventions (e.g. reforestation, agroforestry and grass strips) and agronomic measures (intercropping crops with fruit trees, mulching and fertilising with animal manure) to limit runoff, combat soil erosion and increase soil moisture and productivity (see *Weadapt.org/the equitable payments-for-watershed-service-epws)*.

In Uganda, a brewer is paying for the protection of wetlands to retain their valuable capacity to maintain a steady and abundant supply of clean water. A similar project is in development in Zambia, funded in part by the SABMiller subsidiary Zambian Breweries PLC.

[6] The following section is taken from a paper by Barton H. Thompson, Jr. of the Stanford Law School entitled "Watersheds, Natural Capital, and Water" presented at the 2003 John M. Olin Conference on Watershed Management.

[7] It should be noted that in South Africa the term 'catchment' is used in preference to the term 'watershed' which is used in the US.

the leaching of waste from septic tanks, landfill sites and pit latrines often present significant threats to our surface waterways.

Undeveloped land, moreover, frequently helps to reduce contamination. Both wetlands and soils filter out nutrients and other contamination from runoff before the runoff reaches the main course of a waterway. Vegetation slows down runoff, permitting solid pollutants to settle out, and stabilizes soil, thus reducing contamination from siltation. Land preservation thus performs a double duty in protecting surface water quality: it eliminates a major source of contamination, while also protecting the waterway from those non-point sources of contamination that do exist.

5.1 Natural Capital Versus Technological Investments

There are technological fixes to the various problems that result from watershed degradation. If sedimentation reduces surface storage capacity, for example, government can dredge the reservoir, raise the dam wall, or turn to other water sources like groundwater or the desalination of seawater. If groundwater recharge drops, water users can mine the aquifer by pumping to ever greater depths or again seek out alternative water supplies. If watershed degradation leads to water contamination, water suppliers can filter the water.

Yet these technological fixes often prove to be inferior in many respects to the "natural services" that intact watersheds provide –

- ***Limitations*** - Firstly, the technological fixes often do not solve the entire problem. Filtration systems, for example, do not treat all contaminants.
- ***Cost*** - Secondly, technological solutions typically are often very expensive both in terms of capital costs and running costs. Based on the experience of a number of U.S. cities, it is estimated that every dollar used to protect existing watersheds can save anywhere from $7.50 to $200 in water treatment costs. Dredging, dam expansion, and water importation are all similarly costly.
- ***Environmental impact*** - Thirdly, technological fixes frequently raise serious environmental concerns. Groundwater mining will not only ultimately exhaust the resource, but in the interim can lead to subsidence, desertification, salt water intrusion, spreading contaminant plumes, and biodiversity loss. Dam expansion can lead to further land loss and stream modification, while new water imports bring all of the traditional environmental problems of water supply projects.
- ***Limited co-benefits*** - Finally, watershed preservation can provide a variety of positive externalities such as biodiversity protection, open space, and even carbon sequestration.

In summary, natural capital (in the form of watershed services) and technological investments (in filtration facilities and other engineering solutions) are substitutes and, despite their ascendancy in the 20th century, technological investments in many cases are not always the most efficient and effective means of providing water supply and quality.

5.2 Case Study: New York City and the Catskills

In recent years, a number of ecologists and economists have touted New York City's efforts to preserve the Catskills watershed, one of three major basins from which the city obtains its water supply, as a key example of the benefits of effective watershed management.

The first settlers on the island of Manhattan in the early 17th century drew their drinking water from private wells. For the next three centuries, the City's water supply system grew from a series of simple local reservoirs to complex aqueducts systems that carried water to the City from several kilometres away. At the turn of the 20th century, faced with growing demands for reliable water, the city's Board of Water Supply decided to look to watersheds in upstate New York to supplement existing water supplies. Construction on an increasing number of reservoirs and aqueducts continued until the 1960's. Gradually, the upstate system of reservoirs and aqueducts became the primary source of drinking water for one of the largest cities in the world.

Today, the New York City (NYC) water supply system is still largely derived from surface water north of the metropolitan area. The surface water network consists of three watersheds: the Catskill and Delaware watersheds about 160 kilometres north of the city in the Catskill Mountains and the Croton watershed about 80 kilometres north of the city and east of the Hudson River. The system encompasses over 5 000 square kilometres. The system stretches downstate to NYC via a complex of aqueducts and tunnels to supply 5.3 billion litters of safe drinking water per day to millions of customers including residents, businesses, commuters, and tourists. In fact, the system supplies water to nearly half of the population of New York State. In addition, excess water from upstate reservoirs not used for drinking water is released to the Delaware River to sustain adequate flow in the lower Delaware for New Jersey and other downstream users. The reliable function and safety of this water supply was and is absolutely essential to the existence of NYC.

As New York City and upstate communities have grown, pressures from two different sides have impacted the water supply. Increasing human population and development in watershed communities exerts pressure on natural water flows that supply the water supply system. In addition, expanding populations in New York City exert pressure on the system in order to supply a growing downstate need. The human presence at both ends of the water supply system creates tensions that affect the decisions that must be made to satisfy needs of all stakeholders.

Prior to the 1980s, drinking water from the Catskill/Delaware watersheds and the Croton water supply system was unfiltered as appropriate management of watershed lands had ensured that water quality had been consistently good and there was no perceived need for a filtration facility.

However, by the late 1990s changing laws and land-use impacts prompted NYC to embark on a $250 million program to acquire and preserve up to 350,000 acres of land in the Catskills watershed. A combination of federal regulation and cost realities drove NYC to this program. Under the U.S. federal Safe Drinking Water Act, municipal and other water suppliers must filter their water supplies unless they can demonstrate that they have taken other steps, including watershed protection measures that protect their customers from harmful water contamination. Presented with a choice between building a filtration plant and preserving the watershed, New York City easily concluded that the latter was more cost effective. New York City estimated that a filtration plant would cost between $4 billion and $8 billion to build and another $300,000 annually to operate. By contrast, watershed protection efforts, which would include not only the acquisition of critical watershed lands but also a variety of other programs designed to reduce contamination sources in the watershed, would cost only about $1.5 billion.

In the late 1990s, the U.S. Environmental Protection Agency estimated that more than 140 cities were considering watershed conservation as a means of ensuring high drinking water quality

and the following table provides some insight into the economic advantages of investments in ecological infrastructure for watershed services in other U.S. cities.

Table 3: Examples of U.S. cities that have avoided construction of filtration plants through watershed protection

U.S. City	Investment in ecological infrastructure for watershed services	Avoided technical infrastructure costs
New York City	$1.5 billion spent on watershed protection over 10 years	Avoided at least $6 billion in capital costs and $300 million in annual operating costs
Portland, Oregon	$920,000 spent annually to protect watershed	Avoiding a $200 million capital cost
Portland, Maine	$729,000 spent annually to protect watershed	Avoided $25 million in capital costs and $725,000 in operating costs
Syracuse, New York	$10 million watershed plan	Avoiding $45-60 million in capital costs
Auburn, Maine	$570,000 spent to acquire watershed land	Avoiding $30 million capital cost and $750,000 in annual operating costs

5.3 Investing in ecological infrastructure

The most thorough examination ever undertaken of the health of the planet's ecosystems, the Millennium Ecosystem Assessment, clearly demonstrated that ecosystems provide myriad benefits to human society, while offering an equally compelling social imperative for restoration: maintaining intact and resilient ecosystems enhances human health and well-being.

The Economics of Ecosystems and Biodiversity (TEEB 2010) study concluded that restoration activities can bring high rates of return across a range of biomes, particularly when the value of nature's goods and services are properly accounted for.

Thus, restoring, rehabilitating and maintaining ecological infrastructure is an approach that communities can choose to ensure healthy water provision and the provision of multiple other benefits which support sustainable communities.

Government has invested a substantial amount of resources in programmes that address ecological infrastructure restoration, maintenance and rehabilitation. These programmes have been designed as public works instruments in order to have multiple benefits in that they also address poverty alleviation and job creation through environmental sustainability interventions and benefits for protecting and conserving our natural capital and improving water yield and quality.

Investments in ecological infrastructure aimed at improving water security in South Africa have been developed primarily through the government's Working for Water (WfW) and related programmes (see 11.1, page 54).

6. SIP 19 GOAL

The overall goal of SIP 19 is –

> *To significantly contribute to ensuring a sustainable supply of fresh, healthy water to equitably meet South Africa's social, economic and environmental water needs for current and future generations.*

7. SIP 19 PURPOSE

SIP 19 provides a framework for the integration of a number of impactful water-related ecological infrastructure investments and interventions into a coordinated, coherent and focussed project specifically aimed at improving South Africa's water resource quality and quantity.

Thus, the purpose of SIP 19 is to contribute to the overall goal of ensuring a sustainable supply of fresh, healthy water to equitably meet South Africa's social, economic and environmental water needs for current and future generations through the integrated implementation of projects within identified priority water catchments that measurably –

- Improve the quantity and/or quality of South Africa's water resources;
- Reverse the destruction and/or degradation of the ecological infrastructure that provides watershed services;
- Optimise the use of ecological infrastructure to provide improved watershed services;
- Provide cost effective and high quality alternatives and/or supplements to technological solutions;
- Provide decent jobs to rural and other communities living close to ecological infrastructure that provides watershed services;
- Provide appropriate compensation to people and communities that are the custodians of the ecological infrastructure that provides watershed services;
- Ensure formal legal protection for irreplaceable ecological infrastructure that provides watershed services;
- Test or pilot novel funding mechanisms, such as the concept of environmental offsetting, as alternative sources of funding for the managing, maintaining and/or improving the ecological infrastructure that provides watershed services; and
- Result in a net benefit to the scale and quality of South Africa's ecological infrastructure that provides watershed services.

To this end, SIP 19 component projects will focus on:

- Improving river flow –
  - Decreasing flood/high flows;
  - Improving low flows;
  - Improving sustainable yield from existing and new water infrastructure, and

- Improving the implementation of Resource Directed Measures, such as the Ecological Reserve, through, among others, the restoration and improvement of land management practices and the control of invasive alien plants.

- Reducing sediment loads
  - Reducing siltation of rivers, dams and other infrastructure through, among others, restoration, improvement of land management practices and the control of invasive alien plants.

- Optimising Water quality
  - Optimising water quality to minimize purification costs;
  - Minimising waterweeds, and
  - Optimising water quality in areas where water is extracted from rivers in order to minimize health risks through restoration, improvement of land management practices and the control of invasive alien plants.

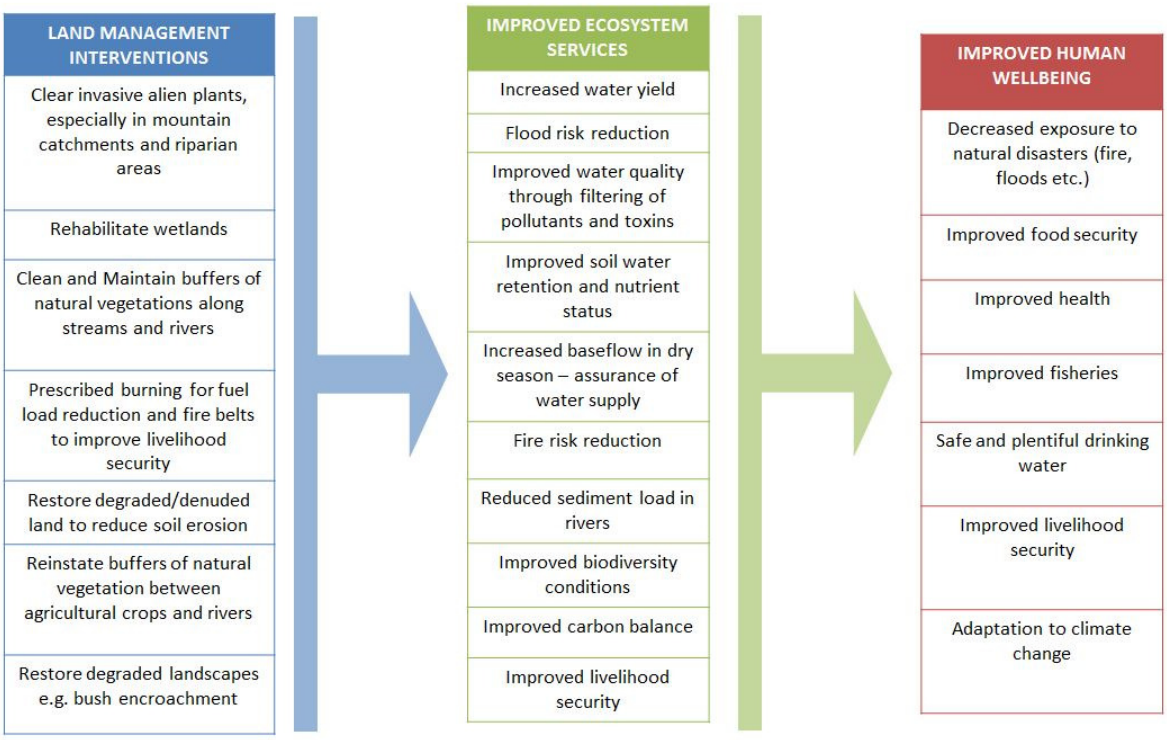

Figure 9: Graphical representation of the types of interventions falling under SIP 19 and their possible positive impacts on ecosystem services and human well-being.

In summary, as far as water related provisioning and regulating services are concerned, the focus of SIP 19 is on investments in ecological infrastructure which regularise flows; decrease floods; improve low flows (dry season flows); improve yield from existing and new water infrastructure, and enable implementation of the Ecological Reserve (the portion of stream flow which must remain in a river to ensure the sustainable and healthy functioning of the river and its wetlands); reduce sediments and siltation of rivers, dams and other infrastructure; optimize water quality for ecological functioning and human health considerations (including thermal

pollution, eutrophication and turbidity); optimize water quality to minimize purification costs; minimize the impact of waterweeds on water reticulation systems, and optimize water quality in areas where water is extracted from rivers in order to minimize health risks.

7.1 SIP 19 and regulatory streamlining and intergovernmental coordination

One of the explicit reasons for existence of the SIPs is to identify challenges impeding or delaying implementation of the component projects, and identify associated remedial actions required. This includes identifying, "any legislation and other regulatory measures that impede or may impede infrastructure development, and advise the executive authority of the relevant sphere of government" (Infrastructure Development Act, section 4(g)(ii)). Regulatory obstacles, and lack of intergovernmental coordination to address these, is thus a specific focus of many SIPs.

The same is true of SIP 19, which has the potential to play an immensely valuable role in unblocking regulatory delays relating to typical activities undertaken by its component projects. For example, many rehabilitation activities, especially those undertaken in wetlands, require authorisation under both water and environmental legislation despite being activities that have a net positive effect on the environment.

Compliance with the current regulatory regime has both cost and time implications, and while it is necessary to undertake the necessary due diligence on rehabilitation activities, there is further potential for regulatory decision-making to be streamlined and coordinated between the relevant departments. This would have the effect of reducing the time and cost incurred in the planning of rehabilitation interventions, thereby freeing up additional resources for implementation and accelerating projects' performance, without undermining legal compliance. In the case of the EPWP-related projects, this often translates to the ability to create additional work opportunities and to keep people employed for a longer duration.

A further key purpose for SIP 19 lies in its potential to improve intergovernmental coordination, both horizontally between sector departments within spheres, as well as between all three spheres of government. The Infrastructure Development Act (section 4(e)) emphasises the role of the SIPs in ensuring "co-operation between organs of state affected by projects undertaken". The environment is assigned by the Constitution as functional areas of concurrent national and provincial competence, thus requiring a high degree of political, administrative and technical coordination between these spheres. Given the multi-faceted and cross-cutting nature of the environment, governance in this sector must be strong and integrated if it is to be effective.

The implementation of emerging novel mechanisms for compensating for legally-sanctioned unavoidable, residual environmental impacts of development activities will also benefit from the governance-enhancing role played by SIP 19. Offsets are a potentially significant funding stream for investing in ecological infrastructure, and policy development in the water and environmental sectors in relation to these mechanisms is already at an advanced stage.

8. SIP 19 AND THE REQUIREMENTS FOR STRATEGIC INTEGRATED PROJECTS

Section 7 of the Infrastructure Development Act, 2014 (Act 23 of 2014) outlines the criteria that a project or group of projects must comply with in order to qualify as a SIP. A project or group of projects is eligible if:

(a) it comprises of one or more installation, structure, facility, system, service or process relating to any matter specified in Schedule 1 if it ;

(b) it complies with any of the following criteria:

i. It would be of significant economic or social importance to the Republic;

ii. it would contribute substantially to any national strategy or policy relating to infrastructure development; or

iii. it is above a certain monetary value determined by the Commission; and

(c) the Commission has included the project in the national infrastructure plan and has, in terms of section 8, designated the project as a strategic infrastructure project.

In relation to criterion (a), there are a number of "matters" specified in Schedule 1 of the Act that are directly supplemented, enhanced and sustained through the activites of SIP 19. These include human settlements and related infrastructure and facilities; productive rural and agricultural infrastructure; and water works and water infrastructure. In addition to these, the role of healthy ecological infrastructure in disaster risk reduction will also be of direct relevance to the lifespan and maintenance costs of other Schedule 1 matters like public roads, railways and sewage works.

The Constitution asserts that everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected for the benefit of present and future generations. In giving effect to these rights and principles, the National Environmental Management Act (1998) states that "sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations". Thinking around sustainable development has evolved to the point where the traditional conception of environment as a nested component within economy has been inverted and the environment is now recognised as underpinning all social and economic development. In this respect, it can certainly be argued that maintenance and rehabilitation of ecological infrastructure, and the healthy environment this contributes to, is of "of significant economic or social importance to the Republic", as outlined in criterion (b) above.

The national strategy or policy relating to infrastructure development, referred to in criterion (b), to which SIP 19 would most closely align is the recently published National Water Resources Strategy (NWRS) 2 and its overarching policy framework. The NWRS 2 provides the framework for the protection, use, development, conservation, management and control of water resources for the country as a whole. It was also the first policy instrument in South Africa to formally recognise the role and value of ecological infrastructure in supporting developmental objectives. In her foreword, the Minister argues that, "There can be no growth and development without water, so water must be at the heart of all our planning, financing and governance frameworks." An entire chapter of the NWRS 2 is dedicated to water resource

protection as one of the mechanisms for ensuring that water contributes to on-going growth and development. The restoration and maintenance of water-related ecological infrastructure is explicitly recognised as a key component of this approach.

9. SIP 19 SPATIAL FOCUS

As with the identification and design of most of the other SIPs, SIP 19's spatial focus and prioritisation is informed by a mapping process that includes that undertaken by the PICC (see. page 8).

The following provides an overview of the SIP 19 mapping process.

9.1 South Africa's "Water Factories"

Given SIP 19's focus on water security, the Strategic Water Source Areas (popularly referred to as South Africa's "water factories"), i.e. the 8% of land area that accounts for over 50% of annual run-off as illustrated in Figure 10, was a key map.

This map identifies a set of Strategic Water Source Areas, which are those areas that supply a disproportionately high amount of the country's mean annual runoff, in relation to their surface area. These areas make up 8% of the land area across South Africa, Lesotho and Swaziland but provide 50% of the water in these countries. Strategic Water Source Areas have been identified for the whole of South Africa, including Mountain Catchment Areas, and some coastal areas such as Pondoland (see also section 11.2, page 56**Error! Reference source not found.**).

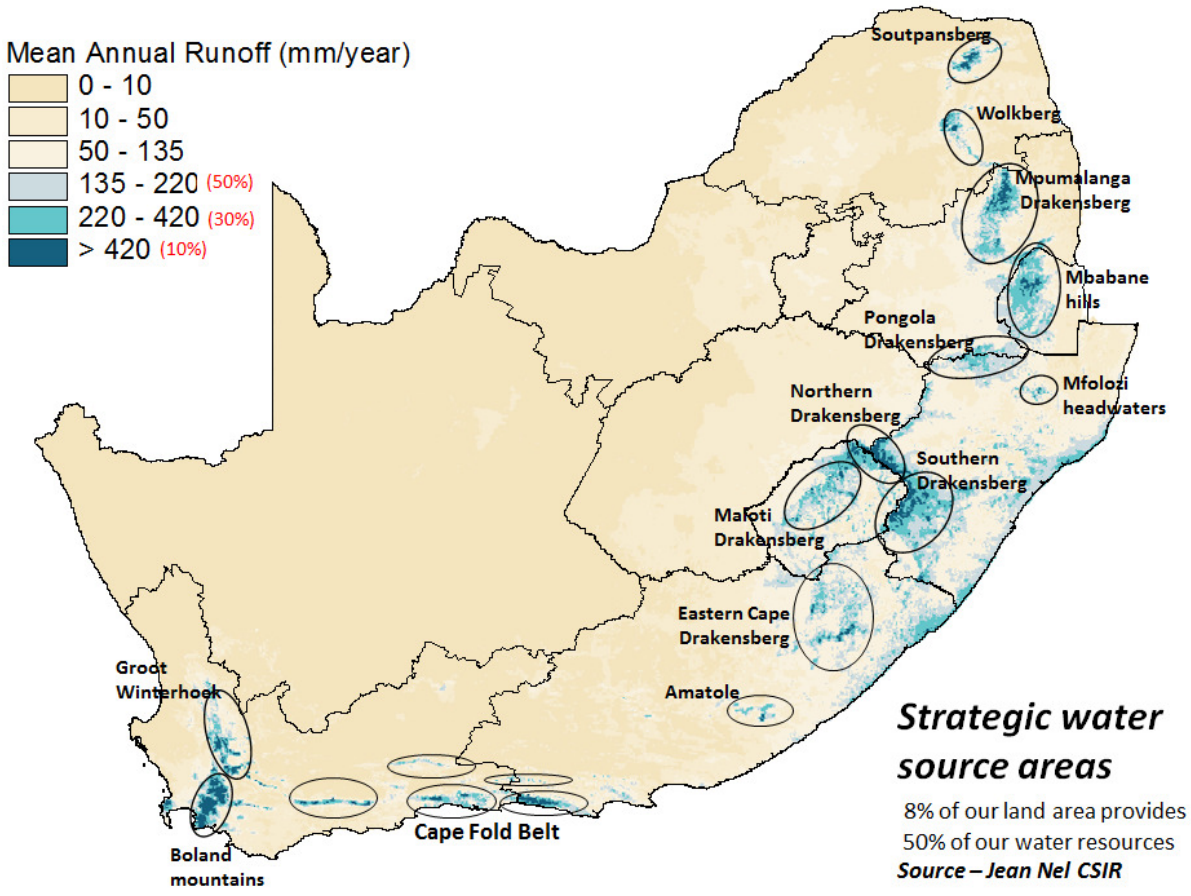

Figure 10: South Africa's "Water Factories" - the strategic water source areas that comprise 8% of our land area that provides over 50% of our surface water resources.

9.2 The State of Ecological Infrastructure

As the second step in the mapping process, a map was compiled based on available information relating to the state of our rivers, our wetlands and our estuaries. The result of this exercise is reflected in Figure 11.

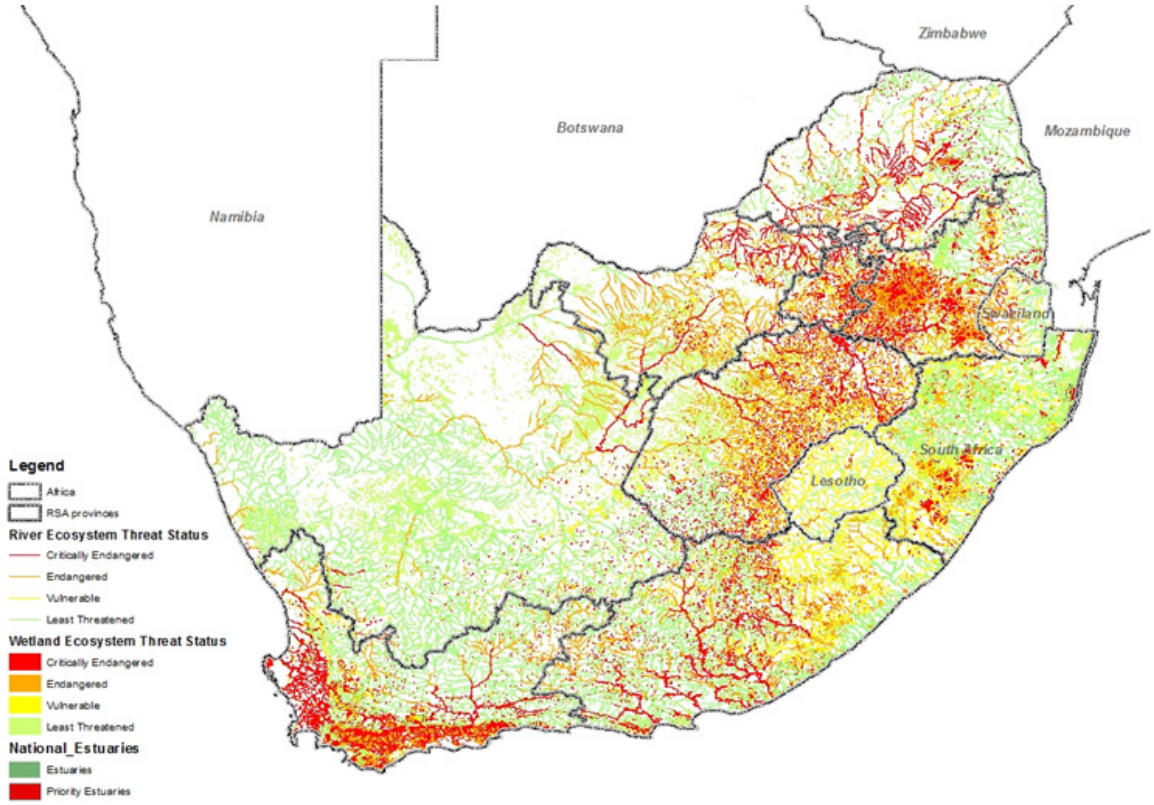

Figure 11: The State of South Africa's rivers, wetlands and estuaries.

From Figure 11 it is clear that water-related ecological infrastructure is in a poor condition in various places around the country with hotspots in the Western Cape, Mpumalanga, KwaZulu-Natal, Gauteng, Free State, Eastern Cape, Limpopo and the North West Province.

With this it is clear that SIP 19 interventions are likely to have the greatest positive ecological infrastructure quality impacts in the areas where rivers and/or wetlands are critically endangered and endangered and where related estuaries have been prioritised.

9.3 Degraded land and Alien Invasive Plants

Given the significance of alien plant invasion on the functioning of water-related ecological infrastructure, as the third step in the mapping process, a map was compiled based on available information relating to the areas were land is seen to be significantly degraded in conjunction with spatial priorities for alien invasive plant control interventions. This exercise resulted in the map reflected in Figure 12.

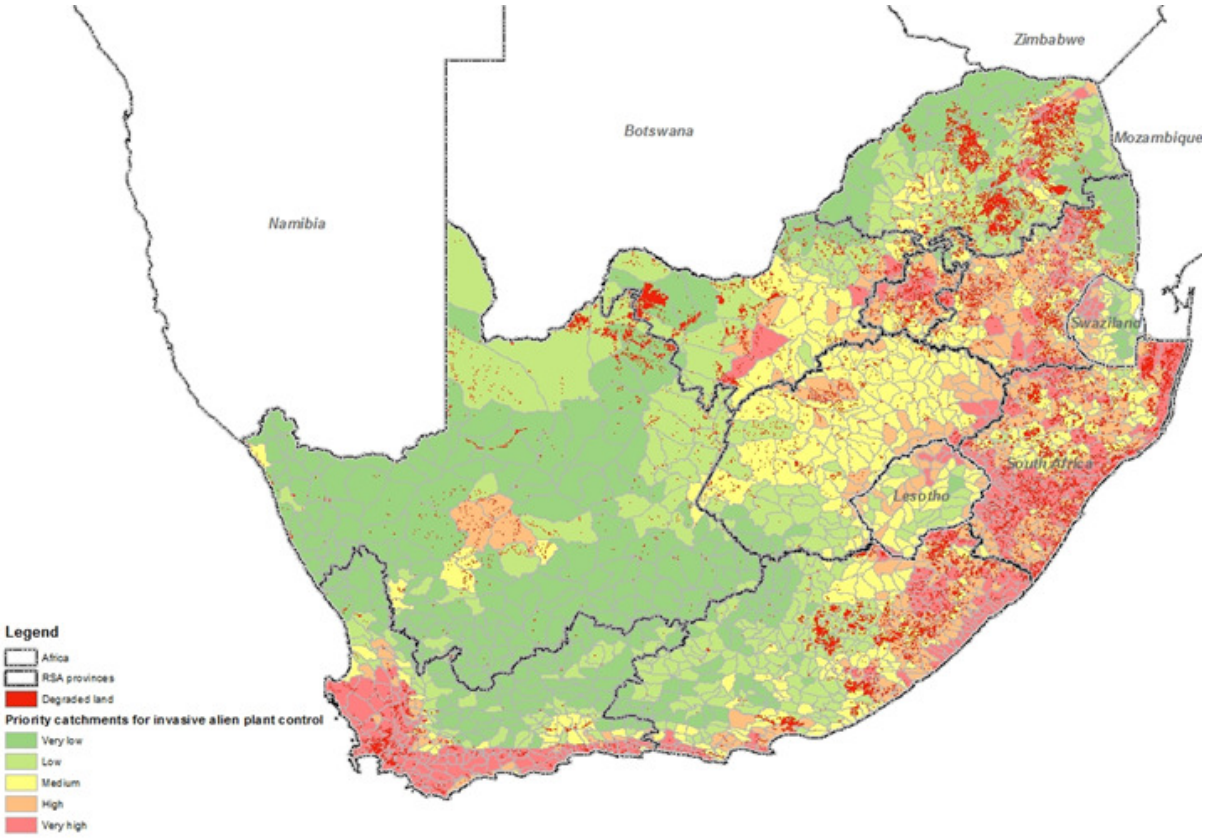

Figure 12: Degraded land and priority catchments for invasive alien plant control interventions.

From Figure 12 it is clear that there are overlaps of land degradation and significant invasive alien plant problems in various places around the country with hotspots in the provinces of KwaZulu-Natal, Eastern Cape, Western Cape, Mpumalanga, Gauteng and Limpopo.

With this it is clear that SIP 19 interventions are likely to have the greatest positive ecological infrastructure quality impacts in the areas where land is degraded and where there is high and/or very high priority given to the need for alien plant control interventions.

9.4 Key Quaternary Catchment Identification

Based on the environmental analysis described in 9.2 and 9.3 above, a correlation analysis of this work was carried out as the forth step in the mapping process to identify which areas would benefit most from water-related ecological infrastructure investments. Given the water-focus of SIP 19, the areas identified were those that corresponded to so-called quaternary catchments[8]. This exercise resulted in the map reflected in Figure 13.

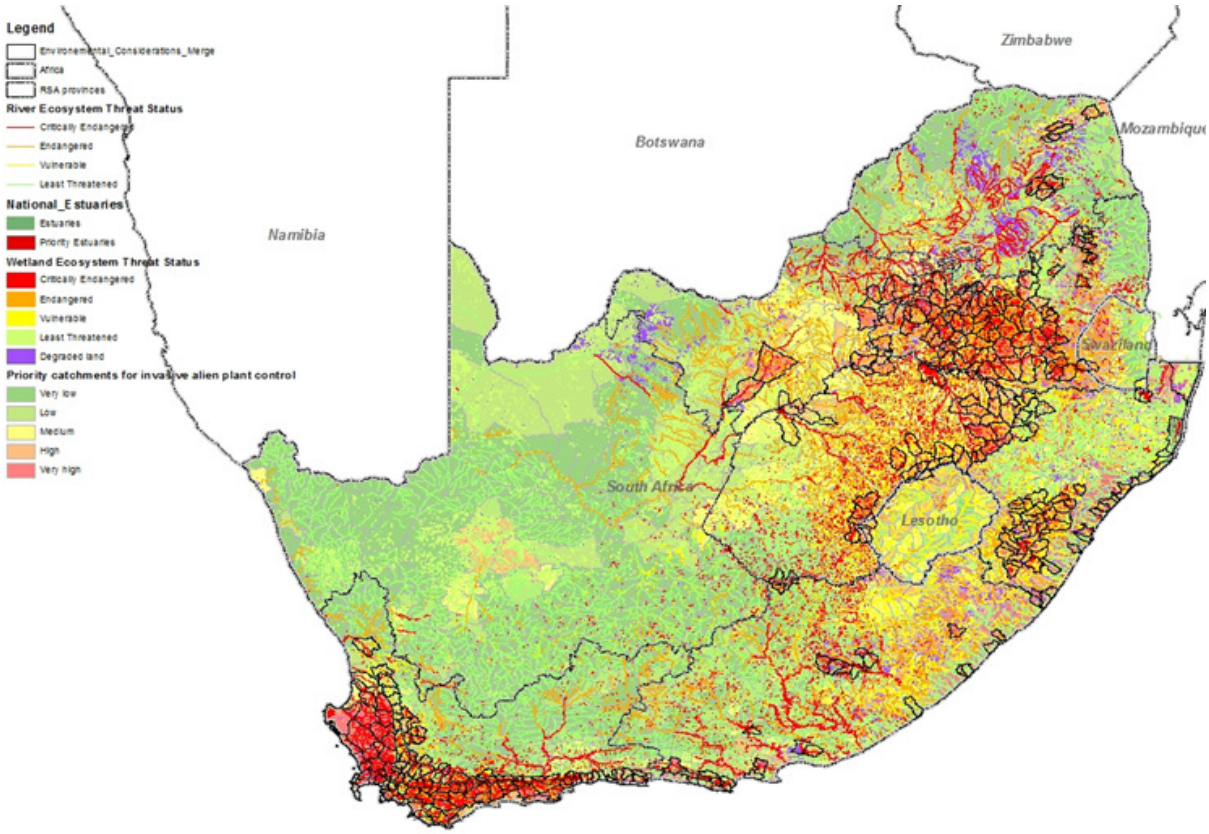

Figure 13: Key quaternary catchments that could greatly benefit from ecological infrastructure interventions.

From Figure 13 it is clear that key quaternary catchments that could greatly benefit from ecological infrastructure interventions are concentrated in the Mpumalanga, Gauteng, Western Cape and KwaZulu-Natal provinces with further smaller clusters in the Eastern Cape and Limpopo Province.

[8] Catchments are a basic hydrological unit. A quaternary catchment is a fourth order catchment in a hierarchal classification system in which a primary catchment is the major unit. Quaternary catchments are the principal water management units in South Africa and 1946 have been demarcated. The quaternary catchment is the basic unit for water resource management in South Africa.

9.5 Poverty and Service Delivery

With a view to addressing spatial imbalances, especially in relation to poverty and levels of public services, as the fifth step in the mapping process, a map was compiled based on available information from the general SIP mapping exercise relating to public service levels and Minimum Living Levels[9]. These spatial variables were then correlated with the Key Quaternary Catchments identified in 9.4. This exercise resulted in the map reflected in Figure 14.

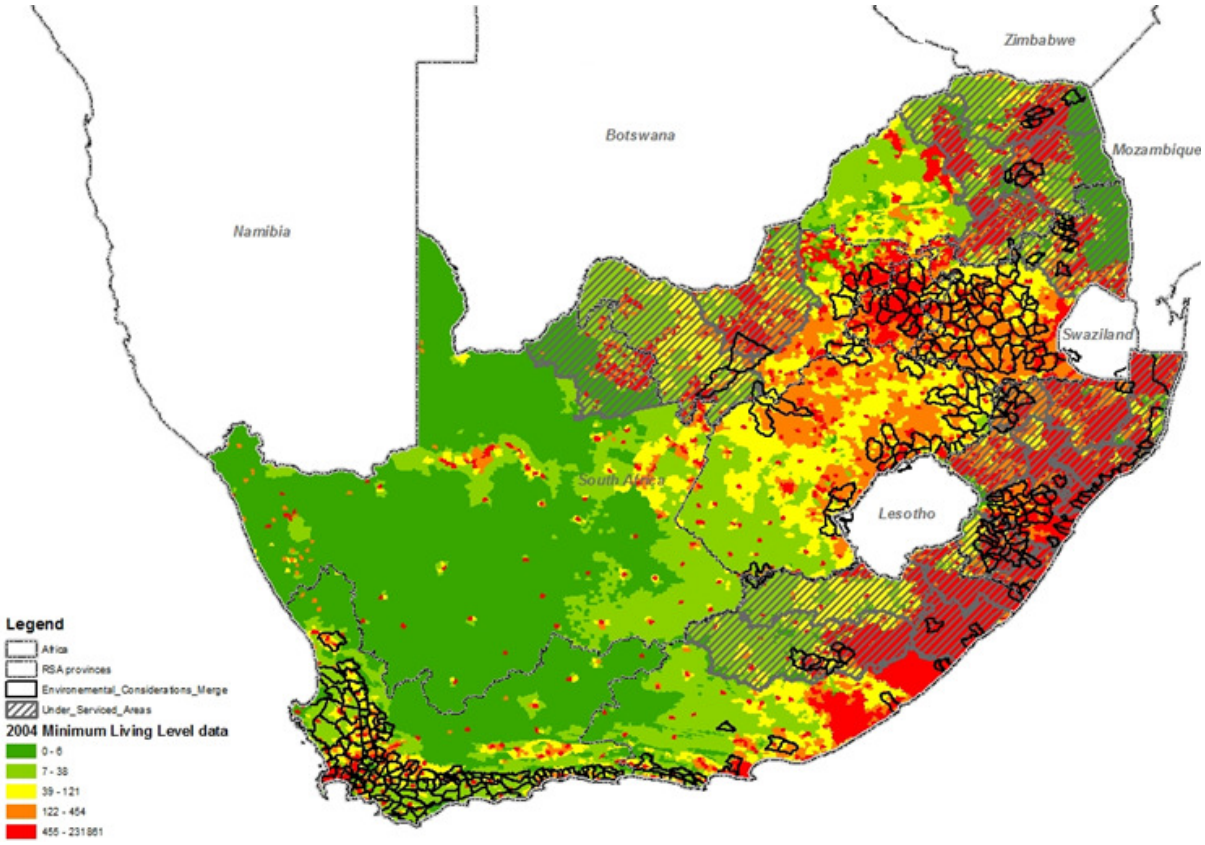

Figure 14: Correlation between Key SIP 19 Quaternary Catchments, poorly serviced areas and poverty levels.

From Figure 14 it is clear that there are significant overlaps of key SIP 19 quaternary catchments, poorly serviced areas and high levels of poverty in various places around the country with hotspots in the KwaZulu-Natal, Gauteng, Eastern Cape, Western Cape, Mpumalanga, and Limpopo Province.

[9] The Minimum Living Level (MLL) reflects the minimum income required to sustain a household and varies in accordance with household size – the larger the household, the larger the income required to keep its members out of poverty. The MLL includes the following items: Food; Clothing; Compulsory payments to local authorities in respect of rent, miscellaneous services, water and electricity; Fuel and light; Washing and cleaning materials; Education; Transport; Contributions to medical funds and medical and dental expenses; Replacement of household equipment; Taxes; and Support of relatives (applicable only to singles).

9.6 SIPs and especially SIP 18

In an attempt to maximise SIP 19's alignment with, or contribution to, the other SIPs, and especially the other water SIP, SIP 18, the correlation between key SIP 19 quaternary catchments and these SIPS was also undertaken as illustrated in Figure 15 and Figure 16.

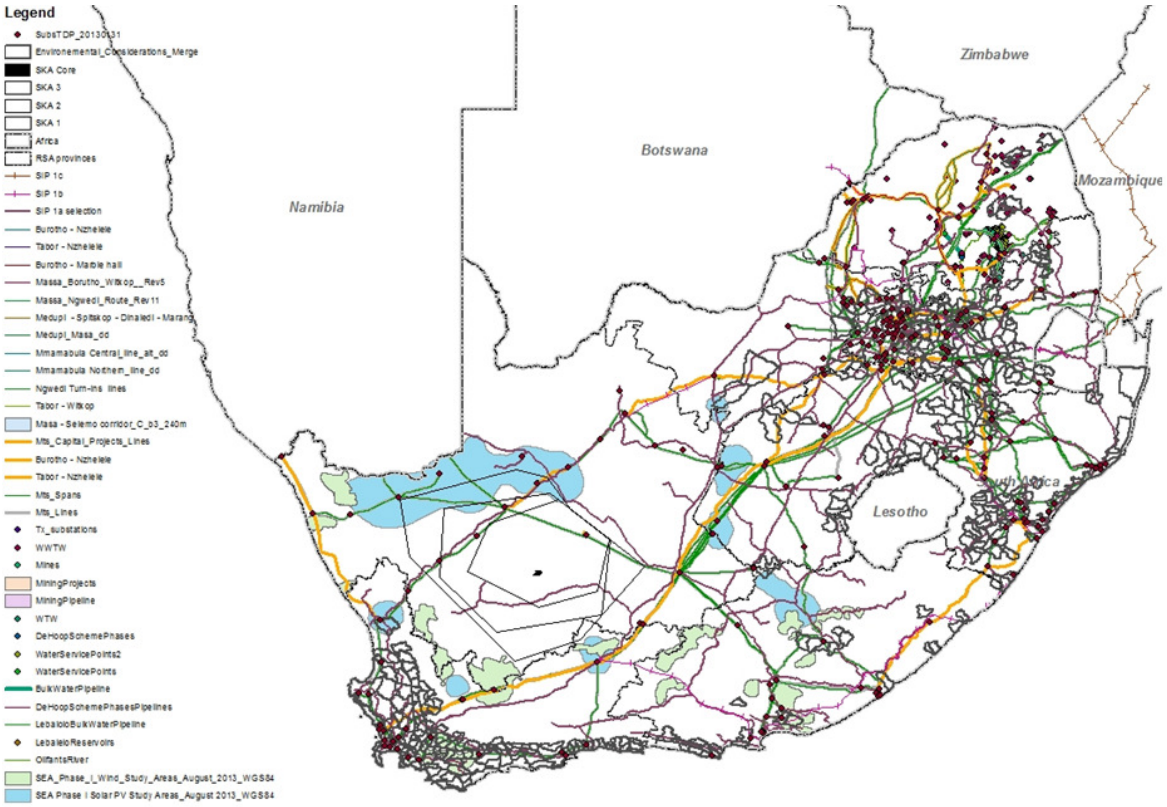

Figure 15: Correlation between Key SIP 19 Quaternary Catchments and the other SIPs and SIP-related activities.

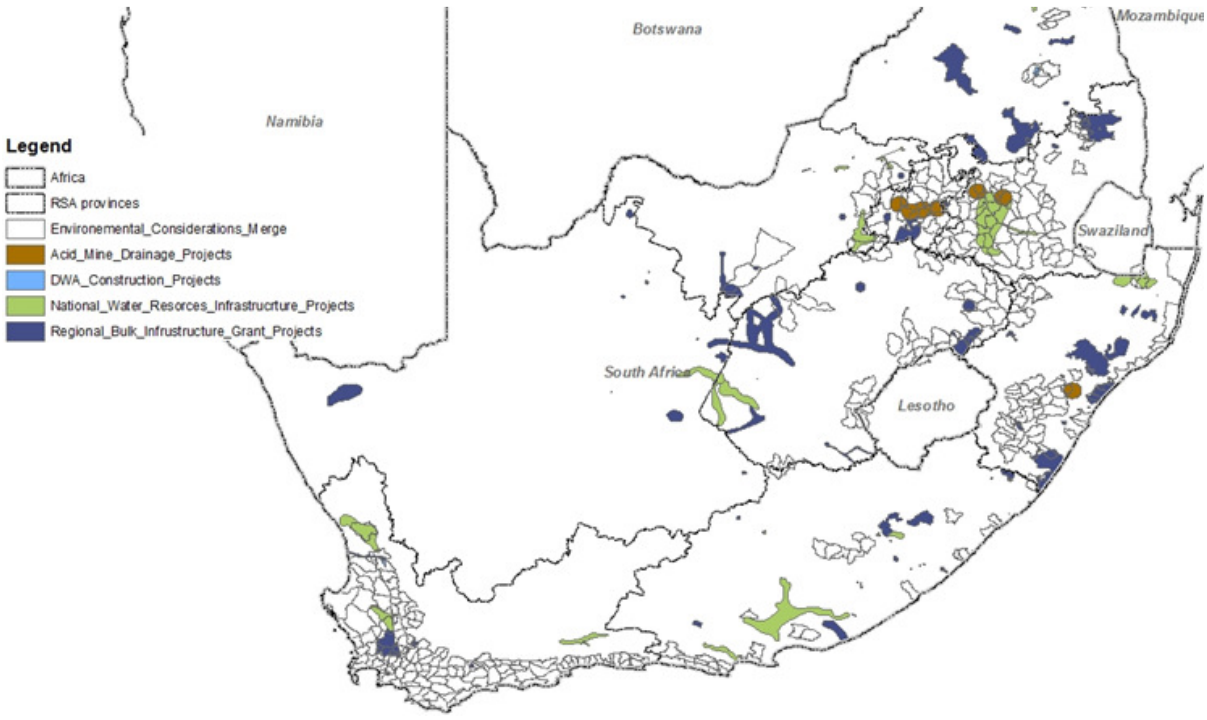

Figure 16: Correlation between Key SIP 19 Quaternary Catchments and key SIP 18 components.

9.7 The SIP 19 Spatial Priority Areas

Based on the mapping exercises described above, the following areas were identified as the SIP 19 Spatial Priority Areas (see Figure 17 and Figure 18)

- ***Phase I Priority Area*** - Quaternary catchment/s associated with the Orange-Vaal-Thukela and/or uMngeni-Mooi-Thukela Strategic Water Source Areas
- ***Phase II Priority Area*** - Quaternary catchment/s associated with the Olifants-Doring-Berg and/or Berg-Breede Strategic Water Source Areas
- ***Phase III Priority Area*** - Quaternary catchment/s associated with the Langeberg-Gouritz and/or Gouritz and/or Kromme-Gouritz and/or Gamtoos-Gouritz and/or Tsitsikamma Strategic Water Source Areas
- ***Phase IV Priority Area*** - Quaternary catchment/s associated with the Vaal-Thukela-Phongola and/or Inkomati-Phongola-Usutu and/or Crocodile-Olifants Strategic Water Source Areas
- ***Phase V Priority Area*** - Quaternary catchment/s associated with the remaining Strategic Water Source Areas including: Letaba-Olifants and/or Luvubu-Mutale and/or Mfolozi-Phongola and/or Zululand Coast and/or Great Kei-Great Fish and/or Mzimvubu-Orange and/or Pondoland Coast

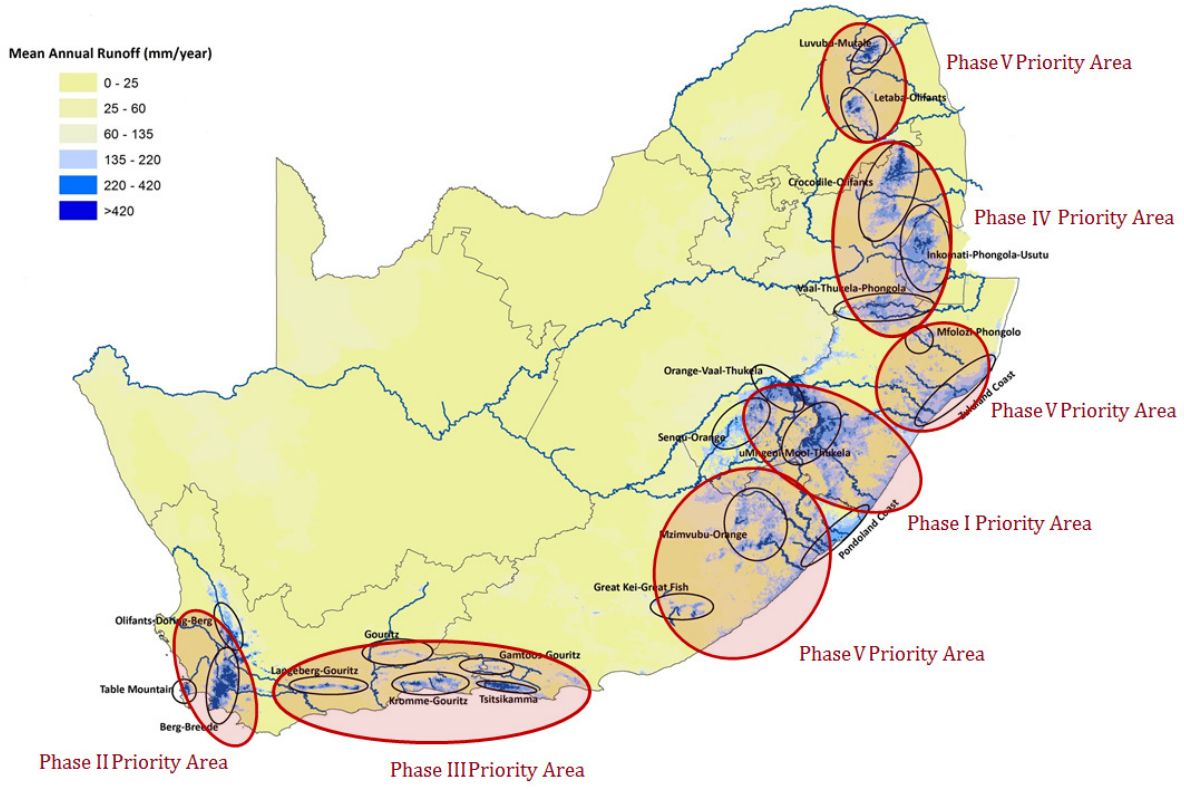

Figure 17: The SIP 19 Spatial Priority Areas

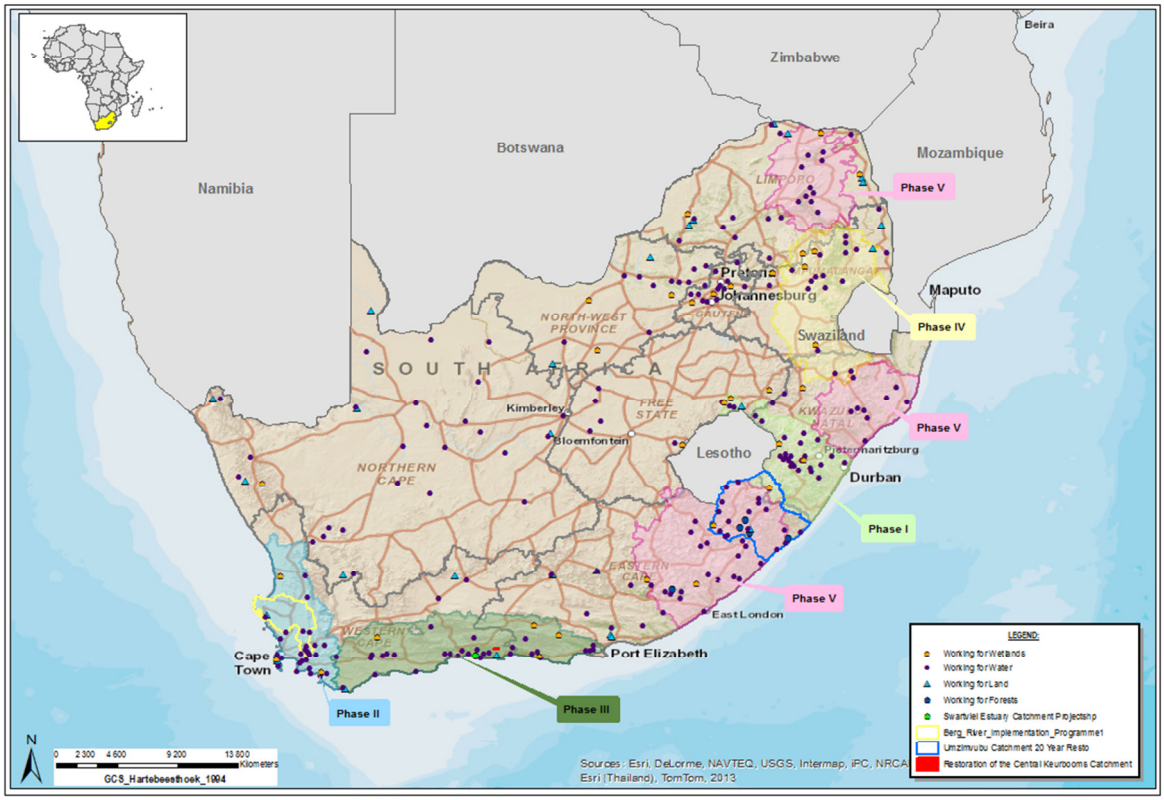

Figure 18: SIP 19 Priority Area Catchments providing an indication of the geographical range of some typical SIP 19-type interventions.

10. COMPONENTS

As with the other SIPs, SIP 19 is a strategic integrated project encompassing a number of linked components that all contribute to the overall goal and purpose of the SIP. Although Annexure A provides a detailed list of the various SIP 19 components/projects, the following provides an overview of the type of interventions that make up SIP 19 –

- A - Improved stream and river-related ecological infrastructure –
  - A.1 - Clearing invasive alien plant infestations, especially in mountain catchments and riparian areas (around 113 projects of which 86 fall under the DEA Natural Resource Management (NRM) Programmes (Working for Water, Working on Fire, Working for Wetlands, Working for Land etc.));
  - A.2 - The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation along streams and rivers (around 29 projects of which 5 are NRM projects);

- B - Improved wetland-related ecological infrastructure –
  - B.1 - The restoration, rehabilitation and/or maintenance of wetlands (around 31 projects of which 5 are NRM projects);
  - B.2 - The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation between agricultural crops and rivers or wetlands (around 28 projects of which 5 are NRM projects);

- C - Improved estuary-related ecological infrastructure (around 3 specific projects)–
  - C.1 - Clearing invasive alien plant infestations;
  - C.2 - The restoration, rehabilitation and/or maintenance of estuaries;
  - C.3 - The reinstatement, restoration, rehabilitation, establishment and/or maintenance of buffers of natural vegetation along estuaries

- D - Improved agriculture-impacted ecological infrastructure –
  - D.1 - The improvement in rangeland management practices (e.g. grazing regime and improved fire management) (around 23 projects of which 4 are NRM projects);
  - D.2 - The improvement of agricultural practices (e.g. improved tillage, contour ploughing, organic agriculture, etc.) (around 19 projects of which none are NRM projects);

- E - The conservation and protection of irreplaceable ecological infrastructure –
  - E.1 - The formal protection of key catchment areas as part of the expansion of South Africa's conservation estate (around 3 projects of which none are NRM projects);
  - E.2 - The reinstatement, restoration, rehabilitation and/or maintenance of grass- and wood-lands, especially in upper-catchment areas (around 8 projects of which 5 are NRM projects);
  - E.3 - Clearing invasive alien plant infestations in protected catchment areas (around 90 projects of which 86 are NRM projects);

- F - The rehabilitation of mining-impacted ecological infrastructure and/or development of synthetic ecological[10] infrastructure –
  - F.1 - The establishment of natural filtration infrastructure, i.e. built wetlands, to purify various small sources of polluted inflows into streams and rivers (e.g. acid mine drainage (AMD) from old mining works, livestock farms, waste dumps, etc.) (around 8 projects of which none are NRM projects);
  - F.2 - The rehabilitation of land affected by derelict and ownerless mines (around 2 projects of which none are NRM projects)

- G - Ecological infrastructure for water security research and development (around 20 projects of which none are NRM projects).

Although South Africa has a lot of experience in implementing many of the specific interventions listed above, the rehabilitation, reinstatement and/or restoration of natural ecological infrastructure and/or the development of synthetic ecological infrastructure is a growing and evolving area of interest. Hence, unlike the other SIPs, SIP 19 specifically contains a research and development component aimed at continuously improving the efficiency and effectiveness of SIP 19 interventions. In this regard, the Water Research Commission (WRC) has agreed to play a leading role and has already made significant contributions in this regard (see below for examples).

[10] This is a form of built infrastructure that, for the purpose of this document, is distinguished from natural ecological infrastructure through its use of biomimicry approaches that incorporate natural principles and processes into technological solutions e.g. constructed/artificial wetlands that replicate physical and chemical processes found in natural wetlands, in order to purify water.

Table 4: Summary of SIP 19 projects per Priority Area

Project Name	SIP Priority Area	Principle Implementing Agency	Value	Duration
uMngeni Ecological Infrastructure Partnership (UEIP)	Phase I Priority Area	South African National Biodiversity Institute (SANBI)	Approximately R500 million	10 years ending in 2023
Benefits of Ecological Infrastructure		Water Research Commission	R5 million	5 years ending in 2020
Rehabilitation of alien invaded riparian zones and catchments using indigenous trees: An assessment of indigenous tree water-use		Water Research Commission	R5 million	5 years ending in 2020
Investing in ecological infrastructure to enhance water security in the uMngeni River catchment		South African National Biodiversity Institute (SANBI)	R4,900,000	18 months ending in 2015
Upper uMngeni Resilient Landscape Approach		WWF-SA (through the Mondi Wetlands Programme)	R9.94 million	3 years
Enhancing ecological infrastructure in the uMngeni catchment through collective private sector action: The role of private finance and markets		WWF-South Africa	R 2 500 000	18 months
Working for Ecosystems		WESSA, on behalf of eThekwini Municipality	R15 554 521	2 years
uMngeni River Basin Water Security Case-study		Monash South Africa	About R 2.5 million	5 years
Durban Green Corridor Project		Duzi Umgeni Conservation Trust (DUCT) and the Ethethwini Metropolitan Municipality	R10 million annual average	On-going
DUCT River Care Teams (RCTs)		Duzi Umgeni Conservation Trust (DUCT)	R60 million	6 years
Expose-a-Sewer Campaign		Duzi Umgeni Conservation Trust (DUCT)	R120 000	3 years
National Lotteries KZN		WESSA	R3 866 899.00	2 years
WESSA/WWF Capacity for Catchments Project		WESSA and WWF	R3 million	3 years
Msinsi Alien Plant Programme		Msinsi Holdings (Pty) Ltd	R664 million	20 years
Threatened grassland species conservation project		EWT	R 6 900 887	5 years
Drakensberg Crane and Wetland Conservation Project		EWT	R 6 933 000	66 months
Securing South Africa's Water Source Areas		WWF	R 240 000	3 years for phase 1
WWF-SA Water Balance Programme		WWF	R 3 277 601	5 years
Maloti Drakensberg Park WHS – Catchment Rehabilitation		Ezemvelo KZN Wildlife	R 35 000 000	3 years
9 Working for Water projects		DEA's Branch: Environmental Programmes	R 6 154 047	Various
1 Working for Wetlands project		SANBI	R 1 944 000	Various
1 Working for Land project		DEA's Branch: Environmental Programmes	R 1 165 720	Various
The Berg River Improvement Plan (BRIP)	Phase II Priority Area	Western Cape Provincial Government	R300 million	10 years

Project Name	SIP Priority Area	Principle Implementing Agency	Value	Duration
Real time monitoring of water quality in urban hotspots in Berg River, Paarl		University of Cape Town	R680 000	18 months
River Environmental Management Plan		Drakenstein Municipality	R 11.0 Million	3 years
Cape Critical Rivers Project (CCR)		EWT	R 900 000	3 years
Alien Vegetation Clearance & Firebreaks		Drakenstein Municipality	R 5 000 000	5 years
Securing South Africa's Water Source Areas		WWF	R 240 000	3 years for phase 1
WWF-SA Water Balance Programme		WWF	R 3 277 601	5 years
20 Working for Water projects		DEA's Branch: Environmental Programmes	R 32 515 441	Various
1 Working for Wetlands project		SANBI	R 1 858 154	Various
1 Working for Land project		DEA's Branch: Environmental Programmes	R 1 359 267	Various
Restoration of the Central Keurbooms Catchment, southern Cape	Phase III Priority Area	WWF South Africa, in partnership with Eden To Addo Corridor Initiative.	R25 million	5 years ending in 2020
Swartvlei Estuary Catchment Project		Eden to Addo Corridor Initiative	R27million	5 years ending in 2020
Building resilient landscapes by linking social networks and social capital to ecological infrastructure		WRC	R2,2 million	3 years
Securing South Africa's Water Source Areas		WWF	R 240 000	3 years for phase 1
WWF-SA Water Balance Programme		WWF	R 3 277 601	5 years
19 Working for Water projects		DEA's Branch: Environmental Programmes	R 31 449 856	Various
1 Working for Wetlands project		SANBI	R 1 769 670	Various
1 Working for Land project		DEA's Branch: Environmental Programmes	R 1 487 384	Various
Mine pollution prevention	Phase IV Priority Area	Council for Geoscience (Environmental Geosciences Unit)	R6 million together with Phase V activities	3 years ending in 2017
An integrated bioregional approach to improve water quality and production... within the Blyde Escarpment and associated catchments…		Kruger to Canyons Man and Biosphere (K2C BR)	R37 500 000	3 Years
Highveld crane and wetland conservation project		EWT		
Limiting and mitigating the impact of coal mines on wetlands		WRC	R528 000	3 years
Securing South Africa's Water Source Areas		WWF	R 240 000	3 years for phase 1
WWF-SA Water Balance Programme		WWF	R 3 277 601	5 years

Project Name	SIP Priority Area	Principle Implementing Agency	Value	Duration
10 Working for Water projects		DEA's Branch: Environmental Programmes	R 20 904 270	Various
1 Working for Wetlands project		SANBI	R 1 650 000	Various
Mine pollution prevention	Phase V Priority Area	Council for Geoscience (Environmental Geosciences Unit)	Included with Phase IV activities	As for Phase IV activities
Umzimvubu Catchment 20 year Restoration Strategy		Conservation South Africa NGO, an affiliate of Conservation International	R28 784 000	5-20 years ending in 2033
Improving Water security in and around iSimangaliso Wetland Park		iSimangaliso Wetland Park Authority	31 million	3 years
Amathole Freshwater Species Conservation Project		EWT	R 21 896 807	3½ years
Limiting and mitigating the impact of coal mines on wetlands		WRC	R 528 000	3 years
Protecting and expanding the Conservation areas within the Wolkberg-Lekgalameetse areas		Kruger to Canyons Man and Biosphere (K2C BR)	R 38 600 000	3 years
Securing South Africa's Water Source Areas		WWF	R 240 000	3 years for phase 1
28 Working for Water project		DEA's Branch: Environmental Programmes	R 43 235 997	Various
1 Working for Wetlands project		SANBI	R 4 000 000	Various
1 Working for Land project		DEA's Branch: Environmental Programmes	R 5 627 378	Various
5 Working for Forests project		DEA's Branch: Environmental Programmes	R 7 109 946	Various

Table 5: Summary of SIP 19 Components/Projects per Priority Area

SIP 19 Intervention		SIP 19 Priority Area					Total
		I	II	III	IV	V	
A.	**Improved stream and river-related ecological infrastructure –**	**26**	**29**	**28**	**17**	**42**	**142**
A.1	Clearing invasive alien plant infestations, especially in mountain catchments and riparian areas	20	25	23	13	32	113
A.2	The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation along streams and rivers	6	4	5	4	10	29
B.	**Improved wetland-related ecological infrastructure –**	**13**	**9**	**8**	**11**	**18**	**59**
B.1	The restoration, rehabilitation and/or maintenance of wetlands	6	5	5	7	8	31
B.2	The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation between agricultural crops and rivers or wetlands	7	4	3	4	10	28
C.	**Improved estuary-related ecological infrastructure –**	**6**	**0**	**0**	**0**	**3**	**9**
C.1	Clearing invasive alien plant infestations	2	0	0	0	1	3
C.2	The restoration, rehabilitation and/or maintenance of estuaries	2	0	0	0	1	3
C.3	The reinstatement, restoration, rehabilitation, establishment and/or maintenance of buffers of natural vegetation along estuaries	2	0	0	0	1	3
D.	**Improved agriculture-impacted ecological infrastructure –**	**14**	**6**	**5**	**6**	**11**	**42**
D.1	The improvement in rangeland management practices (e.g. grazing regime and improved fire management)	8	3	3	3	6	23
D.2	The improvement of agricultural practices (e.g. improved tillage, contour ploughing, organic agriculture, etc.)	6	3	2	3	5	19

SIP 19 Intervention		SIP 19 Priority Area					Total
E.	**The conservation and protection of irreplaceable ecological infrastructure –**	**26**	**12**	**9**	**12**	**19**	**78**
E.1	The formal protection of key catchment areas as part of the expansion of South Africa's conservation estate	10	4	3	5	6	28
E.2	The reinstatement, restoration, rehabilitation and/or maintenance of grass- and wood-lands, especially in upper-catchment areas	8	4	2	4	10	28
E.3	Clearing invasive alien plant infestations in protected catchment areas	8	4	4	3	3	22
F.	**The reinstatement and/or development of new ecological infrastructure –**	**2**	**2**	**0**	**3**	**3**	**10**
F.1	The establishment of natural filtration infrastructure, i.e. built wetlands, to purify various small sources of polluted inflows into streams and rivers (e.g. acid mine drainage (AMD) from old mining works, livestock farms, waste dumps, etc.)	2	2	0	2	2	8
F.2	The rehabilitation of land affected by derelict and ownerless mines	0	0	0	1	1	2
G.	**Ecological infrastructure for water security research and development**	**6**	**4**	**1**	**3**	**6**	**20**
Totals		**93**	**62**	**51**	**52**	**102**	**360**

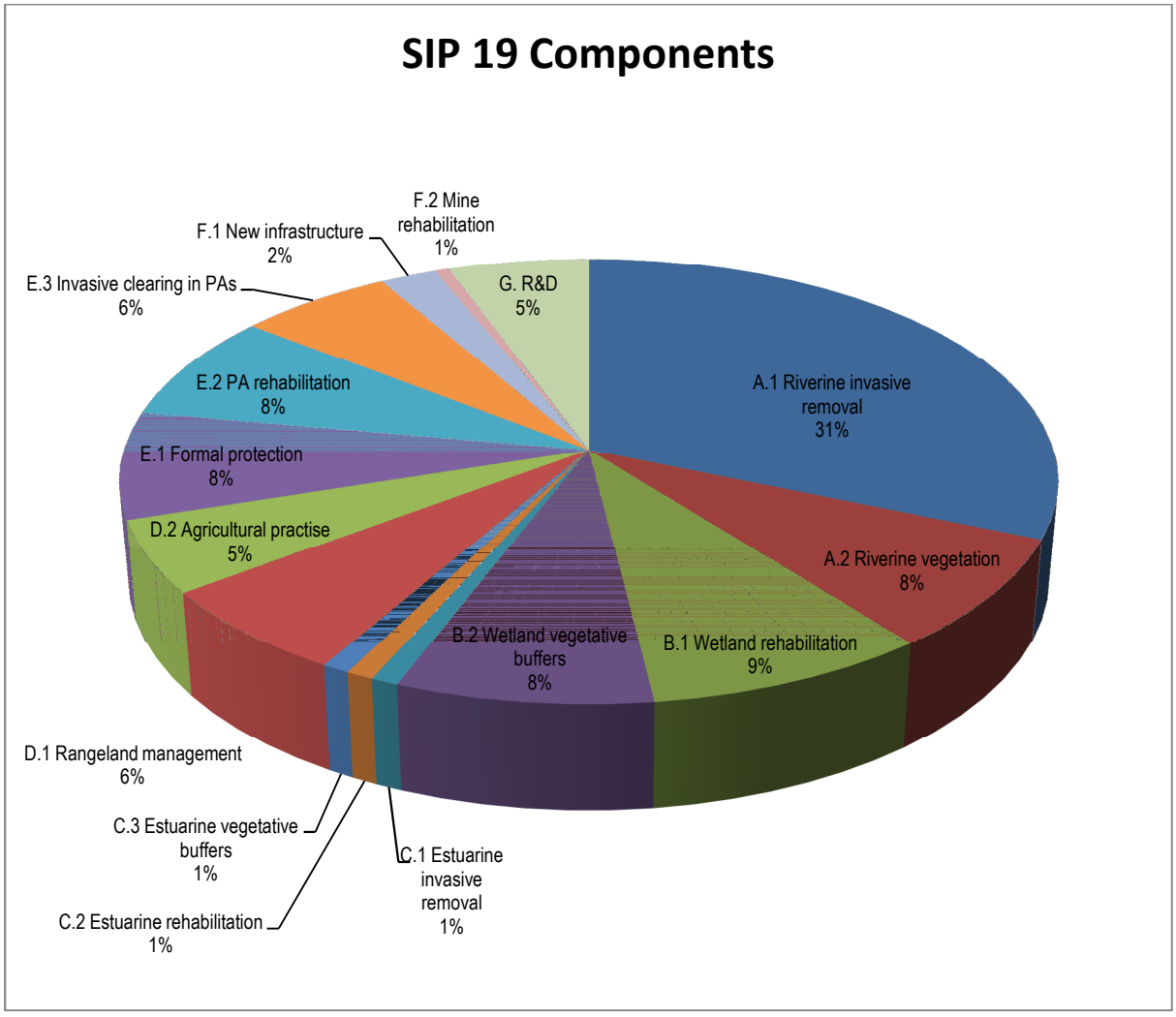

Figure 19: Distribution of the SIP 19 intervention types

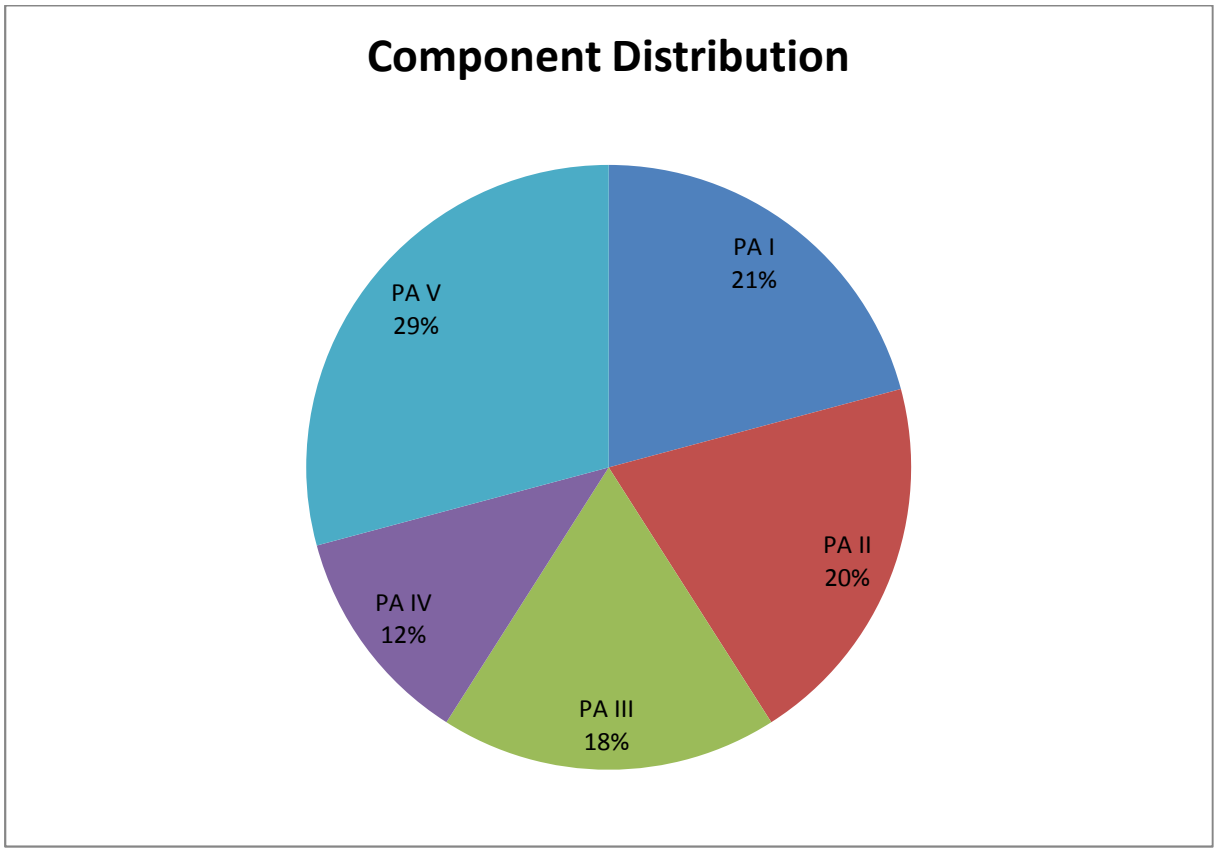

Figure 20: Distribution of the SIP 19 Components within the 5 Priority Areas

11. STATUS

As detailed above (see 5, page 32), Government has already invested, and continues to invest, a significant amount of resources in programmes that address ecological infrastructure restoration, maintenance and rehabilitation.

The following provides a brief summary of various interventions that are likely to either fall under the auspices of SIP 19 or, at least, inform SIP 19 implementation.

11.1 The Natural Resource Management (NRM) Programmes

As noted in section 5.3 (page 35), investments in ecological infrastructure aimed at improving water security in South

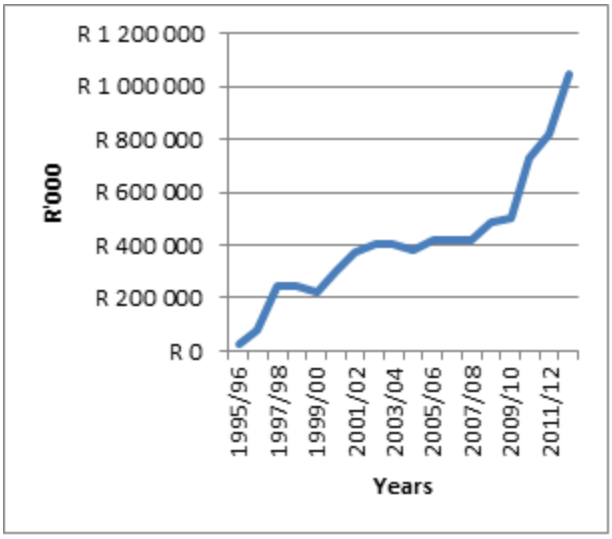

Figure 21: Investment in the Working for Water and sub-programmes since its inception in 1995.

Africa have been developed primarily through government's Working for Water (WfW) Programme.

WfW was launched in 1995 as a response to chronic unemployment in rural areas combined with the threat posed by alien invasive species to scarce water resources and the biodiversity of riparian habitats, montane grasslands and fynbos in which many of South Africa's rivers rise. Since the creation of the WfW, government has developed complementary programmes that also focus on poverty alleviation, biodiversity conservation and water provision, such as Working on Fire, Working for Land and Working on Wetlands.

These programmes are driven by the Department of Environmental Affairs (DEA) and they work in partnership with local communities, to whom they provide jobs, and also cross-sectorally with Government departments including the national departments of Water, Agriculture, Forestry and Fisheries, Trade and Industry, provincial departments of agriculture, conservation and environment and research foundations and private companies.

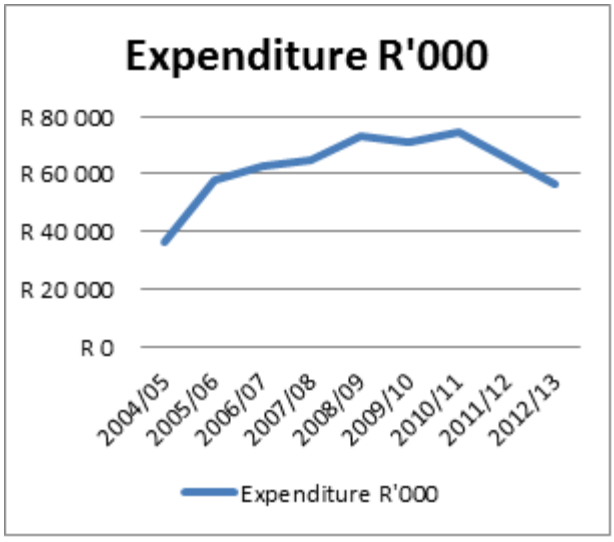

Figure 22: Investments in the Working for Wetlands Programme since 2004.

Since its inception the programme has cleared more than 2.5 million hectares of invasive alien plants providing jobs and training to an average of more than 24 000 people per annum from among the most marginalized sectors of society.

The Working on Wetlands programme aims to facilitate the conservation, rehabilitation and sustainable use of wetland ecosystems, while at the same time fulfilling functions such as poverty alleviation, job creation, training and empowerment.

The Working for Land similarly carries out rehabilitation and restoration efforts at a broader landscape level with additional emphasis placed on carbon sequestration and sustainable harvesting benefits.

Working on Fire is another investment which is a public-private partnership aimed at promoting an integrated approach to veld and forest fire management in South Africa, and involves collaboration between a number of national departments, statutory bodies, the private sector and civil society. It integrates fire management with biodiversity

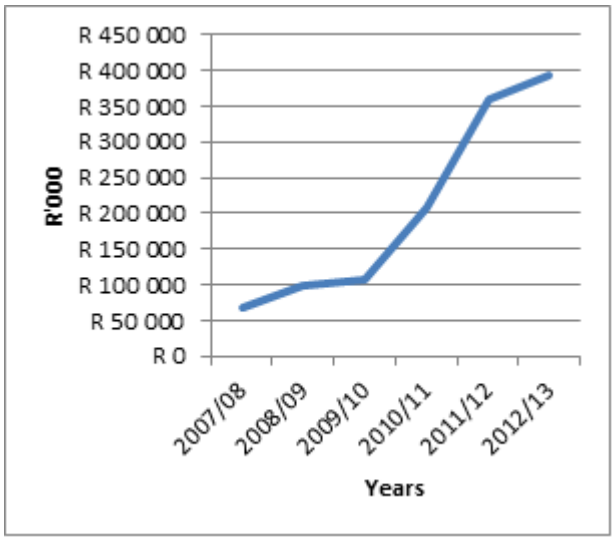

Figure 23: Annual Investment in Integrated Veld and Forest Fire Management between 2007/08 and 2012/13

conservation, the maintenance of ecosystem services, livelihoods strategies, training and research.

There is general consensus that WfW has been a major success in terms of restoring water supplies in areas heavily infested by alien invasive species. It is estimated that the 2.5 million hectares of land that has been cleared since inception is believed to have resulted in a total saving of some 1 444 million m^3/yr or 2.88% of the naturalised mean annual runoff. Furthermore, apart from the programme's jobs creation and training and skills impacts, it has also been used as an entry point for HIV/AIDS awareness programmes.

11.2 The National Freshwater Ecosystem Priority Areas (NFEPAs)

The National Freshwater Ecosystem Priority Areas (NFEPAs) are a set of strategic spatial priorities for conserving water ecosystems and supporting the sustainable use of water resources. Development pressures result in it not always being possible to maintain all water ecosystems in good ecological condition (i.e. in an A or B present ecological state). However, in order to support the health and sustainability of water ecosystems and thus the provision of water-related ecosystem services, a certain proportion of water ecosystems need to be maintained in good ecological condition. The NFEPAs represent such a set of ecosystems, derived systematically and proactively, in the most efficient configuration, based on the best available science.

In the regard, the project to generate maps of NFEPAs has been completed. These maps are available from SANBI and the Water Research Commission in hard copy and electronically, both as image files and as shape files that can be manipulated in GIS. In addition to the maps, two supplementary reports have been published:

- A technical report, which explains the scientific methods and stakeholder engagement process used to create the map products and the analysis of legal and institutional mechanisms available for implementing NFEPA products
- An implementation manual that provides guidance on how to use the FEPA maps in the water sector, the biodiversity sector and other key sectors whose planning and decision-making impacts on freshwater ecosystems

The Strategic Water Source Areas map used to inform the priority spatial areas for the SIP also had its origins in the NFEPA development process (see Figure 10, page 41).

The NFEPA maps provide a single, nationally consistent information source for incorporating water ecosystem goals into planning and decision-making processes. Not every FEPA can automatically be considered key ecological infrastructure, but when combined with other information sources (e.g. the map of Strategic Water Source Areas), the NFEPA maps remain a primary input in the identification of ecological infrastructure of significance for water security. The maps support integrated water resource management by providing guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act. This does not mean FEPAs should be restricted from human use, but rather that they should be supported by good planning, decision-making and management to ensure that human use does not impact unduly on the condition of the resource.

The Strategic Water Source Areas form the foundational ecological infrastructure on which a great deal of built infrastructure for water services depends. They are therefore strategic national assets that are vital for water security, and need to be acknowledged as such at the highest level across all sectors. SIP 19 represents a tremendous opportunity to further embed this thinking into policy and practice.

Deterioration of water quality and quantity in these areas can have a disproportionately large impact on the ability of DWAS to ensure the provision of reasonable quantities of good quality water at acceptable assurance of supply. Appropriate management of these areas, which occupy only a small fraction of the country's total land surface area, can therefore produce significant returns in terms of water quality and quantity. Investing in Strategic Water Source Areas is also an important mechanism for long-term adaptation to the effects on climate change on water provision growth and development.

11.3 Water security – The uMngeni ecological infrastructure partnership

Water from the uMngeni catchment is the cornerstone of the eThekwini and uMgugundlovu municipality's growing economies. However the demand for water is now well beyond the available supply according to the 2009 Water Reconciliation Strategy for the KZN Coastal Metropolitan Areas. In response to this, a series of expensive engineering solutions have been identified and are in the process of being implemented. These include, amongst others, the construction of inter-basin transfer schemes in the adjacent catchments of the Mooi and Mkomazi Rivers. However, it is recognised that these interventions will ultimately not be sufficient to address the water rapidly growing demand.

This situation has prompted eThekwini's Water and Sanitation department to explore alternative solutions to address water security. A growing body of evidence has shown that investing in ecological infrastructure can enhance the efficiency of water service delivery through improving water quality, reducing sediment loads, reducing flood risk and increasing yield through increased winter baseflows. This in turn augments and enhances the efficiency of the engineering investments. The management and restoration of ecological infrastructure in the catchment therefore has huge potential to address some of the most pressing water quantity and quality problems in the catchment.

River bank restoration work carried out by Working for Water on a stretch of the uMngeni River downstream of the Albert Falls Dam has illustrated the delivery of these services through a significant improvement in water quality at a fraction of the cost currently being incurred by the Water Services Authorities in the catchment. This work has shown that for approximately 10% of the current water treatment spend, much of the length of the uMngeni River's riparian area could be restored and maintained through initiatives such as Working for Water, which would result in ecological restoration, improved delivery of water services, and the employment of local people.

The Greater uMngeni River Catchment, together with the upper Mooi and Mkomazi River Catchments, still have a substantial amount of their land surface (approximately 64%) that is in a relatively natural condition and which therefore retains its potential to deliver the water related ecological services listed above.

The South African National Biodiversity Institute (SANBI) and the eThekwini Municipality's Water and Sanitation Department together with the KwaZulu-Natal Regional Office of the DWAS, Umgeni Water and the Water Service Authorities of the uMgungundlovu District and Msunduzi Local Municipalities, have spearheaded the establishment of a partnership to foster better collaboration and coordination of ecological infrastructure investments aimed at improving water security in the greater uMngeni catchment. The partnership is comprised of 36 government and civil society organisations that have finalised a memorandum of understanding for the establishment of the uMngeni Ecological Infrastructure Partnership (UEIP). The UEIP presents an opportunity to tangibly demonstrate the benefits of ecological infrastructure investments and its relevance to the South Africa's broader water security challenges. Lessons from this catchment can then be replicated in other areas of strategic significance in the country.

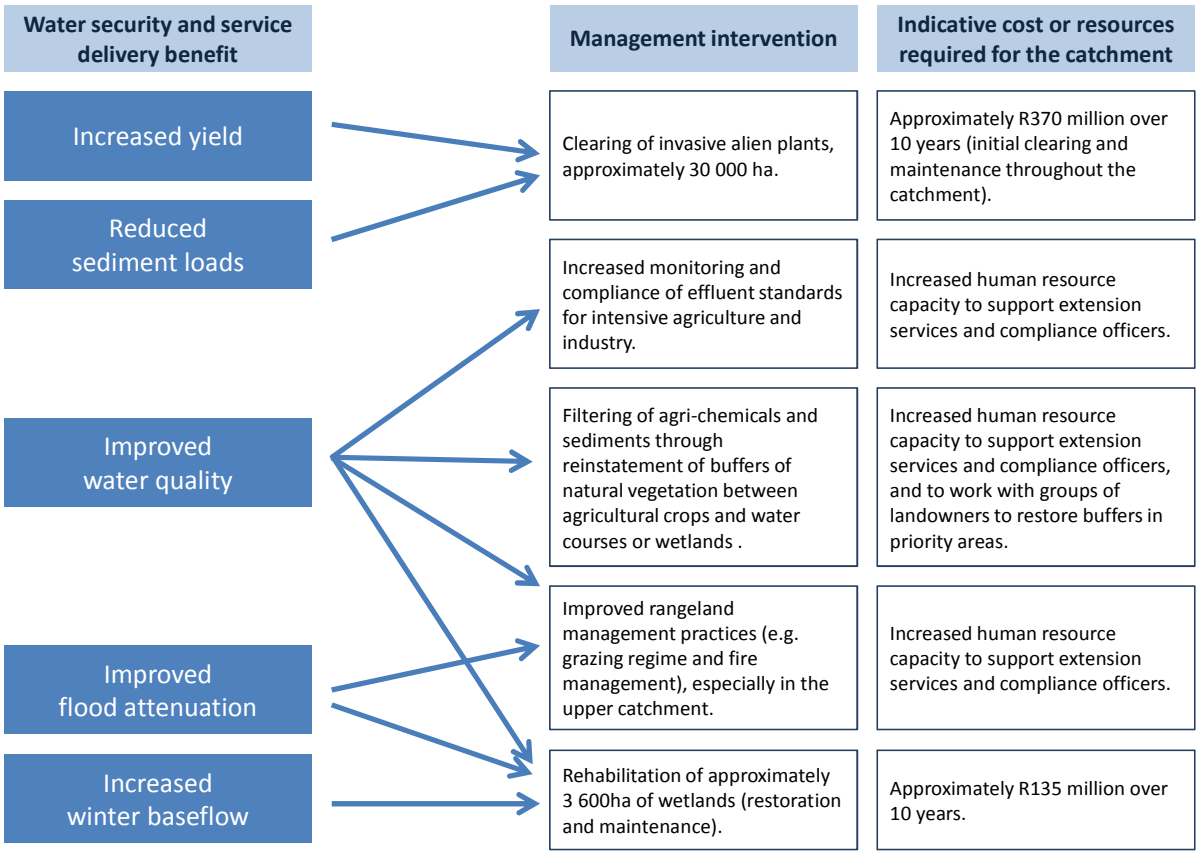

Figure 24: An overview of the envisaged interventions, resources and benefits associated with the uMngeni ecological infrastructure partnership.

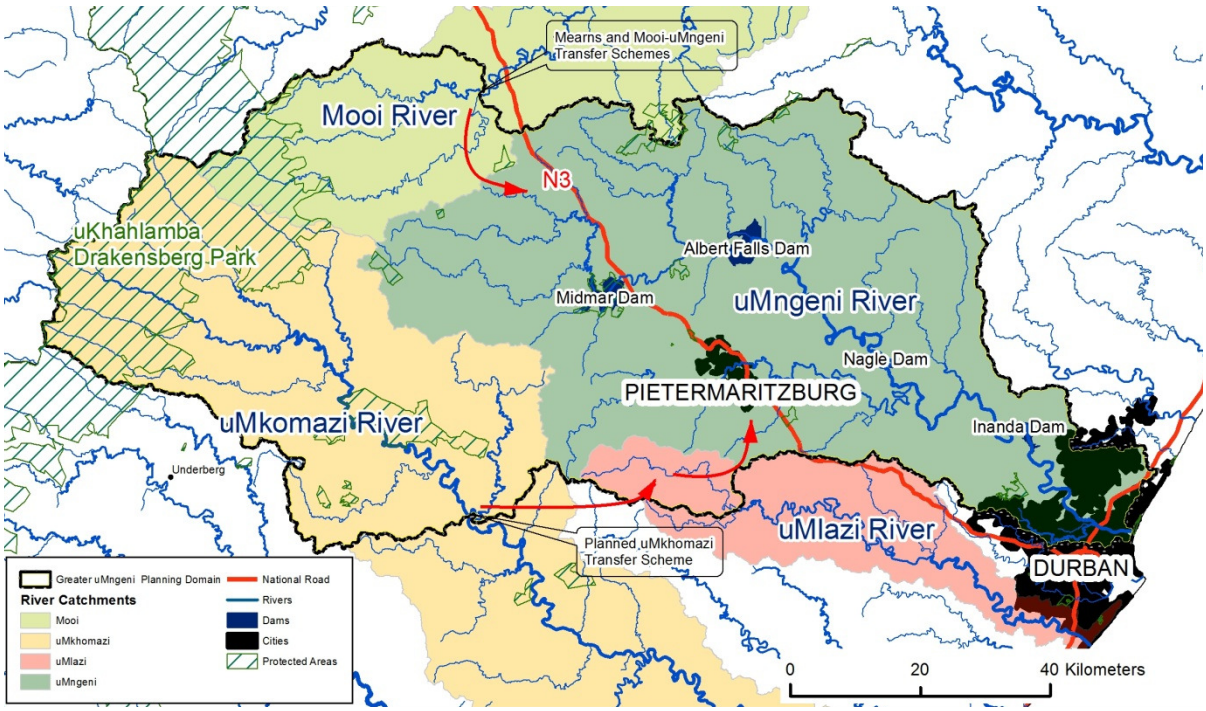

Figure 25: Map of the area that is the focus of the uMngeni ecological infrastructure partnership.

11.4 Building climate change resilience in the greater uMngeni catchment

The Building climate change resilience in the greater uMngeni catchment project is a project that has been selected through SANBI, as South Africa's National Implementing Entity (NIE) to the Adaptation Fund, to receive funding from the Adaptation Fund. The project was endorsed for further development at the 21st Adaptation Fund Board meeting, which was held early in July 2013. The next few months will see SANBI and the uMgungundlovu District Municipality (UMDM) engaging in a stakeholder consultation process that will inform detailed project design. If successful, implementation will start in 2015.

The overall objective of the project is to reduce climate vulnerability and increase the resilience and adaptive capacity in rural and peri-urban settlements and small-scale farmers in productive landscapes in the UMDM that are threatened by climate variability and change, through an integrated adaptation approach. The project will adopt a suite of complementary project interventions, focussing on: a) early warning and response systems; b) a combination of ecological and engineering infrastructure solutions specifically focused on vulnerable groups in rural and peri-urban settlements; c) integrating climate variability and change responses into agricultural practices and infrastructure; and d) disseminating adaptation lessons learnt and policy recommendations, to facilitate up-scaling and replication.

The proposal presents four components:

- Component 1: Early warning systems (US$ 805,750): Early warning and response systems improve preparedness and adaptive capacity of local communities and small-scale farmers drawing on and integrating scientific and local knowledge
- Component 2: Climate-proof settlements (US$ 2,893,375): A combination of ecological and engineering solutions reduces vulnerability of rural and peri-urban communities to existing and anticipated impacts of climate variability and change

- Component 3: Climate resilient agriculture (US$ 2,490,500): Small-scale farmers have improved resilience and reduced vulnerability to existing and anticipated impacts of climate variability and change
- Component 4: Lessons learnt (US$ 439,500): Dissemination of adaptation lessons learnt and policy recommendations facilitates up-scaling and replication.

The uMgungundlovu District Municipality (UMDM) has been identified as the Executing Entity for the uMngeni catchment project.

11.5 The Berg River Improvement Plan (BRIP), an inter-governmental relations partnership

The Berg River catchment is home to cultivated agricultural land, mainly vineyards, fruit trees and wheat fields. 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. About 75% of the crop produced in the catchment is exported to the European Union and the United Kingdom (UK).

Water quality in the Berg River catchment of the Western Cape is, however, a cause for concern, especially to communities, farmers and industry in the various municipalities of the West Coast and Cape Winelands regions. In response, various stakeholders have implemented initiatives to address a number of the water pollution problems in the catchment.

The Western Cape Government recently developed and endorsed the implementation of a Berg River Improvement Plan (BRIP) to address water security concerns (i.e. quality and quantity) in the Berg River catchment.

The vision of the plan is –

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

The ultimate aim is to change the lives of people in the Berg River catchment through the implementation of simple interventions. The desired outcome of the BRIP will be a Berg River that underpins sustainable growth and development towards a green economy in the Western Cape largely as a result of, among others, effective ecological infrastructure function and the concomitant delivery of watershed services in particular and various environmental goods and services in general. The plan identifies short (≤ 5 years) and long term (5 – 30 years) interventions, and their financial implications.

The objectives of the 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.

A, so-called, "systems approach" which addresses all human activities that impact on the Berg River catchment in an integrated manner, has been selected as the method of choice to achieve the objectives and benefits associated with the plan (see Figure 27). A Steering Committee, comprising of various Departments and agencies from the National (Water Affairs and Sanitation; Working for Water (WfW)), Provincial (Environmental Affairs and Development Planning (DEADP); Local Government (DLG); Human Settlements (DHS); Agriculture (DoA); Economic Development and Tourism (DEDAT); CapeNature; GreenCape) and Local Government (Municipalities), have identified the six (6) key tasks to achieve the objectives. The Steering Committee meets every fortnight to monitor and ensure the successful implementation of these tasks:

Figure 26: The Berg River catchment.

R300m to restore Berg River water quality

IT will cost in the region of R300 million to remove alien vegetation from the Berg River that's drastically affecting the water quality.

The Berg River, 294km long, runs through several agricultural communities and is an important element in the development of the tourism industry in areas between Franschhoek and Velddrif.

Iaan Badenhorst, manager and resident at the Berg River Resort, said debris (mainly logs) and alien vegetation were the biggest problems in the Paarl area.

"The vegetation takes oxygen out of the water and affects the ecosystem. The government needs to put money into solving the problem when it can still be solved. This river is essential to farmers.

"Their business depends on the quality of the water. If it isn't right the EU cancels export contracts, which is a major loss to the farmer and the local economy," he said.

A spokesperson for the Western Cape Department of Agriculture, Francis Steyn, said the river's degraded ecosystem was not being managed correctly and would "drastically affect" human health, the rural economy and ecosystem if nothing was done.

"The problem we are addressing is caused by alien vegetation dominating the river system and replacing all the indigenous plants that make the natural system a healthy one with water of good quality."

Steyn said the degraded system affected the entire population of the Western Cape because of the massive amount of work, food and exports produced in the river basin. He said it would cost R30m a year for the next 10 years to improve. The initial funding for the regeneration project came from the Department of Agriculture, which would soon be financially assisted by the Department of Water Affairs and Forestry's Working for Water Programme.

Since the project started, it had created more than 3 000 jobs.

Source: IOL

- Task 1: Implement a Berg River Water Quality Monitoring Regime
- Task 2: Upgrade Wastewater Treatment Works and Train Process Controllers
- Task 3: Upgrade Informal Settlements
- Task 4: Advocate Best Practice in Agricultural and Agro-Industrial Processes

- Task 5: Riparian Zone Rehabilitation and Bioremediation
- Task 6: Pricing Water Management in the Berg River Catchment

The Tasks are at various stages of implementation (see Figure 28), particularly since Departments and Municipalities have been upgrading Wastewater Treatment Works (Task 2; WWTWs), developing plans to upgrade informal settlements (Task 3), as well as implementing projects on water use efficiency (Task 4; www.fruitlook.gov.za) and clearing alien vegetation in the Berg River catchment (Task 5).

The approach taken for implementing Task 1 is that of, *"one can only manage if one knows its status"*; therefore, to manage water quality, one has to monitor water quality if one is to address water security in the Berg River catchment successfully.

The resource condition target is that –

> *"E. coli, suspended sediment and nutrient (dissolved inorganic nitrogen – DIN; phosphates) levels in receiving waters meet the Target Water Quality Range (TWQRs) of the SA Water Quality Guidelines".*

As an initial step, the DEADP developed a River and Estuarine Monitoring Plan for the Berg River catchment, where a total of 20 sampling sites have been identified, in collaboration with DWAS. Sampling sites identified will be monitored from 2013 onwards for trace metals and residuals of pesticides in water and sediment of the Berg River and Berg Estuary, as well as for *E. coli*, where applicable to Task 5. Further, the Drakenstein Municipality is implementing its recently developed Ideal Sampling Plan for Water Quality Monitoring, while the Bergrivier Municipality also monitors water quality parameters in its jurisdiction. All water quality data will feed into the existing DWAS database on water quality monitoring, as part of implementing the systems approach towards managing water quality in an integrated manner in the Berg River catchment.

A "Genius of Place" project that focuses on biomimicry (described as "using nature's processes in a sustainable, efficient and powerful way to achieve environmental stewardship and benefit for all") has been initiated by DEDAT, as part of upgrading an informal settlement in the Berg River catchment in Task 3. This links with the resource condition target that "identified informal settlements are upgraded". Phase 1 (2012/2013) of the project focused on identifying specific interventions for implementation, based on expert opinion; while Phase 2 (2013/2014) is currently identifying the informal settlement where the Genius of Place intervention(s) can be implemented. The project is currently in its infancy and aims to use biomimicry to reduce pollution impacts on the Berg River catchment.

Alien vegetation clearing and rehabilitation of the riparian zone, key to Task 5, is currently underway through collaborative initiatives undertaken by CapeNature and WfW, as well as through DEADP and DoA. The interim management action target is to improve groundcover and riparian vegetation to reduce agricultural runoff; while the resource condition target is to reduce *E. coli*, suspended sediment, nutrients (dissolved inorganic nitrogen – DIN) and pesticide loads to receiving waters. Cleared riparian zones in the Hermon area have been replaced with indigenous vegetation collected in the catchment and grown at the Kluitjieskraal Nursery.

Workers from the Hermon/Tulbagh area were appointed to propagate and plant the indigenous vegetation as part of the Expanded Public Works Programme (EPWP). Approximately 4 FTE jobs were created during 2012/2013 with this number increasing during the 2013/2014 financial year.

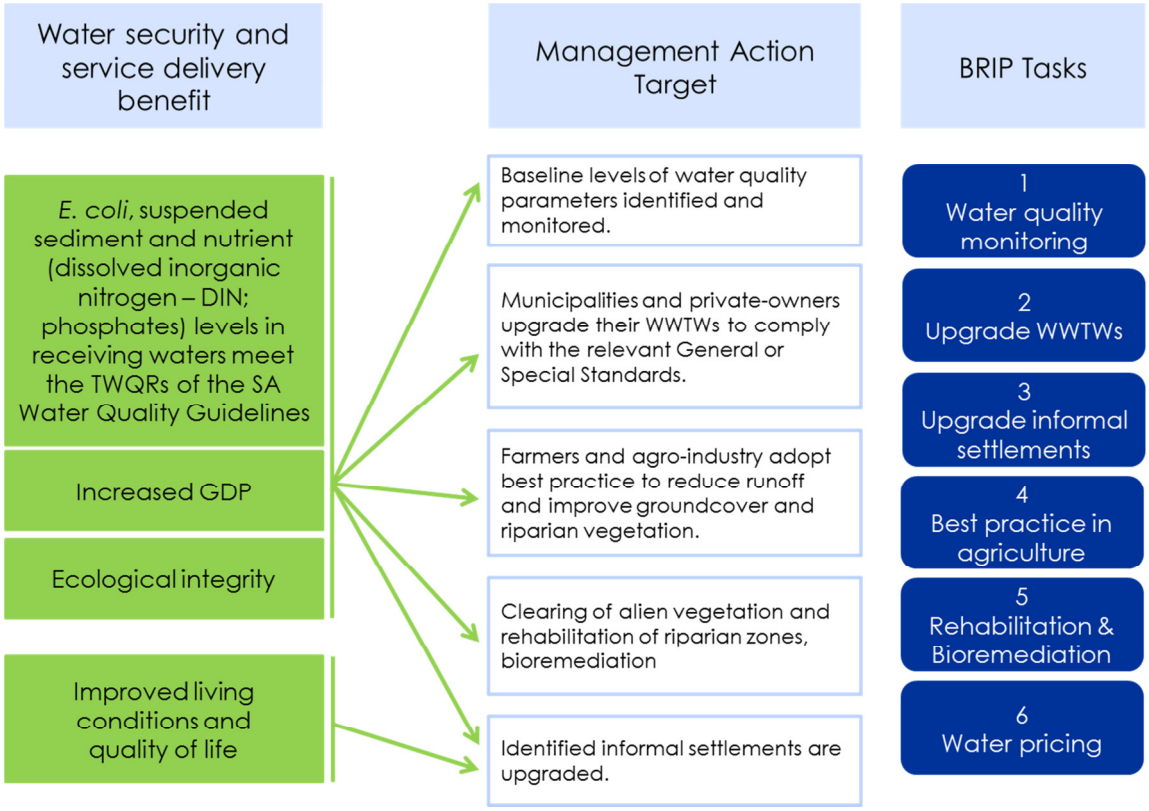

Figure 27: An overview of the envisaged management actions, tasks and benefits associated with the Berg River Improvement Plan partnership (TWQR = Target Water Quality Range).

It was previously estimated that pollution will have a significant impact on the economy, unemployment and social services in the Berg River catchment. As such, the management action target in terms of pricing the value of water in the Berg River catchment (Target 6) is to achieve an "increased GDP in the Berg River catchment". The DEDAT and DEADP is working collaboratively to develop scenarios on the cost of pollution in the Berg River catchment, by initially focusing on how much water is used by the region's economy, and where and how it is used. An analysis of water consumption across the economy will be linked to measures of economic productivity (i.e. water use / GDP contribution). Further, the cost of action versus inaction will be modeled using various scenarios. The ultimate aim is to design and implement interventions to alleviate the constraints in the Berg River catchment.

Overall, the lessons by following a systems approach in this catchment will be replicated in other catchments of strategic significance in the Western Cape.

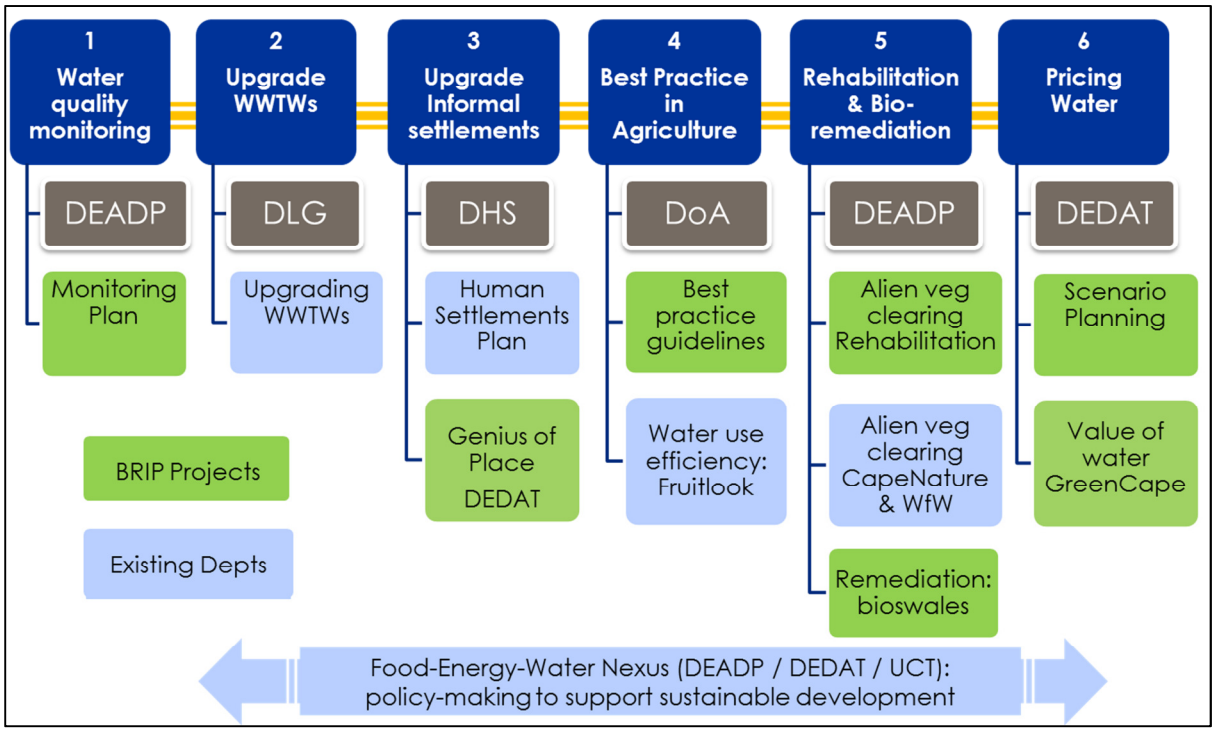

Figure 28: Alignment of new BRIP projects (green) and existing Departmental projects (blue) to Tasks 1 – 6.

11.6 National Protected Area Expansion Strategy for South Africa 2008

The National Protected Area Expansion Strategy for South Africa: Priorities for Expanding the Protected Area Network for Ecological Sustainability and Climate Change Resilience of 2008 notes that South Africa's protected area network currently falls far short of sustaining biodiversity and ecological processes. In this context, the goal of the National Protected Area Expansion Strategy (NPAES) is to achieve cost effective protected area expansion for ecological sustainability and increased resilience to climate change. The NPAES highlights how we can become more efficient and effective in allocating the scarce resources available for protected area expansion. It sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion.

Protected areas are areas of land or sea that are protected by law and managed mainly for biodiversity conservation. Protected areas recognised in the National Environmental Management: Protected Areas Act (Act 57 of 2003) is considered formal protected areas in the NPAES. The Protected Areas Act provides for several categories of protected areas, including special nature reserves, national parks, nature reserves and protected environments.

Protected areas are vital for ecological sustainability and climate change resilience, serving as nodes in our ecological infrastructure network. This natural infrastructure is largely free, so often unnoticed or under-appreciated, but it is just as important as our extensive built infrastructure network and our social infrastructure for underpinning human livelihoods and wellbeing. South Africa has a unique opportunity to take a global lead in giving protected areas a central role in our climate change response strategy. To achieve this, the terrestrial bias of the protected area network will need to change to ensure effective inclusion of river ecosystems, wetlands, estuaries and marine ecosystems.

Through the protection and management they provide for priority ecosystems and catchments, protected areas help to secure the provision of important ecosystem services, such as production of clean water, flood moderation, prevention of erosion, carbon storage, and the aesthetic value of the landscape. Marine protected areas play a particularly important role in keeping our fisheries sustainable.

Protected areas can support rural livelihoods and local economic development. Especially in marginal agricultural areas, evidence to date suggests that conservation-related industries have higher economic potential than regular agricultural activities such as stock farming.

The NPAES sets out a framework for the expansion of the protected areas network in South Africa in order that a representative sample of biological diversity and ecological processes may be conserved and managed. The current protected area network does not cover a representative sample of biodiversity in the country.

Key targets identified for terrestrial areas are:

- An additional 2,7 mil ha or 2.2% needs to be added to the current system by 2012 to address effective conservation of biodiversity in South Africa, and
- An additional 10,8 mil ha or 8.8% needs to be added to the current system by 2028 resulting in a total land surface under conservation of 12.2%

There are three main mechanisms for expanding the land-based protected area network: acquisition of land, contract agreements, and declaration of public land. Each one has an important role to play, with contract agreements being used increasingly.

Protected area agencies, including provincial conservation authorities, South African National Parks (SANParks), World Heritage Site Authorities and the Oceans and Coasts Branch of DEA (O&C), are the primary implementers of the NPAES, and should each develop an agency-specific protected area expansion implementation plan based on the NPAES targets and focus areas. The revitalised Protected Areas Forum will ensure alignment of the efforts of the multiple agencies involved in protected area expansion, provide a forum for discussing challenges and sharing lessons, and track progress towards meeting protected area targets. Establishing and strengthening provincial biodiversity stewardship programmes is an institutional priority for provincial conservation authorities and for DEA.

A number of protected areas are already within the identified “Water factories”. With reference to the following protected areas:

Table 6: Protected areas that are already within the identified “Water factories”.

Key “Water Factory”	Protected areas
Wolkberg	Wolkberg Nature Reserve
	Lekgalametse
Mpumalanga Drakensberg	Blyde Canyon Nature Reserve
Pongola Drakensberg	Kwamandlampisi Protected Environment
Northern Drakensberg	Golden gate Highlands National Park
Southern Drakensberg	uKhalhamba Drakensberg World Heritage Site
Eastern Cape Drakensberg	Proposed Grassland Park (Not declared yet)
Amatole	Link between Mountain Zebra and Camdeboo National Parks
Cape Fold Belt	Garden Route National Park

Key "Water Factory"	Protected areas
	Cape Floral World Heritage Site
Boland Mountains	Cape Floral World Heritage Site
Groot Winterhoek	Cape Floral World Heritage Site

One of the main areas of shortcomings identified in the current NPAES, was specifically on important freshwater areas critical to be added to the protected area system. Therefore research is needed on ecologically meaningful biodiversity thresholds for marine, estuarine and freshwater ecosystems. It was also identified that methods to integrate terrestrial, freshwater, estuarine and marine spatial planning to identify integrated priorities for protected area expansion needs to be developed.

Key information gaps for the NPAES include an accurate spatial layer of existing protected areas, maps and classifications of marine ecosystems and habitats, a complete national wetlands map, and a national spatial data layer on land ownership and tenure. Research needs include further exploration of the role of protected areas in supporting climate change resilience, ecologically meaningful biodiversity thresholds for aquatic ecosystems, innovative ways to consider land price and opportunity costs in the identification of priority areas for protected area expansion, past and present trends in the funding of protected area expansion and likely costs of different mechanisms for protected area expansion into the future, the relative income and job creation potential of regular agriculture compared with protected areas and ecotourism, and research to support and evaluate pilot projects in which biodiversity stewardship agreements are used to support land reform and rural development.

12. IMPACT

Naturally the key impact the SIP 19 is designed to produce is in respect of improved water security. Table 7 provides a summary of the expected water-related impacts of the various components described above (see 10, page 48).

Table 7: Summary of the expected water-related impacts of the various SIP 19 components

SIP 19 Component	Key Impact on Water Security
Clearing invasive alien plant infestations, especially in mountain catchments and riparian areas (and estuaries)	Decreased water used by "water hungry" alien species resulting in increased water yield
The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation along streams, rivers and estuaries	Decreased flood damage to river banks and surrounding land resulting in reduced silt loads and, hence, increased water quality and water yield
The restoration, rehabilitation and/or maintenance of wetlands	Filtration of water resulting in improved water quality
The restoration, rehabilitation and/or maintenance of estuaries	Improved aquatic productivity
The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation between agricultural crops and rivers or wetlands	Reduced siltation of wetlands and silt loads in rivers resulting in increased water quality and water yield
The improvement in rangeland management practices (e.g. grazing regime and improved fire management)	Reduced soil erosion resulting in reduced silt loads and, hence, increased water quality and water yield
The improvement of agricultural practices (e.g. improved tillage, contour ploughing, organic agriculture, etc.)	Reduced soil erosion resulting in reduced silt loads and, hence, increased water quality and water yield
The formal protection of key catchment areas as part of the expansion of South Africa's conservation estate	Improved watershed services including increased water quality and water yield

SIP 19 Component	Key Impact on Water Security
The reinstatement, restoration, rehabilitation and/or maintenance of grass- and wood-lands, especially in upper-catchment areas	Improved watershed services including increased water quality and water yield
The establishment of natural filtration infrastructure, i.e. built wetlands, to purify various small sources of polluted inflows into streams and rivers (e.g. acid mine drainage (AMD) from old mining works, livestock farms, waste dumps, etc.)	Filtration of water resulting in improved water quality
The rehabilitation of land affected by derelict and ownerless mines	Improved watershed services including increased water quality and water yield

In terms of the non-water related impact envisaged from SIP 19, the programme is designed to have a positive impact on all of the key SIP focus areas to a greater or lesser extent as summarised in Table 8 and described in more detail below.

Table 8: Summary of the potential contributions of SIP 19 to the general SIP programme impact focus areas

SIP Programme Impact Focus Areas	SIP 19 Contribution
Job creation	Potentially Significant contribution
Addressing Spatial imbalances	Potentially Significant contribution
Promoting rural development	Potentially Significant contribution
Industrial development and localisation	Minor contribution
Economic performance of poorest provinces	Potentially Significant contribution
Greening economy	Potentially Significant contribution
Regional integration	Potentially Significant contribution

12.1 Job Creation

Unlike built or technological infrastructure that is usually constructed with-, maintained by-, and/or consists of- machines, the development, restoration, rehabilitation and/or maintenance of ecological infrastructure is best suited to manual labour. Simply put, you develop, restore, rehabilitate and/or maintain ecological infrastructure with people, not bulldozers.

As acknowledged in the National Development Plan (NDP 2030) and elsewhere, labour-based public works programmes are significant providers of part-time and full-time jobs. Indeed, NDP 2030's Action 6 specifically calls for the broadening of the expanded public works programme (EPWP) to cover 2 million fulltime equivalent jobs by 2020. In the section on "Active labour-market policies" in Chapter 3: Key Drivers of Change, the NDP 2030 states that several labour-market experiments will be put into action from 2012 including the following proposal, among others, to strengthen labour matching and increase skills development and supply: "extend the non-state-sector Expanded Public Works Programme's employment incentive, aimed at increasing employment in non-profit organisations." Furthermore, in its section on "Public employment schemes" in the same chapter, the NDP 2030 notes that –

> *"The problem of unemployment and underemployment has become too big for market-based solutions to solve in the next 10 to 20 years. There is no doubt that market-based employment is the most sustainable source of job creation, but in even the most optimistic of scenarios, many people are likely to remain out of work. Low productivity, nonmarket services such as expanded public works*

projects in government construction, care, self-help projects and survivalist activities are generically called public employment schemes. The public employment programmes should target the creation of 2 million opportunities annually by 2020 or earlier, if possible. The central challenge is to identify institutional approaches that will enable this scale of achievement."

Government's New Growth Path (NGP) sets a target of growing employment by five million jobs by 2020 (around three million more than the anticipated growth if we extrapolated from 2002 to 2009) thereby ensuring that over half of all working-age South Africans would have paid employment and resulting in narrow unemployment dropping by 10 percentage points from 25% currently to around 15%. To this end, the NGP identifies the following "jobs drivers" –

- Substantial public investment in infrastructure both to create employment directly, in construction, operation and maintenance as well as the production of inputs, and indirectly by improving efficiency across the economy;
- Targeting more labour-absorbing activities across the main economic sectors – the agricultural and mining value chains, manufacturing and services;
- Taking advantage of new opportunities in the knowledge and green economies;
- Leveraging social capital in the social economy and the public services; and
- Fostering rural development and regional integration.

In each of these areas, the NGP notes that special efforts will have to be made to generate opportunities for young people, who face the highest unemployment rate.

The categories of the jobs drivers are not set in concrete – new opportunities may emerge that are not foreseen, assumptions on which existing opportunities are based may change - nor are they fully independent of each other. For instance, the green economy requires profound changes in energy infrastructure, while rural development depends in large part on infrastructure, agriculture and tourism. The aim is not to focus on categorisation, but rather to use the mapping process to think innovatively about new opportunities for employment creation. A critical element of the New Growth Path is to ensure that the drivers leverage and reinforce each other based on their inter-linkages.

As a first step, the NGP prioritises efforts to support employment creation in the following key sectors:

- infrastructure
- the agricultural value chain
- the mining value chain
- the green economy
- manufacturing sectors, which are included in IPAP2, and
- tourism and certain high-level services.

These opportunities will take advantage of the potential of new approaches in the other jobs drivers, notably regional integration in Africa and the knowledge and social economies.

In many areas of the jobs drivers, departments have already initiated strategies to support employment creation; in others, they are currently reviewing their policies and programmes.

For each of the jobs drivers, there is a set target for employment creation. These targets are believed to be achievable if a supportive environment can be assured as well as the implementation of specific support measures.

With specific reference to SIP 19, Table 9 provides a summary of how SIP 19 could contribute to the implementation of the NGP.

Table 9: Summary of how SIP 19 could contribute to the various New Growth Path (NGP) Jobs Drivers

New Growth Path Identified Jobs Drivers	Possible Contribution From SIP 19
Jobs Driver 1: Infrastructure The NGP sees public investment creating 250 000 jobs a year in energy, transport, water and communications infrastructure and in housing, through to 2015. The jobs are in four activities: construction of new infrastructure (the SIPs including: electricity generation infrastructure; transport, especially rail; water-related infrastructure; communications); operation of the new facilities; expanded maintenance; and the manufacture of components for the infrastructure programme. In addition to these four activities, the impact of the massive infrastructure programme on job creation across the economy (the "multiplier effect") will be substantial. The NGP notes that it is critical for increasing opportunities in the former Bantustans, which still suffer the greatest backlogs in household services, transport and communications. In this context, the NGP sees addressing the energy and logistics challenges as proving essential for both overall competitiveness and for overcoming the spatial patterns of apartheid. The NGP identifies crucial steps to achieve the targets for infrastructure as the maintenance of high levels of public investment with a sustainable step change in investment by general government and public sector corporations, backed by investment in skills development and measures to prevent non-competitive pricing by contractors; to strengthen local procurement of inputs in order to maximise the multiplier effect, including through the development of new industries to provide for renewable energy; to use labour-based production methods where appropriate; and to target infrastructure provision to support broad-based growth and rising competitiveness linked to a coherent and sustainable strategy on rural development.	By definition, SIP 19 is an infrastructure programme. Although the concept of ecological infrastructure is relatively new, what the NGP sees for the more traditional built or technological infrastructure applies equally to ecological infrastructure. SIP 19 sees public and private investment in ecological infrastructure for watershed services as creating and sustaining numerous jobs now and into the future. The jobs will be in various activities: the restoration and rehabilitation of ecological infrastructure; the maintenance and enhancement of ecological infrastructure; and the construction of new infrastructure. Most of these jobs will be in rural areas including in the former Bantustans. SIP 19 also sees crucial steps as the maintenance of high levels of public investment with a sustainable step change in investment by general government and public sector corporations, backed by investment in skills development; to strengthen local procurement of inputs in order to maximise the multiplier effect, including through the development of new industries (e.g. products from removed exotic wood); to use labour-based production methods; and to target infrastructure provision to support broad-based growth and rising competitiveness linked to a coherent and sustainable strategy on rural development.
Jobs Driver 2: Main economic sectors The New Growth Path targets opportunities for 300 000 households in agricultural smallholder schemes plus 145 000 jobs in Agro-processing by 2020, while it sees potential to upgrade conditions for 660 000 farmworkers. Initial projections by the Industrial Development Corporation (IDC) suggest that mining can add 140 000 additional jobs by 2020, and 200 000 by 2030, not counting the downstream and side-stream effects. Much of manufacturing is included under other jobs drivers, but IPAP2 targets 350 000 jobs by 2020 in the industries not covered elsewhere. High level services can create over 250 000 jobs directly just in tourism and business services, with many more	Many jobs associated with the development, rehabilitation, restoration and maintenance of ecological infrastructure would be regarded as being agricultural jobs. Indeed SIP 19 provides a direct co-benefit in the form of agricultural sustainability which, in turn, provides a positive contribution to the NGP agricultural jobs target. As, SIP 19 also

New Growth Path Identified Jobs Drivers	Possible Contribution From SIP 19
possible in the cultural industries.	addresses the negative impacts of derelict and ownerless mines in affected areas and where such negative impacts can be addressed through ecological infrastructure-related interventions, SIP 19 also the provides an indirect positive impact on mining sustainability. Furthermore, SIP 19's possible contribution to job creation in the tourism sector should also not be discounted.
Jobs Driver 3: Seizing the potential of new economies The NGP sees technological innovation opening the opportunity for substantial employment creation and targets 300 000 additional direct jobs by 2020 to green the economy, with 80 000 in manufacturing and the rest in construction, operations and maintenance of new environmentally friendly infrastructure. The potential for job creation rises to well over 400 000 by 2030. Additional jobs will be created by expanding the existing public employment schemes to protect the environment, as well as in production of biofuels. The NGP notes that lessons from international experience point to the importance of emulation, adaptation and diffusion of existing technologies in ways that will support large-scale employment creation and improved livelihoods.	Given the specific mention of "additional jobs being created by expanding the existing public employment schemes to protect the environment", it is clear that SIP 19 specifically contributes to this NGP Job Driver.
Jobs Driver 4: Investing in social capital and public services The social economy includes myriad not-for-profit institutions that provide goods and services, including coops, non-governmental organisations (NGOs) and stokvels. The NGP believes that if the sector grew in South Africa closer to international norms, we can anticipate 260 000 new employment opportunities. The public service can also generate 100 000 jobs in health, education and policing by 2020 even if it grows by only 1% a year, as well as substantial opportunities through public employment schemes. In addition, government will set targets for growth in the public service to meet national needs. It will also establish rural, literacy, green and HIV-education youth brigades that engage up to a million young people over the next few years, combined with measures to expose young people to work experience through internships in the private and public sectors. It will also extend the Community Works Programme to more wards. Expansion of public employment will require proper budgeting and a strategy to ensure both affordability and cost effectiveness. Government is committed to developing a multi-pronged strategy to support youth employment in particular.	This is another NGP jobs driver that SIP 19 speaks to directly as it involves the expansion of, among others, public employment, in the improvement of water quality and quantity – a clear public service.

New Growth Path Identified Jobs Drivers	Possible Contribution From SIP 19
Jobs Driver 5: Spatial development While urbanisation will continue, a significant share of the population will remain in rural areas, engaged in the rural economy. Government will step up its efforts to provide public infrastructure and housing in rural areas, both to lower the costs of economic activity and to foster sustainable communities. Rural development programmes can achieve a measurable improvement in livelihoods for 500 000 households, as well as stimulating employment in other sectors. Enhancing rural employment requires finalisation of a spatial perspective that sets out the opportunities available and the choices that we must make in order to lay the basis for aligning government spending, infrastructure and housing investment and economic development initiatives. In addition, government must do more to support small-scale agriculture, including through community food gardens and marketing and service coops as well as accessible banking facilities. Regional development is an imperative for both solidarity and sustainable growth.	This too is another NGP jobs driver that SIP 19 speaks to directly as it specifically involves the creation of jobs in affected rural areas (see also 12.3 and especially 12.3.1.).

12.2 Addressing Spatial imbalances

As noted in 9.5 (see page 45), the mapping exercise that informed the selection of the SIP 19's spatial focus areas included the maps used for the other SIPs, especially those dealing with spatial imbalances. As a result of these attempts to correlate SIP 19's spatial focus areas with, for example, available information from the general SIP mapping exercise relating to public service levels and Minimum Living Levels, SIP 19 will make a positive contribution to addressing spatial imbalances.

Indeed, an extremely important observation has been made through the SIP 19 development process, namely, that often our poorest and least serviced communities are effectively the custodians of our water factories (see 9.1, page 41 and Figure 10) who receive no compensation for this custodianship from the many people who benefit most from the water. With this, SIP 19 intends to specifically address this spatial imbalance through, among others, the creation of jobs and other economic opportunities as described in 12.1 above.

12.3 Promoting rural development

As noted in the National Water Resource Strategy 2 (NWRS-2 (2013)), "water availability is a crucial input to the Rural Development Strategy." This notwithstanding, SIP 19 not only contributes to the water security necessary for successful rural development, but also provides potentially sustainable livelihoods to rural communities in prioritised water catchments (see above). In this regard, the following provides one example of how SIP 19 can contribute to sustainable rural development by way of payments for catchment protection services.

12.3.1 Payments for catchment protection services (PCPS)

Most governments, recognising the close relationship between land use and the quality and quantity of both surface and ground water, have in the past tried to influence land-use decisions through regulation. Typically, important parts of catchments were protected, while land use in other parts of the catchment was controlled through various forms of legislation. Regulatory mechanisms have generally failed to control land use, and water quality in particular has suffered. In the last decade, an approach in which stewards of ecosystems are rewarded has gained increasing recognition and interest amongst conservation and development experts. In

watershed management, payments for good stewardship are generally made by downstream users of water to upstream land managers. The applicability of payments for watershed services (PWS), or payments for catchment protection services (PCPS) as they are known in South Africa, to developing countries has been accelerated by their successful application, amongst others, in Costa Rica, New York, and the Vittel Valley, France.

In South Africa, as mentioned in various sections of this document, controlling the spread of alien invasive species is a major challenge and the removal of these invasives frees up millions of m^3 of water annually. The government's Working for Water (WfW) Programme is one type of PCPS – albeit publicly funded (see 11.1, page 54). WfW uses long-term unemployed persons, mainly from rural areas, to remove invasive alien species from catchments to reduce their negative impact on surface water.

A diagnostic report on payments for catchment protection services identified that the precedent set by Working for Water created interesting but untested opportunities for the development of privately led payments for catchment protection services. It is hoped that SIP 19 will explore how these "interesting but untested opportunities" can be explored, tested and, where appropriate, made a tangible and significant component of sustainable rural development.

12.4 Industrial development and localisation

It is broadly acknowledged that water availability is often a key constraint for industrial development and, hence, an intervention aimed at improving water security must be regarded as being supportive of industrial development. However, in terms of SIP 19's direct contribution to industrial development and localisation through, for example, the establishment of new industries and the production of products that were previously imported, its impact, by definition, is quite limited.

This notwithstanding, "localisation" is inherent to the concept of ecological infrastructure. Investments in the restoration, rehabilitation, maintenance or creation of ecological infrastructure will involve local people using local resources and, more often than not, low-tech locally produced tools and technology. Furthermore, the establishment of small-scale, and often rural, industries is often a spinoff of ecological infrastructure investments. For example, wood from removed alien invasive trees is being used for the manufacture of coffins and furniture, especially furniture like school desks.

12.5 Economic performance of poorest provinces

Improved water quantity and quality is good for the economy of all affected provinces. However, as noted in 12.2 above, the mapping exercise that informed the selection of the SIP 19's spatial focus areas included the maps used for the other SIPs, especially those dealing with spatial imbalances. As a result of these attempts to correlate SIP 19's spatial focus areas with, for example, available information from the general SIP mapping exercise relating to public service levels and Minimum Living Levels, SIP 19 will make a positive contribution to the economic performance of some of the poorest provinces.

12.6 Greening economy

By definition, investing in "ecological infrastructure" is a green economy intervention. It is clear that SIP 19 is the kind of intervention being referred to in the following quote from NDP 2030 –

New initiatives, such as those to do with agriculture in the green economy and conservation efforts, can potentially create new employment opportunities in rural areas.

This notwithstanding, there is an extremely well-researched link between, at least, some components of SIP 19 and greening the economy. DEA, in partnership with the United Nations Environment Programme (UNEP) and with support from United Nations Development Programme (UNDP), embarked on the development of a green economy modelling exercise for South Africa, with technical assistance from the Millennium Institute and the Sustainability Institute, in collaboration with the Centre for Renewable and Sustainable Energy Studies (CRSES) of Stellenbosch University. The need for this modelling work has its origin in the first national green economy summit that was held in May 2010, which was aimed at catalysing efforts towards a resource efficient, low carbon and pro-employment growth path.

The product of this work was the South African Green Economy Modelling (SAGEM) report that was developed to test national targets and the effects of investing in a green economy in South Africa. The SAGEM report was developed on the same basis as the model that underpins the UNEP Green Economy Report (GER).

The SAGEM report, developed through a consultation process, was launched by The Deputy Minister of Water and Environmental Affairs at the Durban UNFCCC COP17 in December 2011. Subsequent engagements included a stakeholder workshop in February 2012 to identify focus areas and data sources for the study, capacity building training in May 2012 for government officials and consultation on the draft report in June 2012. The workshops included participation from the sector departments, provincial and local government representatives, private sector, NGOs, and academia. The modelling report was finalised and validated to incorporate the NDP 2030 from July to November 2012.

The SAGEM report, which is based on a system dynamics modelling approach, is primarily aimed at assessing the impacts of green economy investments in selected sectors pertaining to the South African economy. Based on planned targets and expenditures and/or costs of interventions, the modelling identifies the possible options and opportunities to achieving these targets. Four scenarios were defined: (i) Business-as-usual (BAU); (ii) BAU2% representing a 2 per cent investment of gross domestic product in the BAU activities; (iii) GE2% representing an allocation of 2 per cent of gross domestic product in green economy sectors (natural resource management, agriculture, transport and energy); and (iv) the Green Economy Target Specific Scenario (GETS), which is a scenario aimed at identifying whether policy-makers can achieve the medium- to long-term targets following green economy interventions in the prioritised sectors.

The 2 selected sectors modelled by the SAGEM of direct relevance to SIP 19 are:

- ***Natural resource management*** – including interventions to decrease the land area that is infested with invasive alien species; and
- ***Agriculture*** – including interventions to increase the yield and land under agricultural production.

The modelled scenarios for these two sectors is summarised in Table 10.

Table 10: Summary of scenarios modelled for the natural resource management and agriculture sectors in the South African Green Economy Modelling (SAGEM)

Sector and Objective	Baseline scenario BAU and BAU2%	Green economy scenario 2% (GE2%)	Green economy target specific scenario (GETS)
Natural resource management Decrease the land cover infested with invasive alien species	Less aggressive investment in restoration of land under invasive alien species	An equal allocation of investment in the clearing of the invasive alien species	Target specific on investment requirement to clear the invasive alien species in the WfW programme
Agriculture Increasing the yield and land under agricultural production	Extensive utilisation of chemical fertiliser	An equal allocation of investment to the use of organic fertiliser	Target specific to the amount of land using organic fertilisers. Assumes that the expansion of land as in the National Development Plan will use organic fertiliser

Key messages from SAGEM in this regard include:

- ***Green economy contributes to natural resource management, while maintaining agricultural land size*** - Investments in the green economy simulated in SAGEM will positively contribute to additional restored land without leading to a reduction in land requirements in the agriculture sector. The GE2% scenario reveals an additional 46.4 per cent restored land by 2030 and higher water availability.
- ***Investments in natural resource management (NRM) create jobs, while increasing water supply and making biomass available for power generation -*** Employment in the NRM sector occurs both in the restoration of the water ecosystem services and in the utilization of the biomass for energy. Most of the employment, however, arises from the alien species elimination. With the GETS scenario, employment is created for 701 000 people in 2030, while the GE2% scenario is projected to create jobs for 737 000 people - higher than BAU (568 000) and BAU2% (569 000) scenarios.
- ***Investments allocated to the adoption of ecological agriculture practices (such as organic fertilizer use) provide a sustained increase of the yield per hectare, as opposed to the short-term gains from the use of conventional fertilisers –*** With these green economy investments, crop yield is projected to increase by 5.5 per cent and 23.9 per cent by 2030 for the GETS and GE2% scenarios, respectively
- ***While the increase in the yield per hectare reduces land requirements for agricultural crop production, the effect of population growth on agricultural land requirements is higher, which results in a net increase in land requirements –*** An additional benefit of avoided CO_2 emissions due to the use of organic fertilizer is observed in the GE2% scenario.

12.7 Regional integration

Water is a regionally shared resource and, hence, improvements in water quantity and quality are likely to have positive impacts on our downstream neighbours in the region. Furthermore, there is no doubt that all positive SIP 19 developments and interventions will be of interest to our neighbours which, if implemented by them, may have positive impacts for South Africa.

13. CO-BENEFITS

Although each component of SIP 19 contributes to the water security goal and purpose of the SIP, in almost all instances these interventions also provide significant co-benefits as summarised in the table below –

Table 11: A summary of the non-water related co-benefits likely to be generated by the various SIP 19 components

SIP 19 Component	Key Co-benefit
Clearing invasive alien plant infestations, especially in mountain catchments and riparian areas	Labour intensive intervention, thus high job creation potential; Raw materials for wood products, thus chance to develop new industries with good job creation potential; improved productivity of the land, thus improved economic opportunities for poverty alleviation; improved attractiveness of the land as well as biodiversity improvements, thus improved economic opportunities for poverty alleviation.
The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation along streams and rivers	Labour intensive intervention, thus high job creation potential; improved protection of the productivity of the land, thus reduced risks to economic opportunities; improved attractiveness of the land as well as biodiversity improvements, thus improved economic opportunities for poverty alleviation.
The restoration, rehabilitation and/or maintenance of wetlands	Labour intensive intervention, thus high job creation potential; Raw materials for reed products, thus chance to develop new industries with some job creation potential; improved attractiveness of the land as well as biodiversity improvements, thus improved economic opportunities for poverty alleviation.
The reinstatement, restoration, rehabilitation and/or maintenance of buffers of natural vegetation between agricultural crops and rivers or wetlands	Labour intensive intervention, thus high job creation potential; improved attractiveness of the land as well as biodiversity improvements, thus improved economic opportunities for poverty alleviation.
The improvement in rangeland management practices (e.g. grazing regime and improved fire management)	Improved livestock quality and productivity.
The improvement of agricultural practices (e.g. improved tillage, contour ploughing, organic agriculture, etc.)	Improved soil quality; improved crop yields; reduces high-cost inputs (e.g. fertilizer); high value niche products; improved carbon sequestration.
The formal protection of key catchment areas as part of the expansion of South Africa's conservation estate	Improved eco-tourism opportunities
The reinstatement, restoration, rehabilitation and/or maintenance of grass- and wood-lands, especially in upper-catchment areas	Labour intensive intervention, thus high job creation potential; improved productivity of the land, thus improved economic opportunities for poverty alleviation; improved attractiveness of the land as well as biodiversity improvements, thus improved economic opportunities for poverty alleviation.
The establishment of natural filtration infrastructure, i.e. built wetlands, to purify various small sources of polluted inflows into streams and rivers (e.g. acid mine drainage (AMD) from old mining works, livestock farms, waste dumps, etc.)	Labour intensive intervention, thus high job creation potential; reduced effluent treatment costs
The rehabilitation of land affected by derelict and ownerless mines	Labour intensive intervention, thus high job creation potential; improved productivity of the land, thus improved economic opportunities for poverty alleviation; improved attractiveness of the land as well as biodiversity improvements, thus improved economic opportunities for poverty alleviation.

14. SIP 19 INPUTS

14.1 Funding

Apart from the new funding required to manage and administer the SIP 19, the actual SIP 19 components are required to source their own funds.

Notwithstanding the above, there is a strong belief that –

- Interventions that are recognised as being part of a coordinated, coherent and focussed programme specifically aimed at ensuring a sustainable supply of fresh, healthy water to equitably meet South Africa's social, economic and environmental water needs for current and future generations stand a better chance of being funded than those that are not;
- New funding sources may be made available to recognised components of a successful programme;
- Limited financial resources may be more effectively utilised if they are used in a coordinated, coherent and focussed programme that avoids duplication and unnecessary overlap;
- New funding mechanism can be explored and tested by SIP 19.

14.1.1 Environmental Offsetting

Over the last few years government and other research bodies have been investigating the concept of environmental offsetting as an additional mechanism to address the continuous overall decline in environmental quality and is starting to view environmental offsetting as the possible "missing link" in sustainable development.

For the purposes of this discussion, the following working definition of environmental offsetting is used –

> *"An environmental offset is an intervention, or interventions, specifically implemented to counterbalance an adverse environmental impact of land-use change, resource use, discharge, emission or other activity at one location that is implemented at another location to deliver a net environmental benefit".*

From the initial work in this regard, it is clear that there are a number of environmental offset types, of which Carbon (greenhouse gas emission) offsets[11] and Biodiversity offsets[12] probably have the most relevance to SIP 19. In this regard, SIP 19 could provide a perfect vehicle to identify possible offset projects as SIP 19 components and could be used to test and refine the offsetting concept. In this way, many important SIP 19 components could be funded by

[11] An internationally applicable mechanism for counterbalancing atmospheric greenhouse gas emissions through interventions that reduce current and/or future emissions or that reduce atmospheric greenhouse gas concentrations (e.g. tree-planting).

[12] A nationally or regionally applicable mechanism that the DEA's Biodiversity and Conservation Branch and South African National Biodiversity Institute (SANBI) define as follows – "A biodiversity offset is the measurable conservation outcomes resulting from actions designed to compensate for significant negative residual impacts on biodiversity arising from project development after appropriate prevention and mitigation measures have been taken."

companies wishing, or required, to "compensate for significant negative residual impacts on biodiversity arising from project development".

14.2 Human Resources

As for funding (see 14.1 above), apart from the staff required to manage and administer the SIP 19, the actual SIP 19 components are required to source their own human resources.

15. THE COMPLEMENTARY RELATIONSHIP BETWEEN SIP 19 AND OTHER SIPS, ESPECIALLY SIP 18

From the description of the various components provided in Section 10 above, and especially those related to "improved agriculture-impacted ecological infrastructure", it is clear that SIP 19 must build a strong relationship to the agricultural SIP, SIP 11, in terms of building ecological infrastructure to support rural development and agricultural systems, promote healthy management of rangelands, ensure healthy livestock and promote more productive and sustainable livelihoods.

SIP 18 is the SIP dealing with water and sanitation infrastructure, or more precisely, it is the SIP dealing with the National Water and Sanitation Infrastructure Master Plan. In essence, SIP 18 has been designed to ensure a sustainable supply of water to meet social needs and support economic growth as well as a comprehensive sanitation service that enhances community wellbeing, reduces health care costs and improves productivity.

This 10-year plan will address the estimated backlog of access to adequate water to 1,4 million households and 2,1 million households' access to basic sanitation. The recent Blue Drop Report (2010) and "green drop" report indicates that of 914 water supply systems assessed, 41% scored less than 50%. Similarly, 55% out of 821 wastewater treatment works are in a collapsed state. On site sanitation systems provided in mostly rural areas are relatively robust but there is inadequate provision for pit emptying. Improved arrangements with respect to national entities, catchment management agencies and water boards are proposed for the water institutions responsible for infrastructure with a replacement asset value estimated at R 968bn.

Water wastage and inefficiencies account for revenue losses of more than R11bn per annum in the municipal sector alone. As a water scarce country, the PICC supports water demand measure including advanced pressure management projects, water leak management and water demand awareness measures.

SIP 18 is not spatially focussed and is regarded as being a nation-wide project.

SIP 18 components include:

- Projects to provide new infrastructure, rehabilitate and upgrade existing infrastructure for:
  - Development of water resources
  - Potable water supply
  - Non-potable water distribution
  - Collection of water borne sewage
  - Waste water treatment
  - On-site sanitation

- Projects to improve management of water infrastructure:
  - Focussed Asset Management programme
  - Revision of water sector institutions
  - Capacity building of rural municipalities
  - National Water Conservation/Water Demand Management Programme

Is illustrated in Figure 29, SIP 18 focusses on the "water supply and use chain" from the river or dam and back to the river or ocean.

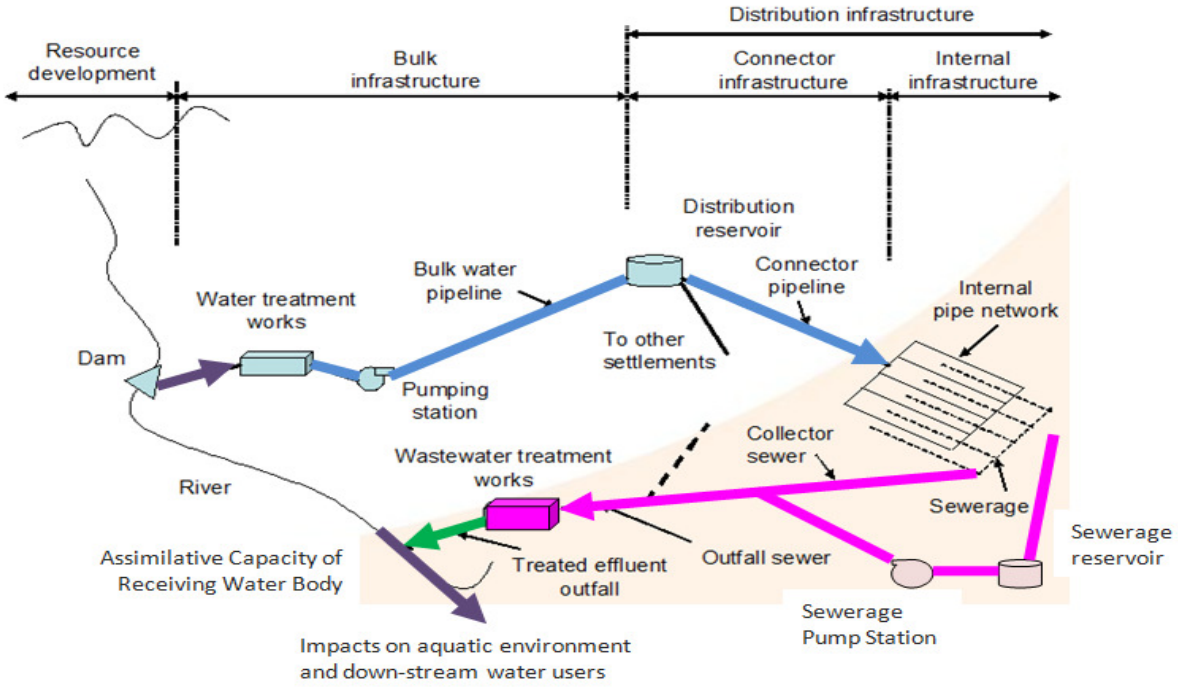

Figure 29: A graphical representation of the focus of SIP 18

From the above illustration and the tables of SIP 18 projects below, it is clear that SIP 18 is focussed on hard engineered infrastructure relating to fresh water storage, treatment and distribution and waste water reticulation and treatment.

Table 12: Summary of SIP 18 Dam Projects

Province	Water Projects	R'bn
Limpopo	• Olifants River Water Resource Project (including De Hoop Dam) (SIP 1) • Mokolo Water Augmentation Project (SIP 1)	• 16 • 19
Eastern Cape	• Mzimvubu Dam and Hydropower (SIP 3)	• 20
KwaZulu-Natal	• Mooi-Umgeni Transfer Scheme (SIP 7)	• 1.7
Mpumalanga	• Komati Water Augmentation Project (SIP 1) • VRESAP (SIP 7)	• 1.7 • 2.7
Western Cape	• Clan William Dam (SP 5)	• 2
Free State	• Sterkfontein Dam Scheme	• 0.3

Table 13: Summary of SIP 18 Bulk Water Supply and Treatment/Sanitation Schemes

Province	Bulk Water Supply and Treatment / Sanitation Schemes	R'm
Limpopo	• Nandoni Bulk Water Scheme	• 750

Province	Bulk Water Supply and Treatment / Sanitation Schemes	R'm
	• Giyani Drought Relief Bulk Water Supply	• 54
	• Moutse	• 382
	• Nebu	• 1 300
	• Mooihoek / Tubatse	• 807
	• Sinthumule Kutama	• 455
Northern Cape	• Namakwa Bulk Water Scheme	• 530
	• Heuningvlei/ Moshaweng Bulk Water Scheme	• 114
Eastern Cape	• Greater Mbizana Bulk Water Supply	• 780
	• Mncwasa	• 136
	• Xhora	• 162
	• Ibika	• 49
	• Cluster 4 CHDM (Ncora Zone B)	• 353
	• Cluster 6 CHDM (Quthubeni)	• 290
	• Cluster 9 CHDM	• 232
	• Xonxa	• 343
	• Middleburg	• 20
	• Ndlambe Bulk Water Scheme	• 879
KwaZulu-Natal	• Dukuduku Bulk Water Supply	• 126
	• Emadlangeni	• 54
	• Ngcebo Regional Bulk III (Lower Tugela)	• 682
	• Mhlabatshane	• 366
	• Jozini	• 761
	• Hlabisa	• 146
	• Greytown	• 247
	• Driefontein Complex	• 146
	• Middledrift Water Treatment Works	• 140
	• Greater Mthonjaneni BWS	• 589
	• Madlakazi	• 163
	• Nongoma	• 137
Mpumalanga	• Emalahleni Bulk Water Services Refurbishment	• 150
	• Acornhoek	• 146
Gauteng	• Sedibeng Regional Sewer Scheme	• 4 800
	• Acid Mine Drainage	
	○ Immediate/short term solution	• 2 245
	○ Medium/ long term solution	• 3 450
North West	• Pilanesberg Bulk Water Scheme	• 1 176
	• Taung/Naledi Bulk Water Scheme	• 548
	• Greater Mamusa Bulk Water Supply	• 410
	• Madibeng Bulk Water Supply	• 270
	• Ratlou Bulk Water Supply	• 240
	• Ventersdorp Bulk Water Supply	• 240
Free State	• Jagersfontein /Fauresmith	• 189
	• Mohokare	• 48

In terms of the envisaged impact of SIP 18, the programme is designed to have a positive impact on –

- ***Job Creation*** - The job creation outcomes will be articulated after the programme detailed design is complete
- ***Addressing Spatial imbalances*** - The spatial imbalances are significantly addressed by raising the level of service delivery and quality across the country and shifting service quality toward areas that are underserviced or un-serviced

- ***Promoting rural development*** - The municipalities that are targeted under this programme are mainly in rural regions and the local nature of the programme delivery does add significant localised benefits in the construction and post build maintenance processes. The impact of accessible clean water and sanitation services, coupled with upgraded road and electricity access will have significant quality of life and economic development benefits.
- ***Industrial development and localisation*** - The programme will initially have limited direct impact in this area, but does have a significant potential to raise the level of attractiveness of these areas to investors , that would also expand the pool of potential investments
- ***Economic performance of poorest provinces*** - The increased service levels and quality as well as infrastructure access shall significantly raise the micro-economic development potential of these areas, while the localised nature of the implementation will ensure direct economic benefits
- ***Greening economy*** - This programme shall have a significant localised positive impact on water quality and environmental sustainability across the country.
- ***Regional integration*** - Direct link with Lesotho and possibilities with other neighbouring countries.

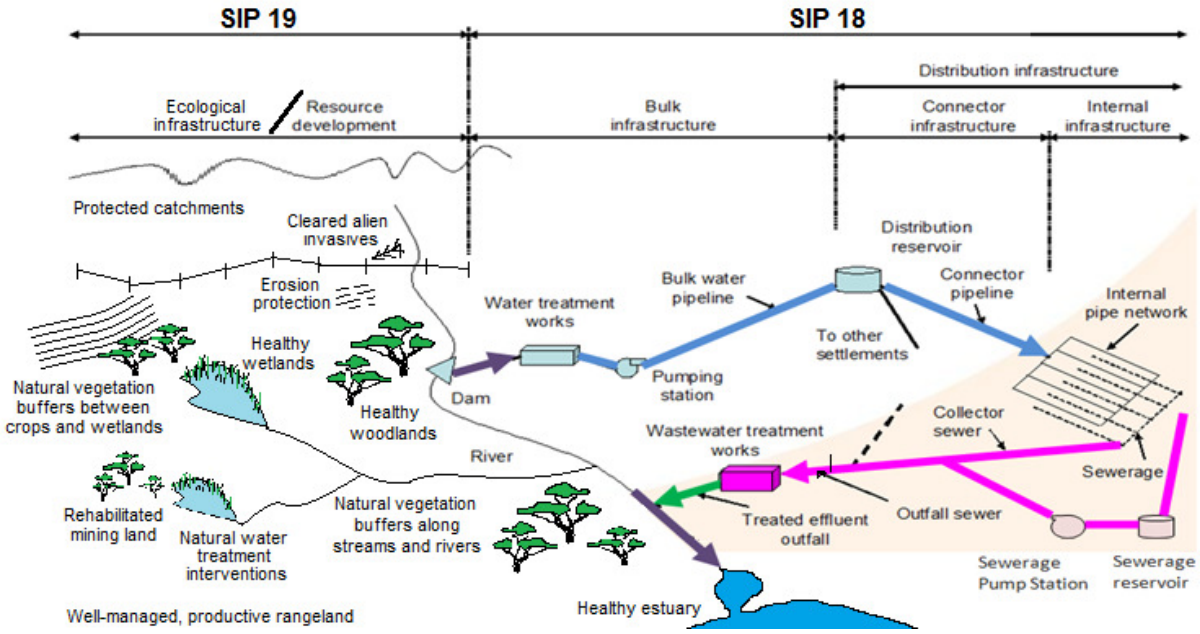

Figure 30: Graphical representation of the relationship between SIP 19 and SIP 18

Notwithstanding the above, SIP 18 also acknowledges the following challenges

- 4,5 million people (9% of population) live in small towns in rural areas and 15,5 million people (31% of population) live in small rural villages and scattered settlements.
- Of approximately 68 000 settlements, 87% are in rural areas.
- Fragmentation of responsibilities for sanitation at national, provincial and local levels
- Low levels of revenue collection
- Inability of the fiscus to allocate substantial increased funding requirements
- The capacity of DWAS and other water sector institutions to drive the programmes
- Inadequate capacity at municipal level (engineers, accountants, planners, etc.)

- Timeous implementation of the proposed water sector institutional realignment
- Low revenue base in rural municipalities due to poverty levels
- Urgently resolve the Acid Mine Drainage (AMD) problem in Gauteng

From all of the above, although it is clear that both SIP 19 and SIP 18 deal with water in the same way as SIPs 8, 9 and 10 deal with energy, SIP 19 and SIP 18 are completely complementary as illustrated in Figure 30. Indeed, it can be strongly argued that the sustained success of SIP 18 is very dependent on the success of SIP 19.

16. ALIGNMENT WITH THE NATIONAL DEVELOPMENT PLAN (NDP 2030)

With specific reference to SIP 19, the NDP 2030 has the following water-specific objective, among others –

> *"Ensure that all people have access to clean, potable water and that there is enough water for agriculture and industry, recognising the trade-offs in the use of water"*

The NDP 2030 also identifies the following specific "actions" among others –

- NDP 2030 Action number 24 – A comprehensive management strategy including an investment programme for water resource development, bulk water supply and wastewater management for major centres by 2012, with reviews every five years;
- 26 – Timely development of several new water schemes to supply urban and industrial centres, new irrigation systems in the Umzimvubu river basin and Makhathini Flats, and a national water conservation programme to improve water use and efficiency;

In the NDP 2030's Chapter 1 entitled "Policy Making in a Complex Environment", section entitled "The environment" the following is recognised –

> *Market and policy failures have resulted in the global economy entering a period of "ecological deficit", as natural capital (ground water, marine life, terrestrial biodiversity, crop land and grazing) is being degraded, destroyed, or depleted faster than it can be replenished. Waste and carbon-equivalent emissions per capita are climbing faster every year in an ecosystem with finite limits.*

In its Chapter 8 – Transforming Human Settlement – sub-section on "Develop a national spatial framework for resource-critical regions", the NDP 2030 notes that there are specific regions of South Africa that have natural resources that provide ecosystem lifelines to the country that may require specific policies to ensure their sustainability. They may include areas of highly valued mineral resources (the platinum belt); areas of great importance for biodiversity (the Western Cape); and critical water production areas (various catchments along the Eastern Escarpment). The NDP 2030 also notes that regions with competition between development

and environment, or between competing environmental uses (the Mpumalanga Highveld) may also fall under this category.

Water-related infrastructure is one of the 8 major infrastructure interventions prioritised by the NDP 2030, specifically: Developing, in a timely manner, several new water schemes to supply urban and industrial centres, new irrigation systems in the Umzimvubu river basin and Makatini Flats, and a national water conservation programme to improve water use and efficiency.

Furthermore, Chapter 4 of the NDP 2030, entitled "Economy infrastructure – The foundation of social and economic development", contains specific sections on, among others, "Access to basic electricity, water and sanitation, and public transport" and "Water resources and services".

The NDP 2030 recognises water as a strategic resource critical for social and economic development and notes growing concern about the potential impact of water-related risks. South Africa ranks low – 128th of 132 countries – in Yale University's Environmental Performance Index. This is attributed, in part, to the poor state of our water ecosystems. South Africa also ranks 148th out of 180 countries in terms of water availability per capita, according to the 2012 World Water Development Report. Since South Africa is already a water-scarce country, the NDP 2030 states that greater attention will have to be paid to its management and use.

To this end, NDP 2030 requires that natural water sources be protected to prevent excessive extraction and pollution and that water is recognised as a foundation for activities such as tourism and recreation, reinforcing the importance of its protection.

The NDP 2030 also suggests that alternative solutions such as community-based management, local franchising or the use of regional water utilities should be allowed if they would be more effective.

The NDP 2030 states that managing, monitoring and protecting South Africa's water resources in a sustainable way while allowing for economic growth demands the following, among others:

- ***Prioritisation*** - There is an urgent need for a coherent plan to ensure the protection of water resources and the environment in the Mpumalanga Highveld coalfields, upstream of the Vaal and Loskop dams, as well as in the Lephalale-Waterberg area. Given environmental pressures and development demands, current water allocations in the upper Vaal and Olifants River water management areas urgently need to be revised.
- ***Manage agricultural use better*** - Agriculture uses the largest volume of water (even though agricultural water supplies are less reliable than those supplied to urban and industrial users). The farming sector will have to increase its water efficiency to improve production and allow for water to be transferred to new users in water-scarce areas, to compensate for the expansion of irrigated agriculture, which has high job-creation potential. The Commission proposes a dedicated national programme to provide support to local and sectoral efforts to reduce water demand and improve water-use efficiency. Water-saving and demand-management projects should be considered as part of the overall range of water-supply investment programmes. These can be compared with supply expansion projects, and should be prioritised accordingly, based on their merits.
- ***Investigate water reuse and desalination*** - There is already extensive indirect reuse of water in inland areas, where municipal and industrial wastewater is reintroduced into

rivers after treatment. However, there is considerable scope for further water reuse. Many municipalities lack the technical capacity to build and manage their wastewater treatment systems. As a result, a regional approach to wastewater management may be required in certain areas. Water infrastructure investment should include projects to treat and reuse water, selected on their merits. Research into water reuse and desalination and the skills to operate such technology should be developed, perhaps under the auspices of a national water-resource infrastructure agency or the Water Research Commission.

The NDP 2030 believes that institutional development is particularly needed for the Olifants River, Crocodile-west sub-catchments of the Limpopo, the Nkomati River and the upper and middle Vaal sub-catchments, and the Umzimvubu River in the Eastern Cape, where water supplies have already reached their limit and where water allocations need to be reviewed. Such catchment-based institutions will need strong support from national bodies, especially in terms of resource monitoring and infrastructure planning.

The NDP 2030 lists the following policy issues, among others, to guide appropriate actions to improve the management, use and conservation of South Africa's water resources:

- Enhanced management capacity will be needed to address the increasing pressures on water resources. This capacity is in decline, partly due to institutional uncertainty. New institutional arrangements should acknowledge limited human resource capacity and give high priority to the development and retention of the specialised staff required. Current human-resource development programmes have had limited success and must be made a strategic priority.
- Institutional arrangements for water-resource management need to be finalised, specifically the number of water-management areas to be established, the mechanisms through which users will be involved in the management of water in these areas, as well as the organisation of the management and development of major water resource infrastructure.
- A review of existing water allocations is needed in areas where new users are seeking access, but current users already take more than can reliably be provided. There is statutory provision for these reviews, which if not undertaken, will result in a rise of illegal use and the over-allocation of the resource. This will reduce supply reliability, jeopardise existing social and economic uses and damage the environment.
- To guide water-management approaches, strategic planning decisions are needed on general economic and social development, as well as environmental protection. Geographic areas where this is needed include:
    - Mpumalanga Highveld coalfields – a balance between environmental protection, agriculture, energy requirements and water resources.
    - Lephalale and Waterberg areas – water requirements and sources for mining and energy investments.
    - Olifants River (Limpopo/Mpumalanga) – careful consideration of the balance between mining, agriculture and nature conservation.
    - Umzimvubu River (Eastern Cape) – water-resource development could support agriculture, domestic supply, hydropower production, transport and tourism if planned in a coordinated manner.

- Investments to support economic uses of water, including urban consumption, should normally be funded by users through appropriate pricing measures, which must include arrangements to ensure that all people can afford access to basic water services. However, the challenges of sustaining service provision in poor municipalities must be recognised and addressed.
- It is likely that a substantial proportion of investments to support rural development (including agriculture and rural settlements) will have to be publicly funded. Policy is needed to guide such investments to achieve a balance between financial costs and social benefits.
- The norms and standards for basic water supply and sanitation services should guide the allocation of funds to municipalities. However, in many cases, new investments are routinely designed to exceed existing norms and standards, resulting in service provision that is financially unsustainable. An urgent review of the norms and standards, together with the financial provisions to meet these, is required.
- Many small and rural municipalities lack the financial and technical capacity to manage water services adequately. Some flexibility in approach is recommended, which could include the use of regional utilities and community management of franchise arrangements, provided municipalities retain their role as the political authority responsible for service oversight.

In charting a way forward for water management, the NDP 2030 lists the following trade-offs and issues, among others –

- A balance has to be achieved between water allocations for industrial and urban use, with important economic implications, and for agriculture and conservation, which have important social and environmental implications.
- Greater water-use efficiency in agriculture tends to be capital- and skills-intensive, but may in turn support job creation. These gains will be difficult for new entrants to agriculture to achieve without substantial support.
- The costs associated with environmental protection (for example, those associated with enforcing pollution standards and extraction of restrictions) should be set against social and economic needs. Current legislation allows for different levels of protection, but in many cases water reserved for the environment is already used for other purposes.
- Any review of norms and standards for basic water supply and sanitation services should consider whether service provision through public infrastructure is advisable outside formal settlement areas, given the high costs associated with serving scattered rural communities. Household grants for self-supply may be considered in some areas.
- A balance is needed between allocating financial resources to support investments in higher levels of service and providing services to underserved households, while also maintaining and periodically refurbishing existing infrastructure.
- In some rural areas (for example, around Sekhukhune district municipality in Limpopo and Bushbuckridge local municipality in Mpumalanga), reliable water supplies can only be made available through large and costly distribution works. Decisions about such schemes must recognise that they are unlikely to be viable without substantial on-going operating subsidies.

Between 2012 and 2015, the following actions are required to achieve the 2030 goals:

- The national water-resource strategy should be tabled for consultation by mid-2012 and approved by year-end to guide the development of the sector. Along with the water-resource investment programme, it should be reviewed in consultation with water users and other stakeholders every five years to ensure that it adapts to changing environmental, social and economic circumstances.
- Future institutional arrangements for water-resource management must be defined by the end of 2012, with implementation by 2015 at the latest, if institutional memory is to be retained and continuity in management ensured. The institutional arrangements could include:
  - A national water-resource infrastructure agency that will develop and manage large economic infrastructure systems.
  - Catchment management agencies to undertake resource management on a decentralised basis, with the involvement of local stakeholders.
  - National capacity to support research, development and operation of water reuse and desalination facilities.
- A dedicated national water-conservation and demand-management programme, with clear national and local targets for 2017 and 2022, and sub-programmes focused on municipalities, industry and agriculture.
- A comprehensive investment programme for water-resource development, bulk-water supply and wastewater management must be established for major centres is being finalised and should be reviewed every five years. This programme will include the following major investment projects, with clear allocation of responsibilities for financing and implementation and set targets for completion:
  - The Lesotho Highlands Project Phase 2, which is to be completed by 2020 to supply the Vaal system.
  - Current KwaZulu-Natal Midlands projects (eThekwini and Msunduzi municipalities and surrounds), which need to be completed and future major augmentations decided on. These augmentations could be through desalination, reuse or by building a new dam on the Mkomazi River in time for water to be available in 2022.
  - Western Cape water-reuse and groundwater projects, which are to be completed by 2017.
- Regional water infrastructure investments and bulk-water supply programmes, which must be defined by the end of 2012, with clear implementation targets.
- The management of water services must be strengthened and regional water and wastewater utilities established to support municipalities (including expanding mandates of existing water boards) by 2017.

17. SIP 19 MANAGEMENT AND IMPLEMENTATION

17.1 Overall SIP Governance Structures

As illustrated in Figure 31, the following governance structures are associated with the development, implementation, overall management and monitoring of all the SIPs.

17.1.1 The Presidential Infrastructure Coordinating Commission (PICC) Council

The PICC Council comprises Cabinet Ministers, Premiers and Executive Mayors and considers the "performance dashboards" for every SIP. The PICC Council reports to Cabinet and recommends any required policy changes to Cabinet in respect to the SIPs and their implementation. The PICC Council is Chaired by the President and meets quarterly.

17.1.2 The Presidential Infrastructure Coordinating Commission Management Committee (PICC Manco)

The PICC Manco comprises a number of key ministries and is responsible for unblocking challenges, monitoring the development and implementation of SIP implementation plans and ensuring coordinated regulatory approvals for every SIP. The PICC Manco reports to the PICC Council and considers all reports and recommendations to be submitted to the PICC Council. The PICC Manco is Chaired by the Minister of Rural development and Land reform, and meets fortnightly (every two weeks).

17.1.3 The Presidential Infrastructure Coordinating Commission (PICC) Secretariat

The PICC Secretariat is supported by Ministers and/or Deputy-Ministers and oversees the day-to-day work of the PICC Technical Task Team (see 17.1.4). The PICC Secretariat reports to the PICC Council and also considers all reports and recommendations to be submitted to the PICC Council. The PICC Secretariat is Chaired by the Minister of Economic Development, and meets fortnightly (every two weeks).

17.1.4 The Presidential Infrastructure Coordinating Commission Technical Task Team (PICC TTT)

The Presidential Infrastructure Coordinating Commission Technical Task Team (PICC TTT) comprises skilled technical experts drawn from various government departments and agencies. The PICC TTT reports to the PICC Secretariat and, together with the PICC Secretariat, are responsible for the coordination of the implementation of all PICC Council and Manco decisions.

17.1.5 The Strategic Integrated Project (SIP) Inter Governmental Forum (IGF)

An IGF is established for each SIP. The IGF Chairperson is the Political Champion of

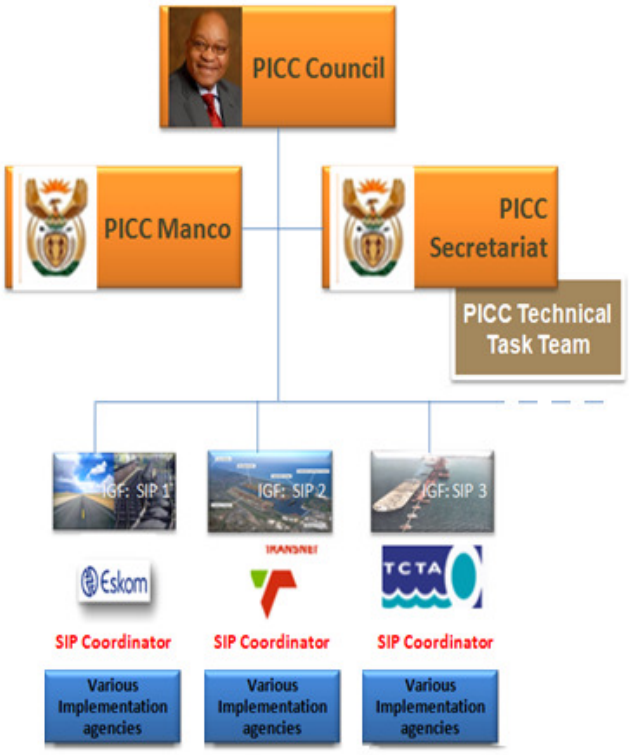

Figure 31: Overall SIP Governance Structures

the SIP. A Minister is appointed as Chair and this Minister need not necessarily be the Minister who is the Shareholder of the SIP Coordinator (see 17.1.6). The IGF coordinates and aligns across all spheres of government and different government departments and is used by the SIP Coordinator for this purpose, i.e. if a coordination or alignment challenges is revealed that the SIP Coordinator cannot effectively address, the issue is escalated to the IGF for intervention. Notwithstanding this relationship between the IGF and the SIP Coordinator, the IGF Chairperson's Department does not have any specific powers in respect of the SIP Coordinator.

17.1.6 The Strategic Integrated Project (SIP) Coordinators

A SIP Coordinator is nominated for each SIP. The SIP Coordinator is usually a State-Owned Entity/Company (SOE/SOC). The SIP Coordinators support the PICC TTT. As such, SIP Coordinators are regarded as an extension of the PICC TTT and reports to the PICC Secretariat through the PICC TTT.

The SIP Coordinator is responsible for the technical coordination of the implementation of the SIP under the guidance of the IGF (see 17.1.5) and must report regularly to the IGF, PICC Secretariat and PICC Manco.

To this end, the SIP Coordinator is responsible for, among others:

- The appointment or assignment of a dedicated senior manager to manage the work of the SIP Coordinator;
- Ensuring that each SIP component has an appointed project manager and that the budgets, costs, timelines, projects definitions and project information are updated, aligned and transferred onto a common project management platform;
- Setting up an interim project office;
- Guiding and assisting the SIP component in achieving the broader goals of the PICC, incorporating skills development, industrialisation (including purchasing of locally-produced components and inputs), and greening the economy;
- Coordinating and aligning the costs, timing, deliverables and development plans of each SIP component (as amended from time to time by the PICC) between the various spheres of Government, public entities, state owned entities and private sector, as identified by the PICC and approved by Cabinet;
- Ensuring that the Chief Executive and dedicated project manager attend meetings of the agency co-ordinating structure that may be established for the first group of SIPs; and
- Reporting to the IGF, PICC Secretariat and PICC Manco on a regular basis on progress with implementation, and identifying challenges to be addressed by the PICC.

The costs of this first phase of work set out above are for the account of the chosen SOE.

Within two weeks of receipt of their directive, the SOE would need to convene an inter-governmental forum to critically review the status, challenges and impact of the various projects/components forming part of the SIP. In addition to these tasks the SOE will need to present any potential related challenges, cost or legal impediments to the PICC Secretariat in coordinating SIP.

17.1.7 The Strategic Integrated Project (SIP) Steering Committee

A SIP Steering Committee is established for each SIP with the purpose of guiding all phases of the implementation of a strategic integrated project through —

- The development of mechanisms to identify and determine the different projects/components which constitute the strategic integrated project, and the submission of these components for approval by the Secretariat;
- The identification of ways and means of giving effect, in the most effective, efficient and expeditious manner, to the Commission's decision to implement the strategic integrated project and in so doing, ensuring the prompt compliance with all applicable laws;
- The development and adoption of a project plan for approval by the Secretariat for the implementation of the strategic integrated project in the most effective and expeditious manner within a period specified by the Minister;
- The facilitation and monitoring of the implementation of the strategic integrated project;
- The coordination of the work of all members of the steering committee;
- Regular meetings with the SIP Chairperson; and
- Serving as a one-stop-shop where any matter relating to the implementation of the strategic integrated project can be resolved.

The steering committee consists of the SIP coordinator as described in 17.1.6 above and representatives of departments and other organs of state affected by the strategic integrated project, and may consist of, among others—

- officials representing departments in the three spheres of government responsible for environment, water, public works, finance, economic development, spatial planning, land use management or any other relevant portfolio or representing any other person who will be required to grant an approval, authorisation, exemption, licence, permission or exemption necessary for the implementation of the strategic integrated project;
- a member of the Construction Industry Development Board established by section 2 of the Construction Industry Development Board Act, 2000 (Act No. 38 of 2000); and
- any other person appointed by the Secretariat based on expert knowledge or skills.

The SIP coordinator is the chairperson of the steering committee. In the event that the SIP coordinator is an entity, the entity nominates a suitably qualified individual to act as chair of the steering committee for approval by the Secretariat.

A member of a steering committee must have relevant knowledge, skills and experience in his or her field of work so as to enable the steering committee to perform its functions effectively and expeditiously.

A member of a steering committee—

- has the authority to take decisions on behalf of the organ of state he or she represents, excluding any decision to grant an approval, authorisation, license, permission or exemption; and
- has direct access to the head of the organ of state he or she represents, the Management Committee and the Secretariat and any of its members.

A member of the steering committee must be available at all times to perform his or her functions as a member of the steering committee. Membership of a steering committee may not be delegated without the approval of the Commission.

The Secretariat may, on good cause shown and following a recommendation by a steering committee—

- appoint additional members to the steering committee; and
- secure the services of or assistance or advice from any person who is not a member of the committee.

The Commission may at any stage of the implementation of a strategic integrated project reconstitute the steering committee in order for it to reflect the necessary skills and expertise required for the implementation of the particular stage.

The Secretariat must dissolve a steering committee upon completion of its functions.

The steering committee must, for projects that fall within the state sector but that may be built or operated by either the public or private sector—

- identify the projects required for the implementation of a strategic integrated project;
- identify opportunities for localisation, which include local job creation and local procurement of goods and services, as well as other opportunities, to ensure that the strategic integrated project contributes to the overall SIP objectives;
- develop and adopt one or more project plans, including feasibility, financial, operational and maintenance plans, setting out actions, targets and periods of time for the strategic integrated project and submit the plans to the Commission for approval;
- identify and ensure compliance with the laws applicable to the strategic integrated project;
- determine the approvals, authorisations, licences, permissions or exemptions required to implement the strategic integrated project;
- ensure that all appropriate persons are appointed as members of the steering committee;
- take all reasonable steps that will assist any relevant authority required to decide an approval, authorisation, license, permission or exemption to take such decision;
- facilitate the implementation of the strategic integrated project;
- report progress on all phases of the planning, development and implementation of a strategic integrated project to the Secretariat; and
- bring to the attention of the Secretariat challenges or matters that it is unable to resolve for resolution or direction, including proposed remedial actions for consideration by the Secretariat.

Each member of the steering committee must evaluate the strategic integrated project from the perspective of his or her area of expertise and—

- identify what is required for the expeditious and effective implementation;
- identify challenges presented by the strategic integrated project that will
- impede or delay the implementation of the project, and identify associated remedial actions required;

- identify amendments required to the strategic integrated project to ensure proper implementation; and
- identify the amendments required to be effected to the strategic integrated project to ensure compliance with applicable laws.

When the steering committee has determined the approvals, authorisations, licences, permissions and exemptions required to enable the implementation of the strategic integrated project, it informs the applicant to submit all applications simultaneously for consideration by the persons authorised by the relevant laws to take the applicable decisions.

A member of the steering committee must do everything possible within his or her power to ensure that an application—

- complies with applicable legislative and other requirements; and
- includes all relevant information to enable the relevant authority to consider the application without delay.

A member of the steering committee must monitor the processing of the application and report to the steering committee any regulatory concerns emerging for exploration or consideration of possible solutions.

The steering committee must report to the Secretariat the outcomes of all applications for approvals, authorisations, licences, permissions and exemptions.

A steering committee may determine its own procedures to be followed at its meetings.

A steering committee must submit a progress report to the Secretariat at least on a monthly basis.

The Minister who chairs the strategic integrated project must provide the steering committee with secretarial or administrative support and with accommodation and work related facilities as may reasonably be required for the proper functioning of the steering committee or may request the Economic Development Department to provide such facilities and support. The costs relating to the functioning of a steering committee are borne by the Department of the Minister who chairs unless otherwise agreed.

17.2 The SIP 19 Coordinator

As noted in 17.1.6 above, a SIP Coordinator is nominated for each SIP. The SIP Coordinator for SIP 19 is the South African National Biodiversity Institute (SANBI).

In essence, SANBI, as the SIP 19 Coordinator, is the agency to be designated by the Commission to coordinate and facilitate the implementation of SIP 19.

In this regard the SIP 19 Coordinator carries out the following functions –

17.2.1 SIP 19 Coordination

As implied by its name, the SIP 19 Coordinator is responsible for coordinating the integrated implementation of the various SIP 19 components. Key to this function is –

- The chairing of the SIP 19 Steering Committee as described in 17.1.7 above;

- The establishment, convening and hosting of SIP 19 Priority Area Coordinating Committees made up of representatives from the principle implementers of the various approved components within each priority area. These structures –
  - Provide a platform for discussions around the coordination of efforts and the identification of any issue that may need to be submitted to the SIP 19 Steering Committee;
  - Identify potential programme gaps that could be addressed through new components;
  - Review progress and impacts in the priority area;
  - Review mutual problems, challenges, threats, weaknesses and opportunities;
  - Identify new partnerships and/or resource sharing opportunities;

- Ensuring coordination, cooperation and alignment with any affected Catchment Management Agencies (CMAs)[13] and regional offices of the Department of Water Affairs and Sanitation.
- SIP 19 component liaison including –
  - Putting components with similar challenges in touch with each other with a view to formulating possible joint solutions;
  - Providing referral services;
  - Facilitating desired engagements between various components;

- New component addition including –
  - Using its networks and other means to bring programme gaps to the attention of the ecological infrastructure for water security implementation community;
  - Assisting in the development of possible gap-filling components;
  - Carrying out all the work necessary for gaining PICC approval for any new proposed component aimed at improving the overall outcome/impact of SIP 19 as a whole.

- Establishing and maintaining a database, including relevant spatial data, on all SIP 19 components that, among others –
  - Provides details of the intervention;
  - Provides comparable statistical information;
  - Provides an up to date status of the intervention;
  - Provides contact details for all the parties involved in the implementation of the intervention;
  - Provides up to date information on the SIP performance of the intervention (e.g. progress reporting record, involvement in relevant SIP 19 events, responses to requests for information from the Coordinator, Steering Committee or PICC, etc.)
  - Provides details, including photographic material, on the area affected by the intervention; and
  - Provides baseline data, including photographic or video material, which can be used to illustrate the physical and/or other impacts of the intervention.

[13] The establishment of four water catchment management agencies (CMAs) was approved by the Minister of Water Affairs on 19 May 2014. The agencies are Inkomati-Usuthu, Breede-Broutiz, Limpopo-North West and the Pongola-Mzimkulu following a decision to establish nine agencies rather than the 19 as originally intended. The realignment process and establishment of all nine CMAs is intended to be complete by 2016. The other five to be set up are the Olifants, Vaal, Berg-Olifants, Mzimvubu-Tsitsikamma, and Orange.

17.2.2 Monitoring and Reporting

Progress monitoring, evaluation and reporting is another key function of the SIP 19 Coordinator. In this regard the SIP 19 Coordinator –

- Implements the standard SIP reporting regime which includes, among others –
  - Developing, testing, maintaining and continuously improving standard operating procedures, protocols and templates for the efficient and effective implementation of the standard SIP reporting regime;
  - Establish basic reporting baselines for progress measurement, comparison and the avoidance of "double-counting";
  - Gathering information from individual components or from existing monitoring activities (e.g. the "Working For…"programmes already have sophisticated monitoring and reporting systems in place);
  - Compiling and maintaining a register of required authorisations for each SIP 19 component and monitoring progress and status in this regard;
  - Storing, sorting, analysing and evaluating progress data;
  - Compiling, submitting and presenting Monthly and Quarterly Progress Reports to the Steering Committee and Secretariat; and
  - Conducting basic progress data quality checks informally during site visits (not a formal progress verification and audit process – implementers are required to ensure the accuracy and correctness of data submitted for progress reporting purposes)

- Develops, tests, implements, maintains, operates, reviews and improves the SIP 19 Outcome/Impact Indicator System as described in 19 below. This includes, but is not limited to –
  - Setting up a team of volunteer professionals and experts in the field to brainstorm and jointly design a possible SIP 19 Outcome/Impact Indicator System that could have value beyond the SIP (e.g. may be a valuable contribution to meeting the NDP 2030 natural resource indicator objective).
  - Coordinating monitoring, evaluation and reporting efforts with organisations already doing relevant work in the field, i.e. exploiting existing opportunities whilst avoiding any wasteful duplication of efforts;
  - Conducting initial reconnaissance missions aimed at establishing and/or confirming on-going monitoring activities in affected areas and identifying any possible gaps;
  - Compiling monitoring, evaluation and reporting frameworks at component, quaternary catchment and priority area scales;
  - Formalising agreements around the efficient and effective implementation of monitoring, evaluation and reporting frameworks at component, quaternary catchment and priority area scales;
  - Establishing monitoring, evaluation and reporting baselines, targets, tipping-points and/or thresholds at component, quaternary catchment and/or priority area scales;
  - Gathering, capturing, storing, archiving, analysing, evaluating and generally using outcome/impact data and/or formalising agreements with other organisations to do this work on behalf of the SIP with a view to the broader application of the system (e.g. the WRC, SAEON, DWAS, SANBI and/or the CSIR);
  - Compiling Annual SIP 19 Outcome/Impact Progress reports and presentations.

17.2.3 Component Assistance and Support

As part of its general coordination role, the SIP 19 Coordinator will also provide support to the components and any other assistance that it is able to provide, including –

- Technical and Legal Support – Given that the SIP 19 Coordinator team will include staff with both technical and legal expertise and/or experience, the coordinator will be able to provide advice and referrals on most of the technical and legal issues that will be commonly faced by the SIP 19 components;
- Donor/partner Match-making – Although the SIP 19 Coordinator will not involve itself in any direct component funding matters, it will –
  - actively engage with donors in the field with a view to flagging new and/or emerging funding opportunities, identifying possible matches and facilitating introductions;
  - actively engage with companies or other organisations seeking relevant offset or social investment opportunities, identifying possible matches and facilitating introductions;
  - establish and maintain a database of potential donors or other funding sources interested in supporting SIP 19 type interventions.
- Enforcement Promotion – Liaise with the Environmental Management Inspectorate (EMIs – the so-called "Green Scorpions") around key enforcement interventions where non-compliance is negatively impacting on the work of SIP 19 components (e.g. illegal effluent discharges);
- Securing sustainability – Actively participate in all significant activities that may have an impact on securing the on-going sustainability of the SIP 19 outcomes/impacts including through various property-related interventions (e.g. provisions in deeds), formal, informal and/or semi-formal form of land protection (e.g. protected area expansion/prioritisation planning, conservancies, stewardship, payment for ecosystem service agreements, etc.)
- Intervention Leverage – Use the status of the SIP to leverage various interventions aimed at addressing issues having a negative impact on the work of SIP 19 components (e.g. poorly maintained waste-water treatment facilities).
- Regional partnerships – Engage with South Africa's water-sharing neighbours around possible complimentary activities in their countries.

17.2.4 Information Sharing and Outreach

Finally, the SIP 19 Coordinator will actively encourage and support the strengthening and broadening of the environmental infrastructure "community of practise" through, among others –

- Annual Conference – Hosting or co-hosting an annual conference on "ecosystem infrastructure for water security";
- Quarterly Seminars – Hosting or co-hosting various workshops, lectures and/or seminars on matters relating to "ecosystem infrastructure for water security";
- SIP 19 Website and newsletter – Hosting and maintaining a useful website with up to date news, views and progress reports; and
- Presentations – Compiling and presenting local and international presentations on the SIP 19 concept and related.

- The compilation and focussed distribution of "ecosystem infrastructure for water security" related pamphlets, articles and posters;

17.2.5 Staffing

Based on an initial assessment of the work required to carry out the activities described above, the following provides a brief summary of the expected SIP 19 Coordinator staffing required over the initial 5 year growth and development period.

General Staff Category	Year 1	Year 2	Year 3	Year 4	Year 5
Senior Managers	1	2	3	4	4
Technical Staff	2	4	6	8	9
Administrative Staff	1	2	3	4	4
Total	**4**	**8**	**12**	**16**	**17**

17.2.6 Budget

Based on an initial assessment of the work required to carry out the activities described above, the following provides a brief summary of the expected SIP 19 Coordinator budget required over the initial 5 year growth and development period.

Table 14: SIP 19 Coordinator Initial 5-Year Budget Estimate

Cost Centre	Year 1	Year 2	Year 3	Year 4	Year 5
1 Monitoring and Reporting	R 933 818	R 739 116	R 1 338 777	R 2 115 745	R 2 470 362
Personnel	R 785 455	R 544 712	R 986 649	R 1 559 257	R 1 820 602
Operational	R 148 363	R 194 404	R 352 128	R 556 488	R 649 760
2 SIP 19 Coordination	R 691 050	R 1 550 711	R 2 719 126	R 4 231 030	R 4 924 735
Personnel	R 665 575	R 1 515 969	R 2 672 198	R 4 168 667	R 4 854 675
Operational	R 25 475	R 34 742	R 46 928	R 62 363	R 70 060
3 Component Assistance and Support	R 303 272	R 750 092	R 1 358 656	R 2 147 162	R 2 507 044
Personnel	R 303 272	R 750 092	R 1 358 656	R 2 147 162	R 2 507 044
4 Information Sharing and Outreach	R 0	R 315 541	R 333 402	R 351 262	R 369 123
Personnel	R 0	R 251 941	R 266 202	R 280 462	R 294 723
Operational	R 0	R 63 600	R 67 200	R 70 800	R 74 400
5 Office Running Costs	R 996 511	R 2 337 152	R 2 893 935	R 2 721 483	R 2 130 412
Unaccounted Personnel Time	R 678 511	R 1 802 912	R 2 014 735	R 1 575 703	R 842 672
Operational	R 318 000	R 534 240	R 879 200	R 1 145 780	R 1 287 740
Total	**R 2 924 651**	**R 5 692 612**	**R 8 643 895**	**R 11 566 683**	**R 12 401 677**
Personnel	R 2 432 813	R 4 865 626	R 7 298 439	R 9 731 252	R 10 319 717
Operational	R 491 838	R 826 986	R 1 345 456	R 1 835 431	R 2 081 960

18. SIP 19 IMPLEMENTATION PLAN

As implied by section 9.7 above that describes the SIP 19 Spatial Priority Areas, the implementation of SIP 19 will take a phased approach. However, as many of the SIP 19 components are already well under way, the phases are likely to overlap in many instances.

In essence, once the SIP 19 management and administrative structures are established (see section 17), the initial focus of SIP 19 will be on integration in the Phase I Priority Area, i.e. the active coordination, cooperation and alignment of ecological infrastructure improvement activities in the quaternary catchments associated with the Orange-Vaal-Thukela and uMngeni-Mooi-Thukela Strategic Water Source Areas.

This first phase will be regarded as the "proof of concept" phase aimed at confirming that the efficient and effective integration of water-related ecological infrastructure investments and interventions into a coordinated, coherent and focussed programme specifically aimed at ensuring a sustainable supply of fresh, healthy water can measurably contribute to equitably meeting South Africa's social, economic and environmental water needs for current and future generations.

An extremely important component of this Phase I work will be the establishment, implementation and testing of the SIP 19 monitoring and evaluation framework as described in Section 19 below.

As soon as there are positive indications of the efficacy of integration in the Phase I Priority Area, appropriate SIP 19 attention will then be given to the Phase II Priority Area, i.e. the quaternary catchments associated with the Olifants-Doring-Berg and Berg-Breede Strategic Water Source Areas.

Using the lessons learned from these two, very different, Strategic Water Source Areas, SIP 19 integration activities will then be rolled out in the remaining priority areas.

19. SIP 19 MONITORING AND EVALUATION

Unlike the other SIPs where "output" monitoring (e.g. number of dams, kilometres of road and rail, power stations built, etc.) is both sufficient and appropriate, SIP 19s impact lies not in an output (e.g. hectares of cleared alien plants from riparian zones), but in its outcome (e.g. improved water quality and quantity). Hence, although the SIP 19 monitoring and evaluation (M&E) regime will include some output-type indicators, the majority of the SIP 19 M&E indicators will be indicators that relate to the desired outcome of the SIP.

In this regard, the following sections outline some of the key indicators to be used in monitoring and evaluating the success, or otherwise, of SIP 19. In essence, SIP 19's M&E regime will include:

- ***Water quantity indicators*** – indicators based on rainfall, runoff, dam status and river flow rates and volume statistics;
- ***Water quality indicators*** – indicators based on statistics related to pollutant concentration, chemical and biological oxygen demand, sediment levels, etc.; and
- ***River health indicators*** – indicators based on DWAS' River Health Programme (see 19.1).

19.1 Water quantity and quality indicators

As noted in Section 18 above, an important component of the first phase of SIP 19 implementation will be the establishment, implementation and testing of the SIP 19 monitoring and evaluation framework. Fortunately, there is a wealth of data and information available relating to the aspects of water quantity and quality in most, if not all, of the SIP 19 Priority Areas. During the first phase the SIP 19 partners will use this information to formulate an

efficient and effective water quantity and quality monitoring and evaluation regime to accurately measure, report and verify the impacts of SIP 19 interventions on these important parameters.

19.2 The River Health Programme (RHP)

The DWAS initiated the formal design of the River Health Programme (RHP) in 1994. The main purpose was that the programme should serve as a source of information regarding the overall ecological status of river ecosystems in South Africa. For this reason, the RHP primarily makes use of in-stream and riparian biological communities (e.g. fish, invertebrates, vegetation) to characterise the response of the aquatic environment to multiple disturbances. The rationale is that the integrity or health of the biota inhabiting the river ecosystems provides a direct and integrated measure of the health of the river as a whole.

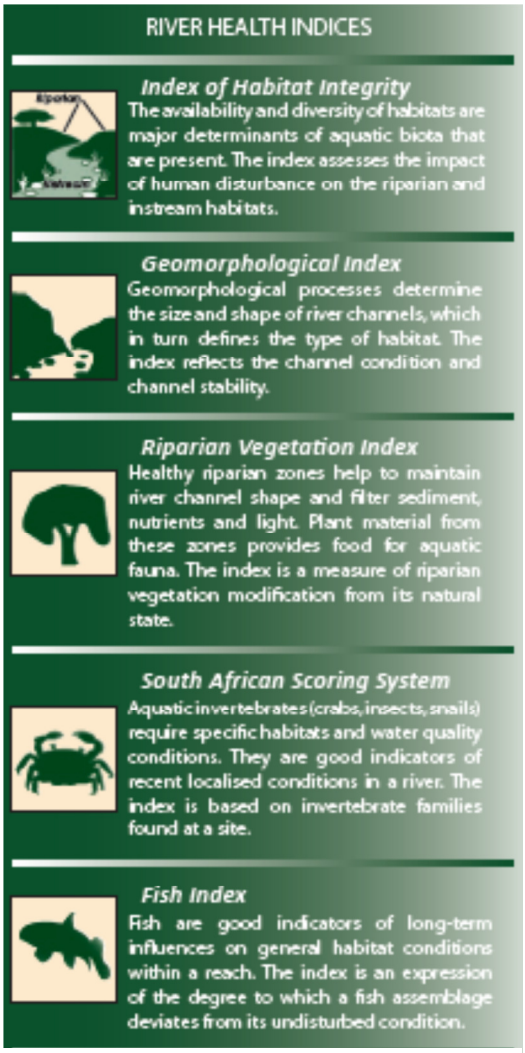

Figure 32: The River Health Programme (RHP) River Health Indices.

Hence, the RHP assesses the biological and habitat integrity of rivers through evaluation of various indicator fish, aquatic invertebrates and riparian vegetation. This assessment enables reports on the ecological state of river systems to be produced in an objective and scientifically sound manner. Information from the RHP assists with identification of those areas where unacceptable ecological deterioration is taking place. In addition, this programme reflects the effectiveness of existing river management policies, strategies and actions.

Monitoring aquatic ecosystem health is a requirement in terms of the National Water Act and the results are important for the application of the National Environmental Management Act (1998). The continued monitoring and comparison of results over time allows for the detection of trends and measurement of compliance to the set objectives for aquatic ecosystems.

The River Health Programme is a collaborative venture and partnerships, like those envisaged for SIP 19, are vital for its success. The national organisations leading the RHP are the DWAS, DEA and the Water Research Commission. A variety of organisations within each province implement the River Health Programme at a local level.

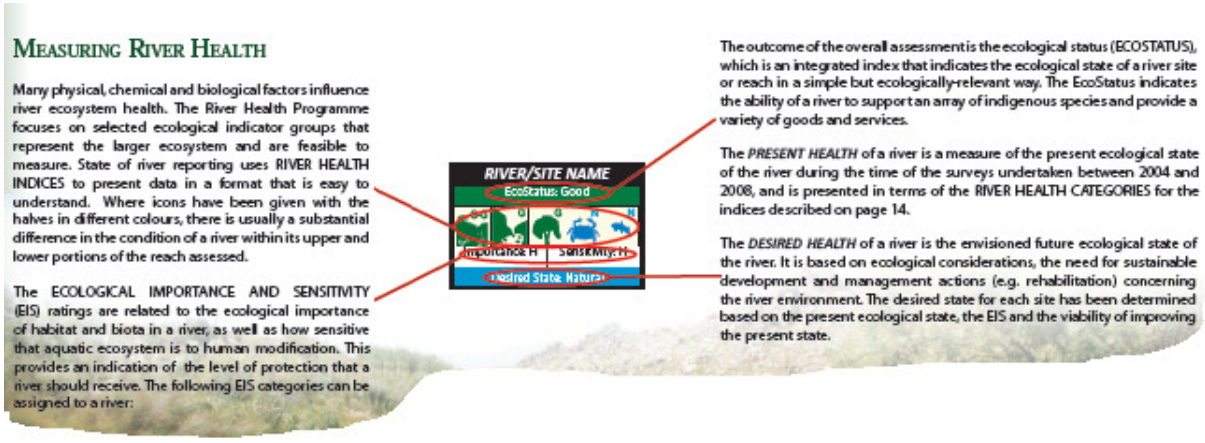

Figure 33: The River Health iconography

State of Rivers reporting is a spin-off of State of the Environment (SoE) reporting, which has become a recognised form of communication on environmental issues over the past decade. The aim is to provide better information for environmental decision-making. The national SoE uses the Driving Force-Pressure-State-Impact-Response framework to explain what causes environmental change, the wider implication of that change and what we can do to manage the change. State of Rivers reporting uses the same approach, but often with slightly different terminology. State of Rivers reporting disseminates information on river health to:

- assist in ecologically sound management of rivers;
- ensure the sustainable utilisation of water resources;
- detect trends in the condition and health of river ecosystems;
- inform and educate people regarding the condition of our rivers; and
- encourage wide participation by all stakeholders.

19.2.1 River Health Indicators and Indices

A multitude of factors determine the health of a river ecosystem: its geomorphological characteristics, hydrological and hydraulic regimes, chemical and physical water quality, and the nature of in-stream and riparian habitats. It is impractical to monitor each of these factors in detail. Therefore, the RHP focuses on selected ecological indicators that are representative of the larger ecosystem and are practical to measure. Since resident aquatic communities reflect the effects of chemical and physical impacts in a time-integrated manner, they are regarded as good indicators of overall ecological integrity.

For the purpose of disseminating results of the RHP, the information resulting from monitoring aquatic community components is simplified to a point where it can be of use to resource managers, conservationists and the general public. This is done with a biological index that integrates and summarises biological data within a particular indicator group. Appropriate indicators, for example selected fish community attributes, need to be tested and justified, and linked to measuring units (metrics) that can be used to index ecological condition. In this context, biological indices are used to quantify the condition or health of aquatic ecosystems and the output format is usually numeric.

While biological indicators and indices are the main focus of the RHP, the development and inclusion of indices of physical and chemical indicators are encouraged to increase the information value of the programme.

Aquatic Invertebrate Fauna

A variety of invertebrate organisms (e.g. snails, crabs, worms, insect larvae, mussels, beetles) require specific habitat types and conditions for at least part of their life cycles. Changes in the structure of aquatic invertebrate communities are a sign of changes in overall river conditions. As most invertebrate species are fairly short-lived and remain in one area during their aquatic life phase, they are particularly good indicators of localised conditions in a river over the short term.

The South African Scoring System (SASS) is the biological index used for assessing aquatic invertebrate fauna. This index, based on the presence of families of aquatic invertebrates and their perceived sensitivity to water quality changes, is currently in its fourth stage of development. SASS has been tested and is used widely in South Africa as a biological index of water quality. SASS results are expressed both as an index score (SASS score) and the average score per recorded taxon (ASPT value).

River Health Category	Ecological Perspective	Management Perspective
Natural N	No or negligible modification from natural	Relatively little human impact
Good G	Biodiversity and integrity largely intact	Some human-related disturbance but ecosystems essentially in good state
Fair F	Sensitive species may be lost; tolerant or opportunistic species dominate	Multiple disturbances associated with the need for socio-economic development
Poor P	Mostly tolerant species; alien invasion, disrupted population dynamics; organisms often diseased	High human densities or extensive resource exploitation

Figure 34: River Health categories

Fish

Fish, being relatively long-lived and mobile, are good indicators of long-term influences on a river reach and the general habitat conditions within the reach. The numbers of species of fish that occur in a specific reach, as well as factors such as different size classes and the presence of parasites on the fish, can be used as indicators of river health.

The Fish Assemblage Integrity Index (FAII) is based on a categorisation of a fish community according to an intolerance rating which takes into account trophic preference and specialisation, requirement for flowing water during different life-stages, and association with habitats with unmodified water quality. Results of the FAII are expressed as a ratio of observed conditions versus conditions that would have been expected in the absence of human impacts. Although this index has been applied and published, it is being further developed and refined under leadership of Dr Neels Kleynhans of the Institute for Water Quality Studies.

Riparian Vegetation

Healthy riparian zones maintain channel form and serve as filters for light, nutrients and sediment. Changes in the structure and function of riparian vegetation commonly result from

changes in the flow regime of a river, exploitation for firewood, or use of the riparian zone for grazing or ploughing.

Nigel Kemper of IWR Environmental has developed a first prototype of the Riparian Vegetation Index (RVI). The RVI determines the status of riparian vegetation within river segments based on the qualitative assessment of a number of criteria in the riparian zone. These criteria are vegetation removal, cultivation, construction, inundation, erosion/sedimentation and exotic species. The output is expressed as percentage deviation from natural or unmodified riparian conditions.

River Habitats

Loss of habitats is regarded as the single most important factor that has contributed towards the extinction of species in the last century. The destruction of a particular type of habitat will result in the disappearance of certain species. Examples of river habitat types are pools, rapids, sandbanks, stones on the riverbed, and vegetation fringing the water's edges. As the availability and diversity of habitat are major determinants of whether a given system is acceptable to a specific suite of biota or not, knowledge of the availability and quality of habitats is very important in an overall assessment of ecosystem health.

Dr Neels Kleynhans of the Institute for Water Quality Studies developed the Index of Habitat Integrity (IHI). The IHI is used to assess the impact of major disturbance factors such as water abstraction, flow regulation, bed and channel modification, removal of indigenous riparian vegetation, and encroachment by exotic vegetation.

20. SIP 19 CHALLENGES

In the light of all of the above, a fundamental question must be – if the intervention proposed as SIP 19 is likely to generate the various positive impacts that are detailed above, why has it not been implemented to date? Although it is probably true that SIP 19 comprises a new and/or novel approach that was simply not broadly recognised before, there are also a number of other challenges that may need to be acknowledged and addressed if SIP 19 is to be successful, including:

20.1 Resistance to change

The following quote from Barton H. Thompson, Jr[14]. provides an insight into one challenge that has possibly contributed to why the SIP 19 concept has not been broadly implemented to date –

> *"In summary, natural capital (in the form of watershed services) and technological investments (in filtration facilities and other engineering solutions) are substitutes. And despite their ascendancy in the 20th century, technological investments in many cases are the inferior means of providing water supply and quality. An important question therefore is how key governmental and*

[14] Barton H. Thompson, Jr. Stanford Law School. *The Importance of Watershed Preservation*, Watersheds, Natural Capital, and Water, John M. Olin Conference on Watershed Management

private players, including water suppliers, developers, land use planners, and environmental regulators, evaluate the choice between natural capital and technological investments. Is there a bias in favour of technological investments due to existing governmental policies, institutional structures, market imperfections, scientific uncertainties, or problems in valuing the natural watershed services? And if a bias exists, how can [we] eliminate that bias? How, in short, can we get the market for natural services to work correctly? Or is regulation the only policy solution?"

20.2 Turf Battles and a "silo mentality"

By definition, SIP 19 is an integrating intervention that not only integrates the work of national, provincial and local spheres, but also integrates across spheres and disciples. Thus, the success of SIP 19 relies heavily on partnerships between departments and organisations that are not traditional partners (e.g. mining and agriculture, environment and forestry, conservation and industry, etc.). Indeed, some of the required partnerships will be between organisations often regarded as having a conflicting relationship.

However, it is probably not these perceived conflicting mandates that present the biggest challenge. Indeed, it is likely to be turf battles between actors that have similar or overlapping mandates that present a challenge that has possibly contributed to why the SIP 19 concept has not been broadly implemented to date.

20.3 Competition for resources

Related to the above is the fact that many of the actors that have similar or overlapping mandates in relation to SIP 19-related activities also often draw from the same pool of financial, human and/or technological resources. Thus, this clear competition for, often, very limited resources may also present a challenge that has possibly contributed to why the SIP 19 concept has not been broadly implemented to date.

20.4 Competition for profile

Related to the competition for resources is the fact that resources are often far more accessible to those actors who have built a recognised profile for successful interventions. Thus, the need to claim ownership of highly successful interventions may also present a challenge that has possibly contributed to why the SIP 19 concept has not been broadly implemented to date.

20.5 Legislative constraints/restrictions

Although SIP 19 mainstreams the relatively new and novel concept of ecological infrastructure, it also introduces a raft of other new concepts and/or approaches that are unlikely to be recognised by current regulatory regimes (e.g. environmental offsetting). Thus, regulatory and legislative constraints, shortfalls and/or restrictions may also present a challenge that has possibly contributed to why the SIP 19 concept has not been broadly implemented to date.