Report No: 109664/8824

REHABILITATION PLAN FOR THE WORKING FOR WETLANDS PROGRAMME, NORTHERN CAPE

PROJECT: KAMIESBERG

F30A, F30C, F50A, F50E, F50G

APRIL 2014

agriculture, forestry & fisheries
Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

EXPANDED PUBLIC WORKS PROGRAMME
Creating opportunities towards human fullfilment

SANBI
Biodiversity for Life

Working for Wetlands

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REHABILITATION PLAN FOR THE KAMIESBERG WETLAND PROJECT, NORTHERN CAPE: PLANNING YEAR 2014

AS PART OF
THE WORKING FOR WETLANDS PROGRAMME

FOR THE
SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE

MAIN REPORT

April 2014

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PROJECT DETAILS

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WORKING FOR WETLANDS: CONTEXT DOCUMENT

1. Introduction

Working for Wetlands (WfWetlands) is a government programme managed by the South African National Biodiversity Institute (SANBI), and is a joint initiative of the Departments of Environmental Affairs (DEA), Water Affairs (DWA) and Agriculture, Forestry and Fisheries (DAFF). In this way the programme is an expression of the overlapping wetland-related mandates of the three parent departments, and besides giving effect to a range of policy objectives, also honours South Africa's commitments under several international agreements, especially the Ramsar Convention on Wetlands.

The programme is mandated to rehabilitate damaged wetlands and to protect pristine wetlands throughout South Africa, with an emphasis on complying with the principles of the Expanded Public Works Programme (EPWP) and using only local Small, Medium and Micro Enterprises (SMMEs). The EPWP seeks to draw significant numbers of unemployed people into the productive sector of the economy, gaining skills while they work and increasing their capacity to earn an income.

2. Wetlands and their importance

Once considered valueless wastelands that needed to be drained or converted to more useful landuse purposes, wetlands are now seen in an entirely different light. Today wetlands are more commonly perceived as natural assets and natural infrastructure able to provide a range of products, functions and services free of charge.

That which actually constitutes a wetland is often not fully understood. Common misconceptions have been that wetlands must be wet, must have a river running through them, or must always be situated in low-lying areas. The definition of a wetland is much broader and more textured: they are characterised more by soil properties and flora than by an abundance of water.

The National Water Act, No. 36 of 1998 defines a wetland as:

> "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*".

The Ramsar Convention defines wetlands as:

> *"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6m"* (Article 1, Ramsar Convention on Wetlands. 1971*).*

Wetlands can therefore be seasonal and may experience regular dry spells (sometimes even staying dry for up to several years), or they can be frequently or permanently wet. Wetlands can occur in a variety of locations across the landscape (Plate A), and may even occur at the top of a hill, nowhere near a river. A pan, for example, is a wetland which forms in a depression. Wetlands also come in many sizes; they can be as small as a few square metres (e.g. at a low point along the side of a road) or cover a significant portion of a country (e.g. the Okavango Delta).

Plate A: A large, seasonal wetland identifiable by the characteristic flora. This wetland contained no surface water at the time of the photograph.

Wetland ecosystems provide a range of ecological and social services which benefit people, society and the economy at large:

- Wetlands offer services such as water provision, regulation, purification and groundwater replenishment are crucial in addressing objectives of water security and water for food security.
- Wetlands play a critical role in improving the ecological health of an ecosystem by performing many functions that include flood control, water purification, sediment and nutrient retention and export, recharge of groundwater, as well as acting as vital habitats for diverse plant and animal species.
- Wetlands provide ecological infrastructure, replacing the need for municipal infrastructure by providing the same or better benefit at a fraction of the cost.
- Wetlands retard the movement of water in the landscape, which offers the dual benefit of flood control as well as a means of purification. The slow movement of water allows heavier impurities to settle and phreatic vegetation and micro-bacteria the opportunity to remove pollutants and nutrients. For these reasons, artificially created wetlands are often used in newer urban drainage systems to aid both mitigation of flooding and improvement of water quality.
- Wetlands function as valuable open spaces and create recreational opportunities for people that include hiking, fishing, boating, and bird-watching.
- Many wetlands also have cultural and spiritual significance for the communities living nearby. Commercially, products such as reeds and peat are also harvested from wetlands (Plate B).

Wetlands are thus considered to be critically important ecosystems as they provide both direct and indirect benefits to the environment and society.

Plate B: Commercial products made by locals from reeds harvested from wetlands.

3. Wetland Degradation

It has been estimated that originally over 10% of the Republic of South Africa (RSA) was covered by wetlands; however, this figure decreases significantly every year owing to unsustainable land-use practices. It is estimated that more than 50% of South Africa's wetlands have been destroyed through drainage of wetlands for crops and pastures, poorly managed burning regimes, overgrazing, disturbances to wetland soils, vegetation clearing as well as industrial and urban development (including mining activities).

Although wetlands are high-value ecosystems that make up only a small fraction of the country; they rank among the most threatened ecosystems in South Africa. According to a recent Council of Scientific Research (CSIR) study,[1] South Africa's remaining wetlands were identified as the most threatened of all South Africa's ecosystems, with 48% of wetland ecosystem types being critically endangered, 12% endangered and 5% vulnerable. Only 11% of wetland ecosystem types are well protected, with 71% not protected at all.

The remaining wetland systems suffer from severe erosion and sedimentation, undesirable plant species and aquatic fauna infestations, unsustainable exploitation, artificial drainage and damming, and pollution. The continued degradation of wetlands will impact on biodiversity, ecological function, and the provision of ecosystem services with subsequent impacts on livelihoods and economic activity, as well as health and wellbeing of communities. In the absence of functional wetlands, the carbon cycle, the nutrient cycle and the water cycle would be significantly altered, mostly detrimentally.

Wetland rehabilitation and conservation should be at the heart of water management. It is necessary to prioritise South Africa's remaining wetlands such that those that offer valuable ecosystem services and are least impacted by current pressures or threats are offered immediate attention to avoid further loss, conversion or degradation.

4. The Working for Wetlands Programme

South Africa is a dry country, but is endowed with exceptionally rich biodiversity. The nation has a pressing reason to value the water-related services that wetlands provide. It is estimated that by 2025, South Africa will be

[1] Nel J.L. and Driver A. 2012. South African National Biodiversity Assessment 2011: Technical Report. Volume 2: Freshwater Component. CSIR Report Number CSIR/NRE/ECO/IR/2012/0022/A, Council for Scientific and Industrial Research, Stellenbosch.

one of fourteen African countries classified as "*subject to water scarcity*" (SANBI Working for Wetlands Strategy 2006-2010). The conservation of wetlands is fundamental to the sustainable management of water quality and quantity, and wetland rehabilitation is therefore essential to conserving water resources in South Africa.

The guiding principles of the National Water Act, No. 36 of 1998, recognise the need to protect water resources. In responding to the challenge of stemming the loss of wetlands and maintaining and enhancing the benefits they provide, government has recognised that, in order to be truly effective, strategies for wetland conservation need to include a combination of proactive measures for maintaining healthy wetlands, together with interventions for rehabilitating those that have been degraded. These objectives are currently being expressed in a coordinated and innovative way through the WfWetlands Programme.

The two main objectives of the WfWetlands Programme are **wetland conservation** in South Africa and **poverty reduction** through **job creation** and **skills development** amongst **vulnerable** and **marginalised** groups.

Wetland conservation: The strategic framework of the WfWetlands Programme underlines the need for a more refined planning process at catchment scale. Catchment scale planning seeks to promote ecosystem-scale outcomes, long-term custodianship, and the entrenchment of rehabilitation in broader local institutions and frameworks. The recent move to a systematic wetland rehabilitation planning process has provided a fertile and conducive platform for partnerships to be formed and/or strengthened as the process draws in a much wider stakeholder base.

Wetlands are not easy ecosystems to map at a broad scale as they are numerous, often small and difficult to recognise and delineate on remotely sensed imagery such as satellite photos. The WfWetlands Programme houses the National Wetlands Inventory Project (NWI) which aims to provide clarity on the extent, distribution and condition of South Africa's wetlands. The project clarifies how many and which rivers and wetlands have to be maintained in a natural condition to sustain economic and social development, while still conserving South Africa's freshwater biodiversity.

The National Freshwater Ecosystem Priority Areas (NFEPA) has used the NWI data to produce the most comprehensive national wetland map to date, called the NFEPA Atlas. This atlas enables the planning of wetland rehabilitation on a catchment scale.

Skills development: In the 12 years since its inception, the WfWetlands Programme has invested R530 million in wetland rehabilitation and has been involved in over 900 wetlands, thereby improving or securing the health of over 70 000 hectares of wetland environment. The WfWetlands Programme currently has a budget of approximately R94 million per year, of which R32 million is allocated directly to paying wages. Being part of the Expanded Public Works Programme (EPWP), the WfWetland Programme has created more than 12 800 jobs and 2.2 million person-days of paid work. The local teams are made up of a minimum of 60% women, 20% youth and 1% disabled persons.

Training and Capacity Building during the Working for Wetlands Programme

The WfWetlands Programme has established a working relationship with the Department of Public Works through the Working for Water programme. This partnership provides accredited training in accordance with the special public works Code of Good Practice agreements. Capacity building in the WfWetlands Programme operates primarily at two levels:

- The first concerns the need to ensure the development of adequate capacity to rehabilitate, manage and conserve wetlands in South Africa.
- The second relates to the commitment of the WfWetlands Programme as an EPWP to provide appropriate training to its workers in order for them to exit the programme with marketable skills and enhanced personal development.

Workers receive two days of training, either vocational or social development-related, for every 22 days worked. Vocational training includes technical matters related to project activities, occupational health and safety, first aid, fire awareness, and business skills (contractor development). Social development includes literacy, primary health, personal finance, HIV/Aids and diversity awareness.

Wage information sourced from the best practice guidelines suggests that workers and contractors would be paid daily rates of R 82 and R 251[2] respectively and would be employed on limited term contracts, i.e. 24 months in a five-year cycle. Employment of workers complies with the Ministerial Determination on Special Public Works Programmes (Government Notice No. R 63, 25 January 2002) and the Code of Good Practice for Employment and Conditions of Work for Special Public Works Programmes (Government Notice No. R 64, 25 January 2002). Targets for employment specify that the programme's workforce should comprise at least 60% women, 20% youth and 2% disabled people.

The WfWetlands Programme engages with provinces, especially government departments and agencies responsible for biodiversity and environment, and municipalities through individual projects. A stronger working relationship with these spheres of government is being promoted through the programme's emphasis on partnerships. In particular, compatibility with Integrated Development Plans and rehabilitation project objectives will be a key area of future focus. The WfWetlands Programme encourages municipalities to participate in provincial wetland forums as these forums are the platform for the roll out of all the programmes' processes, including planning for future work. Provincial forums also offer support from the government departments and private sectors that are represented. Partnerships with non-governmental organizations and the private sector are also critical, requiring collaboration and cooperation with a wider range of stakeholders and role players in the wetland management field.

Other activities that form part of the WfWetlands Programme include:

- Raising awareness of wetlands among workers, landowners and the general public; and
- Providing adult basic education and training, and technical skills transfer (in line with the emphasis of the EPWP on training, the WfWetlands Programme has provided 168 400 days of training in vocation and life skills).

[2]Without a Supervisor

5. Rehabilitation interventions

The successful rehabilitation of a wetland requires that the cause of damage or degradation is addressed, and that the natural flow patterns of the wetland system are re-established (flow is encouraged to disperse rather than to concentrate). Approximately 500 interventions are implemented every year in the WfWetlands Programme. The key purposes of implementing interventions include:

- Restoration of hydrological integrity (e.g. raising the general water table or redistributing the water across the wetland area);
- Recreation of wetland habitat towards the conservation of biodiversity; and
- Job creation and social upliftment.

Typical activities undertaken within the projects include:

- Plugging artificial drainage channels created by development or historical agricultural practices to drain wetland areas for other land use purposes;
- Constructing structures (berms and weirs) to divert or redistribute water to more natural flow paths, or to prevent erosion by unnatural flow rates that have resulted from unsustainable land use practices or development; and
- Removing invasive alien or undesirable plant species from wetlands and their immediate catchments (in conjunction with the Working for Water initiative).

Increased labour requirement for the Working for Wetlands Programme

In response to the government request to increase the labour component of all government funded projects, the WfWetlands Programme project team has had to consider, and where practically feasible incorporate, more labour intensive ways of rehabilitating wetlands in order to obtain the increased labour component. Accordingly the project team members have factored this requirement into their planning when designing structures for wetland rehabilitation.

Methods of wetland rehabilitation may include hard engineering interventions such as:

- Earth berms in conjunction with gabion systems to block artificial channels that drain water from or divert polluted water to the wetland;
- Concrete and gabion weirs to act as settling ponds, to reduce flow velocity or to re-disperse water across former wetland areas thereby re-establishing natural flow paths;
- Earth or gabion structure plugs to raise channel floors and reduce water velocity;
- Concrete or gabion structures to stabilise head-cut or other erosion and prevent gullies; and
- Gabion structures (mattresses, blankets or baskets) to provide a platform for the growth of desired wetland vegetation.

Soft engineering interventions also offer successful rehabilitation methods, and the following are often used together with the hard engineering interventions:

- The re-vegetation of stabilised areas with appropriate wetland and riparian plant species;
- The fencing off of sensitive areas within the wetland to keep grazers out and to allow for the re-establishment of vegetation;

- The use of biodegradable or natural soil retention systems such as eco-logs, plant plugs, grass or hay bales, and brush-packing techniques;
- In some instances, the use of appropriate fire management and burning regimes. The removal of undesirable plant and animal species; and
- Alien invasive plant clearing, which is an important part of wetland rehabilitation (and this is supported by the Working for Water Programme).

6. Programme, projects and phases

In order to manage the **WfWetlands Programme**, wetlands have been grouped into "projects", and each **Wetland Project** encompasses several smaller wetland systems which are each divided into smaller, more manageable and homogenous wetland units. A Wetland Project may be located within one or more quaternary catchments within a Province. SANBI is currently managing 35 Wetland Projects countrywide, and rehabilitation activities range from stabilising degradation to the more ambitious restoration of wetlands to their original conditions.

Each Wetland Project is managed in three phases over a two-year cycle as shown in the flow diagram in Plate C. The first two phases straddle the first year of the cycle and involve planning, identification, design and authorisation of interventions. The third phase is implementation, which takes place during the second year.

The first phase is the identification of suitable wetlands which require intervention. The purpose of Phase 1 and the associated reporting is to identify:

- Priority catchments and associated wetlands/ sites within which rehabilitation work needs to be undertaken; and
- Key stakeholders who will provide meaningful input into the planning phases and wetland selection processes, and who will review and comment on the rehabilitation proposals.

The **Project Team** currently comprises the SANBI Programme Manager who oversees the WfWetlands Programme and Provincial Coordinators (PCs) who oversee the identification and implementation of projects in their regions. They are supported by a small team based at the Pretoria Botanical Gardens who fulfil various roles such as planning, monitoring and evaluation, implementation, Geographical Information Systems (GIS) and training. Independent Design Engineers and Environmental Assessment Practitioners (EAPs) are appointed to undertake the planning, design and authorisation components of the project. The project team is assisted by a number of wetland ecologists who provide scientific insight into the operation of wetlands and bring expert and often local knowledge to the project teams.

The programme makes use of external support to implement its work. External implementing agents are currently employed and some are Section 21 companies. Implementers are responsible for employing contractors and their teams (workers), and ensuring that rehabilitation plans are adequately implemented. Funds are transferred from SANBI to the implementing agents, who in turn pay contractors and their teams.

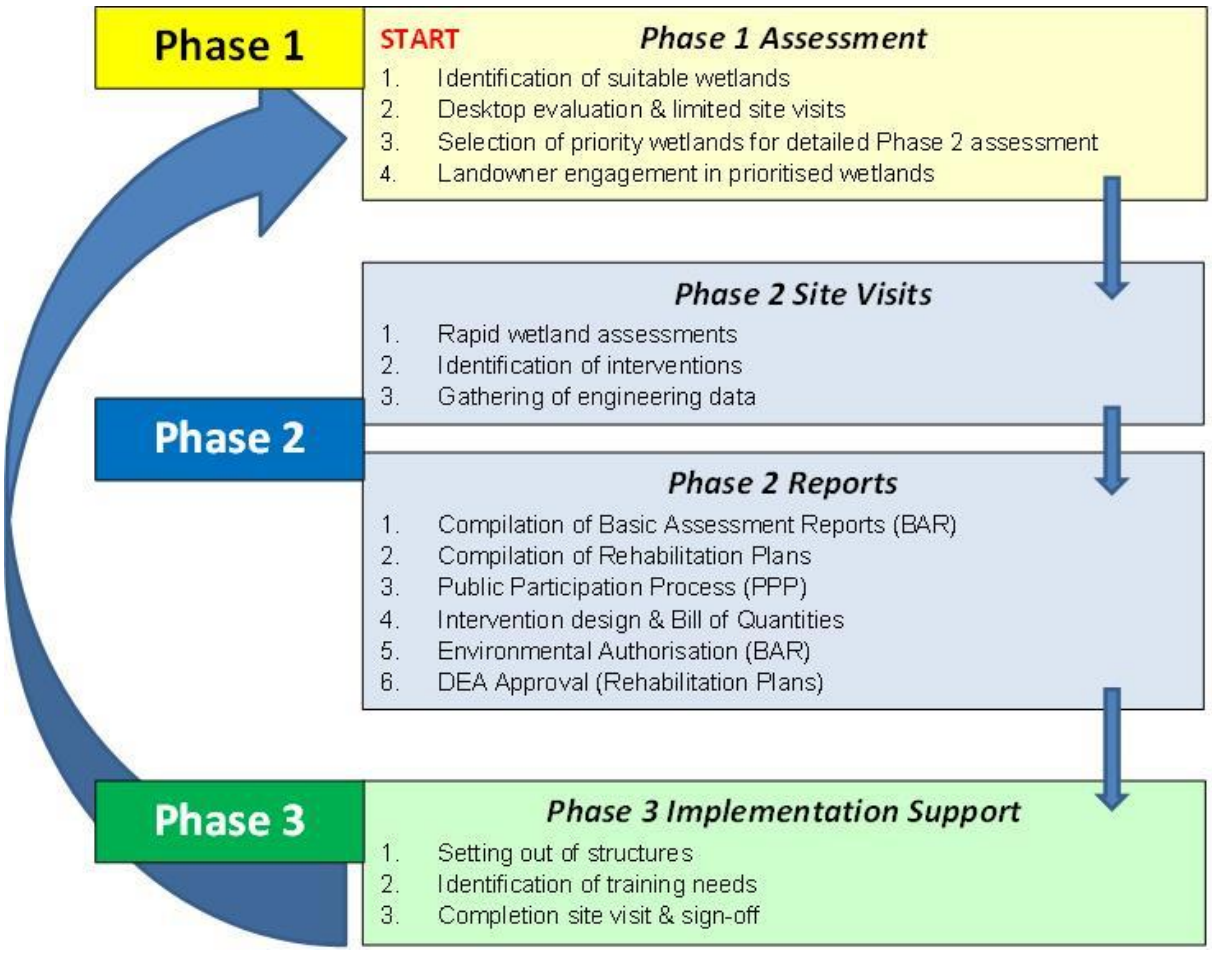

Plate C: The Working for Wetlands planning process (Phase 1 to Phase 3).

Phase 1 commences with a catchment and wetland prioritisation process for every province. The wetland ecologist responsible for a particular province undertakes a desktop study to determine the most suitable wetlands for the WfWetlands rehabilitation efforts. The involvement of Provincial Wetland Forums and other key stakeholders is a critical component of the wetland identification processes since these stakeholders are representative of diverse groups with shared interests (e.g. from government institutions to amateur ecological enthusiasts). This phase also involves initial communication with local land-owners and other Interested and Affected Parties (I&APs) to gauge the social benefits of the work. Aerial surveys of the areas in question may be undertaken, as well as limited fieldwork investigations or site visits to confirm the inclusion of certain wetland projects or units. Once wetlands have been prioritised and agreed on by the various parties, specific rehabilitation objectives are determined for each wetland following a rapid wetland status quo assessment undertaken by the wetland ecologist.

Phase 2 requires site visits attended by the fieldwork team comprising a wetland ecologist, a Design Engineer, an Environmental Assessment practitioner, and a SANBI Provincial Coordinator. Other interested stakeholders or authorities, landowners and in some instances the implementing agents may also attend the site visits on some occasions. This allows for a highly collaborative approach, as options are discussed by experts from different scientific disciplines, as well as local inhabitants with deep anecdotal knowledge. While on site, rehabilitation opportunities are investigated. The details of the proposed interventions are discussed, some survey work is

undertaken by the engineers, and GPS coordinates and digital photographs are taken for record purposes. Furthermore, appropriate dimensions of the locations are recorded in order to design and calculate quantities for the interventions. At the end of the site visit the rehabilitation objectives together with the location layout of the proposed interventions are agreed upon by the project team.

During Phase 2, monitoring systems are put in place to support the continuous evaluation of the interventions. The systems monitor both the environmental and social benefits of the interventions. As part of the Phase 2 site visit, a maintenance inventory of any existing interventions that are damaged and/or failing and thus requiring maintenance is compiled by the PC, in consultation with the Design Engineer.

Based on certain criteria and data measurements (water volumes, flow rates, and soil types); the availability of materials such as rock; labour intensive targets; maintenance requirements etc., the interventions are then designed. Bills of quantity are calculated for the designs and cost estimates made. Maintenance requirements for existing interventions in the assessed wetlands are similarly detailed and the costs calculated. The Design Engineer also reviews and, if necessary, adjusts any previously planned interventions that are included into the historical Rehabilitation Plans.

Phase 2 also comprises a reporting component where Rehabilitation Plans are prepared for each Wetland Project. The Rehabilitation Plans include details of each intervention to be implemented, preliminary construction drawings and all necessary documentation required by applicable legislation. The Rehabilitation Plans are reviewed by various government departments, stakeholders and the general public before a specific subset of interventions are selected for implementation.

Phase 3 requires that certain Environmental Authorisations are obtained before work can commence in the wetlands (please see subsequent sections of this document for detail on Environmental Authorisations). Upon approval of the wetland Rehabilitation Plans by DEA, DWA, and the directly affected landowners is obtained, the work detailed for the project will be implemented within a year with on-going monitoring being undertaken thereafter. The Rehabilitation Plans are considered to be the primary working document for the implementation of the project via the construction/ undertaking of interventions[3] listed in the Plan.

It is typically at this point in the process when the final construction drawings are issued to the Implementing Agents (IAs). Seventeen Implementing Agents are currently employed in the WfWetlands Programme and are responsible for employing contractors and their teams (workers) to construct the interventions detailed in each of the Rehabilitation Plans. For all interventions that are based on engineering designs (typically hard engineered interventions), the Design Engineer is required to visit the site before construction commences to ensure that the original design is still appropriate in the dynamic and ever-changing wetland system. The Design Engineer will assist the IAs in pegging and setting-out interventions. The setting-out activities often coincide with the Phase 1 activities for the next planning cycle. Phase 3 concludes with the construction of the interventions, but there is an on-going monitoring and auditing process that ensures the quality of interventions, the rectification of any problems, and the feedback to the design team regarding lessons learnt.

[3] This could include soft options such as alien clearing, eco-logs, gabion structures as well as hard structures for example weirs.

Rehabilitation work within floodplain systems

Based on lessons learnt and project team discussions held during the National Prioritisation workshop in November 2010 SANBI took an in-principle decision regarding work within floodplain systems.

Recognising the ecosystem services provided by floodplain wetlands and the extent to which they have been transformed, SANBI do not intend to stop undertaking rehabilitation work in floodplains entirely. Instead, SANBI propose to adopt an approach to the rehabilitation of floodplain areas that takes into account the following guiding principles:

1. As a general rule, avoid constructing hard interventions within an active floodplain channel; and rather
2. Explore rehabilitation opportunities on the floodplain surface using smaller (possibly more) softer engineering options outside of the main channel.

When rehabilitation within a floodplain setting is being contemplated, it will be necessary to allocate additional planning resources, including the necessary specialist expertise towards ensuring an adequate understanding of the system and appropriate design of the interventions.

7. Environmental legislation

One of the core purposes of the WfWetlands Programme is the preservation of South Africa's valuable wetland systems through rehabilitation and restoration. The WfWetlands Programme operates within the context of the Constitution of South Africa, Act No. 108 of 1996, whereby everyone has the right to have the environment protected and conserved for the benefit of present and future generations. The following legislation (listed in Table A) informs and guides the WfWetlands Programme in terms of its vision and objectives, whilst simultaneously regulating the wetland rehabilitation activities which WfWetlands carries out.

South Africa has rigorous and comprehensive environmental legislation aimed at preventing degradation of the environment, including damage to wetland systems. Development proposals within or near any wetland system are subject to thorough bio-physical and socio-economic assessment as mandatory processes of related legislation. These processes are required to prevent degradation of the environment and to ensure sustainable and environmentally conscientious development.

The WfWetlands Programme requires that both hard and soft interventions are implemented in the wetland system, and it is the activities associated with the construction of these interventions that triggers requirements for various authorisations, licenses or permits. However, it is important to note that the very objective of the WfWetlands Programme is to improve both environmental and social circumstances. The WfWetlands Programme gives effect to a range of policy objectives of environmental legislation, and also honours South Africa's commitments under several international agreements, especially the Ramsar Convention on Wetlands.

Memorandum of Understanding for Working for Wetlands Programme
A Memorandum of Understanding (MOU) has been entered into between the DAFF, DEA, DWA and SANBI for the WfWetlands Programme. Through co-operative governance and partnerships, this MOU aims to streamline the authorisation processes required by the National Environmental Management Act, No. 107 of 1998, the National Water Act. No. 36 of 1998, and the National Heritage Resources Act, No. 25 of 1999 to facilitate efficient processing of applications for authorisation of wetland rehabilitation activities.

Table A: List of applicable legislation

Title of legislation, policy or guideline:	Administering authority:	Date:
The Constitution of South Africa, Act No.108 of 1996	National Government	1996
National Environmental Management Act, No.107 of 1998	Department of Environmental Affairs	1998
The National Water Act, No. 36 of 1998	Department of Water Affairs	1998
Conservation of Agricultural Resources Act, No. 43 of 1983	Department of Agriculture, Forestry & Fisheries	1983
National Heritage Resources Act, No. 25 of 1999	National Heritage Resources Agency	1999
World Heritage Conventions Act, No. 49 of 1999	Department of Environmental Affairs	1999
The National Environmental Management: Biodiversity Act, No. 10 of 2004	Department of Environmental Affairs	2004
National Environmental Management: Protected Areas Act, No. 57 of 2003	Department of Environmental Affairs	2003
The Mountain Catchments Areas Act, No. 63 of 1970	Department of Water Affairs	1970
• EIA Guideline Series, in particular: • Guideline 3 – General Guide to the Environmental Impact Assessment Regulations, 2006 (DEAT 2006) • Guideline 4 – Public Participation in support of the EIA regulations, 2006 (DEAT 2006) • Guideline 5 – Assessment of Alternatives and Impacts, 2006 (DEAT 2006) • Implementation Guidelines: Sector Guidelines for the EIA Regulations (draft) (DEA, 2010). • DEA&DP. 2013. Guideline on Public Participation (DEA&DP, March 2013). • DEA&DP. 2013. Guideline on Alternatives (DEA&DP, March 2013).	Department of Environmental Affairs	2006 - 2013
International Conventions, in particular:	International Conventions	N/A

Title of legislation, policy or guideline:	Administering authority:	Date:
• The Ramsar Convention • Convention on Biological Diversity • United Nations Conventions to Combat Desertification • New Partnership for Africa's Development (NEPAD) • The World Summit on Sustainable Development (WSSD)		

Of particular relevance in Table A is the following legislation and the WfWetlands Programme has put systems in place to achieve compliance:

- The National Environmental Management Act, No. 107 of 1998 (NEMA)
  - In terms of Regulations pursuant to the NEMA, certain activities that may have a detrimental impact on the environment (termed Listed Activities) require an Environmental Authorisation from the Department of Environmental Affairs (DEA). The implementation of interventions will trigger NEMA Listing Notices 1 and 3 (G.N. R544 and G.N R546 respectively). In order to meet the requirements of these Regulations, it is necessary to undertake a Basic Assessment Process and apply for an EA. This was previously undertaken on an annual basis per Province as the Wetland Projects became known. However as from 2014, an application is now made per Province for Wetland Projects required in the next few planning cycles (anywhere from one to three planning cycles depending on the information gained through the Catchment Prioritisation Process).
  - **Basic Assessment Reports** (BARs) will be prepared for each Province where work is proposed by the WfWetlands Programme. These BARs will present all Wetland Projects that are proposed in a particular province, together with information regarding the quaternary catchments and the wetlands that have been prioritised for the next few planning cycles (anywhere from one to three planning cycles depending on the information gained through the Catchment Prioritisation Process). The EA's will be inclusive of all Listed Activities that may be triggered and will essentially authorise any typical wetland rehabilitation activities required during the WfWetlands Programme implementation phase.
  - A condition of the EA's is that **Rehabilitation Plans** will be prepared every year after sufficient field work has been undertaken in the wetlands that have an EA. These Rehabilitation Plans will be made available to registered Interested and Affected Parties (I&APs) before being submitted to DEA for approval. The Rehabilitation Plans will describe the combination and number of interventions selected to meet the rehabilitation objectives for each Wetland Project, as well as an indication of the approximate location and approximate dimensions (including footprint) of each intervention.
- The National Water Act, No.36 of 1998 (NWA)
  - In terms of Section 39 of the NWA, a General authorisation[4] (GA) has been granted for certain activities that are listed under the NWA that usually require

[4]Government Notice No. 1198, 18 December 2009

a Water Use License; as long as these activities are undertaken for wetland rehabilitation. These activities include '*impeding or diverting the flow of water in a watercourse*[5]' and '*altering the bed, banks, course or characteristics of a watercourse*[6]' where they are specifically undertaken for the purposes of rehabilitating[7] a wetland for conservation purposes. SANBI are required to register the 'water use' in terms of the GA.

- The National Heritage Resources Act, No. 25 of 1999 (NHRA)
  - In terms of Section 38 of the NHRA; any person who intends to undertake a development as categorised in the NHRA must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely the South African Heritage Resources Agency (SAHRA) or the relevant provincial heritage agency. These agencies would in turn indicate whether or not a full Heritage Impact Assessment (HIA) would need to be undertaken. Should a permit be required for the damaging or removal of specific heritage resources, a separate application will be submitted to SAHRA or the relevant provincial heritage agency for the approval of such an activity. SANBI has engaged with SAHRA regarding the wetland planning process and has committed to achieving full compliance with the heritage act over the next few years.

[5]Section 21(c) of the NWA, No. 36 of 1998

[6]Section 21(i) of the NWA, No. 36 of 1998

[7]Defined in the NWA as *"the process of reinstating natural ecological driving forces within part of the whole of a degraded watercourse to recover former or desired ecosystem structure, function, biotic composition and associated ecosystem services"*

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i. CONTEXT OF THE INFORMATION CONTAINED IN THIS REHABILITATION PLAN

Approach to the NEMA Environmental Process

The legislation protecting the environment in South Africa was not written with the intention of preventing wetland rehabilitation efforts, but rather at curtailing development in sensitive environments. It is important to remember that the WfWetlands Programme is not a development proposal, and although this programme technically requires authorisations, licenses and permits, such rehabilitation projects were never meant to be sent through legislative processes aimed at preventing negative environmental impact.

In terms of the environmental management principles of the National Environmental Management Act, No. 107 of 1998 (NEMA), certain activities that may have a detrimental impact on the environment (termed Listed Activities) require Environmental Authorisation (EA) from the Department of Environmental Affairs (DEA). The WfWetlands Programme will require that interventions be implemented and/or constructed in the wetland systems to ultimately restore some of the more natural wetland functions that have been lost to unsustainable land use practices or development. The implementation of certain interventions triggers Listing Notices 1 and 3 (G.N. R544 and G.N R546 respectively).

In order to meet the requirements of the Regulations pursuant to NEMA, it was necessary to undertake a Basic Assessment Process. **Basic Assessment Report (BARs)** were prepared and these reports presented all Wetland Projects for each Province, together with information regarding the quaternary catchments and the wetlands that were prioritised for the next few planning cycles (anywhere from one to three planning cycles depending on the information gained through the Catchment Prioritisation Process).

The EA that has been applied for will be inclusive of all Listed Activities that may be triggered whilst implementing the wetland rehabilitation interventions. Essentially this EA would authorise any typical wetland rehabilitation activities on condition that the specific intervention proposals are submitted in a Rehabilitation Plan to DEA for approval.

The **Rehabilitation Plans** for each Wetland Project will be prepared annually after sufficient field work and stakeholder consultation has been undertaken in the wetlands that have an EA. These Rehabilitation Plans will be submitted to DEA for approval as a condition of the EA for the respective Provincial BAR.

ii. CONTACT DETAILS

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iii. ABBREVIATIONS

BAR	Basic Assessment Report
BMP	Best Management Practise
CEMP	Construction phase Environmental Management Programme
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EPWP	Expanded Public Works Programme
IA	Implementing Agent
I&APs	Interested and Affected Parties
NHRA	National Heritage Resources Act
NEMA	National Environmental Management Act
NEM: BA	National Environmental Management Biodiversity Act
NEM: PAA	National Environmental Management Protected Areas Act
NFA	National Forests Act
NWA	National Water Act
PC	Provincial Coordinator
PIP	Project Implementation Plan
RHP	River Health Programme
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks

iv. GLOSSARY OF TERMS

Auger: An instrument used for boring or perforating soils or rocks, in order to determine the quality of soil, or the nature of the rocks or strata upon which they lie, and for obtaining water (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Avulsion: An abrupt change in the course of a stream from one flow path to another.

Bedload: Sediment that is transported by being rolled or bounced along the bed of the stream (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Bedrock: The solid rock that underlies unconsolidated material, such as soil, sand, clay, or gravel (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

BAR: A report as described in regulation 23 of the EIA regulation, 2006 that describes the proposed activities and their potential impacts.

BMP: Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWet implementers.

Biophysical: The biological and physical components of the environment (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Catchment: All the land area from mountaintop to seashore which is drained by a single river and its tributaries. Each catchment in South Africa has been subdivided into secondary catchments, which in turn have been divided into tertiary catchments. Finally, all tertiary catchments have been divided into interconnected quaternary catchments. A total of 1946 quaternary catchments have been identified for South Africa. These subdivided catchments provide the main basis on which catchments are subdivided for integrated catchment planning and management (consult DWAF [1994]) (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Collation Report: A report describing the Basic Assessment process followed for a provinces and collating the Basic Assessment reports for the various WfWet Projects within a province.

EAP: The individual responsible for the planning, management and coordination of the environmental impact assessments, strategic environmental assessments, environmental management plans and/or other appropriate environmental instruments introduced through regulations of NEMA.

Eco-log: A cylindrical wire mesh sleeve filled with organic material and/or soil used to prevent and/ or repair minor erosion.

Ecosystem Services Or 'eco services': The services such as sediment trapping or water supply, supplied by an ecosystem (in this case a wetland ecosystem).

EIA: A study of the environmental consequences of a proposed course of action via the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

MP: Details the methods and procedures for achieving environmental targets and objectives.

Gabion: A structure made of wire mesh baskets filled with regularly sized stones, and used to prevent and/ or repair erosion. They are flexible and permeable structures which allow

water to filter through them. Vegetation and other biota can also establish in/around the habitat they create.

I&APs: People and organizations that have interest(s) in the proposed activities.

Environmental Impact: An environmental change caused by some human act.

Implementer: The person or organization responsible for the construction of WfWet rehabilitation interventions.

Intervention: An engineered structure such as a concrete or gabion weir, earthworks or re-vegetation that that achieves identified objectives within a wetland e.g. raising of the water table within a drainage canal.

Mitigation: Actions to reduce the impact of a particular activity.

Maintenance: The replacement, repair or the reconstruction of an existing structure within the same footprint, in the same location, having the same capacity and performing the same function as the previous structure ('like for like').

Perched wetland: A wetland where the wetland water table is higher than the local and regional water-table (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

PPP: A process of involving the public in order to identify issues and concerns, and obtain feedback on options and impacts associated with a proposed project, programme or development. Public Participation Process in terms of NEMA refers to: a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to specific project matters.

Project: An area of WfWet intervention generally defined by a quaternary catchment or similar management unit such as a national park in which a single implementer operates.

Q value: The peak flow (m^3/s) for which a structure is designed, based on a given likely return period rainfall within the catchment

Quaternary Catchment: All land area drained by a fourth order tributary river and its tributaries.

Rehabilitation: Refers to re-instating the driving ecological forces (including hydrological, geomorphological and biological processes) that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers.

Rehabilitation: Restoring processes and characteristics that are sympathetic to and not conflicting with the natural dynamic of an ecological or physical system (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Weir: A dam-type structure placed across a watercourse to raise the water table of the surrounding ground and trap sediment on the upstream face without preventing water flow. Weirs are generally used to prevent erosion from progressing up exposed gullies.

Wetland: "Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow

water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils." (SA Water Act of1998).

Wetland: Land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants living there (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

v. ASSUMPTIONS AND LIMITATIONS

In compiling this report, the following has been assumed:

- The information provided in this report is based on site visits that have been undertaken by the project team (EAP, Engineer, Wetland Ecologist, and SANBI PC) and their subsequent input into the Reporting, which includes intervention design drawings, the wetland assessment, in addition to input from SANBI's PC. It is understood that this information is sufficient for the authorisation processes and associated Phase 3 (Implementation phase). This data and relevant information has informed the findings and conclusions of this report.
- Information contained in this Report will be used during Phase 3 to guide and inform the Implementing Agents on design and construction specifications as part of Phase 3. Implementing Agents will thus use this Rehabilitation Plan and the information contained therein when constructing all interventions, the designs of which have been included in this Report.
- SANBI's PCs will be undertaking the landowner engagement and have obtained the requisite landowner consent forms required as part of Phase 1 and 2 of this project. These include:
  - WW(0): Standard operating procedure,
  - WW(1): Wetland survey and Inspection consent,
  - WW(2): Terms and Conditions for carrying out wetland rehabilitation,
  - WW(3): Wetland Rehabilitation Activities Consent, and
  - WW(4): Property Inspection Prior to Wetland Rehabilitation.
- SANBI have provided all relevant information and documentation required to compile this Rehabilitation Plan.
- Rehabilitation activities should not be carried out until the final Wetland Rehabilitation Plan has been approved by DEA and formally signed off by SANBI.
- The implementation of this rehabilitation plan must take into account all relevant provisions of Working for Wetlands Best Management Practices and Construction Environmental Management Plan, the recommendations of the Basic Assessments and the requirements of the Environmental Authorisation (EA) for the project.
- DEA's prerequisite to increase the requirement of percentage of funding to be spent on labour within the Working for Wetlands (WfWet) programme, has been taken into consideration by the project team during the planning process for wetland rehabilitation.
- Due to the dynamic nature of site conditions and associated biophysical changes within wetlands, this wetland rehabilitation plan is only valid for the 2014/15 financial year. Where appropriate interventions that have not been previously implemented or

included in the 2009/10, 2010/11, 2011/12, 2012/2013 and 2013/14 Project Implementation Plans (PIPs) were reviewed and where necessary re-designed for inclusion into the 2014/15 wetland rehabilitation plan. This wetland rehabilitation plan therefore supersedes all previous plans for this project and only interventions from this plan should be included in the 2014/15 PIP.

- Should it be necessary to exclude interventions from the rehabilitation plan, the prioritisation of interventions across the project should strictly be followed.

vi. GAPS IN KNOWLEDGE

- The information in this Report is based on existing available information and input from SANBI's PC, the specialist wetland ecologists, the Engineer, EAP as well as comments from Interested and Affected Parties (I&APs). Until this Final Report has been finalised and signed off by SANBI, the content of the Report should be considered as preliminary.
- Designs for the rehabilitation interventions have been developed for site conditions as at the time of the planning site visits. Should site conditions change before the designs are implemented, changes to the design may be necessary. In this case, project implementers may require the assistance of a professional engineer.
- The cost of construction at each project location will vary due to factors such as the local cost and availability of material, transport distances etc. The unit costs have been agreed with SANBI's PCs based on their knowledge of past projects and include an allowance for escalation.
- The labour intensive targets identified in this project are based on assumed productivity rates for various components of the construction process. This will vary in practise and will require regular monitoring to ensure that labour targets are attained.

Aurecon acknowledges the authorship of any information contained in this document from previous planning years, to the previous provider: Land Resources International (LRI).

This Report must be read in conjunction with the following reports for this project:

1. Phase 2 Planning Reports which include the:
    a. Basic Assessment Report (2014),
    b. Kamiesberg Rehabilitation Plan (February 2012), and the
    c. Wetland Assessment (**Appendix A** of this report).

vii. DISCLAIMER

- This Rehabilitation Plan is for the Kamiesberg Wetland Project in the Northern Cape Province. The plan is to be used to implement the interventions identified as necessary to rehabilitate the Kamiesberg wetlands, and is to be approved by the Department of Environmental Affairs (DEA) as part of the conditions of Environmental Authorisation (EA).
- The intervention points and wetland boundary polygons provided in this report are based on the shapefiles that have been provided by the South African National

Biodiversity Institute (SANBI). The datasets have been updated by the Wetland ecologists and verified by the SANBI Provincial Co-ordinators (PCs). All reasonable efforts have therefore been made to ensure that the data is accurate. However Aurecon South Africa (Pty) Ltd (Aurecon) does not accept responsibility for any remaining inaccuracies in the spatial data provided to us, which may be reflected in this report.

- Aurecon accepts responsibility for the engineering design to the extent that this is based on available information. The available information is limited to what could be interpreted during a single site visit of no longer than a few hours. No geotechnical, topographical, geomorphologic and other engineering related surveys have been undertaken to inform the design. This is non-standard engineering practice and therefore Aurecon is indemnified by the Client and does not accept responsibility for the associated risk of failure from the above limitations or any damages that may occur.
- This Rehabilitation Plan must not be amended without prior consultation and approval from DEA, the responsible Aurecon Environmental Assessment Practitioner (EAP), Engineer, SANBI PC and the SANBI Planning, Evaluation and Monitoring Manager.
- All changes must be motivated using the standard change request form supplemented with additional information as necessary.
- Aurecon is indemnified against any associated damages and accepts no liability associated with the construction and implementation of engineering interventions due to Aurecon being instructed to have limited contact with the implementer during the construction phase resulting in our inability to diligently supervise and assess any progress.
- The Client confirms that by accepting these drawings or reports, he acknowledges and accepts the abovementioned limitation of Aurecon's liability.

viii. DISTRIBUTION LIST

NAME	TITLE	FOR ACTION	FOR INFORMATION	RECEIVED PRIOR TO RELEASE
PROPONENT				
Umesh Bahadur	Programme Manager: Working for Wetlands		✓	
Eric Munzhedzi	Implementation Manager		✓	
Heidi Nieuwoudt	SANBI Provincial coordinator	✓		✓
NATIONAL STAKEHOLDERS				
Refer to **Appendix G**			✓(E-copy of Rehab Plan)	
PROVINCIAL STAKEHOLDERS & I&APs				
Refer to **Appendix H**			✓(E-mail notification)	
LANDOWNERS				
Refer to **Appendix E**			✓(E-copy of Rehab Plan)	

1 INTRODUCTION

1.1 Working for Wetlands programme overview

The Working for Wetlands (WfWetlands) Programme is a government programme (similar to Working for Water, Working on Fire and LandCare) managed by the South African National Biodiversity Institute (SANBI) on behalf of the national government departments of Environmental Affairs (DEA), Water Affairs (DWA), and Agriculture, Forestry and Fisheries (DAFF), and forms part of the Expanded Public Works Programme (EPWP).

The vision of the WfWetlands Programme is to facilitate the protection, conservation, rehabilitation and sustainable use of wetlands in South Africa, in accordance with national policies and commitment to international conventions and regional relationships. The two main objectives of the programme are **wetland conservation** in South Africa and **poverty reduction** through job creation and skills development amongst vulnerable and marginalised groups.

The WfWetlands Programme forms part of the EPWP which seeks to draw significant numbers of unemployed into the productive sector of the economy. These individuals gain skills while they work thus increasing their capacity to earn an income. Rehabilitation efforts are thus focused on wetland conservation and the appropriate use of wetlands in a way that attempts to maximize employment creation, support for small business and the transfer of skills to the unemployed and poor.

In the 12 years since its inception, the WfWetlands Programme has invested R530 million in wetland rehabilitation and has been involved in over 900 wetlands thereby improving or securing the health of over 70 000 hectares of wetland environment. The WfWetlands Programme has created more than 12 800 jobs and 2.2 million person-days of paid work. Local people are recruited to work and targets for employment specify that the programme's workforce should comprise at least 60% women, 20% youth and 2% disabled people.

1.1.1 Programme, projects and phases

In order to manage the WfWetlands Programme, prioritised wetlands that have been identified for rehabilitation have been grouped into "Wetland Projects" within each Province, and each Wetland Project encompasses several wetland systems which are each divided into smaller, more manageable and homogenous wetland units. A Wetland Project may be located within one or more quaternary catchments within a Province.

Each Project is managed in three phases over a two-year cycle. The first two phases (Phase 1 and Phase 2) straddle the first year of the cycle and involve planning, identification, design and authorisation of interventions. The third phase (Phase 3) is implementation of specific interventions to achieve rehabilitation, and this takes place during the second year. SANBI is currently managing 35 Wetland Projects countrywide, and approximately 500 interventions within these Wetland Projects will be implemented to meet the objectives of the Programme.

1.1.2 Methods of rehabilitation

The successful rehabilitation of a wetland requires that the cause of damage or degradation is addressed, and that the natural flow patterns of the wetland system are re-established (and flow is encouraged to disperse rather than to concentrate). The main aims of the WfWetlands Programme are:

- Restoration of hydrological integrity (e.g. raising the general water table or redistributing the water across the wetland area);
- Recreation of wetland habitat towards the conservation of biodiversity;
- Job creation and social upliftment.

Rehabilitation activities range from stabilising degradation to the more ambitious restoration of wetlands to their original conditions. Typical activities within the Wetland Projects include:

- Plugging artificial drainage channels created by development or historical agricultural practices to drain wetland areas for other land use purposes;
- Constructing structures (gabions and weirs) to divert or redistribute water to more natural flow paths, or to prevent erosion by unnatural flow rates that have resulted from unsustainable land use practices or development.
- Removing invasive alien or undesirable plant species from wetlands and their immediate catchments as part of the Working for Water Programme.

1.1.3 Intervention options

Methods of wetland rehabilitation may include hard engineering interventions such as:

- Earth berms in conjunction with gabion systems to block artificial channels that drain water from or divert polluted water to the wetland;
- Concrete weirs to act as settling ponds, to reduce flow velocity or to re-disperse water across former wetland areas thereby re-establishing natural flow paths;
- Concrete, earth or gabion structures plugs to raise channel floors and reduce water velocity;
- Concrete or gabion structures to stabilise head-cut or other erosion and prevent gullies; and
- Gabion structures (mattresses, blankets or baskets) to provide a platform for the growth of desired wetland vegetation.

Soft engineering interventions also offer successful rehabilitation methods, and the following are often used together with the hard engineering interventions:

- The re-vegetation of stabilised areas with appropriate wetland and riparian species;
- The fencing off of sensitive areas within the wetland to keep grazers out and to allow for vegetation to become re-established;
- The use of biodegradable or natural soil retention systems such as eco-logs, plant plugs, grass or hay bales, and brush-packing techniques.
- The removal of undesirable plant and animal species as part of the Working for Water initiative. Alien invasive plant clearing is an important part of wetland rehabilitation;

- In some instances, the use of appropriate fire management and burning regimes.

For more information on the WfWetlands Programme, please refer to the WfWetlands Context Document included in the front of this report.

1.2 Project team

The project team currently comprises the SANBI Programme Manager who oversees the WfWetlands Programme and provincial coordinators (PCs) who oversee the identification and implementation of projects in their regions. They are supported by a small team based at the Pretoria Botanical Gardens who fulfil various roles such as finance, Geographical Information Systems (GIS) and training.

Aurecon South Africa (Pty) Ltd (Aurecon) has been appointed to undertake the project activities and associated reporting required by the WfWetlands Programme. The Aurecon team comprises design engineers and environmental assessment practitioners (EAPs) who undertake the planning, design and authorisation components of the project. The Aurecon Team is assisted by an external team of Wetland Ecologists who provide scientific insight into the operation of wetlands and bring expert and often local knowledge of the wetlands. The project team is also complimented by the SANBI Provincial Coordinators (PCs) who are each responsible for provincial planning and implementation.

1.3 Northern Cape Wetland Projects

Wetland Projects for the 2014/2015 planning cycle were identified during the Phase 1 activities associated with the WfWetlands Programme. Catchment and wetland prioritisation assessments were undertaken by the wetland ecologist/s to identify priority catchments and associated wetlands within which rehabilitation work needed to be undertaken. A review was undertaken to determine local knowledge and identify existing studies of the quaternary catchments in the province. SANBI's current five year strategic plans were further used as a guide to identify wetlands, as well as data from the National Freshwater Ecosystem Priority Areas (NFEPA) project. Decisions on priority areas were informed by input from wetland forums, biodiversity/ conservation plans, municipalities, state departments and various other stakeholders.

Based on this process, the following quaternary catchments (and associated wetland systems) were identified for the 2014/2015 planning cycle in the Northern Cape Province (**Table 1**):

Table 1: Northern Cape Wetland Projects

Project Name	***Wetland Number***	***Wetland System***
Kamiesberg	F30C-01	Kleingaas
	F50G-01	Groenrivier

Project Name	*Wetland Number*	*Wetland System*
	F30A-03	Kleikop
	F30A-06	Schaaprivier
	F30A-08	Langvlei
	F30A-09	Natpad
	F30A-10	Windpoort
	F50A-07	Xharas
	F50E-02	Kraaifontein

A basic EIA application has been lodged with the National DEA on the 14 February 2014 for the undertaking of listed activities in terms of NEMA. The DEA will issue an EA that will permit the WfWetlands Programme to undertake wetland rehabilitation in the abovementioned wetland systems within the Northern Cape Province. This Rehabilitation Plan focusses on the Kamiesberg Wetland Project and is to be submitted to DEA for their approval as a condition of the EA.

1.3.1 The Kamiesberg Wetland Project

This document comprises the Rehabilitation Plan for the Kamiesberg Wetland Project and includes the following wetland systems: Kleingaas, Groenrivier, Kleikop, Schaaprivier, Langvlei, Natpad, Windpoort, Xharas and Kraaifontein Farm Wetland. The Rehabilitation Plan will be the primary working document for the project via the implementation (construction/ undertaking of) of interventions[8] required to meet the wetland rehabilitation objectives. The document details the general methodology that has been adopted for the planning of rehabilitation interventions for identified wetlands. Details of the rehabilitation planning for each wetland and the selected intervention options (including designs, dimensions and locations) within each wetland are presented, along with baseline Monitoring and Evaluation (M&E) data.

Detailed wetland assessment reports and design drawings are included as **Appendix A** of this report. Upon approval of this Rehabilitation Plan by both DEA and the directly affected landowners, the work detail for the project will be implemented within a year with on-going monitoring being undertaken from thereon.

[8] This could include soft options such as alien clearing, eco-logs, gabion structures as well as hard structures, for example weirs.

1.4 Project scope

The scope of this Wetland Project is detailed in the **Table 2** below:

Table 2: Project Scope

Quaternary Catchments	F30A, F50A & F50E
Quaternary Catchment area (Ha)	388 082 Ha
Number of wetlands identified during the assessment	Nine
Extension of existing work (previous financial year)	Yes
Work to commence at new wetlands in 2014/ 2015	Yes
Available budget for new interventions	R 2,058,477
Available budget for maintenance to existing interventions	
Estimated cost of new interventions	R 6,640,744.65
Estimated cost of maintenance to existing interventions	To be confirmed (planning in progress)

2 GENERAL METHODOLOGY

Each Wetland Project is managed in three phases over a two-year cycle as shown in the flow diagram in **Figure 1** below. The first two phases straddle the first year of the cycle and involve planning, identification, design and authorisation of interventions. The third phase is implementation, which takes place during the second year.

2.1 Landowner consent

The flow diagram Figure 1 also clearly demonstrates the point at which various consent forms must be approved via signature from the directly affected landowner. SANBI's PCs are responsible for undertaking the necessary landowner engagement and for ensuring that the requisite landowner consent forms required as part of Phase 1 and 2 of this project are signed. These include:

- WW(0): Standard operating procedure
- WW(1): Wetland survey and Inspection consent,
- WW(2): Terms and Conditions for carrying out wetland rehabilitation,
- WW(3): Wetland Rehabilitation Activities Consent,
- WW(4): Property Inspection Prior to Wetland Rehabilitation, and
- WW(5): Notification of Completion of Rehabilitation.

Refer to **Appendix E** for a copy of the landowner agreements.

2.2 Phase 1

The wetland ecologist responsible for the Northern Cape Province undertook a desktop study to determine the most suitable wetlands for the WfWetlands rehabilitation efforts. This phase also involved initial communication with local land-owners and other interested and affected parties to gauge the social benefits of the work. Limited fieldwork investigations or site visits to confirm the inclusion of certain wetland projects or units were also undertaken in (October 2013). The following wetlands were prioritised and agreed to by the various parties for the Kamiesberg Wetland Project:

1. Kleingaas (F30C-01)
2. Groenrivier (F50G-01)
3. Kleikop (F30A-03)
4. Schaaprivier (F30A-06)
5. Landvlei (F30A-08)
6. Natpad (F30A-09)
7. Windpoort (F30A-10)
8. Xharas (F50A-07)
9. Kraaifontein (F50E-02)

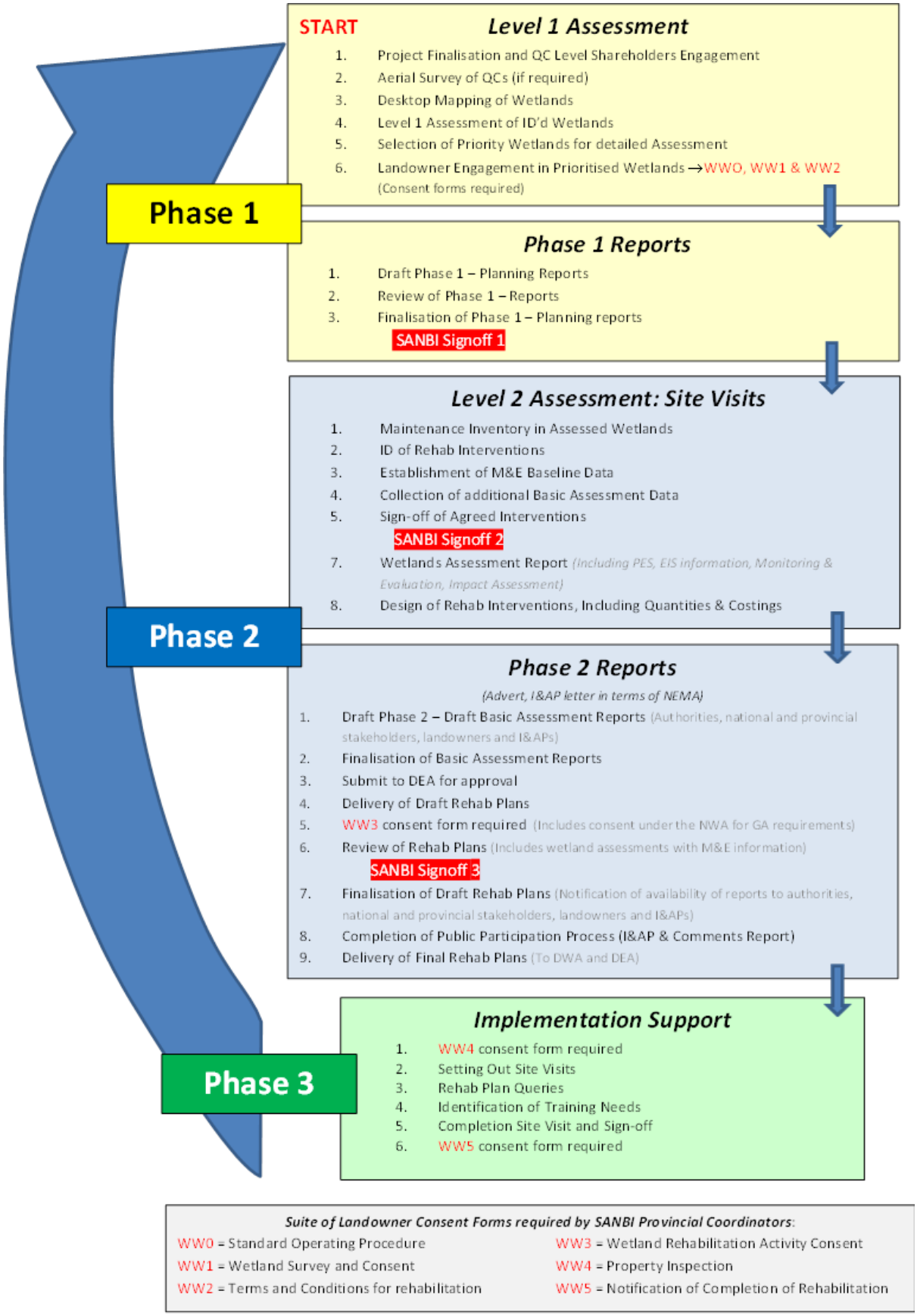

Figure 1: The three phases that must be undertaken for the successful rehabilitation of wetlands

2.3 Phase 2

2.3.1 Site visits

Phase 2 required site visits attended by the fieldwork team comprising a wetland ecologist, a design engineer and a SANBI provincial coordinator. Other interested stakeholders or authorities, landowners and the implementing agents also attended the site visits on this occasion. This allowed for a highly collaborative approach to be used, as options were discussed by experts from different scientific disciplines, as well as local inhabitants with deep anecdotal knowledge. The site visit was undertaken for the Kamiesberg Wetland Project in October 2013.

The following team members attended the site visits:

- Donovan Kotze (wetland ecologists),
- David Townsend (engineer), and
- Heidi Nieuwoudt (SANBI PC)

At the end of the site visit the rehabilitation objectives together with the location layout of the proposed interventions were agreed upon by the project team.

During Phase 2, monitoring systems were put in place to support the continuous evaluation of interventions. The systems monitor both the environmental and social benefits of the interventions. As part of Phase 2 site visit, a maintenance inventory of any existing interventions that were damaged and / or failing and thus requiring maintenance was compiled by the PC, in consultation with the Design Engineer.

2.3.2 Wetland assessments

The time and resources required for detailed assessments of the wetlands was generally limited, and thus a rapid procedure was adopted to assist the project team in systematically carrying out the assessments under constraints. The procedure was based on the following steps:

a. Assess impacts and threats

The following steps were used by the wetland ecologist to assess the impacts and threats within each wetland system:

- The hydro-geomorphic setting of the wetland was described according to Kotze *et al.* (2005);
- The overall health of the wetland at a Level 1 assessment using WET-Health (Macfarlane *et al.*, 2006) was described and verified;
- Based on the above findings, the specific impacts and/or threats to be addressed by structural rehabilitation were identified, and described at a Level 2 assessment (e.g. for headcut erosion, the specific dimensions and level of activity of headcuts would be described).

b. Set rehabilitation objectives and choose appropriate measures for achieving the objectives

Rehabilitation objectives were informed by the above assessments (*e.g.*, if the primary threat to the wetland was identified as headcut erosion threatening to propagate through the wetland then an appropriate rehabilitation objective would be to halt propagation of the erosion headcut). The engineer was assisted by the wetland ecologist and PC in selecting appropriate interventions to achieve the identified rehabilitation objectives.

c. Assess the likely contribution of rehabilitation interventions to wetland health and ecosystem delivery

An assessment of the predicted contribution that the identified rehabilitation interventions would make to improving wetland health and ecosystem delivery through addressing the identified impacts/threats was required. Without these assessments, a wetland rehabilitation programme is unlikely to have a well-informed basis on which to improve the rehabilitation's "return on investment" (with return being measured in terms of wetland health and ecosystem services delivery). This is directly linked into the *WfWet* Monitoring and Evaluation Framework. The following steps were followed to assess the contribution of rehabilitation interventions within each wetland system:

- The spatial area likely to be affected by the proposed intervention/s was identified.
- The benefits that were likely to result from achievement of the rehabilitation objective/s were determined in terms of the integrity of the affected area of the wetland (using WET-Health) and the ecosystem services that the area delivers (using WET-Ecoservices: Kotze *et al.*, 2005).

The same approach was used for the assessment of the different threats/impacts that would be addressed through rehabilitation. In this instance, the situation without rehabilitation (i.e. no intervention or *status quo*) was compared to the situation with rehabilitation. For health, both situations were scored on a scale of 0 (critically altered) to 10 (pristine), and this was undertaken for the hydrology, geomorphology and vegetation components of health.

The benefit achieved is the improvement in relation to the maximum score. For example, in areas threatened by headcut erosion which are to be rehabilitated by halting the spreading of the headcut, the benefits in terms of health would be determined based on the difference between the current health and the projected health if the headcut proceeded to erode through the threatened area. In such a case, stopping the expansion of the headcut would presumably secure the current situation.

Refer to **Appendix A** which contains the Wetland Assessment Reports.

2.3.3 Identification and location of intervention designs

The project teams evaluated the various rehabilitation intervention options available and selected the most appropriate intervention options to achieve the rehabilitation objectives for the wetland. Choices of intervention options were also informed by the increased labour

component as required by DEA. Any previously planned interventions that had not been implemented or included into the previous planning cycle reports were assessed and included into the current year's selection, if appropriate to the re-assessed rehabilitation objectives for the wetland. Agreed cost/benefit ratios in terms of 'Rands per hectare of rehabilitated wetland' were taken into account, along with operational considerations and larger scale project objectives.

After the appropriate intervention options were selected by the planning team, the engineer, in consultation with the wetland ecologist determined the most appropriate designs and locations for the identified interventions in order to achieve the rehabilitation objectives for the wetland in question. GPS coordinates and digital photographs – sufficiently detailed to clearly identify the selected locations were then taken for record purposes. Appropriate dimensions of the locations were measured in order to be able to design and calculate quantities for the interventions.

a. Intervention naming convention

A new naming convention was introduced in the 2011/2012 planning phase and this has been continued in this years' Rehabilitation Plans.

The **historical naming convention** for interventions is explained below:
A00A-00-000, where

Number	**Explanation**
A00A	quaternary number
00	wetland number
000	intervention number

The accepted **naming convention** which has been applied to all interventions (old and new) is explained below with examples being provided as well.

A00A-00-000-00 (new),

A00A-00-000-01 (maintenance), where

Number	**Explanation**		
A00A	quaternary number		
00	wetland number		
200	intervention number with the '**200**' included for differentiation from previous interventions		
00	**New** intervention	**01**	**Maintenance** to intervention

An additional two digits will therefore be added to the end of each of the intervention numbers to indicate maintenance on this specific intervention and/ or whether the structure is new (00) for tracking purposes. All new interventions will have a default of 00. Should built structures require maintenance, they would be numbered numerically beginning with '01' e.g. 01, 02, 03, etc. for each year that maintenance is undertaken on the intervention.

In addition, the new naming convention also added a '200' digit in the front of the intervention number to avoid confusion from previously named interventions.

2.3.4 Collection of Monitoring & Evaluation Baseline and Basic Assessments Data

In accordance with WET-Rehab-Evaluate (Cowden & Kotze, 2007) the collection of baseline monitoring information is important to allow for the evaluation of the performance of wetland rehabilitation activities. Monitoring and evaluation facilitate the dissemination of lessons learnt and provide a means of reporting on the success of specific wetland rehabilitation initiatives. The monitoring and evaluation (M&E) of an identified wetland rehabilitation project's performance is therefore considered vital to inform the evaluation of wetland rehabilitation success. Baseline monitoring needs to be carried out prior to the implementation of rehabilitation activities to provide comparable data for monitoring at a later stage, following the wetland rehabilitation.

While the engineer was working on measurement of the intervention locations, the wetland ecologist gathered the additional data required for M&E baselines which included the following:

- Photographs and GPS co-ordinates of the identified problems;
- Fixed-point photography (in accordance with the guidelines outlined in WET-Rehab-Evaluate: Cowden & Kotze, 2007);
- WET-Health information (allowing the comparison of wetland ecological integrity before and after rehabilitation activities); and
- Details relating to the estimated hectare equivalents.

Any additional data / information required for the assessment of the potential impacts of the proposed interventions and construction activities was also collected by the wetland ecologist and the EAP to inform the Basic Assessments.

At the end of the site visit a location layout of the agreed interventions and rehabilitation objectives was signed off by the SANBI PC and landowner, as indicated by SANBI Signoff 2 in **Figure 1.**

2.3.5 Engineering design

The detailed procedure followed by the engineers is described in the Engineering Design Brief, which documents the procedure agreed upon by Aurecon and SANBI. The document also addresses important issues such as risk and liability. A summary of the process followed for the engineering design is described below:

- A hydrological assessment was undertaken to quantify the volume of water expected to be dealt with by the intervention for various recurrence intervals. The results of this assessment allowed the engineer to select a design flow to be applied to the intervention.
- Construction materials were selected based on a range of site specific criteria including expected velocities, availability of materials such as rock, labour intensive targets, maintenance requirements etc.
- Interventions were designed based on the above to meet the objectives for wetland rehabilitation.
- The intervention designs were drafted to show, at a minimum, a plan view, a longitudinal section and front elevation at appropriate scales, and appropriate dimensions. A legend indicating basket sizes was included for gabion structures to improve design clarity for the implementers.
- Bills of quantities were calculated for the designs and cost estimates were made based on unit costs and norms for each project area, as agreed with the SANBI PC.
- The estimated budget allocation towards labour was indicated.
- Maintenance requirements for existing interventions in the assessed wetlands were similarly detailed and the anticipated costs calculated.

The engineer also reviewed and, if necessary, adjusted any previously planned interventions that are included into the current rehabilitation plan.

2.3.6 Development of the Rehabilitation Plan

The standardised Rehabilitation Plan format has been approved by SANBI Programme Manager: Planning, Monitoring and Evaluation.

Summaries of the wetland prioritisation, problems and rehabilitation objectives were documented in the Kamiesberg Rehabilitation Plan. Detailed wetland assessment reports, based on, *inter alia*, the information collected during the implementation of WET-Tools, were prepared by the wetland ecologist and/ or the EAP, and included as **Appendix A** to this report.

a. Format

All relevant information acquired during the assessments and field visits has been included in this document and its appendices in a hierarchy as shown in **Figure 2** below.

- All intervention locations are given in geographical coordinates, (degrees, minutes and seconds), based on the WGS84 datum.
- Mapping was done in Albers Equal Area Conic projection, WGS84 datum. The grids displayed on all maps are geographic and measured in Degrees Minutes and Seconds. The scale bar on each map is based on Albers Equal Area Conic projection and measured in metres.

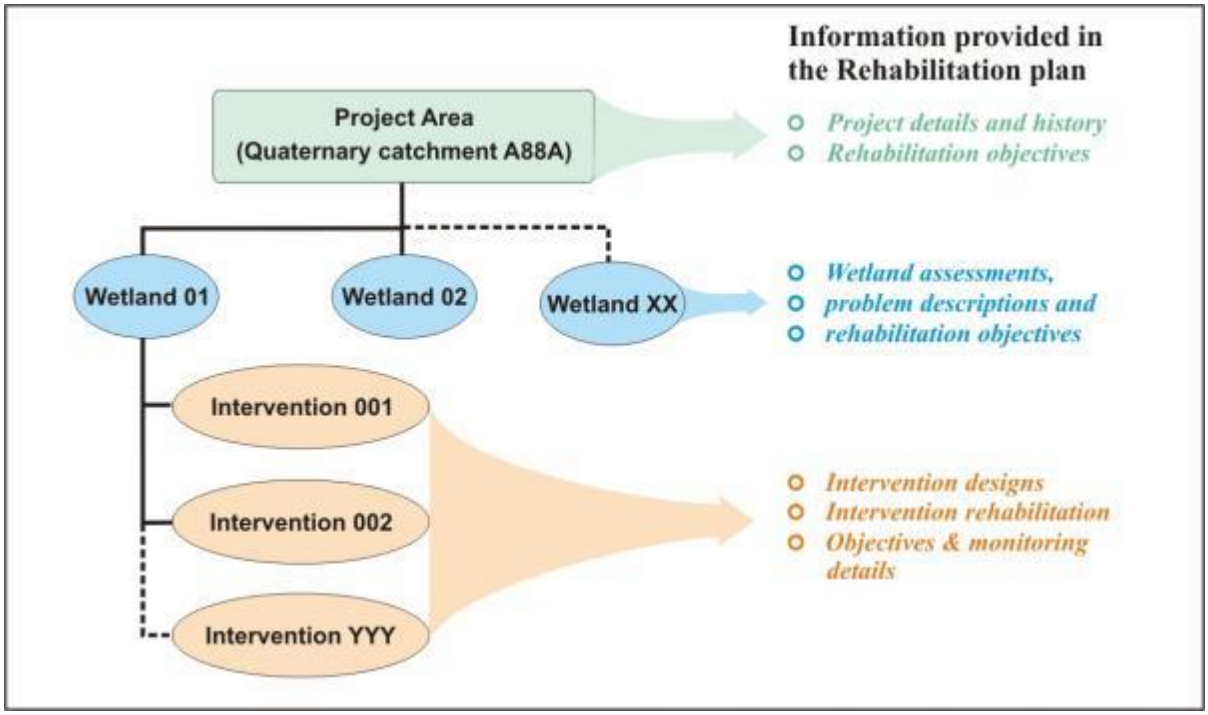

Figure 2: Hierarchy used in the Wetland Rehabilitation Plan

3 PROJECT DESCRIPTION

3.1 Project details

The Kamiesberg Wetland Project was initiated in 2009/2010 by the Working for Water Programme in partnership with the then Northern Cape. It is located in the F30A, F30C, F50A, F50E and F50G quaternary catchments near the towns of Kamieskroon and Leliefontein in the Northern Cape Province (see **Figures 3 to 7** and **Table 3** below):

Table 3: Project details

Project Name	Kamiesberg
Region (Province)	Northern Cape
Project Budget	R 2 058 477
Planning Category	Category 1
Nearest Town/s	Leliefontein and Kamiestroom
Partnership	

The project area focus on the Kamiesberg Uplands which is characterised by peaks and granite and gneiss outcrops located at over 1 000 m above mean sea level. The Kamiesberg Uplands is a global biodiversity hotspot and a centre for plant endemism within the Succulent Karoo biome (Marsh et al., 2009). The Uplands is also an important high water-yield area, with an annual rainfall of 300-400 mm, in contrast to 100 mm or less in the semiarid lower-lying areas.

The wetlands located within the Kamiesberg Uplands are important for maintaining the ecology and biodiversity of the area and in providing useful eco-services to the community. Furthermore, the rivers flowing from the uplands down to the coast are important corridors linking the uplands to the lowlands and are unique biogeographic islands with regard to wetland fauna and flora species.

Historically the Kamiesberg wetlands have been subject to high on-site impacts through cultivation; artificial drainage channels; erosion (e.g. where flow is focussed in the drainage channels) and planting of alien trees, e.g. poplars, although some of the historically cultivated areas have now been abandoned and the vegetation partly recovered. The focus of the wetland rehabilitation is on reducing the hydrological impact of drainage channels within abandoned lands, halting human-induced erosion and removing poplars where willing landowners can be found.

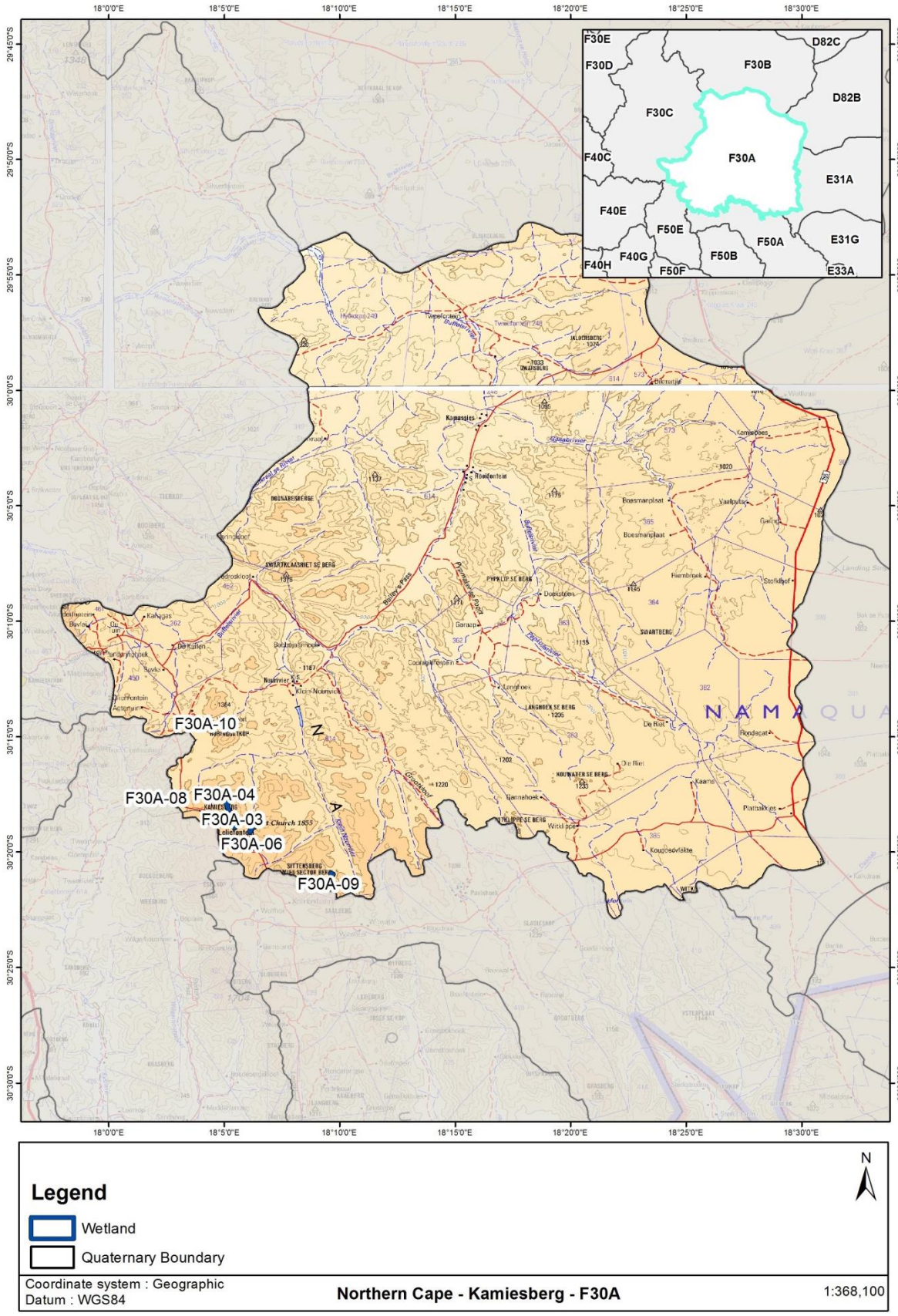

Figure 3: Topographic map showing the F30A quaternary catchment's locality

Figure 4: Topographic map showing the F30C quaternary catchment's locality

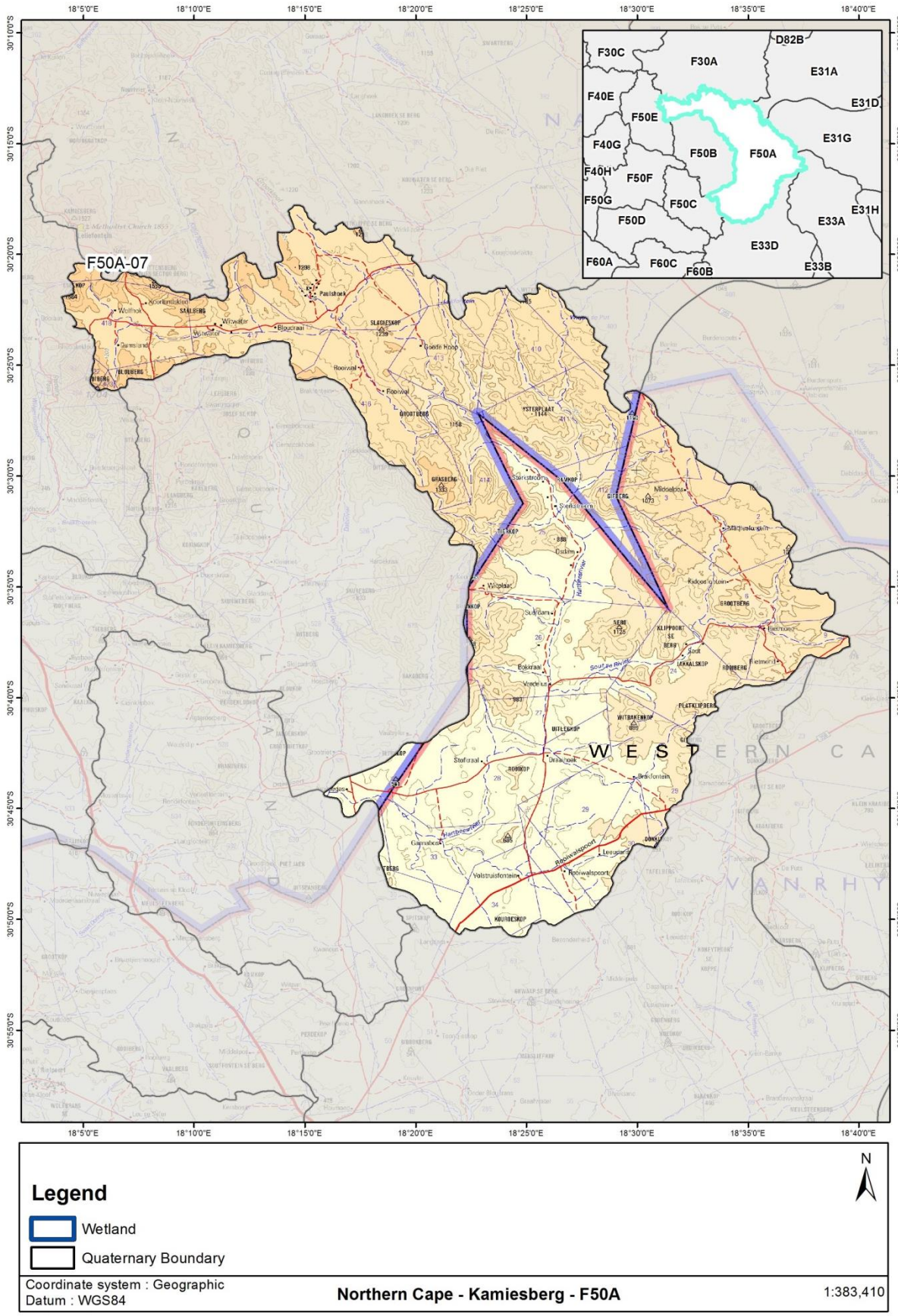

Figure 5: Topographic map showing the F50A quaternary catchment's locality

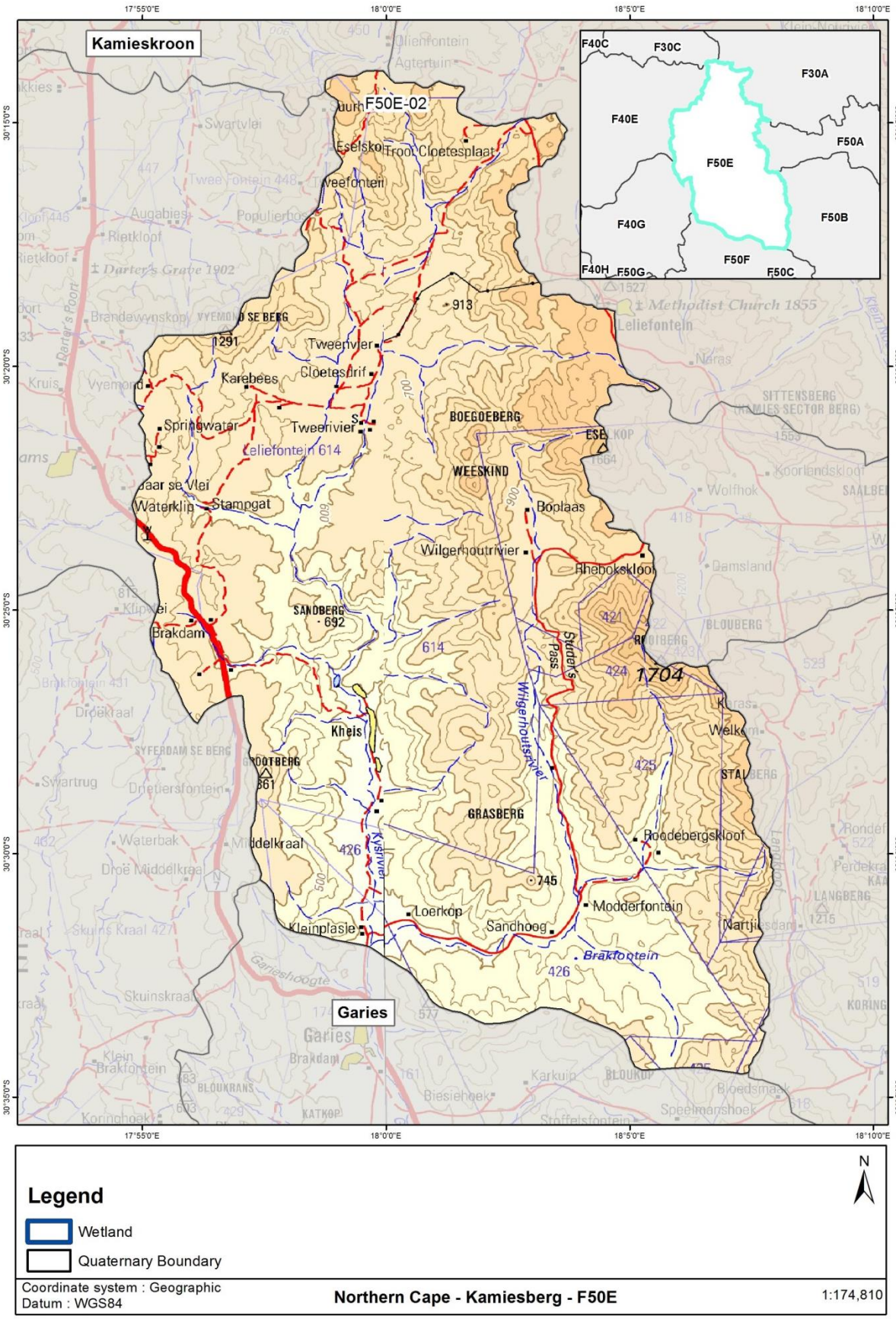

Figure 6: Topographic map showing the F50E quaternary catchment's locality

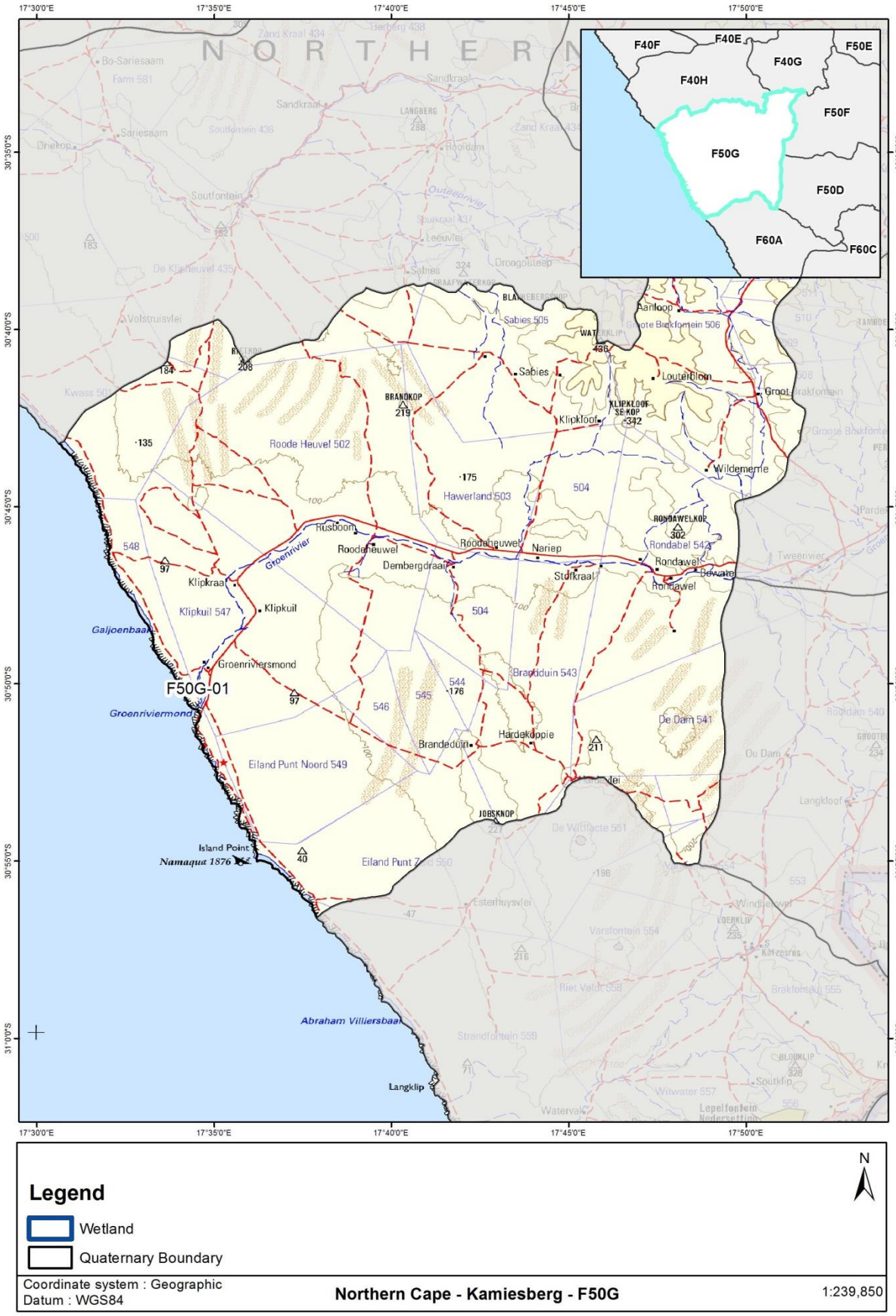

Figure 7: Topographic map showing the F50G quaternary catchment's locality

A review of the Namakwa District Biodiversity Sector Plan (NDBSP) highlights that the majority of the Kamiesberg project area is considered 'under pressure' as a result of competing demands between cultivation, grazing and biodiversity. The approach of focussing on properties where the landowners are already part of the stewardship programme has ensured that the rehabilitation planning is focussed on properties classified as formally protected areas. Kamiesberg recommended spatial planning categories for aquatic critical biodiversity areas in terms of the NDBSP are of priority areas for conservation and protected areas. The proposed rehabilitation is therefore likely to contribute towards future biodiversity objectives of the NDBSP in the region.

Wetlands selected: The nine wetlands within the Kamiesberg Wetland Project that have been identified for rehabilitation efforts for this planning cycle and are listed in the table below (**Table 4**).

Table 4: Identified wetlands within the Kamiesberg Wetland Project

Wetland Number	Wetland Name	Latitude	Longitude
F30C-01	Kleingaas	30 º 10' 36.69" S	17 º 56' 10.89"E
F50G-01	Groenrivier	30 º 50' 2.5"S	17 º 34' 33.7"E
F30A-03	Kleikop	30°17' 44.20"S	18°04'56.70"E
F30A-06	Schaaprivier	30º 18' 39.8''S	18º 06' 14.8''E
F30A-08	Langvlei	30º 17' 28.8''S	18º 03' 10.0''E
F30A-09	Natpad	30º 21' 12.3''S	18º 09' 31.6''E
F30A-10	Windpoort	30º 14' 18.6''S	18º 04' 13.6''E
F50A-07	Xharas	30º 20' 25.2''S	18º 06' 24.5''E
F50E-02	Kraaifontein	30º 14' 29.3''S	18º 00' 09.9''E

3.2 Landowner details

The landowners were identified for this Wetland Project (**Table 5**) and consent for any proposed wetland rehabilitation (subject to the approval of the Final Rehabilitation Plans) has been sought. Copies of the consent obtained are provided in **Appendix E**.

Table 5: List of Landowners and SG Key

Wetland Number	Property SG Key	Owner	Consent Obtained
F30C-01	C05300000000046300004	C. Genis	Yes

Wetland Number	Property SG Key	Owner	Consent Obtained
F50G-01	C05300000000054700001	SANParks: Namaqua National Park	Yes
F30A-03	C05300000000061400468	Kamiesberg Local Municipality	Yes
F30A-06	C05300000000061400525	Kamiesberg Local Municipality	Yes
F30A-08	C05300000000061400461	Kamiesberg Local Municipality	Yes
F30A-09	C05300000000061400298	Kamiesberg Local Municipality	Yes
F30A-10	C05300000000061400444	Kamiesberg Local Municipality	Yes
F50A-07	C05300000000061400509	Kamiesberg Local Municipality	Yes
F50E-02	C05300000000065300000	I.J.M. van Niekerk	Yes

3.3 Projected rehabilitation indicators

The rehabilitation planning process relies on the measurement of wetland ecological integrity based on the assessment of the hydrology, geomorphology and vegetation components of the specified systems. In theory this information could be converted into a hectare equivalent which could serve as a baseline indicator to then provide a projection of the area of wetland habitat gained or secured. In practice the level of confidence associated with interpretations of this nature are usually low and difficult to defend and hence should be interpreted with great caution. For example, this approach should not be followed for hectare equivalents secured where a large wetland complex with many contiguous tributary arms of unknown size are present upstream. Similarly, the area of wetland gained should not be determined if there isn't good knowledge of inter alia the hydrogeological characteristics of both the bedrock and unconsolidated sedimentary cover. In well-known systems rehabilitation plans can outline the following projected values for the proposed wetland rehabilitation, which can be used as an indicator of wetland rehabilitation success within each wetland system (**Table 6**):

Table 6: Projected Values

Wetland No.	Area (ha)	Current hectare equivalents	Projected hectare equivalents gained	Total projected hectare equivalents	% Increase on current hectare equivalents	Projected hectare equivalents secured
F30C-01	0.2	0.07	0.06	0.13	86%	-
F50G-01	10.5	NA	NA	NA	NA	NA
F30A-03	1.13	0.58	-	0.80	38%	0.22
F30A-06	3.70	1.4	1.1	2.5	79%	-

Wetland No.	Area (ha)	Current hectare equivalents	Projected hectare equivalents gained	Total projected hectare equivalents	% Increase on current hectare equivalents	Projected hectare equivalents secured
F30A-08	1.30	0.38	-	0.83	118%	0.45
F30A-09	4.95	2.67	1.04	3.71	39%	-
F30A-10	0.9	0.34	0.17	0.51	50%	-
F50A-07	0.74	0.23	0.28	0.51	122%	-
F50E-02	0.47	0.18	0.12	0.30	67%	-

Please note that important factors such as biodiversity, species habitat, sense of place cultural significance etc. are not incorporated into hectare equivalents and therefore the full value of the system is not quantified. For the purpose of this report and due to the reasons above, the above table (**Table 6**) only reflects the amount of hectares physically gained as a result of the interventions.

3.4 Prioritisation of wetlands

Based on the wetland assessments conducted, the current progress of implementation within the project and the prioritisation of the rehabilitation interventions detailed in the following sections, the wetlands will be prioritised for rehabilitation in the following order (**Table 7**):

Table 7: Prioritisation of wetlands

Priority	Wetland number	Wetland name	Rationale
4	F30A-03	Kleikop	This wetland portion is characterized by predominantly diffuse flow and is dominated by hydric vegetation. Multiple headcuts are present at the nickpoint at the downstream end of the unit where diffuse flow naturally transitions to channelled flow. These headcuts are slightly active, with some limited evidence of active erosion visible, placing the upstream portion under moderate threat.
3	F30A-06	Schaaprivier	The stream channel through this valley bottom wetland is actively incising, with signs of recent erosion clearly visible. One of the factors contributing to this incision is likely to be the increased peak discharges contributed

Priority	Wetland number	Wetland name	Rationale
			by a section of the road to Natpad which descends to the wetland. The current road crossing in the wetland, where stones are packed, has prevented incision within a localized portion of the channel lying upstream of the crossing but the rocks are being undermined. The incision could be practically reduced by greatly improving runoff control on the descending section of road and by installing a series of structures to raise the base level of the channel and by stabilizing the existing road crossing.
1	F30A-08	Langvlei	Largely unchannelled portion characterized by diffuse water flow and an abundance of hydric plant species. However, this relatively large intact portion of wetland is under severe threat from a very active multiple headcut.
5	F30A-09	Natpad	Flow through the wetland area is concentrated in incised stream channels, which are continuing to incise further. However, it now supports terrestrial pioneer species and is poorly vegetated. Historically the lower portion was cultivated. Within the lower portion, the incised channel has lowered the water level and concentrated flow, thereby desiccating the area.
7	F30A-10	Windpoort	The wetland comprises a channelled valley bottom wetland which eroded severely in the past, followed by a period of sediment accumulation and then followed most recently by initial incision of the deposited sediment and a lowering of the water level in the wetland. The area upstream of the incision supports one of the largest stands of *Pseudoschoenus inanus* in the Kamiesberg commonage, which is harvested for building/craft purposes. The incision is still narrow but actively eroding upstream. This erosion could be halted and the water level raised in the wetland through appropriate interventions.

Priority	Wetland number	Wetland name	Rationale
8	F30C-01	Kleingaas	A small, recently constructed drainage furrow runs the length of the unit, which was recently cultivated. The landowner is willing to have the constructed drainage furrow in-filled and to reduce the intensity of use of the portion. His original intention was to establish dryland crops but he has agreed to let the vegetation revert back to indigenous wetland vegetation, which could be used in the dry season for grazing.
2	F50A-07	Xharas	The area was historically cultivated has been subject to a high level of artificial drainage which could be deactivated through appropriate interventions
6	F50E-02	Kraaifontein	A road running directly down through a seepage slope wetland is altering flow patterns through the unit and causing gully erosion. Livestock using the road. The landowner is willing to re-open an alternative road and close the road through the wetland. The priority is also based on the assumed willingness of the landowner to establish a buffer between the wetland and cultivated land lying immediately upslope.
4	F50G-01	Groenrivier	The hide site is at a very scenic location visited by a diversity of wetland-dependent birds. It is located within the Namaqualand National Park and there is good public access. In addition, through the use of appropriate signage, there are good opportunities for raising public awareness of the importance of wetlands in the overall catchment.

3.5 Interventions required

The following table (**Table 8**) provides a list of interventions requiring redesign, maintenance and or new structures for this project and their associated new intervention number.

Table 8: Summary of the interventions including a cross reference of intervention numbers

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
NEW				
Kleikop F30A-03				
Concrete weir	N/A	F30A-03-205-00	Construct concrete weir with concrete capping	Kamiesberg Rehabilitation Plan: April 2014
Schaaprivier (F30A-06)				
Gabion weir	N/A	F30A-06-201-00	Construct gabion weir with concrete capping	Kamiesberg Rehabilitation Plan: April 2014
Concrete weir	N/A	F30A-06-202-00	Construct concrete weir	Kamiesberg Rehabilitation Plan: April 2014
Concrete weir	N/A	F30A-06-203-00	Construct concrete weir	Kamiesberg Rehabilitation Plan: April 2014
Concrete weir	N/A	F30A-06-204-00	Construct concrete weir	Kamiesberg Rehabilitation Plan: April 2014
Earthworks	N/A	F30A-06-205-00	Construct road humps to divert water from the road	Kamiesberg Rehabilitation Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Brushpack	N/A	F30A-06-206-00	Brushpacks and re-seeding	Kamiesberg Rehabilitation Plan: April 2014
Fencing	N/A	F30A-06-207-00	Construct fence to prevent stock from entering the wetland	Kamiesberg Rehabilitation Plan: April 2014
Langvlei F30A-08				
Gabion weir	N/A	F30A-08-201-00	Gabion weir with concrete capping and geo-cells	Kamiesberg Rehabilitation Plan: April 2014
Gabion weir	N/A	F30A-08-202-00	Gabion weir with concrete capping and geo-cells	Kamiesberg Rehabilitation Plan: April 2014
Natpad F30A-09				
Fencing	N/A	F30A-09-201-00	Construct fence to prevent stock from entering the wetland	Kamiesberg Rehabilitation Plan: April 2014
Gabion weir	N/A	F30A-09-202-00	Construct gabion weir with concrete capping	Kamiesberg Rehabilitation Plan: April 2014
Brushpack	N/A	F30A-09-203-00	Brushpacks and re-seeding	Kamiesberg Rehabilitation Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Gabion weir	N/A	F30A-09-204-00	Construct gabion weir with concrete capping	Kamiesberg Rehabilitation Plan: April 2014
Gabion weir	N/A	F30A-09-205-00	Construct gabion weir with concrete capping	Kamiesberg Rehabilitation Plan: April 2014
Gabion weir	N/A	F30A-09-206-00	Construct gabion weir with concrete capping	Kamiesberg Rehabilitation Plan: April 2014
Gabion weir	N/A	F30A-09-207-00	Construct gabion weir with concrete capping	Kamiesberg Rehabilitation Plan: April 2014
Gabion weir with earthworks	N/A	F30A-09-208-00	(a) Construct a gabion weir, (b) grade road surface and (c) use rock packs in erosion channels along the road to prevent sediment being washed into the wetland system.	Kamiesberg Rehabilitation Plan: April 2014
Windpoort F30A-10				
Gabion weir	N/A	F30A-10-201-00	Construct gabion weir with concrete capping	Kamiesberg Rehabilitation Plan: April 2014
Sediment fence	N/A	F30A-10-202-00	Construct a sediment fence	Kamiesberg Rehabilitation Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Kleingaas F30C-01				
Earthworks	N/A	F30C-01-201-00	Fill in of artificial drainage line	Kamiesberg Rehabilitation Plan: April 2014
Revegetation	N/A	F30C-01-202-00	Revegetation	Kamiesberg Rehabilitation Plan: April 2014
Xharas F50A-07				
Concrete weir	N/A	F50A-07-217-00	Construct concrete weir	Kamiesberg Rehabilitation Plan: April 2014
Concrete weir	N/A	F50A-07-218-00	Construct concrete weir	Kamiesberg Rehabilitation Plan: April 2014
Sediment fence	N/A	F50A-07-219-00	Construct a sediment fence	Kamiesberg Rehabilitation Plan: April 2014
Sediment fence	N/A	F50A-07-220-00	Construct a sediment fence	Kamiesberg Rehabilitation Plan: April 2014
Kraaifontein F50E-02				
Earthworks	N/A	F50E-02-201-00	Earthworks with ecologs and MacMat-R	Kamiesberg Rehabilitation Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Sediment fence	N/A	F50E-02-202-00	Construct a sediment fence	Kamiesberg Rehabilitation Plan: April 2014
Groenrivier F50G-01				
Boardwalk	N/A	F50G-01-201-00	Construct boardwalk	Kamiesberg Rehabilitation Plan: April 2014
Birdhide	N/A	F50G-01-202-00	Construct birdhide	Kamiesberg Rehabilitation Plan: April 2014
Boardwalk	N/A	F50G-01-203-00	Construct boardwalk	Kamiesberg Rehabilitation Plan: April 2014

The intervention designs/ drawings included in this Rehabilitation Plan have been labelled according to the **new naming convention** only. For historical labelling of interventions, please use the table above (**Table 8**) as a cross reference.

4 Kleikop Wetland F30A-03

4.1 Wetland details

The Kleikop wetland is located in quaternary catchment F30A near the town of Leliefontein in the Northern Cape. The assessment of the Kleikop wetland F30A-03, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A:** Wetland Assessment Reports. The following sections provide a brief summary for this wetland.

The Kleikop wetland comprises of an unchannelled valley bottom wetland. The majority of the wetland's catchment comprises very rocky areas under natural vegetation. However, the lowest lying areas immediately surrounding and upstream of the wetland comprise cultivated lands. The less wet portions are dominated by renosterbos and wetter portions by *Cyperus thunbergeii,* and to a lesser extent *Ficinia nodosa* and *Carex divisor*. However, this unit is under threat from gully erosion.

Table 9: Summary of the wetland details

Wetland Name	Kleikop wetland
Wetland Number	F30A-03
River System Name	Nouw River, a tributary of the Buffels River
Land Use in Catchment	Mainly natural grazing land but also including some cultivated lands, mainly fallow lands and oats.
Land Use in Wetland	Natural vegetation used for grazing
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	30 September 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	1.13 ha

4.2 Site photos

Figure 8: Site photos of the Kleikop wetland (Courtesy: Donovan Kotze)

4.3 Wetland Problems

The main impacts to the Kleikop wetland are associated with historic disturbance and erosion, which is now currently active. Impacts from the upstream catchment are possibly also contributing. Upstream catchment related impacts have a relatively low impact on the wetland, whereas localized impacts from the degraded old lands adjacent to the wetland is more significant. The impacts to geomorphological integrity of the wetland are associated with both erosion and recent depositional features in the wetland. Within the Kleikop wetland incisional erosion and dominance of the vegetation by pioneer plant species are key impacts, both of which are likely to be linked to heavy grazing pressure and to some extent also to historical cultivation**.**

4.4 Rehabilitation

The primary objective of the rehabilitation is to halt the headcut threatening to advance through the Kleikop wetland by making use of appropriate erosion control structures to deactivate the currently active multiple headcut.

The secondary objective is to install earth plugs (with MacMat-R or a similar erosion protection blanket) to (a) deactivate the drain, (b) spread flows across the wetland and (c) raise the water table to encourage the re-establishment of natural wetland vegetation.

4.5 Summary proposed interventions

Work was initiated in this wetland in 2009 (see Kamiesberg Wetland Rehabilitation Plan, 2009) and required the construction of four concrete weirs. The new intervention proposed for the Kleikop wetland (**Figure 8**) is discussed in detail in the subsequent sections of this report. The table below (**Table 10**) provides a summary of the proposed work. The "implementation order" as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The "priority" as depicted in the table indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 4.7 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 10: Summary of proposed new interventions, F30A-03

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F30A-03-205-00	Concrete weir	1	4	R 220 323.21

4.6 Design selection and sizing

The objective of the interventions is to deactivate and stabilise the headcut and spread flow into the surrounding wetland. The most appropriate and cost effective method of doing this was considered to involve constructing a concrete weir at the nick point.

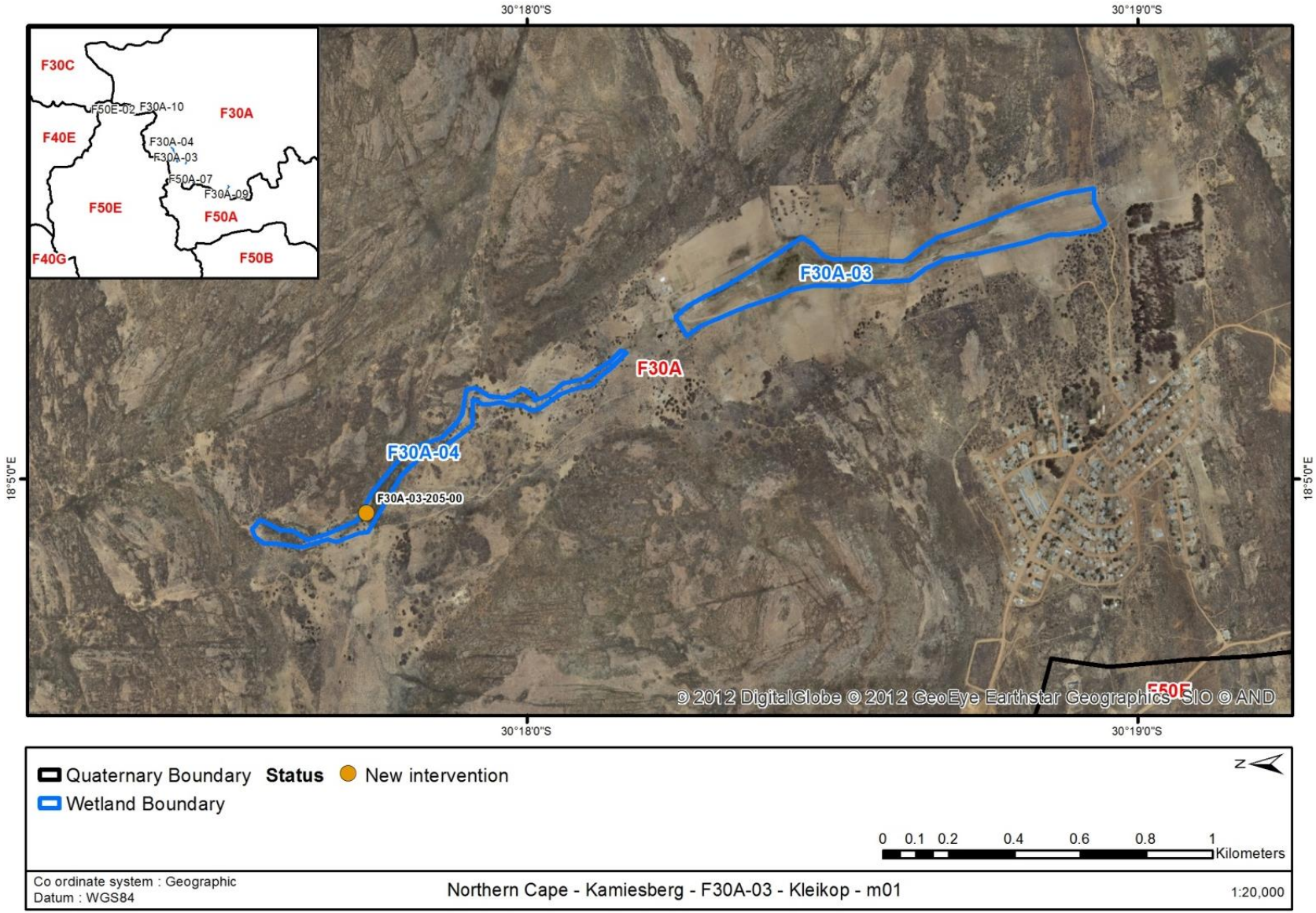

Figure 9: Wetland map F30A-03, indicating the locations of the proposed rehabilitation interventions

4.7 Intervention designs

4.7.1 Intervention: F30A-03-205-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Concrete weir
Rehabilitation Objective	Arrest migration of headcut erosion through wetland
Latitude (DºM'S")	30°17'44.2"S
Longitude (DºM'S")	18°04'56.7"E
Engineering Drawings	F30A-03-205-00

Figure 10: Intervention site F30A-03-205-00

4.7.1.1 Bill of quantities: F30A-03-205-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete	m	25.90	R 8 506.69	R 220 323.21
			Total	**R 220 323.21**

4.7.1.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

4.8 Construction Environmental Management Plan Issues

The proposed rehabilitation is to be undertaken on community owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the community. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F**.

4.9 Wetland Management Recommendations

The system is currently utilised for livestock grazing, but following the implementation of the rehabilitation activities the system may become inaccessible for livestock. The community should consider fencing the wetland and managing livestock access to limit grazing to the winter months.

4.10 Baseline M&E data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

4.10.1 Erosion problems

The main impacts to this wetland unit are associated with the road through the wetland which is concentrating flow through the wetland, increasing runoff intensity and erosion, and reducing opportunities for trapping sediment.

4.10.2 Fixed Point photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

FPP Number	Kleikop-01	
GPS Location (DMS)	Latitude	30°17'44.48"S
	Longitude	18°4'58.12"E
Description of Photography Point		
Type/ Orientation: Panoramic view of wetland		

FPP Number	Kleikop-02	
GPS Location (DMS)	Latitude	30°17'44.95"S
	Longitude	18°4'57.36"E
Description of Photography Point		
Type/ Orientation: 130°		
		

4.10.3 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to **Appendix A**):

Wetland No	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
F30A-03	56	3.0	-2.0	2.0	-2.0	3.8	-2.0
PES Categories		C	↓↓	D	↓↓	C	↓↓
Wetland Impact Score		3.0					
Wetland PES		C↓↓					

5 Schaaprivier Wetland - F30A-06

5.1 Wetland details

The Schaaprivier wetland is located in quaternary F30A near the towns of Leliefontein in the Northern Cape Province. The assessment of the Schaaprivier wetland F30A-06, its problems and the development of the rehabilitation objectives are described in detail in **Appendix A**: Wetland Assessment Report. The following sections provide a brief summary of this wetland.

Wetland comprises a valley bottom hydrogeomorphic setting and comprises of 3 units in which two main units run along the Schaaprivier itself as a naturally channelled valley bottom, Unit 1 the upper and Unit 2 the lower. In contrast, Unit 3 comprises an unchannelled side branch of the wetland fed by a small tributary. Most of the wetland is dominated by natural to semi-natural vegetation, Unit 2 shows signs of extensive recent erosion and Unit 3 is under threat of future erosion.

Figure 11: Units within the Schaaprivier wetland (Courtesy: Donovan Kotze)

Table 11: Summary of the wetland details

Wetland Name	Schaaprivier
Wetland Number	F30A-06
River System Name	Nouw river, a tributary of the Buffels river
Land Use in Catchment	Mainly natural grazing land over the majority of the catchment but much of the catchment immediately adjacent to the wetland comprised degraded old lands with extensive bare ground.
Land Use in Wetland	Natural Vegetation used for grazing
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	03 October 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	3.70 ha

5.2 Site photos

Figure 12: Site photos of the Schaaprivier wetland (Courtesy: Donovan Kotze)

5.3 Wetland problems

The wetland has been subjected to a number of impacts associated with the large modification of the system's hydrology which in turn has had a significant impact on its ecologicy. Although upstream catchment related impacts have a relatively low impact on the downstream wetland, localized impacts associated with old degraded lands adjacent to the wetland are very likely. A further factor likely to be contributing to increased peak flows supplied by the wetland's catchment is the section of the road to Natpad (see Chapter 4) where it descends a steep hill to the Schaaprivier wetland. The road has poor drainage, and it, together with gullies running alongside the road, act to concentrate surface runoff delivered to the wetland, particularly to the lower portion of Unit 2, which lies immediately below the road crossing.

The most important impact on hydrology within the wetland is the incision of the stream channel flowing through the lower portion of Unit 2, which is having a moderate impact on the overall unit. Unit 1 has undergone some channel incision in the past, but it appears to have been to a lesser degree than Unit 2, and current signs of active erosion are less apparent. Most of Unit 3 is still hydrologically intact but is under threat from a moderately active erosion headcut at its downstream end which threatens to advance in an upstream direction through the entire length of the unit. If this occurred, it would have a high impact in drying out the unit.

5.4 Rehabilitation Objectives

The following objectives have been identified:

- To prevent further incision of the channel in Unit 2 particularly in the portion upstream of the road crossing, and to raise the water level in the unit to close to its pre-incised level.
- Halt the advance of the headcut threatening to advance through Unit 3.
- Reduce the intensity of surface runoff delivered by the road running down the hill to the wetland
- Reduce the intensity of surface runoff delivered by the degraded lands lying adjacent to the wetland.

5.5 Summary proposed Interventions

The interventions proposed for the Schaaprivier wetland (**Figure 13**) are discussed in detail in the subsequent sections of this report. The table below (**Table 12**) provides a summary of these interventions. The "implementation order" as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The "priority" as depicted in the table indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 5.7 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 12: Summary of proposed new interventions, F30A-06

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F30A-06-201-00	Gabion weir	2	3	R 224 404.87
F30A-06-202-00	Concrete weir	1	3	R 324 104.79
F30A-06-203-00	Concrete weir	3	3	R 113 138.94
F30A-06-204-00	Concrete weir	4	3	R 124 197.64
F30A-06-205-00	Earthworks		3	R 36 375.00
F30A-06-206-00*	Brushpack	6	3	R 1 125 000.00
F30A-06-207-00*	Fencing	5	3	R 64 000.00
			Total	**R 2 047 596.25**

**This intervention does not trigger activities in terms of NEMA and as such does not require Environmental Authorisation to allow for implementation.*

5.6 Design selection and sizing

The objective of the interventions is to deactivate a drain and spread flow into the surrounding wetland areas. The most appropriate and cost effective method of doing this was considered to involve constructing a series of weirs to raise the water level, and use brush packs and fencing to prevent further erosion in the wetland.

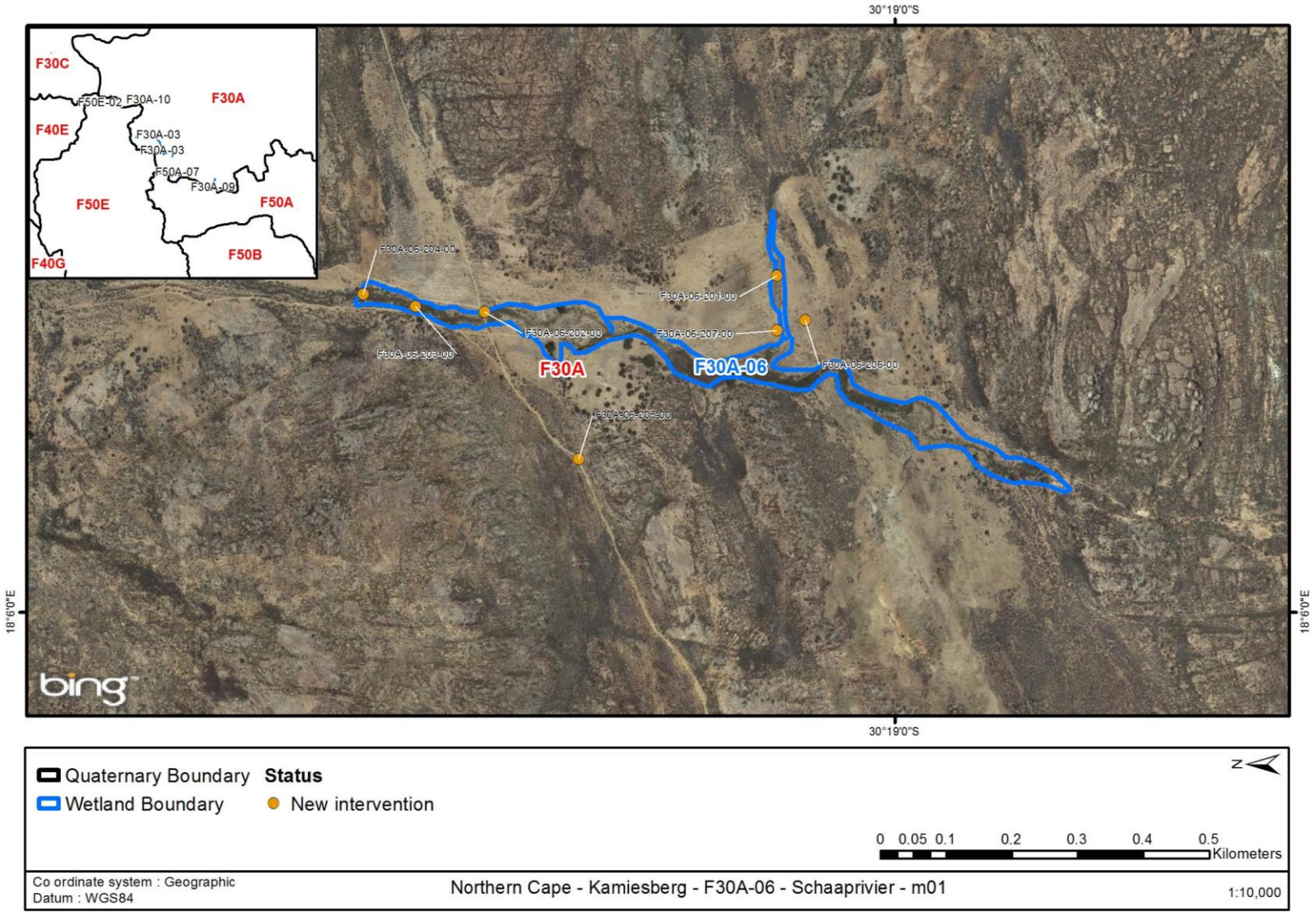

Figure 13: Wetland map, F30A-06 with proposed new wetland interventions indicated

5.7 Intervention designs

5.7.1 Intervention: F30A-06-201-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir
Rehabilitation Objective	Arrest migration of headcut erosion
Latitude (DºM'S")	30°18'54.20"S
Longitude (DºM'S")	18°06'16.60"E
Engineering Drawings	F30A-06-201-00

Figure 14: Intervention site F30A-06-201-00 looking in a south-westerly direction

5.7.1.1 Bill of quantities: F30A-06-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion	m³	63.20	R 3,550.71	R 224,404.87
Concrete (capping)	m³	2.10	R 8 506.69	R 17 864.04
			Total	**R 242 268.92**

5.7.1.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

5.7.2 Intervention: F30A-06-202-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Concrete weir
Rehabilitation Objective	Arrest migration of headcut erosion
Latitude (DºM'S")	30°18'39.80"S
Longitude (DºM'S")	18°06'14.80"E
Engineering Drawings	F30A-06-202-00

Figure 15: Intervention site F30A-06-202-00

5.7.2.1 Bill of quantities: F30A-06-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete	m^3	38.10	R 8 506.69	R 324 104.79
			Total	**R 324 104.79**

5.7.2.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

5.7.3 Intervention: F30A-06-203-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Concrete weir
Rehabilitation Objective	Arrest migration of headcut erosion
Latitude (DºM'S")	30°18'36.40"S
Longitude (DºM'S")	18°06'15.10"E
Engineering Drawings	F30A-06-203-00

5.7.3.1 Bill of quantities: F30A-06-203-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete	m^3	13.3	R 8 506.69	R 113 138.94
			Total	**R 113 138.94**

5.7.3.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

5.7.4 Intervention: F30A-06-204-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Concrete weir
Rehabilitation Objective	Arrest migration of headcut erosion
Latitude (DºM'S")	30°18'33.80"S
Longitude (DºM'S")	18°06'15.70"E
Engineering Drawings	F30A-06-204-00

Figure 16: Intervention site F30A-06-204-00

5.7.4.1 Bill of quantities: F30A-06-204-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete	m^3	14.6	R 8 506.69	R 124 197.64
			Total	**R 124 197.64**

5.7.4.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

5.7.5 Intervention: F30A-06-205-00

Intervention Description	15x road humps of ~5m^3 each
Rehabilitation Objective	Divert water from road to prevent erosion at low points where water leaves the road
Latitude (DºM'S")	30°18'54.92"S
Longitude (DºM'S")	18° 5'41.49"E

5.7.5.1 Bill of quantities: F30A-06-205-00

Item	Units	Quantity	Unit Cost	Item Cost
Road humps	m³	75	R 485.00	R 36 375.00
			Total	**R 36 375.00**

5.7.5.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

5.7.6 Intervention: F30A-06-206-00

Intervention Description	Brushpacks and re-seeding
Rehabilitation Objective	Create micro-habitats and encourage the re-establishment of wetland vegetation species
Latitude (DºM'S")	30°18'55.60"S
Longitude (DºM'S")	18°06'14.40"E

Figure 17: Intervention site F30A-06-206-00

5.7.6.1 Bill of quantities: F30A-06-206-00

Item	Units	Quantity	Unit Cost	Item Cost
Brushpack and re-seeding	m^3	25 000	R 45.00	R 1 125 000.00
			Total	**R 1 125 000.00**

5.7.6.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

5.7.7 Intervention: F30A-06-207-00

Intervention Description	Fencing
Rehabilitation Objective	Prevent cattle from entering sensitive wetland area while allowing the vegetation to re-establish
Latitude (DºM'S")	30°18'54.20"S
Longitude (DºM'S")	18°06'13.92"E

5.7.7.1 Bill of quantities: F30A-06-207-00

Item	Units	Quantity	Unit Cost	Item Cost
Fence	m	400	R 160.00	R 64 000.00
			Total	**R 64 000.00**

5.7.7.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

5.8 Construction Environmental Management Plan issues

The proposed rehabilitation is to be undertaken on community owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the community. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F**.

5.9 Wetland management recommendations

The system is currently utilised for livestock grazing, but following the implementation of the rehabilitation activities the system may become inaccessible for livestock. The community should consider fencing the wetland and managing livestock access to limit grazing to the winter months.

5.10 Baseline M&E data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

5.10.1 Erosion problem

In the absence of any intervention, erosion is likely to worsen in certain portions of the wetland and this, combined with sustained heavy grazing, is likely to result in a slight further increase in renosterbos and other pioneer species over the next five years.

5.10.2 Fixed point photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

FPP Number	Schaaprivier-01	
GPS Location (DMS)	Latitude	30°18'54.20"S
	Longitude	18°06'16.60"E
Description of Photography Point		
Type/ Orientation: Panoramic view of wetland		

FPP Number	Schaaprivier-02	
GPS Location (DMS)	Latitude	30°18'54.22"S
	Longitude	18°06'16.60"E
Description of Photography Point		
Type/ Orientation: 110°		

5.10.3 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to **Appendix A**):

Wetland No	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
F30A-06	56	4.2	-1.0	5.4	-1.0	4.2	-1.0
PES Categories		D	↓	D	↓	D	↓
Wetland Impact Score		4.5					
Wetland PES		D					

6 Langvlei wetland - F30A-08

6.1 Wetland details

The Langvlei wetland is located in quaternary catchment F30A near the towns of Kamieskroon and Leliefontein in the Northen Cape. The assessment of the Langvlei wetland F30A-08 its problems and the development of the rehabilitation objectives are described in detail in **Appendix A**: Wetland Assessment Reports. The following sections provide a brief summary for this wetland.

The Langvlei wetland unit represents one of the largest known unchannelled valley bottom wetland areas in the Kamiesberg Commonage and forms part of a much larger wetland which extends a further 1.1 km in a downstream direction and 1.2 km in an upstream direction, most of which is channelled valley bottom. Although renosterbos is abundant within the wetland, indigenous hydric species such as *Bulbinella latifolia* subsp. *latifolia* and *Ficinia nodosa* are also abundant.

Table 13: Summary of the wetland details

Wetland Name	Langvlei
Wetland Number	F30A-08
River System Name	Nouw River, a tributary of the Buffels River
Land Use in Catchment	Mainly natural grazing land but also including some cultivated lands, mainly fallow lands and oats
Land Use in Wetland	Natural vegetation used for grazing
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	30 September 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	1.30 ha

6.2 Site photos

Figure 18: Site photos of the Langvlei wetland (Courtesy: Donovan Kotze)

6.3 Wetland Problem

The main impacts to this wetland are associated with historic disturbance, the current road alongside the wetland and erosion, which is currently very active (see **Figure 19**). Increasing intensity of runoff from the upstream catchment also contributes to erosion in the wetland.

Figure 19: Headcut erosion in a road crossing the Langvlei wetland (Courtesy: Donovan Kotze)

6.4 Rehabilitation Objectives

The primary objective of the rehabilitation is to halt the advance of the headcut threatening to advance through the Langvlei wetland, by means of installing appropriate erosion control structures to deactivate the currently active multiple headcut. The secondary objective is to close the current vehicle track crossing, which is making the area more susceptible to erosion and for which there is an already established much less risky alternative in the upper Langvlei wetland.

6.5 Summary proposed interventions

The proposed interventions (**Figure 20**) are discussed in detail in the subsequent sections of this report. The table below (**Table 14**) provides a summary of these interventions. The "implementation order" as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The "priority" as depicted in the table indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 6.7 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 14: Summary of proposed new interventions, F30A-08

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F30A-08-201-00	Gabion weir	1	1	R 232 926.58
F30A-08-202-00	Gabion weir	2	1	R 131 731.34
Total				**R 364 657. 92**

6.6 Design selection

The objective of the interventions is to deactivate a headcut along an old road. The most appropriate and cost effective method of doing this was considered to involve constructing a wide gabion weir with a support structure downstream, and closing the road.

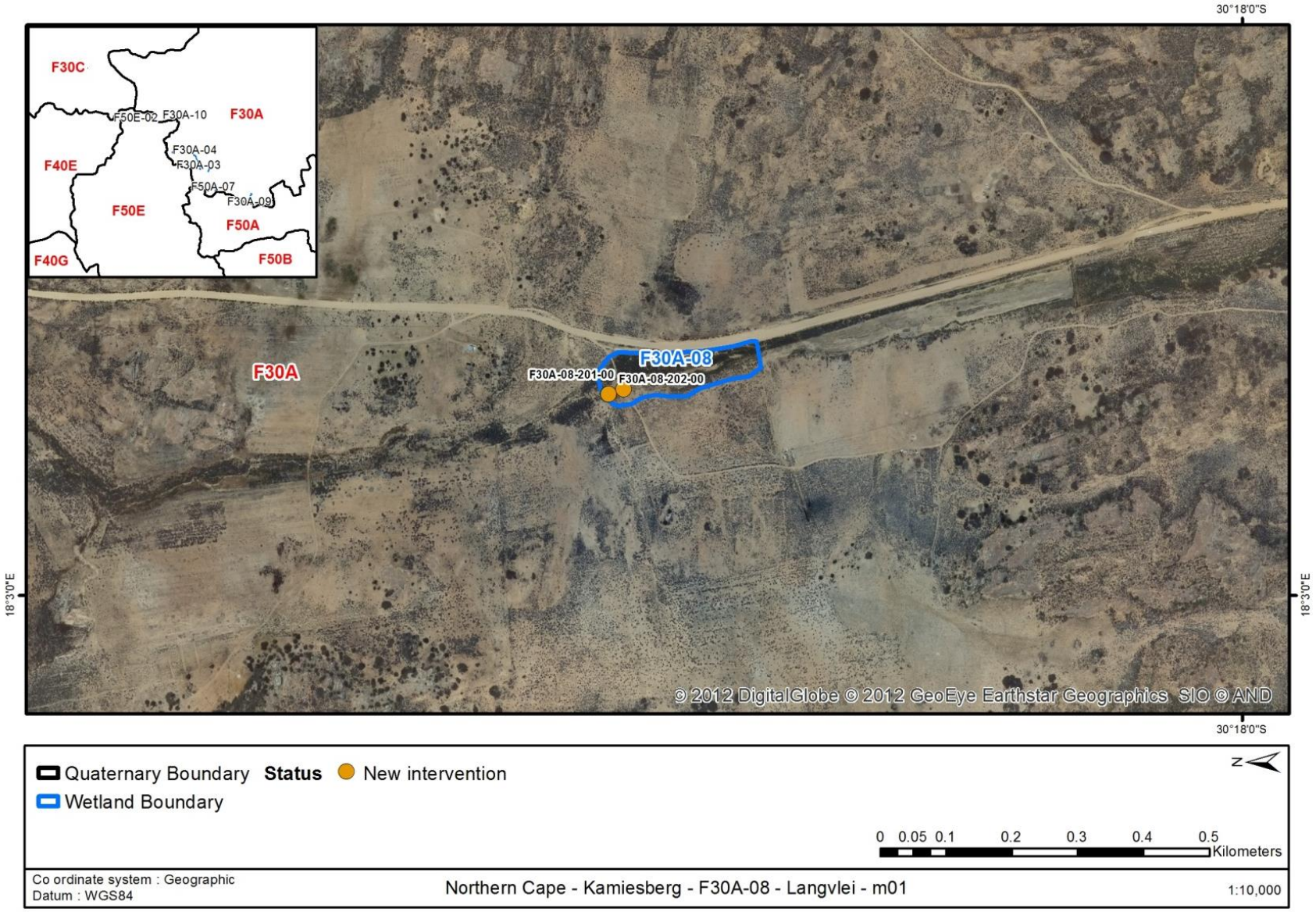

Figure 20: Wetland map, F30A-08 with proposed new wetland interventions indicated

6.7 Intervention designs

6.7.1 Intervention: F30A-08-201-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir with concrete capping and geocells
Rehabilitation Objective	Arrest migration of headcut erosion
Latitude (DºM'S")	30°17'29.54"S
Longitude (DºM'S")	18°03'10.19"E
Engineering Drawings	F30A-08-201-00

Figure 21: Intervention site F30A-08-201-00

6.7.1.1 Bill of quantities: F30A-08-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion and geocells	m^3	65.6	R 3 550.71	R 232 926.58
Concrete capping	m^2	0.9	R 8 506.69	R 7 656.02
			Total	**R 240 582.60**

6.7.1.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

6.7.2 Intervention: F30A-08-202-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir with concrete capping and geocells
Rehabilitation Objective	Arrest migration of headcut erosion
Latitude (DºM'S")	30°17'28.80"S
Longitude (DºM'S")	18°03'09.96"E
Engineering Drawings	F30A-08-202-00

Figure 22: Intervention site F30A-08-202-00

6.7.2.1 Bill of quantities: F30A-08-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion and geocells	m^3	37.1	R 3 550.71	R 131 731.34
Concrete capping	m^2	0.6	R 8 506.69	R 5 104.01
			Total	**R 136 835.35**

6.7.2.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

6.8 Construction Environmental Plan Issues

The proposed rehabilitation is to be undertaken on community owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the community. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F.**

6.9 Wetland Management Recommendations

It is recommended that impacts of the district road running parallel and immediately adjacent to the wetland be addressed. Firstly, the road is impinging directly on the margin of the wetland. Secondly, the road cuts across all of the lateral drainage channels feeding into the right and side of the wetland, and appear to be disrupting natural sedimentation patterns associated with these inputs. It seems that these effects may be concentrating sedimentation in localized areas, which, in turn, may be contributing to concentrating flow in in the wetland and increasing its susceptibility to erosion. Better drainage beneath the road would assist. Furthermore, shifting the road away from the wetland should also be considered, even a relatively short distance away (about 40 m) might assist considerably in association with better drainage. Shifting the road would clearly have cost implications for the municipality, but the long term maintenance costs of the new location are likely to be less than the ongoing work required in its current location.

6.10 Baseline M&E data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

6.10.1 Erosion Problems

The erosional features within the wetland are mostly associated with the roads and historic disturbances. Please refer to Sections 7.3 and 7.8 which provide more detail on the wetland and associated management problems.

6.10.2 Fixed Point photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

FPP Number	Langvlei-01	
GPS Location (DMS)	Latitude	30°17'29.54"S
	Longitude	18°03'10.19"E
Description of Photography Point		
Type/ Orientation: Panoramic view of wetland		
		
FPP Number	Langvlei-02	
GPS Location (DMS)	Latitude	30°17'29.65"S
	Longitude	18°03'10.08"E
Description of Photography Point		
Type/ Orientation: 80°		
		

FPP Number	Langvlei-03	
GPS Location (DMS)	Latitude	30°17'28.64"S
	Longitude	18°03'10.08"E
Description of Photography Point		
Type/ Orientation: NW		

FPP Number	Langvlei-04	
GPS Location (DMS)	Latitude	30°17'30.55"S
	Longitude	18°03'10.37"E
Description of Photography Point		
Type/ Orientation: N to NE		

6.10.3 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to **Appendix A**):

Wetland No	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
F30A-08	56	3.5	-2.0	4.5	-2.0	2.9	-2.0
PES Categories		**C**	**↓↓**	**D**	**↓↓**	**C**	**↓↓**
Wetland Impact Score		**3.6**					
Wetland PES		**C↓↓**					

7 NATPAD WETLAND – F30A-09

7.1 Wetland details

The Natpad wetland is located in quaternary catchment F30A near the towns are Paulshoek and Kamieskroon in the Northern Cape. The assessment of the Natpad wetland F30A-09, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A**: Wetland Assessment Reports. The following sections provide a brief summary for this wetland.

The Natpad wetland comprises of a valley bottom wetland. Its lowermost point is at the junction of two valleys, with most of the wetland fed by the stream of the south-to-north orientated valley and a short arm of the wetland fed by the west-to-east orientated valley. There are fairly extensive footslope areas immediately adjacent to and surrounding most of the wetland which comprise degraded old lands with scattered renosterbos (*Elytropappus rhinocerotis*) bushes and other hardy pioneer species. These old lands have extensive bare ground which appears compacted and shows signs of surface runoff (rills and minor gullies).

The levels of impacts and threats to the wetland hydrology are high. Although upstream catchment related impacts have a relatively low impact on the wetland unit, localized higher impacts from the degraded old lands adjacent to the wetland are very likely. The most important impact on hydrology within the wetland is the incision of the stream channel flowing through the wetland.

Figure 23: Units within the Natpad wetland (Courtesy: Donovan Kotze)

Table 15: Summary of the wetland details

Wetland Name	Natpad
Wetland Number	F30A-09
River System Name	Nouw River, a tributary of the Buffels River
Land Use in Catchment	Mainly natural grazing land over the majority of the catchment but most of the catchment immediately adjacent to the wetland comprised degraded old lands with extensive bare ground.
Land Use in Wetland	Natural vegetation used for grazing
No. of Properties Intersecting Wetland Area	2
Date of Wetland Assessment	03 October 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	4.95

7.2 Site photos

Figure 24: Site photos of the Natpad wetland (Courtesy: Donovan Kotze)

7.3 Wetland problems

Although the overall catchment of the Natpad wetland is largely intact with no major impacts to catchment hydrology, degraded old lands immediately surrounding much of the Natpad wetland appear to be significantly increasing peak surface flows into the wetland. Within the wetland incisional erosion and dominance of the vegetation by pioneer plant species are key impacts, both of which are likely to be linked to heavy grazing pressure and to some extent also to historical cultivation.

7.4 Rehabilitation objectives

The primary objective of the rehabilitation is to halt further incision of the erosion channel in Unit 3 (see **Figure 19**) and raise the water level in the unit to close to its pre-incised level, by means of raising the base level of the channel with a series of structures.

The secondary objective is to re-establish perennial vegetation in Unit 3 and 4, preferably with a high abundance of indigenous hydric species, by:

- fencing off Unit 3 and excluding livestock grazing for three years to promote vegetation recovery;
- shifting the fence of the lamb pen to outside of Unit 4, thereby removing the high livestock pressure from this unit; and
- raise the water level in Unit 3.

The third objective is to deactivate the drainage furrow running alongside Unit 1, by raising the base level of the channel with appropriate structure/s. Lastly to reduce the intensity of surface runoff delivered by the degraded lands lying adjacent to the wetland, by means of improving vegetation cover on the degraded lands through brush packing and other appropriate measures.

7.5 Summary proposed interventions

The new interventions proposed for the Natpad wetland (**Figure 25**) are discussed in detail in the subsequent sections of this report. The table below (**Table 16**) provides a summary of these new interventions. The “implementation order” as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The “priority” as depicted in the table indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 7.7 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 16: Summary of proposed new interventions, F30A-09

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F30A-09-201-00*	Fencing	2	5	R 96 000.00
F30A-09-202-00	Gabion weir	7	5	R 135 282.05
F30A-09-203-00*	Brushpack	8	5	R 112 500.00
F30A-09-204-00	Gabion weir	3	5	R 137 057.41
F30A-09-205-00	Gabion weir	4	5	R 135 282.05
F30A-09-206-00	Gabion weir	5	5	R 121 434.28
F30A-09-207-00	Gabion weir	6	5	R 135 282.05
F30A-09-208-00	Grade road surface, Gabion weir, rock packing	1	5	R 1 059 956.39
			Total	**R 1 932 794.23**

**This intervention does not trigger activities in terms of NEMA and as such does not require Environmental Authorisation to allow for implementation.*

7.6 Design selection and sizing

The objective of the interventions is to deactivate a drain and spread flow into the surrounding wetland. The most appropriate and cost effective method of doing this was considered to involve constructing a series of gabion weirs to raise the water level and reduce flows.

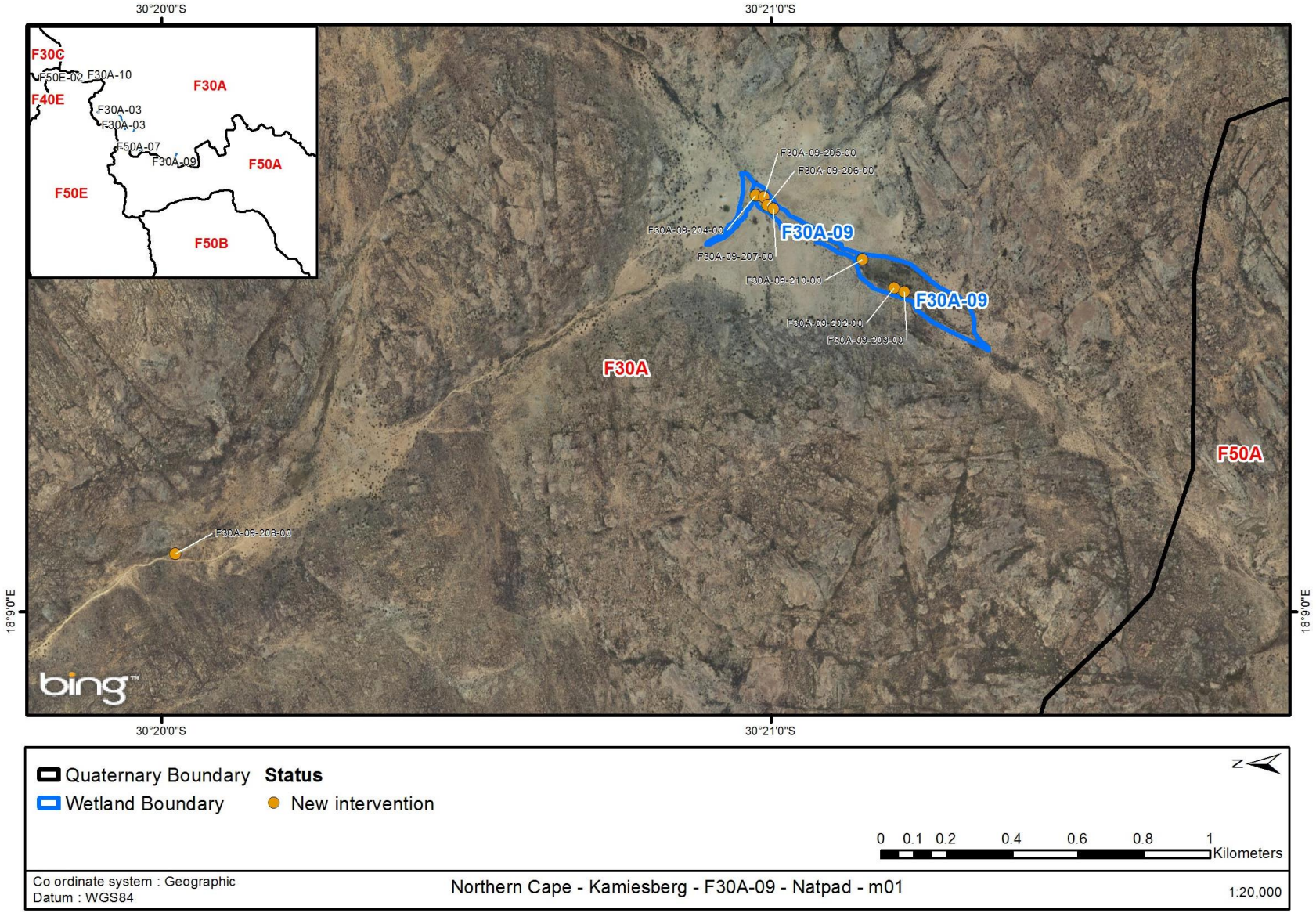

Figure 25: Wetland map, F30A-09 with proposed new wetland interventions indicated

7.7 Intervention designs

7.7.1 Intervention: F30A-09-201-00

Intervention Description	Fencing
Rehabilitation Objective	Promote vegetation recovery
Latitude (DºM'S")	30°21'04.2"S
Longitude (DºM'S")	18°09'38.8"E

Figure 26: Intervention site F30A-09-201-00

7.7.1.1 Bill of quantities: F30A-09-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Fence	m	600	R 160.00	R 96 000.00
			Total	**R 96 000.00**

7.7.1.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

7.7.2 Intervention: F30A-09-202-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir
Rehabilitation Objective	To attenuate floods and sediments
Latitude (DºM'S")	30°21'12.12"S
Longitude (DºM'S")	18°09'31.88"E
Engineering Drawings	F30A-09-202-00

Figure 27: Intervention site F30A-09-202-00

7.7.2.1 Bill of quantities: F30A-09-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion	m^3	38.10	R 3 550.71	R 135 282.05
Concrete (capping)	m^2	0.90	R 8 506.69	R 7 656.02
			Total	**R 142 938.07**

7.7.2.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

7.7.3 Intervention: F30A-09-203-00

Intervention Description	Brushpack
Rehabilitation Objective	Stabalise erosion and re-establish wetland vegetation
Latitude (DºM'S")	30°21'04.2"S
Longitude (DºM'S")	18°09'38.8"E
Engineering Drawings	F30A-09-203-00
Figure 28: Intervention site F30A-09-203-00	

7.7.3.1 Bill of Quantities: F30A-09-203-00

Item	Units	Quantity	Unit Cost	Item Cost
Brushpack, micro catchments and re-seeding	m^3	2500	R 45.00	R 112,500.00
			Total	**R 112,500.00**

7.7.3.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

7.7.4 Intervention: F30A-09-204-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir
Rehabilitation Objective	To attenuate floods and sediments
Latitude (DºM'S")	30°20'58.45"S
Longitude (DºM'S")	18°09'41.03"E
Engineering Drawings	F30A-09-204-00

7.7.4.1 Bill of quantities: F30A-09-204-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion	m^3	38.60	R 3 550.71	R 137 057.41
Concrete (capping)	m^2	2.90	R 8 506.69	R 24 669.39
			Total	**R 161 726.80**

7.7.4.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

7.7.5 Intervention: F30A-09-205-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir
Rehabilitation Objective	To attenuate floods and sediments
Latitude (DºM'S")	30°21'12.12"S
Longitude (DºM'S")	18°09'31.88"E
Engineering Drawings	F30A-09-205-00

Figure 29: Intervention site F30A-09-205-00

7.7.5.1 Bill of quantities: F30A-09-205-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion	m^3	38.10	R 3 550.71	R 135 282.05
Concrete (capping)	m^2	0.90	R 8 506.69	R 7 656.02
			Total	**R 142 938.07**

7.7.5.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

7.7.6 Intervention: F30A-09-206-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir
Rehabilitation Objective	To attenuate floods and sediments
Latitude (DºM'S")	30°20'59.62"S
Longitude (DºM'S")	18°09'40.304"E
Engineering Drawings	F30A-09-206-00

Figure 30: Intervention site F30A-09-206-00

7.7.6.1 Bill of quantities: F30A-09-206-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion	m^3	34.20	R 3 550.71	R 121 434.28
Concrete Capping	m^2	0.60	R 8 506.69	R 5 104.01
			Total	**R 126 538.29**

7.7.6.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

7.7.7 Intervention: F30A-09-207-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir
Rehabilitation Objective	To attenuate floods and sediments
Latitude (DºM'S")	30°21'22.20"S
Longitude (DºM'S")	18°09'39.57"E
Engineering Drawings	F30A-09-207-00

Figure 31: Intervention site F30A-09-207-00

7.7.7.1 Bill of quantities: F30A-09-207-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion	m^3	38.10	R 3,550.71	R 135,282.05
Concrete (capping)	m^2	0.90	R 8 506.69	R 7 656.02
			Total	**R 142 938.07**

7.7.7.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

7.7.8 Intervention: F30A-09-208-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir & earthworks
Rehabilitation Objective	To attenuate floods and sediments
Latitude (DºM'S")	30°20'01.30"S
Longitude (DºM'S")	18°09'05.70"E
Engineering Drawings	F30A-09-208-00

Figure 32: Intervention site F30A-09-208-00

7.7.8.1 Bill of quantities: F30A-09-208

Item	Units	Quantity	Unit Cost	Item Cost
Earth structure	m³	9.00	R 3,550.71	R 31,956.39
Graded road surface	km	7.00	R 4,000.00	R 28,000.00
Rock packing	m³	400.00	R 2,500.00	R 1,000,000.00
			Total	**R 1,070,423.10**

7.7.8.2 Construction Notes:

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

7.8 Construction Environmental Management Plan issues

The proposed rehabilitation is to be undertaken on community owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the community. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F**.

7.9 Wetland management recommendations

The system is currently utilised for livestock grazing, but following the implementation of the rehabilitation activities the system livestock should be excluded from the fenced area for three years to allow for recovery of the vegetation. Thereafter the area needs to be leniently grazed predominantly in the dry season.

7.10 Baseline M&E data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

7.10.1 Fixed point photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

FPP Number	Natpad-01	
GPS Location (DMS)	Latitude	30°20'59.57"S
	Longitude	19°09'38.84"E
Description of Photography Point		
Type/ Orientation: Panoramic view of wetland		




FPP Number	Natpad-02	
GPS Location (DMS)	Latitude	30°20'58.6"S
	Longitude	19°09'41.26"E
Description of Photography Point		
Type/ Orientation: Photo taken in a NE direction.		

7.10.2 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to **Appendix A**):

Wetland No	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
F30A-09	56	3.2	-1.0	4.3	-1.0	5.1	-1.0
PES Categories		C	↓	D	↓	D	↓
Wetland Impact Score		4.1					
Wetland PES		D					

8 Windpoort Wetland - F30A-10

8.1 Wetland details

The Windpoort wetland is located in quaternary catchment F30A near the towns of Kamiestroom and Nourivier in Northern Cape. The assessment of the Windpoort wetland F30A-10, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A**: Wetland Assessment Reports. The following sections provide a brief summary for this wetland.

The Windpoort wetland consist of a channelled valley bottom wetland which eroded severely in the past, followed by a period of sediment accumulation and most recently by the active incision of the sediment and a slight lowering of the water level in the wetland. The incision is still narrow but actively deepening. The area upstream of the incision supports one of the largest stands of *Pseudoschoenus inanis* in the Kamiesberg commonage, which is harvested for building/craft purposes.

Table 17: Summary of the wetland details

Wetland Name	Windpoort
Wetland Number	F30A-10
River System Name	Nouw River, a tributary of the Buffels River
Land Use in Catchment	Mainly natural grazing land but also including some cultivated lands, mainly fallow lands and oats.
Land Use in Wetland	Natural vegetation used for grazing and harvesting of fibre for mat weaving
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	02 October 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	0.9 ha

8.2 Site photos

Figure 33: Site photos of the Windpoort wetland (Courtesy: Donovan Kotze)

8.3 Wetland Problems

The wetland has been subjected to a number of impacts (**Figure 33**) associated with historic disturbance and erosion, which is now currently active. Impacts from the upstream catchment are limited, but adjacent old lands are likely to have slightly increased runoff peaks. A further increase in pioneer species is anticipated where further channel incision is predicted, and thus a slight decline in vegetation condition is anticipated over the next five years. A slight decline in hydrological condition is anticipated as a result of the incision which is predicted to continue. Another slight decline in geomorphological condition is anticipated over the next five years as a result of the incisional erosion which is predicted to continue, but not dramatically so.

8.4 Rehabilitation Objectives

The primary objective of the rehabilitation is to halt further incision of the wetland, by means of blocking the incision with appropriate erosion control measures which promotes the net accumulation of sediment in the incised stream channel. The secondary objective is to slightly raise the overall water level in the unit to close to its pre-incised level.

8.5 Summary proposed interventions

The interventions proposed for the Windpoort wetland (**Figure 34**) are discussed in detail in the subsequent sections of this report. The table below (**Table 18**) provides a summary of these interventions. The "implementation order" as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The "priority" as depicted in the table indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 8.7 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 18: Summary of proposed new interventions, F30A-10

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F30A-10-201-00	Gabion weir	1	7	R 181 583.31
F30A-10-202-00*	Sediment fence	2	7	R 1 300.00
			Total	**R 182 883.31**

**This intervention does not trigger activities in terms of NEMA and as such does not require Environmental Authorisation to allow for implementation.*

8.6 Design selection and sizing

The objective of the interventions is to deactivate a headcut and raise the water level. The most appropriate and cost effective method of doing this was considered to involve constructing a gabion weir.

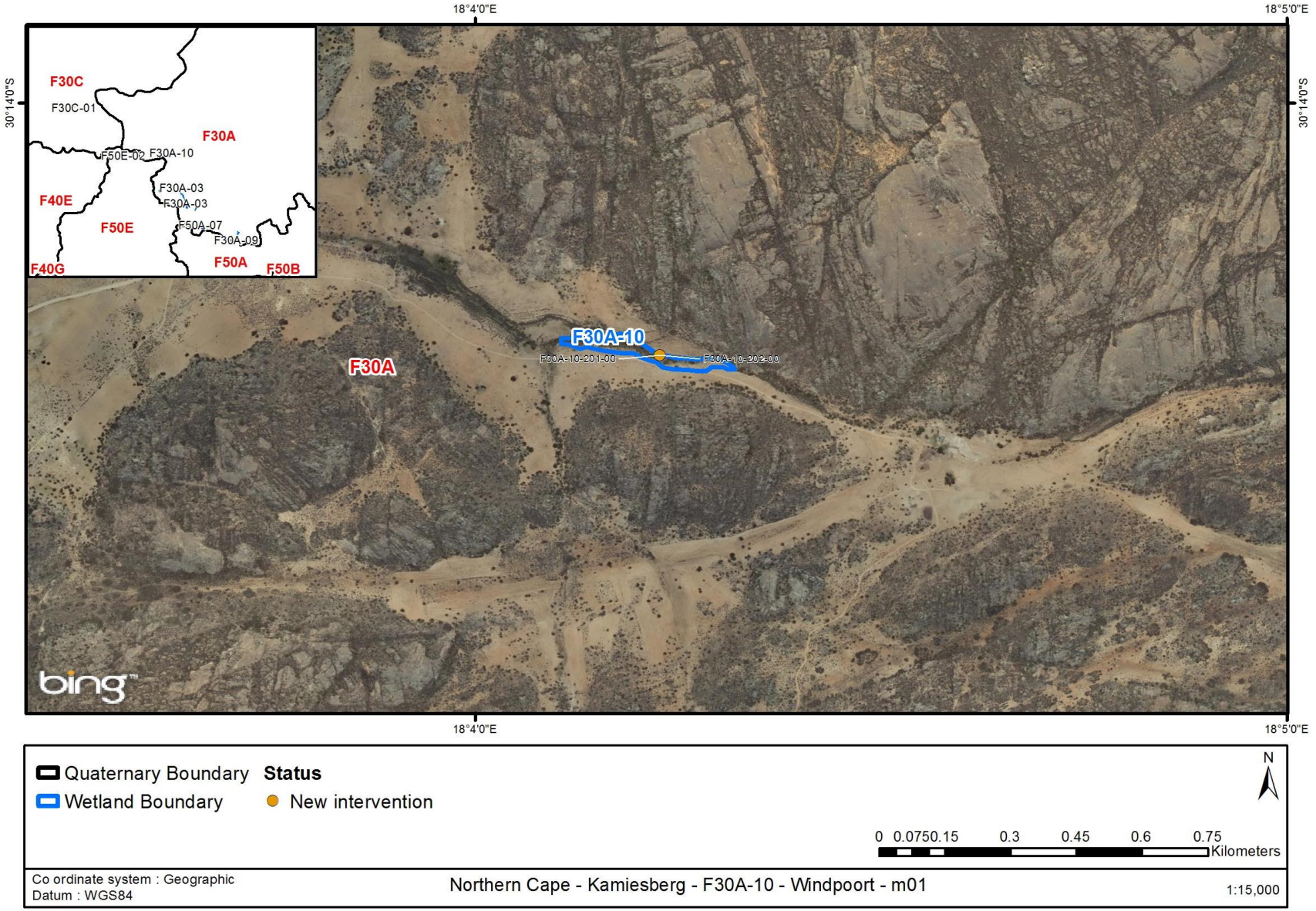

Figure 34: Wetland map, F30A-10 with proposed new wetland interventions indicated

8.7 Intervention designs

8.7.1 Intervention: F30A-10-201-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Gabion weir
Rehabilitation Objective	Reduce incision in wetland and lift water table
Latitude (DºM'S")	30°14'18.64"S
Longitude (DºM'S")	18°04'13.65"E
Engineering Drawings	F30A-10-201-00

Figure 35: Intervention site F30A-10-201-00

8.7.1.1 Bill of Quantities: F30A-10-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion	m^3	51.14	R 3 550.71	R 181 583.31
Concrete (capping)	m^2	1.50	R 8 506.69	R 12 760.03
			Total	**R 194 343.34**

8.7.1.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

8.7.2 Intervention: F30A-10-202-00

Intervention Description	Silt fence
Rehabilitation Objective	Re-hydrate wetland
Latitude (DºM'S")	30°14'18.64"S
Longitude (DºM'S")	18°04'13.65"E

8.7.2.1 Bill of Quantities: F30A-10-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Silt fence	m	2.00	R 650.00	R 1,300.00
			Total	**R 1,300.00**

8.7.2.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

8.8 Construction Environmental Management Plan Issue

The proposed rehabilitation is to be undertaken on community owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the community. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F**.

8.9 Wetland management recommendation

The system is currently utilised for harvesting of *Pseudoschoenus inanus* and to a lesser extent livestock grazing. Following the implementation of the rehabilitation activities the system may become inaccessible for livestock but it is currently of limited grazing value because it is largely dominated by unpalatable plants. The main recommendation would be to avoid over-harvesting of *Pseudoschoenus inanus* by only harvesting any given plant once every second year or more. It may also be necessary in the future to exclude livestock.

8.10 Baseline M&E data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

8.10.1 Erosion problems

The main impacts to this wetland unit are associated with historic disturbance and erosion, which is now currently active. Impacts from the upstream catchment are limited, but adjacent old lands are likely to have slightly increased runoff peaks.

8.10.2 Fixed Point Photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

FPP Number	Windpoort-01	
GPS Location (DMS)	Latitude	30°14'18.64"S
	Longitude	18°04'13.65"E
Description of Photography Point		
Type/ Orientation: Panoramic view of wetland		


FPP Number	Windpoort-02	
GPS Location (DMS)	Latitude	30°14'19.1"S
	Longitude	18°4'14.41"E
Description of Photography Point		
Type/ Orientation: NNE (20°)		


8.10.3 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to **Appendix A**):

Wetland No	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
F30A-10	56	5.5	-1.0	5	-1.0	4.4	-1.0
PES Categories		**D**	**↓**	**D**	**↓**	**D**	**↓**
Wetland Impact Score		**5.0**					
Wetland PES		**D**					

9 Kleingaas Wetland - F30C-01

9.1 Wetland details

The Kleingaas wetland is located in quaternary catchment F30C near the town Kamieskroon in the Northern Cape. The assessment of the wetland, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A:** Wetland Assessment Reports. The following sections provide a brief summary for this wetland.

The wetland unit is an unchanelled valley bottom which has been cultivated. Historically it was dominated by *Pseudoschoenus inanis*, and the wetland area immediately downstream continues to be dominated by this sedge. The majority of the wetland unit's catchment comprises rocky areas under natural vegetation

Table 19: Summary of the wetland details

Wetland Name	Kleingaas
Wetland Number	F30C-01
River System Name	Buffels River
Land Use in Catchment	Mainly actively cultivated lands; also rocky areas with natural vegetation
Land Use in Wetland	Recently cultivated land
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	30 September 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	0.2ha

9.2 Site photos

Figure 36: Site photos of the Windpoort wetland (Courtesy: Donovan Kotze)

9.3 Wetland problems

A small, recently constructed drainage furrow runs the length of the wetland, which was recently cultivated. The landowner is willing to have the constructed drainage furrow in-filled and to reduce the intensity of use of the portion. His original intention was to establish dryland crops but he has agreed to let the vegetation revert back to indigenous wetland vegetation, which could be used in the dry season for grazing.

9.4 Rehabilitation Objectives

The primary objective is to remove the draining effect of the artificial drainage channel by infilling it. This is feasible owing to the narrow and shallow dimensions of the furrow and that much of the excavated material remains next to the furrow. The secondary objective is to encourage the establishment of perennial indigenous vegetation in the wetland by strategic planting of perennial indigenous species, preferably species with forage value.

9.5 Summary proposed interventions

The proposed intervention (**Figure** 25**37**) is discussed in detail in the subsequent sections of this report. Please also refer to the table below (**Table 20**) which provides information on its

priority rating. The “implementation order” as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The “priority” as depicted in the table indicates the relative importance of the intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 9.6 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 20: Summary of proposed new interventions, F30C-01

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F30C-01-201-00*	Earthworks	1	8	R 31 500.00
F30C-01-202-00*	Revegetation	1	8	R 212 500.00
Total				**R 244 000. 00**

**This intervention does not trigger activities in terms of NEMA and as such does not require Environmental Authorisation to allow for implementation.*

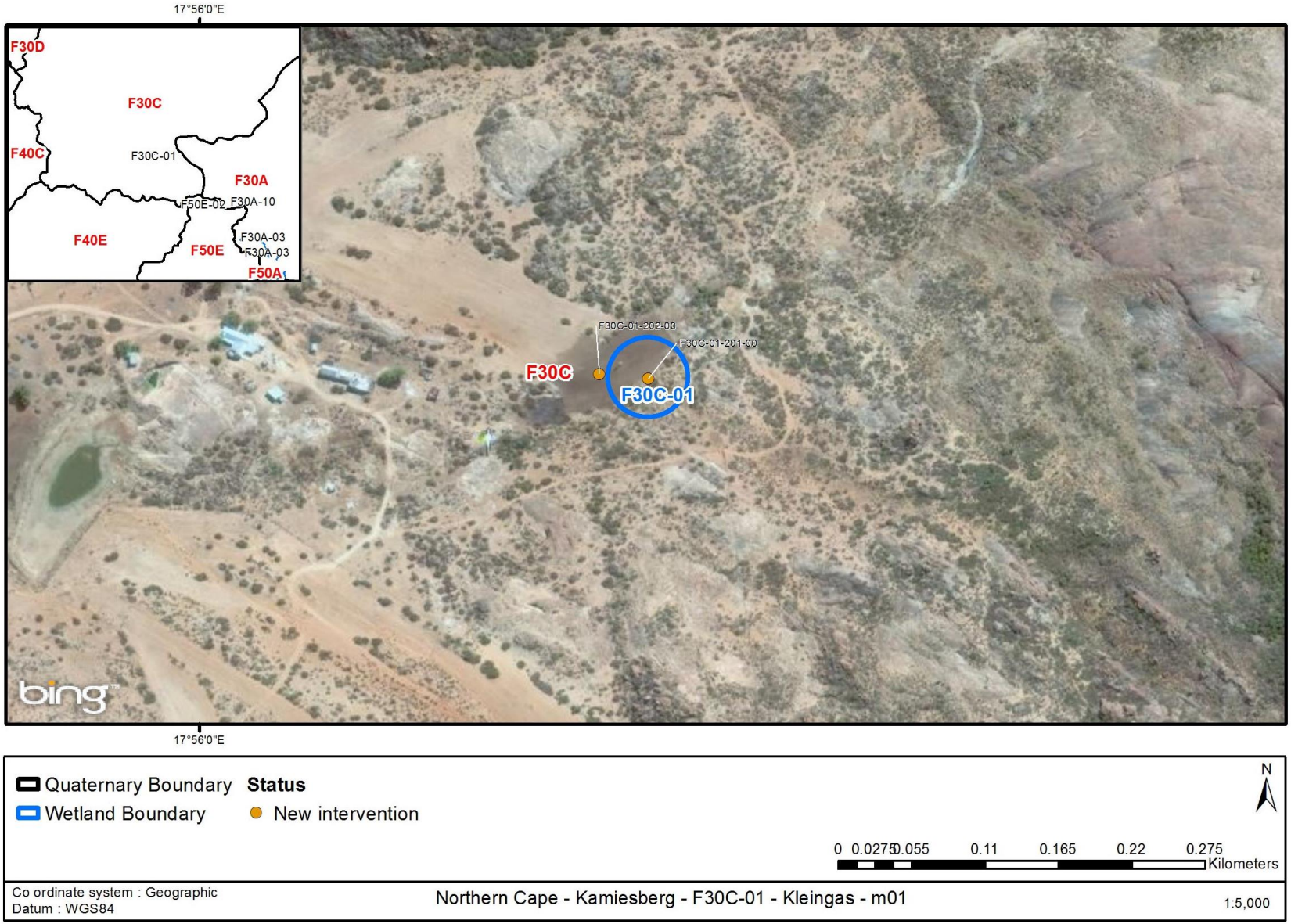

Figure 37: Wetland map, F30C-01 with proposed new interventions indicated

9.6 Intervention designs

9.6.1 Intervention: F30C-01-201-00

Intervention Description	Earthworks
Rehabilitation Objective	Restore hydrology and vegetation
Latitude (DºM'S")	27°17'48.45"S
Longitude (DºM'S")	30°29'04.66"E

Figure 38: Intervention site F30C-01-201-00

9.6.1.1 Bill of quantities: F30C-01-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Earthworks	m^3	75.00	R 420.00	R 31 500.00
			Total	**R 31 500.00**

9.6.1.2 Construction Notes

The CEMP as set out in **Appendix F** applies and must be adhered to at all times.

9.6.2 Intervention: F30C-01-202-00

Intervention Description	Revegetation
Rehabilitation Objective	Restore vegetation cover
Latitude (DºM'S")	30°10'36.6"S
Longitude (DºM'S")	17°56'09.7"E

9.6.2.1 Bill of quantities: F30C-01-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Revegetation	m^3	800	R 85.00	R 68 000.00
			Total	**R 68 000.00**

9.6.2.2 Construction Notes

The CEMP as set out in **Appendix F** applies and must be adhered to at all times. Only locally indigenous species may be used for revegetation purposes. The species must be confirmed by the wetland specialist first and may include, but is not limited to: *Ficinia indica, Pennisetum macrourum* and *Pseudoschoenus inanus..* The vegetation should be planted in 1 m wide strips, 3 m apart, orientated at right angles to the direction of water flow. Over time it is anticipated that the vegetation will spread out of the strips into the areas in between.

9.7 Construction Environmental Management Plan Issues

The proposed rehabilitation is to be undertaken on community owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the community. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F**.

9.8 Wetland management recommendations

The system is currently utilised for dryland crops and livestock grazing, but the landowner has agreed to allow it to revert back to indigenous wetland vegetation, which could be used for grazing in the dry season. However, until the natural vegetation cover has been restored, the site will be sensitive to disturbances (which may result in erosion) and livestock should be temporarily excluded, and the landowner should consider fencing the wetland and.

9.9 Baseline M&E data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

9.9.1 Erosion problems

The erosional features within the wetland are generally limited to channel incision and are relatively stable, and will therefore not be monitored specifically. If these features were to become unstable at any point, monitoring should be undertaken.

9.9.2 Fixed point photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

FPP Number	Kleingaas-01	
GPS Location (DMS)	Latitude	27°17'48.45"S
	Longitude	30°29'04.66"E
Description of Photography Point		
Type/ Orientation: 250°		
		
FPP Number	Kleingaas-02	
GPS Location (DMS)	Latitude	27°17'48.45"S
	Longitude	30°29'04.66"E
Description of Photography Point		
Type/ Orientation: 70°		
		

10 Xharas Wetland - F50A-07

10.1 Wetland Details

The Xharas wetland is located in quaternary catchment F50A near the town of Kamieskroon in the Northern Cape. The assessment of the wetland, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A**: Wetland Assessment Reports. The following sections provide a brief summary for this wetland.

The Xharas wetland is a channelled valley bottom wetland, with the channel comprising of a straightened artificial drainage furrow which runs the entire length of the wetland. Hydric vegetation, mainly *Cyperus thunbergii*, is confined to within the furrow. The remainder of the unit, which was historically cultivated, is dominated by short-growing pioneer species, e.g. *Erodium* sp. The unit forms part of a much larger wetland which extends a further 390 m in a downstream direction and 700 m in an upstream direction, most of which is channelled valley bottom. A large area of the upstream section has recently been rehabilitated, while a large portion of the lower section is in relatively good condition.

Table 21: Summary of the wetland details

Wetland Name	Xharas
Wetland Number	F50A-07
River System Name	Buffels River catchment (F50A)
Land Use in Catchment	Mainly natural grazing land but also including some cultivated lands, mainly fallow lands and oats
Land Use in Wetland	Natural vegetation used for grazing
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	03 October 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	0.74 ha

10.2 Site photos

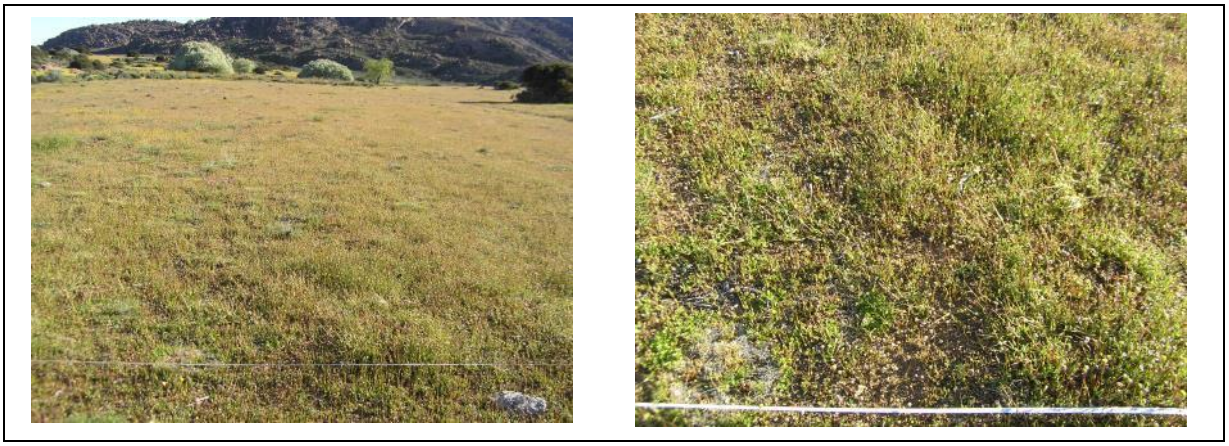

Figure 39: Intervention site F30C-01-201-00 (Courtesy: Donovan Kotze)

10.3 Wetland Problems

The main impacts to this wetland unit are associated with historic drainage and cultivation of the wetland. The artificial drainage furrow has significantly reduced the water storage capacity of the wetland, as well as its ability to provide forage during the dry season. The loss of diverse, natural vegetation coverage has most likely rendered the wetland less effective in controlling erosion than the original wetland vegetation. Also, although the drainage furrow is currently not actively eroding, it contributed to some increased erosion in the past.

10.4 Rehabilitation Objectives

The primary objective of the rehabilitation is to redirect some of the low flows across the wetland, thereby establishing more natural low flow patterns across the wetland, by means of installing an appropriate structure in the drainage furrow near the upstream end of the wetland designed to re-direct some of the low flows across the wetland. The secondary objective is to raise the base level of the artificial drainage channel to raise the water table in the wetland to close to its original level and to allow high flows to readily flow across the wetland as they did so naturally. The third objective is to re-establish vigorous hydric vegetation across most of the wetland.

10.5 Summary proposed interventions

A wetland rehabilitation plan was developed for the lower section of the Xharas wetland in 2011. Interventions (i.e. concrete weirs and alien vegetation clearing) were carried out on the Xharas wetland to prevent erosion from moving upstream.

The new proposed interventions (**Figure 39**) are discussed in detail in the subsequent sections of this report. The table below (**Table 22**) provides a summary of these new interventions. The “implementation order” as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The

"priority" as depicted in the table indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 10.7 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 22: Summary of proposed new interventions, F50A-07

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F50A-07-217-00	Concrete weir	1	2	R 393 008.96
F50A-07-218-00	Concrete weir	2	2	R 452 555.78
F50A-07-219-00*	Sediment fence	3	2	R 2 600.00
F50A-07-220-00*	Sediment fence	3	2	R 2 600.00
Total				**R 850 764.74**

**This intervention does not trigger activities in terms of NEMA and as such does not require Environmental Authorisation to allow for implementation.*

10.6 Design selection and sizing

The objective of the interventions is to deactivate a drain and raise the water level to spread into the surrounding wetland. The most appropriate and cost effective method of doing this was considered to involve constructing concrete weirs to raise the water level and disperse flow upstream, and sediment fences downstream.

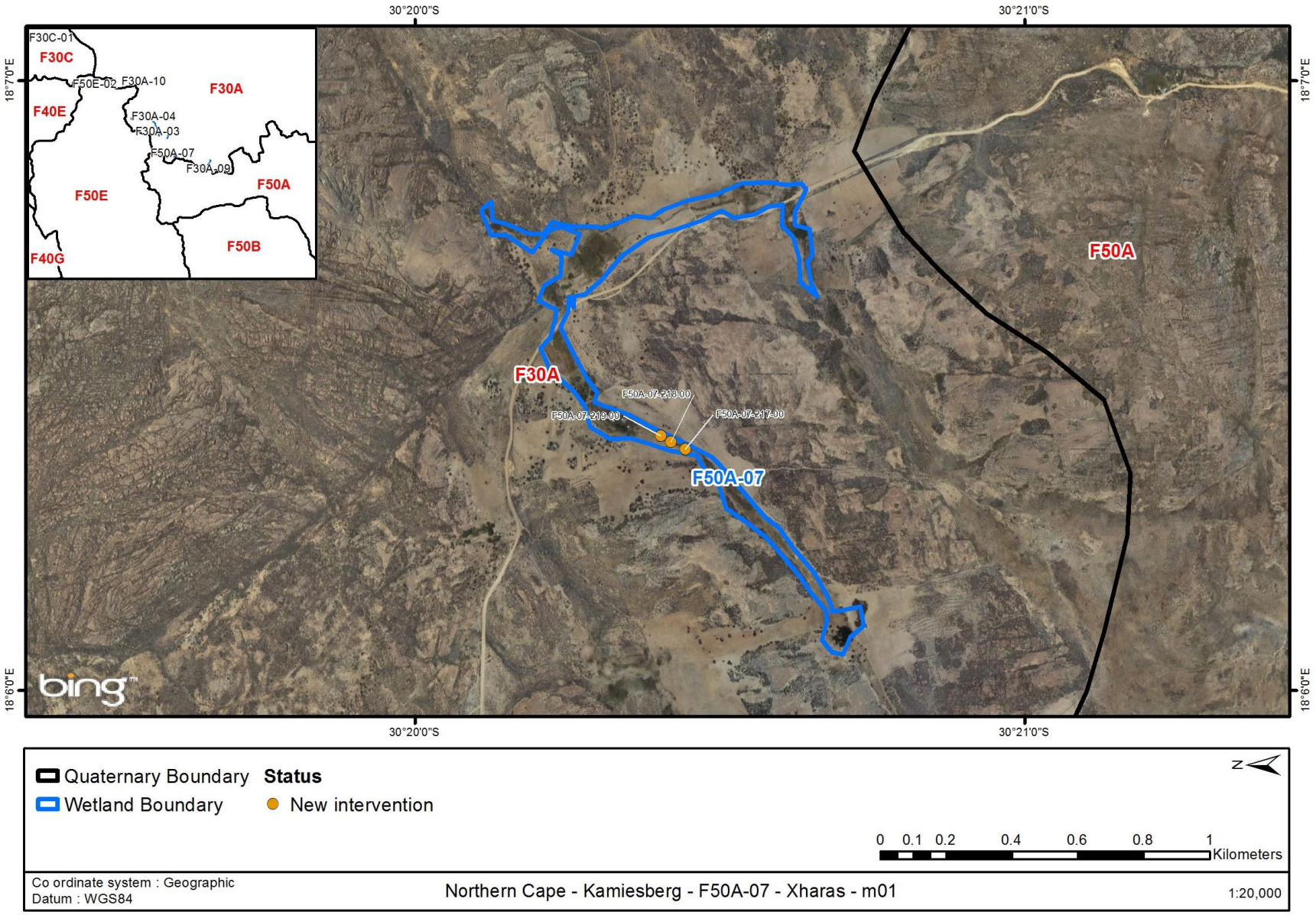

Figure 40: Wetland map, F50A-07 with proposed new wetland interventions indicated

10.7 Intervention Designs

10.7.1 Intervention: F50A-07-217-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Concrete weir
Rehabilitation Objective	Rehydrate wetland
Latitude (DºM'S")	30°20'26.60"S
Longitude (DºM'S")	18°06'23.80"E
Engineering Drawings	F50A-07-217-00

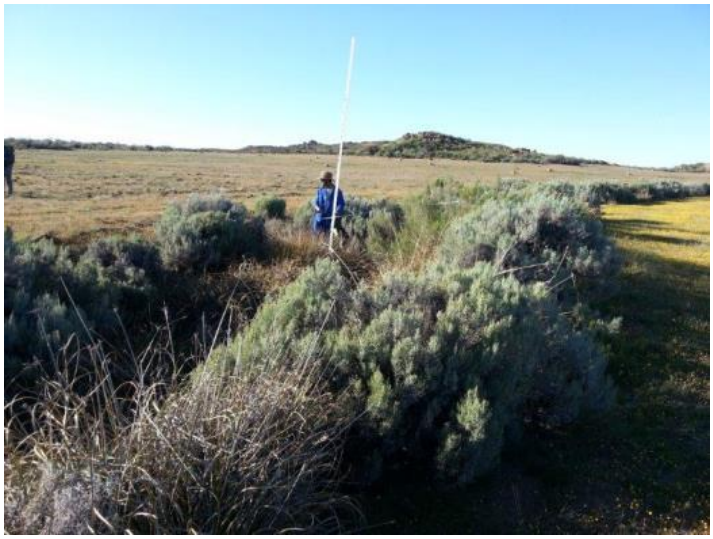

Figure 41: Intervention site F50A-07-217-00

10.7.1.1 Bill of quantities F50A-07-217-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete	m^3	46.2	R 8 506.69	R 393 008.96
			Total	**R 393 008.96**

10.7.1.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

10.7.2 Intervention: F50A-07-218-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Concrete weir
Rehabilitation Objective	Rehydrate wetland
Latitude (DºM'S")	30°20'25.20"S
Longitude (DºM'S")	18°06'24.50"E
Engineering Drawings	F50A-07-218-00

Figure 42: Intervention site F50A-07-218-00

10.7.2.1 Bill of quantities: F50A-07-218-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete	m^3	53.2	R 8 506.69	R 452 555.78
			Total	**R 452 555.78**

10.7.2.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

10.7.3 Intervention: F50A-07-219-00

Intervention Description	Silt fence
Rehabilitation Objective	Rehydrate wetland
Latitude (DºM'S")	30°20'25.20"S
Longitude (DºM'S")	18°06'24.50"E

Figure 43: Intervention site F50A-07-219-00

10.7.3.1 Bill of quantities: F50A-07-219-00

Item	Units	Quantity	Unit Cost	Item Cost
Silt fence	m	4.00	R 650.00	R 2,600.00
			Total	**R 2,600.00**

10.7.3.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

10.7.4 Intervention: F50A-07-220-00

Intervention Description	Silt fence
Rehabilitation Objective	Rehydrate wetland
Latitude (DºM'S")	30°20'25.20"S
Longitude (DºM'S")	18°06'24.50"E

Figure 44: Intervention site F50A-07-220-00

10.7.4.1 Bill of quantities: F50A-07-220-00

Item	Units	Quantity	Unit Cost	Item Cost
Silt fence	m	4.00	R 650.00	R 2,600.00
			Total	**R 2,600.00**

10.7.4.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

10.9 Construction Environmental Plan issues

The proposed rehabilitation is to be undertaken on community owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the community. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F**.

10.10 Wetland Management recommendations

The system is currently intensively utilised for livestock grazing, but following the implementation of the rehabilitation activities the system should be excluded from grazing for three years to allow recovery of the vegetation. Thereafter it can be leniently grazed, preferably mainly in the dry season.

10.11 Baseline M&E data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

10.11.1 Erosion Problems

The erosional features within the wetland are generally limited to channel incision and are relatively stable, and will therefore not be monitored specifically. If these features were to become unstable at any point, monitoring should be undertaken.

10.11.2 Fixed Point Photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

FPP Number	Xharas-01	
GPS Location (DMS)	Latitude	27°17'48.45"S
	Longitude	30°29'04.66"E
Description of Photography Point		
Type/ Orientation: Panoramic view of wetland		

FPP Number	Xharas-02	
GPS Location (DMS)	Latitude	30°20'26.81"S
	Longitude	18°06'23.8"E
Description of Photography Point		
Type/ Orientation: 20°		

FPP Number	Xharas-03	
GPS Location (DMS)	Latitude	30°20'25.69"S
	Longitude	18°06'25.31"E
Description of Photography Point		
Type/ Orientation: 20°		

FPP Number	Xharas-04	
GPS Location (DMS)	Latitude	30°20'24.5"S
	Longitude	18°06'25.81"E
Description of Photography Point		
Type/ Orientation: 20°		

10.11.3 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to **Appendix A**):

Wetland No	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
F50A-07	56	8	0	4.5	0	7.7	0
PES Categories		**F**	→	**D**	→	**E**	→
Wetland Impact Score		**6.9**					
Wetland PES		**E→**					

11 Kraaifontein Wetland - F50E-02

11.1 Wetland details

The Kraaifontein wetland is located in quaternary catchment F50E near the town Kamieskroon in the Northern Cape. The assessment of the wetland, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A:** Wetland Assessment Reports. The following sections provide a brief summary for this wetland.

The Kraaifontein wetland consists of two units. Unit 1 is a hillslope seep, which lies immediately upstream of Kraaifontein unit 2, a channelled valley bottom. Although most of Kraaifontein unit 1 supports natural vegetation, a road within the wetland runs down the full length of it. Much of Kraaifontein unit 2 is occupied by a tall stand of poplars.

Figure 45: Units within the Kraaifontein wetland (Courtesy: Donovan Kotze)

Table 23: Summary of the wetland details

Wetland Name	Kraaifontein
Wetland Number	F50E-02
River System Name	Groen River (F50A)
Land Use in Catchment	Mainly actively cultivated lands; also rocky areas with natural vegetation
Land Use in Wetland	Natural vegetation used for grazing
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	01 October 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	0.74 ha

11.2 Site photos

Figure 46: Site photos of the Kraaifontein wetland (Courtesy: Donovan Kotze)

11.3 Wetland problems

The main impacts to this wetland unit are associated with the road that cuts through the wetland and from the unit's upstream catchment which is being cultivated.

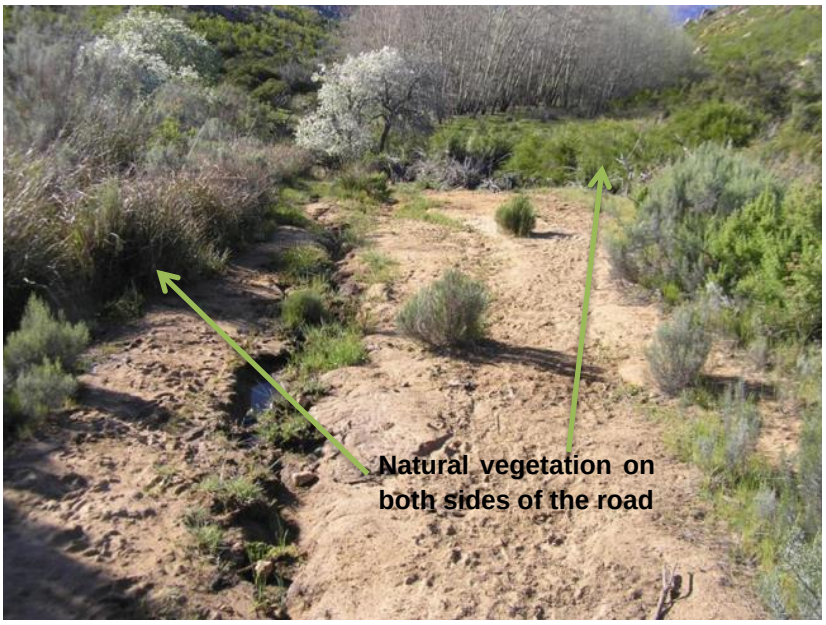

Figure 47: A photo of the road currently cutting through the Kraainfontein wetland (Courtesy: Donovan Kotze)

11.4 Rehabilitation

The primary objective of the rehabilitation is to reduce the intensity of surface flows and associated sediment delivered to the unit from the upslope cultivated lands, by means of establishing a buffer between the unit and the extensively cultivated lands which lie upslope of the unit. The secondary objective is through the effect of the road on flow patterns through the wetland and also to halt active headcut erosion within the unit by strategic removal of fill material and re-direction of flow along its natural path. These two strategies will contribute to addressing the cause of the erosion.

11.5 Summary proposed interventions

The proposed interventions (**Figure 48**Figure 25) are discussed in detail in the subsequent sections of this report. The table below (**Table 24**) provides a summary of the new interventions. The "implementation order" as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The "priority" as depicted in the table indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 11.7 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 24: Summary of proposed new interventions, F50E-02

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F50E-02-201-00	Earthworks	1	6	R 344 100.00
F50E-02-202-00*	Sediment fence	2	6	R 2 600.00
			Total	**R 346 700.00**

**This intervention does not trigger activities in terms of NEMA and as such does not require Environmental Authorisation to allow for implementation.*

11.6 Design selection and sizing

The objective of the interventions is rehabilitate the seep, repairing erosion damage caused by the road and preventing further damage. The most appropriate and cost effective method of doing this was considered to involve covering the surface of the road with ecologs and macmat in order to spread flow into the adjacent wetland areas.

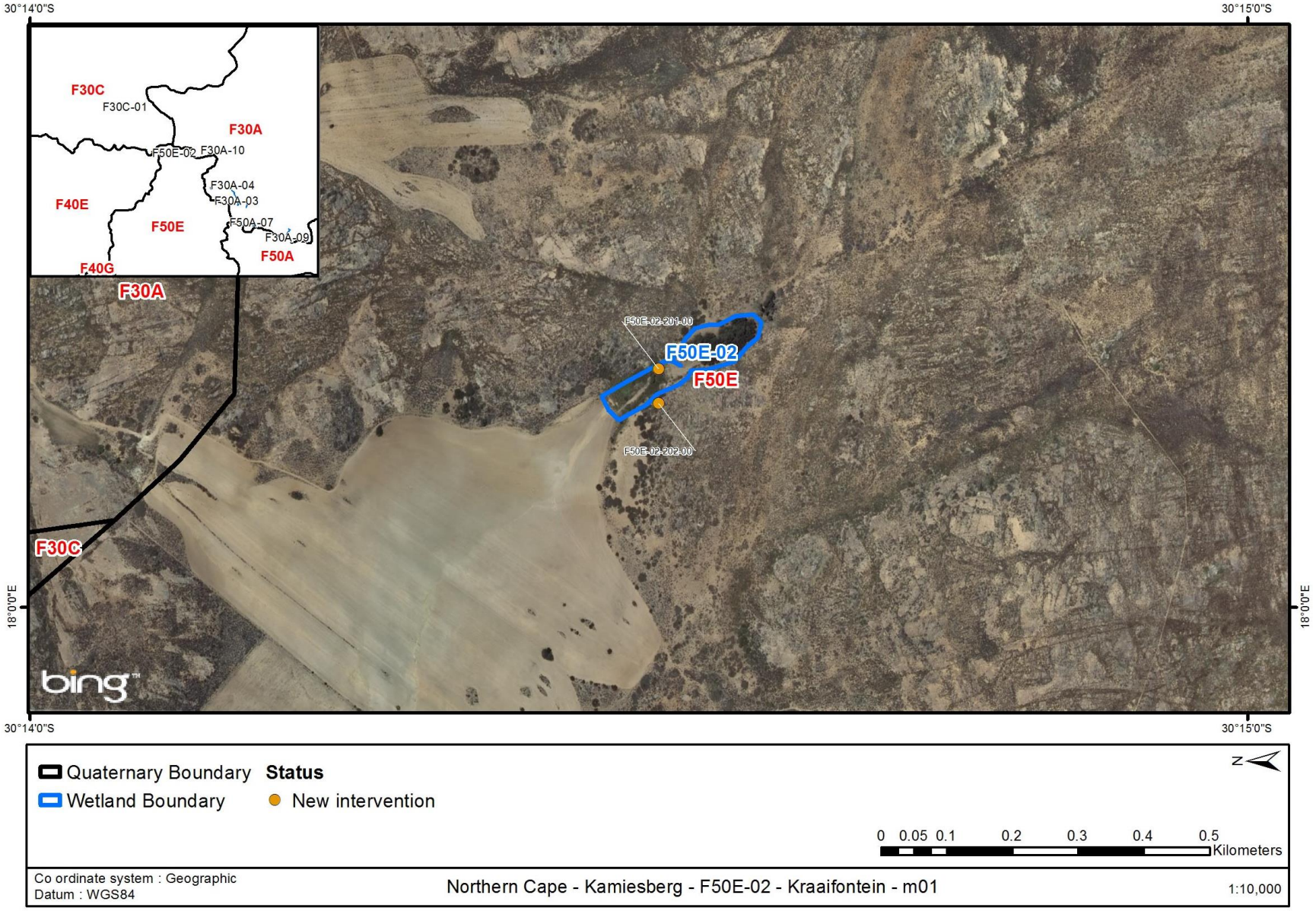

Figure 48: Wetland map, F50E-01 with proposed new wetland interventions indicated

11.7 Intervention designs

11.7.1 Intervention: F50E-02-201-00

Designer	David Townsend
Design Date	October 2013
Intervention Description	Earthworks with ecologs and MacMat-R
Rehabilitation Objective	Arrest migration of headcut erosion through wetland
Latitude (DºM'S")	30°14'31.00"S
Longitude (DºM'S")	18°00'11.80"E
Engineering Drawings	F50E-02-201-00

11.7.1.1 Bill of quantities: F50E-02-201-00

Item	Units	Quantity	Unit Cost	Item Cost
MacMat-R	m³	400.00	R 450.00	R 180 000.00
Ecologs	m³	540.00	R 265.00	R 143 100.00
Earthworks	m³	50.00	R 420.00	R 21 00.00
			Total	**R 344 100.00**

11.7.1.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

11.7.2 Intervention: F50E-02-202-00

Intervention Description	Earthworks with ecologs and MacMat-R
Rehabilitation Objective	Arrest migration of headcut erosion through wetland
Latitude (DºM'S")	30°14'31.00"S
Longitude (DºM'S")	18°00'11.80"E

11.7.2.1 Bill of quantities: F50E-02-202-00

Item	Units	Quantity	Unit Cost	Item Cost
MacMat-R	m	4.00	R 650.00	R 2 600.00
			Total	**R 2 600.00**

11.7.2.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

11.8 Construction Environmental Management Plan issues

The proposed rehabilitation is to be undertaken on privately owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the landowner. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F**.

11.9 Wetland management recommendations

Once the rehabilitation is complete, the wetland must no longer be used as a route for vehicle or livestock movement. In addition the landowner needs to maintain a buffer at least 20 m wide between the wetland and cultivated land lying immediately upslope of the wetland.

11.10 Baseline M&E data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

11.10.1 Erosion problems

The erosional features within the wetland are predominantly rill erosion associated with the old road/track down the wetland. These areas will need to be monitored to see whether they are successfully vegetated and whether the currently active sediment deposition shown in the first fixe point photo below is deactivated.

11.10.2 Fixed point photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

FPP Number	Kraaifontein-01	
GPS Location (DMS)	Latitude	27°17'48.45"S
	Longitude	30°29'04.66"E
Description of Photography Point		
Type/ Orientation: 160°		
		
FPP Number	Kraaifontein-02	
GPS Location (DMS)	Latitude	30°14'29.29"S
	Longitude	18°00'09.94"E
Description of Photography Point		
Type/ Orientation: 160°		
		

11.10.3 Baseline WET-Health data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to Appendix A):

Wetland No	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
F50E-02	56	4	-2	5.5	-2	4.5	-2
PES Categories		**D**	↓ ↓	**D**	↓ ↓	**D**	↓ ↓
Wetland Impact Score		**4.6**					
Wetland PES		**D↓ ↓**					

12 Groenrivier Wetland - F50G-01

12.1 Wetland details

The Groenrivier wetland (F50G-01) is located in quaternary catchment F50G near the town Garies in the Northern Cape. The wetland is in the Namaqualand Nature Reserve. The assessment of the Groenrivier wetland, its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A**: Wetland Assessment Reports. The following sections provide a brief summary for this wetland.

The area considered for this rehabilitation plan is located within an estuary characterized by *Sarcocornia* spp. saltmarsh and *Drosanthemum* sp. low shrubland and open water. It also supports several wetland-dependent bird species including, amongst other: Black-necked Grebe, Greater Flamingo, Lesser Flamingo, South African Shelduck, Cape Teal, Ringed plover, Curlew Sandpiper, Ruff, Greenshank, Avocet, Black-winged Stilt and White-winged Black Tern (Heydorn et al. 1990).

Table 25: Summary of the wetland details

Wetland Name	Groenrivier Estuary
Wetland Number	F50G-01
River System Name	Groen River (F50A)
Land Use in Catchment	Mainly rocky areas with natural vegetation but also some cultivated land and scattered urban settlements
Land Use in Wetland	Bird watching
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	01 October 2013
Wetland Assessor(s)	D Kotze and H Nieuwoudt
Wetland size	-

12.2 Site photos

Saltmarsh with a management track that is no longer in use

Track facing back towards the SANParks offices

Saltmarsh and adjacent vegetation

View from the proposed birdhide

Figure 49: Site photos of the Groenrivier wetland (Courtesy: Donovan Kotze)

12.3 Wetland Problems

The Namaqua National Park is a popular destination that provides opportunities for camping, bird watching, hiking and 4x4 tracks. As a result the wetland has been subjected to a number of impacts associated with the lack of designated public access routes for watching birds as well as short hiking trails to appreciate the scenic beauty of the Groenrivier estuary.

As such, a number of pathways have formed over the years which are increasing the impact of sedimentation and erosion by providing preferential flow routes for surface water draining. Vegetation is also slow in reclaiming pathways once they have formed due to the arid climate and there is a risk of the landscape to be dissected with these pathways if formalised routes are not provide.

12.4 Rehabilitation Objectives

The primary objective of the rehabilitation is to provide enhanced public access for watching birds and appreciate the scenic beauty of the Groenrivier estuary without impacting negatively on the estuary. This can be achieved by means of a bird hide, boardwalk and by demarcating an appropriate pathway to reach the boardwalk. The secondary objective is to raise awareness amongst visitors in terms of wetlands in the overall catchment by putting providing signboards with information on rehabilitation in the overall catchment.

12.5 Summary proposed interventions

The new interventions that are proposed are discussed in detail in the subsequent sections of this report. The table below (**Table 26**) provides a summary of these interventions. The "implementation order" as depicted in the table indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The "priority" as depicted in the table indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

Please note that the location of the interventions described in Section 12.6 may change as a result of changes in the landscape (due to continued erosion, for example) during the time period that has lapsed between the initial planning site visit and the actual implementation thereof.

Table 26: Summary of proposed new interventions, F50G-01

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
F50G-01-201-00	Boardwalk	2	4	R 435 000.00
F50G-01-202-00	Bird hide	1	4	R 55 000.00
F50G-01-203-00	Boardwalk	3	4	R 138 000.00
			Total	**R 628 000.00**

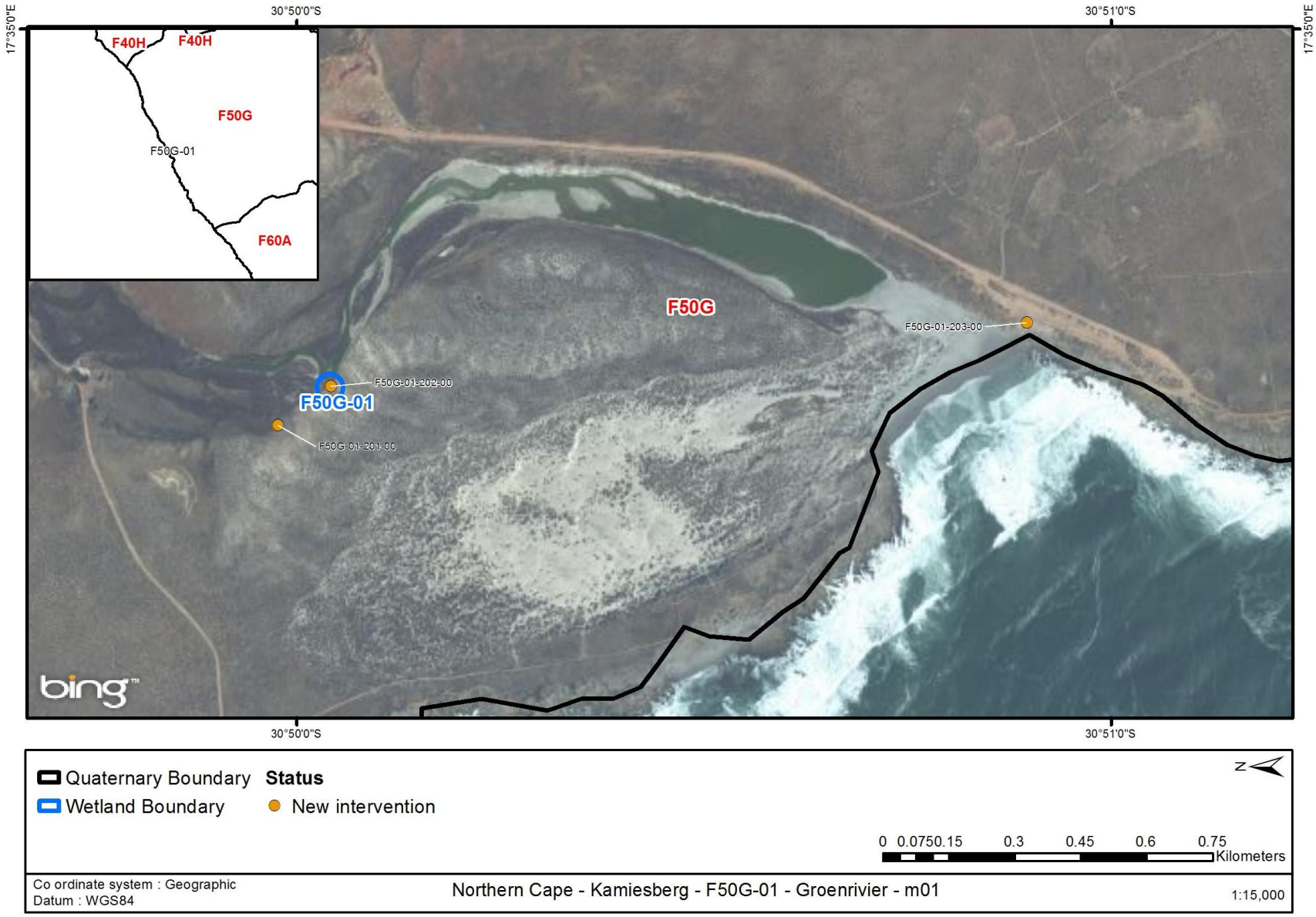

Figure 50: Wetland map, F50G-01 with proposed interventions indicated

12.6 Intervention designs

12.6.1 Intervention: F50G-01-201-00

Designer	-
Design Date	-
Intervention Description	Boardwalk
Rehabilitation Objective	Avoid trampling of saltmarsh and increase awareness among visitors
Latitude (DºM'S")	30°49'58.6"S
Longitude (DºM'S")	17°34'30.8"E
Engineering Drawings	Detailed design to be finalised closer to implementation (generic drawing available in Appendix C)

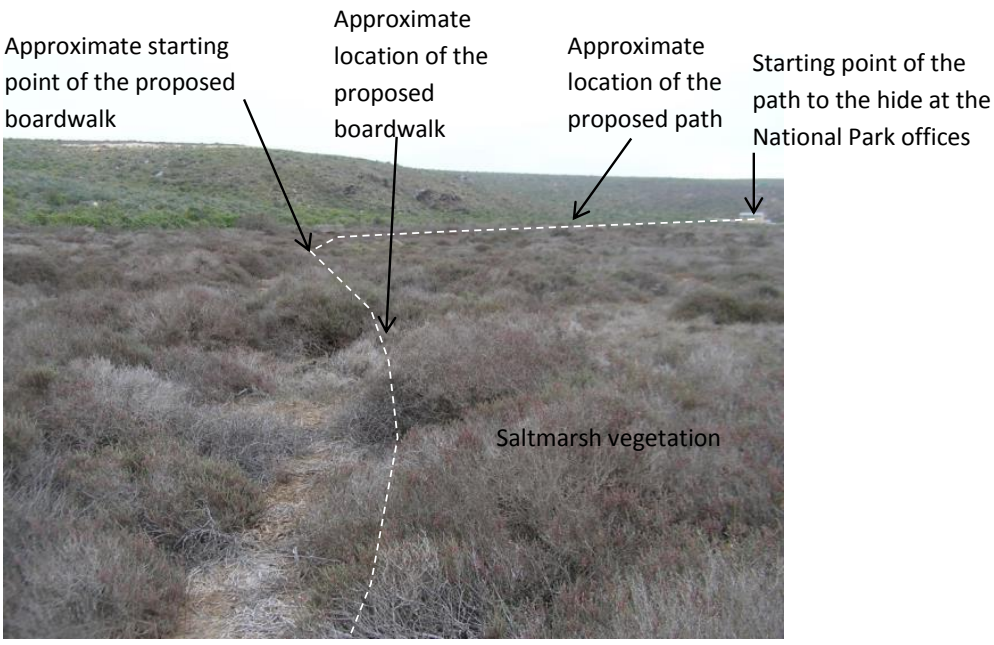

Figure 51: Approximate route for intervention F50G-01-201-00 (Courtesy: Donovan Kotze)

12.6.1.1 Bill of quantities F50G-01-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Boardwalk	m	145.00	R 3 000.00	R 435 000.00
			Total	**R 435 000.00**

12.6.1.2 Construction notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

12.6.2 Intervention: F50G-01-202-00

Designer	-
Design Date	-
Intervention Description	Birdhide
Rehabilitation Objective	Avoid trampling of saltmarsh and increase awareness among visitors
Latitude (DºM'S")	30°50'02.5"S
Longitude (DºM'S")	17°34'33.7"E
Engineering Drawings	Detailed design to be finalised closer to implementation (generic drawing available in Appendix C)

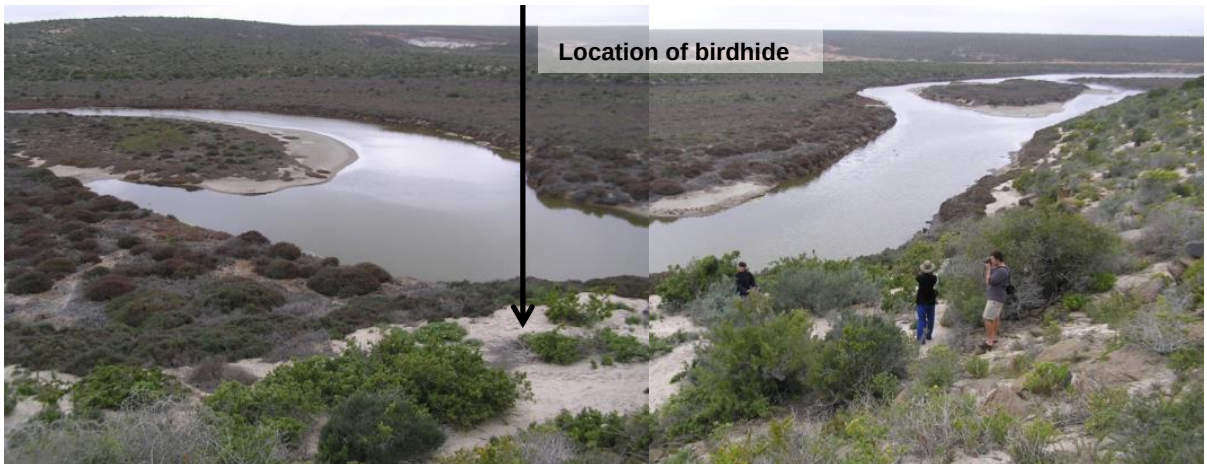

Figure 52: Location of intervention F50G-01-202-00 (Courtesy: Donovan Kotze)

12.6.2.1 Bill of quantities F50G-01-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Birdhide	m^3	10.00	R 5 500.00	R 55 000.00
			Total	**R 55 000.00**

12.6.2.2 Construction notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

12.6.3 Intervention: F50G-01-203-00

Designer	-
Design Date	-
Intervention Description	Boardwalk
Rehabilitation Objective	Avoid trampling of saltmarsh and increase awareness among visitors
Latitude (DºM'S")	30°50'53.77"S
Longitude (DºM'S")	17°34'38.39"E
Engineering Drawings	Detailed design to be finalised closer to implementation (generic drawing available in Appendix C)

12.6.3.1 Bill of quantities F50G-01-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Boardwalk	m	46.00	R 3 000.00	R 138 000.00
			Total	**R 138 000.00**

12.6.3.2 Construction notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

12.7 Construction Environmental Management Plan issues

The proposed rehabilitation is to be undertaken on privately owned land and the project team should access the site and manage the site in accordance with the WfWetlands Best Management Practices and specific requirements of the landowner. The implementation of these interventions must also take into account all relevant provisions of WfWetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the approved Basic Assessments and EA for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as **Appendix B and F.**

12.8 Wetland management recommendations

The Groenrivier Estuary is managed as part of the Namaqua National Park. However, the track through the saltmarsh will need to be rehabilitated. Furhtermore, the Namaqua National Park will be responsible for all maintenance and repair work required to the boardwalk and birdhide.