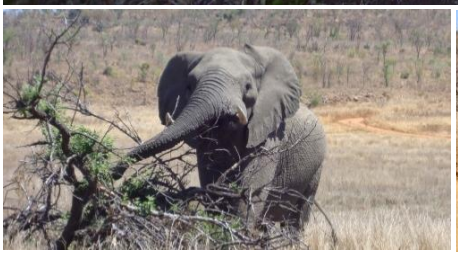
Report No: 109664/8815



REHABILITATION PLAN FOR THE WORKING FOR WETLANDS PROGRAMME, LIMPOPO

PROJECT: WATERBERG

A42D, A61B, A61C

APRIL 2014

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

Working for Wetlands

EXPANDED PUBLIC WORKS PROGRAMME
Creating opportunities towards human fullfilment

SANBI
Biodiversity for Life

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REHABILITATION PLAN FOR THE WATERBERG WETLAND PROJECT, LIMPOPO: 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

TITLE	Rehabilitation Plan for the Waterberg Wetland Project, Limpopo: Planning Year 2014
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PROJECT NAME	Working for Wetlands Programme
REPORT STATUS	Final
REPORT NUMBER	109664/8815
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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.

[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.

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 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 WfWetlands 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).

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).

[2] without a Supervisor

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 (gabions, berms, 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 or 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.

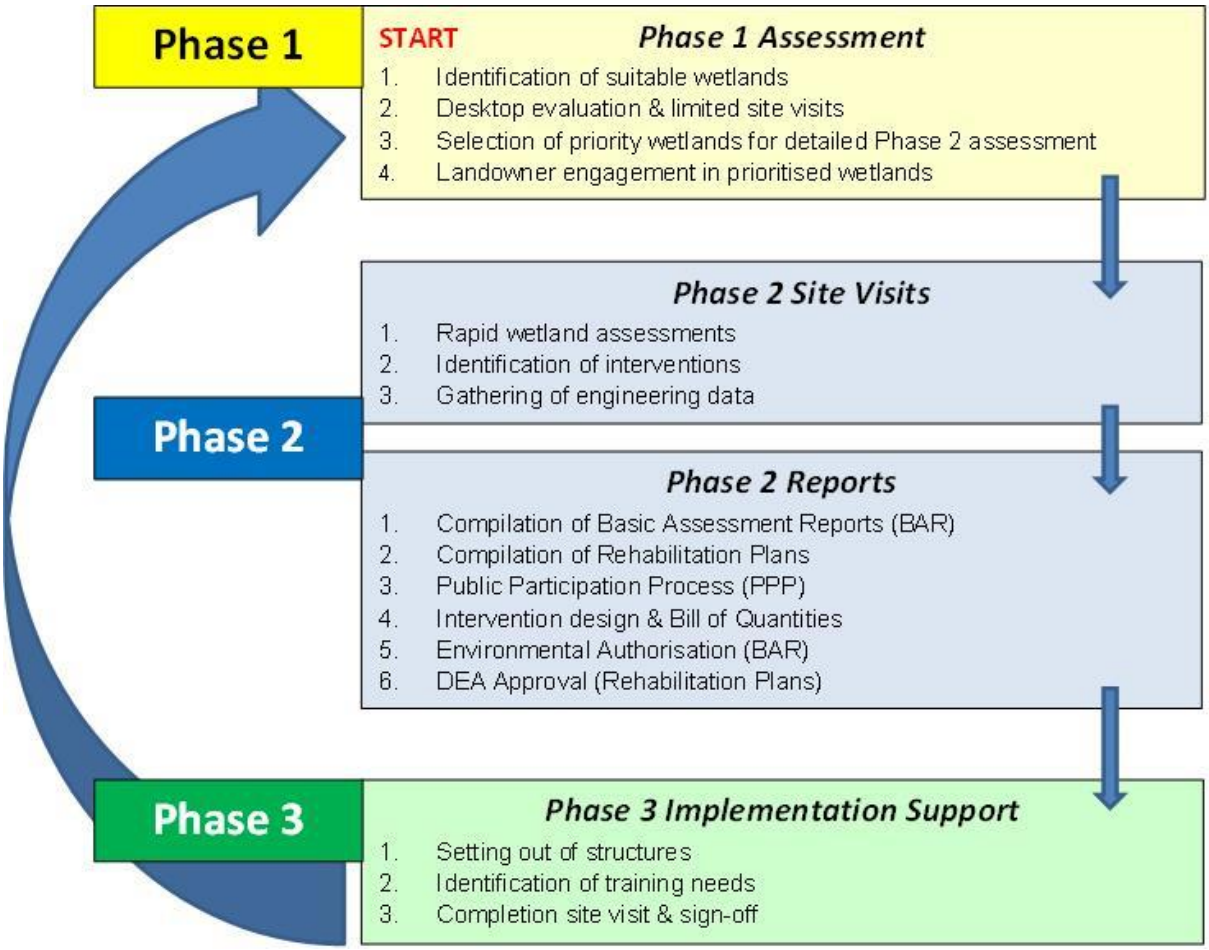

Plate C: The Working for Wetlands planning process (Phase 1 to Phase 3).

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 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: • 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)	International Conventions	N/A

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 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.

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

[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
BID	Background Information Document
BMP	Best Management Practise
CBA	Critical Biodiversity Area
CEMP	Construction Environmental Management Programme
CSIR	Council of Scientific Research
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EA	Environmental Authorisation in terms of the NEMA
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EPWP	Expanded Public Works Programme
GA	General authorisation in terms of the NWA
GIS	Geographical Information System
HIA	Heritage Impact Assessment
IA	Implementing Agent
I&APs	Interested and Affected Parties
M&E	Monitoring and Evaluation
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act
NRMP	Natural Resource Management Programme
NWA	National Water Act
NWI	National Wetlands Inventory
PC	Provincial Coordinator
PIP	Project Implementation Plan
PPP	Public Participation Process
RHP	River Health Programme
SANBI	South African National Biodiversity Institute
SMME	Small, Medium and Micro Enterprises
WfWetlands	Working for Wetlands

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).

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

Background Information Document (BID): A short document describing, and inviting I&APs to comment on, the proposed activities for which authorization is sought.

Best Management Practice (BMP): Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWetlands 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 WfWetlands Projects within a province.

Environmental Assessment Practitioner (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).

Environmental Impact Assessment (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.

Environmental Management Plan (EMP): 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.

Interested and Affected Parties (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 WfWetlands 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).

Public Participation Process (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 WfWetlands interventions 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 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) **and "**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 (WfWetlands) 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. Waterberg Rehabilitation Plan (February 2011), and the
    c. Wetland Assessment **(Appendix A)** of this report).

vii. DISCLAIMER

- This Rehabilitation Plan is for the Waterberg Wetland Project in the Limpopo Province. The plan is to be used to implement the interventions identified as

necessary to rehabilitate the Waterberg 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 included in the Phase 1 Reports 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		✓	
Collin Nemadodzi	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 Working for Land) 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 Limpopo 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 Limpopo Province (**Table 1**):

Table 1: Limpopo Wetland Projects

Project Name	*Wetland Number*	*Wetland System*
Mutale Project	A91G-01	Lwama-Tshedzi
	A91H-01	Lambwe
	A92A-01	Lake Fundudzi
	A92B-13	Upper Sambandou

Project Name	*Wetland Number*	*Wetland System*
	A92B-15; A92B-16; A92B-17; A92B-18	Tshamushoka
Kruger National Park Project	B90E- 01	Langtoon Dam
	X24B-01; X24E 01	Stolsnek Seepage Zones
	X31M- 01	N'waswitshaka Seep Zone Areas[8]
	X40D- 01	Silolweni Dam
Waterberg project	A42D-01	Welgevonden: Pitse
	A42D-02	Welgevonden: Oli-gat
	A42D-03	Welgevonden: Kobus-se-Pad
	A61B-02	Nylsvley: Upper Nyl
	A61C-01	Nylsvley: Boekenhout

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 Limpopo Province. This Rehabilitation Plan focusses on the Waterberg Wetland Project and is to be submitted to DEA for their approval as a condition of the EA.

1.3.1 The Waterberg Wetland Project

This document comprises the Rehabilitation Plan for the Waterberg Wetland Project and includes the following wetland systems: Pitse (A42D-01), Oli-gat (A42D-02), Kobus-se-Pad (A42D-03) and Upper Nyl (A61B-02) and Boekenhout (A61C-01) within the Nylsvley Ramsar site. The Rehabilitation Plan will be the primary working document for the project via the implementation (construction/ undertaking of) of interventions[9] 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.

[8] Although wetlands X24B-01, X24E-01, X31M-01 and X40D-01 have been included in the Limpopo project, they are located in the Mpumalanga Province. These wetlands have been grouped together as they are all in the Kruger National Park and have been included in the Limpopo Project for simplicity in planning and management. Relevant Mpumalanga authorities are being notified.

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

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.

1.4 Project scope

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

Table 2: Project Scope

Quaternary Catchments	A42D, A61B and A61C
Quaternary Catchment area (Ha)	- A42D: 50 222.2 ha - A61B: 36 726.9 ha - A61C: 59 469.4 ha
Number of wetlands identified during the assessment	5
Extension of existing work (previous financial year)	Yes
Work to commence at new wetlands in 2014/ 2015	Yes
Available budget for new interventions	R 4 074 311
Available budget for maintenance to existing interventions	
Estimated cost of new interventions	(**Total: R 6,029,903**) (Pitse: R 447,587) (Oli-Gat: R 1,159,100) (Kobus se Pad: R 1,210,619) (Nylsvley: Upper Nyl & Boekenhout: R 3,212,597)
Estimated cost of maintenance to existing interventions	R 357 395*

* 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 Limpopo Province undertook a desktop study to determine the most suitable wetlands for the WfWetlands rehabilitation efforts. The involvement of Provincial Wetland Forums and other key stakeholders was 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 involved initial communication with local land-owners and other interested and affected parties to gauge the social benefits of the work. The following wetlands were prioritised and agreed to by the various parties for the Waterberg Wetland Project:

1. Welgevonden: Pitse (A42D-01)
2. Welgevonden: Oli-gat (A42D-02)
3. Welgevonden: Kobus-se-Pad (A42D-03)
4. Nylsvley (A61B-02; A61C-01)

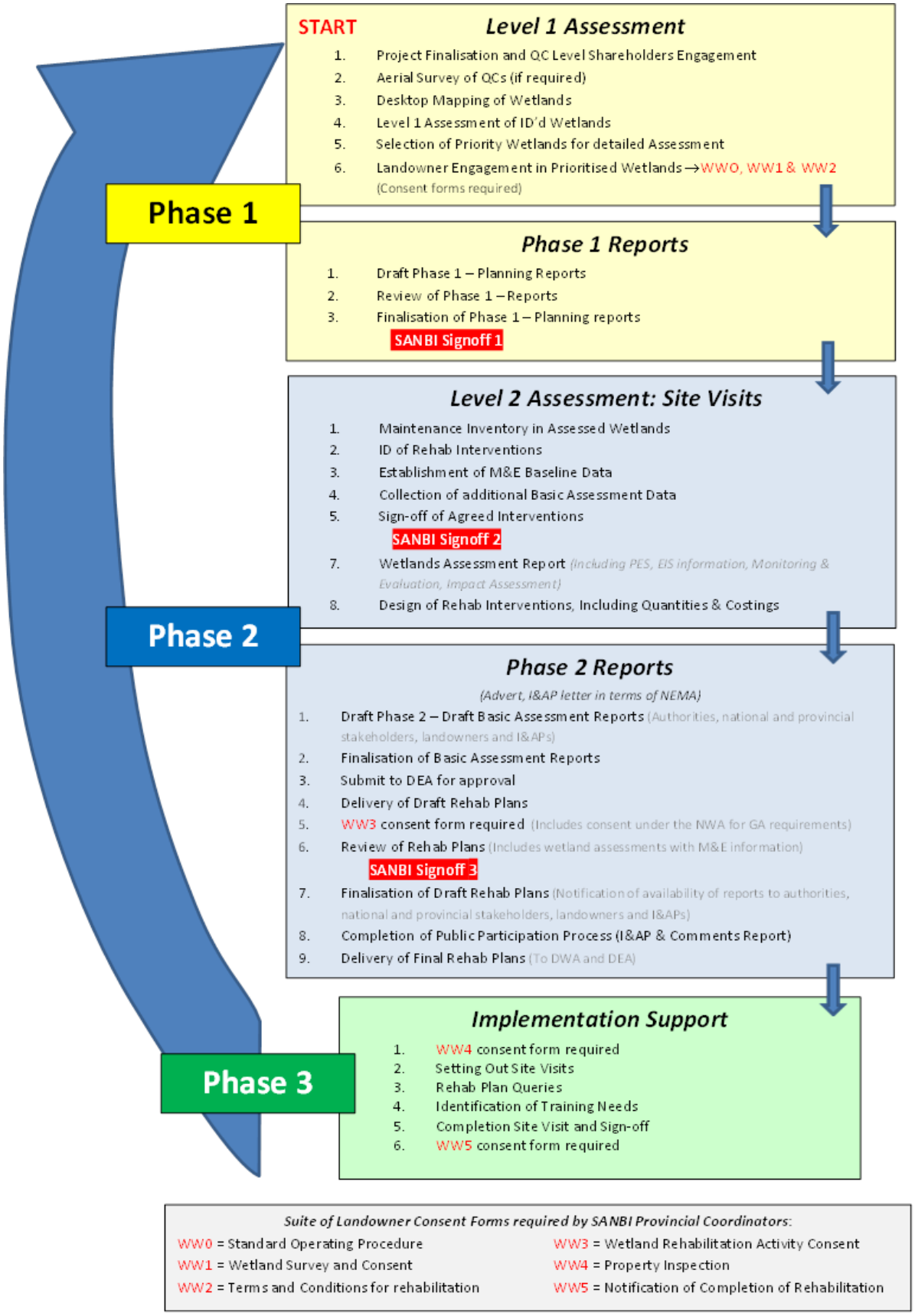


Figure 1: The three phases that must be undertaken for the successful rehabilitation of wetlands

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, an EAP, and a SANBI provincial coordinator. 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 following site visits were undertaken for the Waterberg Wetland Project:

1. Welgevonden: Pitse (August 2010, June 2012 and October 2013)
2. Welgevonden: Oli-gat (June 2010 and October 2013)
3. Welgevonden: Kobus-se-Pad (October 2013)
4. Nylsvley: Upper Nyl: (2008 and August 2010- October 2013)
5. Nylsvley: Boekenhout: (2008 and August 2010- October 2013)

The following team members attended the site visits:

- Collin Nemadodzi (SANBI PC)
- Piet-Louis Grundling (wetland specialist),
- Cilliers Blaauw (engineer)
- Franci Gresse (EAP)

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; and

- 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 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 WfWetlands 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.
- Maintenance requirements for existing interventions in the assessed wetlands will be similarly detailed and the anticipated costs calculated when planning has been completed.

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 Waterberg 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 included as **Appendix A** to this report.

The Waterberg Rehabilitation Plan was submitted to the SANBI PC and wetland ecologist for review before it was made available to stakeholders for comment. Any comments received during the comments period were taken into account in the finalisation of the Rehabilitation Plans.

a. Reporting 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.

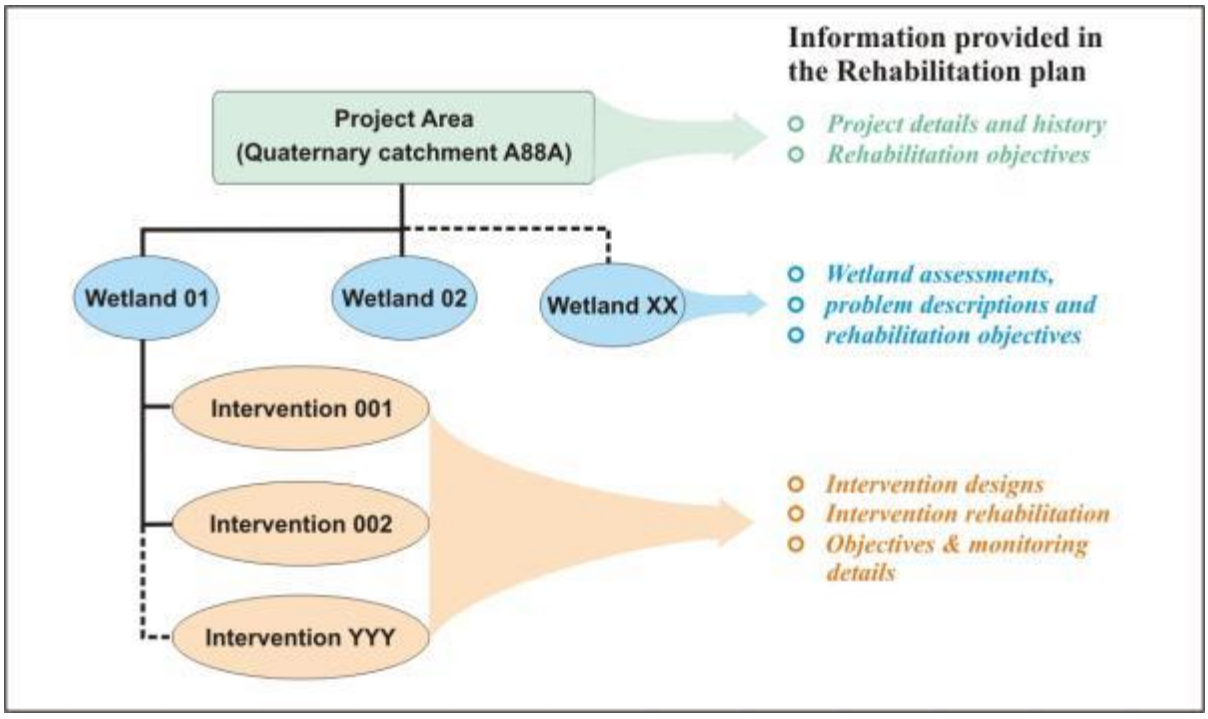


Figure 2: Hierarchy used in the Wetland Rehabilitation Plan

3 PROJECT DESCRIPTION

3.1 Project details

Background: The Waterberg Wetland Project is located in two key conservation areas, the Welgevonden Nature Reserve and the Nyl Floodplain in the Nylsvley Nature Reserve. Welgevonden Nature Reserve is situated west of the town of Vaalwater and the Nylsvlei Nature Reserve is near the town of Mookgophong (refer to **Figure 3** and **Table 3** below):

Table 3: Project details

Project Name	Waterberg
Region (Province)	Limpopo
Project Budget	R 4 074 311
Planning Category	Category 2
Nearest Town/s	Vaalwater, Mookgophong and Modimolle
Partnerships	Welgevonden Nature Reserve and Nylsvley Nature Reserve, Waterberg District Municipality, LEDET, DAFF, DEA, DWA and SANParks

The Waterberg wetland rehabilitation project was previously located across seven quaternary catchments around the Limpopo towns of Vaalwater, Modimolle, Mokopane and Mookgophong. Rehabilitation work commenced in 2006 and initially involved work in quaternary catchments A61A, A61B, A61F and A42A. Subsequently work was done in quaternary catchments A42E, A61F, A61H, A61C and A61E. Work was initiated in the Nyl Floodplain in 2011 and in Welgevonden in 2012. In this planning cycle rehabilitation work will focus on the Welgevonden Nature Reserve (A42D) and on the Nylsvlei Nature Reserve (A61B and A61C). The Nylsvley wetlands form part of the Nyl River Floodplain, within the Waterberg Mountains, as well as the Larger Limpopo River Catchment. This wetland is also of international importance and has been declared a Ramsar site.

Numerous catchments were included in the project due to the distribution of the wetlands in the Waterberg area. The terrain is rugged, steep and rocky and this, coupled with the hot, semi-arid climate and sandy soils confines wetland habitat to long, narrow bands along the bottom of valley systems or to seeps on slopes and plateaus in the mountains. The catchment consists of a mountainous plateau and is covered in mixed broad-leafed woodland savannah of the Waterberg Mountain Bushveld (Mucina and Rutherford, 2006). The upland areas are often characterised by shallow soils and exposed sandstone whilst the valleys contain deep sand deposits. The Mean Annual Precipitation is about 620 mm/annum (Mucina and Rutherford, 2006) with the Mean Annual Runoff (MAR) in the order of 1 422 000 m^3/annum.

Land use within the catchments is conservation and eco-tourism with limited changes to the catchment characteristics. However a significant degree of disturbance has occurred due to anthropogenic activities such as the diversion of cultivation run-off (using a system of berms and water tracts) into the wetland and the construction of dams, drains and roads. Historically, overgrazing practices have also contributed to the current erosion problems experienced in the catchment.

The rehabilitation of the wetlands within their respective catchments will contribute towards the maintenance of the aquatic and terrestrial biodiversity of the region. The Waterberg wetlands are also considered to be regionally important in terms of the maintenance of biological diversity

Wetlands selected: Table 4 provides a summary of the wetlands that have been identified for rehabilitation, as well as central coordinates. All the wetlands that fall within the Waterberg Wetland Project are protected.

Table 4: Identified wetlands within the Waterberg Wetland Project

Wetland Number	Wetland Name	Latitude	Longitude
A42D-01	Welgevonden: Pitse	24°23'24.41"S	27°49'33.92"E
A42D-02	Welgevonden: Oli-gat	24°21'1.12"S	27°47'12.75"E
A42D-03	Welgevonden: Kobus-se-Pad	24°21'23.78"S	27°46'36.72"E
A61B-02	Nylsvley: Upper Nyl	24°39'8.54"S	28°40'19.91"E
A61C-01	Nylsvley: Boekenhout	24°42'14.39"S	28°33'0.39"E

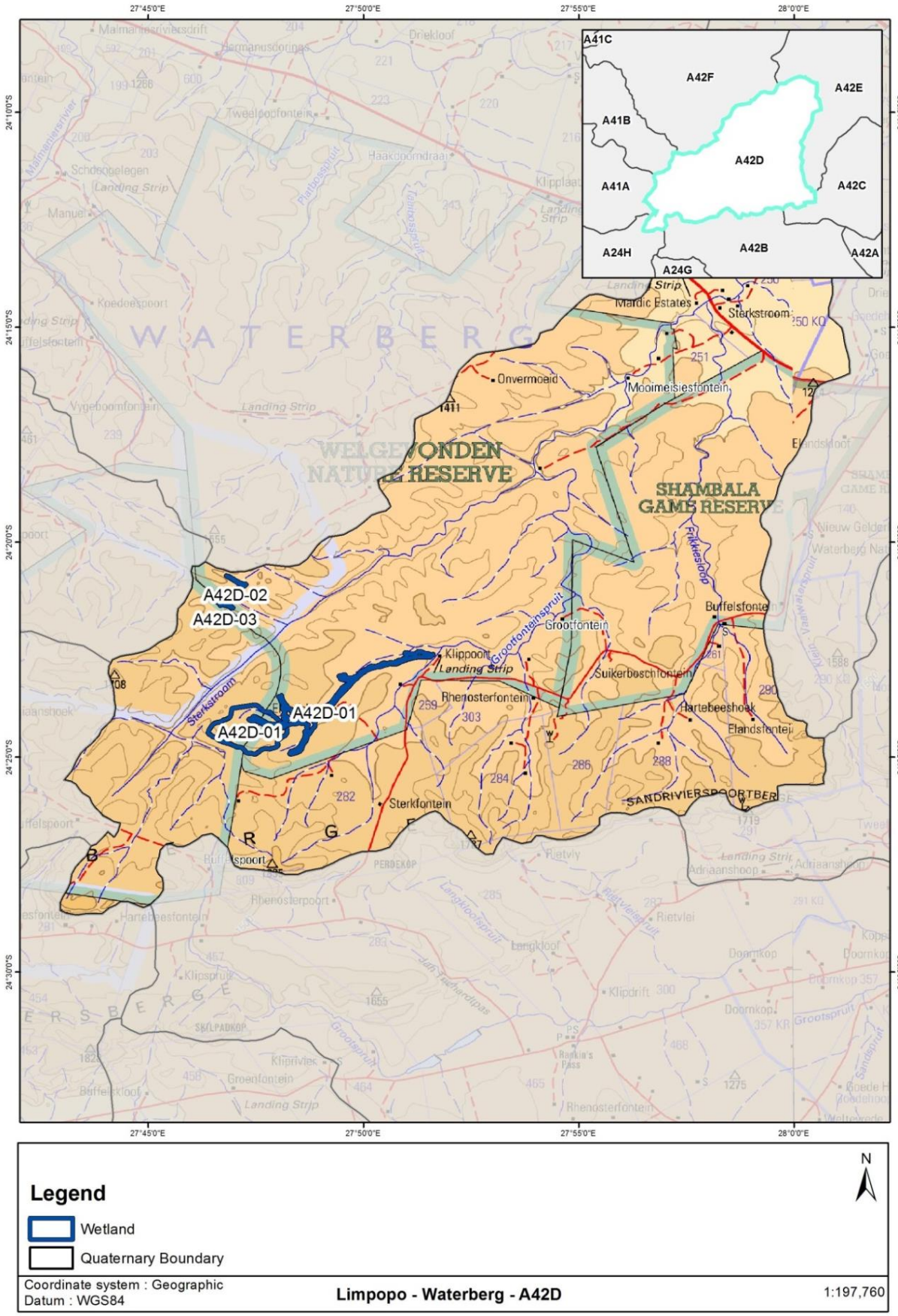


Figure 3: Topographic map showing A42D quaternary catchment's locality, cadastral boundaries and access routes

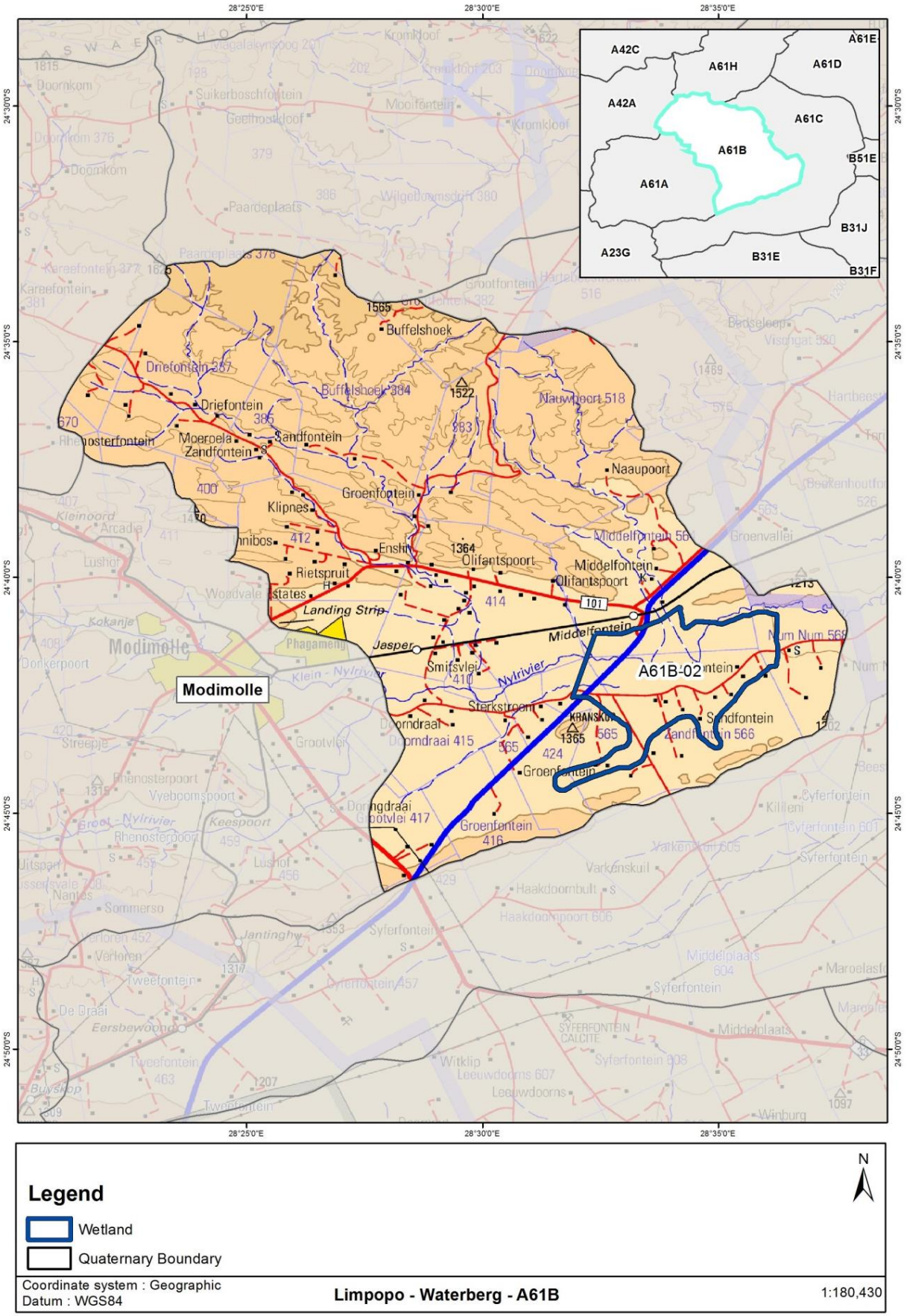


Figure 4: Topographic map showing A61B quaternary catchment's locality, cadastral boundaries and access routes

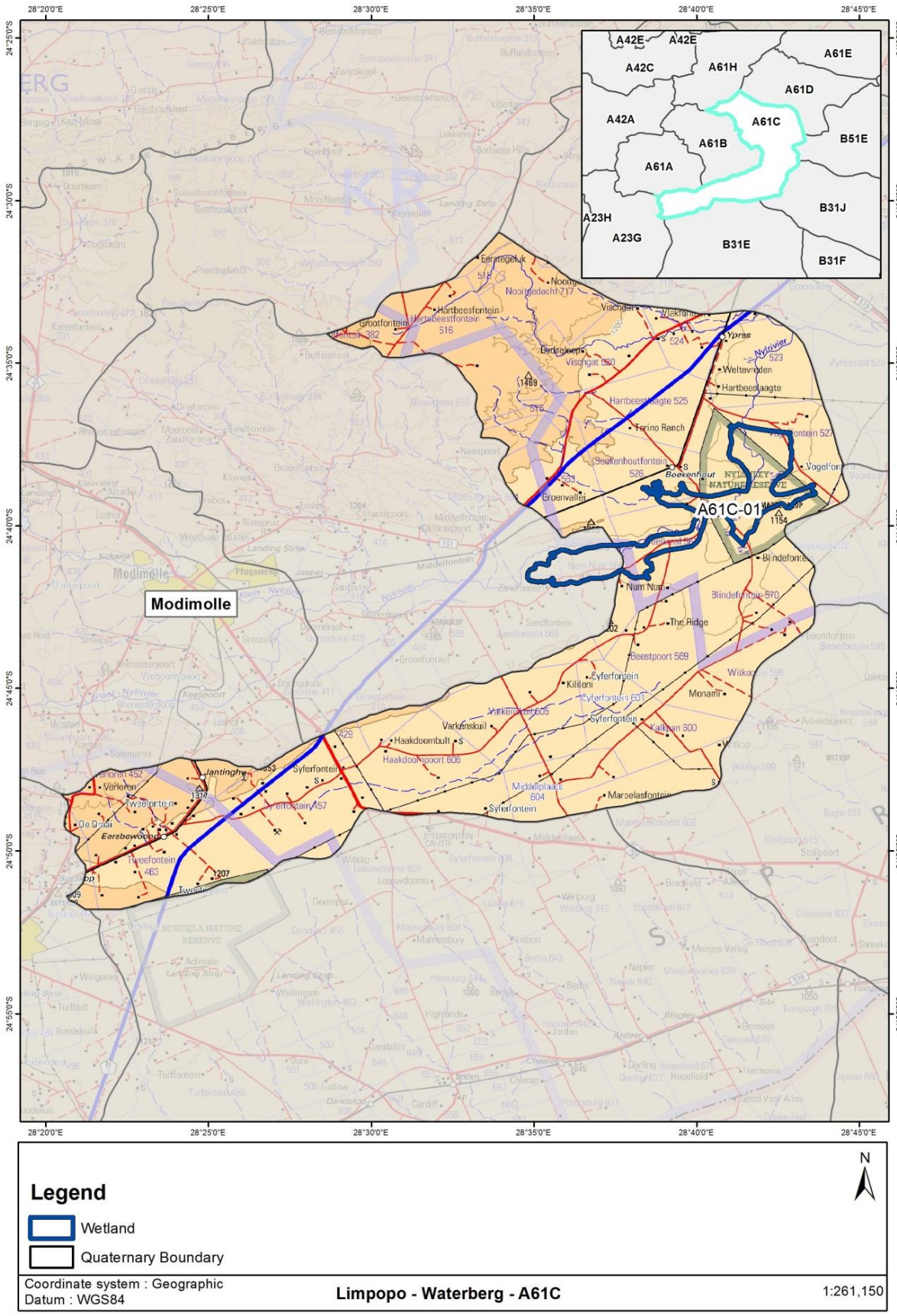


Figure 5: Topographic map showing A61C quaternary catchment's locality, cadastral boundaries and access routes

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
A42D-01	T0KQ00000000047000064	Welgevonden Game Reserve	Yes
A42D-02	T0KQ00000000047000043 T0KQ00000000047000041	Welgevonden Game Reserve	Yes
A42D-03	T0KQ00000000047000042	Welgevonden Game Reserve	Yes
A61B-02	T0KR00000000056600007	Nylsvley Nature Reserve	Yes
A61C-01	T0KR00000000056000000		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)	Future scenario with no intervention	Wetland hectare secured by rehabilitation	Post rehab scenario	% Increase on current hectare	Projected hectare nts secured
A42D-01	183	158	25	183	14%	25
A42D-02	6.6	3.5	2.1	5.6	38%	2.1
A42D-03	3.6	0.5	3.1	3.6	86%	3.1
A61B-02 & A61C-01[10]	5289	4987	302	5289	6%	302

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
2	A42D-01	Welgevonden: Pitse	Historically the area has been disturbed significantly through anthropogenic activities. However, it is
4	A42D-02	Welgevonden: Oli-gat	

[10] The wetlands A61B-02 and A61C-01 are grouped together in some sections of this report as they form part of the same large wetland that spans over more than one quaternary catchment.

Priority	Wetland number	Wetland name	Rationale
3	A42D-03	Welgevonden: Kobus se Pad	anticipated that rehabilitation will be effectual as the landuse practices have changed from agriculture to conservation. Pitse is a wetland well intact but threatened. The other two sites are a management priority in terms of access.
1	A61B-02	Nylsvley: Upper Nyl	The area is of international importance as it forms part of a Ramsar site.
1	A61C-01	Nylsvley	The area is of international importance as it immediate upstream of a Ramsar site.

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				
Welgevonden: Pitse (A42D-01)				
Earth works	N/A	A42D-01-242-00	Removal of dam wall to reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014
Earth works	N/A	A42D-01-243-00	Removal of berm and infilling of head cut to arrest erosion and reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014
Earth works	N/A	A42D-01-244-00	Infilling of head cut to arrest erosion and reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014
Rock pack/ fill	N/A	A42D-01-245-00	Rock packing to address erosion around road crossing	Waterberg Final Rehab Plan: April 2014
Earth works	N/A	A42D-01-247-00	Cut and fill earth works with rock packing to address erosion around road crossing and reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014
Earth structure	N/A	A42D-01-248-00	Infilling of head cut to arrest erosion and reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Earth structure	N/A	A42D-01-249-00	Construct an earth berm with re-vegetation	Waterberg Final Rehab Plan: April 2014
Earth structure	N/A	A42D-01-250-00	Construct an earth berm and infilling of head cut to arrest erosion; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014
Earth works	N/A	A42D-01-251-00	Removal of berm and infilling of drainage channel to arrest erosion and reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014
Earth structure	N/A	A42D-01-252-00	Construct earth berms with re-vegetation to divert surface flow, address erosion and promote sediment trapping.	Waterberg Final Rehab Plan: April 2014
Earth works	N/A	A42D-01-253-00	Infilling and sloping of head cut to arrest erosion and reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab April 2014
Welgevonden: Oli-gat (A42D-02)				
Rock pack/ fill	N/A	A42D-02-201-00	Rock packing. Stabilise donga erosion	Waterberg Final Rehab Plan: April 2014
Rock pack/ fill	N/A	A42D-02-202-00	Rock packing. Stabilise donga erosion	Waterberg Final Rehab Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Rock pack/ fill	N/A	A42D-02-203-00	Rock packing. Stabilise donga erosion	Waterberg Final Rehab Plan: April 2014
Stone masonry weir and rock packing	N/A	A42D-02-204-00	Stabilise headcut.	Waterberg Final Rehab Plan: April 2014
Rock pack/ fill	N/A	A42D-02-205-00	Rock packing. Stabilise donga erosion.	Waterberg Final Rehab Plan: April 2014
Rock pack/ fill	N/A	A42D-02-206-00	Rock packing. Stabilise donga erosion.	Waterberg Final Rehab Plan: April 2014
Rock pack/ fill	N/A	A42D-02-207-00	Rock packing. Stabilise donga erosion.	Waterberg Final Rehab Plan: April 2014
Rock pack (berm)/fill	N/A	A42D-02-208-00	Rock packing berm. Stabilise donga erosion and promote sediment trapping.	Waterberg Final Rehab Plan: April 2014
Rock pack (berm)	N/A	A42D-02-209-00	Rock packing berm. Stabilise donga erosion and promote sediment trapping.	Waterberg Final Rehab Plan: April 2014
Rock pack (berm)	N/A	A42D-02-210-00	Rock packing berm. Stabilise donga erosion and promote sediment trapping.	Waterberg Final Rehab Plan: April 2014
Rock pack (berm)	N/A	A42D-02-211-00	Rock packing berm. Stabilise donga erosion and promote sediment trapping.	Waterberg Final Rehab Plan: April 2014
Rock pack/ fill	N/A	A42D-02-212-00	Rock packing. Stabilise donga erosion.	Waterberg Final Rehab Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Rock pack/ fill	N/A	A42D-02-213-00	Rock packing. Stabilise donga erosion.	Waterberg Final Rehab Plan: April 2014
Rock pack (berm)	N/A	A42D-02-214-00	Rock packing. Stabilise donga erosion.	Waterberg Final Rehab Plan: April 2014
Welgevonden: Kobus-se-Pad (A42D-03)				
Stone masonry and gabion	N/A	A42D-03-201-00	Stabilise donga erosion and trapping sediment in the donga.	Waterberg Final Rehab Plan: April 2014
Stone masonry and gabion	N/A	A42D-03-202-00	Stabilise donga erosion and trapping sediment in the donga.	Waterberg Final Rehab Plan: April 2014
Nylsvley: Upper Nyl (A61B-02)				
Earth works removal of berms	N/A	A61B-02-201-00	Earth works removal of berm to reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014
Nylsvley: Boekenhout (A61C-01)				
Earth works (removal of dam wall)	N/A	A61C-01-204-00	Removal of the dam wall to reinstate natural flow patterns; re-vegetation will also take place	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-208-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-209-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Earth works (Cut and fill)	N/A	A61C-01-210-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-211-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-212-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-213-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-214-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-215-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-216-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth Works (Cut and fill)	N/A	A61C-01-217-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-218-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Earth works (Cut and fill)	N/A	A61C-01-219-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-220-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-221-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-222-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-223-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-224-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
Earth works (Cut and fill)	N/A	A61C-01-225-00	Blocking of drains	Waterberg Final Rehab Plan: April 2014
MAINTENANCE				
			Planning in progress	

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 WELGEVONDEN: PITSE – A42D-01

4.1 Wetland details

The Pitse wetland is located in quaternary catchment A42D in the Welgevonden Nature Reserve which is approximately 30 km west of the town of Vaalwater in the Limpopo Province **Figure 3** in Section 3 of this report). The assessment of the Pitse wetland (A42D-01), 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 Pitse wetland (**Table 9**) is a channelled valley-bottom wetland compromising of unchannelled and hillslope seepage areas which can be temporary or seasonal. The wetland is formed by a tributary of the Grootfontein River which flows into the Sterkstroom River. Soils are highly erodible and freely drained and have a low natural fertility.

The wetland has been selected for rehabilitation in order to continue work already started there. As the area is a conservation area it is important to return the wetland to its natural state and to mitigate the impacts of historical anthropogenic activities. Remnant agricultural related structures such as dams and berms are located across the landscape and have significant direct and indirect impacts on the hydrological and morphological characteristics of seepage zones, wetlands and rivers. These structures are not only draining the area, but also causing erosion across the landscape. In addition, animal activities in these sensitive areas are increasing the impact of disturbances significantly by preventing wetland vegetation to re-establish and escalating the rate at which soil erosion is taking place. The wetland is an important site for wildlife conservation and for tourism.

Table 9: Summary of the wetland details

Wetland Name	Welgevonden: Pitse
Wetland Number	A42D-01
River System Name	A tributary of the Grootfontein that flows into the Sterkstroom, a tributary of the Mokolo River.
Land Use in Catchment	The wetland and its catchment are located in a game farming/ conservation area.
Land Use in Wetland	Game farming
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	August 2010, June 2012 and October 2013
Wetland Assessor(s)	Piet-Louis Grundling
Wetland size	183 ha

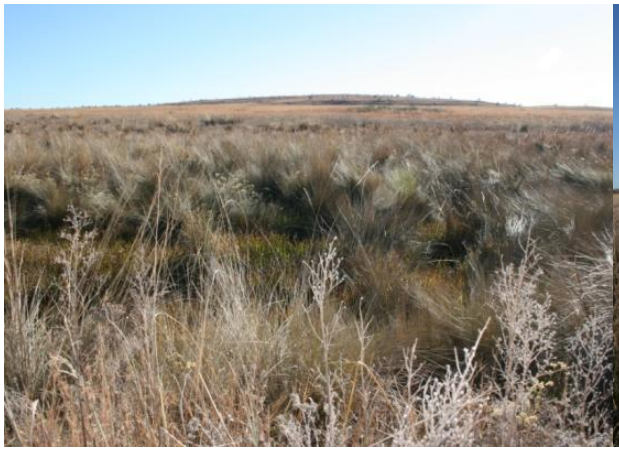
4.2 Site photos

Berms and water tracts in the catchment and seep zones – indicated by dashed lines in photo's

View in a northerly direction

Impact of faunal activities on the local hydrological and morphological characteristics

Impact of anthropogenic activities on the local hydrological and morphological characteristics



View in an easterly direction

View in a westerly direction

Figure 6: The Pitse wetland

4.3 Wetland problems

Historical cattle ranching and cultivation practices within the catchment has resulted in the erosion of shallow water tracts (shallow cultivation runoff ditches) into the wetland. The wetland has also undergone a significant degree of anthropogenic disturbances with the construction of at least seven dams within the wetland. A drain from the lowest dam and associated gully erosion from the dam's spillway has severely impacted on the wetland, especially the lower section below the road crossing. The rehabilitation is focused on addressing the potential impacts of flow modification by erosion migrating into the wetland and addressing impacts of gully erosion, a drain with a berm and a dam in the South Gate tributary section.

4.4 Rehabilitation objectives

Rehabilitation will aim to reduce flow concentration and to re-instate more natural water distribution and retention patterns. The intention is to improve the hydrological function of the wetland and the condition of the associated wetland vegetation. Rehabilitation also aims to facilitate the rewetting of desiccated areas and improve flow regulation and carbon sequestration.

The proposed interventions will address the wetland problems and achieve the rehabilitation objectives as follows:

- Erosion is to be controlled by berms and weirs;
- Road run-off is to be managed by constructing earth berms;
- Donga erosion is addressed by trapping sediment with rock berms.
- Re-wetting of the wetland to facilitate natural flow patterns; and
- Carbon sequestration is to be maintained by erosion control and rewetting.

4.5 Summary proposed interventions

WfWetlands started rehabilitation work in the Pitse wetland in 2011 for the first time. Work was initiated in order to alleviate the damage incurred by historical cattle ranching practices and cultivation. Work was continued in the Pitse wetland in 2012 in order to continue addressing the impacts from historical anthropogenic activities. Wetland assessments were conducted during the 2011 and the 2012 wetland planning cycles and were incorporated into Wetland Rehabilitation Plans; Report no 5265/105782 and 6529/107406 respectively.

Table 10 provides a summary of the new interventions that are discussed in detail in the subsequent sections of this report. 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.

Table 10: Summary of proposed new interventions, A42D-01

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
A42D-01-242-00	Earth works	1	2	R 139 945
A42D-01-243-00	Earth works	2	2	R 16 754
A42D-01-244-00	Earth works	3	2	R 2 189
A42D-01-245-00	Rock pack/ fill	4	1	R 1 262
A42D-01-247-00	Earth Works	5	2	R 63 222
A42D-01-248-00	Earth structure	6	1	R 18 640
A42D-01-249-00	Earth structure	7	1	R 47 577
A42D-01-250-00	Earth structure	8	1	R 32 309
A42D-01-251-00	Earth works	9	1	R 19 599
A42D-01-252-00	Earth structures	10	1	R 86 134
A42D-01-253-00	Earth structure	11	1	R 19 956
Total				**R 447 587**

The following future intervention points were also identified and will be investigated during the next planning cycle, i.e. 2015/2016:

Table 11: Future intervention points

Intervention Number	Structure Type/ Objective	Latitude	Longitude
A42D-01-246-00	Drop inlet weir	24°23'10.94"S	27°49'47.52"E
A42D-01-254-00	Restore flow pattern	24°23'9.63"S	27°49'48.50"E
A42D-01-255-00	Arrest erosion, protect wetland habitat	24°24'7.07"S	27°48'45.89"E
A42D-01-256-00	Stop draining, rewet, restore flow patterns	24°24'12.48"S	27°48'42.98"E
A42D-01-257-00	Stop draining, rewet, restore flow patterns	24°24'14.90"S	27°48'44.42"E
A42D-01-258-00	Arrest erosion, protect habitat	24°24'16.53"S	27°48'44.16"E

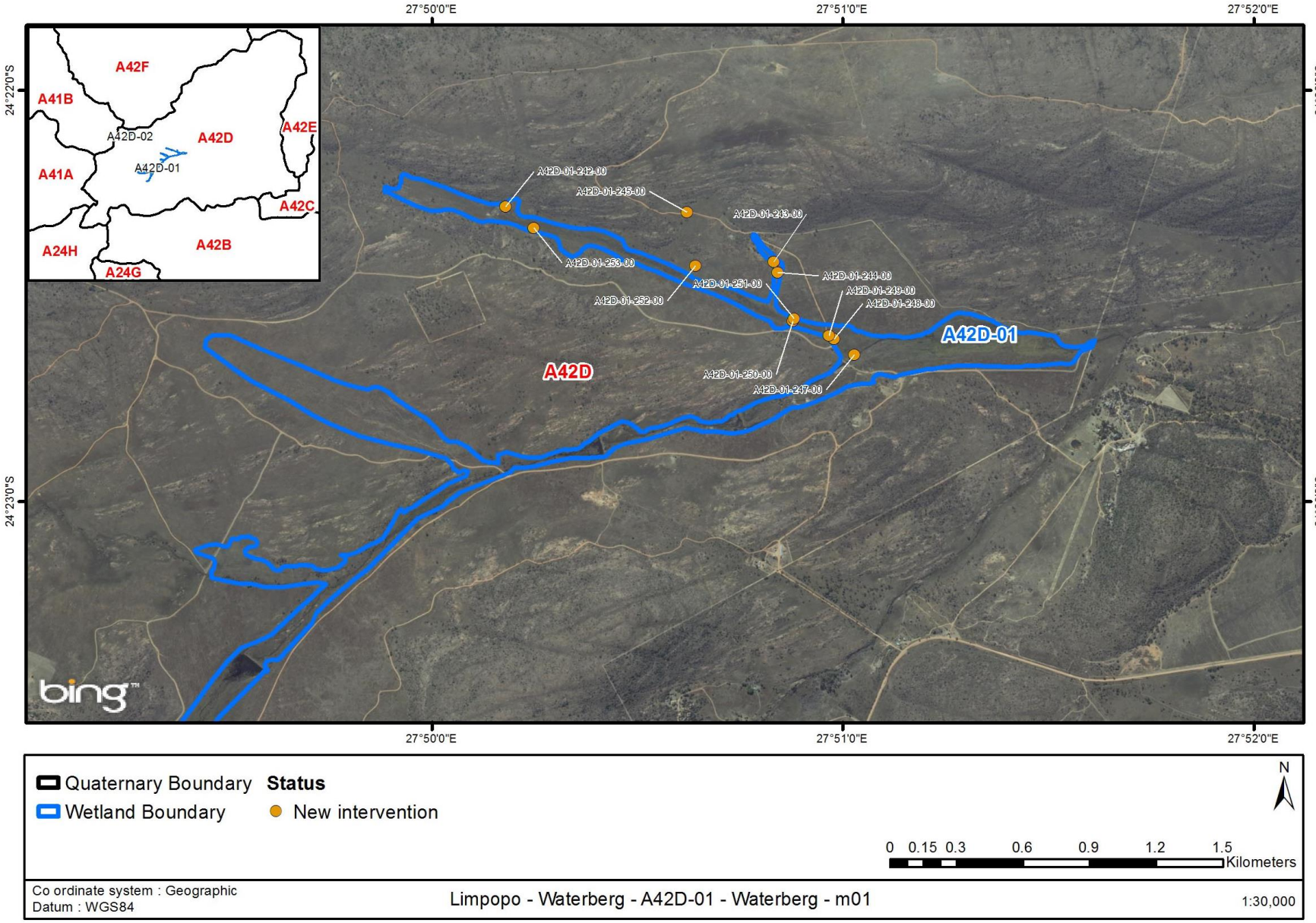


Figure 7: Wetland map, A42D-01 with proposed new wetland interventions indicated.

4.6 Design selection and sizing

Designs were influenced by required objective, type of material available on site, aesthetic concerns of reserve management as well as labour content costing in relation to the required material cost. The sizing was influenced by the area of impact and the footprint of the design to have as little impact as possible.

4.7 Intervention designs

4.7.1 Intervention: A42D-01-242-00

Designer	Cilliers Blaauw
Design Date	15/01/2014
Intervention Description	Earth works
Rehabilitation Objective	Reinstate natural flow patterns
Latitude (DºM'S")	27°50'10.80"S
Longitude (DºM'S")	24°22'16.90"E
Engineering Drawings	A42D-01-242-00

Figure 8: Intervention site A42D-01-242-00

4.7.1.1 Bill of quantities: A42D-01-242-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	370	R 317	R 117 290
Re-vegetate	m^3	985	R 23	R 22 655
			Total	**R 139 945**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.2 Intervention: A42D-01-243-00

Designer	Cilliers Blaauw
Design Date	17/01/2014
Intervention Description	Earth works
Rehabilitation Objective	Arrest erosion and reinstate natural flow patterns
Latitude (DºM'S")	27°50'50.00"S
Longitude (DºM'S")	24°22'25.00"E
Engineering Drawings	A42D-01-243-00

Figure 9: Intervention site A42D-01-243-00

4.7.2.1 Bill of quantities: A42D-01-243-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	23.50	R 317	R 7 449
Rock pack/ fill	m³	4.50	R 841	R 3 784
Re-vegetate	m³	240	R 23	R 5 520
			Total	**R 16 754**

4.7.2.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.3 Intervention: A42D-01-244-00

Designer	Cilliers Blaauw
Design Date	17/01/2014
Intervention Description	Earth works
Rehabilitation Objective	Arrest erosion and reinstate natural flow patterns
Latitude (DºM'S")	27°50'50.50"S
Longitude (DºM'S")	24°22'26.50"E
Engineering Drawings	A42D-01-244-00

Figure 10: Intervention site A42D-01-244-00

4.7.3.1 Bill of quantities: A42D-01-244-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	2.50	R 317	R 792
Rock pack/ fill	m³	1.25	R 841	R 1 051
Re-vegetate	m³	15	R 23	R 345
			Total	**R 2 188**

4.7.3.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.4 Intervention: A42D-01-245-00

Designer	Cilliers Blaauw
Design Date	21/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	Arresting erosion
Latitude (DºM'S")	27°50'37.30"S
Longitude (DºM'S")	24°22'17.70"E
Engineering Drawings	A42D-01-245-00

Figure 11: Intervention site A42D-01-245-00

4.7.4.1 Bill of quantities: A42D-01-245-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m^3	1.50	R 841	R 1 261
			Total	**R 1 261**

4.7.4.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National*

guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

4.7.5 Intervention: A42D-01-247-00

Designer	Cilliers Blaauw
Design Date	17/01/2014
Intervention Description	Earth works (cut & fill)
Rehabilitation Objective	Prevent further erosion
Latitude (DºM'S")	24°22'38.49"S
Longitude (DºM'S")	27°51'01.69"E
Engineering Drawings	A42D-01-247-00

Figure 12: Intervention site A42D-01-247-00

4.7.5.1 Bill of quantities: A42D-01-247-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	9.50	R 317	R 3 011
Rock pack/ fill	m³	70.50	R 841	R 59 290
Re-vegetate	m³	40	R 23	R 920
			Total	**R 63 222**

4.7.5.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.6 Intervention: A42D-01-248-00

Designer	Cilliers Blaauw
Design Date	17/01/2014
Intervention Description	Earth structure (infill & compact)
Rehabilitation Objective	Control runoff, dissipate energy and prevent erosion
Latitude (DºM'S")	24°22'36.19"S
Longitude (DºM'S")	27°50'58.80"E
Engineering Drawings	A42D-01-248-00

Figure 13: Intervention site A42D-01-248-00

4.7.6.1 Bill of quantities: A42D-01-248-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth structure	m³	25	R 626	R 15 650
Re-vegetate	m³	130	R 23	R 2 990
			Total	**R 18 640**

4.7.6.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.7 Intervention: A42D-01-249-00

Designer	Cilliers Blaauw
Design Date	16/01/2014
Intervention Description	Earth structure (berm)
Rehabilitation Objective	Control runoff, dissipate energy and prevent erosion
Latitude (DºM'S")	24°22'35.69"S
Longitude (DºM'S")	27°50'57.99"E
Engineering Drawings	A42D-01-249-00

Figure 14: Intervention site A42D-01-249-00

4.7.7.1 Bill of quantities: A42D-01-249-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth structure	m³	67	R 626	R 41 942
Re-vegetate	m³	245	R 23	R 5 635
			Total	**R 47 577**

4.7.7.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.8 Intervention: A42D-01-250-00

Designer	Cilliers Blaauw
Design Date	16/01/2014
Intervention Description	Earth structure (berm)
Rehabilitation Objective	Control runoff, dissipate energy and prevent erosion
Latitude (DºM'S")	24°22'33.60"S
Longitude (DºM'S")	27°50'52.79"E
Engineering Drawings	A42D-01-250-00

Figure 15: Intervention site A42D-01-250-00

4.7.8.1 Bill of quantities: A42D-01-250-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth structure	m³	30	R 626	R 18 780
Earth works (fill)	m³	30	R 317	R 9 510
Re-vegetate	m³	174.75	R 23	R 4 019
			Total	**R 32 309**

4.7.8.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.9 Intervention: A42D-01-251-00

Designer	Cilliers Blaauw
Design Date	16/01/2014
Intervention Description	Earth works (removal of berm)
Rehabilitation Objective	Control runoff, dissipate energy and prevent erosion
Latitude (DºM'S")	24°22'33.30"S
Longitude (DºM'S")	27°50'52.90"E
Engineering Drawings	A42D-01-251-00

Figure 16: Intervention site A42D-01-251-00

4.7.9.1 Bill of quantities: A42D-01-251-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	27	R 317	R 8 559
Re-vegetate	m³	480	R 23	R 11 040
			Total	**R 19 599**

4.7.9.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.10 Intervention: A42D-01-252-00

Designer	Cilliers Blaauw
Design Date	15/01/2014
Intervention Description	Earth structures (berms)
Rehabilitation Objective	Control runoff, dissipate energy and prevent erosion while promoting sediment trapping.
Latitude (DºM'S")	24°22'25.50"S
Longitude (DºM'S")	27°50'38.50"E
Engineering Drawings	A42D-01-252-00

Figure 17: Intervention site A42D-01-252-00

4.7.10.1 Bill of quantities: A42D-01-252-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth structure	m^3	124	R 626	R 77 624
Re-vegetate	m^3	370	R 23	R 8 510
			Total	**R 86 134**

4.7.10.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.7.11 Intervention: A42D-01-253-00

Designer	Cilliers Blaauw
Design Date	15/01/2014
Intervention Description	Earth structure
Rehabilitation Objective	Control runoff, dissipate energy and prevent erosion
Latitude (DºM'S")	24°22'19.99"S
Longitude (DºM'S")	27°50'14.89"E
Engineering Drawings	A42D-01-253-00

Figure 18: Intervention site A42D-01-253-00

4.7.11.1 Bill of quantities: A42D-01-253-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth structure	m³	26	R 626	R 16 276
Re-vegetate	m³	160	R 23	R 3 680
			Total	**R 19 956**

4.7.11.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cyprus tufts can be used for re-vegetation purposes.

4.8 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**.

4.9 Wetland management recommendations

The system is currently utilised for nature conservation and will continue as such. The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system but will also have a number of positive impacts on the supply of goods and services provided by the wetland.

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 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.

4.10.2 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**):

HGM Unit	Area (Ha)	Extent (%)	Overall impact score for HGM	Area weighted HGM score*	Present Hydrological State category
Unchannelled valley bottom	27	29	5.0	1.5	
Channelled valley bottom	65	71	1.0	0.7	
Total		**100**	**Overall weighted impact score**	**2.2**	**C**

5 WELGEVONDEN: Oli-gat – A42D-02

5.1 Wetland details

The assessment of the Oli-gat wetland A42D-02, 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.

Similar to the Pitse wetland (A42D-01, see Chapter 4), the Oli-gat wetland falls within quaternary catchments A42D (**Table 9**), and is located in the Welgevonden Nature Reserve. The wetland is a valley-bottom wetland with a channel and contains unchannelled and hillslope seepage sections. The habitat is comprised of permanent, seasonal and temporary zones associated with deep sandy soils and shallow organic layers in places. Various springs occur in its headwaters. It is located in a very narrow valley, with a very steep slope and is erosion prone.

Table 12: Summary of the wetland details

Wetland Name	Welgevonden: Oli-gat
Wetland Number	A42D-02
River System Name	A tributary of the Sterkstroom, a tributary of the Mokolo River
Land Use in Catchment	Conservation
Land Use in Wetland	Conservation
No. of Properties Intersecting Wetland Area	June 2010 and October 2013
Date of Wetland Assessment	June 2010 and October 2013
Wetland Assessor(s)	Piet-Louis Grundling
Wetland size	6.6 ha

5.2 Site photos

Figure 19: Photos of some of the severely impacted sections of the Oli-gat wetland system (courtesy of Piet-Louis Grundling)

5.3 Wetland problems

The main impacts to this wetland unit are the result of historically incorrect land use practises that contributed to increased water run off which in turn resulted in gulley erosion. While the catchment of the Oli-gat wetland is largely intact with only minor impacts to catchment hydrology, erosion has caused notable changes to the three components (see **Section 5.9.2**) of wetland health assessed. This has resulted in a wetland that can be currently described as being in a "D" Category or largely modified. The status quo will deteriorate under current management practices but rehabilitation will have a positive change on all factors.

5.4 Rehabilitation objectives

The main object of the planned interventions is to mitigate the impacts of historic incorrect landuse practises. More specifically, the rehabilitation interventions aim to prevent erosion by reducing flow concentration. This will re-instate more natural water distribution and retention patterns that will improve the hydrological functioning of the wetland and the condition of the associated wetland vegetation. Raising the water table is another objective and improving the retention of peak flows, thus allowing these tributaries of the Mokolo River to be recharged throughout the dry season. An overall objective is to improve local biodiversity and to recover the provision of natural resources such as grazing, during the winter months.

The proposed interventions will address the wetland problems and achieve the rehabilitation objectives as follows:

- The base level of the channel will be raised, thus allowing water to escape the channel more frequently. This will be achieved by making use of weirs in the channel itself, and

- Erosion will be managed / controlled by making use of weirs, berms and a number of Rock packs.

5.5 Summary proposed interventions

There are currently no interventions in the Oli-gat wetland, as previous work was confined to the Pitse wetland in the Welgevonden area (see Chapter 4).

Table 13 provides a summary of the interventions that are discussed in detail in the subsequent sections of this report. 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.

Table 13: Summary of proposed new interventions, A42D-02

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
A42D-02-201-00	Rock pack/ fill	14	2	R 39 729
A42D-02-202-00	Rock pack/ fill	15	2	R 81 931
A42D-02-203-00	Rock pack/ fill	9	2	R 92 073
A42D-02-204-00	Stone masonry well and rock packing	8	1	R 257 287
A42D-02-205-00	Rock pack/ fill	10	2	R 57 441
A42D-02-206-00	Rock pack/ fill	7	2	R 104 141
A42D-02-207-00	Rock pack/ fill	11	2	R 30 276
A42D-02-208-00	Rock pack (berm)/ fill	6	2	R 53 730
A42D-02-209-00	Rock pack (berm)	5	2	R 36 862
A42D-02-210-00	Rock pack (berm)	4	2	R 45 306
A42D-02-211-00	Rock pack (berm)	3	2	R 43 156
A42D-02-212-00	Rock pack/ fill	2	2	R 204 666
A42D-02-213-00	Rock pack/ fill	12	2	R 67 280
A42D-02-214-00	Rock pack (berm)	1	2	R 47 314
Total				**R 1 161 192**

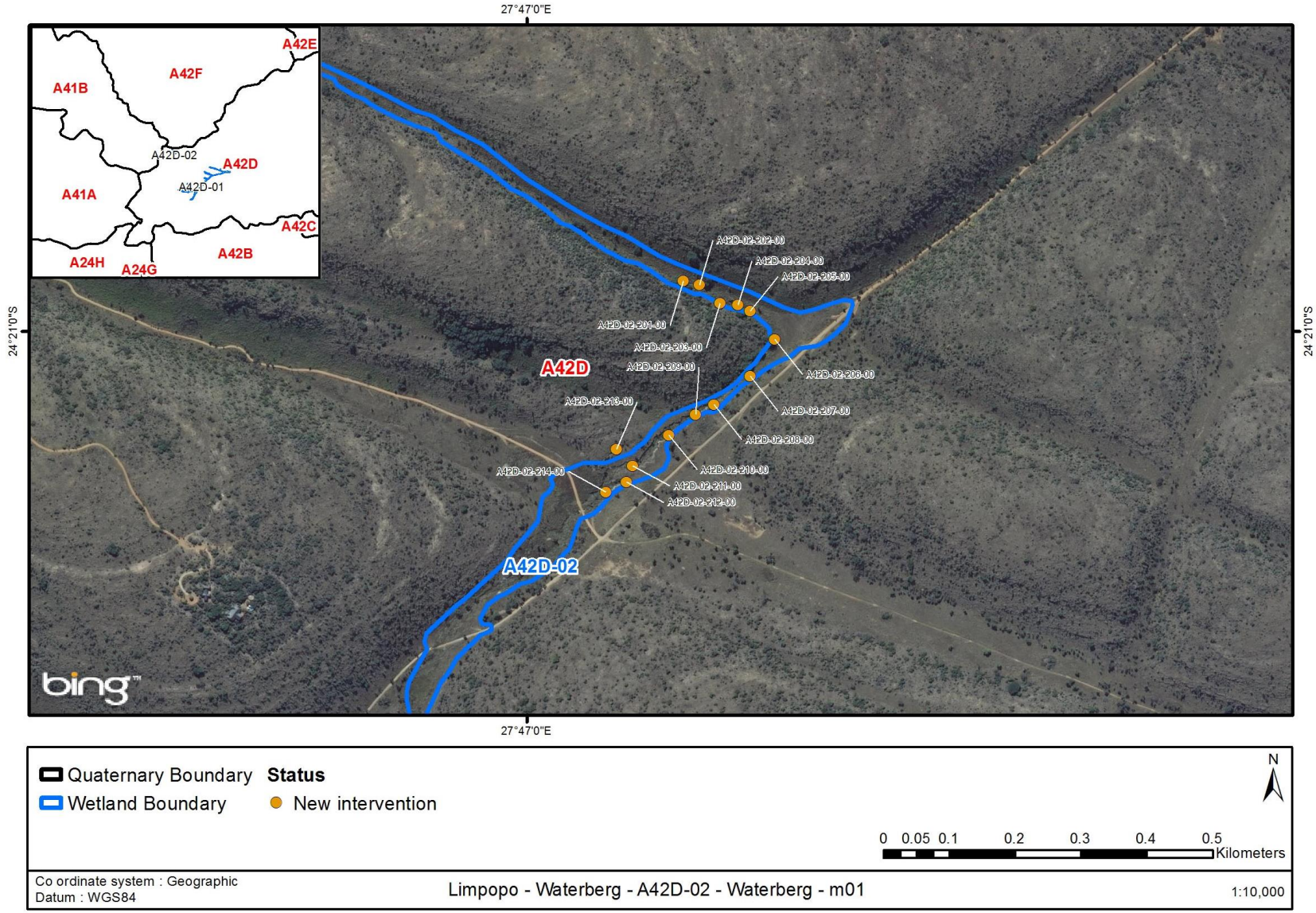


Figure 20: Wetland map, A42D-02 with proposed new wetland interventions indicated.

5.6 Design selection and sizing

Designs were influenced by required objective, type of material available on site, aesthetic concerns of reserve management as well as labour content costing in relation to the required material cost. The sizing was influenced by the area of impact/ donga width and the footprint of the design to have as little impact as possible without compromising the functionality thereof.

5.7 Intervention designs

5.7.1 Intervention: A42D-02-201-00

Designer	Cilliers Blaauw
Design Date	21/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	To arrest erosion and prevent further degradation of area and sediment loss though surface protection and to promote re-vegetation
Latitude (DºM'S")	27°47'07.70"S
Longitude (DºM'S")	24°20'57.50"E
Engineering Drawings	A42D-02-201-00

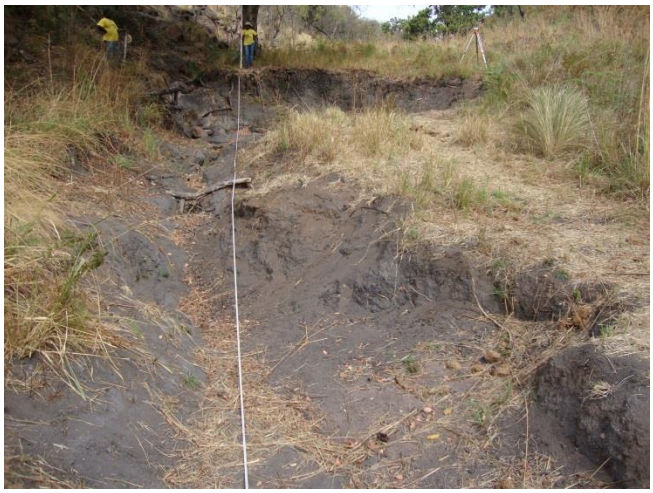


Figure 21: Intervention site A42D-02-201-00

5.7.1.1 Bill of quantities: A42D-02-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m^3	35	R 841	R 29 435
Stone masonry	m^3	2	R 4 830	R 9 660
Earth works	m^3	2	R 317	R 634
			Total	**R 39 729**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.2 Intervention: A42D-02-202-00

Designer	Cilliers Blaauw
Design Date	22/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	To arrest erosion and prevent further degradation of area and sediment loss though surface protection and to promote re-vegetation
Latitude (DºM'S")	27°47'08.50"S
Longitude (DºM'S")	24°20'57.70"E
Engineering Drawings	A42D-02-202-00

Figure 22: Intervention site A42D-02-202-00

5.7.2.1 Bill of quantities: A42D-02-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m^3	76	R 841	R 63 916
Stone masonry	m^3	3.50	R 4 830	R 16 905
Earth works	m^3	3.50	R 317	R 1 109
			Total	**R 81 930**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.3 Intervention: A42D-02-203-00

Designer	Cilliers Blaauw
Design Date	22/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	To arrest erosion and prevent further degradation of area and sediment loss though surface protection and to promote re-vegetation
Latitude (DºM'S")	27°47'09.50"S
Longitude (DºM'S")	24°20'58.60"E
Engineering Drawings	A42D-02-203-00

Figure 23: Intervention site A42D-02-203-00

5.7.3.1 Bill of quantities: A42D-02-203-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m³	85	R 841	R 71 485
Stone masonry	m³	4	R 4 830	R 19 320
Earth works	m³	4	R 317	R 1 268
			Total	**R 92 073**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.4 Intervention: A42D-02-204-00

Designer	Cilliers Blaauw
Design Date	22/01/2014
Intervention Description	Stone masonry well and rock packing
Rehabilitation Objective	Prevent headcut from advancing upstream and prevent further erosion in area by lining a drinking well for elephants.
Latitude (DºM'S")	27°47'10.40"S
Longitude (DºM'S")	24°20'58.70"E
Engineering Drawings	A42D-02-204-00

Figure 24: Intervention site A42D-02-204-00

5.7.4.1 Bill of quantities: A42D-02-204-00

Item	Units	Quantity	Unit Cost	Item Cost
Stone masonry	m³	38	R 4 830	R 183 540
Gabions	m³	7.50	R 4 190	R 31 425
Rock pack/ fill	m³	36	R 841	R 30 276
Earth works	m³	38	R 317	R 12 046
			Total	**R 257 287**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.5 Intervention: A42D-02-205-00

Designer	Cilliers Blaauw
Design Date	22/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	To arrest erosion and prevent further degradation of area and sediment loss though surface protection and to promote re-vegetation
Latitude (DºM'S")	27°47'11.00"S
Longitude (DºM'S")	24°20'59.00"E
Engineering Drawings	A42D-02-205-00

Figure 25: Intervention site A42D-02-205-00

5.7.5.1 Bill of quantities: A42D-02-205-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m³	53	R 841	R 44 573
Stone masonry	m³	2.50	R 4 830	R 12 075
Earth works	m³	2.50	R 317	R 792
			Total	**R 57 440**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.6 Intervention: A42D-02-206-00

Designer	Cilliers Blaauw
Design Date	23/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	To arrest erosion and prevent further degradation of area and sediment loss though surface protection and to promote re-vegetation
Latitude (DºM'S")	27°47'12.20"S
Longitude (DºM'S")	24°21'00.40"E
Engineering Drawings	A42D-02-206-00

Figure 26: Intervention site A42D-02-206-00

5.7.6.1 Bill of quantities: A42D-02-206-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m^3	107	R 841	R 89 987
Stone masonry	m^3	2.75	R 4 830	R 13 283
Earth works	m^3	2.75	R 317	R 872
			Total	**R 104 142**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.7 Intervention: A42D-02-207-00

Designer	Cilliers Blaauw
Design Date	23/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	To arrest erosion and prevent further degradation of area and sediment loss though surface protection and to promote re-vegetation
Latitude (DºM'S")	27°47'11.00"S
Longitude (DºM'S")	24°21'02.20"E
Engineering Drawings	A42D-02-207-00

Figure 27: Intervention site A42D-02-207-00

5.7.7.1 Bill of quantities: A42D-02-207-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m³	36	R 841	R 30 276
			Total	**R 30 276**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.8 Intervention: A42D-02-208-00

Designer	Cilliers Blaauw
Design Date	23/01/2014
Intervention Description	Rock pack (berm)
Rehabilitation Objective	Improved retention of sediment during peak flows that will also allow the system to be recharged during the dry season
Latitude (DºM'S")	27°47'09.20"S
Longitude (DºM'S")	24°21'03.60"E
Engineering Drawings	A42D-02-208-00

Figure 28: Intervention site A42D-02-208-00

5.7.8.1 Bill of quantities: A42D-02-208-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack (berm)	m^3	15.21	R 870	R 13 233
Rock pack/ fill	m^3	17.50	R 841	R 14 718
Gabions	m^3	5.40	R 4 190	R 22 626
Earth works	m^3	9.95	R 317	R 3 154
			Total	**R 53 731**

5.7.8.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.9 Intervention: A42D-02-209-00

Designer	Cilliers Blaauw
Design Date	23/01/2014
Intervention Description	Rock pack (berm)
Rehabilitation Objective	Improved retention of peak flows that will allow the river to be recharged during the dry season
Latitude (DºM'S")	27°47'08.30"S
Longitude (DºM'S")	24°21'04.10"E
Engineering Drawings	A42D-02-209-00

Figure 29: Intervention site A42D-02-209-00

5.7.9.1 Bill of quantities: A42D-02-209-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack (berm)	m^3	14.37	R 870	R 12 498
Gabions	m^3	5.10	R 4 190	R 21 369
Earth works	m^3	9.45	R 317	R 2 996
			Total	**R 36 863**

5.7.9.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.10 Intervention: A42D-02-210-00

Designer	Cilliers Blaauw
Design Date	23/01/2014
Intervention Description	Rock pack (berm)
Rehabilitation Objective	Improved retention of sediment during peak flows while also allowing the system to be recharged through the dry season
Latitude (DºM'S")	27°47'07.00"S
Longitude (DºM'S")	24°21'05.10"E
Engineering Drawings	A42D-02-210-00

Figure 30: Intervention site A42D-02-210-00

5.7.10.1 Bill of quantities: A42D-02-210-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack (berm)	m^3	17.75	R 870	R 15 438
Gabions	m^3	6.30	R 4 190	R 26 397
Earth works	m^3	10.95	R 317	R 3 471
			Total	**R 45 306**

5.7.10.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.11 Intervention: A42D-02-211-00

Designer	Cilliers Blaauw
Design Date	23/01/2014
Intervention Description	Rock pack (berm)
Rehabilitation Objective	Improved retention of sediment during peak flows that will also allow the system to be recharged during the dry season
Latitude (DºM'S")	27°47'05.20"S
Longitude (DºM'S")	24°21'06.60"E
Engineering Drawings	A42D-02-211-00

Figure 31: Intervention site A42D-02-211-00

5.7.11.1 Bill of quantities: A42D-02-211-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack (berm)	m^3	16.90	R 870	R 14 703
Gabions	m^3	6	R 4 190	R 25 140
Earth works	m^3	10.45	R 317	R 3 313
			Total	**R 43 156**

5.7.11.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.12 Intervention: A42D-02-212-00

Designer	Cilliers Blaauw
Design Date	24/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	Stabilise donga erosion to prevent sediment loss with surface protection while promoting re-vegetation
Latitude (DºM'S")	27°47'04.90"S
Longitude (DºM'S")	24°21'07.40"E
Engineering Drawings	A42D-02-212-00

Figure 32: Intervention site A42D-02-212-00

5.7.12.1 Bill of quantities: A42D-02-212-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m^3	225	R 841	R 189 225
Stone masonry	m^3	3	R 4 830	R 14 490
Earth works	m^3	3	R 317	R 951
			Total	**R 204 666**

5.7.12.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.13 Intervention: A42D-02-213-00

Designer	Cilliers Blaauw
Design Date	28/01/2014
Intervention Description	Rock pack/ fill
Rehabilitation Objective	Stabilise donga erosion to prevent sediment loss with surface protection while promoting re-vegetation.
Latitude (DºM'S")	27°47'04.40"S
Longitude (DºM'S")	24°21'05.80"E
Engineering Drawings	A42D-02-213-00

Figure 33: Intervention site A42D-02-213-00

5.7.13.1 Bill of quantities: A42D-02-213-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack/ fill	m^3	80	R 841	R 67 280
			Total	**R 67 280**

5.7.13.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

Please note the existing electrical cable traversing across the intervention that should be encased (sleeved) for ease of future maintenance. The reserve management is to be consulted in this regard.

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.14 Intervention: A42D-02-214-00

Designer	Cilliers Blaauw
Design Date	28/01/2014
Intervention Description	Rock pack (berm)
Rehabilitation Objective	Improved retention of sediment during peak flows that will also allow the system to be recharged during the dry season
Latitude (DºM'S")	27°47'03.90"S
Longitude (DºM'S")	24°21'07.90"E
Engineering Drawings	A42D-02-214-00

Figure 34: Intervention site A42D-02-214-00

5.7.14.1 Bill of quantities: A42D-02-214-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock pack (berm)	m^3	18.59	R 870	R 16 173
Gabions	m^3	6.60	R 4 190	R 27 654
Earth works	m^3	4.40	R 317	R 1 395
			Total	**R 45 222**

5.7.14.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.8 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**.

5.9 Wetland management recommendations

The system is currently utilised for nature conservation and will continue as such. The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system but will also have a number of positive impacts on the supply of goods and services provided by the wetland.

5.9.1 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.

5.9.2 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
A42D-02	6.6	6.5	1	4	1	4.4	1
PES Categories		**D**	**E**	↑	**D**	↑	**D**
Wetland Impact Score		**4.89**					
Wetland PES		**D**					

6 WELGEVONDEN: Kobus-se-Pad – A42D-03

6.1 Wetland details

The assessment of the Kobus-se-Pad wetland (A42D-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.

Kobus-se-Pad wetland (**Table 9**) is also located in the Welgevonden Nature Reserve. The wetland is a channelled valley bottom wetland with an unchannelled section. The wetland is comprised of permanent, seasonal and temporary zones and is located in a steep valley. The catchment consists of a mountainous plateau and steep valleys covered in mixed broad-leafed woodland savanna of the Waterberg Mountain Bushveld. The catchment is fairly steep with shallow soils and various roads in the catchment converge at the wetland, some crossing it.

Table 14: Summary of the wetland details

Wetland Name	Welgevonden: Kobus se Pad
Wetland Number	A42D-01
River System Name	A tributary of the Sterkstroom, a tributary of the Mokolo River
Land Use in Catchment	Conservation
Land Use in Wetland	Conservation
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	June 2010 and October 2013
Wetland Assessor(s)	Piet-Louis Grundling
Wetland size	**3.6 ha**

6.2 Site photos

Branching head cuts occur in the upper part of the wetland next to an access road

An incised but well vegetated gully in the lower part of the wetland

Figure 35: Site photos of the Kobus-se-Pad wetland

6.3 Wetland problems

The main impacts to this wetland unit are the result of historic incorrect land use practises that have contributed to the increase of water run off which in turn have caused gulley erosion. Presently three main drainage lines feed into the system.

6.4 Rehabilitation objectives

The main aim of rehabilitation is to mitigate the impacts of incorrect landuse practises in the past. More specifically, rehabilitation aims to prevent erosion by reducing flow concentration. Another aim is to re-instate more natural water distribution and retention patterns in order to improve the hydrological functioning of the wetland and the condition of the associated wetland vegetation. Rehabilitation will also aim to raise the water table and improve the retention of peak flows, thus allowing the river to be recharged throughout the dry season. An overall objective is to improve local biodiversity and to improve the provision of natural resources such as grazing, during the winter months.

The proposed interventions will address the wetland problems and achieve the rehabilitation objectives as follows:

- By raising the base level of the channel, thus allowing water to escape the channel more frequently by constructing weirs in it; and
- By controlling erosion levels through the constructing weirs.

6.5 Summary proposed interventions

There are currently no interventions in the Kobus-se-Pad wetland, as previous work was confined to the Pitse wetland in the Welgevonden area.

Table 15 provides a summary of the new interventions that are discussed in detail in the subsequent sections of this report. 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.

Table 15: Summary of proposed new interventions, A42D-03

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
A42D-03-201-00	Stone masonry and gabion drop-inlet weir	1	1	R 541 115
A42D-03-202-00	Stone masonry and gabion drop-inlet weir	2	2	R 669 504
Total				**R 1 210 619**

6.6 Design selection and sizing

Designs were influenced by required objective, accessibility to deliver material on site, aesthetic concerns of reserve management as well as labour content costing in relation to the required material cost. The sizing was influenced by the stream width and the footprint of the design to have as little impact as possible without compromising on the functionality thereof.

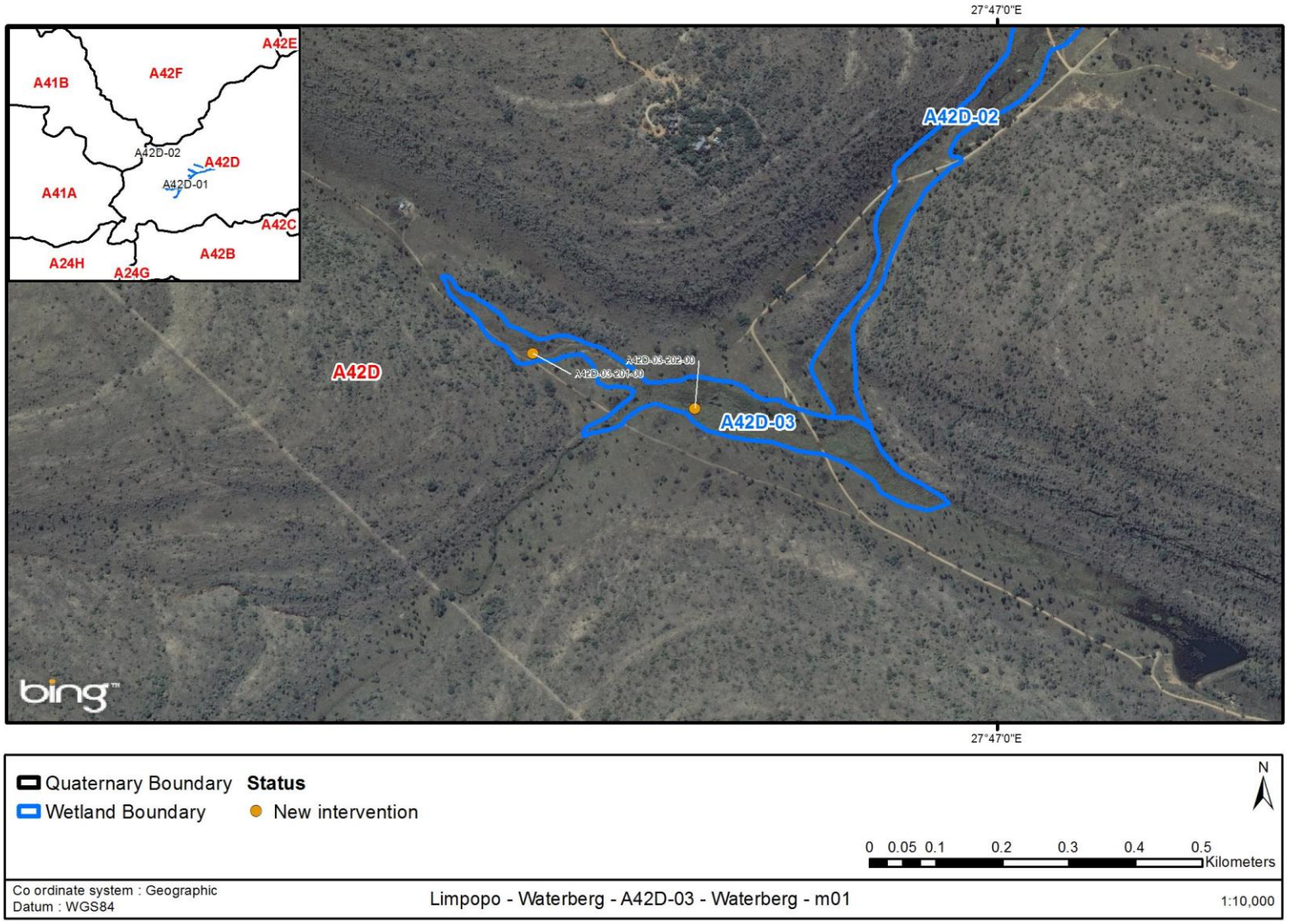


Figure 36: Wetland map, A42D-03 with proposed new wetland interventions indicated.

6.7 Intervention designs

6.7.1 Intervention: A42D-03-201-00

Designer	Cilliers Blaauw
Design Date	21/11/2013
Intervention Description	Stone masonry and gabion drop-inlet weir
Rehabilitation Objective	• Prevent erosion by reducing flow concentration • Re-instate more natural water distribution and retention patterns to improve the hydrological functioning by raising the water table • Improve retention of peak flows and sediment trapping
Latitude (DºM'S")	27°46'37.40"S
Longitude (DºM'S")	24°21'24.00"E
Engineering Drawings	A42D-03-201-00

Figure 37: Intervention site A42D-03-201-00

6.7.1.1 Bill of quantities: A42D-03-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Stone masonry	m^3	103	R 4,830	R 497 490
Gabions	m^3	10	R 4,190	R 41 900
Re-vegetate	m^3	75	R 23	R 1 725
			Total	**R 541 115**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

6.7.2 Intervention: A42D-03-202-00

Designer	Cilliers Blaauw
Design Date	21/11/2013
Intervention Description	Stone masonry and gabion drop-inlet weir
Rehabilitation Objective	• Prevent erosion by reducing flow concentration • Re-instate more natural water distribution and retention patterns to improve the hydrological functioning by raising the water table • Improve retention of peak flows and sediment trapping.
Latitude (DºM'S")	27°46'45.30"S
Longitude (DºM'S")	24°21'26.70"E
Engineering Drawings	A42D-03-202-00

Figure 38: Intervention site A42D-03-202-00

6.7.2.1 Bill of quantities: A42D-03-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Stone masonry	m^3	130	R 4 830	R 627 900
Gabions	m^3	9.60	R 4 190	R 40 224
Re-vegetate	m^3	60	R 23	R 1 380
			Total	**R 669 504**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

6.8 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**.

6.9 Wetland management recommendations

The system is currently utilised for nature conservation and will continue as such. The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system but will also have a number of positive impacts on the supply of goods and services provided by the wetland.

6.9.1 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.

6.9.2 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
A42D-03	3.6	5.0	1	1.6	1	2.2	-1.0
PES Categories		**D**	C	↑	C	↑	C
Wetland Impact Score		**2.57**					
Wetland PES		**C**					

7 UPPER NYL– A61B-02

7.1 Wetland details

The Upper Nyl wetland is located in the quaternary catchment A61B near the town of Mookgophong in the Limpopo Province (refer to **Figure 4** in Section 3 of this report). The assessment of the Nylsvley 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 Upper Nyl is a section of the Nylsvley wetland (**Table 18**). The Nylsvley is a floodplain wetland which occupies approximately 1 600 ha of the Nylsvley Nature Reserve. The wetland forms part of the Nyl River Floodplain and is one of the largest wetland systems in South Africa. The system occurs within the Waterberg mountains and forms part of the Larger Limpopo River Catchment. This is a site of international importance as it has been declared a Ramsar site. Until recently the wetland was utilised for commercial cattle grazing. Fences in the surrounds of the wetland are currently being removed and the land use will change to conservation, which will result in lower grazing pressure on the vegetation.

The Upper Nyl wetland (A61B-02) has been selected for rehabilitation based on its size and position in the landscape. As the wetlands form part of the Nyl Floodplain and are connected to the Nylsvley Nature Reserve Ramsar site it is of international biodiversity and of eco-tourism value. In 2009 the WfWetlands Programme identified work in the wetland A61B-01 and in order to improve wetland health further by securing the integrity of the greater system, wetland A61B-02 has been selected for rehabilitation in the 2014/2015 planning cycle.

Table 16: Summary of the wetland details

Wetland Name	Nylsvley
Wetland Number	A61B-02
River System Name	Nyl River
Land Use in Catchment	Grazing
Land Use in Wetland	Grazing
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	2008, August 2010 and June 2012
Wetland Assessor(s)	Doug McCulloch (2008) and Piet-Louis Grundling (2010 – 2013)
Wetland size	2081 ha

7.2 Site photos

An aerial view of the dyke in the Upper Nyl. The diversion/impeding effect is clear

Figure 39: Site photos of the Nylsvley wetland

7.3 Wetland problems

The wetland has been subjected to a number of impacts associated with the modification of the system's hydrology, which was likely to have been initiated to allow grazing and cultivation within the valley bottom. The confinement of flow within drainage channels and the straightening of the channel in the lower reaches of the wetland have resulted in the incision of the natural channel. This in turn has further impacted the system's hydrology through the desiccation of the adjacent wetland habitat and the encroachment of terrestrial species. The establishment of various berms have also interrupted the natural flow regime.

7.4 Rehabilitation objectives

The primary objective of the proposed intervention is to improve the hydrological integrity of the wetland.

The following rehabilitation objectives were identified:

- To re-instate more natural water distribution and retention patterns in order to improve the hydrological functioning of the wetland and associated condition of wetland vegetation.
- Improved retention of peak flows, allowing the river to be recharged through the dry season;
- Improved local biodiversity.

7.5 Summary proposed interventions

Table 19 provides a summary of the intervention that has been discussed in detail in the subsequent sections of this report. 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.

Table 17: Summary of proposed new interventions, A61B-02

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
A61B-02-201-00	Earth works (removal of berm)	1	1	R 2 950 894
			Total	**R 2 950 894**

The following future intervention points were also identified and will be investigated during the next planning cycle, i.e. 2015/2016:

7.6 Design selection and sizing

Design was mainly influenced by the objective to reinstate natural surface water flow while the sizing was based on the existing berm to be removed.

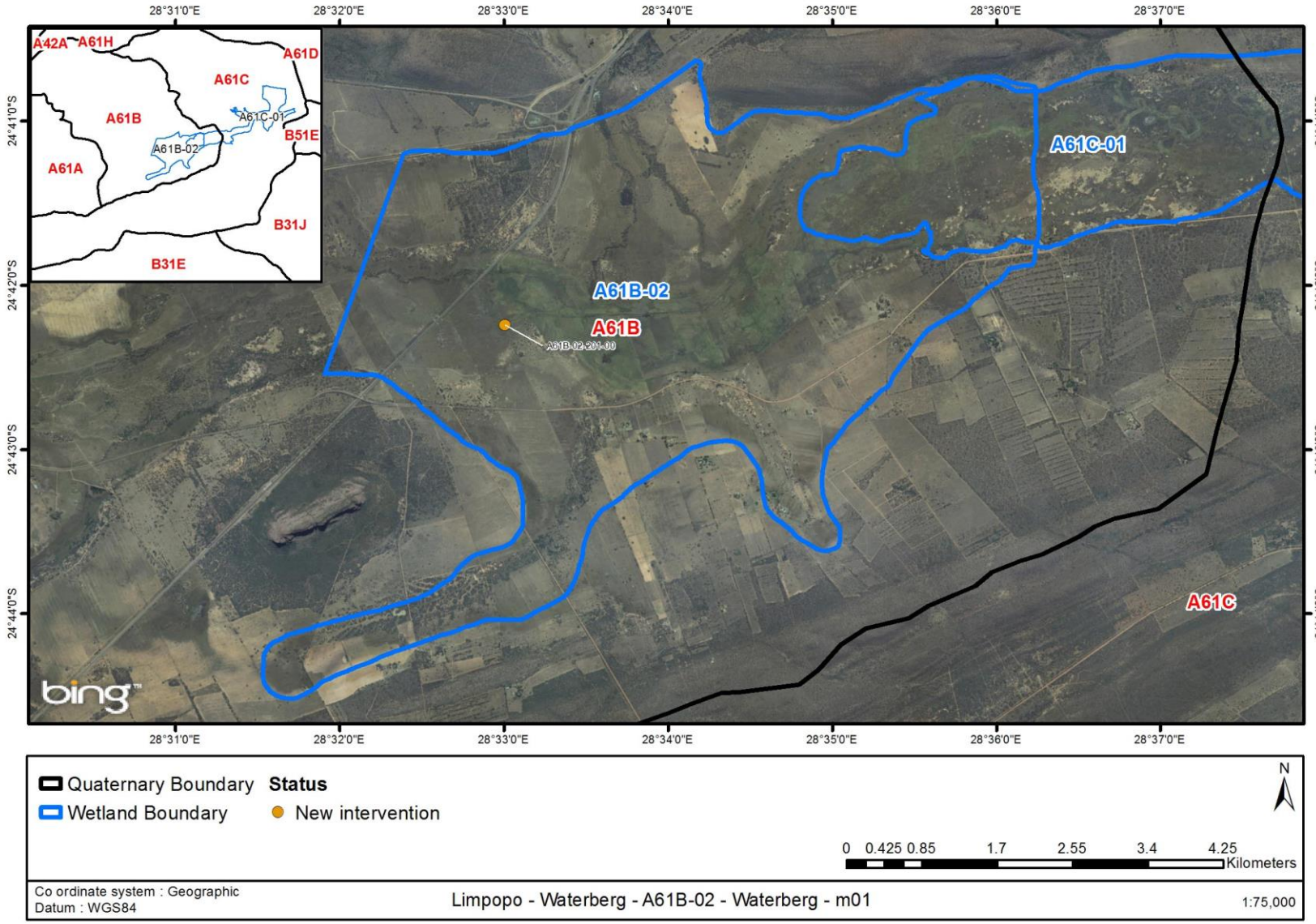


Figure 40: Wetland map, A61B-02 with proposed new wetland interventions indicated.

7.7 Intervention designs

7.7.1 Intervention: A61B-02-201-00

Designer	Cilliers Blaauw
Design Date	14/12/2013
Intervention Description	Earth works (removal of berm)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°42'14.39"S
Longitude (DºM'S")	28°33'00.39"E
Engineering Drawings	A61B-02-201-00

Figure 41: Intervention site A61B-02-201-00

7.7.1.1 Bill of quantities: A61B-02-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works (removal of berm) CH0 to CH50	m³	146	R 317	R 46 282
Cut vegetation	m³	500	R 15	R 7 500
Re-vegetate	m³	470	R 23	R 10 810

Item	Units	Quantity	Unit Cost	Item Cost
Earth works (removal of berm) CH50 to CH100	m³	90	R 317	R 28 530
Cut vegetation	m³	830	R 15	R 12 450
Re-vegetate	m³	375	R 23	R 8 625
Earth works (removal of berm) CH100 to CH183	m³	125	R 317	R 39 625
Cut vegetation	m³	1 125	R 15	R 16 875
Re-vegetate	m³	605	R 23	R 13 915
Earth works (removal of berm) CH193 to CH286	m³	270	R 317	R 85 590
Cut vegetation	m³	930	R 15	R 13 950
Re-vegetate	m³	745	R 23	R 17 135
Cut vegetation for remainder of berm (10m wide)	m³	30 140	R 15	R 452 100
Earth works (removal of remainder of berm)	m³	6 932.20	R 317	R 2 197 507
			Total	**R 2 950 894**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The cutting of vegetation should be conducted prior to the conventional annual pegging and sing-off scheduled in the area of the site. This is required to enable the engineer to survey the planned section of the berm and confirming the volume that needs to be removed. Actions should be co-ordinated with the Project Co-ordinator and the engineer.

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

7.8 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**.

7.9 Wetland management recommendations

The system is currently utilised for nature conservation and will continue as such. The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system but will also have a number of positive impacts on the supply of goods and services provided by the wetland.

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 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.

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
A61B-02	2081	4	1.5	3	2	7	3
PES Categories		**D**	↑	**C**	↑	**E**	↑
Wetland PES		**D**					

8 NYLSVLEY - A61C-01

8.1 Wetland details

The Boekenhout wetland is located in the quaternary catchment A61C near Mookgophong in the Limpopo Province (refer to **Figure 5** in Section 3 of this report). The assessment of the Boekenhout 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.

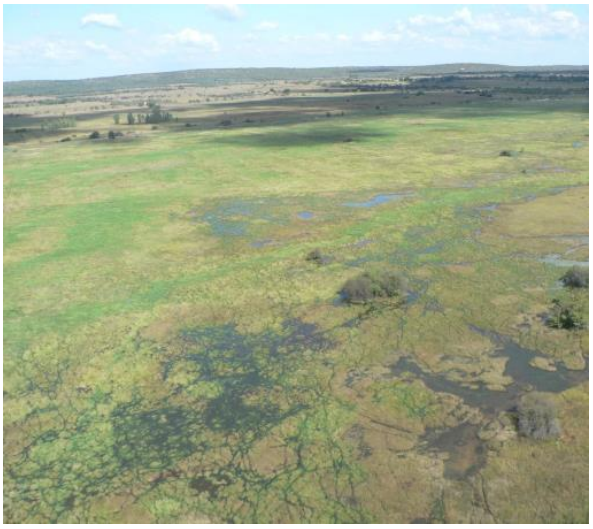
Work was previously carried out on the Boekenhout Wetland (**Table 18**) by Working for Water, and this was mainly concerned with reinforcing the sides of a non-perennial river that feeds the wetland. The focus of this year's planning is mainly on this river as it discharges substantial volumes of sediment into the wetland. The property forms part of the Nylsvley Nature Reserve, a Ramsar site. The Boekenhout wetland (A61C-01) has been selected for rehabilitation as it is connected to the Nylsvley Nature Reserve Ramsar site which is of international biodiversity and eco-tourism value The wetland is of significant importance from the perspective of flood attenuation, streamflow regulation, and water quality and biodiversity maintenance.

Table 18: Summary of the wetland details

Wetland Name	Nylsvley
Wetland Number	A61C-01
River System Name	Nyl River
Land Use in Catchment	Agriculture (grazing and cultivation); game farming; urban development
Land Use in Wetland	Landuse within the wetland is conservation and game farming; previously commercial livestock farming
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	December 2007; 2008, August 2010 and June 2012
Wetland Assessor(s)	Doug McCulloch (2007 and 2008) and Piet-Louis Grundling (2010 – 2013)
Wetland size	256 ha

8.2 Site photos

A typical drain in the Boekenhout wetland section of the Nyl Floodplain



The Nyl Floodplain

Figure 42: Site photos of the Nylsvley: Boekenhout wetland

8.3 Wetland problems

A major dyke of 3.5 km runs parallel to the thalweg (the lowest point of the drainage line) of the system, immediately south of the N1 and diverts water inflows from a south facing alluvial fan. The work in the Nylsvlei will focus on a system of drains starting at the inflow of the floodplain into the reserve. This diversion of water out of the system has disrupted the natural flow of the wetland.

8.4 Rehabilitation objectives

The primary objective of the proposed interventions is to improve the hydrological integrity of the wetland by deactivating the impacts of the drainage network and the incised channel.

The following rehabilitation objectives were identified:

- Prevent erosion by reducing flow concentration;
- Re-instate more natural water distribution and retention patterns to improve the hydrological functioning of the wetland and associated wetland vegetation;
- Raise the water table;
- Substantial improvement of the wetland's flood attenuation potential;
- Improve retention of peak flows, allowing the river to be recharged during the dry season;
- Improve local biodiversity; and
- Improve the availability of natural resources, such as grazing, during the winter months.

The proposed interventions will address the wetland problems and achieve the rehabilitation objectives by:

- Raising the base level of the channel, thereby allowing the water to escape the channel more frequently;
- Reducing the streamflow concentration; and
- Blocking drains to restore more natural water distribution and retention patterns.

8.5 Summary proposed interventions

Table 19 provides a summary of the interventions that are discussed in detail in the subsequent sections of this report. 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.

Table 19: Summary of proposed new interventions, A61B-02

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
A61C-01-204-00	Earth works	1	1	R 125 015
A61C-01-208-00	Earth works	2	1	R 8 118
A61C-01-209-00	Earth works	3	1	R 8 118
A61C-01-210-00	Earth works	4	1	R 8 118
A61C-01-211-00	Earth works	5	1	R 8 118
A61C-01-212-00	Earth works	6	1	R 8 118
A61C-01-213-00	Earth works	7	1	R 8 118
A61C-01-214-00	Earth works	8	1	R 8 118
A61C-01-215-00	Earth works	9	1	R 8 118
A61C-01-216-00	Earth works	10	1	R 8 118
A61C-01-217-00	Earth works	11	1	R 8 118
A61C-01-218-00	Earth works	12	1	R 8 118
A61C-01-219-00	Earth works	13	1	R 8 118

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
A61C-01-220-00	Earth works	14	1	R 8 118
A61C-01-221-00	Earth works	15	1	R 6 738
A61C-01-222-00	Earth works	16	1	R 6 104
A61C-01-223-00	Earth works	17	1	R 6 104
A61C-01-224-00	Earth works	18	1	R 6 104
A61C-01-225-00	Earth works	19	1	R 6 104
			Total	**R 261 703**

The following future intervention points were also identified and will be investigated during the next planning cycle, i.e. 2015/2016:

Table 20: Future intervention points

Intervention Number	Structure Type	Latitude	Longitude
A61C-01-201-00	New walkway to Stemmer bird hide	24°39'33.40"S	28°41'11.20"E
A61C-01-202-00	Bird hide	24°37'9.10"S	28°41'27.90"E
A61C-01-203-01	Bird hide	24°36'53.60"S	28°41'30.80"E
A61C-01-205-01	Steel walkway to Jacana bird hide	24°38'39.51"S	28°41'48.99"E
A61C-01-206-00	New walkway to Crage bird hide	24°37'9.10"S	28°41'27.91"E
A61C-01-207-01	Repair walkway to Kingfisher bird hide	24°36'53.64"S	28°41'30.77"E

8.6 Design selection and sizing

Design was mainly influenced by the objective to reinstate natural surface water flow while the sizing was based on the existing channel dimensions.

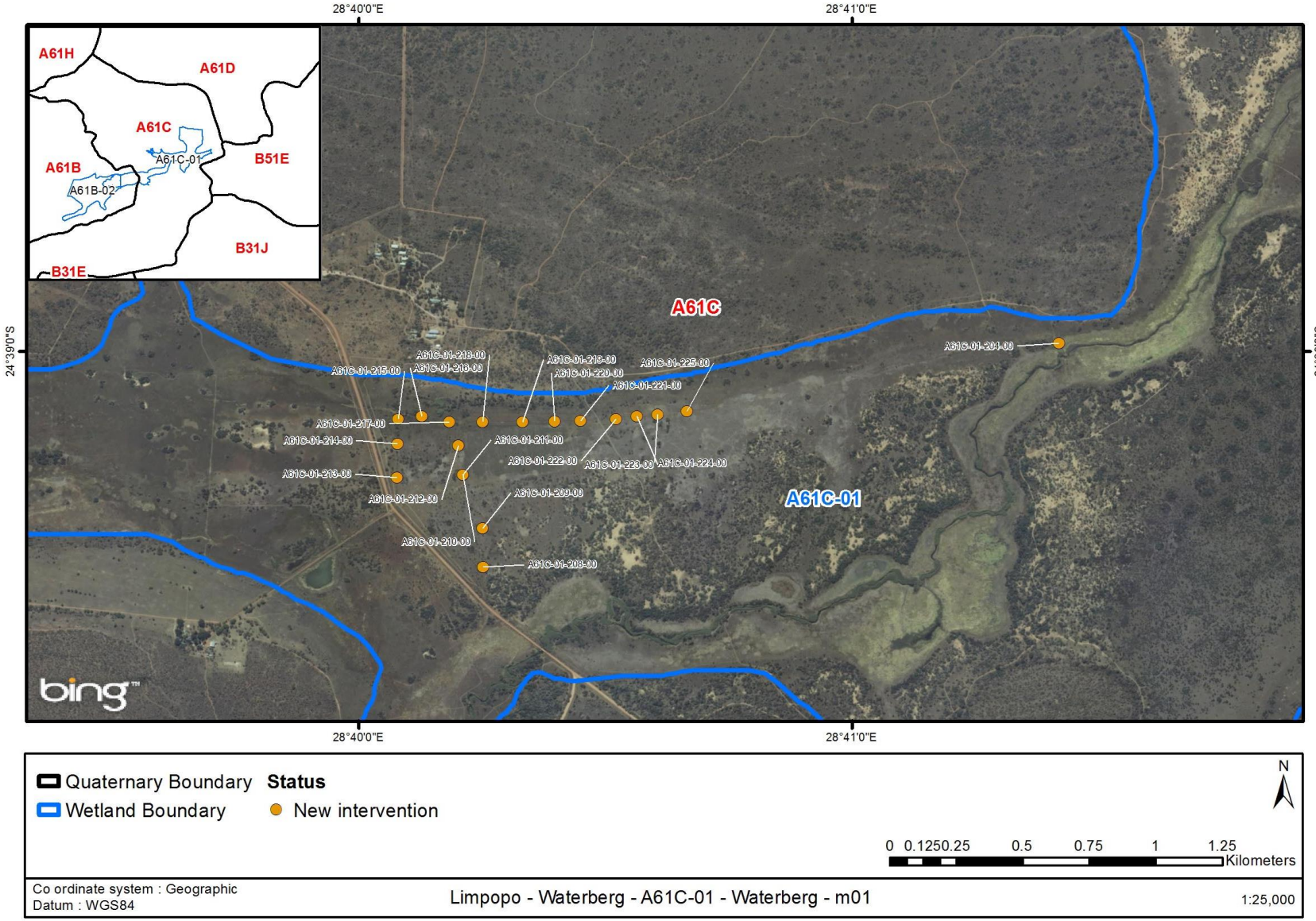


Figure 43: Wetland map A61C-01 with proposed new wetland interventions indicated

8.7 Intervention designs

8.7.1 Intervention: A61C-01-204-00

Designer	Cilliers Blaauw
Design Date	14/12/2014
Intervention Description	Earth works (removal of dam wall)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°38'58.99"S
Longitude (DºM'S")	28°41'25.24"E
Engineering Drawings	A61C-01-204-00

Figure 44: Intervention site A61C-01-204-00

8.7.1.1 Bill of quantities: A61C-01-204-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	320	R 317	R 101 440
Re-vegetate	m^3	1025	R 23	R 23 575
			Total	**R 125 015**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.2 Intervention: A61C-01-208-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'26.24"S
Longitude (DºM'S")	28°40'15.12"E
Engineering Drawings	A61C-01-208-00

Figure 45: Example of channel for intervention A61C-01-208-00

8.7.2.1 Bill of quantities: A61C-01-208-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	160	R 23	R 3 680
			Total	**R 8 118**

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.

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.3 Intervention: A61C-01-209-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'21.51"S
Longitude (DºM'S")	28°40'15.08"E
Engineering Drawings	A61C-01-209-00

8.7.3.1 Bill of quantities: A61C-01-209-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	160	R 23	R 3 680
			Total	**R 8 118**

8.7.3.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.4 Intervention: A61C-01-210-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'15.03"S
Longitude (DºM'S")	28°40'12.64"E
Engineering Drawings	A61B-02-210-00

8.7.4.1 Bill of quantities: A61B-02-210-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	160	R 23	R 3 680
			Total	**R 8 118**

8.7.4.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.5 Intervention: A61C-01-211-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'15.03"S
Longitude (DºM'S")	28°40'12.64"E
Engineering Drawings	A61C-01-211-00

8.7.5.1 Bill of quantities: A61C-01-211-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	14	R 317	R 4 438
Re-vegetate	m³	160	R 23	R 3 680
			Total	**R 8 118**

8.7.5.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.6 Intervention: A61C-01-212-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'11.45"S
Longitude (DºM'S")	28°40'12.15"E
Engineering Drawings	A61C-01-212-00

8.7.6.1 Bill of quantities: A61C-01-212-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	14	R 317	R 4 438
Re-vegetate	m³	160	R 23	R 3 680
			Total	**R 8 118**

8.7.6.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.7 Intervention: A61C-01-213-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'15.33"S
Longitude (DºM'S")	28°40'04.62"E
Engineering Drawings	A61C-01-213-00

8.7.7.1 Bill of quantities: A61C-01-213-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	14	R 317	R 4 438
Re-vegetate	m³	160	R 23	R 3 680
			Total	**R 8 118**

8.7.7.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.8 Intervention: A61C-01-214-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'11.26"S
Longitude (DºM'S")	28°40'04.71"E
Engineering Drawings	A61C-01-214-00

8.7.8.1 Bill of quantities: A61C-01-214-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	160	R 23	R 3 680
			Total	**R 8 118**

8.7.8.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.9 Intervention: A61C-01-215-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'08.24"S
Longitude (DºM'S")	28°40'04.75"E
Engineering Drawings	A61C-01-215-00

8.7.9.1 Bill of quantities: A61C-01-215-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	14	R 317	R 4 438
Re-vegetate	m³	160	R 23	R 3 680
			Total	**R 8 118**

8.7.9.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.10 Intervention: A61C-01-216-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns.
Latitude (DºM'S")	24°39'07.87"S
Longitude (DºM'S")	28°40'07.69"E
Engineering Drawings	A61C-01-216-00

8.7.10.1 Bill of quantities: A61C-01-216-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	160	R 23	R 3 680
			Total	**R 8 118**

8.7.10.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.11 Intervention: A61C-01-217-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'08.53"S
Longitude (DºM'S")	28°40'11.03"E
Engineering Drawings	A61C-01-217-00

8.7.11.1 Bill of quantities: A61C-01-217-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	160	R 23	R 3 680
			Total	**R 8 118**

8.7.11.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.12 Intervention: A61C-01-218-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'08.58"S
Longitude (DºM'S")	28°40'15.09"E
Engineering Drawings	A61C-01-218-00

8.7.12.1 Bill of quantities: A61C-01-218-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m³	14	R 317	R 4 438
Re-vegetate	m³	160	R 23	R 3 680
			Total	**R 8 118**

8.7.12.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.13 Intervention: A61C-01-219-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'08.54"S
Longitude (DºM'S")	28°40'19.91"E
Engineering Drawings	A61C-01-219-00

8.7.13.1 Bill of quantities: A61C-01-219-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	160	R 23	R 3 680
			Total	**R 8 118**

8.7.13.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.14 Intervention: A61C-01-220-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'08.48"S
Longitude (DºM'S")	28°40'23.84"E
Engineering Drawings	A61C-01-220-00

8.7.14.1 Bill of quantities: A61C-01-220-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	160	R 23	R 3 680
			Total	**R 8 118**

8.7.14.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.15 Intervention: A61C-01-221-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'08.40"S
Longitude (DºM'S")	28°40'27.00"E
Engineering Drawings	A61C-01-221-00

8.7.15.1 Bill of quantities: A61C-01-221-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	14	R 317	R 4 438
Re-vegetate	m^3	100	R 23	R 2 300
			Total	**R 6 738**

8.7.15.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.16 Intervention: A61C-01-222-00

Designer	Cilliers Blaauw
Design Date	13/12/2013
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'08.19"S
Longitude (DºM'S")	28°40'31.32"E
Engineering Drawings	A61C-01-222-00

Figure 46: Site of channel for intervention A61C-01-222-00

8.7.16.1 Bill of quantities: A61C-01-222-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	12	R 317	R 3 804
Re-vegetate	m^3	100	R 23	R 2 300
			Total	**R 6 104**

8.7.16.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.17 Intervention: A61C-01-223-00

Designer	Cilliers Blaauw
Design Date	13/12/2014
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'07.90"S
Longitude (DºM'S")	28°40'33.83"E
Engineering Drawings	A61C-01-223-00

8.7.17.1 Bill of quantities: A61C-01-223-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	12	R 317	R 3 804
Re-vegetate	m^3	100	R 23	R 2 300
			Total	**R 6 104**

8.7.17.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.18 Intervention: A61C-01-224-00

Designer	Cilliers Blaauw
Design Date	13/12/2014
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'07.65"S
Longitude (DºM'S")	28°40'36.42"E
Engineering Drawings	7.5.19 A61C-01-224-00

8.7.18.1 Bill of quantities: A61C-01-224-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	12	R 317	R 3 804
Re-vegetate	m^3	100	R 23	R 2 300
			Total	**R 6 104**

8.7.18.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.7.19 Intervention: A61C-01-225-00

Designer	Cilliers Blaauw
Design Date	13/12/2014
Intervention Description	Earth works (cut and fill)
Rehabilitation Objective	Re-instate more natural water distribution and retention patterns
Latitude (DºM'S")	24°39'07.25"S
Longitude (DºM'S")	28°40'39.94"E
Engineering Drawings	A61C-01-225-00

8.7.19.1 Bill of quantities: A61C-01-225-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth works	m^3	12	R 317	R 3 804
Re-vegetate	m^3	100	R 23	R 2 300
			Total	**R 6 104**

8.7.19.2 Construction Notes

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

During construction best management practices for especially deep excavation should be adhered to, in order to stabilise probable unstable soil conditions. Please refer to *"National guidelines and methods for wetland rehabilitation" part of the Wetland Management Series (WRC Report TT341/09, March 2009).*

The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

As this is generally a wet area *Phragmites spp.* and Cypress tufts can be used for re-vegetation purposes.

8.8 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**.

8.9 Wetland management recommendations

The system is currently utilised for nature conservation and will continue as such. The proposed rehabilitation interventions will not only affect the ecological integrity of the broader wetland system but will also have a number of positive impacts on the supply of goods and services provided by the wetland.

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 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.

8.10.2 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
A61C-01	2081	4	1.5	3	2	7	3
PES Categories		**D**	↑	**C**	↑	**E**	↑
Wetland PES		**D**					