

REHABILITATION PLAN FOR THE WORKING FOR WETLANDS PROGRAMME, LIMPOPO

PROJECT: KRUGER NATIONAL PARK

B90E, X24B, X24E, X31M, X40D

APRIL 2014



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Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA



EXPANDED PUBLIC WORKS PROGRAMME
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**REHABILITATION PLAN FOR THE KRUGER NATIONAL PARK WETLAND PROJECT,
LIMPOPO: PLANNING YEAR 2014**

**AS PART OF
THE WORKING FOR WETLANDS PROGRAMME
FOR THE
SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE**

April 2014

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PROJECT DETAILS

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WORKING FOR WETLANDS: CONTEXT DOCUMENT

1. Introduction

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

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

2. Wetlands and their importance

Once considered valueless wastelands that needed to be drained or converted to more useful land use 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 WfWetland Programme has created more than 12 800 jobs and 2.2 million person-days of paid work. The local teams are made up of a minimum of 60% women, 20% youth and 1% disabled persons.

Training and Capacity Building during the Working for Wetlands Programme

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

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

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

Wage information sourced from the best practice guidelines suggests that workers and contractors would be paid daily rates of R 82 and R 251² 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).

²without 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.

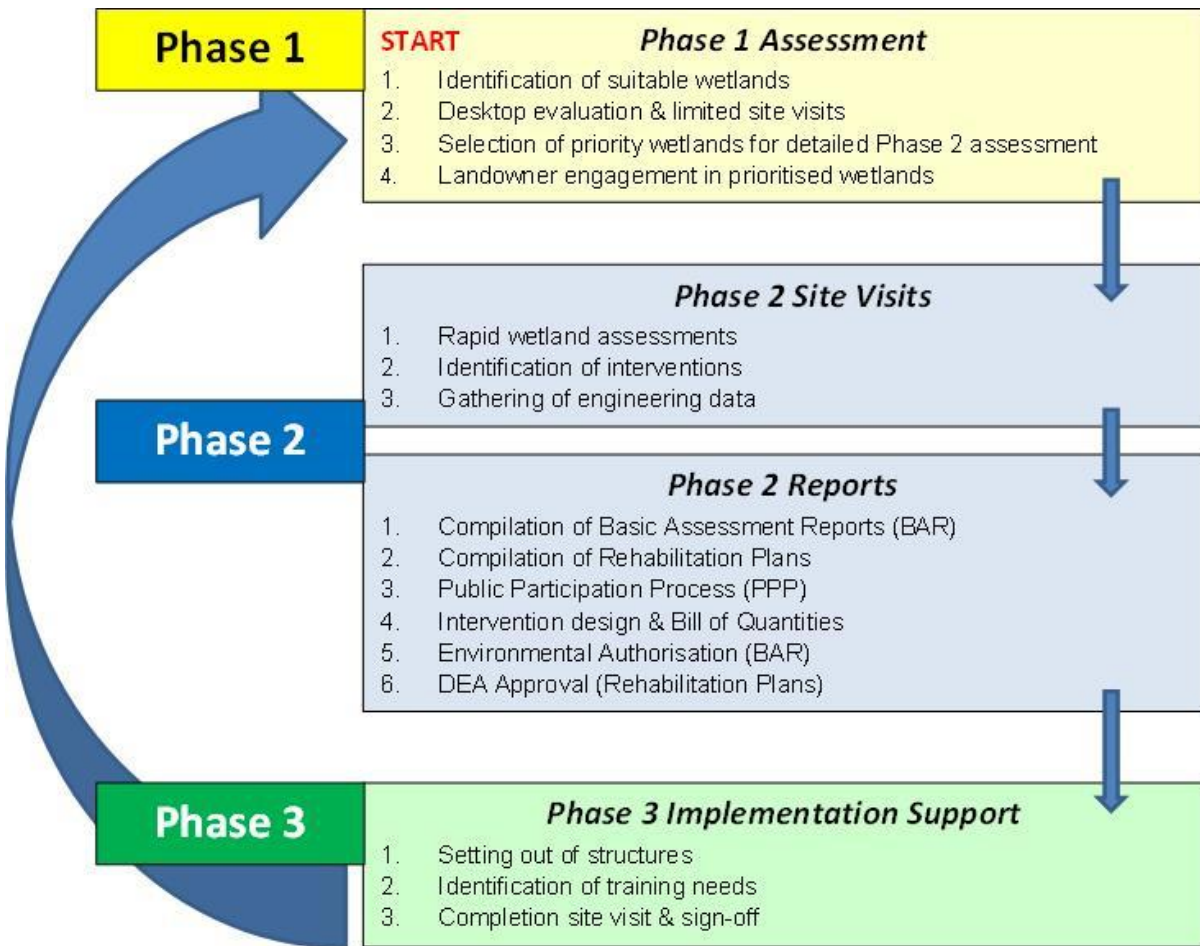


Plate C: The Working for Wetlands planning process (Phase 1 to Phase 3).

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 status quo assessment undertaken by the wetland ecologist.

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

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

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

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

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

Phase 3 requires that certain Environmental Authorisations are obtained before work can commence in the wetlands (please see subsequent sections of this document for detail on Environmental Authorisations). Upon approval of the wetland Rehabilitation Plans by DEA, DWA, and the directly affected landowners is obtained, the work detailed for the project will be implemented within a year with on-going monitoring being undertaken thereafter. The Rehabilitation Plans are considered to be the primary working document for the implementation of the project via the construction/ undertaking of interventions³ 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
<ul style="list-style-type: none"> • 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 (DEDP, March 2013). • DEA&DP. 2013. Guideline on Alternatives (DEA&DP, March 2013). 	Department of Environmental Affairs	2006 - 2013
International Conventions, in particular: <ul style="list-style-type: none"> • 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 authorisation⁴ (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 rehabilitating⁷ 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.

⁴Government Notice No. 1198, 18 December 2009

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

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

⁷Defined 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.

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iii. ABBREVIATIONS

BID	Background Information Document
BMP	Best Management Practise
CCA	Copper Chrome Arsenate
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
IA	Implementing Agent
I&APs	Interested and Affected Parties
IDP	Integrated Development Plans
M&E	Monitoring and Evaluation
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act
NWA	National Water Act
NWI	National Wetlands Inventory
OHSA	Occupational Health and Safety Act
PC	Provincial Coordinator
PIP	Project Implementation Plan
PPP	Public Participation Process
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SMME	Small, Medium and Micro Enterprises
WfWetlands	Working for Wetlands

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 WfWetland implementers.

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

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

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

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 WfWet rehabilitation interventions.

Intervention: An engineered structure such as a concrete or gabion weir, earth works or re-vegetation 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 (m³/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 of 1998) **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).

iv. 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 status quo 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.

v. 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 1 Report – October 2013; and
2. Other Phase 2 Planning Reports which include the:
 - a. Basic Assessment Report (2014),
 - b. KNP (KNP) Rehabilitation Plan (February 2011), and the
 - c. Wetland Status Quo Report (**Appendix A** of this report).

vi. **DISCLAIMER**

- This Rehabilitation Plan is for the KNP Wetland Project in the Limpopo Province. The plan is to be used to implement the interventions identified as necessary to rehabilitate the KNP 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 Coordinators (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.

vii. 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 on 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; and

- 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. In some cases landowners and users may assist the project team.

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

<i>Project Name</i>	<i>Wetland Number</i>	<i>Wetland System</i>
Mutale Project	A91G-01	Lwama-Tshedzi
	A91H-01	Lambwe
	A92A-01	Lake Fundudzi
	A92B-13	Upper Sambandou
	A92B-15; A92B-16; A92B-17; A92B-18	Tshamushoka
KNP Project	B90E- 01	Langtoon Dam
	X24B-01; X24E-01	Stolsnek Seepage Zones ⁸
	X31M- 01	N'waswitshaka Seep Zone Areas
	X40D- 01	Silolweni Dam
Waterberg Project	A42D-01	Welgevonden: Pitse
	A42D-02	Welgevonden: Oli-gat
	A42D-03	Welgevonden: Kobus-se-Pad
	A61B-02	Upper Nyl
	A61C-01	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 KNP Wetland Project and is to be submitted to DEA for their approval as a condition of the EA.

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.

1.3.1 The KNP Wetland Project

This document comprises the Rehabilitation Plan for the KNP Wetland Project and includes the following wetland systems: Langtoon Dam (B90E-01), Stolsnek Seepage Zones (X24B-01 and X24E-01), N'waswitshaka Seep Zone areas (X31M-01) and the Silolweni Dam (X40D-01). The Rehabilitation Plan will be the primary working document for the project via the implementation (construction/ undertaking of) of interventions⁹ 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.

Reports on the current status of the wetland 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	B90E, X24B, X24E, X31M and X40D
Quaternary Catchment area (Ha)	B90E: 48 554.5 ha X24B: 34 354.4 ha X24E: 54 026.4 ha X31M: 72 842.2 ha X40D: 76 514.5 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

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

Available budget for new interventions	
Available budget for maintenance to existing interventions	R 2 500 000
Estimated cost of new interventions	<p>Total: R 6 199 860</p> <p>(Langtoon Dam: R 2 200 000)</p> <p>(Stolsnek: R 1 577 860)</p> <p>(N'waswitshaka: R 222 000)</p> <p>(Silolweni: R 2 200 000)</p>
Estimated cost of maintenance to existing interventions	R 219 298

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 Wetlands 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 KNP Wetland Project:

1. Langtoon Dam (B90E-01)
2. Stolsnek Seepage Zones (X24B-01; X24E-01)
3. N'waswitshaka Seep Zone Areas (X31M-01)
4. Silolweni Dam (X40D-01)

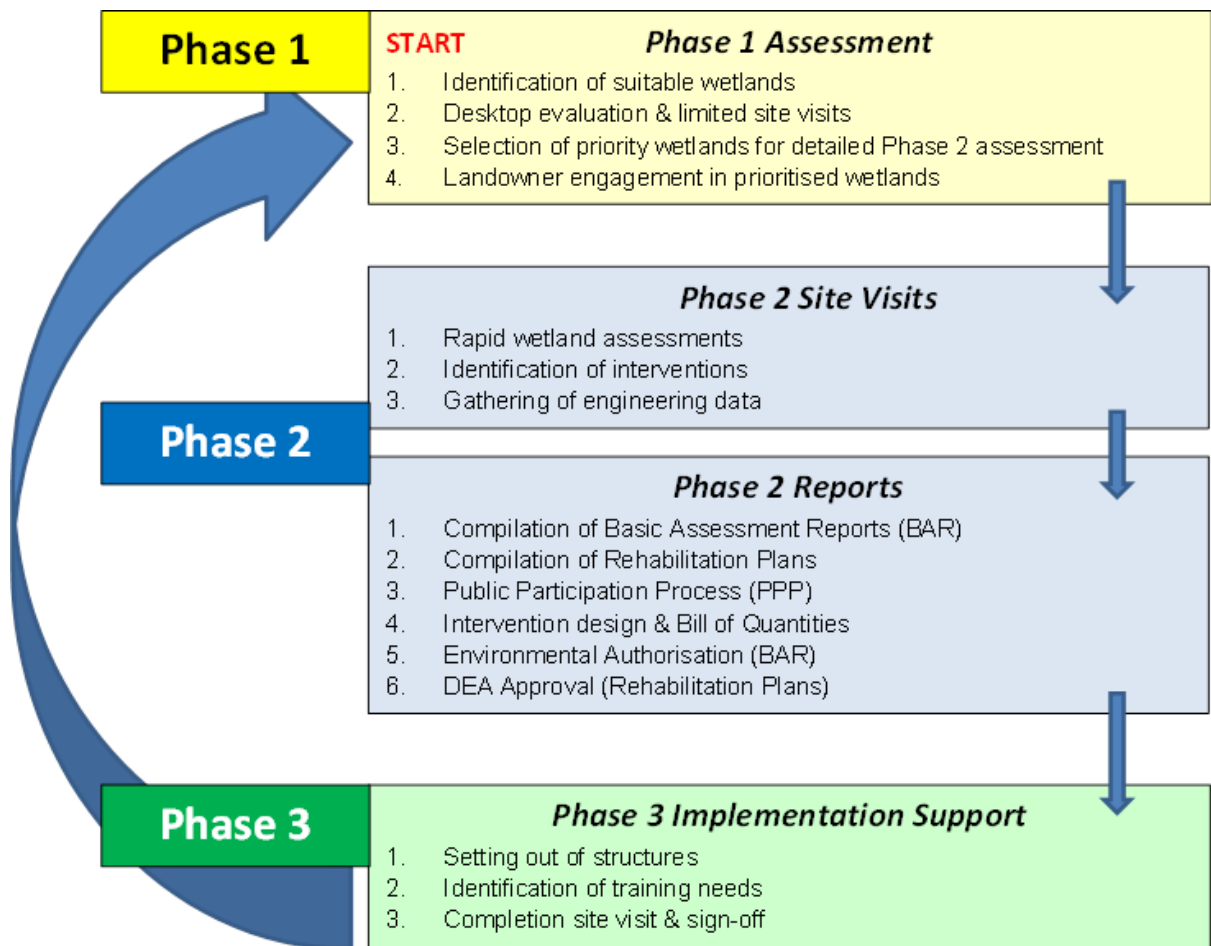


Figure 1: The three phases that must be undertaken for the successful rehabilitation of wetlands

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 KNP Wetland Project:

1. Langtoon Dam: (10 September 2013)
2. Silolweni Dam: (11 September 2013)
3. N'waswitshaka Seep Zone Areas (12 September 2013)
4. Stolsnek Seepage Zones (13 September 2013 and 9-11 January 2014)

The following team members attended the site visits:

- Collin Nemadodzi (PC);
- Franci Gresse (EAP);
- Jealous Mdaka (SANParks-Project Manager);
- Marius Snyders (SANParks);

- Piet-Louis Grundling (Wetlander); and
- Zebulon Hlungwani (SANParks: Implementer).

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 Status Quo Reports

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

a. Assess impacts and threats

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

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

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

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

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

An assessment of the predicted contribution that the identified rehabilitation interventions would make to improving wetland health and ecosystem delivery through addressing the identified impacts/threats was required. Without these assessments, a wetland rehabilitation programme is unlikely to have a well-informed basis on which to improve the rehabilitation's

“return on investment” (with return being measured in terms of wetland health and ecosystem services delivery). This is directly linked into the *WfWet* Monitoring and Evaluation Framework. The following steps were followed to assess the contribution of rehabilitation interventions within each wetland system:

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

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

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

Refer to **Appendix A** which contains the Wetland Status Quo 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 were similarly detailed and the anticipated costs calculated.

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

2.3.6 Development of the Rehabilitation Plan

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

Summaries of the wetland prioritisation, problems and rehabilitation objectives were documented in the KNP Rehabilitation Plan. Reports on the current status of the wetland, 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 KNP 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.

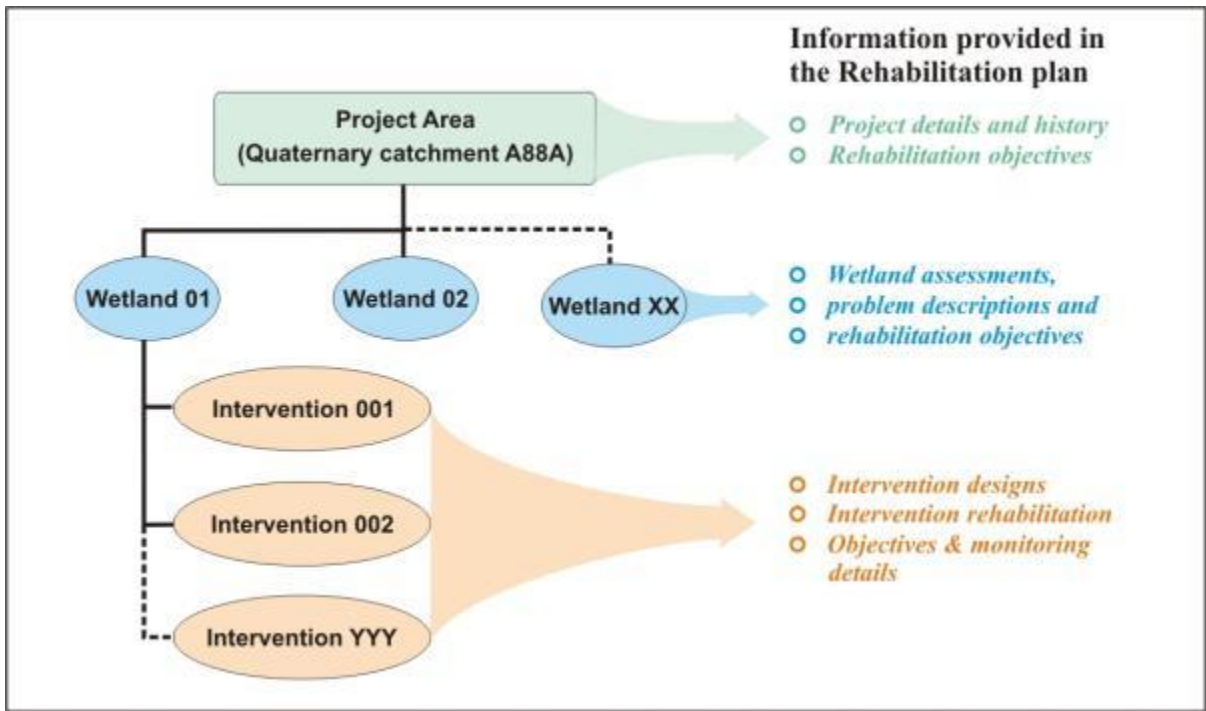


Figure 2: Hierarchy used in the Wetland Rehabilitation Plan

3 PROJECT DESCRIPTION

3.1 Project details

Background: The KNP Wetland Project was historically located in the B90E, X24B, X24E, X31M and X40D and quaternary catchments in the Limpopo Province and in the Mpumalanga Province (refer to **Figure 4** to **Figure 8** and to **Table 3**). Although four of the wetlands are located in Mpumalanga Province and not in Limpopo they have all been grouped in the KNP project and included in the Limpopo wetland rehabilitation project in order to simplify the process and the implementation of the Rehabilitation Plans¹⁰.

Table 3: Project details

Project Name	KNP
Region (Province)	Limpopo
Project Budget	R 1 633 725
Planning Category	Category 1
Nearest Town/s	Skukuza (Main camp KNP)
Partnerships	SANParks

The KNP is divided into four regions and 22 sections. Each region has a Regional Ranger responsible for between five to six sections. The average surface area of a section is between 80 000 to 100 000 ha and the management of these sections are overseen by Section Rangers and their staff.

Historically wetland rehabilitation focused on the removal of earthen dam walls, in keeping with the Park's official policy to remove specific artificial water points in the northern areas. Although the removal of these water points has been a priority for some time, it has been recognised that the impact of roads on seepage wetlands and on other wetland systems cannot be overlooked as it is equally important from a rehabilitation perspective. Structures, such as roads and dams, which have been built near or across wetlands, have caused erosion and changed flow rates within certain wetlands. Game-viewing roads built across wetlands have, for example, introduced eroding channels through the concentration of flow through culverts. In addition, erosion has been initiated upstream of dams in wetlands as a result of energy differentials due to the dam basin being excavated and stream flow concentration at dam outlets. Work was previously confined to the Nxanatseni Regions, but for this planning cycle, priority areas have also been identified in the Marula Regions (Figure 3).

¹⁰ Note that the relevant authorities in Mpumalanga have been notified as part of the process.

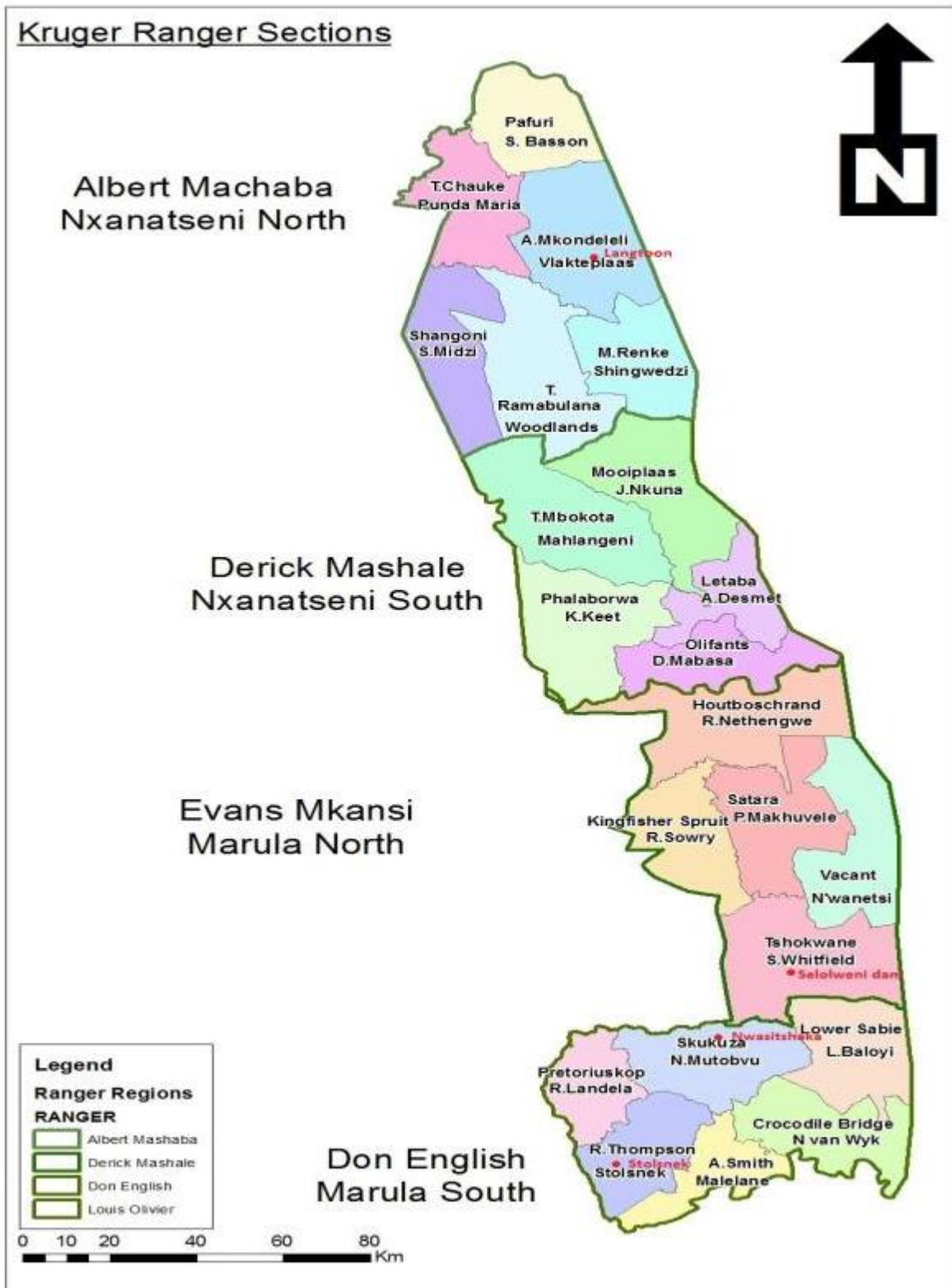


Figure 3: Map of KNP sections (Courtesy: Piet-Louis Grundling)

The KNP benefits from other Expanded Public Works Programmes (EPWP) such as the Working on Land projects. The mandate of this programme is to restore and rehabilitate the integrity inside the park. During the strategic planning phase it was decided that funds from

the Working on Land Programme would be channelled into the removal of the artificial water points. Thus, the WfWetlands project will allocate funds to the rehabilitation of wetlands impacted on by infrastructure in order to maximise the benefit to the Park. The KNP wetland project contributes largely towards the EPWP objective of maximising job opportunities through limited funding by providing jobs at a low person day cost. As the removal of earthen dams requires labour and only basic tools, and thus fulfils the objective of EPWP, this activity will still be included in the WfWetlands project but is classified as a Priority 2 intervention.

The project is located in five catchments within the Park; B90E, X24B, X24E, X31M and X40D. As all catchments are located within the KNP they are important in terms of biodiversity conservation and eco-tourism. Catchment B90E within which the Langtoonvlei is located, is situated in the Limpopo Transfronteir Park and is thus of international importance.

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

Table 4: Identified wetlands within the KNP Wetland Project

Wetland Number	Wetland Name	Latitude	Longitude
B90E-01	Langtoon Dam	22°52 '8.0"S	31°23'11.0"E
X24B-01; X24E-01	Stolsnek Seepage Zones	25°19'15.06"S	31°20'29.19"E
X31M-01	N'waswitshaka Seep Zone Areas	25° 1'42.76"S	31°32'51.06"E
X40D-01	Silolweni Dam	24°49'25.35"S	31°50'15.03"E

3.2 Landowner details

All land included in this project is located within the KNP and is owned by SANParks (Table 5). Consent for any proposed wetland rehabilitation (subject to the approval of the Final Rehabilitation Plans) was obtained from the appropriate representative of SANParks. A copy of the consent obtained is provided in **Appendix E**.

Table 5: List of Landowners and SG Key

Wetland Number	Property SG Key	Owner	Consent Obtained
B90E-01	T0MU00001111111100000	SANParks	Yes
X40D-01	T0KU00000000035500000 T0KU00000000036500000	SANParks	Yes
X31M-01	T0JU00000000014200000	SANParks	Yes
X24E-01; X24B-01	No SG codes available for these areas	SANParks	Yes

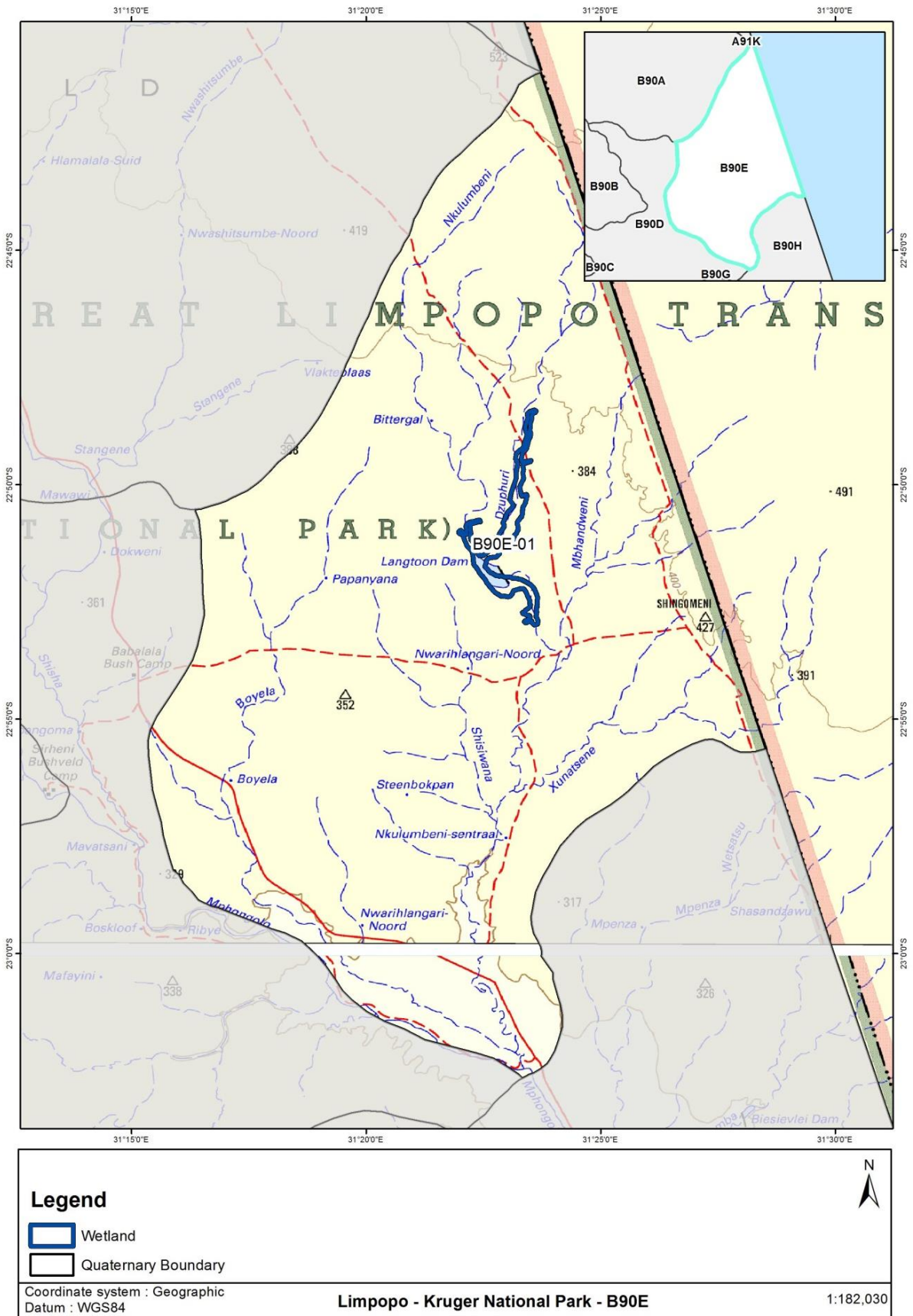


Figure 4: Topographic map showing quaternary catchment's locality, cadastral boundaries and access routes

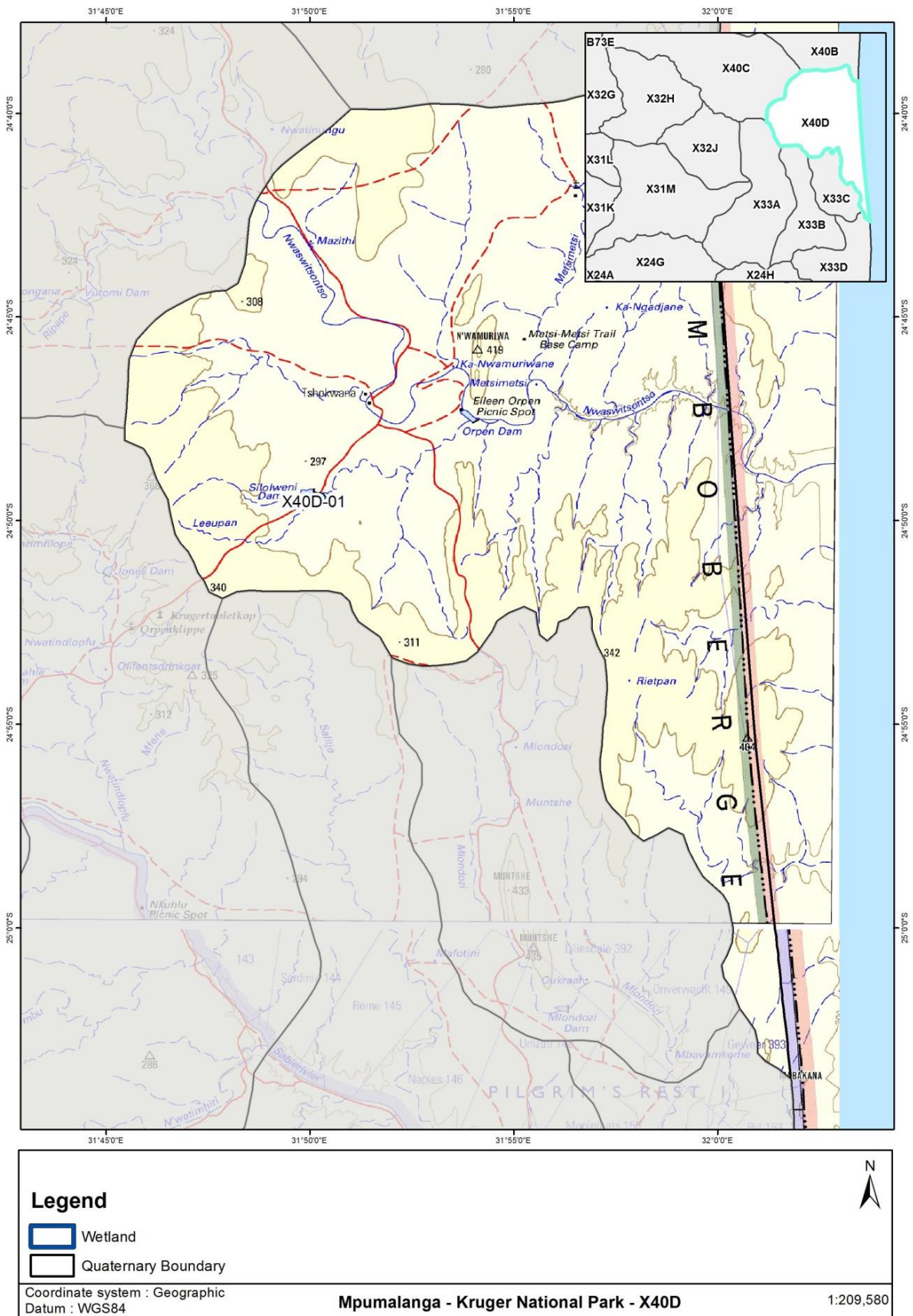


Figure 5: Topographic map showing quaternary catchment's locality, cadastral boundaries and access routes

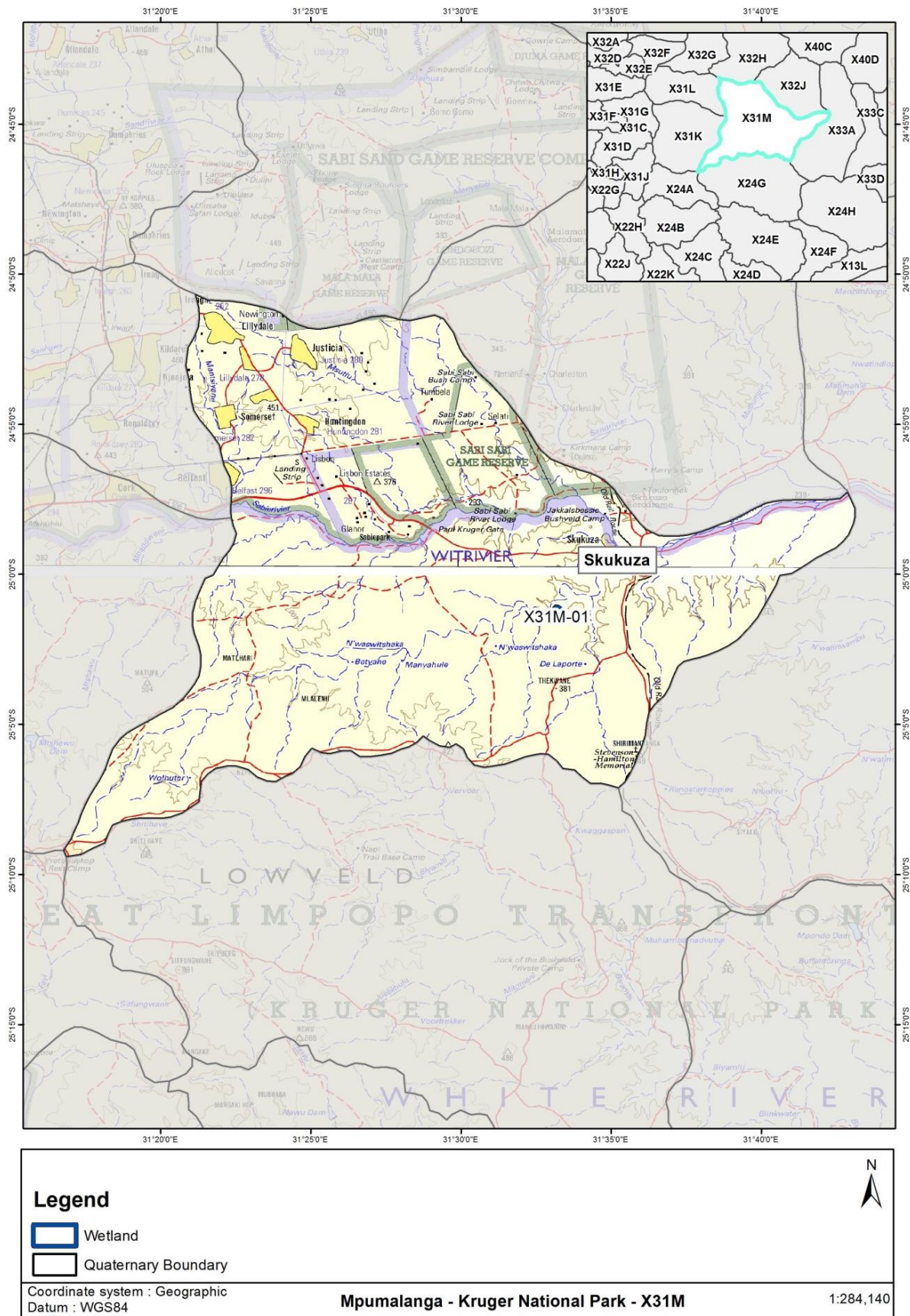


Figure 6: Topographic map showing quaternary catchment's locality, cadastral boundaries and access routes

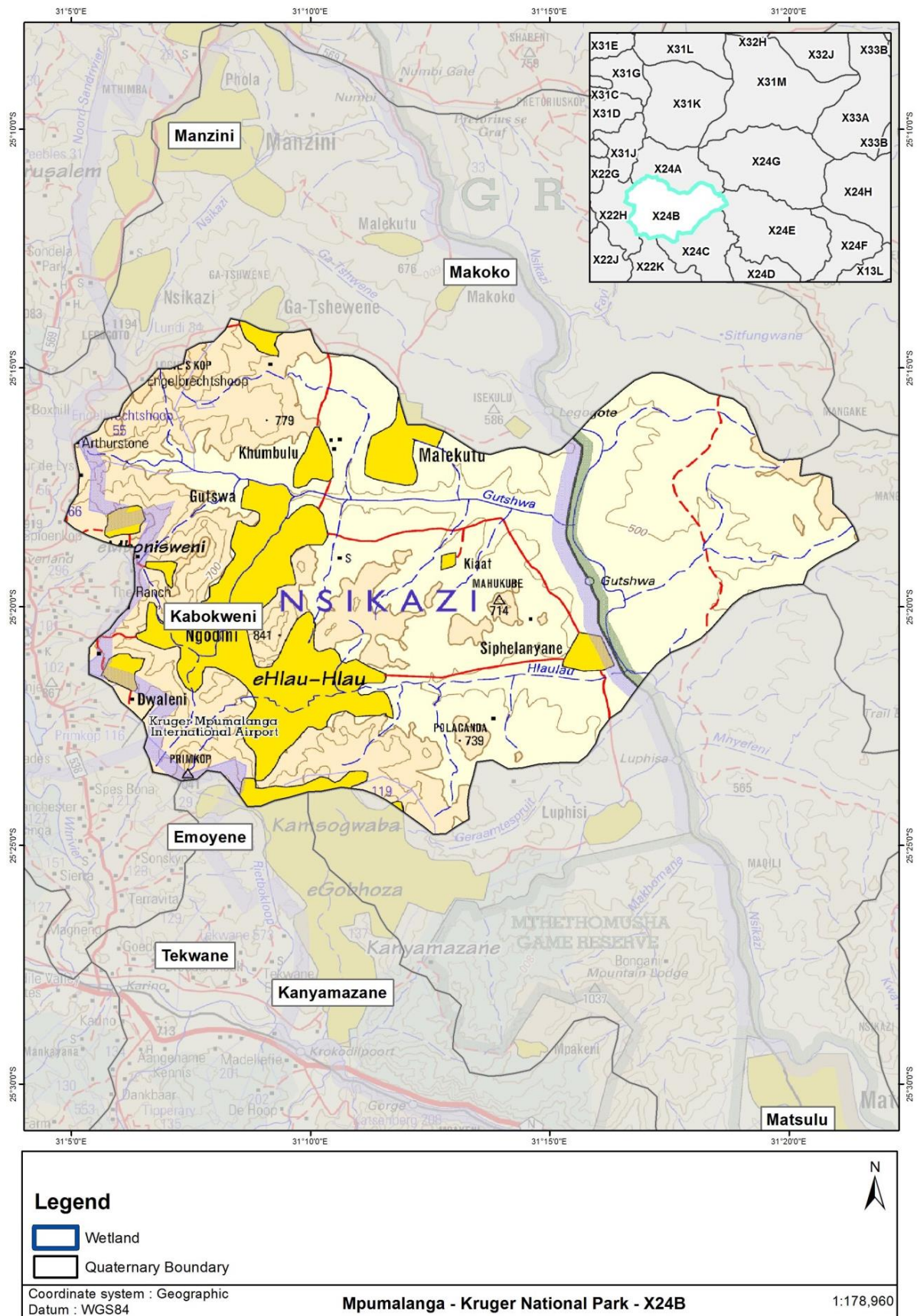


Figure 7: Topographic map showing quaternary catchment's locality, cadastral boundaries and access routes

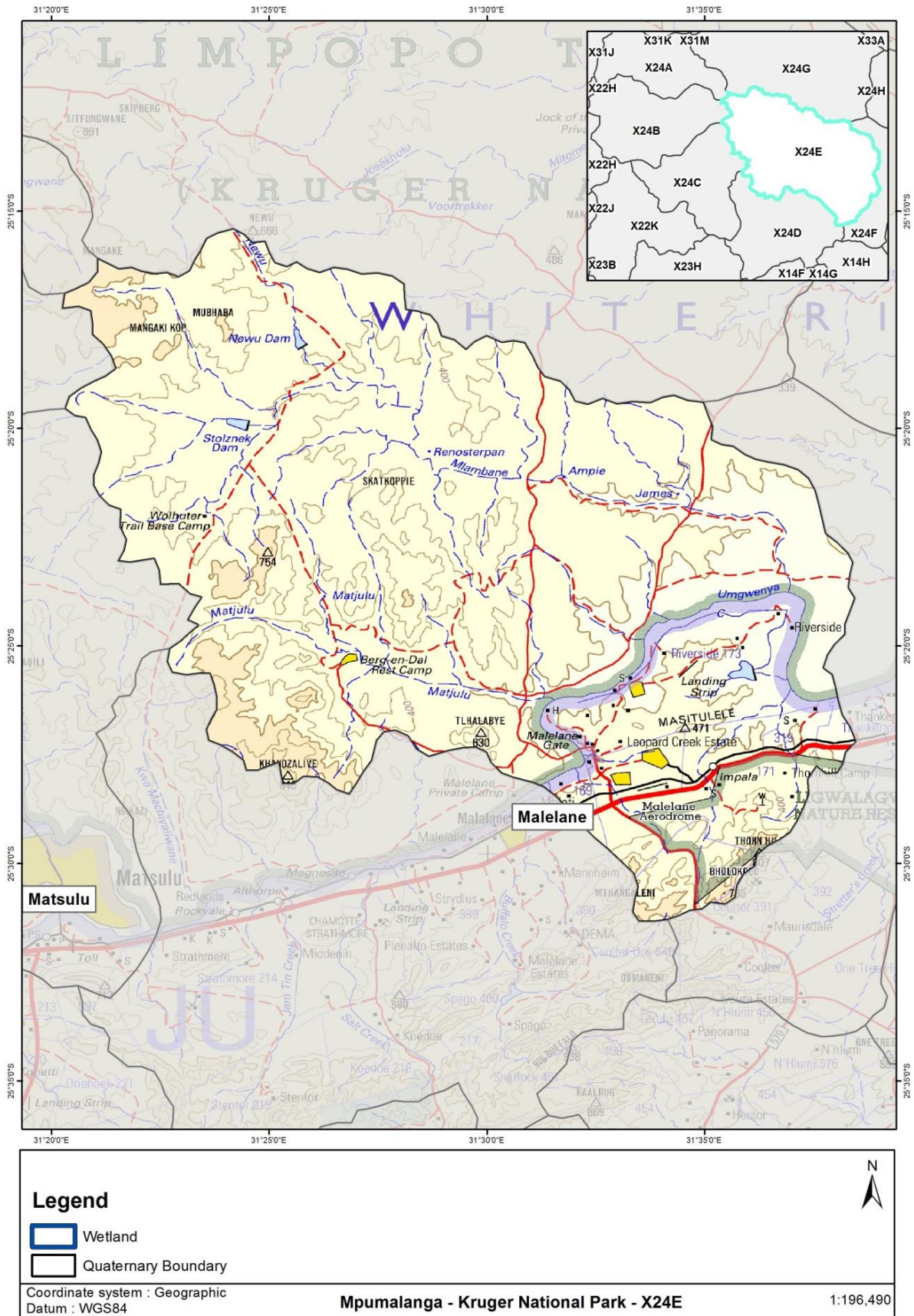


Figure 8: Topographic map showing quaternary catchment's locality, cadastral boundaries and access routes

3.3 Projected rehabilitation indicators

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

Table 6: Projected Values

Wetland No.	Area (ha)	Current hectare equivalents	Projected hectare equivalents gained	Total projected hectare equivalents	% Increase on current hectare equivalents	Projected hectare equivalents secured
B90E-01	285	34.1	10.6	44.7	31%	50
X31M-01	64	25	39	64	156%	39
X40B-01	18	7	4	11	57%	11
X24E-01	160	129	31	160	24%	31
X24B-01	84	42	6	48	14	6

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 status quo 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
3	B90E-01	Langtoon Dam	Dam was initially breached by SANParks Technical services. The breach was incomplete due to insufficient funds. Subsequently, the system was negatively influenced to the extent that this became a high priority.
4	X40D-01	Silolweni	This dam was breached for conservation reasons. The breach was a narrow opening that has impacted negatively on the rest of the system. This is seen as a priority to minimise the negative impact.
1	X31M-01	N'waswitshaka Seep Zone Areas	Road used by staff for recreational purposes. The road runs through sensitive seepage areas and rehabilitation is needed.
2	X24E-01; X24B-01	Stolsnek Seepage Zones	The road runs through sensitive seepage areas. It forms the main access road towards the section and has been used daily. The impact of the road is negative on the systems.

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	Intervention number	Proposed action	Reference document
NEW			
Langtoon Dam (B90E-01)			
Earthworks	B90E-01-201-00	Breaching of dam wall	KNP Final Rehab Plan: April 2014
Rock packing	B90E-01-202-00	Trapping Sediment. Use existing rocks washed down the system	KNP Final Rehab Plan: April 2014
Rock Infilling	B90E-01-203-00	Stabilise donga and Headcut	KNP Final Rehab Plan: April 2014
Silolweni dam (X40B-01)			
Earthworks	X40B-01-201-00	Removal of dam wall	KNP Final Rehab Plan: April 2014
N'waswitshaka (X31M-01)			
Earthworks	X31M-01-201-00	Construct earth berms with geocells and brushpacking	KNP Final Rehab Plan: April 2014
Road maintenance, re-vegetation and earth works	X31M-01-202-00	Re-route the road to by-pass the sodic soil site	KNP Final Rehab Plan: April 2014
Road maintenance, earth works and rock packs	X31M-01-203-00	Re-route the road to by-pass the sodic soil site	KNP Final Rehab Plan: April 2014

Descriptive name	Intervention number	Proposed action	Reference document
Road maintenance and brush packing	X31M-01-204-00	Re-route a section of the road to by-pass the sodic soil site and brush pack exposed area to favour restoration	KNP Final Rehab Plan: April 2014
Road maintenance and brush packing	X31M-01-205-00	Extend existing berms	KNP Final Rehab Plan: April 2014
Road maintenance and brush packing	X31M-01-206-00	Re-route a section of the road to by-pass the sodic soil site and brush pack exposed area to favour restoration	KNP Final Rehab Plan: April 2014
Re-vegetation	X31M-01-207-00	Close section of road through re-vegetation	KNP Final Rehab Plan: April 2014
Earth berms, logs and brush packing	X31M-01-208-00	Relocate Mitre drains	KNP Final Rehab Plan: April 2014
Earth berms and rock packs	X31M-01-209-00	Trap sediment within the donga	KNP Final Rehab Plan: April 2014
Stolsnek (X24B-01 and X24E-01)			
Log silt fence, berms and mitred drains	X24B-01-201-00	Re-align Mitre drains to follow contour line, re-vegetate and arrest erosion	KNP Final Rehab Plan: April 2014
Road contour berms and mitred drains	X24B-01-202-00	Re-align Mitre drains to follow contour line, re-vegetate and arrest erosion	KNP Final Rehab Plan: April 2014
Gabion weir	X24B-01-203-00	Construct drop-inlet gabion weir	KNP Final Rehab Plan: April 2014

Descriptive name	Intervention number	Proposed action	Reference document
Gabion weir	X24B-01-204-00	Construct drop-inlet gabion weir with mitred drains	KNP Final Rehab Plan: April 2014
Low water crossing with earthworks	X24B-01-205-00	Construct concrete drift, earth berms, contour berms, rock packs, mitred drains and infilling with re-vegetation and brush packing.	KNP Final Rehab Plan: April 2014
Low water crossing with earthworks	X24B-01-206-00	Construct concrete drift and earth berms with re-vegetation	KNP Final Rehab Plan: April 2014
Earth works	X24B-01-207-00	Construct earth berms, road contour berms and mitred drains	KNP Final Rehab Plan: April 2014
Gabion retaining wall with earthworks	X24E-01-201-00	Construct a gabion retaining wall with backfill. Also requires earth berms and re-vegetation	KNP Final Rehab Plan: April 2014
Re-vegetate and brush pack	X24E-01-202-00	Re-vegetate and bush pack exposed areas	KNP Final Rehab Plan: April 2014
Earth berms, road contour berms and mitred drains	X24E-01-203-00	Construct road berms	KNP Final Rehab Plan: April 2014
Earth berms, road contour berms and mitred drains	X24E-01-204-00	Construct road berms	KNP Final Rehab Plan: April 2014
Gabion weir	X24E-01-205-00	Add a splashwall and a freeboard to an existing gabion weir	KNP Final Rehab Plan: April 2014

Descriptive name	Intervention number	Proposed action	Reference document
Concrete drift and earth works	X24E-01-206-00	Concrete drift and build up the road	KNP Final Rehab Plan: April 2014
Earth berms, road contour berms and mitred drains	X24E-01-207-00	Construct road berms	KNP Final Rehab Plan: April 2014
MAINTENANCE			
Gabion lining of area downstream of road crossing	B83C-05-204-01	Redo existing downstream rock packing with gabion (Reno) lining to prevent further erosion.	KNP Final Rehab Plan: February 2011

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 LANGTOON WETLAND – B90E-01

4.1 Wetland details

The Langtoon wetland is located in the quaternary catchment B90E (**Figure 4**) north of the Shingwedzi camp in the north-eastern part of the KNP. The assessment of the Langtoon wetland (B90E-01), its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A: Wetland Status Quo Reports**. The following sections provide a brief summary for this wetland.

Wetland B90E-01 (**Table 9**) has been selected for rehabilitation in order to fully breach the Langtoon Dam's wall. The technical service department of the KNP began the task but a funding shortage meant that only some of the work was completed. Further action is required in order to successfully rehabilitate the system. This wetland has been prioritised for rehabilitation as it is one of the water bodies that stem from inside the Park. It is thus not susceptible to land-use impacts outside of the conservation area and thereby an important resource for internal water supply. Water sources stemming from within the park are even more important now as management is closing artificial water points in the Park. In addition, this wetland has been selected for its biodiversity conservation and eco-tourism value as part of the KNP and also as part of the Limpopo Transfrontier Park.

The Langtoonvlei wetland is a floodplain located on basalts in Tsende Mopaneveld. It is 285 ha in extent with a slope of 0.35 % and exhibits classical floodplain features such as meandering channels in its middle section. Vegetation is dominated in places with dense stands of grasses and sedges in wetter areas downstream. The system is seasonal and a dam was built within the wetland to serve as a storage dam and a waterhole for wildlife.

The technical services department of the KNP did begin with rehabilitation work in this wetland, but the WfWetlands project will be initiating work here in order to complete the intervention. Rehabilitation here is thus aimed at restoring the natural flow patterns to this area by fully breaching the Langtoon dam wall.

Table 9: Summary of the wetland details

Wetland Name	Langtoonvlei
Wetland Number	B90E-01
River System Name	Nkulumbeni, tributary of the Shingwedzi River
Land Use in Catchment	Conservation
Land Use in Wetland	Conservation (the dam was built as a water point for game)
No. of Properties Intersecting Wetland Area	1
Date of Planning Site Visit	10 September 2013
Wetland Assessor(s)	Piet-Louis Grundling
Wetland size	285 ha

4.2 Site photos



Figure 9: Site Photos of the Langtoon Dam Wetland

4.3 Wetland problems

The main impacts to this wetland are associated with the incomplete breaching of the dam wall. Channelling the water through an incomplete breach has resulted in erosion both upstream and downstream. Other less significant but noticeable impacts include:

- Sediment deposition downstream due to increased flow concentration; and
- Gully erosion due to increased flow concentrations.

4.4 Rehabilitation objectives

The main objective is to re-instate more natural water distribution and retention patterns in order to improve the hydrological functioning of the wetland and the associated condition of the wetland vegetation. Another objective is to prevent erosion by reducing the overall flow concentration.

4.5 Summary proposed interventions

Rehabilitation within the KNP has been ongoing since 2008. For more detail on past rehabilitation activities, please refer to the WfWetlands rehabilitation plans dated: February 2011, November 2009 and November 2008.

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.

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

Table 10: Summary of proposed new interventions, B90E-01

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
B90E-01-201-00	Earth works	1	12	R 2 200 000
B90E-01-202-00	Rock packing	1	10	R 134 400
B90E-01-203-00	Rock infilling	1	11	R 22 400
Total				R 2 356 800

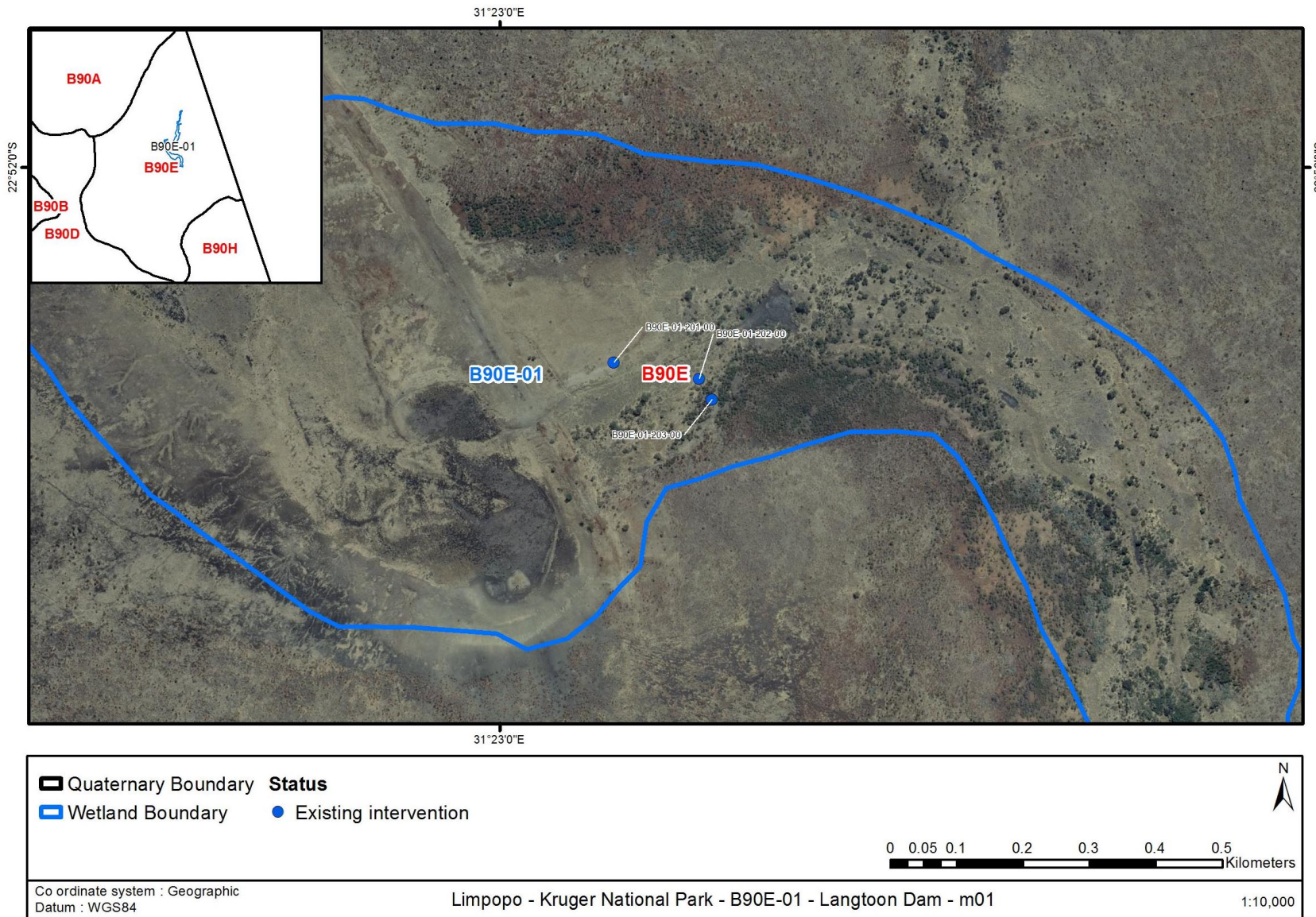


Figure 10: Wetland map, B90E-01 with proposed new wetland interventions indicated.

4.6 Design selection and sizing

The objective of the intervention is to deactivate a drain that has formed at the opening of the breached dam and spread the water across the wetland in a natural flow pattern. The most appropriate and cost effective method of doing this was considered to involve:

- Removal of a section of the remainder of the dam wall to promote the flow of water into the wetland

4.7 Intervention designs

4.7.1 Intervention: B90E-01-201-00

Intervention Description	Earthworks
Rehabilitation Objective	Remove earth dam and encourage natural flow of water across floodplain.
Latitude (D°M'S")	22°52'12.28"S
Longitude (D°M'S")	31°23'1.88"E



Figure 11: Site of intervention B90E-01-201-00

4.7.1.1 Bill of quantities: B90E-01-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Breaching of dam wall	m ³	18 700	R 330	R 2 200 000
Total				R 2 200 000

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Soil removed from the berm must be used for the infilling of erosion drains that have formed in the dam basin and downstream thereof.

4.7.2 Intervention: B90E-01-202-00

Intervention Description	Trapping sediment using in-situ rocks
Rehabilitation Objective	Arresting erosion and trapping sediment
Latitude (D°M'S")	22°52'8.04"S
Longitude (D°M'S")	31°23'11.35"E



Figure 12: Site of intervention B90E-01-202-00

4.7.2.1 Bill of quantities: B90E-01-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock packing	m ³	48	R 2 800	R 134 400
Total				R 134 400

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Soil removed from the berm must be used for the infilling of erosion drains that have formed in the dam basin and downstream thereof.

4.7.3 Intervention: B90E-01-203-00

Intervention Description	Stabilise donga and headcut
Rehabilitation Objective	Arrest erosion
Latitude (D°M'S")	22°52'5.82"S
Longitude (D°M'S")	31°23'13.55"E



Figure 13: Site of intervention B90E-01-203-00

4.7.3.1 Bill of quantities: B90E-01-203-00

Item	Units	Quantity	Unit Cost	Item Cost
Rock infilling	m ³	8	R 2 800	R 22 400
Total				R 22 400

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Soil removed from the berm must be used for the infilling of erosion drains that have formed in the dam basin and downstream thereof.

4.8 Construction Environmental Management Plan issues

The proposed rehabilitation is to be undertaken on SANParks 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. However, it is recommended that a monitoring committee be established to ensure that the rehabilitation activities are implemented in an effective and appropriate manner. This committee should ideally consist of representatives of the Biodiversity and Social Projects Programme, SANBI, the project engineer and the Environmental Assessment Practitioner.

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 road leading to the Langtoon Dam cuts through a number of small wetlands and is protected by various small berms located along the road. A limited degree of erosion and sedimentation problems have started to develop and should be monitored to determine if intervention is required in the future.

Table 11: Monitoring points

Monitoring Point	Latitude (D°M'S")	Longitude (D°M'S")
Langtoon-01	22°54'14.30"S	31°22'15.87"E
Langtoon-02	22°54'0.10"S	31°21'21.10"E
Langtoon-03	22°53'54.77"S	31°20'33.42"E
Langtoon-04	22°53'46.49"S	31°19'2.99"E
Langtoon-05	22°53'44.78"S	31°18'3.17"E
Langtoon-06	22°53'57.37"S	31°17'8.44"E

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**):

Wetland No	Ha	Hydrology		Geomorphology		Vegetation	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
B90E-01	56	5.0	0	1.6	0	4.4	0
PES Categories		D	→	B	→	D	→
Wetland Impact Score		3.87					
Wetland PES		C					

5 STOLSNEK SEEPAGE ZONES – X24B-01 and X24E-01

5.1 Wetland details

The Stolsnek Wetland is located in the quaternary catchments X24E and X24B¹¹ (**Figure 5** and **Figure 6**) in the KNP. The assessment of the Stolsnek seepage zones, the problems, and the development of the rehabilitation objectives are described in detail in **Appendix A: Wetland Status Quo Reports**.

Wetlands X24B-01 and X24E-01 (**Table 12**) have been selected for rehabilitation based on their value for biodiversity conservation and for eco-tourism. The Stolsnek seepage zones are comprised of sodic areas that are sensitive to disturbances. A road crossing the seep zones impacts on the wetland units, affecting the patterns of water movement and retention. Thus rehabilitation is necessary to improve wetland health and contribute to the conservation goals of the KNP.

This road is located towards the western boundary of the Park and forms the main access route to the area. It was constructed in the early days of the section, and crosses several seepage areas. Due to the high rainfall (more than 800 mm on average) and the location of the road, access to the western boundary is difficult. The road enhances channel water runoff causing erosion and creating an unnatural barrier which changes both the hydrology and the vegetation type on the down slope area of the road. The road is for management purposes and used for access towards the Western boundary of the park and is also important for anti-poaching operations. Management roads intersecting these sodic seep zones prove to be problematic and cause severe sheet and gully erosion in places. Although the roads follow in general the contour the gradients towards valley crossings are relatively steep. The surrounding landscape is hillier than in the Nwatsitshaka area and the road runs along steep slopes. These steep gradients enhance water runoff inside the road reserve. The absence of mitre drains causes an increase in velocity of the water that increase the erosion effect by run-off.

Table 12: Summary of the wetland details

Wetland Name	Stolsnek
Wetland Numbers	X24B-01; X24E-01
River System Name	Seepage Areas related to Stolsnek Section
Land Use in Catchment	Catchment area is situated in a formal conservation area
Land Use in Wetland	Conservation while road is used for internal staff to access camping area.
No. of Properties Intersecting Wetland Area	1

¹¹ The two small seeps were assessed together as they are similar and have similar impacts and thus it was found to be more cost effective to assess them together.

Date of Planning Site Visit	13 September 2013
Wetland Assessor(s)	Piet Louis Grundling
Wetland size	Wetland sizes individual to seepage area.

5.2 Site photos



Figure 14: Photo's indicate the impacts that the road have on the surrounding area in the Stolsnek area

5.3 Wetland problems

The catchments of the Stolsnek seep zones are largely intact. However there are some significant impacts to the hydrology in some areas where steeper slopes occur. Impacts are mainly due to infrastructure on or near sensitive wetland areas.

The main impacts to this wetland unit are associated with the incorrect placement of the road. This is causing the following negative impacts on the system:

- Disruption of flows associated with road drainage;
- Increase in flow due to road channelling the water; and
- Uncontrolled erosion resulting in desiccation of sodic areas.

5.4 Rehabilitation objectives

The objectives of rehabilitation in this wetland are as follows:

- To reinstate natural water distribution patterns;
- To prevent erosion by reducing the flow concentration away from the seepage zones; and
- To stabilise existing sheet and gulley erosion.

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

- Construct earth berms to reduce speed of storm water run-off every 40m based on slope
- Construct maître drains to control water run-off away from sensitive areas
- Closing the road through some of the sodic seep zones and detour the road through non sensitive areas
- Arresting erosion by the construction of low costs interventions
- Protect erosion areas from game movement.

5.5 Summary proposed interventions

Table 15 provides a summary of the proposed 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.

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

Table 13: Summary of proposed new interventions, X24B-01 and X24E-01

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
X24B-01-201-00	Log silt fence, brush packing, road contour berms and mitred drains	8	2	R 44 400
X24B-01-202-00	Road contoured berms and mitred drains	5	2	-
X24B-01-203-00	Gabion weir	1	2	R 33 600

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
X24B-01-204-00	Low water crossing with earthworks	6	6	R 81 480
X24B-01-205-00	Low water crossing with earthworks	4	5	R 232 680
X24B-01-206-00	Earth works	9	4	R 144 420
X24B-01-207-00	Gabion retaining wall with earthworks	5	1	R 312 750
X24E-01-201-00	Gabion retaining wall with earthworks	2	1	R 747 170
X24E-01-202-00	Re-vegetation and Brush pack	10	6	R 1 280
X24E-01-203-00	Earth berms, road contour berms and mitred drains	5	2	_ ¹²
X24E-01-204-00	Earth berms, road contour berms and mitred drains	5	2	_ ¹²
X24E-01-205-00	Gabion weir	7	1	R 25 760
X24E-01-206-00	Earthworks, earth berms and road contour berms	6	3	R 41 040
X24E-01-207-00	Earth berms, road contour berms and mitred drains	6	2	_ ¹²
Total				R 1 590 540

¹² To be confirmed

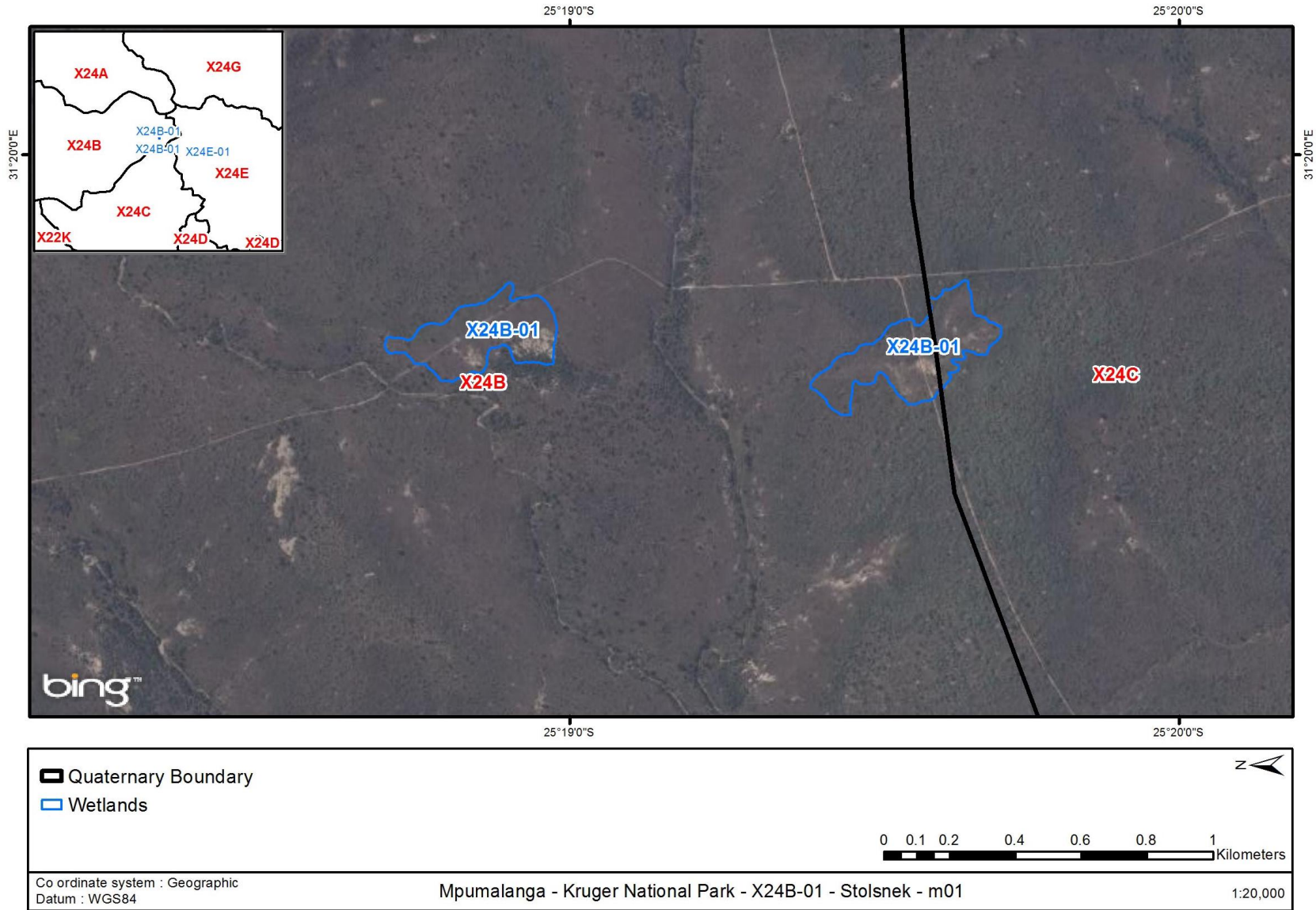


Figure 15: Wetland map, X24B-01 with proposed new wetland interventions indicated

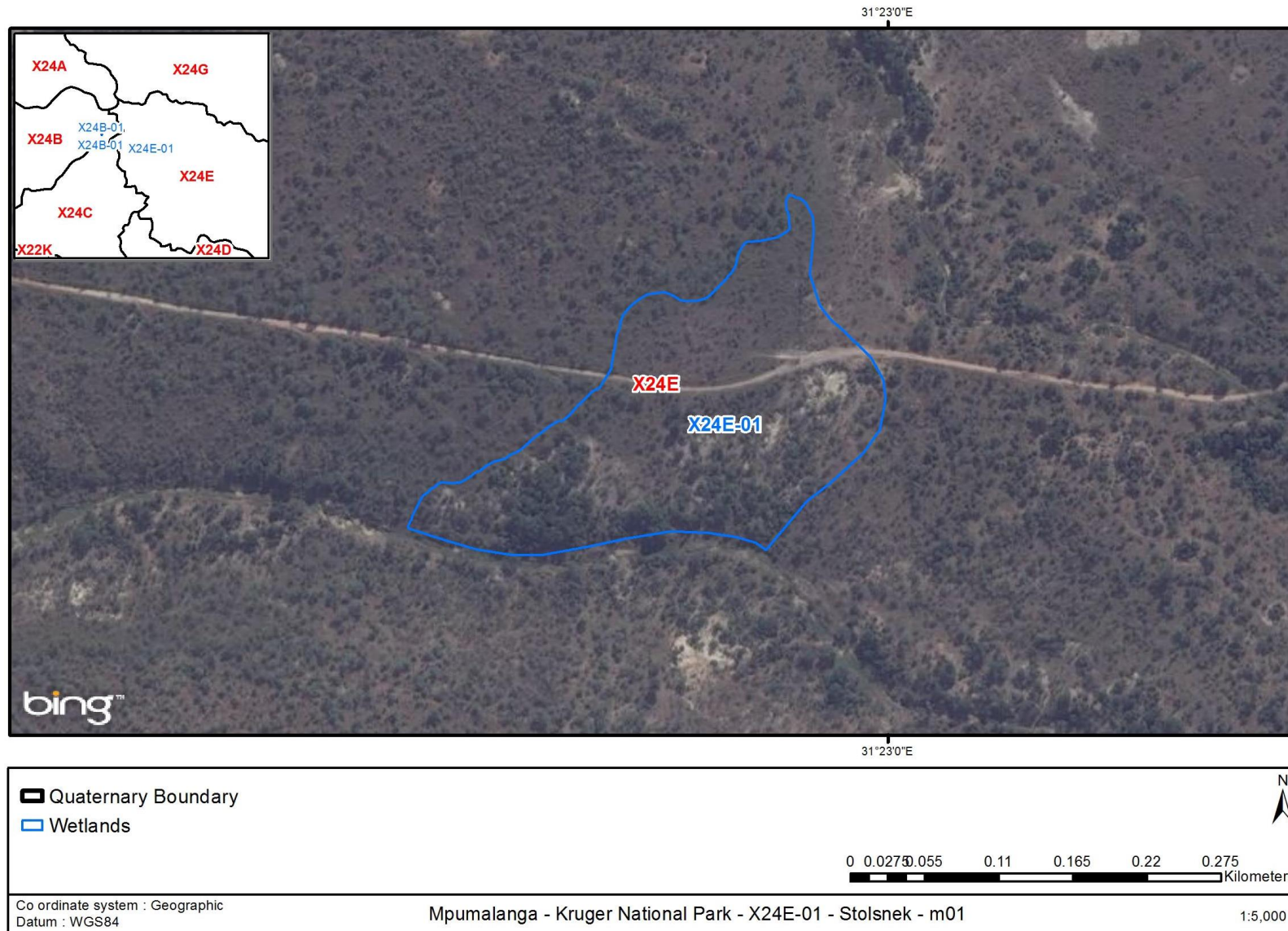


Figure 16: Wetland map, X24E-01 with proposed new wetland interventions indicated

5.6 Design selection and sizing

The design type, construction material and size were selected for the following reasons:

- The size of the structure was determined to be appropriate to deal with the measured dimensions of the headcut/erosion problem encountered, and
- Gabion structures were selected due to their labour intensive nature of construction and because they can probably deal with the expected flow velocities and flow volumes.

5.7 Intervention designs

5.7.1 Intervention: X24B-01-201-00

Intervention Description	Arrest erosion and control stormwater run-off
Rehabilitation Objective	Arrest erosion and Control storm water road run-off, earth plugs, contour berms and retaining logs
Latitude (D°M'S")	25°19'36.1"S
Longitude (D°M'S")	31°19'38.4"E



Figure 17: Intervention X24B-01-201-00

5.7.1.1 Bill of quantities: X24B-01-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Log silt fence	m ²	50	120	R 6 000
Brush packing	m ²	2400	16	R 38 400
Road contour berms and mitred drains	m ³	6	250	R 1 500
Total				R 45 900

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Note that when brush packing:

- In-situ material can be used in order to avoid transport costs;
- Alien plants should not be used for this purpose;
- Brush is to be evenly spread so as not to concentrate the water flow;
- Stacking must be a minimum of 50 cm high, and
- Branches must interlock in order to form a dense cover.

5.7.2 Intervention: X24B-01-202-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Road contour berms and mitred drains
Rehabilitation Objective	Arrest erosion and control storm water run-off
Latitude (D°M'S")	25°19'41.7"S
Longitude (D°M'S")	31°22'21.7"E
Engineering Drawings	P00 007Z001 to 003



Figure 18: Intervention X24B-01-202-00

5.7.2.1 Bill of quantities: X24B-01-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Road contour berms and mitred drains	m ³	15	250	R 3 750-00
Total				R 3 750-00

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

5.7.3 Intervention: X24B-01-203-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Gabion drop inlet
Rehabilitation Objective	Arrest gully erosion and headcut which has migrated into road
Latitude (D°M'S")	25°19' 58.9"S
Longitude (D°M'S")	31°18' 17.2"E
Engineering Drawings	P00 007Z001 to 003



Figure 19: Intervention X24B-01-203-00

5.7.3.1 Bill of quantities: X24B-01-203-00

Item	Units	Quantity	Unit Cost	Item Cost
Drop inlet	m ³	12	R 2 800	R 33 600
Total				R 33 600

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

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

5.7.4 Intervention: X24B-01-204-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Gabion drop inlet of drain head cut and drain re-alignment of mitre drain
Rehabilitation Objective	Arrest gully erosion and headcut which has migrated into road
Latitude (D°M'S")	25° 20' 6.4"S
Longitude (D°M'S")	31° 17' 25.4"E
Engineering Drawings	Drop inlet and concrete drift details



Figure 20: Intervention X24B-01-204-00

5.7.4.1 Bill of quantities: X24B-01-204-00

Item	Units	Quantity	Unit Cost	Item Cost
Drop inlet and mitre drain	m ³	29.1	R 2 800	R 81 480
Total				R 81 480

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

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

5.7.5 Intervention: X24B-01-205-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Earth plugs, contour berms, Rock packs and infilling dropinlet, re-vegetation and brush packing
Rehabilitation Objective	Arrest erosion and Control storm water road run-off
Latitude (D°M'S")	25°19'9.98"S
Longitude (D°M'S")	31°19'46.9"E
Engineering Drawings	P00 007Z001 to 003



Figure 21: Intervention X24B-01-205-00

5.7.5.2 Bill of quantities: X24B-01-205-00

Item	Units	Quantity	Unit Cost	Item Cost
Drift	m ³	9.9	3200	31680
Rock pack	m ³	8	1400	11200
Gabion	m ³	22.1	2800	61880
Contour berm	m ³	18	180	3240
Brush packing	m ³	600	16	9600
Road contour berms and mitred drains	m ³	9.9	250	2475
Total				R 120 075

5.7.5.3 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

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

Note that when brush packing:

- In-situ material can be used in order to avoid transport costs;
- Alien plants should not be used for this purpose;
- Brush is to be evenly spread so as not to concentrate the water flow;
- Stacking must be a minimum of 50 cm high, and

Branches must interlock in order to form a dense cover.

5.7.6 Intervention: X24B-01-206-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Arrest erosion and Control storm water road run-off.
Rehabilitation Objective	Earth plugs, contour berms, Reno drift, re-vegetation and brush packing.
Latitude (D°M'S")	25°18'49.5"S
Longitude (D°M'S")	31°19'42.2"E
Engineering Drawings	P00 007Z001 to 003



Figure 22: Intervention X24B-01-206-00

5.7.6.1 Bill of quantities: X24B-01-206-00

Item	Units	Quantity	Unit Cost	Item Cost
Drift	m ³	7.2	2800	20 160
Contour berm	m ³	125	180	22 500
Brush packing	m ³	6360	16	101 760
Total				R 144 420

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

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

Note that when brush packing:

- In-situ material can be used in order to avoid transport costs;
- Alien plants should not be used for this purpose;
- Brush is to be evenly spread so as not to concentrate the water flow;
- Stacking must be a minimum of 50 cm high, and

Branches must interlock in order to form a dense cover.

5.7.7 Intervention: X24B-01-207-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Main access road from Stolsnek station to western border; one berm every 40 m upslope of or in wetland/stream crossings
Rehabilitation Objective	Mitigate hillslope flow interruption (thus draining) and erosion of road in wetland
Latitude (D°M'S")	25°19'12.58"S
Longitude (D°M'S")	31°20'41.02"E
Engineering Drawings	P00 007Z001 to 003



Figure 23: Intervention X24B-01-207-00

5.7.7.1 Bill of quantities: X24B-01-207-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth berms, road contour berms and mitred drains	m ³	1737.5	180	R 31 2750
Total				R 31 2750

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

5.7.8 Intervention: X24E-01-201-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Gabion retaining wall with earthworks
Rehabilitation Objective	Arrest erosion and control storm water road runoff
Latitude (D°M'S")	25°19'48.2"S
Longitude (D°M'S")	31°22'58.5"E
Engineering Drawings	Gabions and mattresses arrangement for site 1



Figure 24: Intervention X24E-01-201-00

5.7.8.1 Bill of quantities: X24E-01-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion retaining wall	m ³	99	2800	R 277 200
Earth works, retaining wall, backfill	m ³	384	180	R 69 120
Earth berm, retaining wall; cut-off berm	m ³	22	250	R 5 500
Re-vegetation at retaining wall	m ³	1200	16	R 192 00


Earth berm (cut-off berm)	m ³	50	250	R 12 500
Re-vegetation at drop-inlet	m ³	400	16	R 6 400
Drop inlet-gabion	m ³	96	2800	R 268 800
Earth berm-drop inlet-cut-off berm	m ³	22	250	R 5 500
Re-vegetation at drop-inlet	m ³	2000	16	R 32 000
Earth berm	m ³	45	350	R 15 750
Concrete	m ³	11	3200	R 35 200
Total				R 747 170

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Where it is necessary to re-vegetate, in-situ grass species and local Cypress tufts should be used. In wetter areas *Phragmites spp.* (locally indigenous) may be planted. *Local seed should be harvested and sown* to facilitate regrowth by producing a much needed first cover.

5.7.9 Intervention: X24E-01-202-00

Intervention Description	Slope trampling and erosion
Rehabilitation Objective	Arrest erosion from road construction and trampling
Latitude (D°M'S")	25°19'41.7"S
Longitude (D°M'S")	31°22'21.7"E
	
Figure 25: Intervention X24E-01-202-00	

5.7.9.1 Bill of quantities: X24E-01-202-00

Item	Units	Quantity	Unit Cost	Item Cost
Re-vegetation and brush pack	m ²	80	16	R 1 280
Total				R 1 280

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Note that when brush packing:

- In-situ material can be used in order to avoid transport costs;
- Alien plants should not be used for this purpose;
- Brush is to be evenly spread so as not to concentrate the water flow;
- Stacking must be a minimum of 50 cm high, and

Branches must interlock in order to form a dense cover.

Where it is necessary to re-vegetate, in-situ grass species and local Cypress tufts should be used. In wetter areas *Phragmites spp.* (locally indigenous) may be planted. *Local seed should be harvested and sown* to facilitate regrowth by producing a much needed first cover.

5.7.10 Intervention: X24E-01-203-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Road berms as part of access road
Rehabilitation Objective	Arrest erosion and Control storm water road run-off
Latitude (D°M'S")	25°19'39.9"S
Longitude (D°M'S")	31°22'12.6"E
Engineering Drawings	P00 007Z001 to 003



Figure 26: Intervention X24E-01-203-00

5.7.10.1 Bill of quantities: X24E-01-203-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth berms-road contour berms and mitred drains	m ³	28	250	R7000-00
Total				R7000-00

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

5.7.11 Intervention: X24E-01-204-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Road berms as part of the access road
Rehabilitation Objective	Arrest erosion and Control storm water road run-off
Latitude (D°M'S")	25°19'35.2"S
Longitude (D°M'S")	31°21'53.2"E
Engineering Drawings	P00 007Z001 to 003



Figure 27: Intervention X24E-01-204-00

5.7.11.1 Bill of quantities: X24E-01-204-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth berms road contour berms and mitred drains	m ³	19	250	R4750
Total				R 4750

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

5.7.12 Intervention: X24E-01-205-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Add splashwall and freeboard
Rehabilitation Objective	Secure gabion and arrest gully erosion
Latitude (D°M'S")	25°19'27.1"S
Longitude (D°M'S")	31°21'26.6"E
Engineering Drawings	Drop inlet and concrete drift details



Figure 28: Intervention X24E-01-205-00

5.7.12.1 Bill of quantities: X24E-01-205-00

Item	Units	Quantity	Unit Cost	Item Cost
Gabion upgrade	m ³	9.2	R 2 800	R 25 760
Total				R 25 760

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

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

In addition, the following applies:

- Water should be diverted away from the intervention site during the implementation of rehabilitation activities
- Diversions should be temporary in nature (e.g. sand bags, eco-logs)
- Upon completion of the rehabilitation activities at the site, the diversions should be removed to restore natural flow patterns

5.7.13 Intervention: X24E-01-206-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Concrete drift and earthworks
Rehabilitation Objective	Arrest erosion and control storm water road run-off
Latitude (D°M'S")	25°19'19.0"S
Longitude (D°M'S")	31°21'09.2"E
Engineering Drawings	Drop inlet and concrete drift details

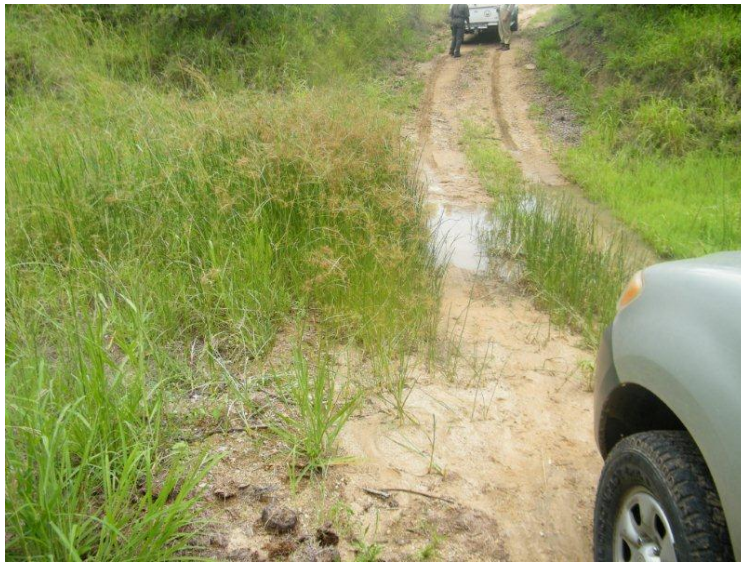


Figure 29: Intervention X24E-01-206-00

5.7.13.1 Bill of quantities: X24E-01-206-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete drift	m ³	7.2	R 3 200	R 23 040
Earth works	m ³	100	R 180	R 18 000
Total				R 41 040

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices. The Engineer will include site specific instructions in the site instructions to be issued prior to construction of this intervention.

5.7.14 Intervention: X24E-01-207-00

Designer	H. Manema of Conceptual Engineering
Design Date	March 2014
Intervention Description	Road contour berms and mitred drains
Rehabilitation Objective	Build up road
Latitude (D°M'S")	25° 19' 15.7" S
Longitude (D°M'S")	31° 20' 28.1" E
Engineering Drawings	P00 007Z001 to 003



Figure 30: Intervention X24E-01-207-00

5.7.14.1 Bill of quantities: X24E-01-207-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth berms, road contour berms and mitred drains	m ³	11.5	R250	R2 875
Total				R 2 875

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

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 SANParks 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.

5.10 Baseline M&E data

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

5.10.1 Erosion 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 N'WASWITSHAKA SEEP ZONE AREAS – X31M-01

6.1 Wetland details

The N'waswitshaka seep zone areas are located in quaternary catchment X31M (

Figure 7) in the south of the KNP. The assessment of the N'waswitshaka wetlands (X31M-01), its problems, and the development of the rehabilitation objectives are described in detail in **Appendix A: Wetland Status Quo Report**. The following sections provide a brief summary for this wetland.

The N'waswitshaka wetlands (**Table 14**) are seepage zones located in relatively small wetland catchments on associated slopes. The area is undulating with gentle slopes steeping into river valleys. The catchment entire quaternary catchment falls within the KNP. The catchment is well vegetated and is part of the Granite Lowveld vegetation unit. The N'waswitshaka Road runs across the sensitive seepage zones and forms the focus of the rehabilitation strategy. The road is used by staff to patrol and to access camping and picnic facilities. The road is used regularly but was constructed through sensitive seepage areas that have a negative impact on the surrounding area and uncontrolled storm water run-off cause erosion in these sensitive areas.

The main aims of rehabilitation work in the N'waswitshaka Seepage zones are to mitigate the negative impacts of the road that runs across the wetland. Run-off from the road has caused extensive erosion and without rehabilitation erosion gullies will develop, changing the drainage regime of the seeps, stripping the top soil and enhancing desiccation. The road is also to be diverted in some areas in order to mitigate erosion. An assessment has indicated that although the catchment is largely intact with only minor impacts to the hydrology, unless the status quo changes the wetland conditions will deteriorate under the current management practises. The 2014/2015 planning cycle aims to address the issues caused by the placement of the N'waswitshaka road through the seepage zones.

Table 14: Summary of the wetland details

Wetland Name	N'waswitshaka Seep Zone Areas
Wetland Number	X31M-01
River System Name	Seepage wetlands related to the N'waswitshaka River
Land Use in Catchment	Conservation
Land Use in Wetland	Conservation (the road is used for management and staff to access the camp area)
No. of Properties Intersecting Wetland Area	1
Date of Planning Site Visit	12 September 2013
Wetland Assessor(s)	Piet Louis Grundling, Zebulon Hlungwani, Marius Snyders, Nick Zambatis,
Wetland size	Wetland sizes individual to seepage area.

6.2 Site photos



Figure 31: Site Photos of the N'waswitshaka Wetland

6.3 Wetland problems

The catchment of the N'waswitshaka Seep Zones is largely intact with only minor impacts to the catchment hydrology. These impacts are mainly caused by infrastructure such as poorly positioned roads. It is evident that the N'waswitshaka management road has a negative impact on the seepage zones and it is therefore important to employ erosion and storm water control measures to mitigate these impacts. It is also necessary to divert the course of the road in areas that are especially sensitive to erosion. Threats to the wetland are severe on the road edge which suggests that unless the status quo is altered, the wetland conditions will deteriorate in the future.

6.4 Rehabilitation objectives

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

- Reinstating the natural water distribution patterns;
- Preventing erosion by reducing the flow concentration away from the seepage zones; and
- By stabilising existing sheet and gully erosion.

6.5 Summary proposed interventions

Table 15 provides a summary of the proposed 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.

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

Table 15: Summary of proposed new interventions, X31m-01

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
X31M-01-201-00	Earthworks	1	2	R 22 200
X31M-01-202-00 ¹³	Earthworks, road maintenance and re-	2	2	R 57 740

¹³ This intervention does not trigger activities in terms of NEMA and as such does not require Environmental Authorisation to allow for implementation.

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
	vegetation			
X31M-01-203-00	Earth berms, Road maintenance and rock pack	3	1	R 54 185
X31M-01-204-00	Road maintenance and brush packing	4	2	R 59 850
X31M-01-205-00	Earth berms	5	1	R 8 160
X31M-01-206-00	Road maintenance and brush packing	6	2	R 215 460
X31M-01-207-00	Re-vegetation	7	3	R 1 500
X31M-01-208-00	Earth berms, logs and brush packing	8	1	R 8 610
X31M-01-209-00	Earth berms and rock packs	9	1	R 3 045
Total				R 421 090

6.6 Design selection and sizing

The objective of the interventions is to promote a more natural surface flow pattern that would not result in the concentration of run-off in erosion channels along the road edge. The design type, construction material and size were selected for the following reason:

- The size of the structure was determined to be appropriate to deal with the measured dimension of the erosion dongas and overland flow.

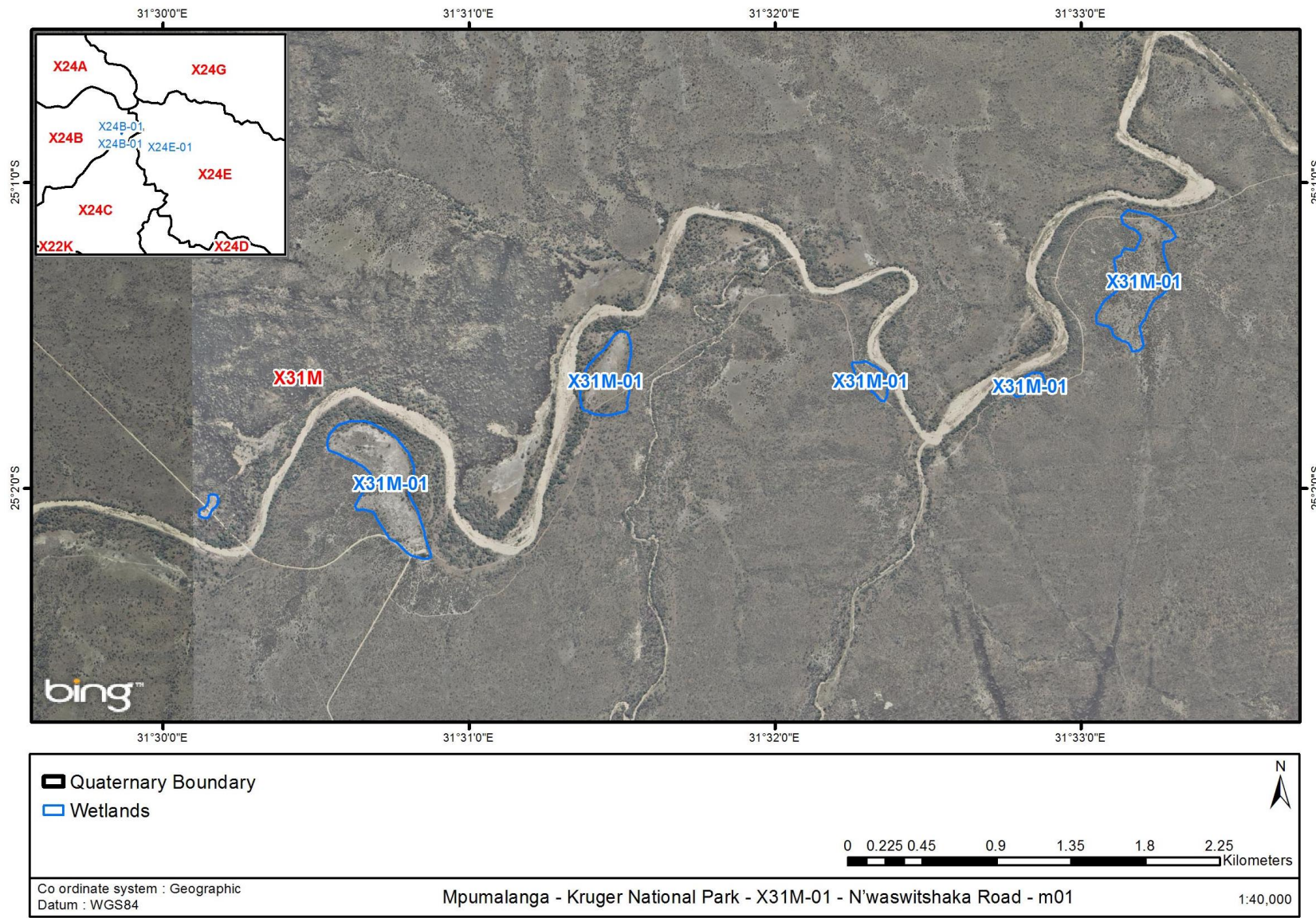



Figure 32: Wetland map, X31M-01 with proposed new wetland interventions indicated.

6.7 Intervention designs

6.7.1 Intervention: X31M-01-201-00

Intervention Description	Earth works
Rehabilitation Objective	Redirect water flow from the road by constructing earth berms at the top of the gully to divert water away and brush pack exposed areas in order to facilitate restoration.
Latitude (D°M'S")	24°49'26.06"S
Longitude (D°M'S")	31°50'07.02"E
	
<p>Figure 33: Site of intervention X31M-01-201-00</p>	

6.7.1.1 Bill of quantities: X31M-01-201-00

	Units	Quantity	Unit Cost	Item Cost
Earth berms	m ³	10	420	R 4 200
Geocells	m ³	50	300	R 15 000
Brush packing	m ³	100	30	R 3 000
Total				R 22 200

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Note that when brush packing:

- In-situ material can be used in order to avoid transport costs;
- Alien plants should not be used for this purpose;
- Brush is to be evenly spread so as not to concentrate the water flow;
- Stacking must be a minimum of 50 cm high, and
- Branches must interlock in order to form a dense cover.

6.7.2 Intervention: X31M-01-202-00

Intervention Description	Earthworks, road maintenance and re-vegetation
Rehabilitation Objective	Re-route the existing road to avoid sensitive areas
Latitude (D°M'S")	25°1'6.89"S
Longitude (D°M'S")	31°33'11.62"E



Figure 34: Site of intervention X31M-01-202-00

6.7.2.1 Bill of quantities: X31M-01-202-00

	Units	Quantity	Unit Cost	Item Cost
Road Maintenance	m ³	300	180	R 54 000
Earth Works	m ³	9.2	250	R 2 300
Re-vegetation	m ³	48	30	R 1 440
Total				R 57 740

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Re-routing of the road may not commence until all members of the implementation team have received training from the KNP Ecologist to prevent potential destabilization of the surrounding landscape.

Note: The re-routed section of the N'waswitshaka Road would consist of a vehicle track that does not require any earth works (i.e. no clearing of vegetation). It would however require shrubs and small trees to be cut back.

6.7.3 Intervention: X31M-01-203-00

Intervention Description	Road maintenance
Rehabilitation Objective	Re-routing and stabilisation of the existing road using Earthberms and rock packs.
Latitude (D°M'S")	25°1'28.05"S
Longitude (D°M'S")	31°33'0.01"E



Figure 35: Site of intervention X31M-01-203-00

6.7.3.1 Bill of quantities: X31M-01-203-00

	Units	Quantity	Unit Cost	Item Cost
Road maintenance	m ³	200	250	R 50 000
Earth berms	m ³	5.25	340	R 1 785
Rock pack	m ³	4	600	R 2 400
Total				R 54 185

6.7.3.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Re-routing of the road may not commence until all members of the implementation team have received training from the KNP Ecologist to prevent potential destabilization of the surrounding landscape.

Note: The re-routed section of the N'waswitshaka Road would consist of a vehicle track that does not require any earth works (i.e. no clearing of vegetation). It would however require shrubs and small trees to be cut back.

6.7.4 Intervention: X31M-01-204-00

Intervention Description	Road maintenance and brush packing
Rehabilitation Objective	Alleviate negative impacts of existing road, reduce sheet erosion and enhance vegetation growth
Latitude (D°M'S")	25°1'55.38"S
Longitude (D°M'S")	31°32'31.47"E



Figure 36: Site of intervention X31M-01-204-00

6.7.4.1 Bill of quantities: X31M-01-204-00

	Units	Quantity	Unit Cost	Item Cost
Road maintenance	m ³	300	180	R 54 000
Brush packing	m ³	195	30	R 5 850
Total				R 59 850

6.7.4.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices. Note that when brush packing:

- In-situ material can be used in order to avoid transport costs;
- Alien plants should not be used for this purpose;
- Brush is to be evenly spread so as not to concentrate the water flow;
- Stacking must be a minimum of 50 cm high, and
- Branches must interlock in order to form a dense cover.

6.7.5 Intervention: X31M-01-205-00

Intervention Description	Extend existing berms
Rehabilitation Objective	Divert water from road
Latitude (D°M'S")	25°1'37.80"S
Longitude (D°M'S")	31°32'17.59"E



Figure 37: Site of intervention X31M-01-205-00


6.7.5.1 Bill of quantities: X31M-01-205-00

	Units	Quantity	Unit Cost	Item Cost
Earth Berms	m ³	24	340	R 8 160
Total				R 8 160

6.7.5.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

6.7.6 Intervention: X31M-01-206-00

Intervention Description	Road maintenance and brush packing
Rehabilitation Objective	Re-route the existing road away from sensitive sodic areas and encourage re-growth of vegetation
Latitude (D°M'S")	25°1'40.67"S
Longitude (D°M'S")	31°31'30.56"E
	
Figure 38: Site of intervention X31M-01-206-00	

6.7.6.1 Bill of quantities: X31M-01-206-00

	Units	Quantity	Unit Cost	Item Cost
Road maintenance	m ²	750	250	R 187 500
Brush packing	m ²	660	30	R 19 800
Total				R 207 300

6.7.6.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Re-routing of the road may not commence until all members of the implementation team have received training from the KNP Ecologist to prevent potential destabilization of the surrounding landscape.

Note: *The re-routed section of the N'waswitshaka Road would consist of a vehicle track that does not require any earth works (i.e. no clearing of vegetation). It would however require shrubs and small trees to be cut back.*

Note that when brush packing:

- In-situ material can be used in order to avoid transport costs;
- Alien plants should not be used for this purpose;
- Brush is to be evenly spread so as not to concentrate the water flow;
- Stacking must be a minimum of 50 cm high, and

Branches must interlock in order to form a dense cover.

6.7.7 Intervention: X31M-01-207-00

Intervention Description	Re-vegetation
Rehabilitation Objective	Stabilise disturbed area
Latitude (D°M'S")	25°2'22.36"S
Longitude (D°M'S")	31°31'1.58"E



Figure 39: Site of intervention X31M-01-207-00

6.7.7.1 Bill of quantities: X31M-01-207-00

	Units	Quantity	Unit Cost	Item Cost
Re-vegetation	m ³	50	30	R 1 500
Total				R 1 500

6.7.7.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Where it is necessary to re-vegetate, in-situ grass species and local Cypress tufts should be used. In wetter areas *Phragmites spp.* (locally indigenous) may be planted. *Local seed should be harvested and sown* to facilitate regrowth by producing a much needed first cover.

6.7.8 Intervention: X31M-01-208-00

Intervention Description	Sediment trapping using brush packing, logs and relocating mitre drains.
Rehabilitation Objective	Stabilise eroded areas and direct water run-off to controlled areas
Latitude (D°M'S")	25°2'4.29"S
Longitude (D°M'S")	31°30'9.12"E



Figure 40: Site of intervention X31M-01-208-00

6.7.8.1 Bill of quantities: X31M-01-208-00

	Units	Quantity	Unit Cost	Item Cost
Earth berms	m ³	9	250	R 2 250
Logs	m ³	36	75	R 2 700
Brush packing	m ³	72	30	R 2 160
Total				R 7 110

6.7.8.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

6.7.9 Intervention: X31M-01-209-00

Intervention Description	Rock packs to trap sediment
Rehabilitation Objective	Direct water away from the erosion gully, trap sediment and enhance vegetation
Latitude (D°M'S")	25°1'8.72"S
Longitude (D°M'S")	31°29'13.37"E



Figure 41: Site of intervention X31M-01-209-00

6.7.9.1 Bill of quantities: X31M-01-209-00

	Units	Quantity	Unit Cost	Item Cost
Earth berms	m ³	5.7	250	R 1 425
Rock packs	m ³	2.7	600	R 1 620
Total				R 3045

6.7.9.2 Construction Notes

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

6.9 Construction Environmental Management Plan issues

The proposed rehabilitation is to be undertaken on SANParks 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**.

6.10 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.

6.11 Baseline M&E data

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

6.11.1 Erosion problems

The erosional features within the wetland are generally limited to channel incision along the road and within sodic patches and as such should be monitored specifically by SANParks to ensure that rehabilitation interventions are successful.

7 SILOLWENI DAM – X40D-01

7.1 Wetland details

The Silolweni wetland is located in quaternary catchment X40D (**Figure 8**) in the KNP. The assessment of the Silolweni wetland (X40D-01), its problems and the development of the rehabilitation objectives are described in detail in **Appendix A: Wetland Status Quo Report**.

The catchment of the Silolweni dam (X40D) falls entirely within the Park and is thus of importance in terms of biodiversity conservation and eco-tourism. The river feeding into the Silolweni dam originates within the Park and is thus an important internal water source as it is not exposed to impacts from land-uses outside of the conservation area. Water sources such as these are becoming more significant as Park authorities remove the artificial waterholes. This wetland is thus deemed significant and has been selected for rehabilitation.

The Silolweni Dam (**Table 16**) was constructed in a water course as a waterhole for wildlife in line with the previous water point policy of the KNP. Although this is a relatively small catchment area, it has held water for a large part of the year and has served as a water point for animals and also as a tourist attraction. The dam wall has been partially breached by conservation authorities of KNP due to the occurrence of a deadly fungal disease. The main source of the dam is a drainage channel and the outflow is into the N'waswitshaka River which exits the Park at the Shishengedzina ranger post and flows into Mozambique.

Table 16: Summary of the wetland details

Wetland Name	Silolweni Vlei
Wetland Number	X40B-01
River System Name	Tributary of the N'waswitshaka River
Land Use in Catchment	Conservation
Land Use in Wetland	Conservation (the dam was built as a water point for the game)
No. of Properties Intersecting Wetland Area	1
Date of Planning Site Visit	11 September 2013
Wetland Assessor(s)	Piet Louis Grundling and Marius Snyders
Wetland size	18 ha

7.2 Site photos



Picture showing the breach in the Silolweni Dam wall

An erosion gully downstream of the breach



Working for Land team widening the existing breached area

Figure 42: Site Photos of the Silolweni Wetland (Courtesy: Piet-Louis Grundling)

7.3 Wetland problems

The main impacts to this wetland unit are associated with the incomplete breaching of the dam wall. Channelling the water through this breach has resulted in erosion both up-stream and down-stream. Other less significant but noticeable impacts include:

- Sediment deposition downstream due to increased flow concentration
- Gulley erosion due to increased flow concentration.

7.4 Rehabilitation objectives

The main objectives of the rehabilitation in this wetland are to re-instate more natural water distribution and retention patterns in order to improve the hydrological functioning of the wetland and the associated condition of the wetland vegetation and the condition of the associated wetland system. In addition, rehabilitation strategies will aim to prevent erosion by reducing the flow concentration.

7.5 Summary proposed interventions

Table 17 provides a summary of the proposed 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.

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

Table 17: Summary of proposed new interventions, X40D-01

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
X40D-01-201-00	Earthworks	1	13	R 2 200 000
Total				R 2 200 000

7.6 Design selection and sizing

The objective of the intervention is to deactivate a drain that has formed at the opening of the breached dam and spread the water across the wetland in a natural flow pattern. Also, the removal of an artificial waterpoint in line with the SANParks review of the waterpoint policy and in line with wetland conservation objectives. The most appropriate and cost effective method of doing this was considered to involve the removal of the remainder of the dam wall to promote the flow of water into the wetland.

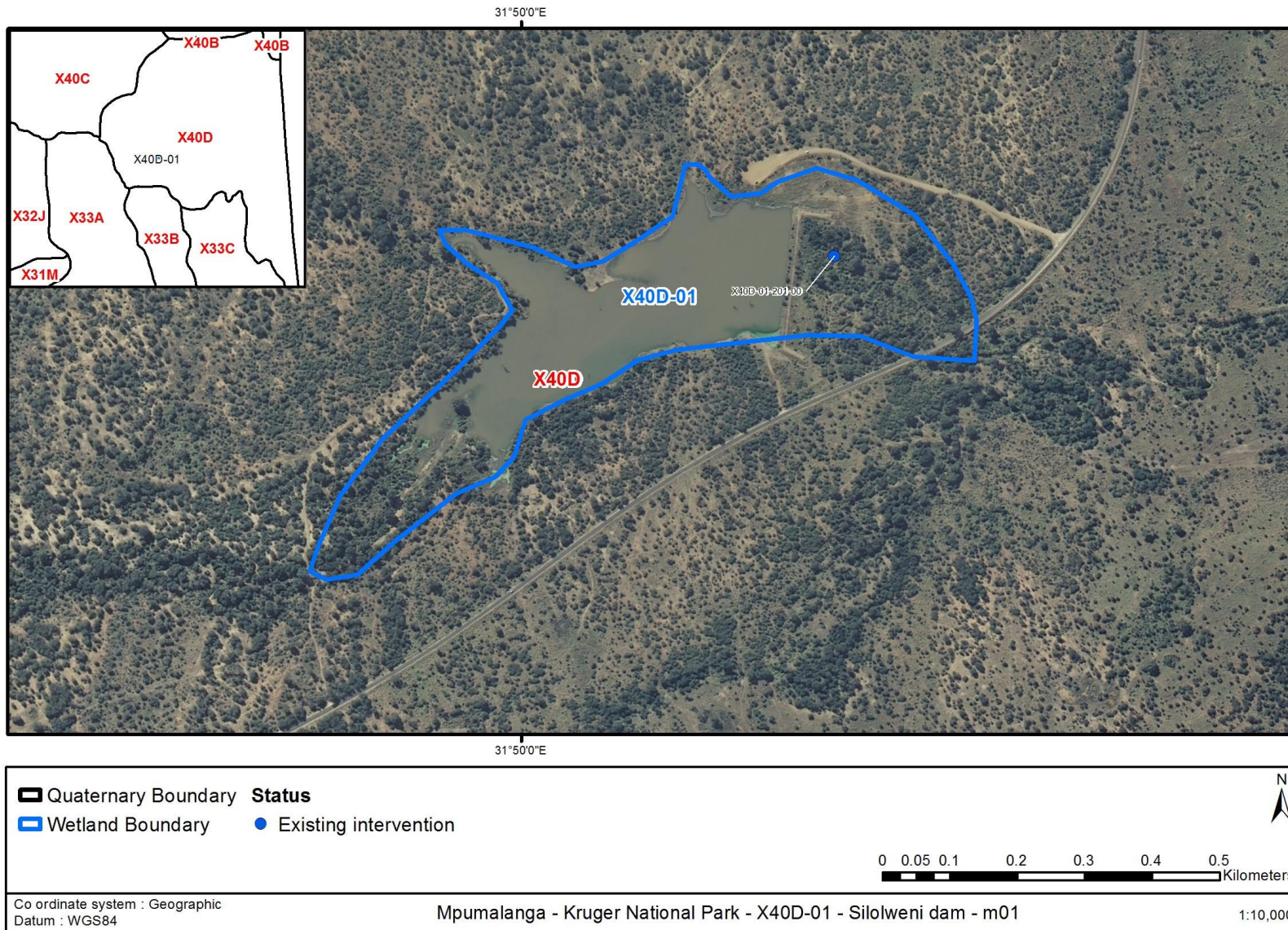


Figure 43: Wetland map, X40D-01 with proposed new wetland interventions indicated.

7.7 Intervention designs

7.7.1 Intervention: X40D-01-201-00

Intervention Description	Breaching of Dam wall
Rehabilitation Objective	Remove earth dam and encourage natural flow of water across floodplain.
Latitude (D°M'S")	24° 49' 26.06"
Longitude (D°M'S")	31° 50' 07.02"



Figure 44: Intervention X40D-01-201-00

7.7.1.1 Bill of quantities: X40D-01-201-00

Item	Units	Quantity	Unit Cost	Item Cost
Breaching of dam wall	m ³	5600	R 392.86	R 2 200 000
Total				R 2 200 000

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. The implementation of this intervention must also take into account all relevant provisions of WfWetlands Best Management Practices.

Soil removed from the berm must be used for the infilling of erosion drains that have formed in the dam basin and downstream thereof.

7.8 Construction Environmental Management Plan issues

The proposed rehabilitation is to be undertaken on SANParks 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 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
X40D-01	18	7.0	1	1.4	1	4.4	2
PES Categories		E	↑	B	↑	D	↑↑
Wetland Impact Score		4.8					
Wetland PES		D					