APPENDIX A – WETLAND ASSESSMENT REPORTS

ASSESSMENT OF WETLAND HABITAT TO INFORM WORKING FOR WETLAND'S PHASE 2 REHABILITATION PLANNING PROCESS.

DRAFT FOR REVIEW

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Project: Wakkerstroom
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Wetland Name: W42C-02
Assessment Date: 1 October 2012

1. Introduction

Specialist input was required as a component of the rehabilitation planning process undertaken by Aurecon South Africa (Pty) Ltd on behalf of the South African National Biodiversity Institute's (SANBI) Working for Wetland's (WfWet) Programme. GroundTruth was appointed to undertake the required assessments of the present ecological state and the ecosystem services supplied, for those wetland systems in the Mpumalanga province projects. These assessments assist in providing a baseline assessment that serves to inform planning and monitoring of the system by:

- identifying the current impacts and threats to the wetland system;
- predicting the levels of loss linked to the continued degradation of the system if interventions are not implemented;
- predicting the contribution of the proposed rehabilitation strategy in terms of improving the wetland functioning and health; and
- evaluating the cost-effectiveness or 'return on investment' of the proposed rehabilitation against the improvement of the identified wetland's functioning and health.

The approach and results from the assessment of the **W42C-02** wetland system within the **Wakkerstroom Project** are outlined in this report.

2. Background Information

The Wakkerstroom wetland rehabilitation project comprises of two current project sites, namely Goedgevonden farm and Paardeplaats Nature Reserve (PNR). Both project sites are located in the W42C quaternary catchment, near the towns of Wakkerstroom and Luneburg. The rehabilitation planning focuses on those portions of the W42C quaternary catchment within Mpumalanga province. The 2012 planning season for this project is a continuation of existing work already identified and implemented within this catchment.

Wetland W42C-01, on the Goedgevonden farm, was generally considered to be the most appropriate candidate for rehabilitation based on the size of the HGM unit, its biodiversity value in terms of peatland habitat and Wattled Crane nesting site, and its position in the landscape. However due to the requirement for labour intensive rehabilitation interventions, additional wetlands needed to be assessed, with PNR being identified as an appropriate candidate for labour-intensive rehabilitation, and terrestrial land management of benefit to freshwater ecosystems. Earthworks and earth structures primarily, would be required to address the identified impacts and effectively enhance management of the reserve.

A review of the Mpumalanga Biodiversity Conservation Plan (MBCP) highlights that seepage wetland W42C-02 falls within a zone that is considered to be ‘critically endangered’ and ‘moderately protected’ in terms of its contribution towards aquatic biodiversity. The rehabilitation of the wetland systems within this area is therefore likely to contribute towards the maintenance of the biodiversity within the region. The W42C catchment is characterised by 1016mm of annual precipitation and in excess of 1813mm of evapotranspiration. This suggests that the wetlands within the catchment are likely to be moderately susceptible to alterations of water inputs in the wetlands' catchments.

3. Methodology

The following methodology was adopted for the study and comprised of multiple steps, which relies on the information generated during previous components of the rehabilitation planning.

3.1 Mapping of the Wetland Boundary and Features

It is necessary at the outset to have an approximation of the size of the wetland to be rehabilitated. In this case the wetland mapping was undertaken at a desktop level using available aerial imagery and contour data. During the site visit, infield sample points were collected using a Trimble Geo XT Global Positioning System (GPS) to inform the production of a spatial coverage of the impacts on the wetland and features within the system. This information was then used in the rehabilitation planning process to calculate impacted areas and those potentially affected by the rehabilitation activities.

3.2 Assessments of Current and Post-Rehabilitation Scenarios

The assessment of the wetland system for the WfWet rehabilitation planning process was based on the 'Rapid WET-Tools' assessment technique, developed and refined in conjunction with the authors of:

- WET-EcoServices (Kotze *et al*, 2007); and
- WET-Health (Macfarlane *et al*, 2007)

This modified approach for assessing the functioning and integrity of the system comprises of the following steps:

- Description of the hydrogeomorphic setting of the wetland;
- Description of the specific benefits and services that will be improved by the proposed rehabilitation;
- Description of the overall health of the wetland at a Level 1 using WET-Health; and
- Identification of specific impacts and/or threats to be addressed by rehabilitation and description of these at a Level 2 using WET-Health, such as, the impacts on the system associated with drainage canals.

In accordance with requirements of the Department of Water Affairs, an assessment of the wetlands' importance and sensitivity was undertaken using the assessment framework developed by Rountree & Malan (2010).

These assessment techniques serve to:

- illustrate the anticipated improvement in the provision of wetland goods and services under the hypothetical rehabilitated conditions brought about by the implementation of the rehabilitation plan;
- provide a description of the systems' importance and sensitivity under the current land-use scenario; and
- provide a description of the systems' ecological integrity under the current land-use scenario and establish a baseline with which the wetland hectare-equivalents gained by the rehabilitation of the system could be compared to those that would be lost with the continued degradation of the system.

The results of these assessments were used to inform the subsequent rehabilitation planning process, set the rehabilitation objectives and choose the appropriate measures to achieve these objectives.

4. Assumptions and Limitations

Studies that focus on the interpretation of future scenarios rely on various assumptions, with the following assumptions being made during the assessment of this particular wetland system:

- The reference/benchmark vegetation of the wetland was considered to be sedge meadow, based on the vegetation composition of the adjacent intact portions of wetland.
- The recovery of the wetland vegetation within the system under anticipated rehabilitated conditions was expected to follow a pattern of succession with ruderal pioneer species first colonising the site and being replaced over a period of time by a more perennial, stable plant community. For this reason a lag period of three years was adopted to illustrate the medium-term impacts on vegetation following the hypothetical rehabilitation of the site.
- An alien plant control programme would be implemented and maintained within the wetlands and their catchments; and
- The importance of the wetland within the landscape would be enhanced by improved management adopted by the landowner or manager.

Limitations and uncertainties often exist within the approaches and techniques used to assess the condition of natural systems, with the following limitations applying to the studies undertaken for this report:

- The extent of the hydrogeomorphic unit was derived from aerial imagery, with limited infield verification, and the accuracy of the derived information is limited.
- The actual response of the system to the proposed rehabilitation may vary from the anticipated conditions due to the dynamic nature of wetland ecosystems within the landscape;
- The assessment techniques used in this study were limited by time and budgetary constraints applicable to the type and level of survey undertaken. Generally, the studies undertaken would be classified as rapid studies with moderate confidence values recorded for the various criteria assessed. GroundTruth therefore reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.

5. Results

The hydrogeomorphic setting of the wetland unit is a hillslope seep feeding a water course fed by water inputs from hillslope processes and sub-surface water (**Figure 5-1**). The system is approximately 0.61ha in extent and has an estimated length of 130m. The wetland occurs within a conservation area that was historically used for agricultural production and the wetland's catchment is characterized by natural veld, but there are areas of alien invasive vegetation and cultivated fields. The system has been subjected to a number of impacts associated with modifications of the system's hydrology, including drainage canals.

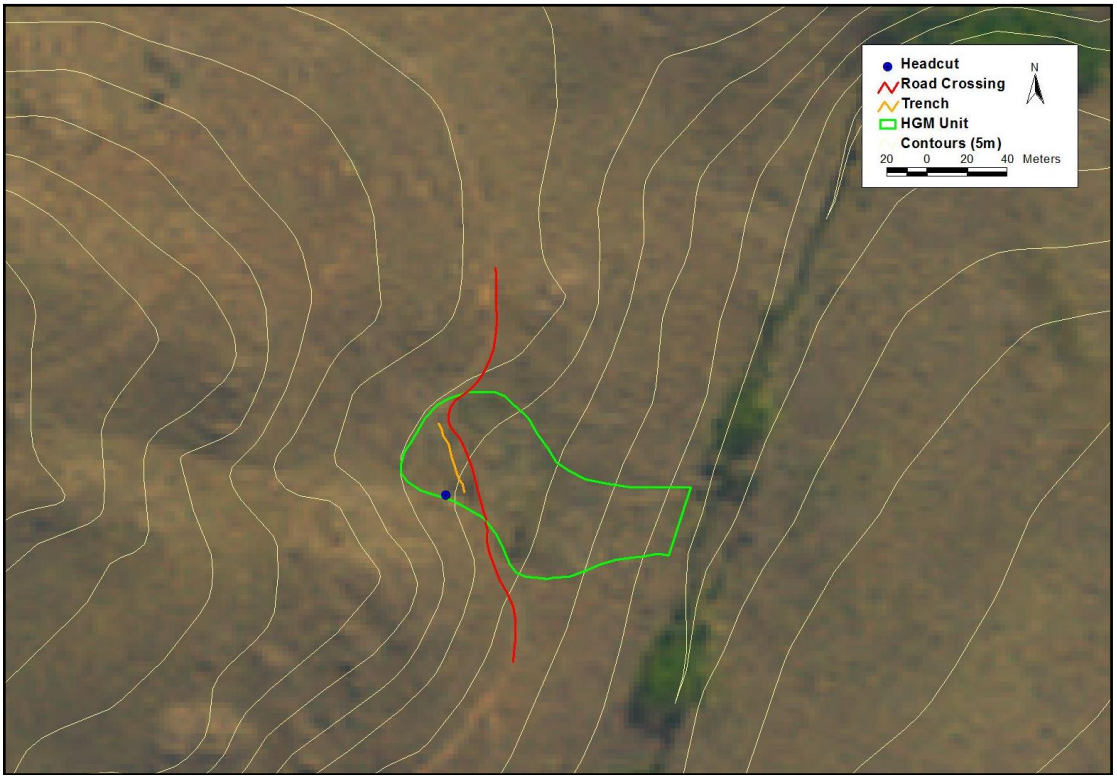

Figure 5-1. View of the W42C-02 wetland

5.1 Wetland Importance and Sensitivity

The assessment of the wetland's importance and sensitivity (**Table 5-1**) suggests that the wetland is contributing towards supporting biodiversity, which is linked to the presence of Wattled Crane in the vicinity. The nature of the system, in terms of being supplied by sub-surface flow, reduces the system's sensitivity to alterations and the likelihood of high levels of services linked to water quantity and quality, with the exception of stream flow regulation, as it is connected to the stream network. The system does provide a level of direct benefits, primarily linked to water and grazing resources.

Table 5-1. Importance and sensitivity of the wetland

	Importance*
Ecological importance & sensitivity	2.0
Hydro-functional importance	1.1
Direct human benefits	0.8

*measured on a scale of None (0) to Very High (4).

In terms of assessing the potential improved benefits and services as a result of the planned rehabilitation, it is anticipated that the rehabilitation of the system is likely to result in improved levels of ecosystem delivery for water quantity and biodiversity within the landscape. It is evident from the current use of the system that the wetland would be important in terms of the direct utilisation of grazing resources within the wetland.

Table 5-2. Anticipated improvement in ecosystem services due to the rehabilitation activities

	Score	**Comments**
Flood attenuation	*No Effect Anticipated*	Slope of the system limits its effectiveness in terms of flood attenuation, which will be unaffected by the rehabilitation activities.
Stream flow regulation	*Slight Positive Effect Anticipated*	The deactivation of the trench will promote an increase in the retention time of water in the system extending the period of time that base flows enter the downstream valley bottom system
Sediment trapping	*No Effect Anticipated*	The lack of identifiable sources of sediments limits the system opportunity to provide this benefit within the landscape.
Phosphate trapping	*No Effect Anticipated*	The lack of identifiable sources of nutrients and toxicants limits the system opportunity to provide this benefit within the landscape.
Nitrate removal	*No Effect Anticipated*	The lack of identifiable sources of nutrients and toxicants limits the system opportunity to provide this benefit within the landscape.
Toxicant removal	*No Effect Anticipated*	The lack of significant sources of toxicants limits the system opportunity to provide this benefit within the landscape.
Erosion control	*Positive Effect Anticipated*	The trench and headcut and the road crossing pose a risk to the erosion control within the system. Interventions addressing these problems are likely to improve erosion control.
Carbon storage	*Slight Positive Effect Anticipated*	The protection of portions of the wetland, especially the seasonal wetness zones, is anticipated to provide more effective carbon storage in these areas. .
Maintenance of biodiversity	*Slight Positive Effect Anticipated*	The protection of portions of the wetland, especially the various wetness zones, is anticipated to provide more habitat variability in the area for wetland dependant species
Water supply for human use	*No Effect Anticipated*	The water in the system will not be utilised directly by humans.

Table 5-2 (cont.) Anticipated improvement in ecosystem services due to the rehabilitation activities

	Score	Comments
Natural resources	*Slight Negative Effect Anticipated*	The wetland will be protected from cattle, limiting the damage done to the system, but reducing the provision of grazing resources
Cultivated foods	*No Effect Anticipated*	The system is not used for crop production and is unlikely to be improved by the proposed rehabilitation.
Cultural significance	*No Effect Anticipated*	There was no evidence that the system is used for by local community for cultural practices.
Tourism and recreation	*No Effect Anticipated*	The system may provide this ecosystem service within the landscape in future, being a reserve, but is unlikely to be improved by the proposed rehabilitation.
Education and research	*No Effect Anticipated*	The system is unlikely to provide this ecosystem service within the landscape

5.2 Wetland Health Assessment

When considering the wetland system's integrity it is important to consider the levels of integrity of each of the ecological components:

- Hydrology;
- Geomorphology; and
- Vegetation.

The integrity of the ecological and biophysical drivers of the wetland was assessed for the current scenario.

Table 5-3. Summary of the present health of the wetland based on the impact score

Wetland No	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
W42C-02	0.61	100	3.0	-1	0.9	-1	1.9	0
PES Categories			**C**	→	**A**	→	**B**	→
Wetland Impact Score			**2.09**					
Wetland PES*			**C**					

*Present Ecological State categories used to define health of wetlands (MacFarlane *et al*, 2007)

Description	Impact score	Present State Category
Unmodified, natural.	0 – 0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1 – 1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 – 3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4 – 5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10	F

5.2.1 Hydrology

The hydrological integrity of the wetland is moderately modified, with impacts recorded as a result of the trench and road in the upper reaches of the system. This has resulted in the alteration of flow characteristics over a portion of the wetland, also resulting in changes in surface roughness. Generally, the system is fed by sub-surface flow and is therefore relatively robust in terms of the impacts of the road and trench.

5.2.2 Geomorphology

The geomorphology of the wetland is considered to be largely unmodified, which is attributed to the fact that the position of the headcut within the system is such that it does not affect a large percentage of the area of the seep. The prevalence of rock near the soil surface and across portions of the wetland, suggests that the system is well protected against erosion with geological control points throughout its length.

5.2.3 Vegetation

The changes to the system's hydrology has resulted in areas of the wetland becoming desiccated and dominated by terrestrial plant species, while other areas have become dominated by species favouring disturbance. The transformation of the vegetation is limited to the upper portions of the wetland where the most historical disturbance has taken place.

5.3 Wetland Rehabilitation

The following section serves to describe the rehabilitation of the wetland, including the problems to be addressed and the objectives, which attempt to maximise the increase in the levels of system functioning and integrity.

5.3.1 Wetland Problems

The biophysical drivers of the wetland have been impacted upon by historical activities, including *inter alia*:

- construction of an access road through the wetland;
- the diversion of flow by a trench adjacent to the road; and
- partial flooding or impoundment of flow by the existing road.

The upper portion of the wetland has been subjected to a number of impacts associated with the modification of the system's hydrology, which was likely to have been initiated to allow access across the wetland (Figure 5-2). The problems identified within the wetland system can be addressed with the implementation of rehabilitation activities, which would include the deactivation of the headcut and trench, and the installation of concrete road strips.

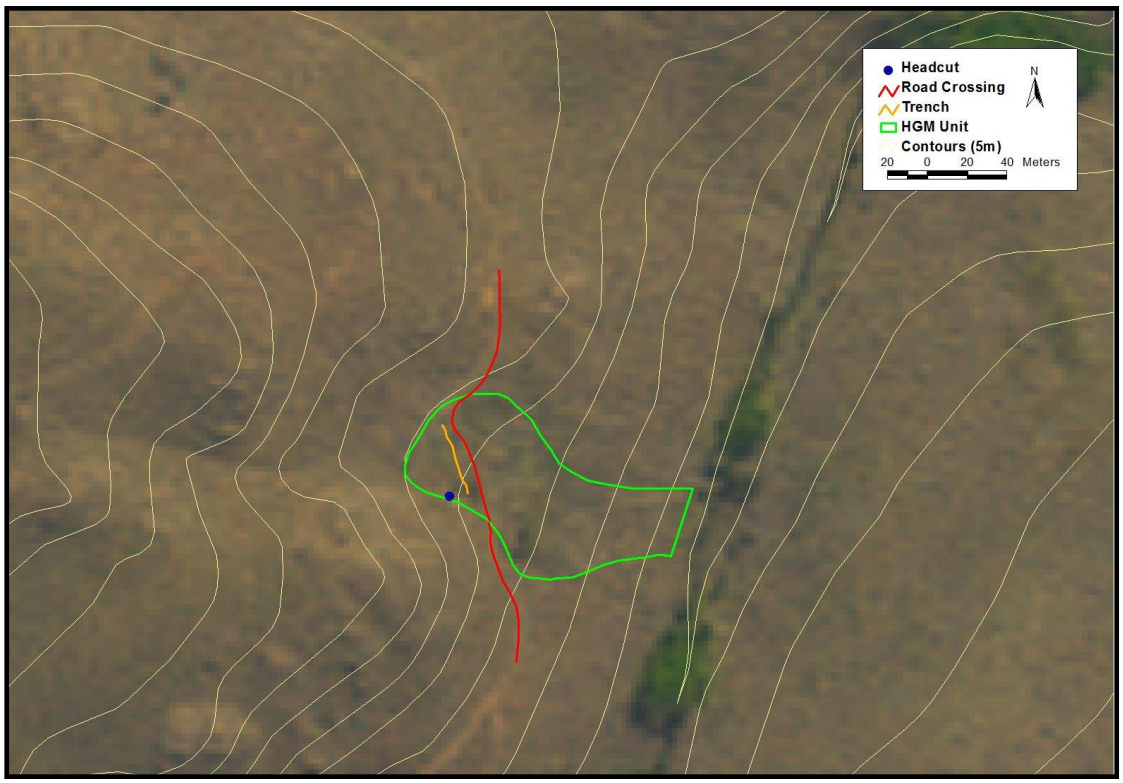

Figure 5-2. View of the problems identified within the HGM unit

5.3.2 Wetland Rehabilitation Objectives

With the implementation of wetland rehabilitation it is important to set aims and objectives for the planned rehabilitation in accordance with WET-RehabPlan (Kotze *et al*, 2009). Based on the assessment of the ecological services supplied by the system, the level of service delivery and system integrity is likely to improve with the promotion of diffuse flow within the wetland.

Objective:
The primary objectives of the rehabilitation are as follows:

- reduce the threat to the seep/wetland area by headcut erosion;
- promote diffuse flow;
- reduce further impacts from the road; and
- protect the wetland from cattle using it as a water point.

5.3.3 Wetland Rehabilitation Strategy

Based on the observation that the functioning and integrity of the wetland system would improve by deactivating the diversions of flow through the system and promoting diffuse flow, the rehabilitation activities would adopt the following approaches.
Interventions:

- to reduce the threat to the seep/wetland area by stabilising the headcut erosion;
- to promote diffuse flow by deactivating a drainage ditch adjacent to the road;
- to reduce further impacts from the road using formalised concrete road strips; and
- to protect the wetland by fencing off the area from cattle using it as a water point.

5.3.4 Effect and Cost-effectiveness of the Proposed Rehabilitation Strategy

The assessment of the wetland for both the current and rehabilitated scenarios highlighted that with the implementation of the rehabilitation strategy it is anticipated that the ecological integrity of the system would improve from a '**C**' to an '**A**' ecological category (**Table 5-2**).

Table 5-4. Ecological Integrity of the wetland system for the assessed scenarios

		Status Quo	With Rehabilitation
Size of wetland (Ha)		0.61	0.61
Impact Scores	**Hydrology**	3.0	1.0
	Geomorphology	0.9	0.5
	Vegetation	1.9	1.7
	Overall Composite Score (3:2:2 Ratio)	2.09	1.06
Ecological Category		**C**	**B**

This improvement in ecological integrity translates into a gain of **0.07 hectare equivalents** within the landscape (**Table 5-5**). With the estimated cost of the rehabilitation within the wetland being **R 721 653** the cost-effectiveness is considered to be '**Low**'. However, the rehabilitation does fall within a nature reserve that is considered to be 'critically endangered' in terms of biodiversity according to the MBCP, and the interventions are geared towards assisting with the improved management of the reserve as a whole by providing stable access that has minimal impacts on sensitive areas, such as wetlands. The rehabilitation

would also serve to improve the nature of flows into the main valley-bottom wetland, which is not taken into consideration in this assessment.

Table 5-5. Evaluation of the expected cost-effectiveness of the rehabilitation strategy

Estimated Cost of planned interventions	R 721 653
Hectare/Functional Equivalents of Wetland Habitat	
Future scenario with no intervention/s	0.48
Future scenario with intervention/s	0.55
Hectare/Functional Equivalents Gained	0.07
Cost per Hectare/Functional Equivalent	R 7 216 530
Cost-effectiveness*	**Low**
Anticipated Maintenance Requirements	**Low**

*Cost-effectiveness of rehabilitation (Kotze *et al*, 2009)

Cost of rehab interventions per hectare of re-instated/ secured intact wetland	**Likely cost effectiveness**
< R50 000 per ha	The cost effectiveness of the project is likely to be high.
R50 000 - R150 000 per ha	The cost effectiveness of the project is likely to be intermediate to high.
R150 001 - 300 000 per ha	The cost effectiveness of the project is likely to be moderate but can be justified if returns in terms of ecosystem system delivery are moderate to high.
R300 001 - 500 000 per ha	The cost effectiveness of the project is likely to be low to intermediate, but can be justified if benefits are high. Therefore, benefits would need to be well justified.
>R500 000 per ha	The cost effectiveness of the project is likely to be low. Such a project would need to be extremely well motivated such that it could only be justified if benefits are exceptionally high.

6. References

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