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Dr. Gwen Theron
PrLArch No 97082

Landscape Architect
Environmental Planner

Imbrilinx cc 2010/089810/23

P.O. Box 13185
Hatfield 0028

FAX: 086 606 6130
012 343 2751
083 302 2116

gwen.theron@telkomsa.net



December 2015

**CLAYVILE X50 SITUATED ON THE REMAINDER OF
PORTION 183, PORTION 30 AND PORTION 31 OF THE
FARM OLIFANTSFONTEIN 410 J.R
GAUT 002/14-15/0098**

AND

**CLAYVILE X71, X76, X77, X78, X79 AND X80 SITUATED
ON PORTION 207 (A PORTION OF PORTION 183) OF
THE FARM OLIFANTSFONTEIN 410 J.R
GAUT 002/14-15/0097**

Wetland and watercourse Rehabilitation and Management Plan



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1. INTRODUCTION

The purpose of the Rehabilitation and Management plan is to guide the management, maintenance and enhancement of the ecological attributes of wetland, watercourse and open space areas associated with the development of Clayville X50, X71, X76, X77, X78, X79 and X80. Suitable rehabilitation measures are also provided in order to ensure the ongoing ecological function and socio-economic service provision of the hillslope seepage wetland system and the section of the Glen Austin Pan and other Pans being affected by the construction activities relating to Clayville X50, X71, X76, X77, X78, X79 and X80.

The purpose of a Wetland and watercourse Management Plan is to guide the rehabilitation work within and adjacent to the sensitive areas on site.

The plans are flexible to be adapted where necessary and to address issues that may arise during the construction phase.

Objectives;

The purpose of this document is to

- guide the management of the ecological attributes of the hillslope seepage wetland and the section of the Glen Austin Pan being affected by the construction of Clayville X50, X71, X76, X77, X78, X79 and X80, as well as
- provide remedial measures that had deteriorated during the various phases of construction.
- suitable rehabilitation measures are provided in order to facilitate the ongoing ecological functioning of the wetland, pan and associated open space features.

2. DOCUMENTATION CONSULTED

The following reference material was considered during the development of the addendum to the rehabilitation and open space management plan:

- Wetland delineation and assessment by Wetland Consulting Servies
- Wetland delineation and assessment completed by Limosella Consulting
- National Environmental Management Act (1998) (NEMA and related EIA regulations;
- National Water Act (Act 36 of 1998)
- National Environmental Management: Biodiversity Act (2004)
- Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983)
- National Heritage Resources Act (1999); and
- The Convention on Biological Diversity (1995)
- Other general stream rehabilitation mitigation and management guidelines.

3. REHABILITATION MANAGEMENT PLAN

This Rehabilitation and Management Plan is designed to manage maintain and improve the Present Ecological State of the Hillslope Seepage wetland as well as the section of the Glen Austin Pan and other pans that are affected by the construction of Clayville X50, X71, X76, X77, X78, X79 and X80. It also contains rehabilitation guidelines for areas which are disturbed by construction or other activities, with specific mention of the wetland zones.

3.1. Rehabilitation objectives

The objectives of this plan are to:

- Ensure as far as is practicable that the measures contained in the report are implemented;
- Manage activities on the study area in order to maintain and improve ecological integrity of the study area;
- Minimise adverse impacts on the environment;
- Minimise impacts on the receiving environment;
- Maximise the service provision of open space areas and especially the wetland areas;
- Maximise the ecological functioning of the open space areas, wetland system and green belts and;
- Monitor the impact of the project on the receiving environment.

3.2. Rehabilitation context

This Rehabilitation plan fits into the overall planning process of the proposed development activities and should be implemented by the proponent as soon as the authorities have granted development rights. It serves as a management plan to manage the ecological characteristics of the study area during construction and during the operational phase of the proposed development.

3.3. Monitoring of the Rehabilitation

During construction, the monitoring of the Rehabilitation will be part of the activities of the Environmental Control Officer (ECO).

3.4. Roles and responsibilities

The developer will be responsible for the appointment of the Environmental Control Officer and relevant specialists and contractors to perform alien removal and control, rehabilitation and monitoring activities.

Construction Phase

- The environmental officer will ensure that the contractor and all subcontractors are aware of all the specifications pertaining to the project;
- Any damage to the environment will be repaired as soon as possible after consultation between the environmental officer, Consulting Engineer and Contractor;
- The environmental officer will ensure that the project staff and/or contractor are adhering to all stipulations of the Rehabilitation Management Plan;
- The environmental officer will be responsible for monitoring the rehabilitation throughout the project by means of site visits and meetings. All site visits and meetings will be documented as part of the site meeting minutes which will be made available for inspection at any time;
- The environmental officer will ensure that all clean up and rehabilitation or any remedial actions required are completed swiftly as and when required.

Operational Phase

- During the operational phase, the Johannesburg Roads Authority or similar body which presides over the administration of the proposed development will be responsible for the implementation and maintenance of the rehabilitation plan and management thereof.

3.5. Mitigation and management

This area has seen some significant impact from past activities in the area, as well as some recent impacts due to agriculture, grazing, sand mining and earthmoving activities. These impacts have affected the structure and function of the wetland environment and could lead to degradation of the system if they are not suitably managed.

The section below will define and describe the various environmental impacts affecting the integrity of the wetland areas. Associated with each impact, the proposed management and mitigation measures will be presented. The management and rehabilitation measures presented below should be consulted and implemented along with the conditions included in the rehabilitation plan.

The section below serves to describe and explain the management measures deemed necessary to effectively manage maintain and improve the ecological characteristics of the study area and functioning of the hillslope seepage wetland and the section of the Glen Austin Pan affected by the construction of Clayville X50, X71, X76, X77, X78, X79 and X80

3.6. Methods to ensure connectivity to biodiversity corridors

Culverts at least 500mm high and 500mm wide must be installed underneath roads crossing the biodiversity corridors to serve as migration tunnels for giant bullfrogs and other small faunal species.

Along the K109 where the road crossing the open space area is wide grates allowing light to pass through must be placed in the median between the lanes and culverts to ensure that enough light is provided.

This must be completed in conjunction with an amphibian specialist and the Gauteng Department of Agriculture and Rural Development during the construction phase.



Figure 1: Examples of culverts to allow amphibians and small faunal species to cross roads

4. REHABILITATION AND MANAGEMENT MEASURES TO BE TAKEN

4.1. Re-vegetation

One of the goals of the Rehabilitation and Management Plan improve the biodiversity of the hillslope seepage wetland and the Glen Austin Pan affected by the construction of Clayville X50, X71, X76, X77, X78, X79 and X80 and thus the natural occurring vegetation in the area that has been lost has to be replaced. The re-vegetation of these areas may only be done using indigenous/endemic species. The final rehabilitated landscape must include green space areas and methods for sediment control and must also integrate flora and fauna indigenous to the area.

The following measures must be implemented for the successful re-vegetation and stabilisation of the wetland and pan areas will require:

- **The use of acceptable fill materials:**

It is important that the site is correctly prepared to enable plant establishment and survival. Locally sourced topsoil must be used as far as possible. The topsoil used must be certified weed free.

- **Correct site preparation:**

It is important that the site is correctly prepared to enable plant establishment and survival. All areas which have been compacted must be ripped prior to being rehabilitated and re-vegetated.

All surfaces areas that are susceptible to erosion, such as areas steeper than 2:1, must be protected by cladding with biodegradable material (erosion control blankets), which provides soil surface stabilisation and protection from erosion while the vegetation establishes.

Silt fences must also be installed to control sediment and other debris from the construction areas and to protect water quality in the stream situated along the eastern boundary of the site, from sediment in storm water run-off where soil is being disturbed during the rehabilitation process.



Figure 2: An example of a silt fence to control sediment and other debris

Straw bales must be placed and adequately secured on all downhill locations where erosion may occur to prevent washouts and to retain siltation and topsoil from the site.



Figure 3: Straw bales must be placed tightly against each other on downhill locations where erosion may occur

Erosion berms must be installed to prevent gully formation and siltation. The following points should serve to guide the placement of the erosion berms:

- Where the track has slope of less than 2%, berms every 50m should be installed.

- Where the track slopes between 2% and 10%, berms every 25m should be installed.
- Where the track slopes between 10% and 15%, berms every 20m should be installed.
- Where the track has slope greater than 15%, berms every 10m should be installed.

Adequate storm water management according to the stormwater management plan prepared by Bigen Africa must be incorporated into the management of the construction site and completed development in order to prevent erosion. Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed. Runoff from paved surfaces should be slowed down by the strategic placement of berms.

- **Schedule in respect of re-vegetation**

The establishment of vegetation is subject to weather conditions and it is important to schedule the re-vegetation, as far as possible, to occur in the most favourable growing seasons, in order to avoid soil erosion and to ensure that the rehabilitation of the private open space area occurs optimally. Reseeding must preferably take place during rainy season (Sept – March).

- **Appropriate species selection and appropriate sowing rates and species Proportions:**

The re-vegetation must be done using only indigenous/endemic species to the area. It is proposed that a company known as Thabakholo, Environmental Solutions, who specialises in environmental restoration be contacted, to assist in obtaining the correct seed mixtures and proportions for the re-vegetation of the area.

It is proposed that the grass species *Cynodon dactylon* (Couch grass) be used as grass cover. *Pennisetum clandestinum* (Kikuyu grass) must NOT be used. It is also strongly recommended that indigenous trees be planted in order to improve the overall ecological state of the development and surrounding areas, and provide habitat for faunal species and an improved micro-climate in the open space systems

- **Selection of the most suitable establishment technique:**

Where possible, the surface will be harrowed immediately after the seed and fertiliser have been applied and where native species are included in the seed mix, the harrowing will be undertaken first.



Figure 4: Example of a surface being harrowed

Soil must be added to the seed mix to assist in achieving an even spread. The areas which have not been satisfactory re-vegetated must be investigated to determine the reason for the failure and the appropriate remedial actions must be taken to replace any lost topsoil

- **Application of soil ameliorants and fertilizers to promote establishment and growth:**
The re-vegetated area must be monitored on a regular basis and if required fertilizers and soil ameliorants must be added to supplement minerals in the soil and promote establishment and growth.

- **Management and control of Alien Plant Vegetation and weeds:**
Alien plant removal is to take place manually on the site. Before any re-seeding of re-profiled areas takes place, alien and invasive species must be removed.

It must also be insured that any topsoil, subsoil and seed mixtures used in respect of the rehabilitation process is certified weed free and that all alien and invasive species is removed from topsoil stockpiles before being reinstated on re-profiled areas.

Removal of alien and invasive species must continue throughout the rehabilitation and re-profiling process.

5. GENERAL REHABILITATION MEASURES TO BE IMPLEMENTED IN RESPECT OF THE PRIVATE OPEN SPACE WHICH INCLUDES THE HILLSLOPE SEEPE WETLAND, GLEN AUSTING PAN AND OTHER PANS

The measures as set out in the Rehabilitation Plan and Table 1 below are deemed sufficient for the conservation of ecological processes and provide a tool for improving and managing the open space area. If these measures are adhered to, ecological processes within the private open space areas allow the improvement of the functionality of the system. If these measures are sufficiently implemented, impacts on the system can be adequately minimised.

Table 1: Rehabilitation and Ecological Management Plan

POTENTIAL IMPACT	ACTIVITY	RECOMMENDED MITIGATION MEASURES / REMARKS	TIME FRAMES
Issues Related to Wetland Ecology			
Erosion	Erosion below storm water outlets	<ul style="list-style-type: none"> ▪ Soil to be ripped to a depth of 100mm to loosen compaction. ▪ Erosion gulleys to be filled and levelled with good quality topsoil after ripping. ▪ Slopes devoid of vegetation to be hydroseeded with indigenous 	Immediately, as part of the construction phase of the development. Reseeding must take place during

POTENTIAL IMPACT	ACTIVITY	RECOMMENDED MITIGATION MEASURES / REMARKS	TIME FRAMES
		<p>veldgrass mixture.</p> <ul style="list-style-type: none"> Stone pitching or gabion mattresses to be placed below outlets to prevent erosion. 	rainy season (Sept – March)
	Erosion within the wetland and pan areas due to loss of vegetation cover	<ul style="list-style-type: none"> Soil to be ripped to a depth of 100mm to loosen compaction. Erosion gulleys to be filled and levelled with good quality topsoil after ripping. Slopes devoid of vegetation to be hydroseeded with indigenous veldgrass mixture. Resloped and hydroseeded slopes are to be protected from erosion with hessian sheets which will degrade over time preventing erosion while hydroseeded grasses re-establish in the area 	Immediately, as part of the construction phase of the development. Reseeding must take place during rainy season (Sept – March)
	Construction activities may lead to disturbance and increase in storm water runoff	<ul style="list-style-type: none"> Areas which are at risk of erosion (disturbed areas associated with the construction activities) and areas which have already been eroded/incised along the wetland /watercourse are to be considered as priority areas for rehabilitation earthworks. All areas of compacted soils occurring on gradient must be covered with hessian sheets to ensure that newly established topsoil does not erode due to rain or water flow associated with the wetland Construct small earth berms at intervals on all slopes to slow storm water runoff and during the construction phase of the rehabilitation activities. 	Immediately, as part of the construction phase of the development.
Alien vegetation	Removal of current alien	<ul style="list-style-type: none"> Alien plant removal is to take place manually within the wetland area. 	Immediately as part of the

POTENTIAL IMPACT	ACTIVITY	RECOMMENDED MITIGATION MEASURES / REMARKS	TIME FRAMES
encroachment	vegetation species within the wetland and pan areas	<ul style="list-style-type: none"> ▪ Before any re-seeding of re-profiled areas takes place, alien and invasive species must be removed. ▪ Removal of alien and invasive species must continue throughout the process of wetland rehabilitation and re-profiling. 	construction phase of the development. Reseeding must take place during the rainy season (Sept – March)
	Construction activities will lead to disturbance of the natural environment and encourage growth of pioneer species	<ul style="list-style-type: none"> ▪ Topsoil stockpiles must be cleared of any alien and invasive species before being reinstated on re-profiled areas; ▪ The seed mixtures used for re-vegetation must be certified weed-free; ▪ Any mulches or compost mixtures must be certified weed-free; ▪ After construction, a bi-monthly eradication exercise must be performed to remove alien and invasive species. This must for part of the responsibilities of the maintenance staff for a period of two years. ▪ After the two year period, an annual eradication exercise is deemed suitable for management of alien species for the life of the proposed development 	Immediately as part of the construction phase of the development. Ripping of compacted areas and reseeded of these areas must take place upon completion of the profiling of the area and before the onset of winter
	Greening and landscaping must be performed by utilising indigenous / endemic species to reduce alien encroachment	<ul style="list-style-type: none"> ▪ Ensure that greening and landscaping of the proposed development is done using indigenous/endemic species only. It is proposed that the grass species <i>Cynodon dactylon</i> (couch grass) be used as lawn cover instead of <i>Pennisetum clandestinum</i> (Kikuyu grass) this indigenous species will ensure stabilisation of the stream banks 	Immediately as part of the construction phase of the development. Ripping of compacted areas and reseeded of these areas must take place upon completion of the

POTENTIAL IMPACT	ACTIVITY	RECOMMENDED MITIGATION MEASURES / REMARKS	TIME FRAMES
		<p>due to the extensive root structure of this grass species.</p> <ul style="list-style-type: none"> It is recommended that indigenous tree species such as <i>Combretum</i> sp. and <i>Celtis Africa</i> be planted within the open space areas in order to improve the overall ecological state of the development and surrounding areas, and provide habitat for wetland faunal species and an improved micro-climate along the system. 	reprofiling of the area and before the onset of winter
Dumping of material within the wetland section	Ensure the removal of rubble / building material	<ul style="list-style-type: none"> The removal of rubble material must be done prior to and in conjunction with alien removal. Large rocks already present on the stream banks may remain but are to be placed in such a manner as to resemble natural habitat and conducive to supporting faunal communities. 	Immediately as part of the construction phase of the development
	Security measures	<ul style="list-style-type: none"> Ensure that security personnel are aware of problems of illegal dumping and littering. 	Implement immediately during the construction phase and during life span of development
Loss of indigenous vegetation and functionality of the wetland	Re-vegetation of the wetland and other disturbed areas	<ul style="list-style-type: none"> The wetland and the section of the Glen Austin Pan that is affected by the construction of Clayville X50, X71, X76, X77, X78, X79 and X80 needs to be sloped and reseeded with indigenous vegetation. Reseed wetland and pan areas with indigenous grass seed mixtures to prevent further erosion. All earthworks must be 	Implement immediately at construction site. Reseeding must take place during the rainy season (Sept – March)

POTENTIAL IMPACT	ACTIVITY	RECOMMENDED MITIGATION MEASURES / REMARKS	TIME FRAMES
		<p>rehabilitated after construction.</p> <ul style="list-style-type: none"> ▪ When re-profiling takes place it should be done to ensure water movement through the system at all times. Thus no obstruction should take place in the flow of water through the wetland areas except for the use of berms to slow surface water runoff. 	
Sedimentation wetland and pan areas	Implement an adequate Storm Water Management Plan to prevent siltation, limit the edge effects from storm water runoff and preserve and improve the ecological integrity of the wetland and pan	<ul style="list-style-type: none"> ▪ Adequate storm water management must be incorporated into the design of the development in order to prevent erosion and the associated sedimentation of the wetland and instream areas. ▪ Sheet runoff from cleared areas, and the road surfaces needs to be curtailed. ▪ Runoff from paved surfaces should be slowed down by the strategic placement of berms. ▪ During the construction and operational phases of the development erosion berms should be installed to prevent gully formation and siltation of the wetland resources. The following points should serve to guide the placement of the erosion berms: <ul style="list-style-type: none"> • Where the track has slope of less than 2%, berms every 50m should be installed. • Where the track slopes between 2% and 10%, berms every 25m should be installed. • Where the track slopes between 10% and 15%, berms every 20m should 	Implement immediately at construction site. Ongoing monitoring of the storm water system will be necessary. If excessive sediment builds up in the system, it should be removed. Removal should preferably take place in the winter when no rainfall is expected.

POTENTIAL IMPACT	ACTIVITY	RECOMMENDED MITIGATION MEASURES / REMARKS	TIME FRAMES
		<p>be installed.</p> <ul style="list-style-type: none"> • Where the track has slope greater than 15%, berms every 10m should be installed ▪ Refuge pools and stilling basins are to be constructed within the stream bed at 30m intervals to minimise siltation/sedimentation, aid in attenuation and provide habitat. ▪ Cobble beds may be constructed within the streambed to minimise siltation. ▪ Regular desilting is to take place. 	
Loss of affectivity of rehabilitation actions	Veld fire management and clean-up program for littering	<ul style="list-style-type: none"> ▪ Control access to the open space areas ▪ No informal fires must be allowed on the site during and after construction ▪ Implement a bi-monthly clean-up program where staff performs a clean-up of the open space areas ▪ Specific attention must be paid to the wetland and pan area, especially during the rainy season 	Throughout construction phase of development as necessary. Bi-monthly program for life span of development
Construction footprint	Control of construction activities	<p>The following criteria apply during the eradication process:</p> <ul style="list-style-type: none"> ▪ Construction areas must be clearly marked ▪ During the construction phase no vehicles should be allowed to indiscriminately drive through the wetland areas or a 32m buffer surrounding the wetland areas. ▪ Landscaped gardens may only be planted with indigenous vegetation and escape of garden specimens is to be prevented. 	Throughout construction phase of development as necessary. Reseeding to take place during the rainy season (Sept – March)
Migration of	Ensure that the	<ul style="list-style-type: none"> ▪ Limit activity footprints in order to 	Immediately as

POTENTIAL IMPACT	ACTIVITY	RECOMMENDED MITIGATION MEASURES / REMARKS	TIME FRAMES
faunal wetland inhabitants and impact on their habitats	remaining habitat integrity is conserved by limiting activity footprints and access control	<p>limit disturbance</p> <ul style="list-style-type: none"> ▪ Barricade of all open space areas with danger tape and designate them as no go areas for unauthorised staff during construction and especially after rehabilitation has taken place. ▪ Control access to the property especially along roads and along the wetland, Glen Austin and associated buffer zone in order to control illegal dumping, littering and fires. ▪ No trapping or hunting of fauna is to take place. Access control must be implemented to ensure that no illegal trapping or poaching takes place. ▪ Education on identification of any RDL faunal species as well as the Giant African Bullfrog that are present or may occur within the study site. ▪ Educate construction and project personnel about the importance of the natural faunal species and biodiversity of the natural surroundings. 	part of the construction phase of the development.