



TGM ENVIRONMENTAL SERVICES

FINAL ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR

**PROPOSED MONTANA SPRUIT CHANNEL IMPROVEMENT –
PHASE 1**

REF: GAUT 002/19-20/E0055

PREPARED FOR:
City of Tshwane
Transport Infrastructure Design & Construction Division
P.O. Box 1409
Pretoria
0001

Tel: 012 358 4811

COMPILED BY:
TGM Environmental Services
P.O. Box 219
Groenkloof
0027

Tel: 012 346 7655
Fax: 012 346 6074

October 2019

Enq: Delia de Lange

CONTENTS

CONTENTS	I
LIST OF TABLES AND FIGURES	II
ABBREVIATIONS	II
INFORMATION SHEET	1
1 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP).....	1
ENVIRONMENTAL MANAGEMENT PROGRAMME	2
2 INTRODUCTION	2
3 OBJECTIVE OF THE EMPr	7
4 A DESCRIPTION OF THE IMPACT MANAGEMENT OUTCOMES	8
5 A DESCRIPTION OF THE PROPOSED IMPACT MANAGEMENT ACTIONS	10
6 IMPLEMENTATION OF THE EMPr	10
6.1 <i>The Applicant</i>	10
6.2 <i>Environmental Control Officer</i>	11
6.3 <i>Contractor</i>	11
7 MONITORING AND ENVIRONMENTAL REPORTING PROCEDURES	11
8 ENVIRONMENTAL AWARENESS PLAN.....	12
9 ENVIRONMENTAL CONTROL MEASURES.....	13
10 CONTRACT.....	13
11 STATUTORY, LEGAL AND OTHER REQUIREMENTS.....	14
12 ENVIRONMENTAL MANAGEMENT PROGRAMME.....	14
13 SITE DOCUMENTATION, MONITORING AND REPORTING	41
13.1 <i>What needs to be monitored</i>	41
13.2 <i>How, what procedures</i>	41
13.3 <i>Recording of Information/Data</i>	41
13.4 <i>Reporting</i>	42
14 POST CONSTRUCTION AUDIT.....	42
15 AMENDMENTS TO THE EMPr	42
ANNEXURE A	43
ANNEXURE B	44
ANNEXURE C	45
CURRICULUM VITAE OF EAP	45
ANNEXURE D	46
ENVIRONMENTAL CODE OF CONDUCT	46
ANNEXURE E	47
ENVIRONMENTAL COMPLAINTS REGISTER	47

ANNEXURE F	48
ENVIRONMENTAL INCIDENTS REGISTER.....	48
ANNEXURE G	49
ENVIRONMENTAL TRAINING REGISTER.....	49

LIST OF TABLES AND FIGURES

FIGURE 1: LOCALITY MAP	2
FIGURE 2: SCHEMATIC LAYOUT OF RIVER BED	4
FIGURE 3: TYPICAL CROSS SECTION OF SPRUIT IMPROVEMENT	5
FIGURE 4: C-PLAN	6
FIGURE 5: SENSITIVITY MAP	7
TABLE 1: REQUIREMENTS ACCORDING TO APPENDIX 4 OF GNR 982	7
TABLE 2: IDENTIFIED IMPACTS AND THEIR PRE-MITIGATION AND POST-MITIGATION IMPACT SIGNIFICANCE RATING SCORES	9
TABLE 3: THE FREQUENCY OF MONITORING THE IMPLEMENTATION OF THE EMPr.....	12
TABLE 4: PLANNING, DESIGN AND PRE-CONSTRUCTION PHASE	15
TABLE 5: CONSTRUCTION PHASE.....	17
TABLE 6: OPERATIONAL PHASE	38

ABBREVIATIONS

CTMM	City of Tshwane Metropolitan Municipality
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
GDARD	Gauteng Department of Agriculture and Rural Development
NEMA	National Environmental Management Act
OHSA	Occupational Health and Safety Act
PPE	Personal Protective Equipment
PHRA-G	Provincial Heritage Resources Agency Gauteng
SAHRA	South African Heritage Resources Agency
SAPS	South African Police Service
SCC	Species of Conservation Concern

INFORMATION SHEET

1 Details of the Environmental Assessment Practitioner (EAP)

Consultant	TGM Environmental Services CC
Contact Person	Delia de Lange
Qualifications	BSc (Honours) Geography Masters in Development and Management
Postal Address	P.O. Box 219 Groenkloof 0027
Telephone	012 346 7655
Cell	083 289 3240
Facsimile	012 346 6074
Email	delia@tgmenviron.co.za
Expertise	Delia de Lange has been involved in environmental consulting since 2006 and has expertise in a wide range of environmental disciplines including Environmental Impact Assessments, Environmental Management Plans/Programmes, Auditing and Monitoring, Public Participation and Facilitation. She obtained her Honours degree in Geography from the University of Pretoria during 2005 and worked as an Environmental consultant ever since. She currently also holds a Masters in Development and Management from the North West University. (Please refer to Annexure: C for her Curriculum Vitae)
Professional affiliation/registration:	IAIAsa

ENVIRONMENTAL MANAGEMENT PROGRAMME

2 Introduction

TGM Environmental Services was appointed by Ditlou Nevhutalo Consortium on behalf of City of Tshwane, Transport Infrastructure Design & Construction Division to submit an application to the Gauteng Department of Agriculture and Rural Development (GDARD) for the proposed Montana Spruit Channel Improvement – Phase 1, located within the City of Tshwane Metropolitan Municipality.

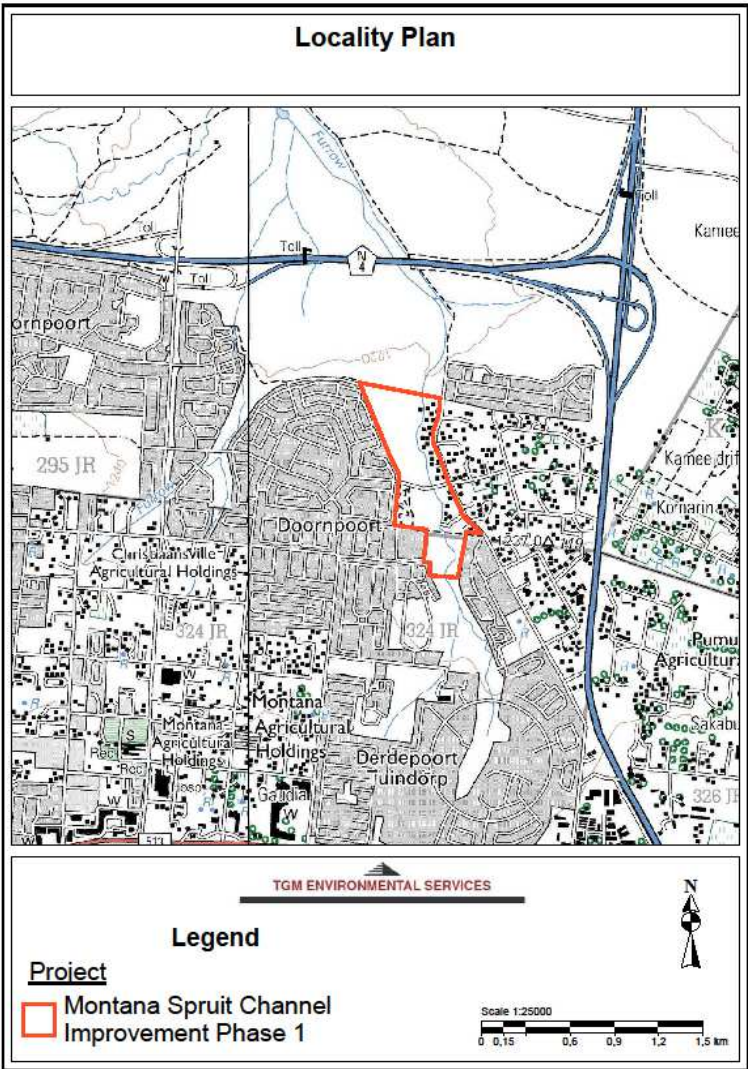


Figure 1: Locality Map

Project description

The Proposal intends to improve the Montana Spruit between an area 600m upstream of the Tsamma Road stream crossing and to about 600m downstream of the Tsamma Road crossing in order to reduce the impact of the 1:100-year flood on adjacent properties and houses. The shape of the spruit will be improved to accommodate more flow and to ensure that all the buildings and houses adjacent to the spruit are located outside the 1:100-year flood line. Tsamma street will also be upgraded and realigned to improve on the flood line position, culvert capacity and road layout. The culvert crossing at Tsamma street will be upgraded to accommodate the 1:2-year flow by means of a portal culvert crossing, flows from recurrence intervals greater than 1:2 years will overtop Tsamma street and flow on surface.

The project area for the Montana Spruit Channel Improvement – Phase 1 is located within the Doornpoort and Montana Park residential area, south of Pretoria, and is defined to include: the Montana Spruit Flood Management area; an area 600m upstream of the Tsamma road stream crossing and to about 600m downstream of the same crossing; and Tsamma Road between Breed Street and Cassia Street.

Proposed new road upgrades

The existing Tsamma Street will be reconstructed on the same horizontal alignment as before. The vertical alignment will be changed to lower the road and accommodate the culvert crossing. The lowering of the road is also required to ensure that the 1:100-year flood can overtop the road without the flood lines encroaching against the buildings on adjacent land.

The 9 x Ø450mm existing concrete pipe has insufficient capacity to accommodate the minor flood and will be replaced by 20 1500x450mm CL100S portal culverts to accommodate the 1:2-year flow. Flow from storms greater than the 1:2-year recurrence interval will overtop Tsamma Street and run on surface.

The roadway will be 6.0m wide consisting of 2 x 3,0m lanes in each direction. The higher side of the road will have a 400mm sloping kerb with a 2m wide paved walkway and the lower side will have a 400mm sloping kerb. The road will have a 3% crossfall with the natural slope to improve on the channel flow and to drain surface water away.

The road crossfall at the culvert crossing will be 1%, this is to match the slope of the portal culverts. A 250mm concrete slab will be cast over the portal culverts as the final road surface.

250Ø Concrete pillars of approximately 1000mm high will be constructed on both sides of the concrete slab and road as to indicate to motorists the extend of the road width during floods. The embankments at the Tsamma crossing will be lined with reno mattresses to protect against erosion.

Proposed new channel improvement

Following the investigation of the hydrology analysis, the following solutions will be implemented:

- Channelize the Montana Spruit by changing the existing channel through excavating & shaping and widening of the spruit.
- The overall objective of any natural stream channelisation improvement design should be to provide enough space to meet flood conveyance targets, increase vegetation in the channel, improve habitat conditions, and improve water quality in the stream.
- The horizontal alignments decided for the proposed Montana Spruit Improvements will follow the existing stream bed line.
- The natural low flow area of the spruit will be kept and all improvements will be above the water level of the low flow. This option is preferred because it does not disturb flow and natural ecological activities in the main stream influence.
- A berm will be constructed at the old age home to prevent any flood water from entering the estate. The floodline will not encroach onto the berm, the berm is just a precautionary measure implemented to prevent any flood damage.
- A well-designed stream channelization will typically have three zones on either side of the watercourse: a streamside zone, a middle zone, and an outer zone as per the figure below.

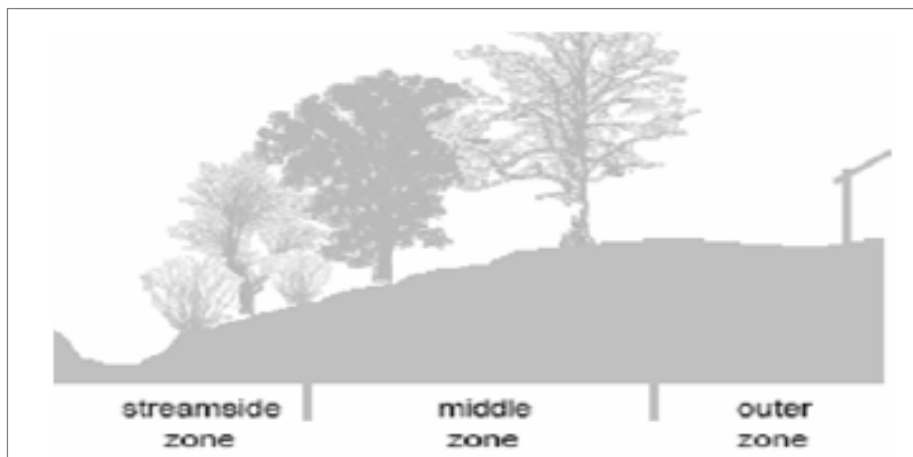


Figure 2: Schematic Layout of river bed

To enhance the ecological conditions, natural bedding and excavated stream flood banks with re-vegetation will be provided for the Montana Spruit Channelisation. To make the proposed Spruit more environmentally friendly, the stream banks will be lined with natural substrates to produce a suitable environment similar to the existing main stream condition as per the figure below. The cross-sectional

area of the stream channel will be widening by excavating one or both banks outwards to provide a larger cross-section for flow conveyance.

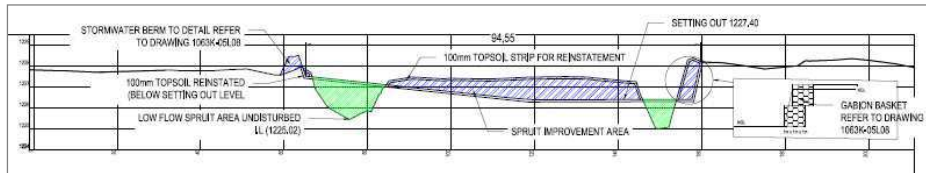


Figure 3: Typical Cross section of spruit improvement

From the hydraulic analysis for a 1:50 year and 1:100 year return period it is evident that some embankment erosion might occur especially along the eastern embankment of the Montana Spruit. The general velocity of the spruit will be around 1,4-1,9m/s with isolated areas where the velocity will be around 2,4m/s. The embankment of the spruit will be 1:5 and hydro seeded for erosion protection. In some sections of the spruit where buildings and walls are close to the waterfront a gabion basket wall will be used for erosion protection.

The 1:50 and 1:100 year return period flood may cause extensive surface erosion and it is important that the slope and surfaces be protected by grass. The topsoil will be replaced on the entire disturbed area and will be hydroseeded with a recommended seed mixture.

Two types of attenuation ponds aimed at attenuating flow will be excavated. The first is a very shallow pond located within the newly widened channel and the second attenuation pond type is located outside of the widened channel.

The disturbed spruit area will be rehabilitated as recommended in the Rehabilitation and Floodplain Restoration Plan, dated April 2011 and the Review Rehabilitation Plan, dated July 2019.

Sensitivity according to the C-Plan

According to GDARD's conservation plan (C-Plan version 3.3) the proposed project site falls within an Ecological Support Area (ESA) as well as a Remaining Threatened Ecosystem – Marikana Thornveld.

An ESA provides connectivity and important ecological processes between Critical Biodiversity Areas (CBA) and is therefore important in terms of habitat conservation.

Marikana Thornveld is a threatened veld type with a threat status of vulnerable (VU)

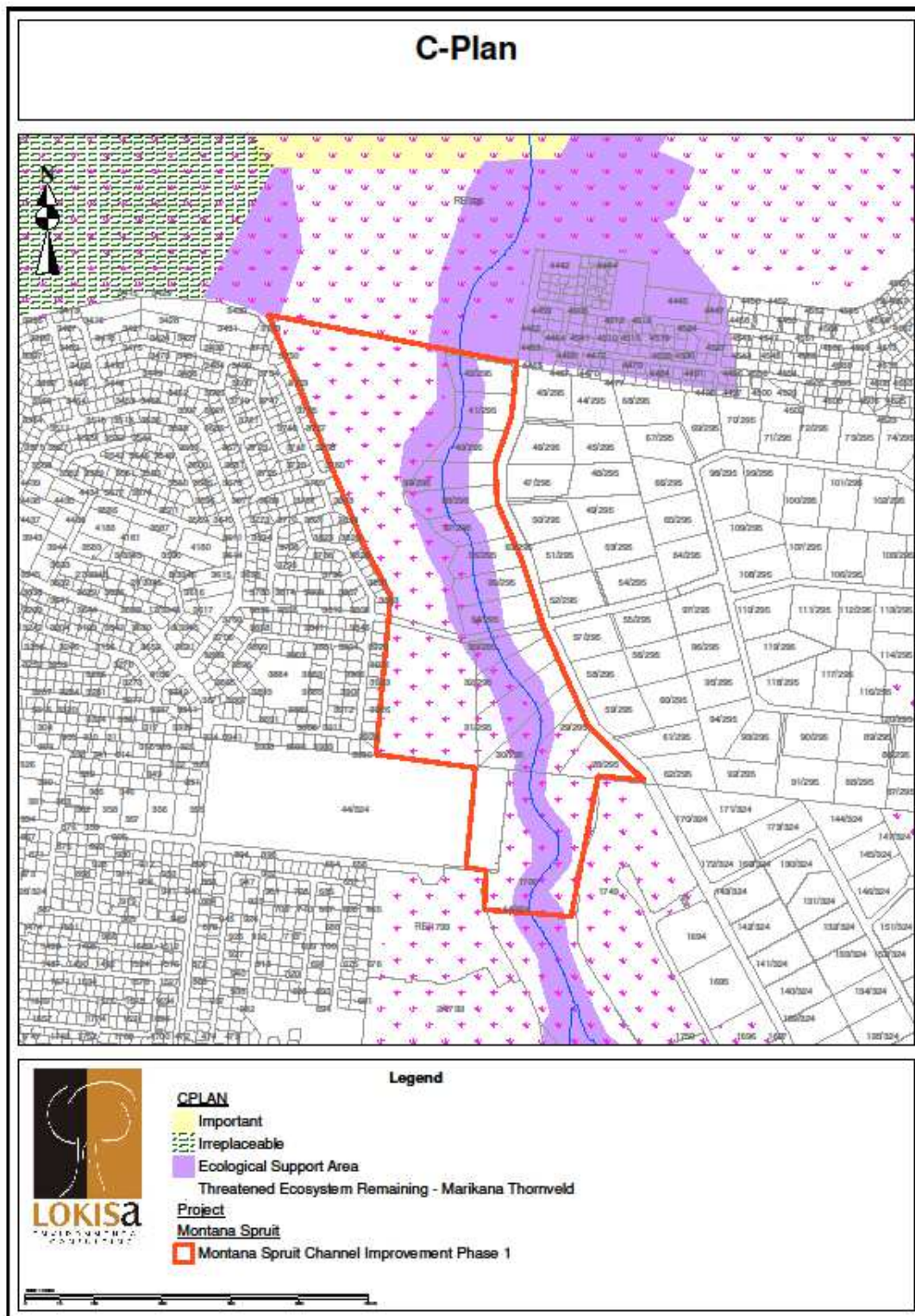


Figure 4: C-Plan

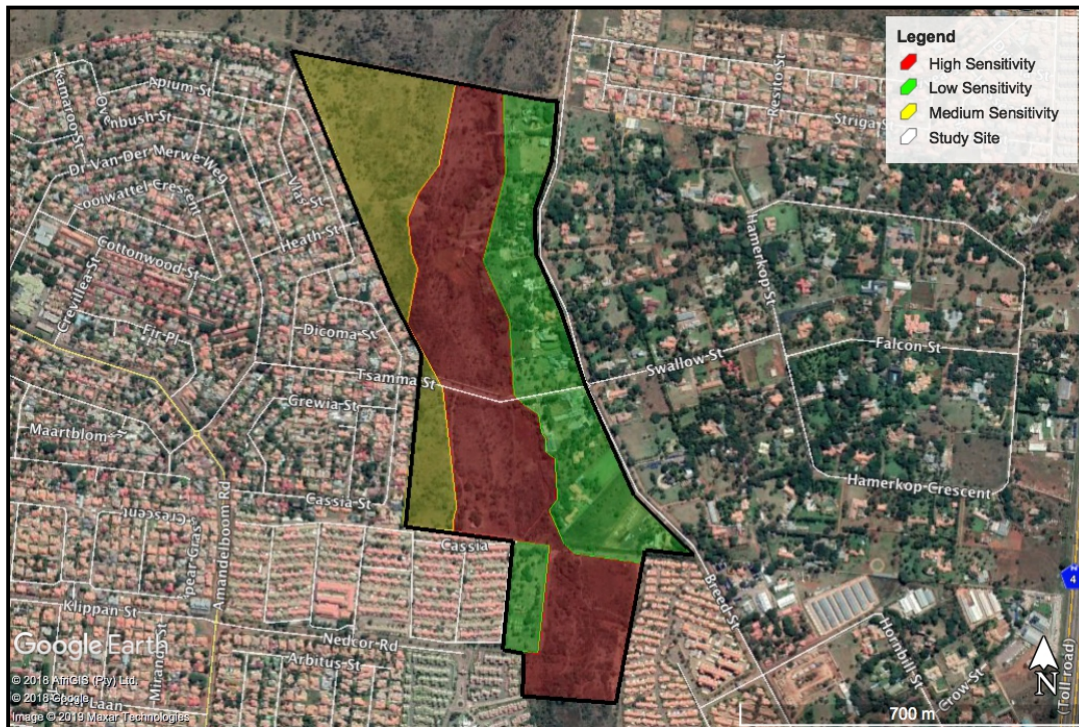


Figure 5: Sensitivity Map

This Environmental Management Programme (EMPr) serves the purpose to ensure that the facility is operated in an environmentally responsible manner and that potential impacts identified and associated with this activity are adequately mitigated during the construction and operational phases of the project.

3 Objective of the EMPr

As per As per Section (1) of Appendix 4 of Regulation 982 an EMPr must comply with Section 24N of the Act and include –

Table 1: Requirements according to Appendix 4 of GNR 982

Requirements according to Appendix 4 of GNR 982	Section in report
a) Details of the EAP who prepared the EMPr and the expertise of that EAP to prepare the EMPr, including curriculum vitae.	Section 1 Annexure C
b) A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	Section 2
c) A map at an appropriate scale which superimposes the proposed activity, its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers.	Section 2
d) A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the	Section 4 Section 12

environmental impact assessment process for all phases of the development including – <ul style="list-style-type: none"> • Planning and design; • Pre-construction activities; • Construction activities; • Rehabilitation of the environment after construction and where applicable post closure; • Where relevant, operation activities. 	
f) A description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must where applicable, include actions to – <ul style="list-style-type: none"> • Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; • Comply with any prescribed environmental management standards or practices; • Comply with any applicable provisions of the Act regarding closure where applicable; • Comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable; 	Section 5 Section 12
g) The method of monitoring the implementation of the impact management actions as mentioned in the above paragraph (f);	Section 7
h) The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 7 Section 12
i) An indication of the persons who will be responsible for the implementation of the impact management actions;	Section 6 Section 12
j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 12
k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 6
l) A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 7
m) An environmental awareness plan describing the manner in which - <ul style="list-style-type: none"> • The applicant intends to inform his or her employees of any environmental risk which may result from their work; and • Risks must be dealt with in order to avoid pollution or the degradation of the environment; and 	Section 8
n) Any specific information that may be required by the competent authority.	Section 9 & 10

4 A description of the Impact Management Outcomes

The purpose of the EMPr is to act as an instrument to be used by the City of Tshwane Metropolitan Municipality to ensure sound environmental practices are incorporated during the construction and operational phase of the development.

The EMPr is a detailed programme for the implementation of the mitigation measures to minimise negative environmental impacts during the life-cycle of a project. The EMPr contributes to the preparation of the contract documentation by developing clauses to which the contractor must adhere for the protection of the environment. The EMPr specifies how the construction of the project is to be carried out

and includes the actions required for the Post-Construction Phase to ensure that all the environmental impacts are managed for the duration of the project's life-cycle.

The EMPr is to be implemented in a co-operative spirit with all parties (project proponent, contractor, affected parties) involved in the setting of environmental objectives and practices.

The table below provides a summary of the identified impacts and their pre-mitigation and post-mitigation impact significance rating scores as per the environmental impact assessment process for the following phases of the proposed development –

- Construction phase; and
- Operational phase.

Table 2: Identified impacts and their pre-mitigation and post-mitigation impact significance rating scores

Potential Impacts:	Significance rating of impacts	Significance rating of impacts after mitigation:
OPERATIONAL PHASE		
1.1 Dust /Air pollution - The generation of dust associated with construction activities & earthworks	Very Low	Very Low
2.1 Visual Intrusion and Light Pollution	Low	Low
2.2 Impact on the visual character of the area	Low	Low
3.1 Soil erosion, loss of topsoil, deterioration of soil quality	Medium	Low
3.2 Soil Pollution	Medium	Low
4.1 Site clearing and the removal of vegetation	Medium	Low
4.2 Degradation, destruction of habitats/ ecosystems and loss of natural vegetation	Medium	Low
4.3 Impacts on fauna and flora and loss of RDL faunal and floral species	Low	Low
4.4 Invasive species	Medium	Low
5.1 Stormwater flow and drainage	Medium	Low
5.2 Impacts on water quality	Medium	Low
5.3 Sedimentation of the channel and the downstream spruit	Medium	Low
6.1 Noise/ vibration	Low	Low
6.2 Impact on the privacy of adjacent land owners.	Medium	Low
7.1 Safety and Security	Medium	Low
7.2 Employment opportunities	Positive - Medium	Positive – Medium
8.1 Destruction of cultural / heritage sites	Insignificant	Insignificant
9.2 Traffic- Construction Vehicles	Medium	Low
10.1 Waste	Low	Low
10.2 Pressure on existing infrastructure and services	Medium	Low
10.3 Construction activities at Tsamma Street	Medium	Low

11.1 Rehabilitation during construction	High	Medium
OPERATIONAL PHASE		
1.1 Species of Conservation Concern: Rescue, Persistence and Monitoring	Medium	Low
1.2 Alien Invasion	Medium	Low
2.1 Stormwater flow and drainage	High	Medium
2.2 Erosion of drainage lines, riparian zone and floodplain	Medium	Low
3.1 Safety and Security	Low	Low
4.1 Contribute to the provision of quality basic services and infrastructure in the area	Positive - High	Positive - High
4.2 Infrastructure at Tsamma Street - 20 (1500 x 450mm) portal culverts	Positive - Medium	Positive - Medium

5 A description of the proposed impact management actions

The specifications outlined in the EMPr are applicable to all activities undertaken by all persons involved in the execution of the works, including sub-contractors, the workforce and suppliers for the duration of activities for the proposed project.

In order to attain the impact management outcomes as outlined in Section 4 the EMPr is to address issues in the following manner:

The objective of the EMPr is to address the following issues:

1. Environmental Management considerations are implemented from the start;
2. Precautions against damage are taken timely, and
3. Impacts of the development on the environment are minimised.

6 Implementation of the EMPr

6.1 The Applicant

- 6.1.1 The overall responsibility for ensuring compliance lies with the Applicant.
- 6.1.2 The Applicant shall comply with the conditions set in the Environmental Authorisation by the GDARD.
- 6.1.3 The Applicant shall ensure that the Contractor and all staff members, sub-contractors and suppliers understand and adhere to the EMPr.
- 6.1.4 The Applicant shall ensure that all sub-contractors and suppliers are contractually bound to adhere to the EMPr and Environmental Code of Conduct.

6.2 Environmental Control Officer

- 6.2.1 The Applicant shall appoint a suitably qualified Environmental Control Officer (ECO) to supervise the implementation of the EMPr.
- 6.2.2 The Contractor must be notified of this appointment and furnished with the contact details of the ECO.
- 6.2.3 The ECO shall be responsible for:
- Day to day implementation of the EMPr and coordination of all environmental matters on site.
 - Ensuring that all staff members are adequately trained and aware of the EMPr and its Environmental Code of Conduct.
 - Fortnightly environmental inspections (according to the criteria specified in the EMPr).
 - Liaison with the project manager, client and public.

6.3 Contractor

- 6.3.1 The Contractor, including all sub-contractors, shall comply with the specifications in the EMPr.
- 6.3.2 A representative of each sub-contractor will receive a copy of the EMPr.
- 6.3.3 A representative of each sub-contractor will be required to sign the Environmental Code of Conduct to give assurance that they understand the EMPr and that they undertake to comply with conditions therein.

7 Monitoring and Environmental Reporting Procedures

The ECO will conduct fortnightly environmental inspections as part of the monitoring process to ensure the day to day implementation of the EMPr and coordination of all environmental matters on site. A monthly ECO Report must be provided to the Applicant, Contractor, GDARD and other relevant role-players.

Monitoring during ECO site visits will consist of meetings, observations and photographic evidence collection and the ECO will also be responsible for monitoring the rehabilitation works throughout the project.

An Environmental Incidents Register and an Environmental Complaints Register will be in place and will be maintained. Upon occurrence of non-compliance or a complaint of an environmental nature the incident will be recorded in the relevant register.

The registers must be made available to the ECO upon every fortnightly site visit. EMPr related issues would be discussed at all construction site meetings. A copy of the relevant sections of the minutes of these site meetings must be made available to the ECO.

The table below provides a summary of the frequency of monitoring the implementation of the EMPr.

Table 3: The frequency of monitoring the implementation of the EMPr

Daily	<ul style="list-style-type: none"> • Pollution • Ensure no species of fauna and flora is being utilized by the construction workers or destroyed. • Socio-Economic (ensure that socio-economic impacts are adequately mitigated) • On-site sanitary facilities • Excavations • Disposal of Material • Construction activities • Rehabilitation • Rainfall and temperature
Weekly	<ul style="list-style-type: none"> • Ensure environmental training of construction workers is up to date • Progress in terms of construction programme • Removal of rubble • Community relations
Two-weekly	<ul style="list-style-type: none"> • Site visit to be undertaken by the ECO • ECO checklist to be completed during site visit • Dated photographs should be taken from fixed high importance spots (marked on a map) and included in the ECO checklists and ECO Report for comparison • Control of Environmental Incidents Register and an Environmental Complaints Register
Monthly	<ul style="list-style-type: none"> • Report on the state of the environment during construction

8 Environmental Awareness Plan

The ECO will be responsible for putting in place an Environmental Awareness Training Programme for all staff members. Before commencing with any work, all staff members shall be briefed about the Environmental Code of Conduct. The training programme has to be approved by the ECO. After being briefed about the contents of the Environmental Code of Conduct, staff members shall sign an Environmental Training register as proof of their training.

The training must include, but are not limited to:

- Identification of protected species, both fauna and flora
- Identification of potential heritage resources
- Identification and avoidance of demarcated no-go areas
- Site access and security

- Safety measures

9 Environmental Control Measures

The EMPr outlines measures to be implemented in order to minimise any potential environmental degradation associated with the construction activities. It should serve as a guide for the Contractor and the construction workforce on their roles and responsibilities concerning environmental management on the construction site and provide a framework for environmental monitoring throughout the construction period.

Measures to control potential environmental impacts during the construction phase are specified. Except where otherwise stated, all these control measures will apply throughout the construction period and, as part of the project contract, the Contractor shall adhere to these measures at all times.

10 Contract

The Contractor/s shall be handed a copy of all relevant documentation regarding the project and shall, before any work is conducted, meet with the ECO in order that the contractor shall familiarise himself with the environmental issues concerning the site.

A commitment from the Contractor is required on the following issues:

- To take into consideration the landowners in the surrounding area;
- Always behave professionally on and off site;
- To ensure quality of work done, technical and environmental;
- To resolve problems and claims arising from damage immediately to ensure a smooth flow of operations (take relevant steps to ensure no further damage or disturbance and resolve environmental problems adequately with the use of risk management and emergency response procedures);
- To use this EMPr for the benefit of all involved;
- To preserve the natural environment by limiting destructive actions on site;
- To have an eco-friendly approach; and
- Not to litter.

An agreement is to be signed by the contractor that:

- He knows and understands the content of the EMPr; and
- He is able and shall comply with all legislation pertaining to the nature of the work to be done and all things incidental thereto.

11 Statutory, Legal and other requirements

The following sources of South African Law have been identified and will form the basis of the EMPr:

- 9.1 Constitution of the Republic of South Africa, Act No. 108 of 1996
- 9.2 National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)
- 9.3 NEMA EIA Regulations, 2014 (Government Notice Regulations Nos. 982, 983, 984, 985)
- 9.4 National Water Act, 1998 (Act No. 36 of 1998)
- 9.5 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
- 9.7 National Road Traffic Act, (Act No. 93 of 1996)
- 9.8 Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
- 9.9 National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004)
- 9.10 Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)
- 9.11 National Heritage Resources Act 1999 (Act No. 25 of 1999) (NHRA)
- 9.12 National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- 9.13 Gauteng Agriculture Potential Atlas
- 9.14 GDARD Requirements for Biodiversity Assessments (Version 3)
- 9.15 Red Data Plant Policy
- 9.16 Gauteng Conservation Plan (C-Plan Version 3.3)
- 9.17 South African Guidelines for Sustainable Drainage Systems
- 9.18 Gauteng Environmental Management Framework
- 9.19 City of Tshwane by-laws

12 Environmental Management Programme

The following tables form the core of this EMPr for the construction and operational phases of this project. These tables should be used as a checklist on site, especially during the construction phase.

Table 4: Planning, Design and Pre-construction Phase

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
DESIGN Negative impacts on environment during construction	<ul style="list-style-type: none"> • Ensure proper initiation of project 	<ul style="list-style-type: none"> • Compile tender documentation and Specifications • All the aspects listed under Construction and Closure • Ensure acceptable management of environmental issues during construction. • Ensure that relevant environmental management specifications as per the EMPr are incorporated in the Tender and Contract documentation. • Appoint an ECO who must monitor the contractor's compliance with the EMPr. • Appoint an Ecological/Wetland Consultant to oversee demarcation of wetland/sensitive area 	<ul style="list-style-type: none"> • Engineering Design Consultant • Applicant 	<ul style="list-style-type: none"> • N/A
ENVIRONMENTAL EDUCATION AND TRAINING	<ul style="list-style-type: none"> • Ensure proper and sufficient environmental training and education for all construction personnel 	<ul style="list-style-type: none"> • The ECO will be responsible for putting in place an Environmental Awareness Training Programme for all staff members. • Before commencing with any work, all staff members shall be briefed about the Environmental Code of Conduct. • The training programme has to be approved by the ECO. • After being briefed about the contents of the Environmental Code of Conduct, staff members shall sign an Environmental Training register as proof of their training. 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing
SENSITIVE AREAS	<ul style="list-style-type: none"> • Ensure protection of sensitive areas during construction 	<ul style="list-style-type: none"> • Drainage areas are to be demarcates as sensitive areas and treated as NO-GO areas. • Appoint an Ecological/Wetland Consultant to oversee demarcation of wetland/sensitive area. 	<ul style="list-style-type: none"> • ECO • Contractor • Ecological/ Wetland Consultant 	<ul style="list-style-type: none"> • Ongoing
FAUNA AND FLORA Site clearing and the removal of vegetation	<ul style="list-style-type: none"> • Selective removal of vegetation during site clearing 	<ul style="list-style-type: none"> • Sensitive areas to be identified and mapped according to the specialist studies and input from the ECO. • It must be ensured that, as far as possible, all proposed infrastructure is placed outside of sensitive habitat areas. Where this is not possible, suitable mitigation measures as outlined in the Terrestrial Ecological 	<ul style="list-style-type: none"> • ECO • Contractor • Ecological Consultant 	<ul style="list-style-type: none"> • Ongoing

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>Habitat Integrity Investigation and the Wetland Ecological Assessment and Rehabilitation Plan should be adhered to.</p> <ul style="list-style-type: none"> • Areas of increased ecological importance and sensitivity, such as watercourse areas, should be considered during all phases of the development planning and construction activities. • The boundaries of the development footprint areas are to remain as small as possible, be clearly defined and it should be ensured that all activities remain within defined footprint areas. • All areas of increased ecological sensitivity beyond the development footprint should be designated as No-Go areas and be off limits to all unauthorised vehicles and personnel. Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities. • It must be ensured that storm water is managed on site in a suitable manner. • Disturbance to birds, animals and reptiles and their habitats should be prevented at all times. • All rescue and relocation plans should be overseen by a suitably qualified specialist. 		

Table 5: Construction Phase

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
<p>DEVELOPMENT FOOTPRINT, CONSTRUCTION CAMP AND RELATED ACTIVITIES</p> <p>Location of construction site office and related buildings</p> <p>Access control</p> <p>Ablution facilities</p>	<ul style="list-style-type: none"> • Location of construction site office and related buildings must not be detrimental to the environment • Proper access control must be implemented • Adequate provision and control of ablution facilities 	<ul style="list-style-type: none"> • It must be ensured that, as far as possible, all proposed infrastructure is placed outside of sensitive habitat areas. Where this is not possible. Suitable mitigation measures as outlined in the specialist reports and rehabilitation plan should be adhered to. • All areas of increased ecological sensitivity beyond the development footprint should be designated as No-Go areas and be off limits to all unauthorised vehicles and personnel. Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities. • An environmental awareness training programme for all staff members must be put in place by the Contractor. Before commencing with any work, all staff members shall be appropriately briefed about the EMPr and relevant occupational health and safety issues. • No temporary accommodation or temporary storage sites to be erected within 100m of any river, stream, drainage line, wetland or farm dam. • All construction material, equipment and any foreign objects brought into the area by contractors and staff to be removed immediately after completion of construction. • All development footprint areas should remain as small as possible and should not encroach into the freshwater areas unless absolutely essential and part of the proposed development. It must be ensured that the freshwater habitat is off-limits to construction vehicles and non-essential personnel; • The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled; • Planning of temporary roads and access routes should 	<ul style="list-style-type: none"> • ECO • Contractor • Project Manager 	<ul style="list-style-type: none"> • Ongoing by Contractor. • Twice a month by ECO. • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>avoid freshwater areas and be restricted to existing roads where possible;</p> <ul style="list-style-type: none"> • Appropriate sanitary facilities must be provided for the life of the construction phase and all waste removed to an appropriate waste facility; • All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas; • It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage; • No fires should be permitted in or near the construction area; and • Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills. • Construction related traffic to and from site to be minimised. • Access to construction site to be controlled. • Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities. • The Contractor shall make available safe drinking water fit for human consumption at the construction camp and all other working areas • No water for drinking, cooking or other purposes should be taken out of farm dams without prior consent of the landowners. • Washing and toilet facilities shall be provided on site and in the construction camp • At least 1 toilet must be available per 15 workers using the construction camp • Toilet paper must be provided and must be available at all times • Only certified portable toilets to be used. These are not to be situated within 100m of any watercourses or artificial impoundments (farm dams). These portable 		

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
<p>AIR QUALITY AND DUST</p> <p>The generation of dust associated with construction activities & earthworks</p>	<ul style="list-style-type: none"> • Limitation of dust during the construction phase 	<p>toilets to be administered and serviced by a certified, registered company only.</p> <ul style="list-style-type: none"> • Dust generation should be kept to a minimum. • Dust must be suppressed at construction areas during dry periods by the regular application of water or a biodegradable soil stabilisation agent. • Speed limits must be implemented in all areas, including public roads and private property to limit the levels of dust pollution. • It is recommended that the clearing of vegetation from the site should be selective and done just before construction so as to minimise erosion and dust. • Excavating, handling or transporting erodible materials in high wind or when dust plumes are visible shall be avoided. • All materials transported to site must be transported in such a manner that they do not fly or fall off the vehicle. This may necessitate covering or wetting friable materials. • No burning of refuse or vegetation is permitted. • Material stockpiles must be covered with tarpaulins when the use of water or chemicals is not sufficient to prevent particulate matter from becoming airborne. • Dirt or other materials that could become airborne from paved roads/areas must be promptly removed. 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor. • Twice a month by ECO. • Monthly report
<p>VISUAL IMPACTS</p> <p>Visual impacts as a result of construction activities</p>	<ul style="list-style-type: none"> • Ensure that the construction site is not visually intrusive 	<ul style="list-style-type: none"> • Site development to be limited to footprint area. • The construction camp must be located as far from other properties as possible. • Low flux and frequency lighting should be utilised. • Light pollution should be minimised. • Lighting on site is to be sufficient for safety and security purposes, but shall not be intrusive to neighbouring residents, disturb wildlife, or interfere with road traffic. • The site must be managed appropriately and all rubbish and rubble removed to a registered landfill site. • No waste may be placed in any excavations on site. 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor. • Twice a month by ECO. • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<ul style="list-style-type: none"> • The channel should be finished with natural earth tones. • The palisade fencing on either side of the roads should be constructed in such a way as to avoid visual intrusion. • Trees/bushes along side the channel may be removed after consultation with adjacent landowners to avoid possible hiding places for criminals. • Provide the necessary erosion control measures. • Ensure that all erosion control measures are in good repair and working condition. • Avoid development on excessively steep slopes. • Avoid cutting steep embankments. • No waste may be placed in excavations on site. • Excess soil and bedrock should be disposed off at an appropriate waste disposal facility. 		
<p>GEOLOGY AND SOILS</p> <p>Earthworks/ Excavations</p> <p>Soil erosion, loss of topsoil, deterioration of soil quality</p> <p>Soil Pollution</p>	<ul style="list-style-type: none"> • Prevent/limit soil erosion, loss of topsoil, deterioration of soil quality and soil pollution 	<ul style="list-style-type: none"> • Implementation of the Rehabilitation and Floodplain Restoration Plan as well as the Review Rehabilitation Plan. • All construction activities should take place during winter when no rainfall is expected to occur. • Attenuate flows within the drainage system, to reduce runoff velocity. • Minimise the duration of land clearing. • Install erosion control measures around the works and construction yard areas prior to the onset of construction. • Install temporary diversion channels and silt traps within the stream channel for each section prior to undertaking earthworks adjacent to the existing channel. • Identify all stormwater outlets and drainage lines entering the works area and install temporary attenuation ponds of suitable volume to detain and gradually release stormwater thereby avoiding erosion and increased sediment load within the stream in the event of out of season rainfall • Stockpiles must be located outside of the proposed channel and the 1:50 year flood line; 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor. • Twice a month by ECO. • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<ul style="list-style-type: none"> • Locate stockpiles away from concentrated flows and divert stormwater around them using sandbags or low earth walls; • Stockpiles must not be higher than 2m to avoid compaction, • Instead of stockpiles single handling is recommended, strip topsoil and vegetation from a new work section to rehabilitate the previous work section. • Reduce run-off over exposed areas by using diversion earth banks, catch drains and silt fences. • Use soil saver blankets to protect exposed soil or disturbed vegetation with gradients of 1:5 or greater. • Appropriate flow diversion and erosion control structures i.e. earth embankments must be put in place where soil may be exposed to high levels of erosion due to steep slopes, soil structure etc. • Should a freak storm displace the temporary earth embankments or other erosion control structures, a visual inspection of the site must be made and any damage be recorded. Any damage and loss of soil resulting from a storm is to be remedied immediately. Should the temporary walls collapse due to construction error, the contractor is to fund the remediation process. • Storm water at the construction crew camps must be managed so as to reduce the silt loads in the stream channel. Measures must be implemented to distribute storm water as evenly as possible to avoid point sources of erosion. • Construction on steep slopes and in soft or erodable material will require erosion control measures and correct grassing methods • All construction areas should be suitably top soiled and vegetated as soon as is possible after construction. Vegetation should be indicative of pre-development status. • Disturbed surfaces to be rehabilitated must be ripped, and the area must be backfilled with topsoil or 		

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>overburden.</p> <ul style="list-style-type: none"> • No storage or stockpiling of any soils or construction materials should take place in areas where it may be washed into water courses. • Implementation of anti-erosion measures such as the construction of berms to reduce the water velocity is essential. • Only clear vegetated areas on which the proposed activity is to occur and rehabilitate these areas as soon as possible, once construction is complete. • Stormwater runoff must be taken into account during design of construction camps and its flow controlled on the construction site. • By maintaining the maximum amount of vegetated area on site, the extent of erosion and ecosystem loss can be contained. • It is also imperative that the topsoil layer be retained and used in facilitating the reinstatement of indigenous vegetation; • Backfill of trench areas must be raised to accommodate the bulking factor and subsidence. • When soil is replaced, excavation and installations should be carried out when the soil is at its driest, where possible; • All access roads must be demarcated, and existing roads must be used as far as possible • Disturbed surfaces to be rehabilitated must be ripped, and the area must be backfilled with topsoil. • All bulk fuel tanks kept on site should be appropriately and effectively bunded to a capacity of 110% of that of the tanks themselves. • All hazardous materials stored on site should also be stored in an appropriately bunded and well ventilated area; • All contaminated soils should be immediately removed and placed within a hazardous waste skip located on site, for end disposal at an appropriately licensed 		

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>hazardous waste disposal site by a reputable waste disposal contractor;</p> <ul style="list-style-type: none"> • All construction vehicles and plant operating on site should be regularly serviced in order to prevent the potential for oil and fuel leaks to occur; • Drip trays should be placed under vehicles that stand within the contractors yard for extended periods of time. • Vehicles should not be serviced out on terrain, but only in designated workshops established for that purpose that are equipped with oil water separators and sumps for the collection of contaminated materials. • Ensure correct position of construction caps, equipment yards, refueling depots, concrete batching plant etc. to avoid areas susceptible to soil and water pollution. • Ensure appropriate handling of hazardous substances. • Remediate polluted soil. • All construction vehicles, plant, machinery and equipment must be properly maintained to prevent leaks. • Plant and vehicles are to be repaired immediately upon developing leaks. Drip trays shall be supplied for all repair work undertaken on machinery on site or campsite area. • Drip trays are to be utilised during daily greasing and re-fueling of machinery and to catch incidental spills and pollutants. • Drip trays are to be inspected daily for leaks and effectiveness, and emptied when necessary. This is to be closely monitored during rain events to prevent overflow. • Vehicles to be used during the construction phase are to be kept in good working condition and should not be the source of excessive fumes. • Fuels and chemicals must be stored in adequate storage facilities that are secure, enclosed and banded. • Allowance will also need to be made for the environmentally friendly introduction of stormwater into the improved channel to ensure that no erosion occurs 		

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		at discharge points. • For the Tsamma Street Bridge it is recommended that rock-packed mattresses be installed immediately upslope and downslope of the bridge to ensure that no erosion occurs		
FLORA AND FAUNA Site Clearing and the removal of vegetation Impacts on existing fauna and flora and loss of RDL faunal and floral species Degradation, destruction of habitats/ ecosystems and loss of natural vegetation Invasive species	<ul style="list-style-type: none"> • Prevention of impacts on existing fauna and flora • Protection of existing indigenous flora and fauna against degradation, destruction of habitats/ ecosystem • Eradication of invasive species 	<ul style="list-style-type: none"> • Implementation of the Rehabilitation and Floodplain Restoration Plan as well as the Review Rehabilitation Plan. • Implementation of the Ecological Management Plan. • Only one works section may be cleared of vegetation at a time to reduce the area of exposed soil at any given time. • Limit vegetation clearance to only those areas affected by the construction activities. This will also prevent the activity footprint from expanding outside the sites boundaries. • Ensure re-vegetation of the cleared areas occurs as soon as possible after construction. • Nutrient rich top soils must be utilized during the re-vegetation process wherever possible. • Large trees on site must be retained as far as possible. • No indigenous trees or woody plant species may be collected for use as firewood. • No fires are permitted beyond the campsite boundaries, and no fires may be ignited with the intention to destroy the natural vegetation on site. • Access to the site must be limited to the workforce only, to prevent further disturbance of the vegetation. • Only indigenous species may be used during the rehabilitation process. • Workers must be made aware of the Animal Protection Act (Act 71 of 1962), as well as the penalties that will incur should an animal be intentionally harmed, or harmed as a result of negligence. • No animals may be brought into the construction site, or camp. • The construction site must be kept clean and litter free to 	<ul style="list-style-type: none"> • ECO • Contractor • Ecological Consultant 	<ul style="list-style-type: none"> • Ongoing by Contractor • Twice a month by ECO • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>prevent attracting vermin or pest species.</p> <ul style="list-style-type: none"> • Although there were only two Gauteng orange listed species (ODL) observed on site (<i>Crinum bulbispermum</i> and <i>Hypoxis hemerocallidea</i>), the possibility of encountering other species of conservation concern during the construction phase do exist. • The areas earmarked for exclusion from activity must be fenced off (using permeable fencing) prior to construction phase to ensure that the developer and his contractors do not disturb the natural vegetation in these areas. Dumping of building rubble and other waste, storage of equipment or crew camps in these areas must be prevented. • Education of new construction staff about the value of wildlife and environmental sensitivity should occur as the need arises. • Poaching is illegal and it must be a condition of employment that any employee caught poaching will be dismissed. • If any fauna species are encountered / observed on site, they should not be disturbed in any way until the relevant specialist has been consulted. If a Red Data species is encountered the Environmental Control Officer should be informed immediately. Should the wildlife, Red Data or other, need to be caught and removed, the animals should be relocated to a conservation area in the vicinity. • A list of fauna specialists should be available should any wildlife be encountered on site and their possible removal implemented during construction and/or operation. Capture and removal of all fauna species must be done under the supervision of a relevant specialist. • The remaining wildlife on site should not be trapped or hunted by construction crew or inhabitants of the activity. • Solid barriers such as walls should not be built on the periphery (or inside) of the study area. Barriers should incorporate into their design, fauna movement structures 		

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>such as culverts or openings to encourage movement between the activity and adjacent areas.</p> <ul style="list-style-type: none"> • During the construction phase noise should be kept to a minimum to reduce the impact of the activity on the site and the activity should be done in phases to allow faunal species to temporarily migrate into the conservation areas in the vicinity. • Lighting must be positioned in such a way so as not to disturb species of nocturnal herpetofauna currently dependant on the wetland habitat. • Plants of conservation concern must be removed prior to construction within an area. • Removed plants should be held in the on-site nursery for safe keeping until such time as it can be replanted in the natural landscaping. • When conservation important species are relocated to the dedicated open spaces, only replant in areas where disturbance took place. • A list of plant species should be kept on site as a checklist for plants to be dug out during construction. • Education of new construction staff about the value of the natural environment. • Landscaping associated with the activity should include forage and host plants required by pollinators and other fauna. These would include various grasses and forbs and <i>Acacia</i> trees which occur naturally in the area. • Implementation of the Rehabilitation and Floodplain Restoration Plan as well as the Review Rehabilitation Plan. • Implementation of the Ecological Management Plan. • Only trained staff should apply herbicides to alien invasive plants only. Take care not to apply foliar spray to any other vegetation than the targeted invasive plant specie. • No earth moving or soil disturbances are allowed in areas which does not form part of the construction footprint . Any disturbances could lead to the area being 		

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>colonised by alien invasive plants which will lead to the degradation of ecological processes.</p> <ul style="list-style-type: none"> • Flow connectivity has to be maintained across the width of the wetland habitat and care must be taken to avoid impoundment of flows upslope and concentration of flows downslope of the crossing so as to avoid erosion. • The crossing structure must be suitably designed to allow for the movement of both land-based and aquatic fauna. This will require the crossing structure to be of sufficient height to allow small mammals to cross underneath the bridge and ideally to have a natural soil or rock base. Where a cement base is needed to the structure, such a cement base should utilise a rough finish (e.g. wire brush finish) to ensure aquatic macroinvertebrates will be able to cross over the cement. • Disturbed areas should be re-vegetated as soon as possible following completion of construction activities. • Only locally occurring indigenous species should be used for revegetation. • A monitoring plan must be established and implemented (for a minimum of 5 years after construction) to ensure successful re-establishment of vegetation and to ensure that any erosion damage is quickly identified and repaired (refer to the Ecological Management Plan Volumes 1 and 2). • An alien vegetation management plan must be developed and implemented. For a minimum period of 5 years following completion of construction all invasive alien vegetation observed on site should be controlled and removed (An Alien Plant Monitoring and Eradication Plan is included as Chapter 5 in the Ecological Management Plan Volume 1; Alien Invasive Management – Methodologies and Guidelines is included as Chapter 5 in the Ecological Management Plan Volume 2). 		
STORM-WATER MANAGEMENT	<ul style="list-style-type: none"> • Manage storm water flow and 	<ul style="list-style-type: none"> • Recommendations as per the Stormwater Plan and Review Stormwater Management Plan to be 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
Stormwater flow and drainage	drainage	implemented. <ul style="list-style-type: none"> Recommendations as per the Rehabilitation and Floodplain Restoration Plan as well as the Review Rehabilitation Plan to be implemented. All construction activities should take place during winter when no rainfall is expected to occur; and A seasonal incidences of water runoff from the surrounding premises should be identified and contained or diverted prior to entering the floodplain during the period of alteration 		<ul style="list-style-type: none"> Twice a month by ECO After heavy rains Monthly report
WATER QUALITY AND SEDIMENTATION Sedimentation of the channel and the downstream spruit Impact on water quality	<ul style="list-style-type: none"> Minimise the sedimentation of the channel and the downstream spruit Minimise the impact on the water quality 	<ul style="list-style-type: none"> Construction vehicles are to be maintained in good working order, to reduce the probability of leakage of fuels and lubricants. A walled concrete platform, dedicated store with adequate flooring or bermed area should be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas. Storage of potentially hazardous materials should be above the 100-year flood line, or as agreed with the ECO. These materials include fuel, oil, cement, bitumen etc. Sufficient care must be taken when handling these materials to prevent pollution. Surface water draining off contaminated areas containing oil and petrol would need to be channelled towards a sump which will separate these chemicals and oils. Oil residue must be treated with oil absorbent such as Drizit or similar and this material removed to a licensed waste disposal site. Concrete is to be mixed on mixing trays only, not on exposed soil. Concrete and tar shall be mixed only in areas, which have been specially demarcated for this purpose. All concrete and tar that is spilled outside these areas shall be promptly removed by the contractor and taken 	<ul style="list-style-type: none"> ECO Contractor 	<ul style="list-style-type: none"> Ongoing by Contractor. Twice a month by ECO. Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>to an approved dumpsite.</p> <ul style="list-style-type: none"> • After all the concrete / tar mixing is complete all waste concrete / tar shall be removed from the batching area and disposed of at an approved dumpsite. • Stormwater shall not be allowed to flow through the batching area. • Cement sediment shall be removed from time to time and disposed of in a manner as instructed by the Consulting Engineer. • All construction materials liable to spillage are to be stored in appropriate structures with impermeable flooring. • Contractor/s must provide regularly serviced portable chemical toilets outside of the 1:100 flood line where practical for construction workers at a distance no more than 200m from the place of construction. • No materials may be discharged from the working area. • Underground services running within the Spruit's servitude should be treated with care in order to avoid possible damage. This will ensure minimum maintenance that would disturb the subsurface environment. Should damage occur to any pipes, they should be fixed immediately. • To prevent erosion of material that is stockpiled for long periods, the material must be retained in a bermed area. • The temporary storage of topsoil, inert spoil, fill etc. should be above the 20 year floodline or at least 20 m from the top of the bank of any drainage lines, whichever is the maximum or as agreed with the ECO. • Mulch, roughen or sterile grass seeding can be used on any batter or soil stockpile that is to be maintained for longer than 28 days. • Construct an earth bank around the upslope portion of any stockpiles in order to redirect runoff and prevent scouring of stockpiles. • Erect a silt fence around any stockpiles in order to trap sediment and prevent stockpile sediment loss. 		

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<ul style="list-style-type: none"> • Dust suppression is necessary for stockpiles older than a month – with either water or a biodegradable chemical binding agent. • The propose Montanaspruit Improvement Project should tie into the upstream channel improvement project currently under construction. Currently it appears from the layout plans that a short reach of the stream will not be addressed by either project. It must be ensured that this will not compromise either of the channel improvement project. The same applies to the proposed downstream channel improvement project • Construction should ideally commence at the upstream end and progress downstream. This will ensure that ongoing construction activities will not continuously disturb and impact on sections of the stream already completed. • Construction should ideally take place during low-flow periods. Unprotected bare soils during flood events could lead to severe erosion and soil loss. Construction should therefore ideally take place in winter. • Construction activity must be carefully planned and supervised to allow the project schedule to be implemented without undue delays. A scenario of incomplete or partially completed work left standing for extended periods must be avoided. • The existing channel of the stream should be retained intact as far as possible. This will limit direct disturbance of sediments within the flow path, resulting in reduced turbidity issues. 		
<p>NOISE</p> <p>Noise as a result of construction activities</p>	<ul style="list-style-type: none"> • Reduce noise from construction activities impacting on neighbours and on the fauna residing on the site 	<ul style="list-style-type: none"> • Noise levels shall be kept within acceptable limits, and construction crew must abide by National Noise Laws and local by-laws regarding noise. • No sound amplification equipment such as sirens, loud hailers or hooters are to be used on site except in emergencies and no amplified music is permitted on site. • All construction vehicles are to be kept in good repair 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor. • Twice a month by ECO. • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<ul style="list-style-type: none"> • Construction / management activities involving use of the service vehicle, machinery, hammering etc., must be limited to the hours between 7:00am and 5:30pm weekdays; 7:00am and 1:30pm on Saturdays; no noisy activities may take place on Sundays or Public Holidays. • Activities that may disrupt neighbours (e.g. delivery trucks, excessively noisy activities etc.) must be preceded by notice being given to the affected neighbours at least 24 hours in advance. • Equipment that is fitted with noise reduction facilities (e.g. side flaps, silencers etc.) must be used as per operating instructions and maintained properly during site operations. 		
<p>ADJACENT LANDOWNERS</p> <p>Impact on the privacy of adjacent land owners.</p>	<ul style="list-style-type: none"> • Prevent nuisance to adjacent land owners 	<ul style="list-style-type: none"> • The construction camp must be located as far from residential properties as possible. • No access to neighbouring holdings should be allowed. Construction crew to respect adjacent landowners. 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor. • Twice a month by ECO. • Monthly report
<p>SAFETY AND SECURITY</p> <p>Impacts on social well-being of general public and construction personnel</p>	<ul style="list-style-type: none"> • Ensure social well-being of general public and construction personnel 	<ul style="list-style-type: none"> • The developer must ensure that an effective security system is installed on the site. • The handling of equipment and materials must be adequately supervised and instructed. • Access to the construction crew camp should be limited to the workforce. • Do not allow the movement of public within the development area. • Except for 24hour security guards and permanent staff, no workforce may stay on site during the night. • Signs should be erected on all entrance gates to the site camp indicating that no temporary jobs are available, thereby limiting opportunistic labourers and crime. • The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act (Act No. 85 of 1993) and the National Building Regulations. 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor. • Twice a month by ECO. • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<ul style="list-style-type: none"> • All structures that are vulnerable to high winds must be secured (including toilets). • Potentially hazardous areas such as trenches are to be cordoned off and clearly marked at all times. • The Contractor is to ensure traffic safety at all times, and shall implement road safety precautions for this purpose when works are undertaken on or near public roads. • Necessary Personal Protective Equipment (PPE) and safety gear appropriate to the task being undertaken is to be provided to all site personnel (e.g. hard hats, safety boots, masks etc.). • All vehicles and equipment used on site must be operated by appropriately trained and / or licensed individuals in compliance with all safety measures as laid out in the Occupational Health and Safety Act (Act No. 85 of 1993) (OHSA). • An environmental awareness training programme for all staff members shall be put in place by the Contractor. Before commencing with any work, all staff members shall be appropriately briefed about the EMP and relevant occupational health and safety issues. • All construction workers shall be issued with ID badges and clearly identifiable uniforms. • Access to fuel and other equipment stores is to be strictly controlled. • Emergency procedures must be produced and communicated to all the employees on site. This will ensure that accidents are responded to appropriately and the impacts thereof are minimised. This will also ensure that potential liabilities and damage to life and the environment are avoided. • Adequate emergency facilities must be provided for the treatment of any emergency on the site. • The nearest emergency service provider must be identified during all phases of the project as well as its capacity and the magnitude of accidents it will be able to handle. Emergency contact numbers are to be displayed 		

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>conspicuously at prominent locations around the construction site and the construction crew camps at all times.</p> <ul style="list-style-type: none"> • The Contractor must have a basic spill control kit available at each construction crew camp and around the construction site. The spill control kits must include absorptive material that can handle all forms of hydrocarbon as well as floating blankets / pillows that can be placed on water courses. • The Contractor shall make available safe drinking water fit for human consumption at the site offices and all other working areas. • Washing and toilet facilities shall be provided on site and in the Contractors camp. • Adequate numbers of chemical toilets must be maintained in the Contractors camp to service the staff using this area. At least 1 toilet must be available per 20 workers using the camp. Toilet paper must be provided. • The chemical toilets servicing the camp must be maintained in a good state, and any spills or overflows must be attended to immediately. • The chemical toilets must be emptied on a regular basis. 		
<p>EMPLOYMENT OPPORTUNITIES</p> <p>Employment opportunities for local community</p>	<ul style="list-style-type: none"> • Make provision for local employment where possible. 	<ul style="list-style-type: none"> • Make use of local labour. • Provide clear and realistic information regarding employment opportunities and other benefits for local communities in order to prevent unrealistic expectations. • Provide skills training for construction workers. 	<ul style="list-style-type: none"> • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor
<p>GRAVES, ARCHAEOLOGICAL AND OTHER HERITAGE SITES</p> <p>Destruction of cultural/heritage sites</p>	<ul style="list-style-type: none"> • Protection of cultural and heritage sites • Protection of graves 	<ul style="list-style-type: none"> • Known sites should be clearly marked in order that they can be avoided during construction activities. • The contractors and workers should be notified that archaeological sites might be exposed during the construction activities. • Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon 	<ul style="list-style-type: none"> • ECO • Contractor • PHRA-G • SAHRA • SAPS 	<ul style="list-style-type: none"> • Ongoing by Contractor • Twice a month by ECO • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<p>as possible;</p> <ul style="list-style-type: none"> • All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken; • Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and • Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1). • In order to achieve this, the following should be in place: <ul style="list-style-type: none"> • A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage. • Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above. • In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures. 		
<p>TRAFFIC</p> <p>Disturbance caused by construction traffic</p>	<ul style="list-style-type: none"> • Prevent construction vehicles from disturbing the general public and environment 	<ul style="list-style-type: none"> • A traffic management strategy must be put in place. • The contractor is to ensure traffic safety at all times and shall implement road safety precautions. • Signs should be erected on all entrance gates • Speed limits should be implemented and adhered to. • It must be ensured that a backlog of traffic does not develop at the access points during peak hours, through the implementation of an efficient and effective access control system. 	<ul style="list-style-type: none"> • ECO • Contractor 	<ul style="list-style-type: none"> • Ongoing by Contractor. • Twice a month by ECO. • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<ul style="list-style-type: none"> Only roads with low volume traffic should be closed off when altering the Tsamma Road crossing. 		
<p>SOLID WASTE MANAGEMENT</p> <p>Refuse and waste produced during the construction phase</p> <p>Dumping of building material, rubble and any material used during construction or rehabilitation.</p> <p>Stockpiled material</p>	<ul style="list-style-type: none"> Ensure wastes are appropriately stored, handled and safely disposed of at a licensed waste facility Ensure separation at source and recycling Control of dumping of building material, rubble and any material used during construction or rehabilitation. Manage stockpiled material 	<ul style="list-style-type: none"> Adequate number of waste disposal receptacles is to be positioned at strategic locations within the development. No burning of waste. Waste will be collected and removed off-site to a registered waste site. 	<ul style="list-style-type: none"> ECO Contractor 	<ul style="list-style-type: none"> Ongoing by Contractor. Twice a month by ECO. Monthly report
<p>PRESSURE ON EXISTING INFRASTRUCTURE AND SERVICES</p> <p>Dark Fibre Africa Optical Fibre Infrastructure</p>	<ul style="list-style-type: none"> Minimise pressure on existing infrastructure and services 	<ul style="list-style-type: none"> Integrity of existing services to be ensured. Dark Fibre Africa's terms and conditions will be considered and adhered to. 	<ul style="list-style-type: none"> ECO Contractor 	<ul style="list-style-type: none"> Ongoing by Contractor. Twice a month by ECO. Monthly report
<p>POLLUTION</p> <p>Soil, surface- and groundwater pollution</p>	<ul style="list-style-type: none"> Minimise soil, surface- and groundwater 	<ul style="list-style-type: none"> All hazardous materials such as but not limited to paint, turpentine and thinners must be stored appropriately to prevent these contaminants from entering the terrestrial 	<ul style="list-style-type: none"> ECO Contractor 	<ul style="list-style-type: none"> Ongoing by Contractor.

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
	pollution	<p>and water environments.</p> <ul style="list-style-type: none"> • Provide containment areas for potential pollutants at construction camps • Fuels and chemicals must be stored in adequate storage facilities that are secure, enclosed, banded and lined • Ensure handling, transport and disposal of hazardous substances are adequately controlled and managed according to the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (2nd Edition, 1998). • Any residue from spillages shall be removed from site by appropriate contractors. Handling, storage and disposal of excess or containers of potentially hazardous materials shall be in accordance with the requirements of the adjudicating authority or any other relevant department. • All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil; • In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss. • All spills should they occur, should be immediately cleaned up and treated accordingly. • Drip trays are to be utilised during daily greasing and re-fuelling of machinery and to catch incidental spills and pollutants • Drip trays are to be inspected daily for leaks and effectiveness, and emptied when necessary. This is to be closely monitored during rain events to prevent overflow • The Contractor must have a basic spill control kit available at each construction camp site and around the construction site. The spill control kits must include absorptive material that can handle all forms of 		<ul style="list-style-type: none"> • Twice a month by ECO. • Monthly report

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		hydrocarbon as well as floating blankets / pillows that can be placed on watercourses.		
CONSTRUCTION ACTIVITIES AT TSAMMA STREET	<ul style="list-style-type: none"> Limit inconvenience to surrounding landowners 	<ul style="list-style-type: none"> Notify surrounding property owners before construction commences. Sign should be erected indicating construction activities. Signs should be erected indicating alternative routes. 	<ul style="list-style-type: none"> Contractor 	<ul style="list-style-type: none"> Ongoing by Contractor Twice a month by ECO Monthly report
CONCRETE AND CEMENT PREPARATION AND HANDLING The use and preparation of concrete on site has the potential to impact negatively on the environment	<ul style="list-style-type: none"> Concrete spills must be contained on site and mitigated. 	<ul style="list-style-type: none"> No mixed concrete may be deposited outside of the designated construction footprint; A batter / dagga board mixing trays and impermeable sumps should be provided, onto which any mixed concrete can be deposited whilst it awaits placing; and Concrete spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site. Waste disposal certificates must be obtained for any waste that is disposed of. 	<ul style="list-style-type: none"> ECO Contractor 	<ul style="list-style-type: none"> Ongoing by Contractor Twice a month by ECO Monthly report
CLOSURE AND REHABILITATION Reduction in the potential of land if construction and construction camp sites are not rehabilitated	<ul style="list-style-type: none"> Implementation of the Rehabilitation and Floodplain Restoration Plan as well as the Review Rehabilitation Plan. 	<ul style="list-style-type: none"> Implementation of the Rehabilitation and Floodplain Restoration Plan as well as the Review Rehabilitation Plan. Rehabilitation actions must be implemented as an integrated part of the overall construction programme. 	<ul style="list-style-type: none"> ECO Contractor 	<ul style="list-style-type: none"> Ongoing by Contractor Twice a month by ECO Monthly report

Table 6: Operational Phase

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
<p>FLORA AND FAUNA</p>	<ul style="list-style-type: none"> • Protection of existing indigenous flora and fauna • Alien invasive eradication 	<ul style="list-style-type: none"> • Depending on the protection status of the open spaces (e.g. conservancy / protected environment) a management entity must be appointed to manage, safeguard and monitor the conservation open space. • The open space should be clearly demarcated and prevent any edge effect. • If grazing is allowed, ensure that overgrazing does not take place through applying appropriate stocking rates according to the areas carrying capacity. • Access must be controlled and detrimental activities such as quad bikes prohibited. • During the operational phase, the use of natural open spaces should be regulated to prevent degradation to the system. This may involve fencing off the area and using it as a nature conservation area. No pollution or dumping should be allowed. • An environmental notice board or centre could be incorporated into the design of the open space system. It should ideally be located before people gain entrance into the open space system and should inform them of the value of wildlife and environmental sensitivity. • Domestic animals (cats and dogs) must be kept on leashes when walked within open spaces. They may not harass faunal species or destroy vegetation. • A suitably qualified floral specialist should assess the success of species relocated annually for the first three years. • Continuous monitoring of open spaces for 	<ul style="list-style-type: none"> • CTMM 	<ul style="list-style-type: none"> • Ongoing

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
		<ul style="list-style-type: none"> re-emergence or new infestations • New infestations or re-emergence must be controlled immediately. 		
<p>HYDROLOGY</p> <p>Stormwater flow and drainage</p> <p>Erosion of drainage lines, riparian zone and floodplain</p>	<ul style="list-style-type: none"> • Protection of the watercourses on site • Manage stormwater flow • Prevent erosion 	<ul style="list-style-type: none"> • Implementation of the Stormwater Management Plan and Review Stormwater Management Plan. • The modified channel and stormwater inlets must be inspected on a monthly basis or after a heavy storm during the first 12 months after construction for signs of erosion which must be repaired as soon as practically possible before the next heavy rainfall event by means of a permanent and ecologically sympathetic solution. • The silt traps and widened channel must be inspected monthly during the first 12 months after construction for signs of excessive sediment and debris build up which must be removed as soon as practically possible without damaging vegetation cover and to restore their capacity before the next heavy rainfall event. • Monitoring of the channel and silt traps and remedial action must be undertaken at least twice a year for another five years: once before the commencement of the rainy season; and the second time at the end of the rainy season. • Ensure continuous monitoring of rehabilitated vegetation cover and address all problems as they arise. 	<ul style="list-style-type: none"> • CTMM 	<ul style="list-style-type: none"> • Ongoing
<p>SAFETY AND SECURITY</p>	<ul style="list-style-type: none"> • Implementation of security measures 	<ul style="list-style-type: none"> • Security measures to be in place. 	<ul style="list-style-type: none"> • CTMM 	<ul style="list-style-type: none"> • Ongoing
<p>CONTRIBUTE TO THE PROVISION OF QUALITY BASIC SERVICES AND</p>	<ul style="list-style-type: none"> • Provision of quality infrastructure 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • CTMM 	<ul style="list-style-type: none"> • Ongoing

IMPACT	OUTCOME/ OBJECTIVE	MITIGATION MEASURES/ACTIONS	RESPONSIBILITY	MONITORING FREQUENCY
INFRASTRUCTURE IN THE AREA				
INFRASTRUCTURE AT TSAMMA STREET - 20 (1500 X 450MM) PORTAL CULVERTS	<ul style="list-style-type: none"> • Provision of quality infrastructure 	<ul style="list-style-type: none"> • Upgraded Portal Culvert crossing will accommodate the 1:2-year flow. • Recurrence intervals greater than 1:2 years will overtop Tsamma street and flow on surface. • Regular maintenance of the culvert crossing. 	<ul style="list-style-type: none"> • CTMM 	<ul style="list-style-type: none"> • Ongoing

13 Site documentation, monitoring and reporting

13.1 What needs to be monitored

- Site clearance
- On-site sanitary facilities
- Excavation
- Community relations
- Removal of rubble
- Disposal of Material
- Construction activities
- Protection of buildings and structures
- Protection of the watercourse on site
- Construction of structures
- Progress in terms of construction programme
- Rehabilitation
- Re-vegetation

13.2 How, what procedures

- Site inspections by the ECO
- Site inspections by the Contractor
- Reporting to by the Project Manager

13.3 Recording of Information/Data

The standard site documentation shall be used to keep records on site. All documents shall be kept on site and be made available for monitoring purposes. The documentation shall be signed by all parties to ensure that such documents are legal.

The following documentation shall be kept on site:

- Environmental Authorisation
- Copy of the Environmental Management Programme
- Environmental Complaints register
- Environmental Incidents register
- Environmental Training register

13.4 Reporting

Who should be reported to?

- Applicant
- GDARD
- City of Tshwane
- SAHRA
- PHRA-G

14 Post Construction Audit

A post construction environmental audit is to be conducted by the ECO in order to ensure that all conditions of the EMPr have been adhered to.

15 Amendments to the EMPr

The EMPr is to be submitted to the GDARD for approval prior to implementation. Any changes to the EMPr are to be indicated in the form of addendums.

ANNEXURE A

REHABILITATION AND FLOODPLAIN RESTORATION PLAN REVIEW REHABILITATION PLAN

ANNEXURE B

**ECOLOGICAL MANAGEMENT PLAN
REVIEW ECOLOGICAL MANAGEMENT PLAN**

ANNEXURE C

CURRICULUM VITAE OF EAP

ANNEXURE D

ENVIRONMENTAL CODE OF CONDUCT

The applicant is committed to ensuring that the construction of the development is done according to the highest environmental standards so that the ecological footprint of the development is minimised where possible.

The applicant requires that all construction personnel involved in the construction process accept their responsibilities towards the EMPr and the environment. This includes all permanent, contract or temporary workers as well as any other person involved with the project or visiting the site. Ignorance, negligence, recklessness or a general lack of commitment will not be tolerated.

If you do not understand the rules you must seek assistance to ensure compliance. The following people can assist you in ensuring compliance with the EMPr.

Your Supervisor:

Environmental Control Officer:

Project Manager:

ANNEXURE E

ENVIRONMENTAL COMPLAINTS REGISTER

Environmental Complaints Register					
Name of Complainant	Contact Details	Nature of Complaint	Responsible Person	Date Action Taken	Details of Action Taken

