

# ENVIRONMENTAL MANAGEMENT PROGRAMME

To facilitate compliance and sustainability during the  
development of a low-level crossing

Kaingo Game  
Reserve

**ENVIRONMENTAL MANAGEMENT PROGRAMME**



**File Reference Number:**

**Project Title:**

The development of a low-level crossing on the Mokolo River between the Farm Laurel 159 KQ and the Farm Mokolo River Private Nature Reserve 660 KQ within Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo.

**Prepared for:**

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## DECLARATION

I the undersigned in my capacity as designated below, do hereby undertake to ensure that the conditions and recommendations in terms of the Environmental Management Programme (EMPr) relating to *the development of a low-level crossing on the Mokolo River within Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo* are implemented in so far as they apply to my responsibilities. I assume accountability and responsibility in this respect.

Proponent:	Jurie Willemse	
Name:		
Date:		
		<b>Signature</b>

Reserve Manager:	Jacque Fourie	
Name:		
Date:		
		<b>Signature</b>

Engineer:	Francois Joubert (PG Consulting Engineers)	
Name:		
Date:		
		<b>Signature</b>

*Contractor:		
Name:		
Date:		
		<b>Signature</b>

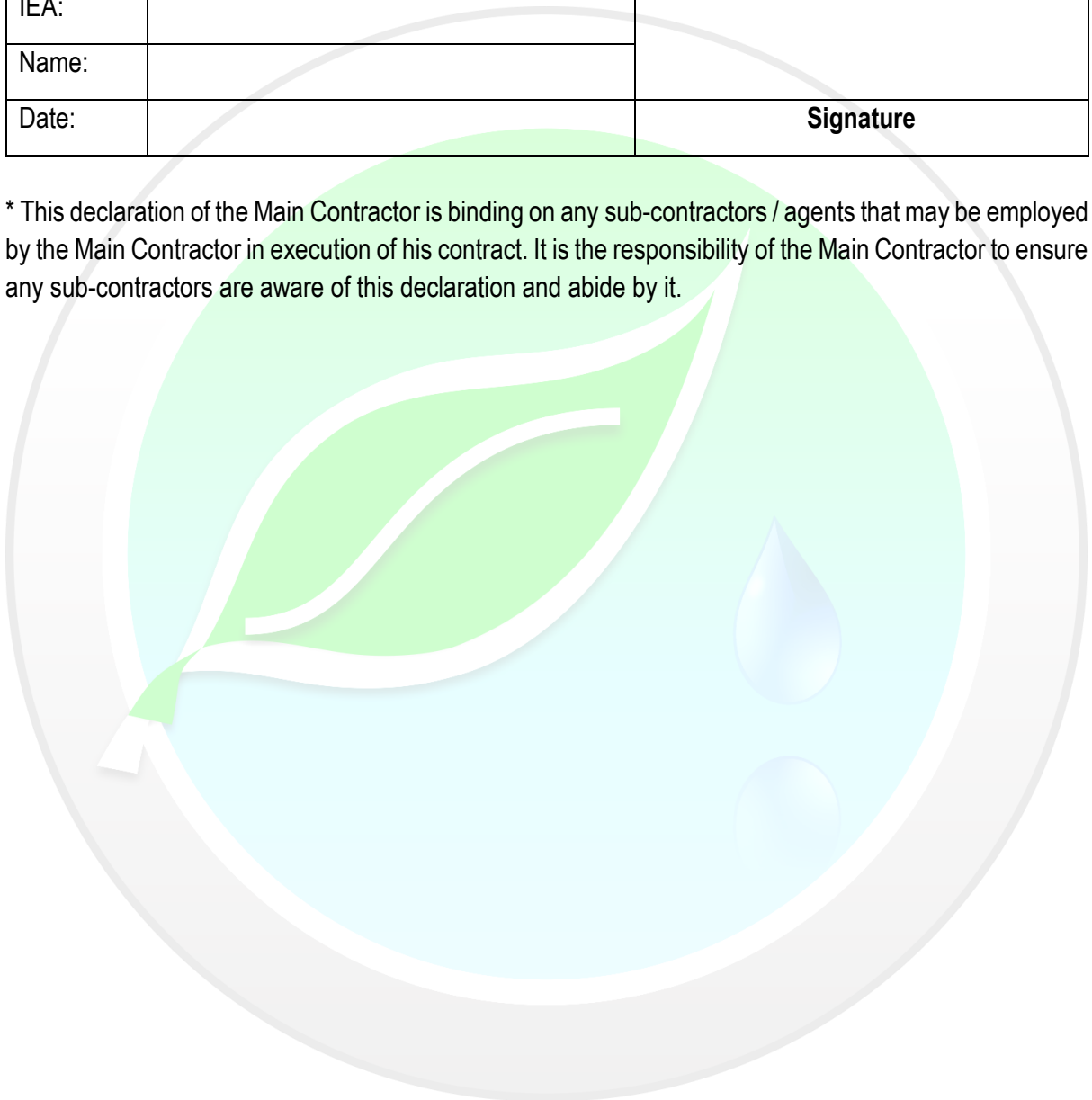
SEO:		
Name:		
Date:		
		<b>Signature</b>

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

ECO:		
Name:		
Date:		<b>Signature</b>

IEA:		
Name:		
Date:		<b>Signature</b>

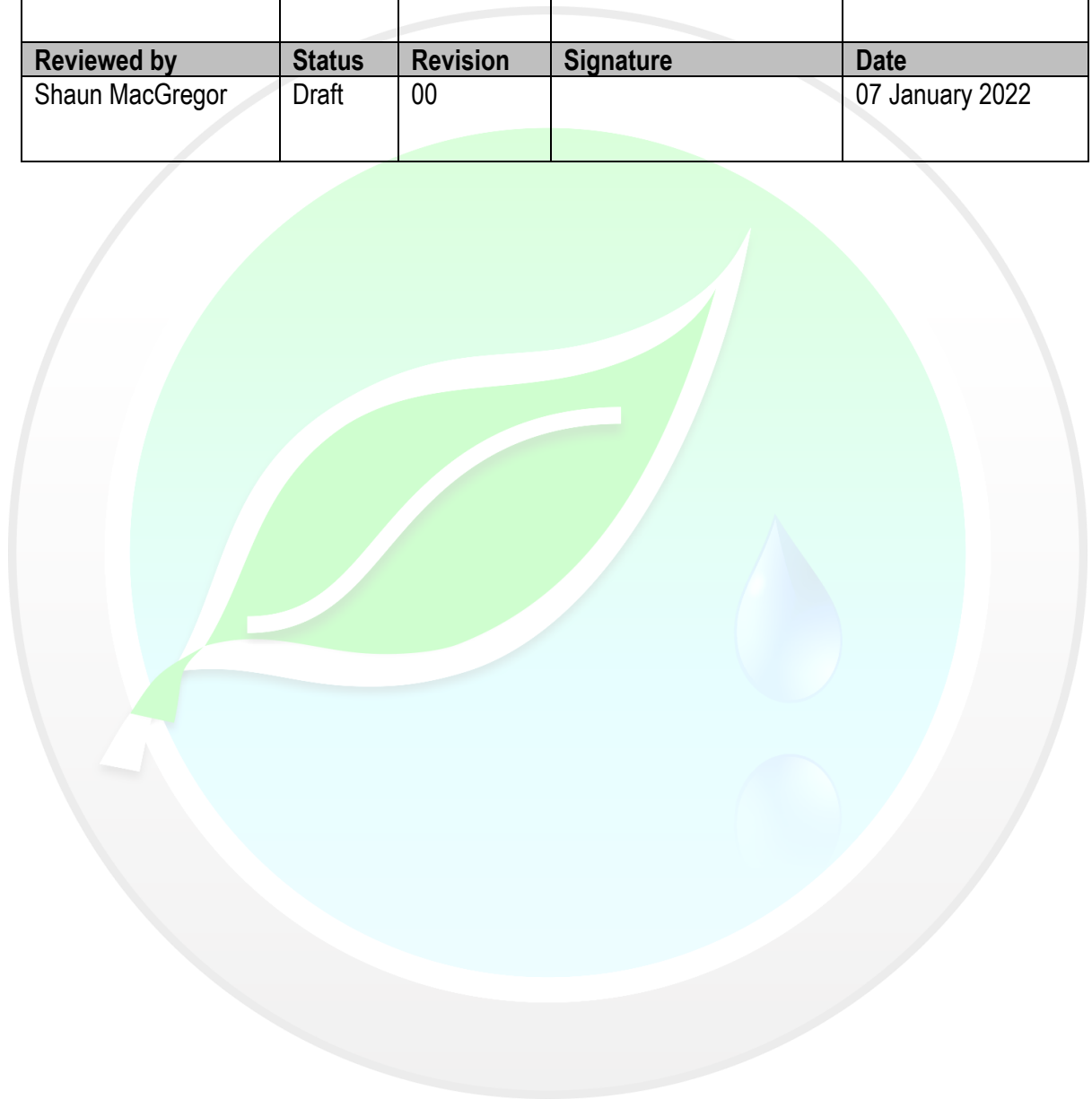
\* This declaration of the Main Contractor is binding on any sub-contractors / agents that may be employed by the Main Contractor in execution of his contract. It is the responsibility of the Main Contractor to ensure any sub-contractors are aware of this declaration and abide by it.



## DOCUMENT CONTROL

**Table 1.** Document Control.

Compiled by	Status	Revision	Signature	Date
Shannon Farnsworth	Draft	00		31 December 2021
Reviewed by	Status	Revision	Signature	Date
Shaun MacGregor	Draft	00		07 January 2022



## EXECUTIVE SUMMARY

Kaingo Reserve (Pty) Ltd, Landowner and Management Authority of Kaingo Game Reserve (a declared Private Nature Reserve in terms of the NEMPAA, 2003 (Act No. 57 of 2003)) acquired a neighbouring property on the opposite bank of the Mokolo River, called Mokolo River Private Nature Reserve. LEDET is in the process of merging both reserves as it will function as a single declared Private Nature Reserve. Year-round access to the enlarged property is required for eco-tourism activity and by the Management Authority to fulfil its conservation mandate during the day-to-day operations or management of the entire Nature Reserve.

Hence the proposed development of a low-level crossing on the Mokolo River between the Farm Laurel 159 KQ and the Farm Mokolo River Private Nature Reserve 660 KQ within Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo. This EMPr (**Table 2**) was developed using the impact and risk assessment, which formed part of the application for an Environmental Authorisation (EA) and Water Use License (WUL), in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the National Water Act, 1998 (Act No. 36 of 1998), respectively.

**Table 2.** Description of the Scope of this Environmental Management Programme.

Scope	
<b>Physical Location and Site:</b>	
Descriptions of all affected farm portions:	Farm Laurel 159 KQ, and Farm Mokolo River Private Nature Reserve 660 KQ
GPS coordinates (Approach Right Bank):	24°04'49.12" S and 27°46'29.40" E
GPS coordinates (Centre):	24°04'46.65" S and 27°46'26.79" E
GPS coordinates (Approach Left Bank):	24°04'44.43" S and 27°46'25.52" E
<b>Estimated Timeframe:</b>	
3 months during the dry season and low flows in the Mokolo River plus post-construction (rehabilitation and monitoring).	
<b>Organisational Structure:</b>	
Applicant: Jurie Willemse	Cell: +27 (0)78 299 3437 Email: <a href="mailto:jurie@kaingo.co.za">jurie@kaingo.co.za</a>
<b>Phases and Activities:</b>	
None of the listed and/or specified activities that were triggered, and which required environmental authorisation, specifically included the term ' <i>and related operation</i> '. Consequently, the scope of the activities pertaining to this project does not have an operational (or decommissioning) component. Consequently, all activities that are to be undertaken during the development of a low water crossing on the Mokolo River, have been described for the planning and design, pre-construction, construction, and post-construction phases only. Pre-construction follows on from the final project planning and tender phase and leads up to the establishment of the appointed contractor on site.	

The EMPr is an extension of the EA and WUL, and as such is a legally binding document that should form part of any tender documentation and appointment contract to ensure its consideration and implementation throughout the life cycle of the project, that is from planning and design to post-construction rehabilitation and monitoring.



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## CHECKLIST

An environmental management programme (EMPr) must comply with section 24N of the NEMA, 1998, as amended and contain those requirements prescribed in the EIA Regulations, 2014, as amended, including regulation 23 and Appendix 4. The full suite of requirements is listed in **Table 3**, which have dictated the layout and content of this EMPr.

**Table 3.** Environmental Management Programme Checklist.

Content of Environmental Management Programme	Checked
1. (1) An EMPr must comply with section 24N of the Act and include-	
(a) details of	
(i) the EAP who prepared the EMPr; and	
(ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	
(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;	
(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 environmental impact assessment process for all phases of the development including-	
(i) planning and design;	
(ii) pre-construction activities;	
(iii) construction activities;	
(iv) rehabilitation of the environment after construction and where applicable post closure; and	
(v) 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 -	
(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;	

<i>(ii) comply with any prescribed environmental management standards or practices;</i>	
<i>(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and</i>	N/A
<i>(iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;</i>	N/A
<i>(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);</i>	
<i>(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);</i>	
<i>(i) an indication of the persons who will be responsible for the implementation of the impact management actions;</i>	
<i>(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;</i>	
<i>(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);</i>	
<i>(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;</i>	
<i>(m) an environmental awareness plan describing the manner in which-</i>	
<i>(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and</i>	
<i>(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and</i>	
<i>(n) any specific information that may be required by the competent authority.</i>	
<i>(2) Where a government notice gazetted by the Minister provides for a generic EMPr, such generic EMPr as indicated in such notice will apply.</i>	N/A

## ABBREVIATIONS / ACRONYMS AND DEFINITIONS

**Table 4.** List of terms for abbreviations used in this document.

Abbreviation / Acronym	Term
BA	Basic Assessment as provided for in NEMA (Act 107 of 1998) and EIA Regulations (2014), as amended.
CA	Competent Authority
CAR	Corrective Action Report
CLO	Community Liaison Officer
CRE	Chief Resident Engineer
LEDET	Limpopo Department of Economic Development, Environment and Tourism
DMRE	Department of Mineral Resources & Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAPASA	Environmental Assessment Practitioners Association of South Africa
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment as provided for in NEMA (Act 107 of 1998) and EIA Regulations (2014), as amended.
EIR	Environmental Impact Assessment Report
EMPr	Environmental Management Programme
ELU	Existing Lawful Use as per Part 3 of the National Water Act (Act 36 of 1998)
EM	Environmental Manager
IEA	Independent Environmental Auditor
GA	General Authorisation as per Section 39 of the National Water Act (Act 36 of 1998)
HSO	Health and Safety Officer
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
LA	Listed Activity (EIA Regulations, 2014)

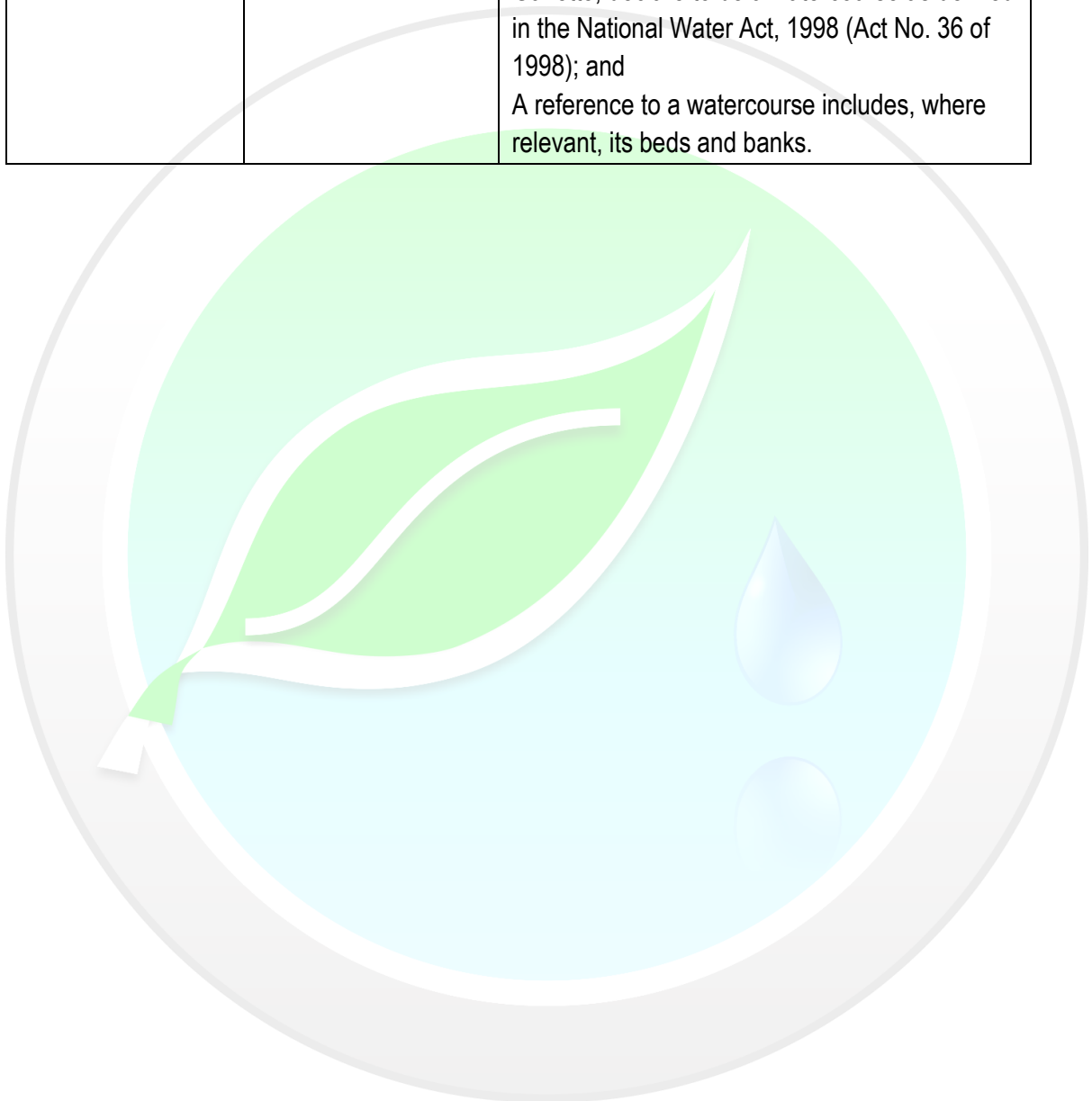
LN1	Listing Notice 1: GN. No. R. 983, 4 December 2014, as amended in GN. No. R. 327, 7 April 2017.
LN2	Listing Notice 2: GN R. 984, 4 December 2014, as amended in GN. No. R. 325, 7 April 2017.
LN3	Listing Notice 3: GN R. 985, 4 December 2014, as amended in GN. No. R. 324, 7 April 2017.
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MS	Method Statement
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SEO	Site Environmental Officer
SO	Social Officer
SOP	Standard Operating Procedure
WUL	Water Use License

**Table 5.** Definitions of some terms used in this document.

Term	Source	Definition
Aspect (environmental)	ISO 14001: 2015	<p>Element of an organisation's activities or products or services that interacts or can interact with the environment.</p> <p>An environmental aspect can cause (an) environmental impact(s). A significant environmental aspect is one that has or can have one or more significant environmental impact(s).</p>
Corrective Action	ISO 14001: 2015	Action to eliminate the cause of a non-conformity (or non-compliance in the case of an EMPr) and prevent recurrence.
Development	EIA Regulations (2014)	Means the building, erection, construction or establishment of a facility, structure or

		infrastructure, including associated earthworks or borrow pits, that is necessary for the undertaking of a listed or specified activity, but excludes any modification, alteration or expansion of such a facility, structure or infrastructure, including associated earthworks or borrow pits, and excluding the redevelopment of the same facility in the same location, with the same capacity and footprint.
Environmental Impact	ISO 14001: 2015	Change to the environment, whether adverse or beneficial, wholly or partially resulting an organisation's environmental aspects.
Maintenance	EIA Regulations (2014)	Means actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint.
Performance	ISO 14001: 2015	Measurable unit. Performance can relate either to quantitative or qualitative findings.
Regulated Area of a watercourse	National Water Act (Act 36 of 1998)	(a) The outer edge of the 1:100-year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; (b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or (c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.
Significant impact	EIA Regulations (2014)	Means an impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.
Watercourse	EIA Regulations (2014)	(a) A river or spring;

		<p>(b)A natural channel in which water flows regularly or intermittently;</p> <p>(c)A wetland, pan, lake or dam into which, or from which, water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998); and</p> <p>A reference to a watercourse includes, where relevant, its beds and banks.</p>
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## Section 1: DETAILS AND EXPERTISE OF EAP AND APPLICANT

*Details of –*

(i) *The EAP who prepared the report;*

<b>Environmental Assessment Practitioner</b>	Ecoleges Environmental Consultants
<b>Contact Person</b>	Shannon Farnsworth
<b>Postal Address</b>	P.O. Box 516, Machadodorp, 1170
<b>Office phone</b>	+27(0)72 654 8202
<b>Cell phone</b>	+27(0)72 654 8202
<b>E-mail</b>	shannon@ecoleges.co.za

*Details of the Applicant;*

<b>Project Applicant</b>	Kaingo Reserve (Pty) Ltd
<b>Trading Name (if any)</b>	Kaingo Game Reserve
<b>Contact Person</b>	Jurie Willemse
<b>Physical Address</b>	Kaingo Game Reserve, Witfontein Road, Bulge Rivier, Limpopo Province, South Africa
<b>Postal Address</b>	Box 580 Vaalwater
<b>Postal Code</b>	0530
<b>Telephone</b>	087 150 1326
<b>Cell</b>	078 299 3437
<b>Fax</b>	
<b>Email</b>	jurie@kaingo.co.za



(ii) *The expertise of the EAP to prepare the EMP, including a curriculum vitae;*

Abbreviated Curriculum Vitae of **Shannon Farnsworth**

<b>Name</b>	Shannon Farnsworth
<b>Date of birth / ID No.</b>	02 February 1990 9002020127087
<b>Nationality</b>	South African
<b>Marital Status</b>	Single
<b>Current Address</b>	Raptors View Wildlife Estate, Hoedspruit, Limpopo, South Africa Cell: 072 654 8202 E-mail: shannon@ecoleges.co.za
<b>Languages</b>	English, basic Afrikaans
<b>Driver's Licence</b>	Code B
<b>Specialisations</b>	Key Fields: environmental/ecological management plans, environmental auditing, Environmental Impact & Basic Assessment, protected area management
<b>Qualifications &amp; Courses Attended</b>	<p><b>2009 – 2011</b> Bachelor of science: environmental management &amp; geography, University of Kwa-Zulu Natal, Pietermaritzburg.</p> <p><b>2012 – 2019</b></p> <ul style="list-style-type: none"> <li>• Firearm training in the handle and use of handgun, shotgun, manual and self-loading operated rifle and carbine.</li> <li>• Environmental Management Inspector [EMI] basic training course for government officials conducted by the national Department of Environmental Affairs [DEA]. designated by the hon. MEC in KwaZulu-Natal for Economic Development, Tourism and Environmental Affairs, Mr. Sihle Zikalala, as a grade 2 environmental management inspector</li> <li>• Wetland wet-heath and Wet-ecoservices training provided by WESSA and UKZN</li> <li>• Certificate of successful completion of: basic Geographic Information Systems [GIS] arc 10 training course</li> <li>• Mini-SASS [stream assessment scoring system] by Duzi Umgeni Conservation Trust [DUCT] and the then Department of Agriculture and Environmental Affairs [DAEA]</li> <li>• Certificate of attendance issued by Maccaferri Africa for hydraulics: introduction to river protection and for hydraulics: introduction to coastal protection</li> <li>• Ecological infrastructure training workshop by WESSA</li> </ul>
<b>Memberships &amp; Registrations</b>	<p><b>2013 - Present</b></p> <p>Registered member of the South African Council for Natural Scientific Professions [SACNASP] as a Certified Natural Scientist in terms of section 20[3] of the <i>Natural Scientific Professions Act, 2003 [Act 27 of 2003]</i> in the field of Environmental Science. Registration Number: 200215/13</p>

	<p><b>2020 - Present</b> Registered as a professional Environmental Assessment Practitioner [EAP] with the Environmental Assessment Practitioners Association of South Africa [EAPASA]. Registration Number: 2020/176</p>
<b>Career Summary</b>	<p><b>September 2021 – Current</b> Environmental Assessment Practitioner – Ecoleges Environmental Consultants</p> <p><b>December 2020 – Current</b> Member of the Mopani District Municipal Planning Tribunal – Environmental Portfolio</p> <p><b>February 2020 – November 2020</b> Operational Management - African Dawn Safaris</p> <p><b>April 2019 – December 2019</b> Manager: Environmental Management Unit at Msunduzi Municipality</p> <p><b>January 2012 – March 2019</b> Environmental Scientist: Environmental Management Unit at Msunduzi Municipality</p> <p><b>2008–2009</b> Invasive Alien Plant planning, control, and eradication with Servest Landscapes.</p>

Full Curriculum Vitae available if required

## **Section 2: DESCRIPTION OF THE ACTIVITY**

*(b) a detailed description of the aspects of the activity that are covered by the EMP as identified by the project description.*

### **Project Title**

The development of a low-level crossing on the Mokolo River between the Farm Laurel 159 KQ and the Farm Mokolo River Private Nature Reserve 660 KQ within Kaingo Private Nature Reserve, Lephalale Local Municipality, Waterberg District, Limpopo.

### **Detailed Project Description**

Kaingo Reserve (Pty) Ltd, Landowner and Management Authority of Kaingo Game Reserve (a declared Private Nature Reserve in terms of the NEMPAA, 2003 (Act No. 57 of 2003)) acquired a neighbouring property on the opposite bank of the Mokolo River, called Mokolo River Private Nature Reserve. LEDET is in the process of merging Mokolo River Private Nature Reserve with Kaingo Game Reserve as it will function as a single declared Private Nature Reserve. Access to the enlarged property is required for eco-tourism activity and by the Management Authority to fulfil its conservation mandate during the day-to-day operations or management of the declared Nature Reserve. There is currently one existing sand bed crossing that is only accessible during the dry winter months of the year. For the remainder of the year, access to the neighbouring property entails an extended round trip that requires any driver to exit Kaingo Game Reserve and then enter the newly acquired Mokolo River Private Nature Reserve section via a district gravel road. The proposal therefore is to construct a low-level crossing further downstream (on a site selected for its favourable geotechnical aspects without compromising environmental integrity) to ensure year-round connectivity between two properties that form part of the Kaingo Game Reserve, specifically the Farm Mokolo River Private Nature Reserve 660 KQ and the Farm Laurel 159 KQ. The proposed activity (the development of a low-level crossing) will negate the unnecessary and wasteful expenditure of time and money to access the neighbouring property by exiting Kaingo Game Reserve, as well as avoid negative impacts on eco-tourism activities, such as game drives. The low-level crossing will be confined to a single, consolidated game reserve for the benefit of the Management Authority during its day-to-day operations or management of the Nature Reserve. As such the activity does not affect or impact any broader societal needs, communities, or economies.

The proposed low-level crossing will consist of a rubble masonry concrete (RMC) structure with integrated concrete storm water pipes and a precast portal culvert at the critical river flow section. The bridge deck will be at CL 940.362 masl which is approximately 0.58 m lower than the 1:20-year expected flood level. The main features of the proposed low-level crossing are:

- Length of bridge deck section - 134.4 m
- Length of entire crossing (including approaches) - 183.0 m
- Crest level of bridge deck - CL 940.362 masl
- Lowest riverbed level - CL 938.021 masl
- Average bridge height to deck level - 1.40 m
- Bridge deck width - 3.66 m

Construction of the proposed low-level crossing shall be as follows:

A 3000mm x 1200mm precast concrete portal culvert is proposed for the crossing at the river's low flow section. This will assist in an unobscured flow regime at the low flow critical section in the river, thus not allowing any damming / containment of water at the crossing structure. In addition to the precast culvert, a set of 30 precast stormwater pipe barrels are proposed to cater for the required design flood.

Most of the structure, including sidewalls and infill between the stormwater pipes and sidewalls, is proposed to be constructed with rubble masonry concrete (RMC) which will act as a gravity structure for stability purposes. The sidewalls of the structure will be built up and anchored to the bedrock with Y20 rebar anchors. The rebar will be drilled into the bedrock and chemically anchored.

After construction of the RMC structure, a bridge deck with flooding indicator blocks will be constructed consisting of a concrete slab with mesh for crack prevention. Finally, the causeway approaches (existing roads) will be excavated and constructed with concrete slabs and associated side drains to link up with the bridge deck. (*Concept Design Report for the proposed low-level crossing at Kaingo Reserve across the Mokolo River prepared by PG Consulting Engineers dated October 2021, Final Report*).

An application for an EA has been submitted to the Limpopo Department of Economic Development, Environment and Tourism (LEDET) in terms of the EIA Regulations, 2014 as amended to undertake listed activity 19 of **Listing Notice 1** (GG No. 40772, GN No. 327, 07th April 2017), and listed activities 12 and 14 of **Listing Notice 3** (GG No. 40772, GN No. 324, 07 April 2017) (**Table 6**).

**Table 6.** Listed and specified activities triggered by the development.

Activity	Description
LN 1 Activity 19	<p><b>The infilling or depositing of any material of more than 10 cubic metres into</b>, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from <b>a watercourse</b>;</p> <p>but excluding where such infilling, depositing, dredging, excavation, removal or moving –</p> <p>(a) will occur behind a development setback;</p> <p>(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;</p> <p>(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;</p> <p>(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or</p> <p>(e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.</p>
LN 3 Activity 12	<p>The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.</p> <p><b>e. Limpopo</b></p>

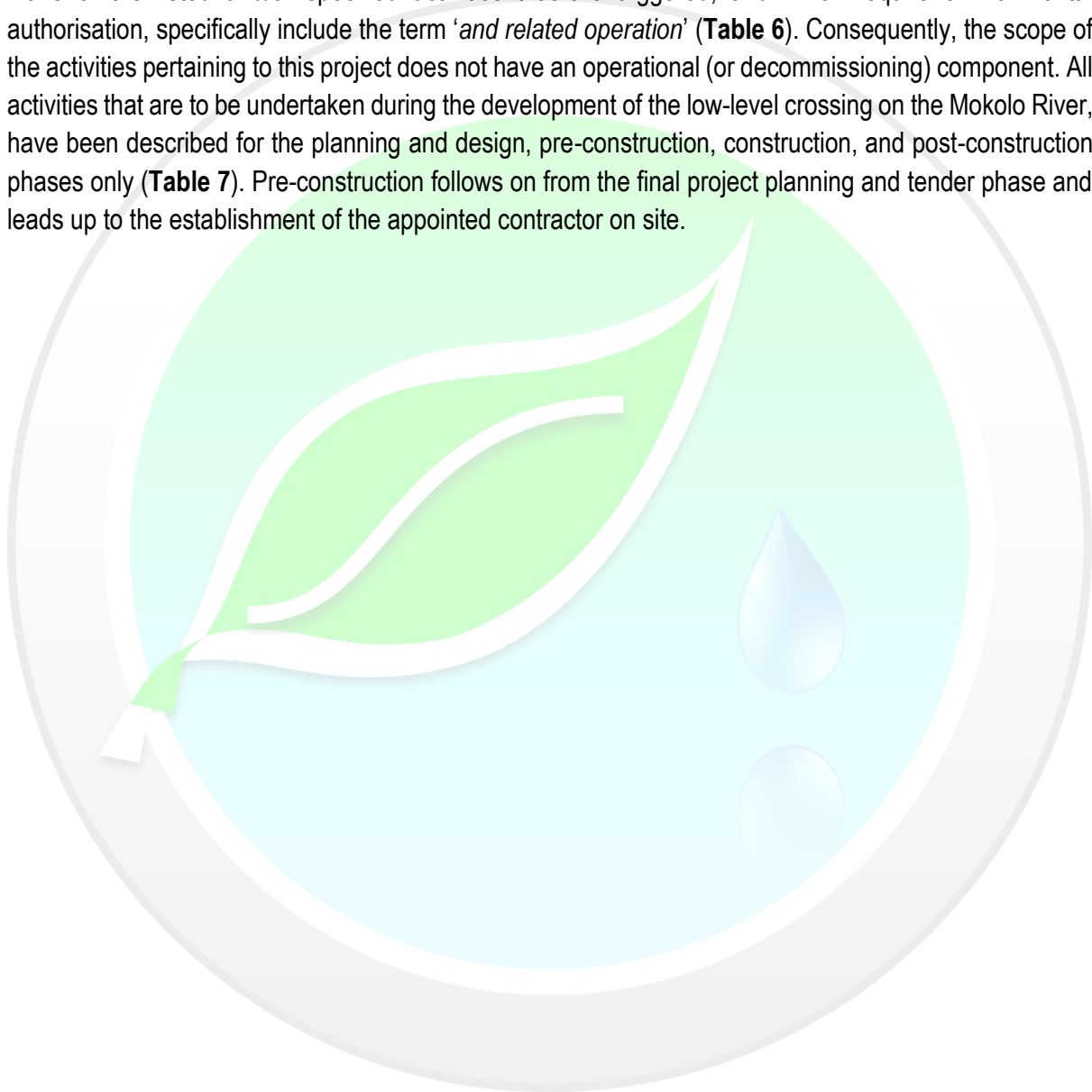
	<p>i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;</p> <p>ii. <b>Within critical biodiversity areas identified in bioregional plans;</b> or</p> <p>iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning</p>
<p>LN 3 Activity 14</p>	<p>The development of –</p> <p>(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or</p> <p>(ii) <b>infrastructure or structures with a physical footprint of 10 square metres or more;</b></p> <p>where such development occurs -</p> <p><b>(a) within a watercourse;</b></p> <p>(b) in front of a development setback; or</p> <p>(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;</p> <p>excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.</p> <p><b>e. Limpopo</b></p> <p><b>i. Outside urban areas:</b></p> <p><b>(aa) A protected area identified in terms of NEMPAA, excluding conservancies;</b></p> <p><b>(bb) National Protected Area Expansion Strategy Focus areas;</b></p> <p><b>(cc) World Heritage Sites;</b></p> <p><b>(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;</b></p> <p><b>(ee) Sites or areas identified in terms of an international convention;</b></p> <p><b>(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;</b></p> <p><b>(gg) Core areas in biosphere reserves; or</b></p> <p><b>(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.</b></p>

Section 24E of NEMA requires that every EA must ensure that adequate provision is made for the ongoing management and monitoring of impacts of the activity on the environment throughout the life cycle of the activity. The life cycle of the activity is determined by the scope of the activity. If the activity requires EA for development only, the development phase is the scope of the activity. If the activity requires EA for development and operation, the development and operational phases make up the scope of the activity



(Environmental Authorisation Validity Period Explanatory Document, 2018). Only when the activity includes such an operational component, the relevant basic assessment report, environmental impact assessment report, the environmental authorisation (including any conditions thereto) and the EMPr can include aspects regarding the operation scope of the activity e.g., mitigation actions for the operational phase (Environmental Authorisation Validity Period Explanatory Document, 2018).

None of the listed and/or specified activities that are triggered, and which require environmental authorisation, specifically include the term '*and related operation*' (**Table 6**). Consequently, the scope of the activities pertaining to this project does not have an operational (or decommissioning) component. All activities that are to be undertaken during the development of the low-level crossing on the Mokolo River, have been described for the planning and design, pre-construction, construction, and post-construction phases only (**Table 7**). Pre-construction follows on from the final project planning and tender phase and leads up to the establishment of the appointed contractor on site.



**Table 7.** Detailed Description of the Phases, Activities and Environmental Aspects of the Development (and that will be managed by this EMPr).

Construction Activities	Sub-activity	Environmental Aspect
<b>Planning &amp; Design</b>		
Legal - Acquiring Authorisations, permits and/or licenses for activities/uses undertaken during construction and operation		
Consideration of Alternatives, including Location and Design.	Alternative Sites	NA
	Alternative Designs	NA
<b>Pre-construction</b>		
Contractor Readiness	Awarding of preferred bidder	
	Acquiring permits and licenses	
	Employment of labour	
	Development of Method Statements (or SOPs)	
	Environmental Awareness Training	
Site Establishment (including Site Offices, Flammable and other hazardous substance stores, Laydown areas, Machinery Parking Area, Maintenance and workshop areas, Fuel storage, Vehicle wash bays, Sanitation/Ablutions, Eating/Rest Areas, Accommodation, Kitchen, Temporary access roads, Sand washing plant, Batching plant/Cement-mixing area)	Site Selection	
	Site Area (size)	
	Perimeter/boundary	
<b>Construction</b>		
Employee management	Supervision	Avoid harm to the environment and persons
	Communicating	Noise generation
	Eating (lunch breaks)	Organic and inorganic waste arisings
	Abluting	Land contamination

Waste (and alien plant) management	Keeping warm or cooking	Starting fires
	Harvesting and/or poaching	Removal of medicinal plants and/or wildlife
	Handling and Collection (incl. chemical toilets)	Effluent discharges
		Land contamination
		Watercourse contamination
	Storage	Land contamination
	Storage	Watercourse contamination
	Transport	Land contamination
	Transport	Watercourse contamination
	Disposal	Land contamination
	Disposal	Watercourse contamination
	Disturbance to natural areas	Favourable conditions for alien plant recruitment.
Clearing/Grubbing and Grading	Construction camp, working servitude and clearing of exposed bedrock and sand shoal	Removal of vegetation
		Noise generation
		Dust generation
		Creating bare surfaces
		Effects on flora/fauna biodiversity
		Alien invasive plant recruitment
Topsoil stripping (construction camp)	Clearing of exposed bedrock and sand shoal up to 3m on both sides of the crossing alignment	Sedimentation of watercourse
		Mixing soil horizons
		Disruption to burrowing fauna
River Diversion	Using construction works, e.g., RMC sidewalls	
	Using imported aggregate	Sedimentation of watercourse
Drilling	Hand-held drilling equipment and portable generator	Noise generation
		Dust generation



	Chemically anchor steel rebar to exposed bedrock	Causing spills
		Watercourse contamination
		Waste arisings (packaging)
Position pre-cast portal culvert and stormwater pipe barrel sets	Driving vehicles in watercourse	Watercourse contamination
Sourcing materials (aggregate)	Mining sand from the riverbed	Depletion of natural resources
		Dust generation
		Sedimentation of watercourse
Stockpiling	Sourcing rock	Depletion of natural resources
	Mulch, topsoil, aggregate and spoil (from causeway excavations)	Cover fauna/nests/burrows
		Cover and damage flora
		Wind erosion & entrainment
		Impede river flow
		Sedimentation of watercourse
		Removal by runoff
	Topsoil	Viability of stockpiled material
Water abstraction and use	Pumping from a borehole	Use of natural resources
		Surface water run-off
	Pumping from the river	Use of natural resources
		Damage to the riverbank
	Washing sand	Surface water run-off
	Mixing with cement	Surface water run-off
Mixing concrete	Mixing on site	Effluent (cement slurry) discharges
		Watercourse contamination
		Land contamination
		Waste arisings (cement bags)

	Importing Ready mix/Cleaning the cement trucks	Generating dust
		Generating noise
		Speed (en route to & from site)
		Generating emissions
		Damage to the environment
		Land contamination
		Watercourse contamination
		Waste arisings (cement slurry)
Placing Concrete	Transporting concrete	Land contamination
	Placing concrete	Watercourse contamination
Earthworks	Excavate causeway approaches	Disturb borrowing animals
		Alter surface water hydrology
		Waste arisings (spoil)
Construction Plant Management	Transporting	Generating dust
		Generating noise
		Speed (en route to & from site)
		Generating emissions
		Damage to the environment
	Operating equipment	Generating noise
	Operating equipment	Causing spills
	Parking	Causing spills
	Parking	Damage to the environment
	Maintenance	Land contamination
	Maintenance	Watercourse contamination
	Washing plant	Land contamination
	Washing plant	Watercourse contamination
	Refuelling	Use of resources

		Causing spills
<b>Post-construction</b>		
Rehabilitation	Removal of structures and infrastructure	
	Pollution control	
	Removal of inert waste and rubble, and hazardous waste	
	Final shaping	
	Ripping and scarifying	
	Topsoil replacement and soil amelioration	
	Brush packing, grassing and/or planting	
Maintenance and monitoring		

### Section 3: LAYOUT MAP OF PROPOSED ACTIVITY

(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 any areas that should be avoided, including buffers.

“The Environmental Management Programme (EMPr) to be submitted as part of the EIAR must include the following:

ii. The final site layout map.

iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.

v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.”

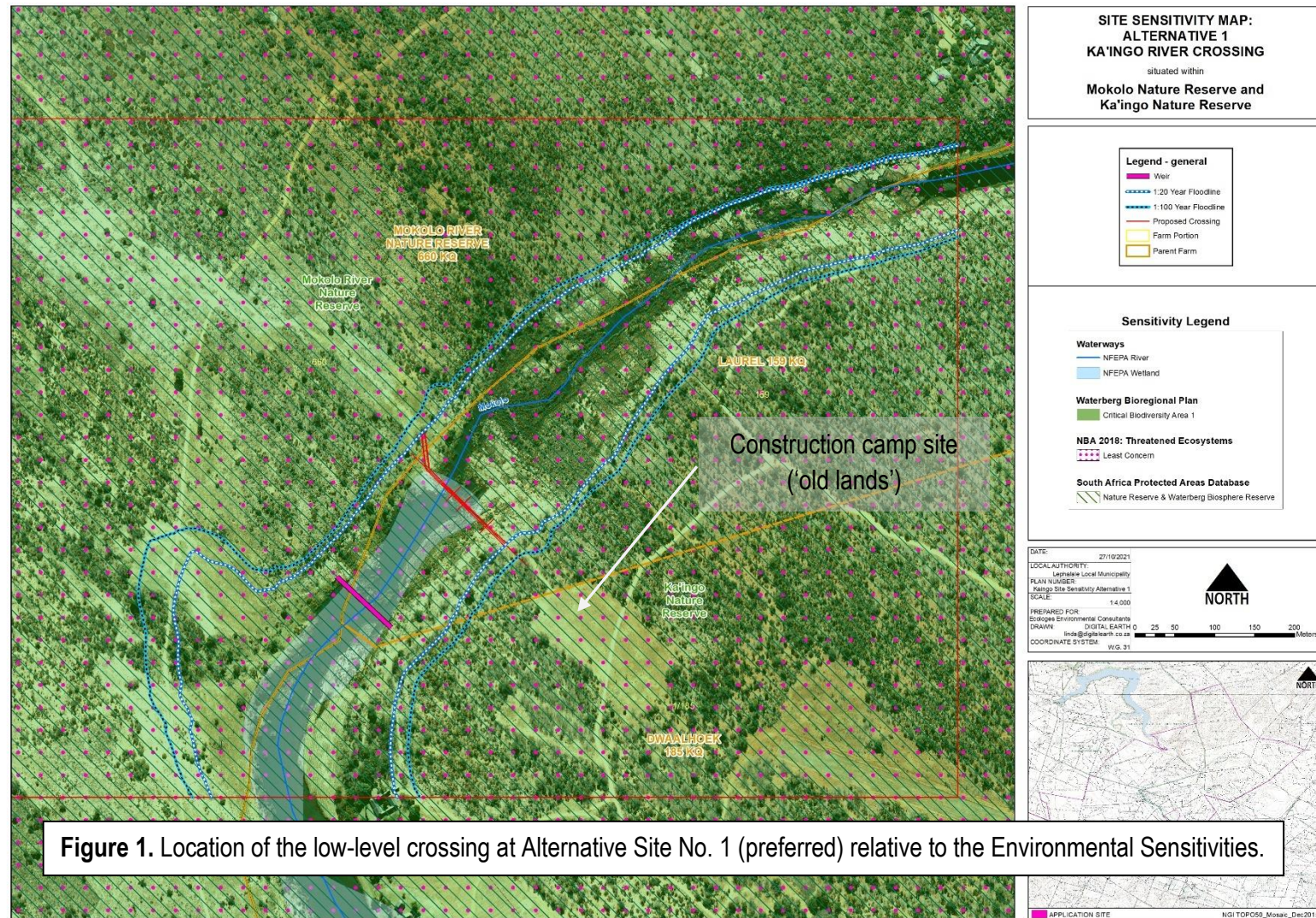
The preferred site of the low-level crossing was determined through an iterative process, to ensure that it remains outside of all the assessed sensitive receptors, including biodiversity priority areas (**Figure 1**), protected trees (**Figure 2** and **Table 8**) and highly sensitive habitat types, including the riparian, sandy bushveld and rocky ridge habitats (**Figure 3**). All construction related activities must remain outside the 10m ecological buffer from the delineated edge of the riparian zone (**Figure 4**).

**Table 8.** Other protected plants that may occur in the development area.

Family	Taxon	National Forest Act, 1998	Limpopo Environmental Management Act, 2003
Apocynaceae	<i>Ceropegia ampliata</i> var. <i>ampliata</i>		X
Combretaceae	<i>Combretum imberbe</i>	X	
Combretaceae	<i>Combretum petrophilum</i>		X
Sapindaceae	<i>Erythrophysa transvaalensis</i>	X	X
Orchidaceae	<i>Eulophia angolensis</i>		X
Malvaceae	<i>Grewia rogersii</i>		X
Apocynaceae	<i>Orbea carnosa</i> subsp. <i>keithii</i>		X
Amaryllidaceae	<i>Scadoxus puniceus</i>		X

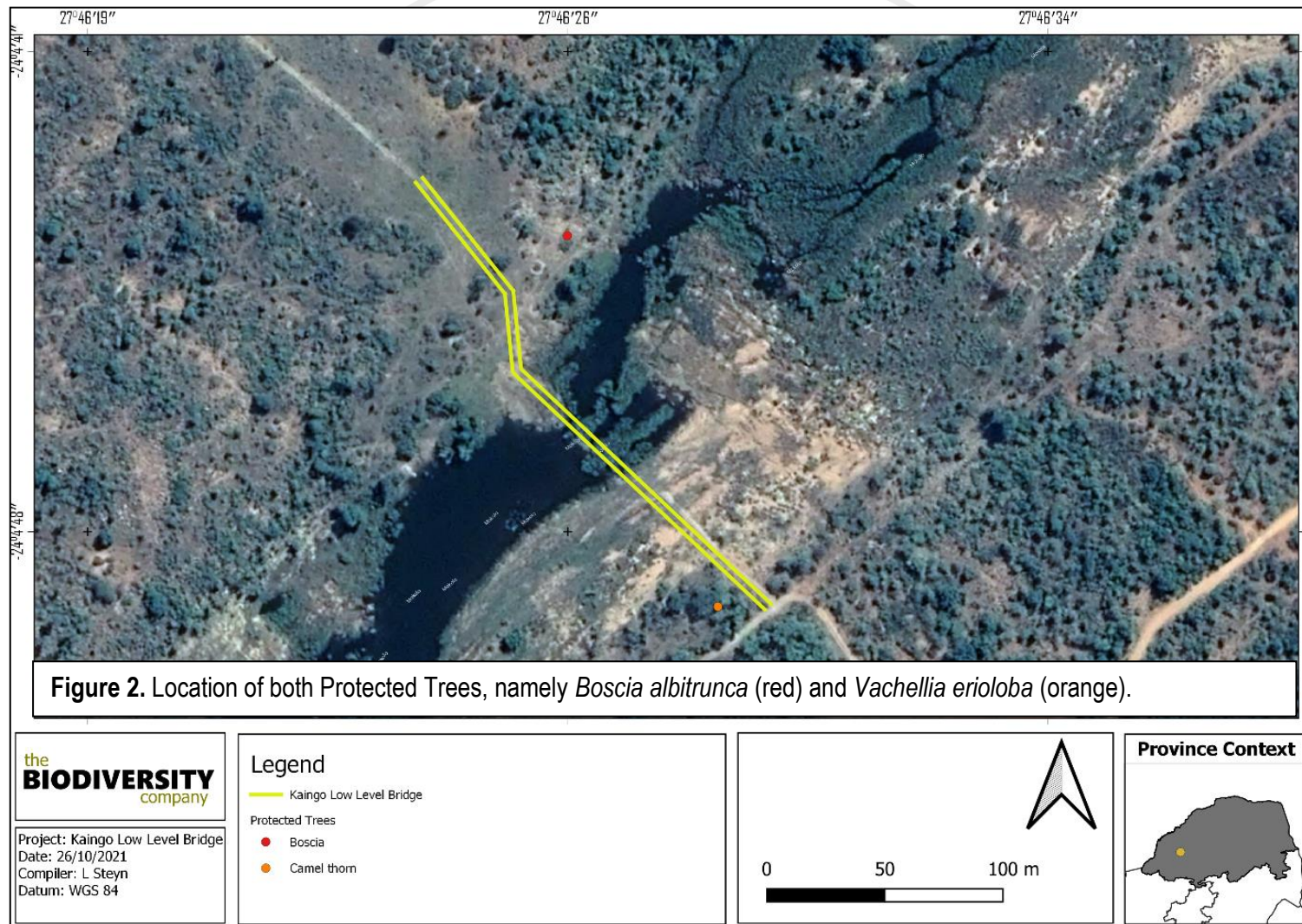


**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

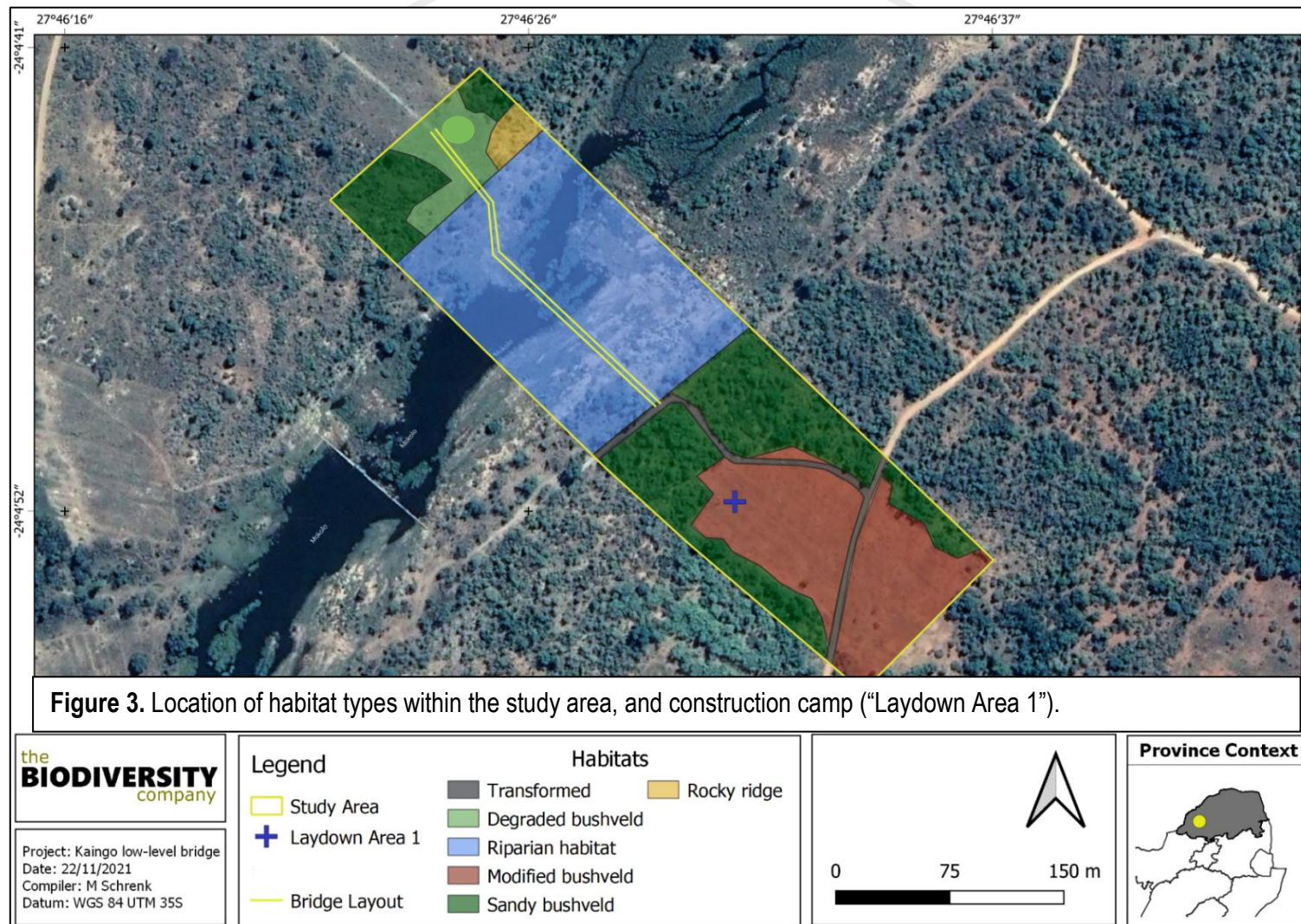


**MEMBERS:** J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)  
Reg: 2006/023163/23



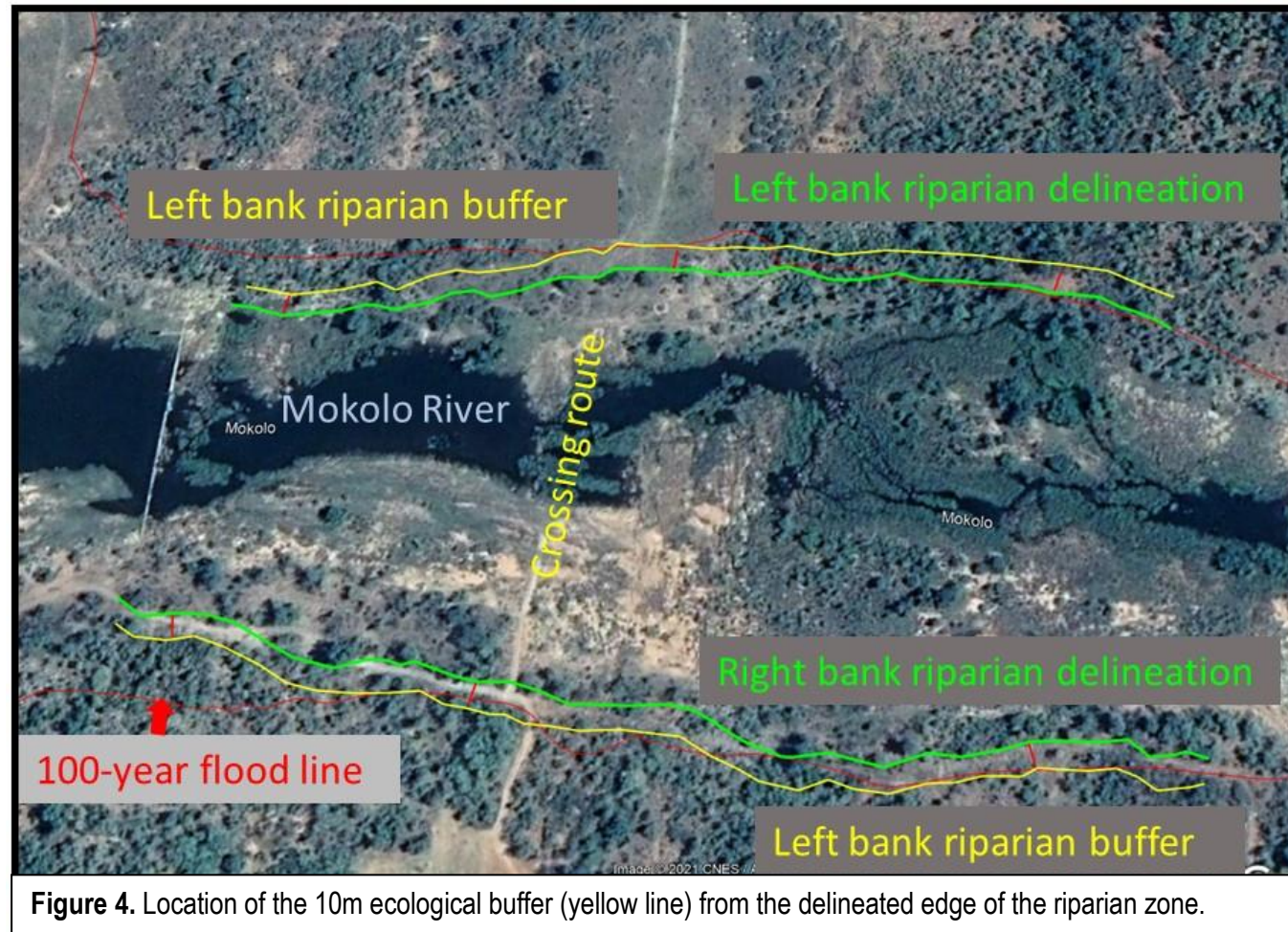






**MEMBERS:** J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)  
 Reg: 2006/023163/23







#### **Section 4: ROLE PLAYERS AND RESPONSIBILITIES**

The approved EMPr shall be printed, completed, and kept in an on-site file designated for all matters pertaining to environmental management. Co-operation is required between the applicant, engineer, contractor, and ECO to ensure that activities are managed in an amicable and responsible manner and in accordance with the philosophies of environmental legislation and principles of the EMPr.

This EMPr is predominantly compiled for the management of construction activities associated with the development of the low-level crossing, once the Planning and Authorisation phases are complete. The tabulated management protocols assign responsibilities to one or more role players. Those responsibilities and accountabilities are described in more detail below to avoid any uncertainty.

##### **Applicant**

The applicant remains ultimately accountable for ensuring that the development is implemented according to the requirements of the EMPr. Although the applicant delegates specific responsibilities to role players to perform functions on his / her behalf, the ultimate accountability cannot be delegated. The applicant is responsible for ensuring that sufficient resources (time, financial, manpower, equipment, etc.) are available to ensure the effective and efficient implementation of any management actions that fall under his/her responsibility. The responsibility of restoring the environment in the event of any negligence, which leads to damage of the environment, also falls on the applicant.

The applicant must ensure that the EMPr (and EA) are included in tender documents and the contracts of appointment so that the appointed engineer and contractor are legally bound to the conditions of the EMPr (and EA).

The applicant must appoint an Environmental Control Officer (ECO) prior to commencement of construction, to help identify conditions that need to be fulfilled prior to commencement and avoid any unnecessary delays.

The applicant must, for the period during which the EMPr (and EA) remain valid, (a) ensure that compliance with the conditions of the EMPr (and EA) is audited by an independent person with the relevant environmental auditing expertise (IEA); and (b) submit an environmental audit report to the LEDET at intervals stipulated in the EA, alternatively in accordance with Regulation 54A(3) of the EIA Regulations (2014), as amended.

The applicant must notify all potential and registered I&APs of the submission of an environmental audit report within 7 days of the date of submission to the LEDET and make such report immediately available (a) to anyone on request; and (b) on a publicly accessible website, if the applicant has such a website.

If the findings of the environmental audit report indicate (a) insufficient mitigation of environmental impacts associated with the undertaking of the activity; or (b) insufficient levels of compliance with the EMPr (and EA), the applicant must, when submitting the environmental audit report to the LEDET, submit recommendations to amend the EMPr to rectify the shortcomings identified in the environmental audit report.

Such recommendations must have been subjected to a public participation process, which process has been agreed to by the LEDET and was appropriate to bring the proposed amendment of the EMPr to the attention of potential and registered I&APs, including organs of state which have jurisdiction in respect of any aspect of the relevant activity and the competent authority, for approval by the LEDET.

#### Reserve Manager

The Reserve Manager is permanently employed by the applicant and can fulfil certain responsibilities in the absence of the ECO, like the preparation of SOPs (on behalf of the applicant), performing Environmental Inductions, informal site inspections and taking field measurements of surface water quality as per the Surface Water Monitoring Plan (**Appendix B**).

#### Engineer

The engineer, as the applicant's agent on site, is bound to the conditions of the EMPr through his/her contract with the applicant and is responsible for ensuring their effective and efficient implementation. The Engineer is responsible for ensuring that sufficient resources (time, financial, manpower, equipment, etc.) are available to ensure the effective and efficient implementation of any management actions that fall under his/her responsibility.

#### Contractor

The contractor, as the applicant's agent on site, is bound to the conditions of the EMPr through his/her contract with the applicant and is responsible for ensuring their effective and efficient implementation. The contractor shall be responsible for the actions undertaken by all their employees including sub-contractors. The contractor must thoroughly familiarise him/herself with the EMPr requirements before coming onto site and must request clarification on any aspect of these documents, should they be unclear. The contractor is responsible for ensuring that sufficient resources (time, financial, manpower, equipment, etc.) are available to ensure the effective and efficient implementation of any management actions that fall under his/her responsibility. The contractor must comply with all instruction (whether verbal or written) given by the environmental manager, project manager or site engineer in terms of the EMPr.

### Site Environmental Officer (SEO)

The Site Environmental Officer (SEO) shall be appointed by the contractor to implement and monitor implementation of the EMPr daily. Findings relating to any impacts resulting from current construction activities will be recorded in a site diary. The SEO shall monitor daily (visual inspections) the surface water quality of the Mokolo River, specifically relating to erosion and turbidity.

The SEO shall also ensure that all construction activities are implemented according to the relevant conditions of the EMPr by establishing Standard Operating Procedures (SOPs)/Method Statements for each construction activity.

The SEOs development of SOPs has been facilitated by assigning management categories to each of the management actions identified in the management protocols (**Section 7**). The management categories include (1) Compliance management, (2) Contractor readiness, (3) Site establishment, (4) Employee management (5) Waste & Alien Plant Management (6) Clearing/Grubbing and Grading (7) Topsoil Stripping (8) River Diversion (9) Surveying and Pegging (10) Drilling (11) Position pre-cast portal culvert and stormwater pipe barrel sets (12) Sourcing Materials (13) Stockpiling (14) Water Abstraction and Use (15) Mixing Concrete (16) Placing concrete (17) Earthworks (18) Construction Plant Management, (19) Rehabilitation, (20) Maintenance and Monitoring, (21) Chance Find Protocol, and (22) River Monitoring and Remediation.

The SEO shall also be responsible for training the workforce on how to carry out their tasks according to the applicable SOPs.

### Environmental Control Officer (ECO)

The Environmental Control Officer (ECO) is appointed by the applicant as a compliance monitor of the implementation of the EMPr. He/she must form part of the project management team and be involved in all aspects of decision-making that can influence environmental compliance on the site.

The ECO (or Reserve Manager) shall prepare Standard Operating Procedures (SOPs)/Method Statements on behalf the applicant. The development of SOPs on behalf of the applicant has been facilitated by assigning management categories to each of the management actions identified in the management protocols (**Section 7**). The management categories applicable to the applicant include (A1) Compliance management, (A2) Contractor Appointment and Induction, (A3) Site establishment, (A4) Health and Safety, (A5) Alien Plant Management, (A6) Clearing/Grubbing, (A7) Topsoil Stripping, (A8) River Diversion, (A9) Surveying/Pegging, (A10) Drilling, (A11) Position Pre-cast Culvert and stormwater pipe barrel sets, (A12) Sourcing Materials, (A13) Stockpiling, (A14) Water Abstraction and Use, (A15) Mixing Concrete, (A16) Placing Concrete, (A17) Earthworks, (A18) Construction Plant Management, (A19)

Rehabilitation, (A20) Maintenance and Monitoring, (A21) Chance Find Protocol, and (A22) River Monitoring and Remediation.

The ECO (or Reserve Manager) shall also be responsible for preparing and presenting environmental inductions.

The ECO must conduct site inspections to assess compliance with the EMPr, undertake field measurements of surface water quality as per the Surface Water Monitoring Plan (**Appendix B**), attend relevant project management meetings, and provide feedback on any findings associated with the development. In addition, the ECO is responsible for:

- Liaising with relevant authorities;
- Liaising with contractors regarding environmental management; and
- Appointing a competent person / institution to be responsible for any specialist monitoring (if required).

Monitoring must track past findings and, on a sampled basis, confirm compliance using verifiable evidence, such as existing documentation, conducting interviews with managers and personnel, and observing activities on site.

The ECO has the right to enter the site and undertake monitoring at any time, subject to compliance with health and safety requirements applicable to the site (wearing safety boots, head gear, mouth mask etc.).

#### Independent Environmental Auditor (IEA)

The IEA is appointed by the applicant to conduct audits and submit environmental audit reports to the LEDET at intervals as indicated in the EA.

The environmental audit report must –

- (a) provide verifiable findings, in a structured and systematic manner, on (i) the level of compliance with and performance against the provisions of the EMPr (and EA); and (ii) the ability of the measures contained in the EMPr to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an ongoing basis; and
- (b) contain all information set out in Appendix 7 of the EIA Regulations (2014), as amended.

If the findings of the environmental audit report indicate (a) insufficient mitigation of environmental impacts associated with the undertaking of the activity; or (b) insufficient levels of compliance with the EMPr (and EA), the IEA should propose recommendations to amend the EMPr to rectify the shortcomings identified in the environmental audit report.

## **Section 5: COMPLIANCE MONITORING**

*(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);*

*(l) a program for reporting on compliance, considering the requirements as prescribed by the Regulations;*

### Mechanism for Monitoring Compliance

The SEO shall maintain a site diary to record any environmental impacts, that is any change to the environment, whether adverse or beneficial, wholly, or partially resulting from construction activities.

The ECO and IEA will be responsible for monitoring and reporting on compliance for the life cycle of the activity.

Site inspections shall be a systematic and documented process of gathering verifiable evidence to objectively determine the extent to which the audit criteria are complied with. The audit criteria (or reference conditions) against which compliance is assessed, includes the management actions contained in this EMPr and the conditions of the EA.

The Environmental Compliance or Audit Reports shall identify the actual and potential transgressions, describe the impacts, provide verifiable evidence (photographs, records, or statements) and recommend corrective and preventive actions (including completion dates). Environmental Compliance Reports prepared by the ECO shall measure the applicant/contractor's level of compliance with the aforesaid criteria, whereas Environmental Audit Reports prepared by the IEA shall measure the level of compliance with and performance against the provisions of the EMPr (and EA).

The project management team should engage in bi-weekly or monthly site meetings so that the ECO can give regular feedback, and any identified concerns can be addressed timeously.

### A Programme for Reporting on Compliance

A Site Environmental Officer (SEO) is appointed by the contractor to *inter alia* monitor implementation of the EMP daily, and record findings relating to any impacts resulting from construction activities in a site diary.

An Environmental Control Officer (ECO) is appointed by the applicant to monitor compliance with the EMPr (and EA). The ECO shall undertake bi-weekly site inspections, and submit Environmental Compliance Reports to the LEDET within 14 days of the site inspection, unless otherwise specified in the EA.



An Independent Environmental Auditor (IEA) is appointed by the applicant to conduct audits and submit Environmental Audit Reports to the LEDET at intervals as indicated in the EA. The applicant must notify all potential and registered I&APs of the submission of an environmental audit report within 7 days of the date of submission to the LEDET. If the applicant submits recommendations to amend the EMPr to rectify any shortcomings identified in the environmental audit report, then such recommendations must have been subjected to a public participation process.

#### Mechanism for Resolving Non-compliance

The EMPr is a legally binding document and should form part of the contract. Should the contractor fail to comply with the EMPr (or EA) the following steps are suggested:

**Step 1.** The ECO or IEA meets with the contractor and points out the deviation from the EMPr either during the site inspection or closure meeting. The ECO or IEA and Contractor verbally agree on a solution and deadline, depending on the nature and severity of the finding.

**Step 2.** The non-compliance is recorded by the ECO or IEA in the Environmental Compliance/Audit Report, as well as the proposed corrective action and the time within which it needs to be implemented. In the absence of a prescribed deadline or completion date, findings shall, as far as is practical, be corrected or prevented immediately upon being found to occur.

**Step 3.** Should the non-compliance not be corrected within the required timeframe the Chief Resident Engineer (CRE) or Project Manager (PM) shall order the contractor to suspend construction in that specific area or the project until the activity at variance with the EMPr is corrected and/or remedial actions taken. Any cost incurred by such action shall be for the account of the contractor.

**Step 4.** Where there is non-compliance with the EMPr and no evidence of the contractor intending to comply, the applicant may terminate the contract due to non-compliance (breach of contract). Such termination does not negate any legal proceedings that may result from the non-compliance.

## **Section 6: ENVIRONMENTAL AWARENESS PLAN**

The EMPr needs to include, *inter alia*:

- (m) an environmental awareness plan describing the manner in which-*
- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and*
- (ii) risks must be dealt with to avoid pollution or the degradation of the environment; and*
- (n) any specific information that may be required by the competent authority.*

This section of the report is included to comply with Section 24N(3)(c) of the NEMA and the EIA Regulations (2014), as amended.

Ongoing environmental awareness training should be provided to all employees to promote the effective implementation of the EMPr's management actions throughout the life cycle of the activity/project. The applicant shall ensure that the project team, including the engineer, contractor, and any sub-contractors are adequately trained on the implementation of the EMPr, (and EA) prior to commencing with construction through environmental inductions, as well as during construction through toolbox talks.

### Environmental Inductions

The ECO (or Reserve Manager) shall be responsible for preparing and presenting environmental inductions. A slideshow can be developed using visual aids to explain the potential impacts and their management. Inductions shall be undertaken prior to the commencement of construction. If any new personnel will be contracted or arrive on site during the construction period, they should attend an environmental induction beforehand. Inductions shall be targeted at two distinct levels of employment: management (applicant, architect, engineer, contractor / site agent) and labourers (including the site foreman). Where possible the presentation will be conducted in the language of the employees.

The Environmental induction for management shall include mitigations that are relevant to or require management's involvement prior to implementation including, but not limited to, measures required during the planning and design phase and pre-construction phase, e.g., site establishment.

The Environmental induction for the contractor's labourers and foreman shall, as a minimum, include the following:

- The dangers posed by local wildlife, including lion, elephant, hippo, brown hyaena, and the Nile Crocodile, as well as precautionary and emergency procedures.

- No-go areas, including the Riparian (outside the working servitude), Rocky Ridge and Sandy Bushveld habitat types.
- Drivers must adhere to the reserve's speed limit (35km/hr) and slow down when approaching game. Drivers must be vigilant and on the lookout for such sedentary animals as the South African Hedgehog (NT) and Lobatse hinged-back tortoise (VU) when driving.
- Staff conduct including, noise, sanitation, poaching and movement,
- A synopsis of key management actions including the environmental impacts they are meant to avoid and the desired management outcomes, and
- The steps to be taken should any archaeological artefacts be located or unearthed.

### Training

The SEO is responsible for preparing and presenting training to the workforce on standard operating procedures (SOPs)/Method Statements for undertaking construction activities (e.g., waste management, mixing concrete, operating equipment, etc.), as well as any adopted Emergency Response Plans (see **Appendix A**).

### Toolbox Talks

The SEO and ECO (or Reserve Manager) shall undertake an informal training needs analysis throughout construction to identify appropriate environmental topics and the appropriate labourers to target. The analysis shall be informed by the findings contained in the site diary and compliance reports. Applicable toolbox talks shall be prepared and given by the SEO.

The ECO (and/or Reserve Manager) and SEO shall keep records (e.g., signed attendance registers) of environmental inductions, training and toolbox talks in an on-site file designated for all matters pertaining to environmental management.

### Posters

It is recommended that posters are developed and placed in highly visible areas at the construction or contractor's camps to provide a constant awareness of key environmental issues, any required information, such as emergency numbers, and remind employees of their duties regarding environmental protection.



## **Section 7: IMPACT MANAGEMENT**

*(d) a description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed, and mitigated as identified through the environmental impact assessment process for all phases of the development including-*

*(i) planning and design;*

*(ii) pre-construction activities;*

*(iii) construction activities;*

*(iv) rehabilitation of the environment after construction and where applicable post closure; and*

*(v) where relevant, operation activities;*

*(e) a description and identification of impact management outcomes required for the aspects contemplated in paragraph (d),*

*(f) a description of proposed impact management actions, identifying the way the impact management objectives and outcomes contemplated in paragraph (d) and (e) will be achieved, and must, where applicable, include actions to -*

*(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;*

*(ii) comply with any prescribed environmental management standards or practices;*

*(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and*

*(iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;*

*(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);*

*(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);*

*(i) an indication of the persons who will be responsible for the implementation of the impact management actions;*

*(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;*

Ecoleges set out to identify, predict and evaluate impacts and risks firstly by identifying the activities that are to be undertaken during the development of the listed or specified activity(ies). The activities were used to identify environmental aspects, which are defined as elements of an organisation's activities, products or services that interact or can interact with the environment (ISO 14001). The environmental aspects were used to identify environmental impacts, which are

defined as any change to the environment, whether adverse or beneficial, wholly, or partially resulting from an organisation's environmental aspects (ISO 14001). Finally, management actions were sought and tailored to achieve measurable targets (quantitative and qualitative) and ensure desired environmental outcomes that are dictated by legal requirements, scientific standards, social acceptability and/or environmental best practice.

Management protocols have been prepared for each attribute of the receiving environment, including (1) Legal System, (2) Terrestrial fauna, (3) Terrestrial flora, (4) Aquatic fauna, (5) Aquatic flora, (6) Soil and Rock, (7) Ground and Surface Water, (8) Atmosphere, (9) Terrestrial ecosystem, (10) Aquatic ecosystem, (11) Economical, (12) Social, (13) Land use, (14) Health and Safety, (15) Security, (16) Public services, (17) Visual aesthetics and (18) Heritage and Culture. Each management protocol provides management actions to avoid, mitigate or remedy various construction-related impacts and achieve stated targets that will ensure desired outcomes for an attribute of the receiving environment. Indicators are used to measure the level of compliance, whereas targets (and outcomes) are used to measure the level of performance.

However, if this EMPr is to be effectively and efficiently implemented by the applicant and contractor, they must develop Standard Operating Procedures (SOPs)/Method Statements for the different activities.

The ECOs development of SOPs on behalf of the applicant has been facilitated by assigning management categories to each of the management actions identified in the management protocols (**Section 7**). The management categories applicable to the applicant include (A1) Compliance management, (A2) Contractor Appointment and Induction, (A3) Site establishment, (A4) Health and Safety (A5) Alien Plant Management, (A6) Clearing/Grubbing, (A7) Top Soil Stripping, (A8) River Diversion, (A9) Surveying/Pegging, (A10) Drilling, (A11) Position Pre-cast Culvert and stormwater pipe barrel sets, (A12) Sourcing Materials, (A13) Stockpiling, (A14) Water Abstraction and Use, (A15) Mixing Concrete, (A16) Placing Concrete, (A17) Earthworks, (A18) Construction Plant Management, (A19) Rehabilitation, (A20) Maintenance and Monitoring, (A21) Chance Find Protocol, and (A22) River Monitoring and Remediation.

The SEOs development of SOPs on behalf of the contractor has been facilitated by assigning management categories to each of the management actions identified in the management protocols (**Section 7**). The management categories applicable to the contractor include (1) Compliance management, (2) Contractor readiness, (3) Site establishment, (4) Employee management (5) Waste & Alien Plant Management (6) Clearing/Grubbing and Grading (7) Topsoil Stripping (8) River Diversion (9) Surveying and Pegging (10) Drilling (11) Position pre-cast portal culvert and stormwater pipe barrel sets (12) Sourcing Materials (13) Stockpiling (14) Water Abstraction and Use (15) Mixing Concrete (16) Placing concrete (17) Earthworks (18) Construction Plant Management, (19) Rehabilitation, (20) Maintenance and Monitoring, (21) Chance Find Protocol, and (22) River Monitoring and Remediation.

Although impacts and management actions have been addressed under the various project development phases, they are not intended to be mutually exclusive, and impacts from one phase may occur in subsequent phases; but in the interest of reducing redundancy, they have not been repeated for each phase.

Any appendices to this EMPr form part of the EMPr and must be implemented accordingly.



## Planning and Design Phase

**Table 9.** Management Protocol for Legal System

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
1	A1	Unlawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.	Lawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.	A water use license for Section 21(c) and (i) water uses.	Obtain a water use license for Section 21(c) and (i) water uses from the regional office of the Department of Water and Sanitation.	Applicant	Prior to commencement of construction.	Compliance to be verified by ECO and IEA.
1	A1	Unlawful activities involving any threatened or protected flora.	Lawful activities involving any threatened or protected flora.	A license under the NFA, 1998, a permit under LEMA, 2003 and/or a permit under NEMBA, 2004.	Obtain the applicable permit(s) and/or license prior to carrying out a restricted activity involving, or picking, or cutting, disturbing, damaging or destroying any threatened or protected flora.	Applicant, ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
1	A1	Unlawful picking of any indigenous plant (“pick” includes to gather, cut off, chop off, uproot, damage or to destroy wholly or partially, or any similar action).	Lawful clearing of any indigenous plants.	A permit under LEMA, 2003.	Obtain a permit prior to clearing (picking) any indigenous plants within an area bordering the Mokolo River (within 50m from the high watermark).	Applicant, ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
1	A1	Unlawful commencement of land development without approved building plans,	Lawful commencement of land development.	Building plans approved by the Lephalale Local Municipality.	Obtain building plan approval from the Lephalale Local Municipality.	Applicant	Prior to commencement of construction.	Compliance to be verified by ECO and IEA.
1	A1	Failure to comply with Duty of Care relating to Listed Invasive Species	Duty of Care relating to Listed Invasive Species	Written Notification	The Management Authority must notify the Minister (DFFE) and/or MEC (LEDET), in writing, of the listed invasive species occurring in the study area, namely <i>Opuntia ficus-indica</i> (NEMBA Category 1b), <i>Myriophyllum aquaticum</i> (NEMBA Category 1b), and <i>Verbena bonariensis</i> (NEMBA Category 1b).	Management Authority	Once-off	Compliance to be verified by ECO and IEA.

**Table 10.** Management Protocol for Ground and Surface Water

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
1.1	Design	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	Final Design indicating stabilised Stormwater outlets.	Stormwater outlets associated with the low-level crossing should be designed in such a way so as not to cause erosion of the riverbank or bed by incorporating such stabilisation mechanisms as terracing, boulder and rock placement, minor gabion	Engineer	Once-off	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					basket work construction, reno mattresses and/or rock pitching.			

**Table 11.** Management Protocol for Health and Safety

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
1.2	Design	Safety risk when using a low-level crossing during strong flows.	Enhance safety when using the low-level crossings.	Final Design, indicating flooding indicator blocks.	Design flooding indicator blocks on the bridge deck.	Engineer	Once-off	Compliance to be verified by ECO and IEA.



## Pre-construction Phase

**Table 12.** Management Protocol for Legal System

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
2	2 and A2	Contractor is unaware of EA and EMP: poor implementation of environmental management or mitigations resulting in significant impacts (Risk)	Compliance with the EA and EMPr	Contractor has an environmental file on site including the EA and EMPr	Contractor must be provided with a copy of the EA and EMPr	Applicant, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
2	2	Conditions of EA and EMP are not enforced or penalised through employment contracts: Significant Impacts on different aspects of the environment (Risk).	Reduced occurrence of labour being non-compliant with EA and EMPr	Clause within labour employment contracts relating to a penalty system for incidences of non-compliance with the EA and EMPr	Contractor should include in labour employment contracts a penalty system regarding incidences of non-compliance with the EA and EMPr	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
2	2 and A2	Lack of environmental awareness:	Environmentally sensitive and responsible	Signed attendance register of	Conduct Environmental Awareness talks to sensitize employees on the	Contractor, ECO (or	Pre-construction	Compliance to be verified



**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		Significant environmental impacts (direct)	conduct by employees	Environmental Awareness training	requirements of the EMP (and EA).	Reserve Manager)		by ECO and IEA.
3	2	Unlawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.	Lawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.	A water use license for Section 21(c) and (i) water uses.	Construction may not commence without a water use license for Section 21(c) and (i) water uses.	Contractor	Prior to commencement of construction.	Compliance to be verified by ECO and IEA.
3	2	Unlawful activities involving any threatened or protected flora.	Lawful activities involving any threatened or protected flora.	A license under the NFA, 1998, a permit under LEMA, 2003 and/or a permit under NEMBA, 2004.	Construction may not commence without the applicable permit(s) and/or license to carry out a restricted activity involving, or picking, or cutting, disturbing, damaging or destroying any threatened or protected flora.	Contractor	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
3	2	Unlawful picking of any indigenous plant (“pick” includes to gather, cut off, chop off, uproot, damage or to destroy wholly or partially, or any similar action).	Lawful clearing of any indigenous plants.	A permit under LEMA, 2003.	Construction may not commence without a permit to clear (pick) any indigenous plants within an area bordering the Mokolo River (within 50m from the high watermark.	Contractor	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
3	2 and A2	Unlawful abstraction of	Lawful abstraction of	No signs of water	Identify water abstraction points: ground water shall be	Applicant and Contractor	During construction,	Compliance to be verified

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		water for use during construction, e.g., mixing concrete.	water for use during construction, e.g., mixing concrete.	abstraction from the excluded geographical areas.	taken from existing boreholes that are further than 500m from the boundary (delineated edge) of a wetland or pan and further than 100m from the delineated riparian edge of a water course.		e.g., when mixing concrete.	by ECO and IEA.
3	2 and A2	Unlawful abstraction of water for use during construction, e.g., mixing concrete.	Lawful abstraction of water for use during construction, e.g., mixing concrete.	No signs of water abstraction from the excluded geographical areas.	Identify water abstraction points: if surface water must be taken from the Mokolo River, then it shall be further than 500m from the boundary (delineated edge) of a wetland or pan, including the identified NFEPA wetland.	Applicant and Contractor	During construction, e.g., when mixing concrete.	Compliance to be verified by ECO and IEA.
3	2	Unlawful commencement of land development without approved building plans.	Lawful commencement of land development.	Building plans approved by the Lephalale Local Municipality.	Construction may not commence without building plan approval from the Lephalale Local Municipality.	Contractor	Prior to commencement of construction.	Compliance to be verified by ECO and IEA.

**Table 13.** Management Protocol for Terrestrial Fauna

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
4	3 and A3	Loss of sedentary fauna and aves when clearing site.	Ensure the protection of sedentary fauna and aves.	No unnecessary physical harm to wildlife	Undertake a search within the development, working servitude (up to 3m on either side of the development footprint), the designated sand mining area, and construction camp footprints for local sedentary or burrowing fauna, such as the South African Hedgehog (NT), Lobatse hinged-back tortoise (VU), the Swamp Musk Shrew (NT), the nest holes and surface runways of the African Marsh Rat, and ground nesting birds, such as the African Finfoot (VU) and the Greater Painted-snipe, which are found along shoreline vegetation.	ECO or Reserve Manager	After marking the boundaries of the construction camp and working servitude.	Compliance to be verified by ECO and IEA.
4	3 and A3	Loss of sedentary fauna and aves when clearing site.	Ensure the protection of sedentary fauna, and aves.	Photographic evidence of relocation operation.	If any sedentary animals or ground nesting birds are found, then these are to be relocated to a suitable distance and habitat by the Reserve Manager or ECO, and only if it is not possible to relocate the footprint.	Reserve Manager or ECO, Engineer, Contractor.	After marking the boundaries of the construction camp and working servitude.	Compliance to be verified by ECO and IEA.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
4	2, A2, 4, A4, 18 and A18	Loss of sedentary or active fauna and aves when driving.	Ensure the protection of active fauna, and aves.	No signs of speeding. Content of induction.	Drivers must adhere to the reserve's speed limit (35km/hr) and slow down when approaching game. This is to be included in the induction.	Contractor, Reserve Manager or ECO.	Ongoing	Compliance to be verified by ECO and IEA.
4	2, A2, 4, A4, 18 and A18	Loss of sedentary or active fauna and aves when driving.	Ensure the protection of sedentary fauna.	Content of Induction. Drivers have a knowledge of which animals to be vigilant for.	Drivers must be vigilant and on the lookout for such sedentary animals as the South African Hedgehog (NT) and Lobatse hinged-back tortoise (VU) when driving. This is to be included in the induction.	Contractor, Reserve Manager or ECO.	Ongoing	Compliance to be verified by ECO and IEA.
4	2 and A2	Illegal harvesting of animals.	Ensure the protection of sedentary fauna, and aves.	Signed register of attendance, and content of induction.	The contractor's staff must be made aware of the prohibitions relating to wild animals in an induction, specifically: No wild animal may under any circumstance be handled, removed, or be interfered with. No wild animal may be fed on site. No wild animal may under any circumstance be hunted, snared, captured, injured or killed. This includes animals perceived to be vermin.	Contractor, Reserve Manager or ECO.	Ongoing	Compliance to be verified by ECO and IEA.
4	A2 and A4	Human-caused harm to arachnids, reptiles and	Ensure the protection of fauna	An attendance register signed by all applicable staff.	Staff responsible for collecting rocks are to be given an induction or toolbox talk on the best way to collect rocks without	Management Authority and Reserve Manager.	Before collecting rocks.	Compliance to be verified by ECO and IEA.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		other fauna living under rocks.			causing harm to the animals living under the rocks, such as the Waterberg Dwarf Gecko (NT) and the Northern Craig Lizard (NT), and specifically told not to harm any animal.			
4	3	Animals may enter the construction camp and have access to waste, hazardous substances, equipment causing injury or death	Ensure the protection of fauna	No incidents of animals entering the construction camp	Erect and maintain a barrier (e.g., shade cloth fence) around the perimeter of the construction camp.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
4	3 and 5	Loss of fauna if inorganic waste is ingested.	Ensure the protection of fauna	No incidents of animals entering the construction camp	General and hazardous waste or materials shall be stored in access-controlled areas and/or receptacles, e.g., storerooms, covered skips, scavenger proof bins, etc.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.



**Table 14.** Management Protocol for Terrestrial Flora

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
5	A3	Loss of local terrestrial plants.	Avoid the unnecessary loss of terrestrial plants.	No disturbance to protected or threatened plants, unless necessary.	Perform a search for any threatened or protected flora in those areas that will be disturbed by construction activities, including the working servitude and construction camp.	ECO or Reserve Manager	After marking the boundaries of the construction camp and working servitude.	Compliance to be verified by ECO and IEA.
5	A1, 2 and A2	Loss of local terrestrial plants.	Avoid the unnecessary loss of terrestrial plants.	No disturbance to protected or threatened plants, unless necessary.	Only apply for permit(s) and/or a license to “pick” a threatened or protected plant if it is not possible to relocate the footprint.	Applicant, Engineer, and Contractor	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
5	3 and A3	Loss of local terrestrial plants.	Avoid the unnecessary loss of terrestrial plants.	No signs of disturbance to protected trees.	High visibility flags must be placed near protected plants, including the Camel Thorn ( <i>Vachellia erioloba</i> ) and the Shepherds Tree ( <i>Boscia albitrunca</i> ) (see <b>Figure 2</b> ) to avoid any damage or destruction of these species.	Contractor, SEO	Ongoing	Compliance to be verified by ECO and IEA.
5	2 and A2	Illegal harvesting of terrestrial plants.	Avoid the unnecessary loss of or harm to terrestrial plants.	Signed register of attendance, and content of induction.	The contractor’s staff must be made aware of the prohibition on harvesting any plant or plant part in an induction.	Contractor, Reserve Manager or ECO.	Prior to site establishment.	Compliance to be verified by ECO and IEA.

**Table 15.** Management Protocol for Soil and Rock

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
7	3 and 18	Contamination of soil with hydrocarbons.	Avoid contamination of soil from leaks	No leaking parts	Any construction plant, machinery, and equipment which leaks shall not be permitted on site.	Contractor, SEO	Ongoing	Compliance to be monitored by SEO and verified by ECO and IEA.
6	3	Parking of vehicles will compact the ground increasing surface water run-off and erosion	Minimise erosion	No formation of soil erosion rills	Parking areas should as far as practical be located on flat ground.	Contractor	Once-off	Compliance to be verified by ECO and IEA.
7	3	Hydrocarbon and other hazardous material spills (concrete slurry) can contaminate the soil	To reduce the amount of soil pollution	Adequate number of drip trays available.	Enough drip trays must be available for all construction plant.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
7	3	Hydrocarbon and other hazardous material spills can contaminate the soil.	Control or contain soil pollution	Spill response equipment.	Provide accidental spill response equipment at the construction camp.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
7	3 and 5	Hydrocarbon and other hazardous material spills/leaching can contaminate the soil	To reduce the amount of soil/water pollution	A designated waste storage area is contained – waste is not in direct contact with the ground.	Designate and contain a temporary waste storage area within the construction camp (e.g., covered skips, scavenger proof bins, etc.)	Contractor	Ongoing	Compliance to be verified by Compliance to be verified by ECO and IEA
7	3	Decrease in water/land quality due to fuel spills	To reduce the amount of soil/water pollution	No fuel tanks on site.	No fuel tanks except for a mobile fuel bowser are allowed.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
7	3	Decrease in water/land quality due to fuel spills	To reduce the amount of soil/water pollution	Bunded area located within construction camp.	Any mobile fuel bowser shall be parked in a suitably bunded area within the construction camp.	Contractor	Ongoing	Compliance to be verified by ECO and IEA

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
7	3 and 15	Decrease in water/land quality due to batching plant	To reduce the amount of soil/water pollution	A designated batching plant is contained – deflects surface water runoff.	Designate and contain a concrete batching plant within the construction camp by deflecting surface water runoff on the up-and down-slope side using, for example, sandbags.	Contractor	Ongoing	Compliance to be verified by ECO and IEA

**Table 16.** Management Protocol for Terrestrial Ecosystem

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
8	2 and 3	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No construction creep beyond demarcated boundaries.	Construction creep, particularly into the adjacent “Riparian habitat” ( <b>Figure 3</b> ), shall be avoided by: (a) reinforcing this in an induction talk, (b) clearly demarcating the working servitude (up to 3m on either side of the development footprint), the designated sand mining area, and construction camp boundaries. Do not paint or mark any natural feature. Marking for surveying and other purposes must be done using	Contractor, SEO	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					pegs, beacons, danger tape or rope and droppers, as well as (c) regular supervision by the SEO.			
8	3	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No disturbance of undisturbed or sensitive vegetation units.	The construction camp shall be in the “Modified Bushveld” habitat type ( <b>Figure 3</b> ), outside the 10m ecological buffer zone ( <b>Figure 4</b> ), including the 1:100-year flood line and delineated riparian habitat, and 100m from the river.	Contractor, SEO	Before clearing topsoil.	Compliance to be verified by ECO and IEA.
8	3, 5, 13, 15 and 19	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No disturbance of undisturbed or sensitive vegetation units.	The site office, portable ablutions, overnight parking of machinery, waste storage area, concrete mixing area (batching site), cement, mulch, topsoil and aggregate stockpiles, flammable and other material stores and culvert laydown area shall be confined to the construction camp.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
8	2, 3, 4 and 18	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No construction-related activities within these three habitat types/zones.	All construction personnel and construction-related activities shall remain outside No-Go Areas, including the adjacent “Rocky Ridge” and “Sandy Bushveld” habitat types ( <b>Figure</b>	Contractor	Ongoing	Compliance to be verified by ECO and IEA.



Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					3) and the 10m ecological buffer zone ( <b>Figure 4</b> ).			
8	12 and A12	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	As far as practical, use local (from within the same property/reserve) materials (aggregate).	Applicant, Engineer, Contractor.	When sourcing materials.	Compliance to be verified by ECO and IEA.
8	3	Project activities that can cause disruption/alteration of ecological life cycles due to light	Reduce disruption of ecological life cycles	Lighting is positioned away from sensitive areas.	Any outside lighting should be minimised, positioned at or below roof height and directed away from highly sensitive areas, e.g., downwards.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
8	3	Project activities that can cause disruption/alteration of ecological life cycles due to light	Reduce disruption of ecological life cycles	No fluorescent lighting on site	Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (green/red) lights should be used wherever possible.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.

**Table 17.** Management Protocol for Aquatic Ecosystem

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
9	A3	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Water Quality Sampling Results.	Establish background TSS and Turbidity levels as per the Surface water Monitoring Plan in <b>Appendix B</b> , shortly before the contractor arrives on site.	Applicant, Water Quality Monitor or ECO or Reserve Manager.	Before construction commences within the watercourse.	Compliance to be verified by ECO and IEA.
9	3 and 15	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes from cement slurry in the river.	Designate and contain a concrete batching plant within the construction camp by deflecting surface water runoff on the up-and down-slope side using, for example, sandbags.	Engineer, Contractor, SEO	Ongoing	Compliance to be monitored by the SEO and verified by ECO and IEA.
9	3 and 9	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes from washing sand in the river.	Designate and contain any sand washing plant within the construction camp by deflecting surface water runoff on the up-and down-slope side using, for example, sandbags.	Engineer, Contractor, SEO	Ongoing	Compliance to be monitored by the SEO and verified by ECO and IEA.
9	3	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No construction creep.	Restrict clearing of the in-situ material from the bedrock to the physical footprint of the Rubble Masonry Concrete structure and where necessary up to the edge of the working servitude, that is up to 3m on either side of the	Engineer, Contractor	Prior to clearing and grubbing operations	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					development footprint, and the designated sand mining area.			
9	3, 22 and A22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	TWQR: Any increase in TSS concentrations must be < 10 % of the background TSS concentrations.	The SEO is to monitor turbidity regularly, and if the water is more visibly turbid downstream of the site compared with the clarity of the water upstream of the site for more than two successive days, then commence with bi-weekly monitoring of TSS until such time as corrective measures have succeeded in achieving the Target Water Quality Range (TWQR).	Contractor, SEO, Water Quality Monitor.	Ongoing	Compliance to be monitored by the SEO and a Water Quality Monitor and verified by ECO and IEA.
9	3, 12 and 13	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No Stockpiles within the 1:100-year flood line, ecological buffer, and riparian habitat.	Aggregate (sand) stockpiles must be stored in the construction camp and outside the 10m ecological buffer zone (Figure 4), including the 1:100-year flood line and delineated riparian habitat.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.

**Table 18.** Management Protocol for Health and Safety

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
10	A4 and A12	Injured staff from stings, bites, and falls	Avoid injury or fatality amongst staff.	An attendance register signed by all applicable staff.	Staff responsible for collecting rocks are to be given an induction or toolbox talk on the best way to collect rocks without causing harm to themselves.	Management Authority, Reserve Manager	Before collecting rocks.	Compliance to be verified by ECO and IEA.
10	A4	Injured staff from chance encounters with dangerous animals	Avoid injury or fatality amongst staff.	An attendance register signed by all applicable staff.	All staff are to be given an induction or toolbox talk on the dangers posed by chance encounters with lion, elephant, hippo, hyaena, and the Nile Crocodile, as well as the necessary precautionary and emergency procedures.	ECO or Reserve Manager	Before site establishment	Compliance to be verified by ECO and IEA.

## Construction Phase

**Table 19.** Management Protocol for Terrestrial Fauna

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
13	5	Loss of fauna if inorganic waste is ingested.	Ensure the protection of fauna	Waste receptacles are contained, e.g., scavenger proof bins, covered skips, etc.	The designated temporary waste storage area must be contained (e.g., covered skips and scavenger proof bins) to prevent windblown litter, rainfall accumulation and animals accessing waste.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
13	5	Loss of fauna if inorganic waste is ingested.	Ensure the protection of fauna	No litter	General waste, such as empty epoxy packaging, food packaging and cement bags shall be immediately disposed of in the designated receptacles, e.g., scavenger proof bins, covered skips, etc. No waste shall be permitted on the construction site overnight.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
13	5	Loss of fauna if inorganic waste is ingested.	Ensure the protection of fauna	No litter Waybills	Waste receptacles must not be overfilled. General waste shall be disposed of at the nearest licensed landfill.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
14	4 and A4	Forced redistribution of fauna out of territories or home ranges.	Ensure least impact on animal behaviour.	Proper personal conduct by all construction staff - no unnecessarily loud noise that	Keep noise levels as low as practically possible when working, that is no loud music or shouting.	Management Authority, Contractor	Ongoing	Compliance to be monitored by SEO and verified by ECO and IEA.



Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				can cause a nuisance to wildlife.				
14	4	Disturbance during construction can cause active mammals to temporarily emigrate from the area.	Ensure least impact on animal behaviour.	Service or maintenance records.	Construction plant, machinery and equipment must be regularly serviced and well maintained to reduce noise levels.	Contractor	Ongoing	Compliance to be monitored by SEO and verified by ECO and IEA.
17	4 and 4A	Loss of fauna through poaching	Ensure the protection of sedentary fauna, and aves.	No poaching (e.g., snares)	Except for legitimate search and rescue operations, no wild animal, including animals perceived to be vermin, may be handled, removed, interfered with, fed, hunted, snared, captured, injured, or killed.	Management Authority, Contractor	Ongoing	Compliance to be verified by ECO and IEA.

**Table 20.** Management Protocol for Terrestrial Flora

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
18	1 and 4	Illegal harvesting of terrestrial plants.	Avoid the unnecessary loss of or harm to terrestrial plants.	No illegal harvesting of plants or plant parts, e.g., debarked trees or dug-	Harvesting of any plant or plant part is prohibited.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				up tubers, used for muthi.				
18	6	Loss of vegetative material for revegetation.	Successful rehabilitation	Separate mulch stockpiles for terrestrial and aquatic vegetation.	Cleared vegetation from the river and construction camp footprint shall be stockpiled separately within the construction camp for use during rehabilitation.	Contractor	Once-off	Compliance to be verified by ECO and IEA.
19	18	Increase in dust covering flora species resulting in reduced photosynthetic functioning	Manage dust on access roads to reduce vegetation dust cover	No offloading during windy conditions	Offloading of dispersive materials should be avoided during windy conditions.	Contractor	Ongoing	Compliance to be verified by SEO/ECO/Professional service provider
19	18	Increase in dust covering flora species resulting in reduced photosynthetic functioning	Manage dust on access roads to reduce vegetation dust cover	Vehicles are covered while transporting materials	Vehicles transporting dispersive materials shall be covered.	Contractor	Ongoing	Compliance to be verified by SEO/ECO/Professional service provider

**Table 21.** Management Protocol for Soil and Rock

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
20	18	Contamination of soil with hydrocarbons.	Avoid contamination of soil from leaks	Service or maintenance records.	Construction plant, machinery and equipment must be regularly serviced and well maintained to reduce risk of leaks.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
20	18 and A18	Contamination of soil with hydrocarbons.	Avoid contamination of soil from servicing	No maintenance on site (except for emergency repairs).	Any planned maintenance or servicing of construction plant, machinery and equipment shall be undertaken at Kaingo's Main Workshop.	Management Authority, Contractor	Ongoing	Compliance to be verified by ECO and IEA
20	18	Contamination of soil with hydrocarbons.	Avoid contamination of soil from servicing	Use of drip trays during emergency repairs	Any emergency repairs on site shall be undertaken with drip trays.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
20	5 and A5	Contamination of soil with hydrocarbons.	Avoid contamination of soil from servicing	Waybill(s) from registered collector.	Any waste oil shall be collected by a registered collector for recycling and reuse or appropriate disposal.	Management Authority, Contractor	Ongoing	Compliance to be verified by ECO and IEA
9	A18 and 18	Contamination of soil with hydrocarbons.	Avoid contamination of soil from servicing	No washing of vehicles and other equipment outside the designated wash area	Any washing of construction vehicles and other equipment shall be undertaken at the designated service area in Kaingo's main workshop.	Management Authority, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
20	3 and 4	Contamination of soil with sewerage.	Avoid contamination	Use of chemical toilets	Chemical toilets (1 toilet for 20 or less staff) shall be provided in the construction camp.	Contractor	Ongoing	Compliance to be verified

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
			of soil from ablutions					by ECO and IEA
20	3 and 4	Contamination of soil with sewerage or chemicals.	Avoid contamination of soil from ablutions	No leaks or spills.	Chemical toilets are to be contained.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
20	5	Contamination of soil with sewerage.	Avoid contamination of soil from ablutions	Waybill(s) from service provider.	Chemical toilets shall be regularly emptied by the appointed service provider for appropriate disposal.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
20	5	Contamination of soil with hydrocarbons.	Reduce contamination of soil through proper waste management	Low incidence of waste induced ground contamination with a trend indicating constant improvement over time. Waybills	In event of a spill, immediately remove the contaminated soil to the depth of penetration and temporarily store in a sealed container within the designated waste storage area for disposal at a licensed hazardous waste landfill.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
20	5	Contamination of soil with hydrocarbons and waste.	Reduce contamination of soil through proper waste management	Low incidence of waste induced ground contamination with a trend indicating constant	Implement precautionary measures such as drip trays and adequate waste receptacles must be available.	Contractor	Ongoing	Compliance to be verified by ECO and IEA

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				improvement over time.				
20	4 and 5	Contamination of soil with hydrocarbons.	Reduce contamination of soil when refuelling	Refuelling at construction camp only with drip trays	Refuelling with a mobile fuel bowser is to be undertaken at the construction camp only and drip trays are to be used.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
20	15	Mixing concrete on exposed ground can create a hardpan layer resulting in sterile habitat for fauna and flora.	To reduce the amount of soil and water pollution	No observed hard pan layers of concrete.	Mix concrete on a mixing tray and not on open ground.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
20	5 and 15	Mixing concrete on exposed ground can create a hardpan layer resulting in sterile habitat for fauna and flora.	To reduce the amount of soil and water pollution	No observed hard pan layers of concrete.	Cement slurry from the concrete batching plant shall be reused in a mortar mix or hardened and either reused as building material or disposed of at the nearest licensed landfill with other inert concrete rubble.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
20	5 and 15	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers, effectively sterilising patches of ground (and	To reduce the amount of soil and water pollution	No residual RMC dumped on site	Mixer trucks should return any residual RMC to their batching plant after the delivery.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.



**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		contaminate water resources).						
20	A5 and A15	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers, effectively sterilising patches of ground (and contaminate water resources).	To reduce the amount of soil and water pollution	Residual RMC stored in a temporary waste storage facility at the workshop area	If it is not possible for mixer trucks to return the residual RMC to their batching plant after the delivery, then the residual RMC within the truck mixers shall be disposed in a temporary waste storage facility designated for this purpose at the Management Authority's Workshop Area. Temporary storage means a once off storage of waste for a period not exceeding 90 days.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.
20	A5 and A15	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers, effectively sterilising patches of ground (and contaminate water resources).	To reduce the amount of soil and water pollution	A designated and contained, impervious waste storage area	Designated RMC waste storage facilities shall be covered and contained, that is impervious, and shall not detrimentally impact on a water resource (surface and groundwater).	Management Authority	Ongoing	Compliance to be verified by Compliance to be verified by ECO and IEA.
20	A5 and A15	Cleaning residual ready-mixed concrete (RMC) from truck mixers	To reduce the amount of soil and water pollution	Compliance with conditions of the GA for S21(g) in GN	The temporary storage of residual RMC for re-use (or disposal) must comply with the limits and conditions of the GA for S21(g) in	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		can create hardpan layers, effectively sterilising patches of ground (and contaminate water resources).		665 of 06 September 2013	GN 665 of 06 September 2013, particularly those provisions relating to the location of the wastewater storage facility and incidence reporting.			
20	A5 and A15	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers, effectively sterilising patches of ground (and contaminate water resources).	To reduce the amount of soil and water pollution	Waste temporarily stored has been removed (by recycling/re-use)	Temporarily stored waste shall be re-used, recycled, and/or disposed of within a period not exceeding 90 days.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.
20	A5 and A15	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers, effectively sterilising patches of ground (and contaminate water resources).	To reduce the amount of soil and water pollution	Residual water is re-used	Any residual water in the RMC waste can be re-used by replacing domestic water for making new mortar or concrete. It is estimated that a replacement of up to 50% should be used to achieve the greatest gains in strength in relation to either 100% domestic water or 100% residual water.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
20	A5 and A15	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers, effectively sterilising patches of ground (and contaminate water resources).	To reduce the amount of soil and water pollution	Hardened cement has been removed (by recycling/re-use)	Once hardened, solid waste arising from the concrete mixer truck washing can also be recycled or re-used in concrete production or as fill material.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.
20	3, 7 and 13	Hydrocarbon and other hazardous material spills (concrete slurry) can contaminate the topsoil	To avoid pollution of the topsoil.	Topsoil removed and stored for rehabilitation	Topsoil must be removed from the construction camp footprint to a depth of 150 to 200mm and stockpiled within the construction camp.	Contractor	Once-off	Compliance to be verified by ECO and IEA.
21	5 and 13	Stockpiled topsoil left for extended period resulting in compaction and contamination.	Minimise the disturbance and contamination of topsoil	Topsoil stockpiles are not disturbed or compacted.	No driving, parking, or storing of construction plant is permitted on topsoil stockpiles.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
21	5 and 13	Stockpiled topsoil left for extended period resulting in the seed bank becoming depleted and increased	Minimise the disturbance and contamination of topsoil	No alien plant growth on stockpiles	Alien plant growth on stockpiled topsoil must be uprooted manually by hand.	Contractor	Ongoing	Compliance to be verified by ECO and IEA

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
22	19	growth/dispersal of alien plants Surface water run off could result in loss of soil.	Reduce erosion induced soil losses	Implement suitable pre-emptive and remedial measures	Correct any cause of erosion at the onset by controlling or diverting storm water runoff before rehabilitating the site.	Contractor	Ongoing	Compliance to be verified by ECO and IEA

**Table 22.** Management Protocol for Ground and Surface Water

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
25	8 and A8	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve in-stream hydrological pattern	In-stream diversion.	River diversion works must remain inside the active channel, e.g., the works may not extend into the active channel bank. The location of the active channel bank must be verified by the ECO.	Engineer, Contractor, ECO	Before clearing and grubbing operations	Compliance to be verified by ECO and IEA.
25	8	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve in-stream hydrological pattern	No erosion of banks or bars.	Any river diversion works, and their outlets must be designed in such a way so as not to cause scouring of any bank or mid-channel bar.	Engineer, Contractor, SEO	Before clearing and grubbing operations	Compliance to be verified by ECO and IEA.
25	8	Alter the flow dynamics in a river,	Preserve in-stream	SEO's site diary – findings	The river diversion works must be monitored daily by the SEO for signs of scouring.	Contractor, SEO	Daily	Compliance to be monitored by

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo  
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Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		exacerbating scour and enhancing sedimentation.	hydrological pattern	relating to monitoring river diversion works.				SEO and verified by ECO and IEA.
25	8	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve in-stream hydrological pattern.	Appropriate remediation measures.	Any signs of scouring caused by the river diversion works must be immediately rectified and remediated using emergency erosion protection materials, e.g., sandbags, geotextile fabric, and/or shade cloth.	Engineer, Contractor.	When required.	Compliance to be verified by ECO and IEA.
25	12	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve river channel hydrological pattern.	No large, random, and deep excavations in the riverbed.	Sand mining must as far as possible be confined to the physical footprint of the Rubble Masonry Concrete (RMC) Culvert Structure and concrete causeway approaches.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
25	12	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve river channel hydrological pattern.	No large, random, and deep excavations in the riverbed.	When sand mining cannot be confined to the development footprint then it shall be taken from the areas of sediment accumulation or sand shoal towards the right side of the river.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
25	12	Alter the flow dynamics in a river, exacerbating	Preserve river channel hydrological pattern.	No sand mining in the active channel.	Wet Pit Mining for construction activities in the active flow channel	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.



**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		scour and enhancing sedimentation.			is prohibited because ecological risks are too high.			
25	12	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve river channel hydrological pattern.	No large, random, and deep excavations in the riverbed.	Sand shall be mined using the Dry Pit Mining method, which requires scraping off the top layer from within dry ephemeral streambeds and/or from exposed sand bars without excavating below the low-flow water level, e.g., conventional sand bar skimming, or scalping.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
25	12	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve river channel hydrological pattern.	No large, random, and deep excavations in the riverbed.	Skim as little sand as possible (300-600mm) from different sand banks/ bars outside the active channel to minimise impacts at one area.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
25	12 and 19	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve river channel hydrological pattern.	Shaped to natural forms during operations.	Re-instatement of the original landscape levels must be done concurrent with mining operations.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
25	12 and 19	Alter the flow dynamics in a river, exacerbating scour and enhancing sedimentation.	Preserve river channel hydrological pattern.	Shaped to natural forms.	The final grading of the mined area should not significantly alter the flow characteristics of the river during periods of high flows, e.g., shaped to natural forms that blend in with pre-mining topography.	Engineer, Contractor.	Upon completion of mining sand.	Compliance to be verified by ECO and IEA.

**Table 23.** Management Protocol for Atmosphere

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
26	4	Fires for keeping warm/cooking could result in uncontrolled runaway fires.	Reduce air quality impacts by proper management of staff	No <i>ad hoc</i> fires	Open fires are prohibited.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
27	5	Burning of waste as a disposal method. Resulting in increased emissions to the air	Reduce air quality impacts by disposing of waste correctly	No incidences of burning waste	Burning of waste is prohibited.	Contractor	Ongoing	Compliance to be verified by ECO and IEA

**Table 24.** Management Protocol for Terrestrial Ecosystem

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
28	A12	Reduced habitat for arachnids, reptiles, and other fauna.	Avoid mass habitat loss in localised areas.	Recycle salvaged rock.	As far as possible, use existing stockpiles of salvaged rock from demolished camps.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.
28	5	Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents. - Alteration of fauna assemblages due to habitat modification	Sanitary conditions and good waste management.	No signs of unsanitary conditions or of increased rodent populations	Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
28	A1	Creation of infrastructure suitable for breeding activities of alien and/or invasive birds.	No alteration to fauna assemblages.	No nesting sites of alien/invasive birds	Any nesting sites of alien invasive birds should be reported to the relevant authorities.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
28	A12	Reduced habitat for arachnids, reptiles, and other fauna.	Ensure the protection of sensitive vegetation units.	No collection of rocks from sensitive vegetation units.	Once the stockpile of suitable salvaged material has been exhausted, collect rocks from among the least sensitive vegetation units in Kaingo Game Reserve.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.
28	A12	Reduced habitat for arachnids, reptiles, and other fauna	Avoid mass habitat loss in localised areas.	No visibly distinct patches of bare ground within the landscape.	Collect every other rock, e.g., not rocks immediately adjacent to another, and without focusing on single sites, e.g., from many areas, and at a rate that is relative to the density of rocks on each site.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.
28	A5	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductivel y mature alien invasive plants observed on site.	The Reserve Manager or ECO must, upon identifying an alien invasive plant on site, such as <i>Opuntia ficus-indica</i> , <i>Myriophyllum aquaticum</i> , and <i>Verbena bonariensis</i> , report it to the Contractor or SEO.	Reserve Manager or ECO	Ongoing	Compliance to be verified by ECO and IEA.
28	5	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductivel y mature alien invasive plants observed on site.	Immediately control any alien invasive plant in its entirety (including roots and propagating material) upon being identified on site, using preferably mechanical control methods as opposed to chemical spraying.	Contractor, SEO	Ongoing	Compliance to be verified by ECO and IEA.

**Table 25.** Management Protocol for Aquatic Ecosystem

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
30	8 and 12	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Natural aquatic habitat remained intact	As far as possible, refrain from removing any natural material or structures from the riverine environment, such as rocks, stones, grit, sand, gravel, dead trees, or tree trunks (excluding work relating to sand mining and the working servitude up to 3m on either side of the development footprint).	Engineer, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	8	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes of suspended sediment in the river.	If it is practical to do so, construct river diversion works within the perimeter of the working servitude (up to 3m on either side of the development footprint) before clearing the in-situ material from the bedrock.	Engineer, Contractor	Prior to clearing and grubbing operations	Compliance to be verified by ECO and IEA.
30	15	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes from cement slurry in the river.	No concrete mixing is permitted within the watercourse or construction site.	Engineer, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	8 and 9	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No driving or working in flowing water within the working servitude.	The working servitude (up to 3m on either side of the development footprint) alongside the Rubble Masonry Concrete structure and within the river shall be kept as dry	Engineer, Contractor	Ongoing	Compliance to be verified by ECO and IEA.



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Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					as possible, that is free of flowing water, using river diversion works.			
30	8 and 14	Altered aquatic ecosystem structure and function.	Preserve riparian habitat.	Water pump outflows directly into river	Any pump outflows used to maintain a dry working servitude shall be released directly into the river so as not to cause erosion of the bed or banks.	Engineer, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	8 and 12	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes of suspended sediment in the river.	Aggregate used in the construction of river diversion works shall not be in direct contact with flowing water, by using for example, plastic sheets, sandbags, culverts, or pipes.	Engineer, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	8 and 12	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No turbid, cloudy, or milky plumes of suspended sediment in the river.	Aggregate used in the construction of river diversion works shall not include dispersive soils.	Engineer, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	4, A4, 18 and A18	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No driving through flowing water, unless at a designated crossing.	Construction vehicles shall as far as reasonably practical reach the site without having to cross the Mokolo River. In instances where it is impractical to do so, then only existing river crossings designated by the Management Authority may be used.	Management Authority, Contractor	Ongoing	Compliance to be verified by ECO and IEA.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
30	18	Degradation of riparian habitat.	Preserve riparian habitat.	No new access roads through riparian habitat or on the riverbank.	Access to the low-level crossing and sand mining site is to be at the existing approaches.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	18	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Access over river diversion is either rock protection, a low-level bridge, or a culvert bridge.	Access to work areas whilst on site and through flowing water is only to be via rock protection, a low-level bridge, or a culvert bridge.	Engineer, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	18 and A18	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	No washing of vehicles and other equipment in or within proximity to the river.	Any washing of construction vehicles and other equipment shall be undertaken at the designated service area in Kaingo's main workshop.	Management Authority, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	1 and A1	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Low flow in the river.	Construction may only be carried out during low flows in the dry season, preferably from May to September, but as late as November if needed.	Applicant, Engineer, Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	A22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	SEO's site diary – findings relating to weekly field measurements.	The ECO and/or Reserve Manager shall implement the Surface Water Monitoring Plan as per <b>Appendix B</b> .	ECO and/or Reserve Manager	Weekly	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
30	22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	SEO's site diary – findings relating to visual inspections of turbidity.	The SEO is to monitor TSS and turbidity daily, by visibly inspecting the surface water downstream of the site compared with the clarity of the water upstream of the site.	Contractor, SEO	Daily	Compliance to be monitored by the SEO and verified by ECO and IEA.
30	22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Appropriate corrective measures being implemented. TWQR: Any increase in TSS concentrations must be < 10 % of the background TSS concentrations.	Immediately upon seeing an increase in TSS or turbidity downstream of the site compared with the clarity of the water upstream of the site, identify the source of the problem and implement corrective measures until the Target Water Quality Range (TWQR) has been achieved.	Contractor, SEO	When required.	Compliance to be monitored by the SEO and a Water Quality Monitor and verified by ECO and IEA.
30	22	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Written report, e.g., email, WhatsApp text, etc.	If the water is more visibly turbid downstream of the site compared with the clarity of the water upstream of the site <b>for more than two successive days</b> , then report it in writing to the ECO and Reserve Manager.	Contractor, SEO	Daily	Compliance to be monitored by the SEO and verified by ECO and IEA.
30	22 and A22	Altered aquatic ecosystem	Preserve aquatic	Results from a SANS-	Upon being notified by the SEO of a persistent increase in turbidity, the	Contractor, SEO, and	When required.	Compliance to be

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		structure and function.	ecosystem structure and function.	accredited laboratory. TWQR: Any increase in TSS concentrations must be < 10 % of the background TSS concentrations.	ECO or Reserve Manager shall take water samples for laboratory analysis (as per the Surface Water Monitoring Plan in <b>Appendix B</b> ) until the contractor has succeeded in achieving the Target Water Quality Range (TWQR). The laboratory analyses shall be at the Contractor's expense.	Water Quality Monitor, ECO or Reserve Manager		verified by ECO and IEA.
30	12	Degradation of riparian habitat.	Preserve riparian habitat.	No sand mining in riparian habitat and active channel.	Riparian habitat and riverbanks are excluded from sand mining.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	9 and 9A, 12 and A12	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	Demarcated buffers.	Buffers must be demarcated by the ECO and maintained between the active water channel, riparian habitat, and the mining area.	Engineer, Contractor, SEO, ECO	Ongoing	Compliance to be monitored by the SEO and verified by ECO and IEA.
30	7, 12 and 13	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function.	Stockpiled (river channel) topsoil.	Topsoil from vegetated sand bars must be skimmed, and stored separately of the terrestrial topsoil, in the construction camp and outside the 10m ecological buffer zone ( <b>Figure 4</b> ), including the 1:100-year	Contractor	Prior to sand mining.	Compliance to be verified by ECO and IEA.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					flood line and riparian habitat, for rehabilitation purposes.			
30	4	Illegal harvesting of fish.	Ensure the protection of aquatic macro- and microfauna.	No fishing and netting in the Mokolo River.	Fishing and netting of any fish are prohibited.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
30	2 and A2	Illegal harvesting of fish.	Ensure the protection of aquatic macro- and microfauna.	Signed register of attendance, and content of induction.	The contractor's staff must be made aware of the prohibition on fishing and netting in an induction.	Contractor, ECO or Reserve Manager	Prior to site establishment.	Compliance to be verified by ECO and IEA.
30	12	Ponded water isolated from the main channel may strand entrapped fish carried there during high water events.	Ensure the protection of aquatic macro- and microfauna.	No large, random, and deep excavations in the riverbed.	Sand shall be mined using the Dry Pit Mining method, which requires scraping off the top layer from within dry ephemeral streambeds and/or from exposed sand bars without excavating below the low-flow water level, e.g., conventional sand bar skimming, or scalping.	Engineer	Ongoing	Compliance to be verified by ECO and IEA.



**Table 26.** Management Protocol for Heritage and Culture

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
33	6, 7, 17 and 21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Supervision	The bulk of archaeological remains are normally located beneath or near the soil surface, so please be especially vigilant when clearing and grubbing, and excavating.	Contractor, SEO	During clearing and grubbing operations and excavations.	Compliance to be monitored by the SEO and verified by ECO and IEA.
33	6, A6, 21 and A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Written findings or photographs of cursory inspection.	The ECO or Reserve Manager must give a cursory inspection of the bedrock after clearing and before drilling, in this case for small marine invertebrates and/or trace fossils (e.g., footprints, trails, burrows, etc.).	Contractor, SEO, ECO or Reserve Manager	After clearing and grubbing of bedrock in river.	Compliance to be verified by ECO and IEA.
33	6, 7, 17 and 21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Supervision	The SEO shall supervise all clearing and grubbing, as well as excavation activities. Examples of cultural or archaeological objects include <i>inter alia</i> (a) skeletal remains (bones) in middens (refuse heaps) or graves, (b) burned hut clay or other hut debris, (c) broken pieces of ceramic pottery (potsherds), (d) large quantities of iron smelting slag or	Contractor, SEO	During clearing and grubbing operations and excavations.	Compliance to be monitored by the SEO and verified by ECO and IEA.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					sub-surface charcoal and ash deposits, etc.			
33	21 and A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Construction has ceased at a site of discovery.	<p>If any evidence of archaeological sites or remains (e.g., remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal, and ash concentrations), fossils or other categories of heritage resources are found or uncovered by construction staff during construction:</p> <ol style="list-style-type: none"> <li>1. <b>IMMEDIATELY cease</b> the construction activity,</li> <li>2. <b>notify</b> the Reserve Manager or ECO, and</li> <li>3. <b>don't</b> tamper with the finds.</li> </ol>	Contractor, SEO, Reserve Manager or ECO.	Chance Find Protocol - artefacts	Compliance to be monitored by the SEO and verified by ECO and IEA.
33	21 and A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Site of discovery has been cordoned off.	The site of discovery must be cordoned off and demarcated a no-go area. Access to construction staff shall be prohibited until further notice by the Reserve Manager or ECO.	Contractor, SEO, Reserve Manager or ECO.	Chance Find Protocol - artefacts	Compliance to be monitored by the SEO and verified by ECO and IEA.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
33	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	A written response from the LIHRA.	The Reserve Manager or ECO shall alert the Limpopo Heritage Resources Authority (LIHRA) and if necessary, arrange for a registered heritage specialist to assess the significance of the discovery and advise on further actions.	Reserve Manager or ECO, Heritage Specialist.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
33	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	A written response from the SAPS.	In the case of unmarked human burials, the Reserve Manager or ECO shall also alert the local police.	Reserve Manager or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
33	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Permits issued by LIHRA.	If the newly discovered heritage resources prove to be of archaeological or paleontological significance, a Phase 2 rescue operation may be required subject to permits issued by the Limpopo Heritage Resources Authority (LIHRA).	Applicant, Heritage Specialist.	Prior to a Phase 2 rescue operation.	Compliance to be verified by ECO and IEA.
33	21 and A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Site of discovery has been cordoned off.	Ensure the heritage site remains safeguarded until clearance is given by the Limpopo Heritage Resources Authority (LIHRA) for work to resume.	Contractor, SEO, Reserve Manager or ECO.	Upon a chance find.	Compliance to be verified by ECO and IEA.
33	21 and 21A	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Protected fossiliferous material, photographs, and	If possible, any fossiliferous material should be put aside in a suitably protected place and photographs of putative fossils should be sent to a	Management Authority, Contractor, SEO	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				a preliminary assessment.	palaeontologist for a preliminary assessment.			
33	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Palaeontologist's findings of site visit.	If necessary, the palaeontologist should visit the site to inspect the fossiliferous material.	Management Authority, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.
33	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	SAHRA permit	Fossil plants or vertebrates that are of good quality or Scientific interest by the palaeontologist must be removed, catalogued, and housed in a suitable institution where they can be made available for further study. A SAHRA permit must be obtained first.	Management Authority, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.
33	A21	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	A Final Report	If there are fossils, a final report by the palaeontologist must be sent to the SAHRA once the project has been completed.	Management Authority, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.

**Table 27.** Management Protocol for Health and Safety

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
34	4	Improper use of PPE, machinery, or hazardous materials.	To ensure effective Health and Safety implementation	CV of appointed HSO	Appoint a suitably qualified HSO to implement OHSA (Act 85 of 1993)	Contractor	Construction	Compliance to be verified by HSO

34.1	16	Low-level crossings or bridges allow safe passage across rivers.	Enhance safety when using the low-level crossings.	Final Design, including flooding indicator blocks.	Construct flooding indicator blocks on the bridge deck.	Engineer, Contractor	Once-off	Compliance to be verified by ECO and IEA.
34.1	A4 and A12	Injured staff from stings, bites, and falls	Avoid injury or fatality amongst staff.	Protective gloves worn by staff.	Equip staff responsible for collecting rocks with protective gloves.	Management Authority.	Before collecting rocks.	Compliance to be verified by ECO and IEA.
34.1	2, A2, 4 and 4A	Injured staff from stings, bites, falls or chance encounters with dangerous animals	Remedy injury or avoid fatality amongst staff.	First Aid Certificates and an adequate First Aid Kit with each team.	At least one person within each working team must have a valid First Aid Certificate and a First Aid Kit that is adequate to deal with the range of possible life-threatening injuries.	Management Authority, Contractor	Ongoing	Compliance to be verified by ECO and IEA.

**Table 28.** Management Protocol for Property

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
35	4	Staff keeping warm by open fires could lead to uncontrolled runaway bush fires resulting in	No damage to property caused by runaway fires.	No <i>ad hoc</i> fires	Open fires are prohibited.	Contractor	Ongoing	Compliance to be verified by ECO and IEA



		damage to property						
35	12 and 19	Deep excavations in the river or floodplain can alter channel hydraulics during high flows. This change in slope increases water speed causing excessive bank erosion, undercutting of property.	To ensure channel hydraulics are not altered and the riverbank is stable	Limited alterations to the channel hydraulics, limited undercutting.	Re-instatement of the original landscape levels must be done concurrent with mining operations.	Contractor	Ongoing	Compliance to be verified by ECO and IEA

## Post-construction Phase

**Table 29.** Management Protocol for Soil and Rock

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
36	5, 19	Decrease in water/land quality due to pollution, e.g., spills.	Good quality soil for reinstatement.	No signs of pollution, e.g., contaminated soil.  Waybill(s)	Remove all signs of pollution from site (camp and working servitude), e.g., litter, hydrocarbon spills, slurry, concrete hardpan layers, etc. to the depth of penetration for disposal at an appropriate licensed landfill.	Contractor, SEO	Ongoing	Compliance verified by ECO and IEA
36	5, A5, 19	Decrease in water/land quality due to pollution, e.g., waste.	Good quality soil for reinstatement.	No signs of pollution, e.g., waste.  Document from collection and/or Waybill(s)	Remove all waste from site (camp and working servitude), e.g., concrete debris or rubble, used oil, etc. for collection by a registered collector and/or disposal at an appropriate licensed landfill.	Contractor, SEO, Applicant (if applicable)	Ongoing	Compliance verified by ECO and IEA
37	19	Altered surface water flow pattern causing ponding or erosion.	Preserve landscape hydrological pattern.	Shaped to natural forms indicative of the site's location within the landscape (catena).	All disturbed areas should be reshaped to retain landscape hydrological pattern, that is the natural functioning of the site (as a source, transfer, sink or any combination of these) relating to the redistribution of surface water and sediment.	Engineer, Contractor, SEO	Once-off	Compliance to verified by ECO and IEA.

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
37	19	Soil compaction, e.g., Parking of vehicles will compact the ground increasing surface water run-off and erosion.	Good quality soil for reinstatement.	Compacted surfaces on site have been ripped.	All compacted surfaces within the construction camp area must be ripped to a minimum depth of 250 mm in two directions at right angles.	Contractor, SEO	Once-off	Compliance verified by ECO and IEA
37	19	Loss of reinstated topsoil.	Good quality soil for reinstatement	Ripped areas remain rough.	All ripped areas must be left rough to facilitate binding of topsoil.	Contractor, SEO	Once-off	Compliance verified by ECO and IEA
37	19	Unsuccessful rehabilitation due to lack of topsoil	Good quality soil for reinstatement	Ripped areas have been covered with a sufficient topsoil layer	Reinstate 150mm – 200mm of topsoil on the ripped subsoil.	Contractor, SEO	Once-off	Compliance verified by ECO and IEA
37	19	Erosion of replaced topsoil	Good quality soil for reinstatement	No rills in the replaced topsoil	Topsoil replaced on steep slopes that are particularly susceptible to erosion must be stabilised with erosion control fabric, mats, netting, or blankets made of natural fibres (proper installation is critical to success).	Engineer, Contractor, SEO	Ongoing	Compliance to verified by ECO and IEA.
37	19	Erosion of replaced topsoil	Good quality soil for reinstatement	Rehabilitated areas have been mulched.	Reinstated topsoil must be stabilised with the stockpiled	Contractor, SEO	Once-off	Compliance to be verified

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Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					mulch from the clearing operations (good mulch-to-soil contact is critical to success).			by ECO and IEA.
37	A20	Erosion of rehabilitated areas.	Successful rehabilitation	No signs of erosion on rehabilitated areas.	Regularly monitor rehabilitated areas for signs of erosion and implement appropriate stormwater management and erosion control measures at the onset of erosion.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.
37	A20	Erosion of rehabilitated areas.	Successful rehabilitation	No signs of erosion on rehabilitated areas.	Stormwater management and erosion control measures shall adhere to the following principles: (a) Identify and control the source of the erosion. (b) Diffuse any concentrated flows. (c) Encourage infiltration of surface water runoff (e.g., good mulch-to-soil contact). (d) Avoid releasing stormwater directly into a watercourse. (e) Repair and stabilise the site of erosion.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.

**Table 30.** Management Protocol for Ground and Surface Water

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
38	19	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	Stormwater outlets have been stabilised.	Any stormwater outlets associated with the low-level crossing shall not cause erosion of the riverbank or bed by incorporating such stabilisation mechanisms as terracing, boulder and rock placement, minor gabion basket work construction, reno mattresses and/or rock pitching.	Engineer, Contractor.	Once-off	Compliance to be verified by ECO and IEA.
38	19	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	No sign of temporary man-made structures or infrastructure on site.	Remove all temporary man-made structures, e.g., river diversion works and materials, e.g., sandbags, plastic sheets, etc. associated with the working servitude in the Mokolo River.	Contractor, SEO	Once-off	Compliance to be verified by the ECO and IEA
38	19	Altered surface water flow pattern causing sedimentation and/or erosion.	Preserve river channel hydrological pattern.	Shaped to natural forms.	The final grading of the disturbed areas within the sand bed should not significantly alter the flow characteristics of the river during periods of high flows, e.g., shaped to natural forms that blend in with pre-construction topography.	Engineer, Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.
38	12 and 19	Erosion of exposed sand bars	Preserve river channel hydrological pattern.	Revegetated sand bars	Reinstate the topsoil containing plant material (e.g., <i>Cynodon</i> stolons and rhizomes) onto those sand mining areas that were previously grassed lawns.	Contractor, SEO	Once-off upon completion of sand mining activities.	Compliance to be verified by ECO and IEA.



Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
38	12 and 19	Erosion of exposed sand bars	Preserve river channel hydrological pattern.	Revegetated sand bars	Irrigate the reinstated topsoil on the sand bars daily during the remaining of the construction phase, and the rehabilitation phase.	Contractor, SEO	Ongoing upon completion of sand mining activities and until end of rehabilitation.	Compliance to be verified by ECO and IEA.

**Table 31.** Management Protocol for Terrestrial Ecosystem

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
39	A20	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	The rehabilitated construction site must be monitored regularly for the presence of alien invasive plant species.	Management Authority	Ongoing	Compliance to be verified by the ECO and IEA.
39	A20	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Immediately control alien invasive plants upon being identified, using preferably mechanical control methods as opposed to chemical spraying given the proximity to a watercourse.	Management Authority	Ongoing	Compliance to be verified by the ECO and IEA.
39.1	19	Loss of ecosystem structure and function or	Restoration of ecological functioning or biodiversity pattern.	No sign of temporary man-made structures or	Remove all temporary man-made structures and infrastructure including fences, barriers, and other demarcations, e.g., danger tape,	Contractor, SEO	Once-off	Compliance to be verified by the ECO and IEA

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Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		Altered biodiversity pattern.		infrastructure on site.	associated with the construction camp.			
39.1	19	Loss of ecosystem structure and function from poor recruitment.	Restoration of ecological functioning.	No bare areas within construction camp.	The construction camp area is to be re-seeded by hand with locally indigenous plants once the topsoil has been reinstated.	Contractor, SEO	After the reinstatement of the topsoil and prior to mulching.	Compliance to be verified by ECO and IEA.
39.1	19 and A19	Loss of ecosystem structure and function from overgrazing.	Restoration of ecological functioning.	Vegetation recruitment is not overgrazed.	Protect vegetation recruitment from grazers by packing brush from legitimate bush clearing operations on reseeded and mulched areas.	Contractor, SEO, Management Authority	Ongoing	Compliance to be verified the ECO and IEA
39.1	A20	Loss of ecosystem structure and function from poor recruitment.	Successful Rehabilitation.	Revegetated areas must achieve at least 75% of the aerial cover of adjacent undisturbed areas within the first growing season.	Regularly monitor the effectiveness of revegetation on the camp site and if necessary, implement appropriate corrective measures, which may include bringing in additional topsoil, reseeded, mulching and/or additional brush packing depending on the reasons for the failure of the original re-vegetation methods.	Management Authority	Ongoing	Compliance to be verified by ECO and IEA.

**Table 32.** Management Protocol for Visual Aesthetics

Impact No.	Mgt Category	Impacts and Risks	Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
40	19	Reduced aesthetic values.	Retain aesthetic values and sense of place.	Shaped to natural forms.	All disturbed areas must be reshaped to blend in with the natural surrounding landforms.	Engineer, Contractor, SEO	Ongoing	Compliance to verified by ECO and IEA.

## **Appendix A**

### **EMERGENCY RESPONSE PLANS**

#### Definition of an Incident

An “Incident” is an unexpected, sudden, and uncontrolled (loss of containment) release of a hazardous substance, including from a major emission, fire or explosion, that causes, has caused or may cause significant (have noticeable effects) harm to the environment, human life or property (definition in Section 30(1) of NEMA).

#### Procedure

The contractor shall ensure that emergencies are reported and controlled in accordance with the sequence of events prescribed for spillages in a watercourse, spillages on land and fire, including:

- Action to be taken
- Clean-up and remediation measures to be implemented
- Internal and external communication plan
- Prescribed reporting procedure

The contractor shall ensure that their employees are adequately trained to react to environmental emergencies in accordance with this procedure.

The SEO shall complete the table of contact numbers, erect them in a conspicuous place within the construction camp and make its whereabouts known to all of the contractor’s staff.

#### Equipment

The following equipment is required to successfully implement this procedure. It must be ensured that the equipment is supplied to or is readily available for all living quarters, site offices, kitchen areas, workshop areas, stores and on site.

1. A spill kit including absorbent fibres, mats, and booms
2. A net
3. A whistle
4. Adequate lighting for night shifts
5. Spades
6. Sandbags
7. Designated hazardous waste drums
8. (Trained personnel with) protective clothing for extinguishing fires
9. Fire extinguishers
10. Fire beaters

11. Water carts/tankers with pumps and hoses
12. Water pumps and pipes (for fires started at the watercourse crossings)

### Hazardous Substances

A “hazardous substance” is a solid, liquid, vapour, gas or aerosol, or combination thereof, which is a source of danger to persons and to the environment, by reason of its toxic, corrosive, irritant, strongly sensitizing or flammable nature, or because it generates pressure through decomposition, heat, or other means.

The contractor must consult the Safety Data Sheets of all substances stored on site and/or used during construction to identify which substances are listed as hazardous in the “Guidelines on the Administration of Incidents” published by DEA (2019) and update the table below (**Table 33**) to reflect applicable substances including their Reportable Quantity (RQ) in either kg (for solids) or litres (for liquids).

**Table 33.** List of hazardous substances and their reportable quantities (RQs).

Substance	RQ (kg or l)
Benzene	5
brake fluid, hydraulic	10
Battery fluid	10
Chlorine	5
Coal	1000
Creosote	0.5
Diesel fuel	100
Gasoline	100
Lubricating oil	5000
Paraffin	100
Petrol	100
Petroleum crude oil	10
Petroleum thinners (turpentine)	100
Printing ink, flammable	10
Urea	1000



**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Contact Numbers

Organisation	Name	Cell phone and Email
<b>Project Personnel</b>		
Applicant/Landowner		
Reserve Manager		
Engineer		
Contractor		
HSO		
SEO		
ECO		
<b>Interested and Affected Parties</b>		
Adjacent Landowner		
Adjacent Landowner		
Adjacent Landowner		
<b>Emergency Services</b>		
Spill Clean-up Service Provider		
Fire Department		
Chief Fire Officer (Fire Chief)		
SA Police Services		
Disaster Management Centre		
Local Municipality		
District Municipality		
Irrigation Board		
Water Catchment Management Agency		

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Water Treatment Works		
DWS (Regional Head of Department / Chief Director)		
DWS (Regional Director: Water sector Regulation & Use)		
DEA (Provincial Head of Department)		
DEA (Director: Environmental Impact Management)	Mrs T. Patience Makgoka Deputy Director, Directorate: Environmental Compliance and Enforcement, LEDET	083 640 5583 <a href="mailto:Makgokatp@ledet.gov.za">Makgokatp@ledet.gov.za</a>
DEA (Director General)		

**MEMBERS:** J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)  
Reg: 2006/023163/23

## SPILLAGE IN A WATERCOURSE

ACTION TO BE TAKEN		
Personnel	Responsibility	Action
Employee	Reporting	The person responsible for, or who discovers, a hazardous substance spill must report the incident to their immediate Supervisor.
Supervisor	Reporting	Report the incident to the SEO, HSO and Resident Engineer. ● Note that the SEO will take control of all relevant actions once he/she arrives on the scene.
HSO	Reporting	Report the incident to an Inspector (designated under section 28 of the Occupational Health & Safety Act, 1993) within the prescribed period and manner.
Supervisor / SEO	Initial investigation	Determine the amount of hazardous substance that was released, if it exceeds the RQ and whether it is reportable in terms of the definition of an incident, e.g., was it an unexpected, sudden, and uncontrolled (loss of containment) release? Determine the extent of the spill, e.g., its boundaries, by observing for the following: 1. Any visual indication of pollution, 2. Any odours or emissions detected, 3. Any indication of the source of pollution, 4. Any sign of damage to the natural system. ● The Supervisor / SEO should provide lighting if working at night.
Supervisor / SEO	Co-ordination	Sound an alarm/whistle. ● The designated response team consisting of area specific personnel and including the environmental leader, will congregate at the spill kit. ● All other employees who do not have specific duties to perform are to evacuate the affected area to a location designated by the Supervisor / SEO.

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Supervisor / SEO	Co-ordination	Minimise the effects of the incident on the environment and persons by removing the source of the spill at least 100m away from the watercourse or cut-off the supply of the spill if the source is not moveable.
Supervisor / SEO	Co-ordination	Contain the spill by laying an absorbent sock or boom across the width of the watercourse at a predetermined location downstream of the construction area (spill). ● A series of parallel booms may be required.
Supervisor / ECO	Co-ordination	Secure the affected area with danger tape.
HSO	Co-ordination	The site shall not be disturbed, and no article or substance may be removed (without the consent of the inspector) if there is or likely to be a death, or if there is a loss of limb or part of a limb. However, action can be taken to prevent a further accident, to remove the injured or dead or rescue persons from danger.
Engineer / SEO / HSO	Decision-making	The Engineer will assess the situation in consultation with the SEO and HSO and act as required. ● The risk involved shall be assessed before anyone approaches the scene of the incident. ● The HSO will consult the MSDSs. ● The scale of the spill will dictate whether the spill will be cleaned up by using the on-site spill kit and in the prescribed manner, or by contacting a Spill Clean-Up Service Provider for assistance. ● The SEO will take photographs of the affected area. ● No person shall be allowed to approach a spill unless he/she is equipped with the personal protective clothing.
SEO	Directions	If a Spill Clean-Up Service Provider is used, assist the emergency services by clearly marking the route to be taken to the spill site.
SEO	Co-ordination	Take such measures as the Catchment Management Agency may either verbally or in writing direct within the time specified by such institution.

## SPILLAGE IN A WATERCOURSE

CLEAN-UP AND REMEDIATION MEASURES TO BE IMPLEMENTED		
Personnel	Responsibility	Action
SEO	Co-ordination	Remove the contaminated sock or boom from the surface of the water. If lose fibres were scattered on the surface to capture hydrocarbons in shallow (still) pools, 'fish' it out with a net.
SEO	Co-ordination	Remove the contaminated soil from the banks of the watercourse to the depth of penetration using a spade or shovel.
SEO	Co-ordination	Temporarily store the contaminant in the designated hazardous waste storage facility at the construction camp.
SEO	Co-ordination	Contact a licensed hazardous waste service provider to collect and transport the waste to a licensed hazardous waste landfill site.
SEO	Co-ordination	Rehabilitate the banks of the watercourse by replacing the topsoil and planting indigenous plants.
SEO	Monitoring	Immediately follow any known spillage of toxic substances into a stream or river with monitoring of the receiving streams or rivers and public health to assess the immediate and long-term effects on these sensitive receptors.
SEO	Co-ordination	Should water downstream of the spill be polluted, and fauna and flora show signs of deterioration or death, specialist hydrological or ecological advice must be sought for appropriate treatment and remedial procedures to be followed.
SEO	Monitoring	Take photographs of the affected area during rehabilitation.



## SPILLAGE IN A WATERCOURSE

INTERNAL & EXTERNAL COMMUNICATION PLAN		
Personnel	Responsibility	Action
Employee	Reporting	The person responsible for, or who discovers, a hazardous waste spill must report the incident to their immediate Supervisor.
Supervisor	Reporting	Report the incident to the SEO, HSO and Resident Engineer.
HSO	Reporting	Report the incident to an Inspector (designated under section 28 of the Occupational Health & Safety Act, 1993) within the prescribed period and manner.
SEO	Reporting	Report the incident to the Site Agent and / or Manager and the ECO or Reserve Manager.
SEO	Reporting	If the spill is too big for the spill kit, contact a Spill Clean-Up Service Provider.
SEO	Reporting	<p>If the spill is going to affect downstream users, inform the Landowner, the Irrigation Board and water treatment works (if applicable).</p> <ul style="list-style-type: none"> <li>• Provide the following information to the water treatment works: <ol style="list-style-type: none"> <li>1. The exact location of the spillage,</li> <li>2. The time of the spillage,</li> <li>3. As much information about the nature of the pollution,</li> <li>4. The name and telephone number of the person contacting them.</li> </ol> </li> <li>• Irrigation Boards control river structures and may be able to divert/or impound the river to protect 'water supply intakes'.</li> </ul>

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

SEO	Reporting	<p>The responsible person or the employer of the responsible person must generate an Alarm Report immediately and without delay. The Alarm Report must be submitted by the responsible person to the following relevant authorities:</p> <ol style="list-style-type: none"> <li>1. DEA (Director General),</li> <li>2. DWS, Polkwane (Director General and Chief Director),</li> <li>3. SA Police Services,</li> <li>4. Emergency Services or Fire Department,</li> <li>5. Catchment Management Agency,</li> <li>6. LEDET (provincial Head of Department) or Local Municipality, and</li> <li>7. Any persons whose health may be affected by the incident, e.g., neighbours and/or downstream water users.</li> </ol>
SEO	Reporting	<p>The Alarm Report must contain the following information:</p> <ul style="list-style-type: none"> <li>• The nature of the incident,</li> <li>• Any risks posed by the incident to public health, safety and property,</li> <li>• The toxicity of substances or by-products released by the incident,</li> <li>• Any steps that should be taken to avoid or minimise the effects of the incident on public health and the environment,</li> <li>• Responsible person name, location, organisation, and telephone number,</li> <li>• Name and address of the party responsible for the incident,</li> <li>• Date and time of the incident,</li> <li>• Location of the incident,</li> <li>• Medium (e.g., land, water) affected by release or spill,</li> <li>• Number and types of injuries or fatalities (if any),</li> </ul>

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

		<ul style="list-style-type: none"> <li>• Weather conditions at the incident location,</li> <li>• Name of the carrier or vessel, the railcar/truck number, or other identifying information,</li> <li>• Whether an evacuation has occurred,</li> <li>• Other departments notified or about to be notified, and</li> <li>• Any other information that may help emergency personnel respond to the incident.</li> </ul>
ECO / Applicant / Site Agent / CRE	Reporting	<p>If the nature of the impact constitutes a gross violation of the EA or any legislation:</p> <ul style="list-style-type: none"> <li>• The ECO must report the incident to the applicant.</li> <li>• The applicant must report the incident to the Local Municipality, LEDET, and DWS (Polokwane).</li> <li>• The Site Agent and / or Manager must report the incident to their Environmental Group Manager, Divisional MD and CEO.</li> <li>• The Resident Engineer must report the incident to his Superiors.</li> </ul>

## SPILLAGE IN A WATERCOURSE

PRESCRIBED REPORTING PROCEDURE		
Incident Reporting		
Personnel	Responsibility	Action
SEO	Investigation	Investigate, including interviews, and record all details of the incident. • The cause must be investigated.
SEO	Reporting	Complete an Incident Report and forward it to all key project personnel, with the exception of the Emergency Services. • An Incident Report Template is provided in the “Guidelines on the Administration of Incidents” published by DEA (2019)
SEO	Reporting	The responsible person or his or her employer, must, within 14 days of the incident, submit the Incident Report to the following authorities. 1. DEA (Director General), 2. LEDET (Provincial Head of Department), 3. Local Municipality, 4. DWS, Polokwane (Regional Director).
SEO	Reporting	The Incident Report shall include the following information: 1. The nature of the incident, 2. The substances involved, and an estimation of the quantity released and their possible acute effect on persons & the environment & data needed to assess these effects, 3. Initial measures to minimise impacts, 4. Causes of the incident, whether direct or indirect including equipment, technology, system or management failure, and 5. Measures taken & to be taken to avoid a recurrence of such incident.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

SEO	Reporting	Submit an action plan within 14 days, or a shorter period, if specified by the Regional Director (DWS).
SEO	Reporting	The action plan must include the following information: 1. A detailed time schedule of measures taken to: 1.1 Correct the impacts resulting from the incident; 1.2 Prevent the incident from causing any further impact; and 1.3 Prevent a recurrence of a similar incident.
<b>Progress reporting</b>		
SEO	Revising Procedures	Identify methods for preventing the incident from re-occurring and revise method statements and/or procedures for implementing as early as possible.
SEO	Training	Conduct either a toolbox talk or environmental awareness training/re-induction to the all employees and include additional mitigations to avoid a re-occurrence. <ul style="list-style-type: none"> <li>• Keep the program, including a signed attendance register, in the on-site environmental file.</li> </ul>



## SPILLAGE ON LAND

ACTION TO BE TAKEN		
Personnel	Responsibility	Action
Employee	Reporting	The person responsible for, or who discovers, a hazardous substance spill must report the incident to their immediate Supervisor.
Supervisor	Reporting	Report the incident to the SEO, HSO and Resident Engineer. ● Note that the SEO will take control of all relevant actions once he/she arrives on the scene.
HSO	Reporting	Report the incident to an Inspector (designated under section 28 of the Occupational Health & Safety Act, 1993) within the prescribed period and manner.
Supervisor / SEO	Initial investigation	Determine the amount of hazardous substance that was released, if it exceeds the RQ and whether it is reportable in terms of the definition of an incident, e.g., was it an unexpected, sudden, and uncontrolled (loss of containment) release? Determine the extent of the spill, e.g., its boundaries, by observing for the following: ● Any visual indication of pollution, ● Any odours or emissions detected, ● Any indication of the source of pollution, ● Any sign of damage to the natural system. The Supervisor / SEO should provide lighting if working at night.
Supervisor / SEO	Co-ordination	Sound an alarm/whistle. ● The designated response team consisting of area specific personal and including the environmental leader, will congregate at the spill kit. ● All other employees who do not have specific duties to perform are to evacuate the affected area to a location designated by the Supervisor / SEO.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

Supervisor / SEO	Co-ordination	Minimise the effects of the incident on the environment and persons by removing the source of the spill at least 100m away from the watercourse or cut-off the supply of the spill if the source is not moveable.
Supervisor / ECO	Co-ordination	Contain the spill to a confined area to prevent the spreading of the spilled chemical or substance. <ul style="list-style-type: none"> <li>● Use sandbags or construct earth berms.</li> <li>● If relevant, close off all storm water drains with absorbent mats.</li> <li>● Do not wash the spill with water as it will cause the spill to spread.</li> </ul>
Supervisor / ECO	Co-ordination	Secure the affected area with danger tape.
HSO	Co-ordination	The site shall not be disturbed, and no article or substance may be removed (without the consent of the inspector) if there is or likely to be a death, or if there is a loss of limb or part of a limb. However, action can be taken to prevent a further accident, to remove the injured or dead or rescue persons from danger.
Engineer / SEO / HSO	Decision-making	The Engineer will assess the situation in consultation with the SEO and HSO and act as required. <ul style="list-style-type: none"> <li>● The risk involved shall be assessed before anyone approaches the scene of the incident.</li> <li>● The HSO will consult the MSDSs.</li> <li>● The scale of the spill will dictate whether the spill will be cleaned up by using the on-site spill kit and in the prescribed manner, or by contacting a Spill Clean-Up Service Provider for assistance.</li> <li>● The SEO will take photographs of the affected area.</li> <li>● No person shall be allowed to approach a spill unless he/she is equipped with the personal protective clothing.</li> </ul>
SEO	Directions	If a Spill Clean-Up Service Provider is used, assist the emergency services by clearly marking the route to be taken to the spill site.

## SPILLAGE ON LAND

CLEAN-UP AND REMEDIATION MEASURES TO BE IMPLEMENTED		
Personnel	Responsibility	Action
SEO	Co-ordination	Remove the contaminated soil to the depth of penetration using a spade or shovel.
SEO	Co-ordination	Temporarily store the contaminant in the designated hazardous waste facility at the construction camp.
SEO	Co-ordination	Contact a licensed hazardous waste service provider to collect and transport the waste to a licensed hazardous waste landfill site.
SEO	Co-ordination	Rehabilitate the area cleared of hazardous waste by replacing the topsoil and planting indigenous plants.
SEO	Monitoring	Immediately follow any known spillage of toxic substances with monitoring of the receiving environment, and public health to assess the immediate and long-term effects on these sensitive receptors.
SEO	Monitoring	Take photographs of the affected area during rehabilitation.

## SPILLAGE ON LAND

INTERNAL & EXTERNAL COMMUNICATION PLAN		
Personnel	Responsibility	Action
Employee	Reporting	The person responsible for, or who discovers, a hazardous waste spill must report the incident to their immediate Supervisor.
Supervisor	Reporting	Report the incident to the SEO, HSO and Resident Engineer.
HSO	Reporting	Report the incident to an Inspector (designated under section 28 of the Occupational Health & Safety Act, 1993) within the prescribed period and manner.
SEO	Reporting	Report the incident to the Site Agent and/or Manager and the ECO or Reserve Manager.
SEO	Reporting	If the spill is too big for the spill kit, contact a Spill Clean-Up Service Provider.
SEO	Reporting	<p>The responsible person or the employer of the responsible person must generate an Alarm Report immediately and without delay. The Alarm Report must be submitted by the responsible person to the following relevant authorities:</p> <ol style="list-style-type: none"> <li>1. DEA (Director General),</li> <li>2. South African Police Services,</li> <li>4. Emergency Services or Fire Department,</li> <li>5. Catchment Management Agency,</li> <li>6. LEDET (provincial Head of Department) or Local Municipality, and</li> <li>7. Any persons whose health may be affected by the incident, e.g., neighbours and/or downstream water users.</li> </ol>

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

SEO	Reporting	<p>The Alarm Report must contain the following information:</p> <ul style="list-style-type: none"> <li>• The nature of the incident,</li> <li>• Any risks posed by the incident to public health, safety and property,</li> <li>• The toxicity of substances or by-products released by the incident,</li> <li>• Any steps that should be taken to avoid or minimise the effects of the incident on public health and the environment,</li> <li>• Responsible person name, location, organisation, and telephone number,</li> <li>• Name and address of the party responsible for the incident,</li> <li>• Date and time of the incident,</li> <li>• Location of the incident,</li> <li>• Medium (e.g., land, water) affected by release or spill,</li> <li>• Number and types of injuries or fatalities (if any),</li> <li>• Weather conditions at the incident location,</li> <li>• Name of the carrier or vessel, the railcar/truck number, or other identifying information,</li> <li>• Whether an evacuation has occurred,</li> <li>• Other departments notified or about to be notified, and</li> </ul> <p>Any other information that may help emergency personnel respond to the incident.</p>
ECO / Applicant / Site Agent / RE	Reporting	<p>If the nature of the impact constitutes a gross violation of the EA or any legislation:</p> <ul style="list-style-type: none"> <li>• The ECO must report the incident to the applicant.</li> <li>• The applicant must report the incident to the Local Municipality and LEDET.</li> <li>• The Site Agent and/or Manager must report the incident to their Environmental Group Manager, Divisional MD and CEO.</li> <li>• The Resident Engineer must report the incident to his Superiors.</li> </ul>

## SPILLAGE ON LAND

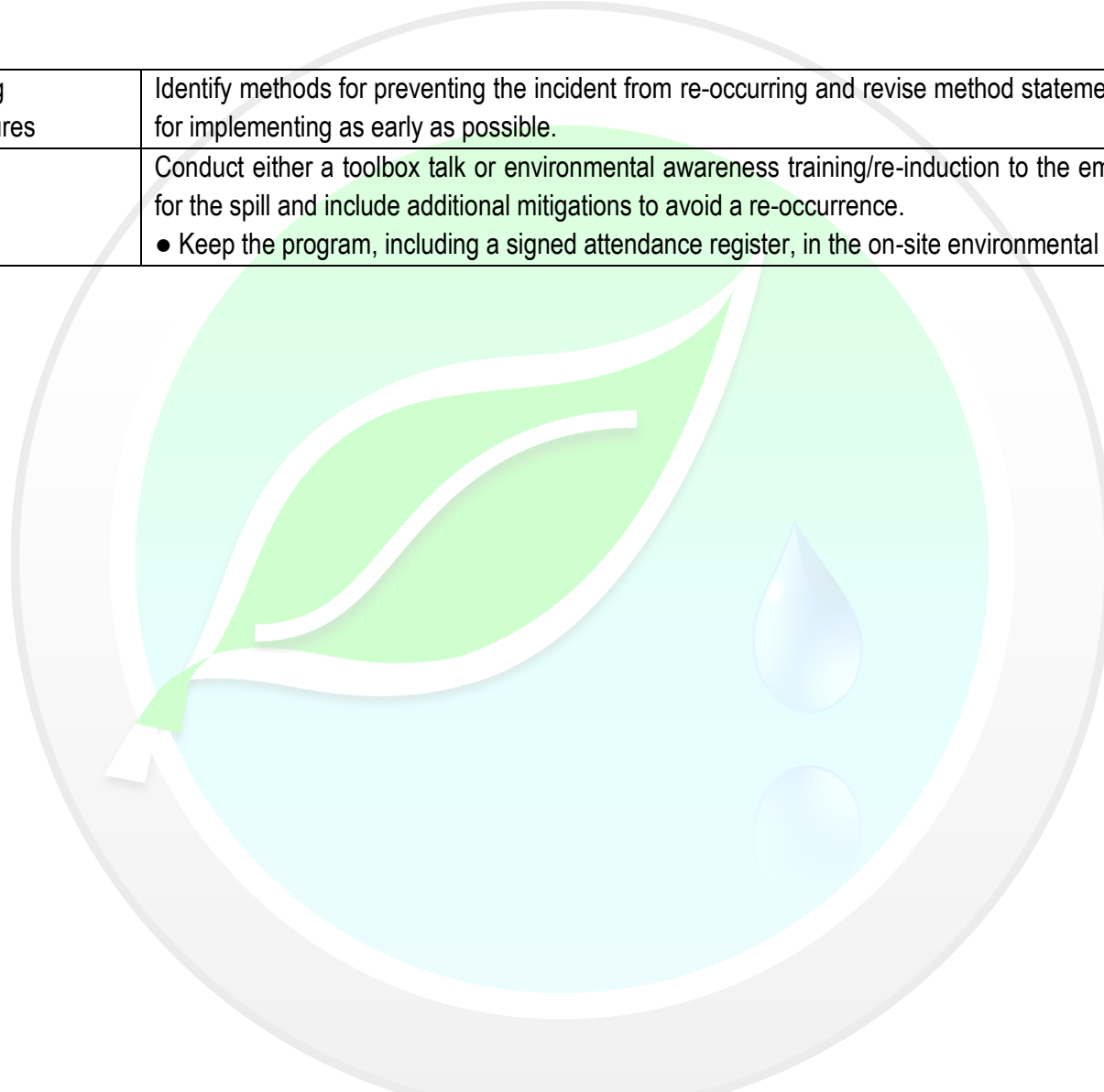
PRESCRIBED REPORTING PROCEDURE		
Incident recording		
Personnel	Responsibility	Action
SEO	Investigation	Investigate, including interviews, and record all details of the incident. ● The cause must be investigated.
SEO	Reporting	Complete an Incident Report and forward it to all key project personnel, except for the Emergency Services. ● An Incident Report Template is provided in the “Guidelines on the Administration of Incidents” published by DEA (2019)
SEO	Reporting	The responsible person or his or her employer, must, within 14 days of the incident, submit the Incident Report to the following authorities. 1. DEA (Director General), 2. LEDET (Provincial Head of Department), 3. Local Municipality.
SEO	Reporting	The Incident Report shall include the following information: 1. The nature of the incident, 2. The substances involved, and an estimation of the quantity released and their possible acute effect on persons & the environment & data needed to assess these effects, 3. Initial measures to minimise impacts, 4. Causes of the incident, whether direct or indirect including equipment, technology, system or management failure, and 5. Measures taken & to be taken to avoid a recurrence of such incident.
Progress reporting		

**MEMBERS:** J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)  
Reg: 2006/023163/23



**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

SEO	Revising Procedures	Identify methods for preventing the incident from re-occurring and revise method statements and/or procedures for implementing as early as possible.
SEO	Training	Conduct either a toolbox talk or environmental awareness training/re-induction to the employee(s) responsible for the spill and include additional mitigations to avoid a re-occurrence. <ul style="list-style-type: none"><li>● Keep the program, including a signed attendance register, in the on-site environmental file.</li></ul>



**MEMBERS:** J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)  
Reg: 2006/023163/23

## FIRE

ACTION TO BE TAKEN		
Personnel	Responsibility	Action
Employee	Reporting	The person who starts or discovers a fire must report the incident to their immediate Supervisor.
Supervisor	Reporting	Report the incident to the SEO, HSO and Resident Engineer. ● Note that the SEO will take over co-ordination of all relevant actions once he/she arrives on the scene.
SEO	Reporting	If there is potential for a fire to spread and endanger life, property, or the environment, alert the landowner and Fire Department.
Landowner	Reporting	Alert the owners of adjacent land.
HSO	Reporting	Report the incident to an Inspector (designated under section 28 of the Occupational Health & Safety Act, 1993) within the prescribed period and manner.
Supervisor / SEO	Co-ordination	Sound an alarm/whistle. ● The designated response team consisting of area specific personnel and including the environmental leader, will congregate at the fire-fighting equipment. ● All other employees who do not have specific duties to perform are to evacuate the affected area to a location designated by the Supervisor / SEO.
SEO	Directions	Assist the Fire Department by clearly marking the route to be taken to the fire.
SEO	Co-ordination	Stop the spread of the fire.
SEO	Co-ordination	Extinguish the fire or assist in doing so.
SEO	Co-ordination	Aid a fire protection officer or forest officer if they take control over the fighting of a fire.

**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)

HSO	Co-ordination	The site shall not be disturbed, and no article or substance may be removed (without the consent of the inspector) if there is or likely to be a death, or if there is a loss of limb or part of a limb. However, action can be taken to prevent a further accident, to remove the injured or dead or rescue persons from danger.
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## FIRE

REMEDATION MEASURES TO BE IMPLEMENTED		
Personnel	Responsibility	Action
SEO	Assessment	Immediately follow any fire with an assessment of the effects on the environment, public health, safety, and property.
SEO	Search	Search the scorched earth for reptiles and other creatures that can be rehabilitated and saved. <ul style="list-style-type: none"> <li>• Use only a licensed rehabilitation facility.</li> </ul>
SEO	Monitoring	Monitor for signs of erosion after the first few rains and new flush. <ul style="list-style-type: none"> <li>• Manage erosion resulting from a loss in plant basal or aerial cover.</li> <li>• Ensure that the control measures are not destructive.</li> </ul>
SEO	Managing	No Vehicles or plant are permitted to drive through burnt areas.

**MEMBERS:** J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)  
Reg: 2006/023163/23

## FIRE

INTERNAL & EXTERNAL COMMUNICATION PLAN		
Personnel	Responsibility	Action
Employee	Reporting	The person who starts or discovers a fire must report the incident to their immediate Supervisor.
Supervisor	Reporting	Report the incident to the SEO, HSO and Resident Engineer. ● Note that the SEO will take control over all relevant actions once he/she arrives on the scene.
SEO	Reporting	Report the incident to the Site Agent and/or Manager and the ECO or Reserve Manager.
SEO	Reporting	If there is potential for a fire to spread and endanger life, property, or the environment, alert the landowner, Fire Department, and the South African Police Service.
Landowner	Reporting	Alert the owners of adjacent land, e.g., neighbours.
HSO	Reporting	Report the incident to an Inspector (designated under section 28 of the Occupational Health & Safety Act, 1993) within the prescribed period and manner.
ECO / Applicant / Site Agent / RE	Reporting	If the nature of the impact constitutes a gross violation of the EA or any legislation: ● The ECO must report the incident to the applicant. ● The applicant must report the incident to the Local Municipality, DEA, and DWS. ● The Site Agent and / or Manager must report the incident to their Environmental Group Manager, Divisional MD and CEO. ● The Resident Engineer must report the incident to his Superiors.

## FIRE

PRESCRIBED REPORTING PROCEDURE		
Incident recording		
Personnel	Responsibility	Action
SEO	Investigation	Investigate, including interviews, and record all details of the incident. ● The cause must be investigated.
SEO	Reporting	Complete an Incident Report and forward it to all key project personnel, except for the Emergency Services.
SEO	Reporting	The Incident Report must include the following information: 1. The nature of the incident, 2. Initial measures to minimise impacts, 3. Causes of the incident, whether direct or indirect including equipment, technology, system, or management failure, and 4 Measures taken & to be taken to avoid a recurrence of such incident.
Progress reporting		
SEO	Revising Procedures	Identify methods for preventing the incident from re-occurring and revise method statements and/or procedures for implementing as early as possible.
SEO	Training	Conduct either a toolbox talk or environmental awareness training/re-induction to the employee(s) responsible for the spill and include additional mitigations to avoid a re-occurrence. ● Keep the program, including a signed attendance register, in the on-site environmental file.

## Appendix B

### SURFACE WATER MONITORING PLAN

The surface water quality of the Mokolo River must be monitored daily by the SEO (visual inspections for TSS or turbidity), and weekly by the ECO and/or Reserve Manager (Field measurements) during the construction phase.

Two (2) sampling points must be established, one upstream and one downstream of the position where the low-level crossing will be constructed (**Figure 5**).

Field measurements shall include:

- pH,
- Electrical Conductivity (EC) / Total Dissolved Solids (TDS), and
- Temperature.

The results of the field measurements must be compared with the results of the baseline water quality samples (**Table 34**). In the event of (1) any significant exceedances or (2) the SEO reporting a noticeable increase in TSS or turbidity, resulting from the construction site then a laboratory analysis shall be performed.

Surface water samples must be collected and handled as follows:

- Samples must be taken in 1 L polyethylene containers.
- Samples must be taken in areas where clear river/streamflow is observed (**Figure 5**). No stagnant water should be sampled.
- Samples must not be filtered or preserved with acid.
- Samples must be kept at a cool temperature and out of direct sunlight during storage and transport to a SANS-accredited laboratory, to slow down potential chemical reactions.

The laboratory analysis shall measure the following parameters:

- Turbidity (TUR) and suspended solids (SS),
- EC and pH (to determine *inter alia* whether the portable meter is correctly calibrated),
- Ca, Mg, Na, Fe and Mn, and
- BTEX, PAH, DRO and GRO (if obvious signs of oil/fuel spillages are observed and concurrently occur).



**Table 34.** Baseline water quality of the Mokolo River to be used as the Resource Water Quality Objectives (RWQO).

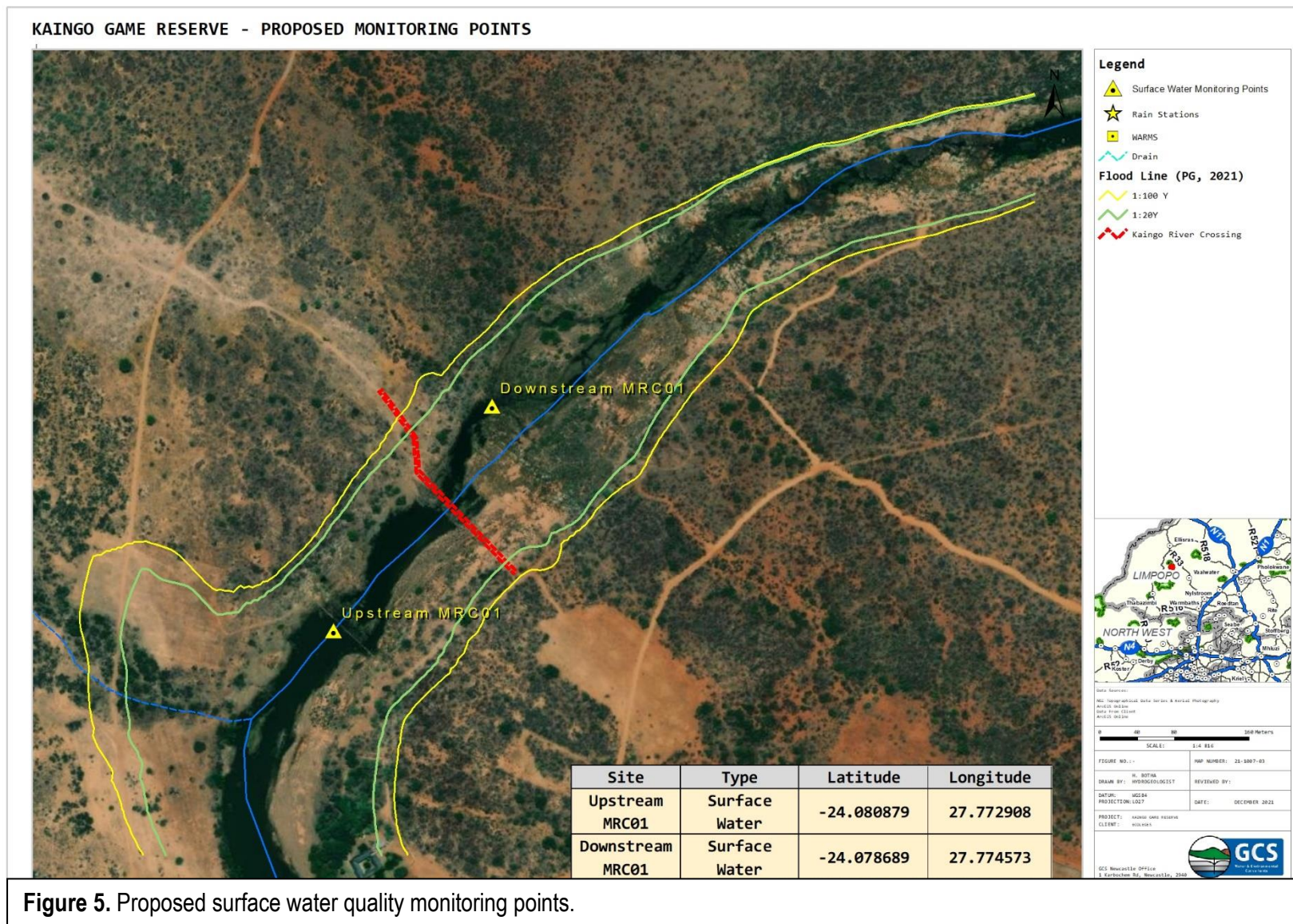
Analyte Name	Unit	Upstream MRC01	Downstream MRC01	DWAF 1996 Domestic Use – TWQR
pH in water at 25°C	-	7.4	7.4	4 - 9
Conductivity in mS/m @ 25°C	mS/m	13	13	0 - 70
TDS (0.7µm) @ 105°C	mg/l	80	85	0-350
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/l	30	30	ns
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/l	<12	<12	ns
Total Alkalinity as CaCO <sub>3</sub>	mg/l	30	30	ns
Aluminium	mg/l	0.02	0.02	<0.15
Arsenic	mg/l	<0.01	<0.01	<0.01
Boron	mg/l	0.008	0.008	ns
Barium	mg/l	0.012	0.007	ns
Calcium	mg/l	3.8	4	0 - 32
Ca hardness as CaCO <sub>3</sub>	mg/l	9.5	9.9	ns
Cadmium	mg/l	<0.001	<0.001	<0.005
Chromium	mg/l	<0.002	<0.002	<0.05
Copper	mg/l	<0.02	<0.02	<1
Iron	mg/l	0.19	0.33	<0.1
Potassium	mg/l	1.1	1.1	0 - 50
Magnesium	mg/l	5	4.9	0 - 30
Mg hardness as CaCO <sub>3</sub>	mg/l	21	20	ns
Manganese	mg/l	<0.01	<0.01	<0.05
Sodium	mg/l	11	11	0 - 100
Nickel	mg/l	<0.005	<0.005	ns
Phosphorus	mg/l	<0.03	<0.03	ns
Lead	mg/l	<0.01	<0.01	<0.01
Antimony	mg/l	<0.01	<0.01	ns
Selenium	mg/l	<0.01	<0.01	<0.02
Strontium	mg/l	0.033	0.033	ns
Total hardness as CaCO <sub>3</sub>	mg/l	30	30	<50 Soft
Uranium	mg/l	<0.01	<0.01	ns
Vanadium	mg/l	<0.001	<0.001	ns
Zinc	mg/l	<0.01	<0.01	0-3
Chloride	mg/l	15	15	0 - 100
Fluoride	mg/l	0.13	0.25	0 - 1

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Analyte Name	Unit	Upstream MRC01	Downstream MRC01	DWAF 1996 Domestic Use – TWQR
Nitrate	mg/l	<0.1	<0.1	0 - 6
Sulphate	mg/l	6	5.8	0 - 200
Mercury	µg/l	<0.001	0.001	<0.01
Ammonia	mg/l	<0.012	<0.012	<1



**Environmental Management Programme:** Development of a low-level crossing on the Mokolo River in Kaingo Game Reserve, Lephalale LM, Waterberg District, Limpopo (2022)



**Figure 5.** Proposed surface water quality monitoring points.