

APPENDIX 4.4.3.
FISHWAY/LADDER STUDY AND REPORT

**ASSESSMENT OF POTENTIAL MIGRATION BARRIER CAUSED BY
A PROPOSED DAM IN AN UNNAMED (KMAE) TRIBUTARY OF THE
CROCODILE RIVER (MALALENE, MPUMALANGA)**

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EXECUTIVE SUMMARY

The following primary **conclusions** were drawn from the current study:

- Based on available information, **three of the five criteria** (60%) in the “fishway necessity protocol” indicated that a **fishway is not needed/feasible**. Assessment therefore indicates that implementation of a fishway **may not be required or feasible at this site**.
- A “priority protocol” score of 42% was calculated, indicating that the provision of a fishway at this proposed barrier is considered of **very low priority**.
- Based on the above considerations it is unlikely that the cost of a fishway would be justified since little ecological benefit will be gained.
- Other more cost-effective options to move fish across the barrier could be considered, but may not be required due to the poor state and limited value of upstream habitats. Other options that may be further considered include:
 - Physical collection of fish during peak migrations and moving them over the migration barrier.
 - Utilising natural rocky areas at edges of dam wall to create “natural type fishway/rapids” (if available and applicable).

The following **recommendations** are made:

- Based on the results of this assessment it was concluded that a fishway will add little if any ecological benefit at the proposed dam site and no fishway is required for installation at the proposed dam. His recommendation is based on ecological considerations.
- Ideally the existing barrier (bridge) should be removed and if access is required a bridge should be reconstructed with minimal impact on the riverbed.
- The proposed development can contribute by taking ownership of the stream of concern. It is strongly recommended that this river reach should be rehabilitated to improve its ecological integrity and its contribution towards the receiving Crocodile River. The following aspects could be considered:
 - Clearing of all alien vegetation from riparian zone (and preferably entire catchment area by relevant authority). Indigenous riparian zone vegetation should be maintained (no clearing of indigenous riparian vegetation).
 - Cleaning of all solid waste and preventing further rubbish dumping in this stream. Preventing solid waste/rubbish to be transported via this stream towards the Crocodile River (Kruger National Park).
 - Stabilization of river banks and addressing current erosion problems. Inclusion of all possible erosion control measures within the proposed development to decrease the inflow of sediment that result in bed modification within this stream and the receiving Crocodile River (includes erosion in upstream catchment).
 - Prohibiting the introduction of any fish species (indigenous or alien) within this proposed development.
 - Regular monitoring (at least quarterly) of water quality of this stream at the inflow and outflow of property to ensure that no deterioration of water quality occur as a result of the proposed development.

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1.INTRODUCTION

The Kruger Malelane Agri Estate (KMAE) Development is planned as a unique lifestyle gated community inside a high intensity agricultural farm in the Greater Malelane Town Area, Mpumalanga Province. The ± 28.4 ha study area comprises a portion of Portions 8, 13 & 14 of the Farm Malelane Estate 140- JU. The area is located outside the 1:100 flood line of the Crocodile River and the river forms the southern boundary of the Kruger National Park. The study area is bordered by a non-perennial drainage feature to the east, by a railway line to the south, by a wholesale nursery to the west and by the Crocodile River to the north. The ground surface drains via sheetwash and the aforementioned drainage feature drains towards the north in the direction of the Crocodile River at an average gradient ranging of some 5%. Water for the project will be provided from three sources. Firstly, the property has 13Ha of water rights on the Malelane Irrigation Board water canal which will be used for the farming operation. In addition to this, there are 3 boreholes on the property. Two of the boreholes will be utilized for domestic water supply to the residential properties and the other as supplementary water for the farm. Finally, water will be recovered from the sewerage treatment plant and this will be used to supplement the irrigation water (from the canal) on the farm.

As part of the proposed development a small dam wall (that will also serve as a river crossing) at an existing low water bridge is considered. This proposed dam wall may create a migration barrier to fish and the primary objective of this study was to assess the potential migratory impact of this proposed dam and determine the necessity and priority of implementing a fishway at the proposed structure.

All rivers are naturally continuous longitudinal ecosystems, as described by the River Continuum Concept (Vannote *et al.*, 1980). This concept views all rivers as possessing continuous gradients of physical and chemical conditions that are progressively and continuously modified downstream from the headwaters to the sea. There is thus a continuous gradation along the length of any river, with the gradients of physical and chemical conditions eliciting a series of biological responses. Under natural or pre-development conditions, every species, and individual, form part of a balanced ecosystem. The disturbance of this balance, such as the prevention of a species to reach its breeding or feeding grounds may result in a shift in this balance. This change may be detrimental to the specific species, but also to the entire ecosystem, which includes humans.

One of the most important socio-economic impacts on the ecological processes of river systems is fragmentation through the building of dams and weirs (Jungwirth, 1998). The change from lotic (running) to lentic (stagnant) systems causes a loss in habitat and also act as migration barriers to aquatic biota. The prevention of aquatic biota to move freely throughout river systems can be detrimental to the continued survival of some species and also negatively impact on the maintenance of population abundance and distribution in general. The free passage of aquatic biota should therefore as far as possible be maintained in river systems to ensure sustainability of its ecological integrity and socio-economic value.

In some countries, the importance of providing free passage for fish during migration is driven by their economic importance (e.g. salmon, trout, etc.). In South Africa, there is no migratory fish with similar economic importance. The importance of the free passage of South African species (and their conservation/preservation) regarding socio-economic value is generally related to recreational value of a species for angling purposes. The main importance to facilitate the free passage of fish during migration is in South African rivers should, however, be our responsibility to protect the ecological integrity of our aquatic ecosystems. The National Water Act (NWA) No. 36 of 1998 advocates the equitable and sustainable utilization of water resources in South Africa within a **protective framework** (DWAf, 1999). It therefore includes our responsibility to allow free passage to migratory species if we are to protect the ecological integrity, and ensure sustainability.

The **current phase** aimed to achieve the following:

- **Determining the need for providing a fishway at the said barrier (necessity protocol):** Assess the ecological need for a fishway and the feasibility of providing a successful and cost- effective fishway.
- **Determining the priority of fishway provision (priority protocol):** Quantify the ecological impact of the barrier on migratory species present – i.e. importance of providing a fishway at the barrier.

2.OBJECTIVES & SCOPE OF WORK

The primary objectives of this study are as follows:

- Establish whether potential migratory fish and macroinvertebrates utilize the river reach to be influence by the proposed dam.
- Conduct the necessary fishway assessment to determine the need of providing a fishway at the said site.
- Provide preliminary biological criteria and recommendations for consideration in the design of the fishway (not required).

3.STUDY AREA AND BACKGROUND INFORMATION

The proposed dam is situated in an unnamed tributary (named KMAE stream for the purpose of this study) of the Crocodile River (East) (Figure 1, Table 1). It is though that this stream may have been a seasonal drainage line under natural conditions and have been altered (made perennial) by irrigation return flows (sugar cane). The present ecological status of this stream is discussed in detail in the aquatic specialist report (compiled by Dr. A. Deacon) that forms part of the EIA process of the proposed development.

Table 1:Approximate location of KMAE Dam (barrier of concern) assessed.

River	Barrier name	Latitude	Longitude	SQ reach no.
Unnamed tributary of the Crocodile River	Kruger Malalane Agricultural Estate (KKMAE) Dam	25.498734°	31.477650°	N/A (Trib of X24D-994 (Crocodile East))



Figure 1: Location and catchment area of proposed barrier

4.METHODOLOGY

The typical procedure for the planning, design, provision and operation of a fishway at any particular instream structure is provided in Figure 2 (from Bok *et. al.*, 2007¹).

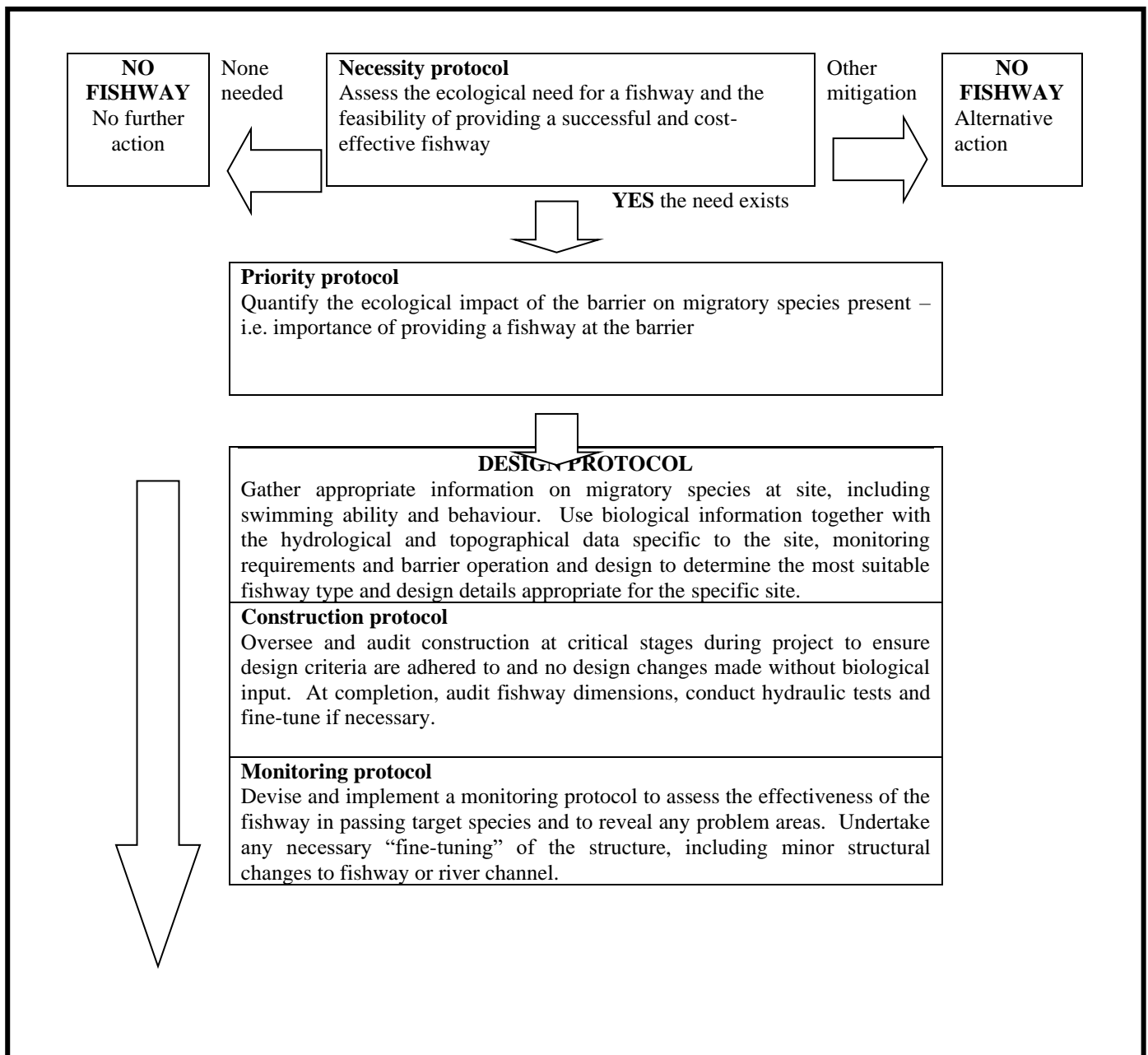


Figure 2: A summary of the procedure for the planning, design, provision and operation of a fishway at any particular in-stream structure.

¹ BOK A, KOTZE P, HEATH R and ROSSOUW J (2007) Guidelines for the planning, design and operation of fishways in South Africa. WRC Report No TT 287/07. Water Research Commission, Pta, South Africa.

4.1 Barrier information.

The following information was gathered for the proposed dam:

- GPS coordinates of wall and estimated upstream inundation point.
- Photographic views of various points in reach.
- Information required in the completion of fishway protocols (necessity and priority rankings):
 - Height of barrier,
 - Estimation of the flow range that the obstacle may be a barrier.
 - Whether fish will survive downstream migration over the barrier.
 - If there are potentially other more cost-effective mitigation measures that can be considered.
 - The estimated ecological status of the river.
 - The presence, status and accessibility of biologically significant upstream habitats.
 - Whether negative impacts of fishway will outweigh benefits.
 - Estimated drown-out (when flow becomes high enough to eliminate the drop in water level) characteristics of weir.
 - Feasibility of constructing a successful fishway.
 - Presence of permanent/natural barriers up- and downstream of site.
 - Identification of potential areas at the site that could be used for fishway construction.
 - An estimation of the potential fishway types that could be constructed at the site.

4.2 Determining the need for providing fishways at these barriers (necessity protocol)

The first step when investigating whether a particular in-stream structure will block migrations of aquatic biota is to determine the presence of migratory aquatic species in the river reach under consideration, as well as the characteristics of the structure and the site in terms of blocking of migrations. By answering a number of questions set out in a protocol (or steps) given in Figure 3, the necessity for providing a fishway at the structure can be determined. As indicated in Figure 3, there are a number of special circumstances when the construction of a fishway is not required or cannot be justified (Bok *et al.* 2007).

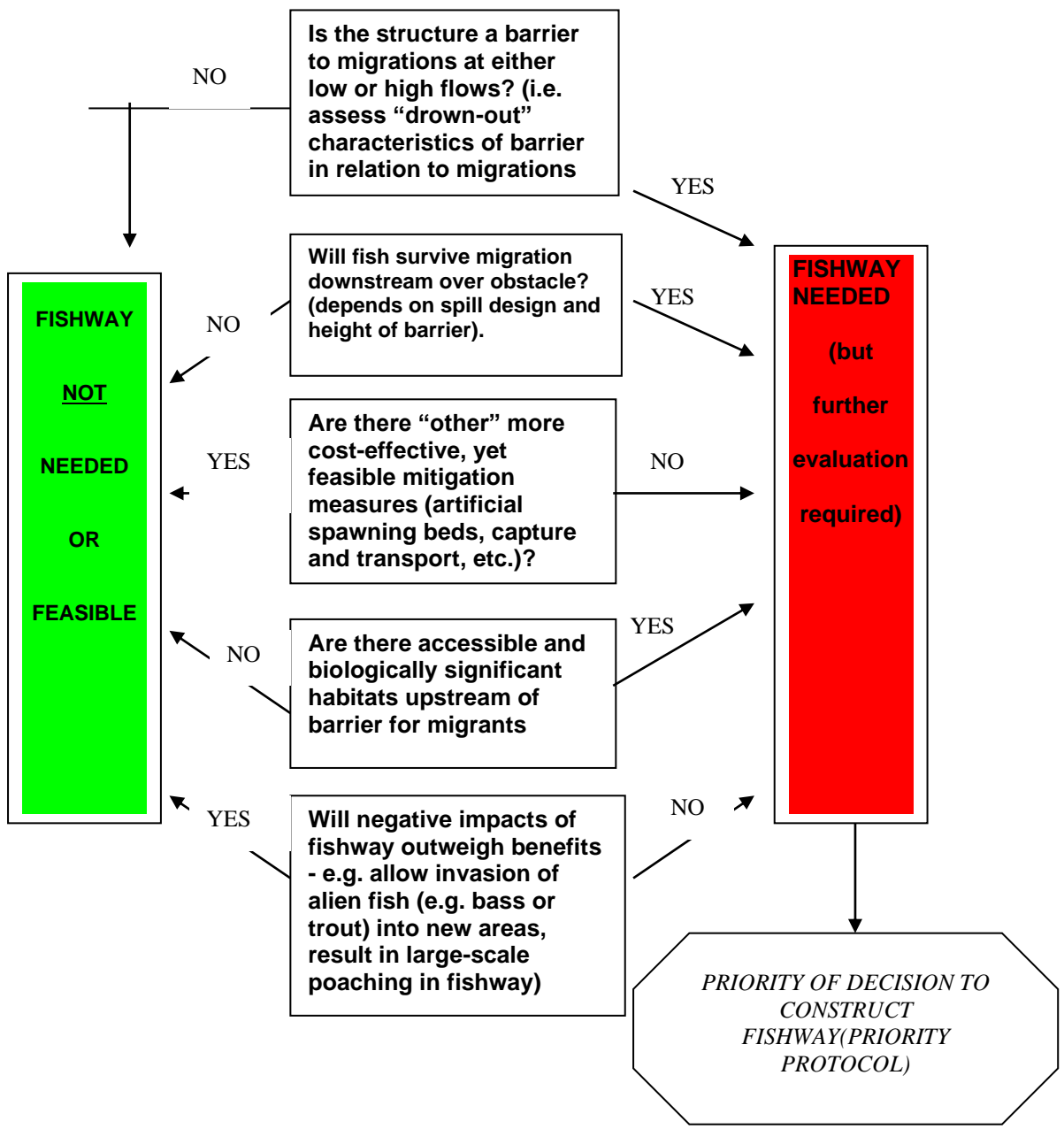


Figure 3: Protocol for assessing the need for providing a fishway at an in-stream barrier

4.3 Determining the importance or priority of fishway provision (priority protocol):

Once the necessity for providing a fishway at a proposed in-stream structure has been established, the cost-benefit or relative importance of providing fish passage past the barrier should be assessed. This will allow managers to identify priority sites for fishway construction in a standard and structured way to help ensure that the limited funding available for fishway construction is spent optimally and high priority sites receive the necessary attention. A quantitative ranking scheme, using a number of ecological and socio-economic criteria, was used during the current study (Table 2). A final score of >85 indicates “Very High Priority”, 75 to 85 “High priority”, 50 to 75 “Moderate priority” and less than 50 “Low priority”.

Table 2: Scoring scheme to determine the importance (priority) of providing a fishway

Criteria	Max. Score	Site Score	Explanation
Socio-economic value of migratory species present	12		Value for food, angling, eco-tourism Low (4); moderate (8) and high (12)
Conservation status of migrants present (number of Red Data or threatened species)	12		Taken on a provincial level (4); national level (8); global level (12)
Ecological value of migrants (importance of role in eco-system functioning)	12		value in natural food web, e.g. high in reserves Low (4); moderate (8) and high (12)
Importance of upstream habitat to migrants	12		Low (4), moderate (8) and high (12)
Proportion of catchment/upstream habitat obstructed	9		<25% (3), 25- 50% (6), >50% (9).
Fish habitat integrity of river for migrants (i.e. PES/Management Class)	9		Poor, or Class E/F (3), moderate or Class C/D (6), good, Class A/B (9)
Percentage of stream flows that structure blocks fish passage due to drown-out characteristics of site	8		20 –40% (3); 40 – 60% (5), > 60% (8)
Feasibility of constructing a successful fishway (i.e. confidence of success)	8		Low (3), moderate (5), excellent (8)
Expense of fishway in relation to the ecological benefits	6		High (2), moderate (4), low (6)
Financial and other support from NGO's, government, special interest groups, etc.)	6		Low (2), moderate (4), high (6)
Presence of permanent/natural barriers downstream	6		None (6), rare (4), many (2)
TOTAL SCORE	100		

4.4 Providing preliminary biological consideration for the design of fishways at the identified barriers.

The fish species estimated to occur in the river both up- and downstream from the barrier was determined based on the latest available information. The primary source of information used during this process was the aquatic specialist report produced by Dr. A. Deacon. The migratory characteristics and requirements of the important migratory species were considered.

5.RESULTS & DISCUSSION

5.1 General observations and notes (based on site visits and Google Earth aerial imagery)

1. An existing low-water bridge located on the property and in close proximity to the inflow of the Crocodile River (approximately 100m) is already creating a migration barrier (due to drop/height during low flows and high velocity through pipes during high flows) (Plate 1).
2. The current stream utilizable for fish (aquatic biota) upstream of the current and hence proposed dam is only approximately 650m long (from dam wall/bridge to train bridge) (see aerial imagery in Figure 3). Upstream of the train bridge the catchment has been radically transformed by sugarcane (see aerial imagery in Figure 3 and plate 3). Irrigation return flows are transported in a canal along the railway line that flows into the stream at the railway bridge. The canal is of no habitat value to fish and another migration barrier to movement (due to continuous high velocity over long distance) (Plate 2).
3. The stream in its current state is highly transformed from its natural state, and it is estimated that the return flows have created a perennial stream that was once only a seasonal/ephemeral drainage line.
4. The habitat available within the approximately 650m of river is also in a poor state due to sedimentation and alien vegetation encroachment in the riparian zone and is generally of limited value to aquatic fauna.
5. Although this stream provides some refugia for fish (utilized by opportunistic biota as a result of the artificial habitat created by the return flows), it is thought to be of very limited ecological value (due to the short reach and relative low diversity).

5.2 Necessity and priority (importance) protocols

- Based on available information, **three of the five criteria** (60%) in the “necessity protocol” indicated that a **fishway is not needed/feasible** (Table 3). Assessment therefore indicates that implementation of a fishway **may not be required or feasible at this site**.
- A “priority protocol” score of 42% was calculated, indicating that the provision of a fishway at this proposed barrier is of **very low priority** (Table 4).



Plate 1: Existing bridge (barrier)



Plate 2: Canal / irrigation return flows (upstream of railway bridge).



Plate 3: Radically transformed upstream catchment (upstream of railway bridge).

Table 3: Results of the fishway necessity protocol applied for barrier of concern.

FISHWAY NECESSITY PROTOCOL			
QUESTIONS	Yes / No / ?	COMMENTS	Result
Is the structure a barrier to migrations at either low or high flows? (i.e. assess “drown-out” characteristics of barrier in relation to migrations)	Yes	Dam wall height of 5m. Barrier at low and high flows.	Fishway needed
Will fish survive migration downstream over obstacle? (depends on spillway design and height of barrier)	Yes		Fishway needed
Are there “other” more cost-effective, yet feasible mitigation measures (artificial spawning beds, capture & transport, etc.)?	Yes	Capture and transport.	Fishway not needed/feasible
Are there accessible and biologically significant habitats upstream of barrier for migrants	No	Catchment area small and 90% transformed (sugar cane fields). Only approximately 650m of transformed and artificially created river available for utilization (negligible).	Fishway not needed/feasible
Will negative impacts of fishway outweigh benefits - e.g. allow invasion of alien fish (e.g. bass or trout) into new areas, result in large-scale poaching in fishway)?	Yes	Potentially, as fish may be attracted to migrate upstream and after spending energy to cross barrier (fishway), there is no to very limited suitable habitats available. The proposed dam may furthermore create suitable habitat (pool) for colonization of high abundance of predatory Sharptooth catfish (and potential other unwanted species such as alien Largemouth Bass). These species will prey on and potentially eradicate all small and juvenile fish species that may enter the dam.	Fishway not needed/feasible

Table 4: Results of the fishway priority protocol (descriptions) for the barrier of concern.

IMPORTANCE RATINGS				
Criteria	Site score	Explanation	Result	Comments
Socio-economic value of migratory species present	1	Value for food, angling, eco-tourism. Low (4), Moderate (8), High (12)	Low	Limited (if any) utilization of fish in catchment.
Conservation status of migrants present (number of Red Data or threatened species)	2	Taken on provincial level (4), national level (8), global level (12)	Low	<i>Labeobarbus</i> species becoming scarcer in Mpumalanga. Only <i>L. marequensis</i> (still abundant in Lowveld reaches of Crocodile River) will utilise short reach of this stream.
Ecological value of migrants (importance of role in ecosystem functioning)	4	Value in food web, e.g. high in reserve. Low (4), moderate (8) and high (12)	Low	Small number of species utilising short stretch of this stream.
Importance of upstream habitat to migrant.	2	Low (4), moderate (8), high (12)	Low	Very small catchment, almost completely transformed (sugar cane farming), altered flows (irrigation return flows), deteriorated river condition (flow modification, sedimentation).
Proportion of catchment/upstream habitat obstructed.	3	<25% (3), 25-50% (6), >50% (9)	Low	Although this dam is present in lower reaches of this stream, the obstructed proportion of catchment that is still utilizable by fish is small/insignificant (approximately 650m).
Fish habitat integrity of river for migrants (i.e. PES/Managment class)	6	Poor: Class F (1) and E (3), moderate: class D (4) and C (6), good: class B (7), A (9)	Moderate	Estimated to be in moderately to largely transformed status due to extent of transformation in catchment.
Percentage of stream flows that structure blocks fish passage due to down-out characteristics of site	8	20 –40% (3); 40 – 60% (5), > 60% (8)	High	Permanent barrier at most flows (low and high).
Feasibility of constructing a successful fishway (i. e. confidence of success)	5	Low (3), moderate (5), excellent (8)	Moderate	Limited potential for natural bypass.
Expense of fishway in relation to ecological benefits	2	High (2), moderate (4), low (6)	High	High cost for limited to no ecological benefit.
Financial and other support from NGO's, government, special interest groups, etc.)	4	Low (2), moderate (4), high (6)	Moderate	Potential contribution by developer (if required).
Presence of permanent/natural barriers downstream	5	None (6), rare (4), many (2)	None	None in KMEA stream, various in receiving Crocodile River
TOTAL	42		Low priority	

5.3 Migratory species

Background and motivation

Aquatic biota differ in their requirement for various factors such as habitat, water quality, food source as well as the need for migration (both longitudinal and lateral). The importance of migration for survival therefore differs significantly between different species and life-stages (Table 6). Some species can for instance not survive if they cannot move between fresh and seawater (such as eels), while others can successfully breed and even thrive within a single dam or a short stretch of river. The migratory life histories of fish can be divided into the following groups (McDowell, 1987; Porcher & Travade, 2002):

- **Diadromous:** Truly migratory fishes which migrate between the sea or saline water and freshwater. This category can be subdivided in the following:
 - **Catadromous** – Diadromous fishes which spend most of their lives in freshwater and migrate to the sea (or saline reaches of estuaries) to breed as adults (e.g. eels). The post-larvae and juveniles then migrate back to freshwater habitats. This term is used to include species which have an obligatory freshwater phase in their life cycle (obligatory catadromous) and ii) which have a facultative habit of entering fresh water that is carried out by only a portion of the population (facultative catadromous)
 - **Amphidromous** – Diadromous fishes where migration occurs both as adults and juveniles from freshwater to the sea, or vice-versa, is not for the purpose of breeding, but occurs regularly at some other definitive stage. These species can spawn in fresh water or in saline water (the sea or estuaries).
 - **Anadromous** – Diadromous fish that spend most of their lives in the sea and migrate to freshwater to breed.
- **Potadromous:** Truly migratory species whose entire life cycle is completed within freshwater and that undertake migrations within freshwater zones of rivers for a variety of reasons, such as for spawning, feeding, dispersion after spawning, colonisation after droughts, for over-wintering, etc.

Most aquatic biota need to migrate for survival or for the maintenance of population abundance and distribution (Harris, 1984). The most common specific reasons mentioned in literature (Chutter & Heath, 1993; Northcote, 1998; Olivier, 2003; Pethebridge *et al.*, 1998; Skelton, 2001) for the migration of aquatic biota are to reach suitable habitats to breed/spawn (reproduction), to reach suitable habitats to feed (growth) and to seek refuge from harmful environmental conditions such as extreme temperatures or predators (survival).

The migratory behaviour of aquatic biota are regulated by a complex interaction between environmental cues, environmental controls on physiological functions (for example hormonal ones), and species-, size, age and sex- related changes, as well as differences in these and their related behavioral manifestations (Northcote, 1998). The factors “triggering” the movement or migrations of fish are, as yet, not fully understood for most species.

Aquatic biota usually possess specific features and adaptations to assist them through the migratory process. The primary mechanisms related to migrations include swimming ability, jumping ability and crawling ability. Fish size influences hydraulic characteristics since swimming speed is positively related to fish length. Thus, the fishway elements should be sized to suit the largest fish and for the largest number of fish expected to use it at any one time. At the same time, hydraulic conditions in the fishway, including upstream and downstream reaches, must be such that the weakest migratory species negotiate it.

KMAE Stream fish species

- Six (6) fish species were sampled in the lower reaches of the KMAE stream by Dr. A. Deacon (as part of EIA study) (refer to specialist report for details). Although some other species may also be expected to occur and/or utilize this stream at times, the overall fish species diversity is low. The natural fish species diversity in this stream may have been even lower should this stream have been ephemeral/seasonal under reference conditions.
- The most important migratory species sampled in the river reach of concern is *Labeobarbus marequensis* and two Labeo species (*L. molybdinus* and *L. cylindricus*). The habitat upstream of the proposed dam/bridge is however not suitable for colonization of these species (limited feeding value, no breeding value).

6. CONCLUSIONS & RECOMMENDATIONS

The following primary **conclusions** were drawn from the current study:

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 - Prohibiting the introduction of any fish species (indigenous or alien) within this proposed development.

Regular monitoring (at least quarterly) of water quality of this stream at the inflow and outflow of property to ensure that no deterioration of water quality occur as a result of the proposed development.

7. REFERENCES

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APPENDIX 4.4.4.
HERITAGE SPECIALIST REPORT

SPECIALIST REPORT
PHASE 1 ARCHAEOLOGICAL/HERITAGE IMPACT ASSESSMENT FOR THE
PROPOSED GOUVEIA-CROCODILE RIVER PROJECT: AGRICULTURAL AND
RESIDENTIAL DEVELOPMENT ON THE REMAINDER OF PORTIONS 8 & 13 AND
PORTION 14 of the farm MALELANE ESTATE A 140JU,
MALELANE, MPUMALANGA PROVINCE



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EXECUTIVE SUMMARY

A Phase 1 Heritage Impact Assessment (HIA) regarding archaeological and other cultural heritage resources was conducted on the footprint for the proposed agricultural and residential development on *the remainder of portions 8 & 13 and portion 14 of the farm MALELANE ESTATE A no. 140JU*, Malelane.

The study area is situated on topographical map 1:50 000, 2531AD / BC, which is in the Mpumalanga Province. This area falls under the jurisdiction of the Ehlanzeni District Municipality, and Nkomazi Local Municipality. The project site is in the extent of 28.431ha.

The National Heritage Resources Act, no 25 (1999)(NHRA), protects all heritage resources, which are classified as national estate. The NHRA stipulates that any person who intends to undertake a development, is subjected to the provisions of the Act.

The owner and applicant, BLUE GRASS Trading 128cc in co-operation with RHENGU Environmental Services, is requesting the development of disturbed land for agricultural as well as residential purposes, on the banks of the Crocodile River, facing the Kruger National Park. The entire project site was used to cultivate vegetables since the Gouveia family bought the farm in 1955. The original farmhouse was built during 1955/1956 and is the only feature that falls under the protection of the NHRA as it is older than 60 years and needs to be mitigated (see discussion further in text).

The survey revealed no other archaeological or historical features of significance, and no graves were observed during the survey.

Apart from the mitigation measures recommended for the historical house, the rest of the farm is situated on entirely disturbed land. The owner & developers need to be made aware that distinct archaeological material or human remains may only be revealed during the construction activities of the agricultural and residential development. It is recommended that earthmoving activities be monitored by a qualified archaeologist and that an assessment be done. Based on the survey and the findings in this report, Adansonia Heritage Consultants state that there are no compelling reasons which may prevent the proposed development to continue.

Disclaimer: *Although all possible care is taken to identify all sites of cultural significance during the investigation, it is possible that hidden or sub-surface sites could be overlooked during the study. Christine Rowe trading as Adansonia Heritage Consultants will not be held liable for such oversights or for costs incurred by the client as a result.*

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- 1) The results of the project;*
- 2) The technology described in any report;*
- 3) Recommendations delivered to the Client.*

A handwritten signature in black ink, appearing to read 'C. Rowe', is placed over a light grey rectangular background.

CHRISTINE ROWE

FEBRUARY 2021

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RESIDENTIAL DEVELOPMENT ON THE REMAINDER OF PORTIONS 8 & 13 AND
PORTION 14 of the farm MALELANE ESTATE A 140JU, MALELANE, MPUMALANGA
PROVINCE**

A. BACKGROUND INFORMATION TO THE PROJECT

The owner and applicant, BLUE GRASS Trading cc, in co-operation with RHENGU ENVIRONMENTAL SERVICES is requesting the development of disturbed land for agricultural as well as residential purposes, on the banks of the Crocodile River, facing the Kruger National Park. The proposed project area is situated on the remainder of portions 8 & 13 and portion 14 of the farm MALELANE ESTATE A no. 140JU. The project site is in the extent of 28.431ha. ²

The study area is situated on topographical map 1:50 000, 2531AD / BC, which is in the Mpumalanga Province. This area falls under the jurisdiction of the Ehlanzeni District Municipality, and Nkomazi Local Municipality. The proposed agricultural development is situated less than 1km north of the N4 national road, near the town of Malelane. The area is zoned as agricultural, and no rezoning will take place. The area was flat and accessible, with a network of paths and roads to access the area. ³

Adansonia Heritage Consultants were appointed by RHENGU ENVIRONMENTAL SERVICES, to conduct a Phase 1 heritage impact assessment (HIA) on archaeological and other heritage resources on the study area. A literature study, relevant to the study area as well as a foot survey was done, to determine that no archaeological or heritage resources will be impacted upon. (See Map. 2: Topographical Map: 2531AD/BC).

The aims of this report are to source all relevant information on archaeological and heritage resources in the study area, and to advise the client on sensitive heritage areas as well as where it is viable for the development to take place in terms of the specifications as set out in the National Heritage Resources Act no., 25 of 1999 (NHRA). Recommendations for maximum conservation measures for any heritage resources will also be made. The study area is indicated in maps 1 - 7, and Appendix 1 & 2.

² D. Peacock, Memorandum in support of the application for the consolidation, subdivision and lease of remainder portion 8, remainder portion 13 and portion 14 MALELANE ESTATE A 140 JU, p. 4.

³ D. Peacock, Memorandum in support of the application for the consolidation, subdivision and lease of remainder portion 8, remainder portion 13 and portion 14 MALELANE ESTATE A 140 JU, p. 4.

- This study forms part of an EIA, Consultant: RHENGU ENVIRONMENTAL SERVICES., P.O. Box 1046, Malelane, 1320, Cell: 0824147088 / Fax: 0866858003 / e-mail: rhengu@mweb.co.za
- Type of development: 28.431ha, are earmarked for a proposed agricultural as well as residential development, on the remainder of portions 8 & 13 and portion 14 of the farm MALELANE ESTATE A no. 140JU, Mpumalanga Province.
- The site is currently zoned as agricultural, and no rezoning will take place.
- Location of Province, Magisterial district / Local Authority and Property (farms): The area falls within the Mpumalanga Province under the jurisdiction of the Ehlanzeni District Municipality and Nkomazi Local Municipality.
- Land owner and applicant: BLUE GRASS Trading cc. ⁴

Terms of reference: As specified by section 38 (3) of the NHRA, the following information is provided in this report.

- a) The identification and mapping of heritage resources where applicable;
- b) Assessment of the significance of the heritage resources;
- c) Alternatives given to affected heritage resources by the development;
- d) Plans for measures of mitigation.

Legal requirements:

The legal context of the report is grounded in the National Heritage Resources Act no. 25, 1999, as well as the National Environmental Management Act (1998) (NEMA) (as amended)

• **Section 38 of the NHRA**

This report constitutes a heritage impact assessment investigation linked to the environmental impact assessment required for the development. The proposed development is a listed activity in terms of Section 38 (1) of the NHRA. Section 38 (2) of the NHRA requires the submission of a HIA report for authorisation purposes to the responsible heritage resources agency, (SAHRA).

Heritage conservation and management in South Africa is governed by the NHRA and falls under the overall jurisdiction of the South African Heritage Resources Agency (SAHRA) and its provincial offices and counterparts.

⁴ D. Peacock, Memorandum in support of the application for the consolidation, subdivision and lease of remainder portion 8, remainder portion 13 and portion 14 MALELANE ESTATE A 140 JU, p. 4.

Section 38 of the NHRA requires a Heritage Impact Assessment (HIA) to be conducted by an independent heritage management consultant, for the following development categories:

- Any development or other activity which will change the character of a site:
 - exceeding 5000m² in extent;
 - the rezoning of a site exceeding 10 000m² in extent;

In addition, the new EIA regulation promulgated in terms of NEMA, determines that any environmental report will include cultural (heritage) issues.

The end purpose of this report is to alert RHENGU ENVIRONMENTAL SERVICES, as well as the client BLUE GRASS Trading cc, and interested and affected parties about existing heritage resources that may be affected by the proposed development, and to recommend mitigation measures aimed at reducing the risks of any adverse impacts on these heritage resources. Such measures could include the recording of any heritage building or structure older than 60 years prior to demolition, in terms of section 34 of the NHRA and also other sections of this act dealing with archaeological sites, buildings and graves.

The NHRA section 2 (xvi) states that a “heritage resource” means any place or object of cultural significance, and in section 2 (vi) that “cultural significance” means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Apart from a heritage report assisting a client to make informed development decisions, it also serves to provide the relevant heritage resources authority with the necessary data to perform their statutory duties under the NHRA. After evaluating the heritage scoping report, the heritage resources authority will decide on the status of the resource, whether the development may proceed as proposed or whether mitigation is acceptable, and whether the heritage resource require formal protection such as a Grade I, II or III, with relevant parties having to comply with all aspects pertaining to such a grading.

- **Section 35 of the NHRA**

Section 35 (4) of the NHRA stipulates that no person may, without a permit issued by SAHRA, destroy, damage, excavate, alter or remove from its original position, or collect, any archaeological material or object. This section may apply to any significant archaeological sites that may be discovered. In the case of such chance finds, the heritage practitioner will assist in investigating the extent and significance of the finds and consult with an archaeologist about further action. This may entail removal of material after documenting the find or mapping of larger sections before destruction. No archaeological material was found during the survey.

- **Section 36 of the NHRA**

Section 36 of the NHRA stipulates that no person may, without a permit issued by SAHRA, destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority. It is possible that chance burials might be discovered during development of the road infrastructure or agricultural activities. No graves were observed within the study area, which was also confirmed by Mr. Gouveia, who grew up on the farm.⁵

- **Section 34 of the NHRA**

Section 34 of the NHRA stipulates that no person may alter, damage, destroy, relocate etc, any building or structure older than 60 years, without a permit issued by SAHRA or a provincial heritage resources authority. This section does apply as the original farmhouse is older than 60 years and mitigation measures are recommended.

- **Section 37 of the NHRA**

This section deals with public monuments and memorials but does not apply in this report.

- **NEMA**

The regulations in terms of Chapter 5 of the National Environmental Management Act, (107/1998) (as amended), provides for an assessment of development impacts on the cultural (heritage) and social environment and for specialist studies in this regard.

⁵ Personal information: Mr. G. Gouveia, Previous owner, 2021-02-09.

B BACKGROUND TO ARCHAEOLOGY AND HISTORY OF THE STUDY AREA

• Literature review, museum databases & previous relevant impact assessments

The study area, the remainder of portions 8 & 13 and portion 14 of the farm MALELANE ESTATE A no. 140JU, is located next to the town of Malelane, on the banks of the Crocodile River, overlooking the Kruger National Park (KNP). Swaziland is situated approximately 40 km to the south. An irrigation scheme was planned in 1957 for the farms south of the Crocodile River and KNP. Huge citrus farms were already established during that time. The irrigation scheme was delayed, and the farmers Danie and Dirk van Graan of Thankerton, started their own scheme, and built the 'Van Graan Dam', in the Crocodile River with a canal and three turbines on their farm. ⁶

The area is quite rich in archaeological history and the first evidence of ancient mining occurred between 46 000 and 28 500 years ago during the Middle Stone Age. Hematite or red ochre was mined at Dumaneni (near Malelane), and is regarded as one of the oldest mines in the world. Iron ore was also mined in the area and a furnace, as well as iron slag were documented.⁷

Bushman (or San) presence is evident in the area as research by rock art enthusiasts revealed 109 sites in the Kruger National Park,⁸ and over 100 rock art sites at Bongani Mountain Lodge and its immediate surrounds⁹ (west of Malelane), as well as many sites in the Nelspruit, Rocky's Drift and White River areas. Thirty-one rock art sites were recorded on the Mpumalanga Drakensberg Escarpment. Rock art sites were also recorded in Swaziland.^{10 11} However, Smith and Zubieta claim that the area towards the east (Komatipoort) has no known rock art sites. The Bushman painters most probably obtained the ochre which was used as a pigment in the paintings, from the Dumaneni ochre mine.^{12 13}

History in the wider vicinity is closely connected to the study area and is briefly outlined below. The name Komati appears in historical records for the first time in 1589, in the form *Macomates*. It was recorded by a traveler on board the Portuguese ship *Sao Thome*, which sailed from Cochin, South India and ran aground on the shores of the *Land of the Makomati*,

⁶ Bornman, H., *The Pioneers of the Lowveld*, p. 69-70.

⁷ Bornman, H., *The Pioneers of the Lowveld*, p. 1.

⁸ English, M. Die Rotskuns van die Boesmans in die NKW, in *De Vos Pienaar, U., Neem uit die Verlede*, p. 18-24.

⁹ Hampson, et al., The rock art of Bongani Mountain Lodge, SA Archaeological Bulletin 57: p. 15.

¹⁰ Rowe, C. 2009. Heritage Management of Archaeological, Historical and Industrial resources on the Blyde River Canyon Nature Reserve, MA dissertation. Pretoria: UP.

¹¹ Masson, J. 2008. Views from a Swaziland Cave. *The Digging Stick*, Vol. 25 no 1: 1-3.

¹² Bornman, H. *The Pioneers of the Lowveld*, p. 1.

¹³ Masson, J. 2008. Views from a Swaziland Cave. *The Digging Stick*, Vol. 25 no 1: 1-3.

near *Lake Sibayi*, in what became known as KwaZulu Natal. The *Land of Makomati* comprised the entire hinterland as far north as the Limpopo River, as far south as St Lucia, and as far west as the Drakensberg escarpment. It was the trading zone of the Komati gold and ivory traders who had established themselves in Delagoa Bay (which was known up to the 17th century as *Makomati*), long before the arrival of the first Portuguese in 1498. The name of the Komati River came from *Makomati* who used it for trading purposes.¹⁴

In order to place the areas around Malelane in an archaeological context, primary and secondary sources were consulted. Ethnographical and linguistic studies by early researchers such as Ziervogel and Van Warmelo shed light on the cultural groups living in the area since ca 1600. Historic and academic sources by Küsel, Meyer, Voight, Bergh, De Jongh, Evers, Myburgh, Thackeray and Van der Ryst were consulted, as well as historic sources (Makhura and Webb).

Primary sources were consulted from the Pilgrim's Rest Museum Archives for a background on the pre-history and history of the study area. Several circular stone-walled complexes and terraces as well as graves have been recorded in the vicinity of Hazyview¹⁵, Bushbuckridge, Graskop and Sabie, clay potsherds and upper as well as lower grinders, are scattered at most of the sites.¹⁶ Many of these occur in caves as a result of the Swazi attacks (1900's), on the smaller groups. The 1984 topographical map (2531BC) did not show any historical features of interest. The 1926 topographical map of *Komatipoort* revealed quite a few black settlements along the Lomati River (a branch of the Komati River), approximately 20km south of the study area (indicated in pink on Map 3).¹⁷ These black settlements were recorded by names such as *Sonquela*, *Induna*, *Gomeni*, *Mahlilan*. They settled along the rivers and in the hills.

The author was also involved in desktop studies and surveys in the area, such as:

- *Study for the Proposed Eskom Powerlines, Hazyview – Dwarsloop* (2008);
- *Inspection of Umbhaba Stone-walled settlement, Hazyview*, (2001);
- a *Phase 1 Archaeological and Heritage Impact Assessment for 132Kv Powerlines from Kiepersol substation (Hazyview), to the Nwarele substation Dwarsloop* (2002);
- a *Phase 1 Archaeological and Heritage Impact Assessment for a proposed traffic training academy, Calcutta, Mkhuhlu, Bushbuckridge* (2013);
- *Phase 1 Archaeological and Heritage Impact Assessment for the proposed Nkambeni*

¹⁴ Bornman, H., *The Pioneers of the Lowveld*, p. 9.

¹⁵ PRMA: Information file 9/2.

¹⁶ D. Ziervogel, *The Eastern Sotho, A Tribal, Historical and Linguistic Survey*, p. 3.

¹⁷ Map: 1926 Topographical Map: Komati Poort no. 22.

cemetery in Numbi, Hazyview (2013);

- Phase 1 Archaeological and Heritage Impact Assessment for a *Development on the farm Agricultural Holding no 56 JU, White River* (2013) was done in the wider area;
- Phase 1 Archaeological and Heritage Impact Assessment for proposed *agricultural development on the farm SIERAAD, Komatipoort area*, (2013) revealed one possible Late Stone Age borer which was identified in a soil sample, one meter below the surface.
- Phase 1 Archaeological and Heritage Impact Assessment for *proposed debushing of natural land for agricultural use on portion 10 of Thankerton 175JU, Hectorspruit*, (2014), some LSA stone tools were observed but they were not in any archaeological context. Graves were situated outside of the study area.

The SAHRA database for archaeological and historical impact assessments was consulted and revealed other recent Archaeological Impact assessment reports in the area of Komatipoort:

- J. Van Schalkwyk: *Proposed new Lebombo Port of Entry and upgrade of Komatipoort railway station between Mpumalanga (SA) and Mozambique* (2008) – Some historic buildings were identified but no archaeological remains were observed;
- A. Van Vollenhoven: *Report on a cultural Heritage Impact Assessment for the proposed Kangwane Antracite Mine, Komatipoort* (2012) – An archaeological site with Middle and Late Stone Age tools were identified as well as some Iron Age artifacts and decorated pottery. Mitigation measures were recommended by exclusion from the development or a Phase 2 study;
- JP Celliers: *Report on Phase 1 Archaeological Impact assessment on erven at Komatipoort 182 JU Extension 4, Komatipoort* (2012) – Revealed two pieces of undecorated sherds of pottery which was of low significance. It was recommended that any earthmoving activities be monitored by a qualified archaeologist.
- A. Van Vollenhoven: *Archaeological Impact Assessment for Border site at Komatipoort* (2012) – Revealed historic remains linked to the Steinaeker's Horse regiment during the South African War.

Very little contemporary research has been done on prehistoric African settlements in the study area. Later Stone Age sites in the Kruger National Park date to the last 2500 years and are associated with pottery and microlith stone tools.¹⁸ The only professionally excavated Early Iron Age site near the area, besides those in the Kruger National Park, is the Plaston

¹⁸ J.S. Bergh (red), *Geskiedenis Atlas van Suid Afrika: Die vier Noordelike Provinsies*, p. 95.

site near White River, dating ca 900 AD.¹⁹ No other archaeological excavations have been conducted to date within the study area, which have been confirmed by academic institutions and specialists in the field.^{20 21} A stone walled settlement with terracing was recorded by C. van Wyk (Rowe) close to Hazyview,²² as well as several which were documented in the southern parts of the Kruger National Park.²³ The southern Kruger Park and Nelspruit areas have an abundance of San rock art sites,²⁴ as mentioned above, but none were identified in the direct vicinity of the study area.

Several early ethnographical and linguistic studies by early researchers such as D. Ziervogel and N.J. Van Warmelo, revealed that the study area was mainly inhabited by the Tsonga (Nhlangu and Tšhangana), as well as Swazi from before the 18th century.^{25 26} (See Map 1: 1935: Map of Van Warmelo). When concentrating on ethnographical history, it is important to include a slightly wider geographical area in order for it to make sense. Van Warmelo based his 1935 survey of *Bantu Tribes of South Africa* on the number of taxpayers in an area. The survey does not include the extended households of each taxpayer, so it was impossible to actually indicate how many people were living in one area.²⁷

The whole district is divided in two, with the Drakensberg Escarpment in the west, and the Low Veld (in which the study area is situated) towards the east. Today, we found that the boundaries of groups are intersected and overlapping.²⁸ Languages such as Zulu, Xhosa, Swazi, Nhlangu, Nkuna, sePedi, hiPau and seRôka, are commonly spoken throughout this area.²⁹

During the middle of the 18th century some Sotho and Swazi groups combined under a fighting chief Simkulu. The tribe so formed became known as the BakaNgomane. The principal settlement of Simkulu was in the vicinity of the confluence of the Crocodile and Komati Rivers. It is believed that the BakaNgomane chiefs were buried there.³⁰

¹⁹ M.M. Van der Ryst., Die Ystertydperk, in J.S. Bergh (red.), *Geskiedenis Atlas van Suid Afrika: Die vier Noordelike Provinsies*. p. 97.

²⁰ Personal information: Dr. J. Pistorius, Pretoria, 2008-04-17.

²¹ Personal information: Dr. MS. Schoeman, University of Pretoria, 2008-03-27.

²² C. Van Wyk, *Inspection of Umbhaha Stone-walled settlement, Hazyview*, pp. 1-2.

²³ Eloff J.F., Verslag oor Argeologiese Navorsing in die Krugerwildtuin, June / July, 1982.

²⁴ Hampson, J., et al., The rock art of Bongani Mountain Lodge and its environs, *South African Archaeological Bulletin* 57: pp. 17-28.

²⁵ N.J. Van Warmelo, *A Preliminary Survey of the Bantu Tribes of South Africa*. pp. 90-92 & 111.

²⁶ H. S. Webb, The Native Inhabitants of the Southern Lowveld, in *Lowveld Regional Development Association, The South-Eastern Transvaal Lowveld*. p.16.

²⁷ N.J. van Warmelo, *A Preliminary Survey of the Bantu Tribes of South Africa*, p.9.

²⁸ N.J. van Warmelo, *A Preliminary Survey of the Bantu Tribes of South Africa*, p. 51.

²⁹ M. De Jongh (ed)., *Swatini*, p. 21.

³⁰ Bornman H., *The Pioneers of the Lowveld* pp. 10-11.

The Swazi under Mswati II (1845), commenced on a career of large-scale raids on the prosperous tribal lands to the north of Swaziland. His regiments such as the *Nyatsi* and the *Malelane* brought terror to African homes as far afield as Mozambique.³¹ During their northern expansion they forced the local inhabitants out of Swaziland, or absorbed them.³² There is evidence of resistance, but the Eastern Sotho groups who lived in the northern parts of Swaziland, moved mainly northwards.³³ This appears to have taken place towards the end of the 18th century,³⁴ when these groups fled from Swaziland to areas such as Nelspruit, Bushbuckridge, Klaserie, Blyde River and Komatipoort.³⁵

Mswati II built a line of military outposts from west to east of the upper Komati River and the Mlambongwane (Kaa River). At each outpost he stationed regiments to watch and stop the BaPedi returning to their old haunts.³⁶

Shaka in the course of his military actions, came into conflict with Zwide Mkhathshwa (1819). Notwithstanding Zwide's numerical superiority, Shaka defeated him. The remnants of Zwide's tribe fled into the Eastern Transvaal where they settled. They ultimately found a new kingdom in Gaza land, which extended from just north of the current Maputo, up the east coast as far as the Zambezi river.³⁷

Soshangane was a very powerful chief of the Gaza people, even though he was under the rule of Zwide. Soshangane decided to leave and was given full passage through Swaziland. He passed on his way through the Komati gorge, today known as Komatipoort, taking with him a great booty of cattle and women. Meanwhile more Shangane arrived and by 1896 some 2000 refugees settled between Bushbuckridge and Acornhoek where they are still living today. With the establishment of the Sabie Game Reserve (later known as the Kruger National Park), the BakaNgomane, their Shangaan protégés and Swazis who lived within its borders, were evicted in 1902, and went westward into Klaserie and Bushbuckridge areas, or south of the Crocodile River and established themselves in the Tenbosch and Coal Mine (Strijdom Block) areas (close to the current study area), west and south of Komatipoort. The Swazi of Khandzalive moved to Mjejane or Emjejane, the current name for Hectorspruit.³⁸ (See also: Map 1: 1935 Map of Van Warmelo).

³¹ Bornman H., *The Pioneers of the Lowveld* p 11.

³² A.C. Myburgh, *The Tribes of Barberton District*, p. 10.

³³ N.J. Van Warmelo, *A Preliminary Survey of the Bantu Tribes of South Africa*. p. 111.

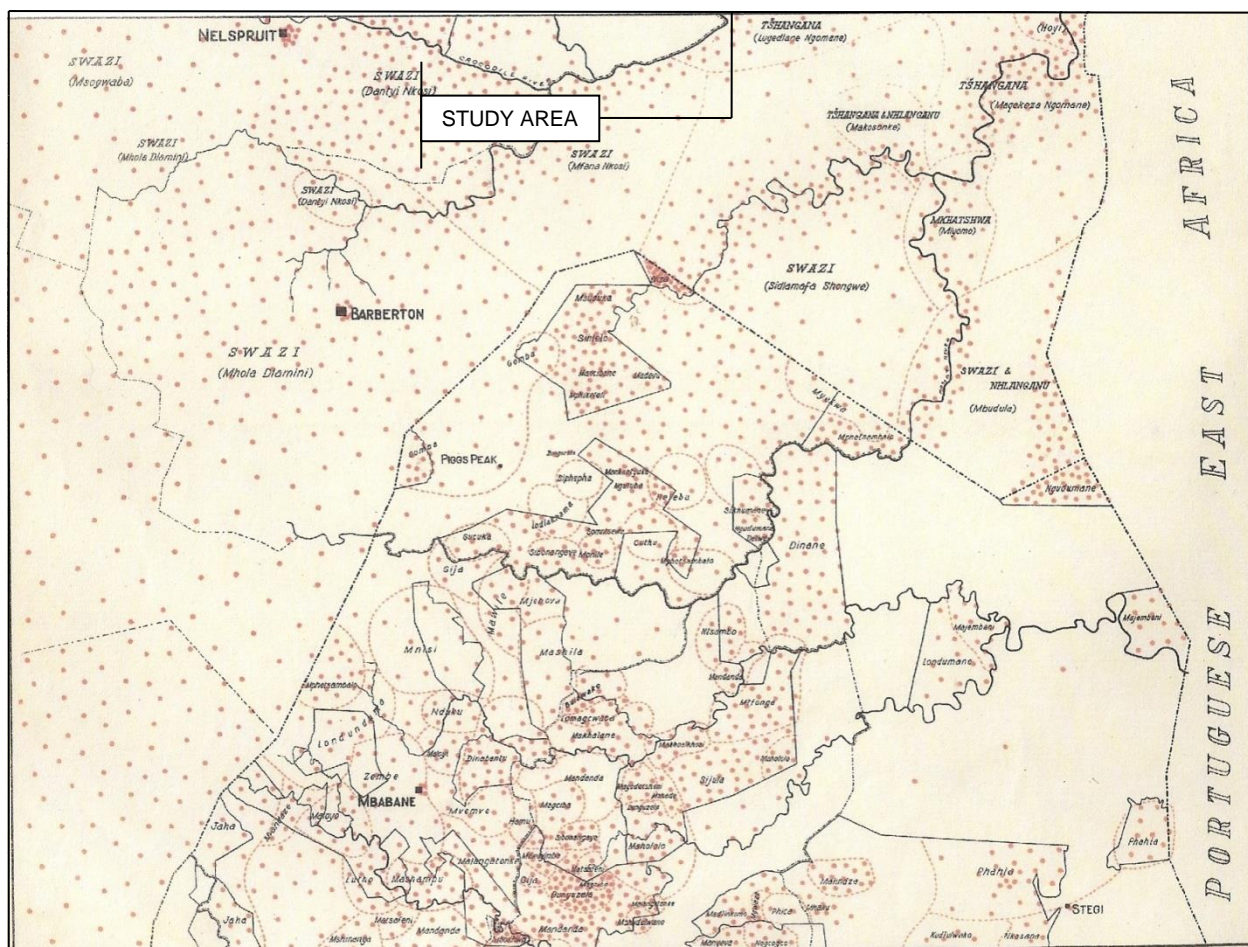
³⁴ H. S. Webb, *The Native Inhabitants of the Southern Lowveld, in Lowveld Regional Development Association, The South-Eastern Transvaal Lowveld*. p. 14

³⁵ *Ibid.*, p. 16.

³⁶ Bornman H., *The Pioneers of the Lowveld* p. 12.

³⁷ Bornman, H., *The Pioneers of the Lowveld*, p.17.

³⁸ Bornman, H., *The Pioneers of the Lowveld*, p.19.



MAP 1: Van Warmelo: 1935: Study area is indicated.

Tsonga groups: The Nhlangu and Tshangana

The Nhlangu and Tshangana (also generally known as the Shangaan-Tsonga)³⁹ form part of the larger Tsonga group of which the original group occupied the whole of Mozambique (Portuguese East Africa), and it has been recorded that by 1554, they were already living around the Delagoa Bay area (Maputo).⁴⁰ They fled from the onslaughts of the Zulu (Nguni) nation from the Natal area, and great numbers of emigrants sought safety in the “Transvaal” as recently as the 19th century, especially in the greater Pilgrim's Rest district (including the study area that we are concerned with). The Tsonga also moved west from Mozambique into the “Transvaal”. They have never formed large powerful tribes but were mostly always subdivided into loosely-knit units, and absorbed under the protection of whichever chief would give them land.⁴¹ They were originally of Nguni origin.⁴² The term “Shangaan” is commonly employed to refer to all members of the Tsonga division.⁴³

³⁹ M. De Jongh (ed.), *Swatini*, p. 24.

⁴⁰ N.J. Van Warmelo, Grouping and Ethnic History, in Schapera I., *The Bantu-Speaking Tribes of South Africa. An Ethnographical survey*, p. 55.

⁴¹ N.J. Van Warmelo, *A Preliminary Survey of the Bantu Tribes of South Africa*, pp. 90-91.

The **Nhlanganu** occupied the Low Veld area in their efforts to escape the Zulu raids during 1835-1840. They lived side by side with the Tšhangana, and the differences between the two are inconsiderable. They have mixed extensively with other tribes.⁴⁴

The **Tšhangana** are also of Nguni origin who fled in the same way as the Nhlanganu and settled in the “Transvaal” a little later than the former. Most of the Tsonga were subjects to *Soshangane*, who came from Zululand.⁴⁵ The downfall of *Ngungunyana* (son of *Soshangane*) saw his son seeking sanctuary in the “Transvaal”, and the latter became known as *Thulamahashi*,⁴⁶ the name that is still used for the area east of Bushbuckridge.

The historical background of the study area confirmed that it was occupied since the 17th century by the Tsonga groups (Nhlanganu and Tšhangana). These groups have intermarried extensively or were absorbed by other groups in time.⁴⁷

Swazi

The Swazi people descend from the southern Bantu (Nguni) who migrated from central Africa in the 15th and 16th centuries.⁴⁸ The differences between the Swazi and the Natal Nguni were probably never great, their culture as far as is known from the comparatively little research being carried out, does not show striking differences. Their language is a ‘Tekeza’ variation of Zulu, but through having escaped being drawn into the mainstream of the Zulus of the *Shaka* period, they became independent and their claim to be grouped apart as a culture is now well founded.⁴⁹

- **History of Malelane & the farm Malelane Estate**

The NZASM railway line between Delagoa Bay and the Transvaal was opened in 1895 and brought more white settlers to the area. The towns Komatipoort, Hectorspruit, Malelane and Kaapmuiden, were established as a result of the railway line and the railway line reached Hectorspruit on 1 October 1891.⁵⁰ The surveying of the railway line was done by Steinmetz

⁴² N.J. Van Warmelo, Grouping and Ethnic History, in *Schapera I., The Bantu-Speaking Tribes of South Africa. An Ethnographical survey*, p. 55.

⁴³ N.J. Van Warmelo, *A Preliminary Survey of the Bantu Tribes of South Africa*, p. 92

⁴⁴ *Ibid.*, pp. 91-92.

⁴⁵ N.J. Van Warmelo, Grouping and Ethnic History, in *Schapera I., The Bantu-Speaking Tribes of South Africa. An Ethnographical survey*, p. 57.

⁴⁶ N.J. Van Warmelo, *A Preliminary Survey of the Bantu Tribes of South Africa*, p. 92.

⁴⁷ M. De Jongh (ed)., *Swatini*, p. 40.

⁴⁸ <http://en.wikipedia.org/wiki/Swaziland> p.1.

⁴⁹ N.J. Van Warmelo, *A Preliminary Survey of the Bantu Tribes of South Africa*, p. 83.

⁵⁰ Bornman, H., *The Pioneers of the Lowveld*, p. 23.

and Bouton, who also gave names to the towns. Malelane is a small farming town between Kaapmuiden and Komatipoort and produce sugarcane, subtropical fruits and vegetables.⁵¹

George and Alice Gouveia were early pioneers in the area and bought the Malelane Estate farm in 1955. They started to develop it extensively for the cultivation of vegetables. They built the original farmhouse in 1955/1956, where Mr. George Gouveia (jr.), was born in 1959. The house (called the Tin Shack), had no electricity or running water. The house still has the original layout and nothing was changed over the years (fig. 5). During the early 1960's, they built a modern house which is the current farm residence in the southern section of the farm, closer to the railway line (fig. 18). The property was in the possession of the Gouveia family until 2011 when they sold it.⁵² In later years they established the earth canals to channel water to the various sections on the farm (figs. 6, 11 – 14, 22, 23) (See Appendix 2).

⁵¹ <http://www.org./wiki/hectorspruit> Access: 15-12-13.

⁵² Personal communication: Mr. G. Gouveia, previous owner, 2021-02-09.

C. DESCRIPTION OF THE AREA TO BE AFFECTED BY THE PROPOSED DEVELOPMENT

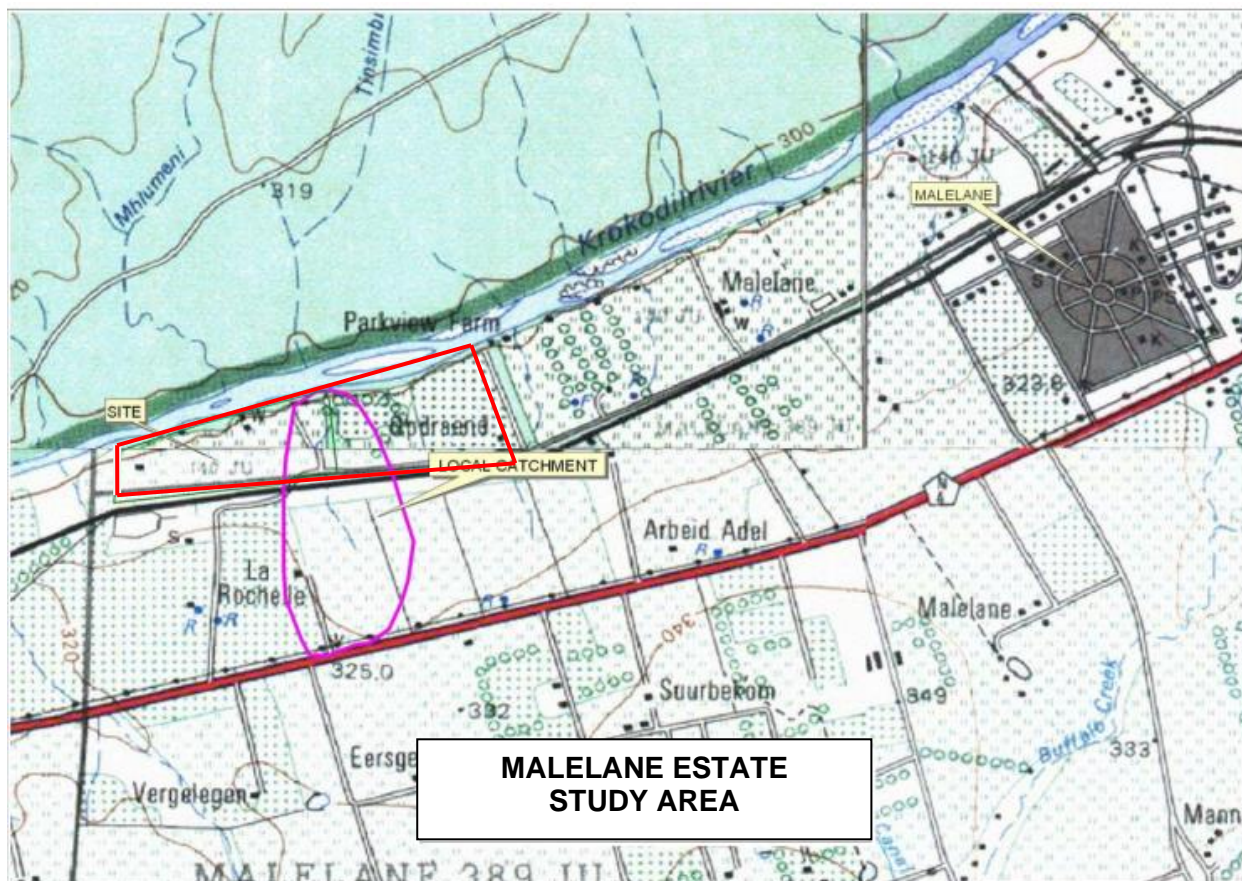
The proposed project will involve the following: Approximately 28.431ha are earmarked for the proposed agricultural and residential development. The proposed area for development is disturbed historically cultivated lands on the banks of the Crocodile River.⁵³ The 1970 topographical map also show that the entire area along the River was cultivated in the past (see Appendix 2 & map 2).

The property has a very moderate down slope from the south towards the north and the Crocodile River. An unnamed nonperennial watercourse (drainage line) is situated on the eastern side of the property⁵⁴ and forms the eastern boundary of the study area (fig. 29). A small section in the north-eastern corner of the study area, belongs to the Malelane irrigation board, and is fenced (fig. 30). Several earth canals and weirs form part of the irrigation network on the farm (figs. 6, 11 – 14, 22, 23).

The original pumphouse next to the Crocodile River was replaced in later years with a modern one. A few old pumps are still visible on the farm (figs 20 – 21), and the reservoirs are still in use (fig. 19). Earth canals and concrete sluices used to channel water to the various sections, but these are of no historical significance (figs. 6, 11, 14, 22, 23). The original farmhouse dating from 1955/56, is still visible on the farm (fig. 5), and has never been changed, even after the Gouveia family built a modern house in 1962 (fig. 18).

⁵³ Personal communication, EAP, Mr. Ralf Kalwa, 2021-01-09.

⁵⁴ D. Peacock, Memorandum in support of the application for the consolidation, subdivision and lease of remainder portion 8, remainder portion 13 and portion 14 MALELANE ESTATE A 140 JU, p. 4.



MAP 2: Topographical Map 2531AD / BC, indicating the study area (Map from Hydrological assessment).⁵⁵

A number of other structures (farm residence, sheds, worker's accommodation and compound) are present on the farm, but are of no significance (figs. 16, 24, 25, 18, 26 – 28).

Technically the ecozone representing this area is referred to as *Mixed bushwillow woodland* on granite and *Sabie Crocodile thorn thickets* on granite.⁵⁶ Although the natural vegetation was removed in the 1950's to make way for cultivated lands, the surrounding vegetation in the area is characterized by *mixed Lowveld Bushveld* with tall woodlands made up of knob-thorn and other acacia species mixed in with trees such as marulas, bushwillow, apple-leaf, silver cluster-leaves, and jackalberry along the drainage lines. The typical granite and dolerite plains have sandy soils and clayey soils in the lower areas.^{57 58 59}

⁵⁵ Coetzee, R., Malelane Estate Hydrological assessment, June 2020, p.20

⁵⁶ Deacon, A., e-mail access 26-01-14, after (Mucina & Rutherford 2007 & Alcocks 1953).

⁵⁷ SANPARKS, Visitors Guide to the Kruger National Park, p. 2.

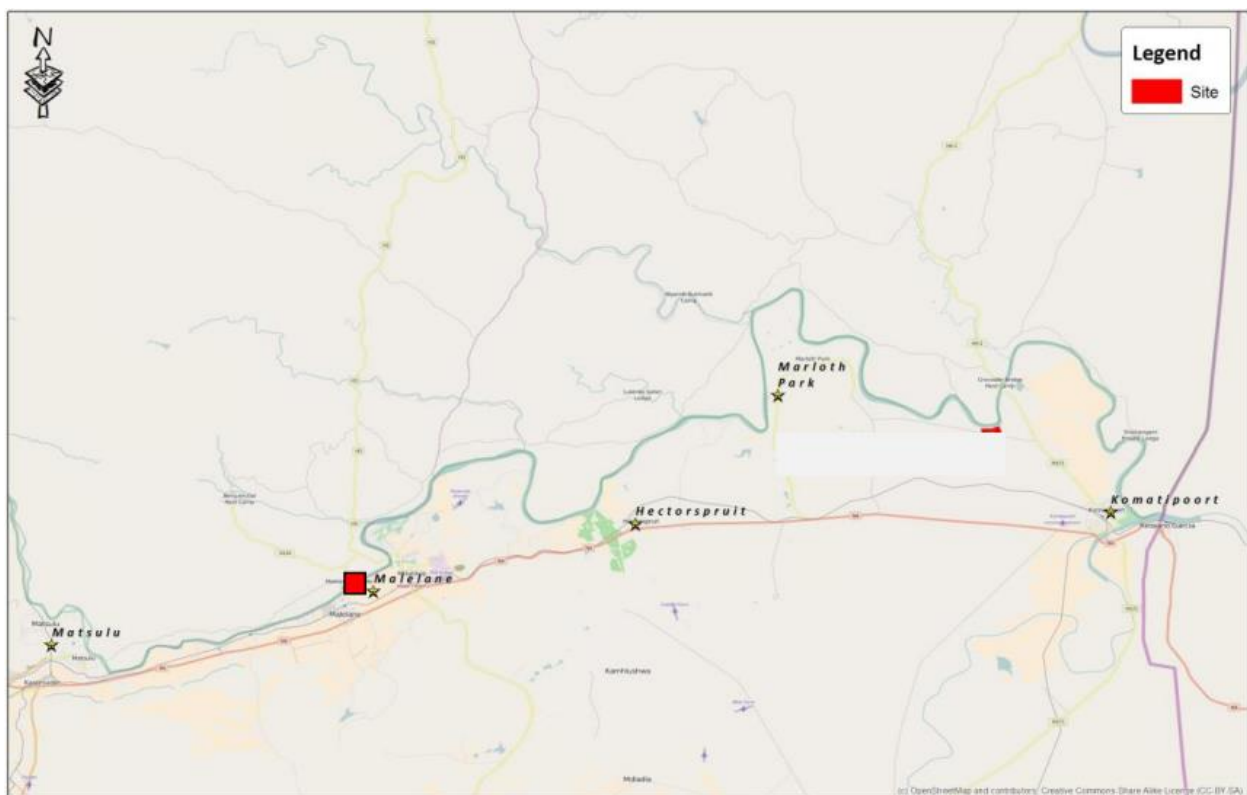
⁵⁸ Van Wyk, B., & Van Wyk P., Field Guide to Trees of Southern Africa, 1997, p. 500.

⁵⁹ Deacon, A., e-mail access 26-01-14, after (Mucina & Rutherford 2007 & Alcocks 1953).

D. LOCALITY

The proposed project site, located on the remainder of portions 8 & 13 and portion 14 of the farm MALELANE ESTATE A no. 140JU, is situated in Malelane about 3km west of the crossing of Dwergarend Street and the District road D1239.⁶⁰ It is located just north of the N4 and is approximately 40km north of Swaziland. The project site is on the banks of the Crocodile River, overlooking the Kruger National Park.

The site falls under the Nkomazi Local Municipal jurisdiction, which in turn falls within Ehlanzeni District Municipality, in the Mpumalanga Province (see Maps 2 - 5: Topographical Map & Google images of sites; Appendix 2 for the study area).



Map. 5: The project site within the wider area (Map from Hydrological assessment).⁶¹

- **Description of methodology:**

The 1970 topographical map, (map 2), as well as a 1926 map (Map 3), and Google images of the site (Map 4 – 7), indicate the study area of the proposed development. These were intensively studied to assess the current and historically disturbed areas and infrastructure. In order to reach a comprehensive conclusion regarding the cultural heritage resources in the study area, the following methods were used:

⁶⁰ D. Peacock, Memorandum in support of the application for the consolidation, subdivision and lease of remainder portion 8, remainder portion 13 and portion 14 MALELANE ESTATE A 140 JU, p. 4.

⁶¹ Coetzee, R., Malelane Estate Hydrological assessment, June 2020, p. 7.

- The desktop study consists mainly of archival sources studied on distribution patterns of early African groups who settled in the area since the 17th century, and which have been observed in past and present ethnographical research and studies.
- Literary sources, books and government publications, which were available on the subject, have been consulted, in order to establish relevant information.
- Several specialists currently working in the field of anthropology and archaeology have also been consulted on the subject.

-Literary sources: A list of books and government publications about prehistory and history of the area were cited, and revealed some information;

-The archaeological database of SAHRA as well as the National Cultural History Museum were consulted. Heritage Impact Assessment reports of specialists who worked in the area were studied and are quoted in section B.

- The entire study area was historically disturbed (cultivated), and belonged to the Gouveia family who farmed extensively with vegetables.⁶²
- The site visit consisted of 2 people. Features of interest were pointed out during the visit, such as the historical house.
- The fieldwork and survey were conducted extensively on foot and with a vehicle. Gravel roads in the various sections were used to access the area (See Appendix 1).
- The terrain was flat, even and accessible, with some areas which had recent crops and some sections which were lying fallow. Visibility throughout the survey was excellent.
- The relevant data was located with a GPS instrument (Garmin Etrex) datum WGS 84, and plotted. Co-ordinates were within 4-6 meters of identified sites.
- Evaluation of the resources which might be impacted upon by the footprint, was done within the framework provided by the National Heritage Resources Act, no. 25 (1999);
- Personal communication with relevant stakeholders on the specific study area, were held, such as the farm manager, Mr. Jansen Van Vuuren⁶³, and environmental practitioner Mr. R. Kalwa.⁶⁴
- GPS co-ordinates were used to locate the perimeters and any heritage features within the study area (Co-ordinates provided by RHENGU Environmental Services, Map 7).

⁶² Personal communication: Mr. G. Gouveia, previous owner, 2021-02-09.

⁶³ Personal information: Mr. Jansen Van Vuuren (farm Manager: 2021-01-09.

⁶⁴ Personal information: Mr. R. Kalwa, Rhengu Environmental Services, 2020-01-09.

GPS CO-ORDINATES

Location	South	East	Elevation
A	S 25° 30' 02.03"	E 31° 28' 09.48"	297m
B	S 25° 29' 56.51"	E 31° 28' 33.94"	304m
C	S 25° 29' 54.69"	E 31° 28' 40.05"	304m
D	S 25° 30' 06.05"	E 31° 28' 40.30"	304m
E	S 25° 30' 09.88"	E 31° 28' 08.98"	302m

E. DESCRIPTION OF IDENTIFIED SITES

The owner and applicant, BLUE GRASS Trading cc, in co-operation with RHENGU ENVIRONMENTAL SERVICES is requesting the development 28.431ha of disturbed agricultural land for agricultural as well as residential purposes, on the banks of the Crocodile River, facing the Kruger National Park (see map 6). The proposed project area is situated on the remainder of portions 8 & 13 and portion 14 of the farm MALELANE ESTATE A no. 140JU.⁶⁵

The study area falls within the Malelane area which has historically been known for agricultural farming. Large sections on adjacent properties are cultivated with citrus, mangoes or sugarcane. The area is flat, accessible and without any rocky outcrops. Modern topographical maps also clearly show extensive farming activities in the surrounding area (Map 2). The 1926 topographical map (Map 3) does not indicate any historic settlements directly in the study area, although several settlements were indicated (in pink), in the hills towards the current Swaziland and along the Lomati and Komati rivers (to the south and east). The 1935 map by Van Warmelo indicated the groups living in the area as mainly Shangaan and Swazi (Map 1).

The study area is indicated in maps 2 & 4 (see Appendix 2). The sections were accessible between the historically disturbed cultivated lands and were surveyed on foot and per vehicle.

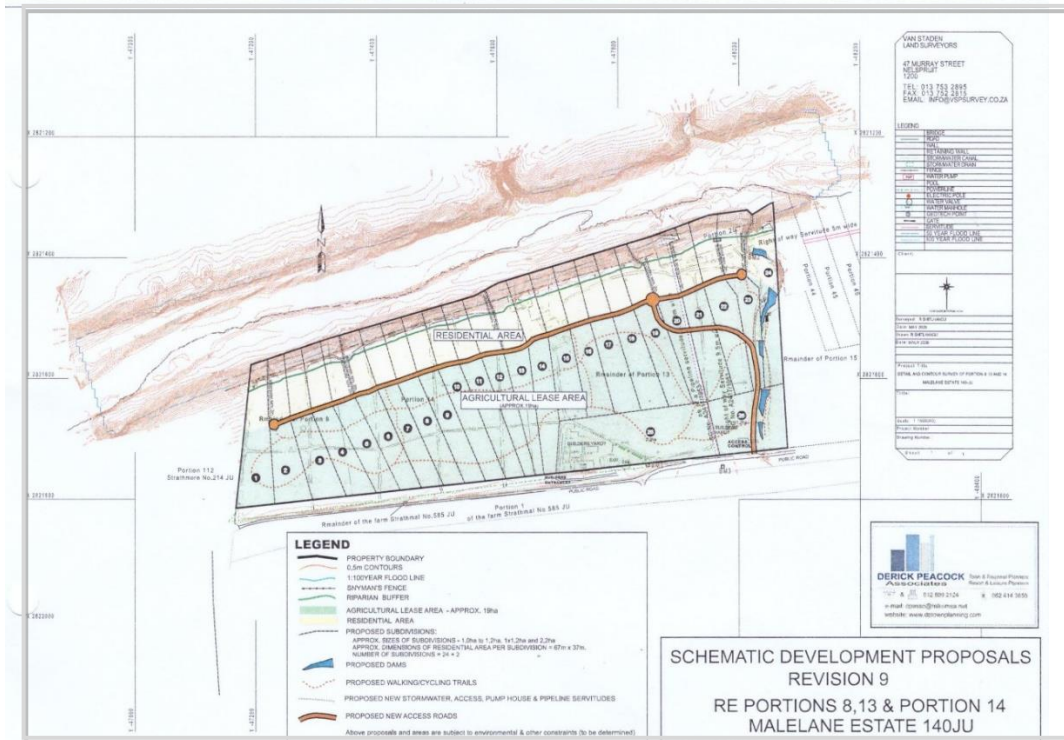
The only feature of interest on the property is the original farmhouse, built by the pioneer couple, George and Alice Gouveia, who bought the property for the purpose of farming vegetables. They built the original farmhouse in 1955/1956, where Mr. George Gouveia (jr.), was born in 1959. The house (called the Tin Shack), had no electricity or running water. The house still has the original layout and nothing was changed over the years (fig. 5). During the early 1960's, they built a modern house with surrounding infrastructure which is the current managers residence in the southern section of the farm, closer to the railway line (fig. 18). The property was in the possession of the Gouveia family until 2011 when they sold it⁶⁶ (see Appendix 2).

All comments should be studied in conjunction with the maps, figures and appendices, which indicate the study area, and which corresponds with the summary below. Photographs in Appendix 2 show the general view of the study area.

⁶⁵ D. Peacock, Memorandum in support of the application for the consolidation, subdivision and lease of remainder portion 8, remainder portion 13 and portion 14 MALELANE ESTATE A 140 JU, p. 4.

⁶⁶ Personal communication: Mr. G. Gouveia, previous owner, 2021-02-09.

No archaeological sites of significance were identified, but the original historic farmhouse is older than 60 years and mitigation measures area proposed.



MAP 6: Proposed layout of the new development (map from report ⁶⁷).



Map 7: Heritage and other features on the study area.

⁶⁷ D. Peacock, Memorandum in support of the application for the consolidation, subdivision and lease of remainder portion 8, remainder portion 13 and portion 14 MALELANE ESTATE A 140 JU, p. 4.

Heritage features (See Map 7):

Heritage Feature	Description / Comments	Site Location
Original farmhouse	Farmhouse built in 1955 / 56 for the Gouveia family. According to George Gouveia jr. the house has never been changed from its original plan. ⁶⁸ Brick & corrugated iron.	S25° 30' 04.93" E31° 28' 12.88" Elev. 300m Fig. 5

Section 34 of the NHRA stipulates that no person may alter, damage, destroy, relocate etc, any building or structure older than 60 years, without a permit issued by SAHRA or a provincial heritage resources authority and therefore mitigation measures are proposed.

No other archaeological features, structures of significance or graves were identified in the study area during the survey.

⁶⁸ Personal communication: Mr. G. Gouveia, previous owner, 2021-02-09.

F. DISCUSSION ON THE FOOTPRINT OF THE PROPOSED DEVELOPMENT

ACT	COMPONENT	IMPLICATION	RELEVANCE	COMPLIANCE
NHRA	S 34	Impact on buildings and structures older than 60 years	Original Gouveia farmhouse, 1955/56	Mitigation measures proposed
NHRA	S35	Impacts on archaeological heritage resources	None	None
NHRA	S36	Impact on graves	None	None
NHRA	S37	Impact on public monuments	None present	None
NHRA	S38	Developments requiring an HIA	Development is a listed activity	HIA done
NEMA	EIA regulations	Activities requiring an EIA	Development is subject to an EIA	HIA is part of EIA

- **Summarised identification and cultural significance assessment of affected heritage resources: General issues of site and context:**

Context		
Urban environmental context	No	NA
Rural environmental context	No	NA
Natural environmental context	No	NA.
Formal protection (NHRA)		
(S. 28) Is the property part of a protected area?	No	NA
(S. 31) Is the property part of a heritage area?	No	NA
Other		
Is the property near to or visible from any protected heritage sites	No	NA
Is the property part of a conservation area of special area in terms of the Zoning scheme?	No	NA

Context		
Does the site form part of a historical settlement or townscape?	No	NA
Does the site form part of a rural cultural landscape?	No	NA
Does the site form part of a natural landscape of cultural significance?	No	NA
Is the site adjacent to a scenic route?	No	NA
Is the property within or adjacent to any other area which has special environmental or heritage protection?	Yes	Opposite the Kruger National Park
Does the general context or any adjoining properties have cultural significance?	No	NA

Property features and characteristics		
Have there been any previous development impacts on the property?	Yes	Entire property was cultivated in the past
Are there any significant landscape features on the property?	No	NA
Are there any sites or features of geological significance on the property?	No	NA
Does the property have any rocky outcrops on it?	No	NA
Does the property have any fresh water sources (springs, streams, rivers) on or alongside it?	Yes	Crocodile River directly north & a drainage line forms the eastern boundary

Heritage resources on the property		
Formal protection (NHRA)		
National heritage sites (S. 27)	No	NA
Provincial heritage sites (S. 27)	No	NA
Provincial protection (S. 29)	No	NA
Place listed in heritage register (S. 30)	No	NA

Heritage resources on the property

General protection (NHRA)

Structures older than 60 years (S. 34)	Yes	Gouveia farmhouse dating from 1955/56
Archaeological site or material (S. 35)	No	NA
Graves or burial grounds (S. 36)	No	NA
Public monuments or memorials (S. 37)	No	NA
<i>Other</i>		
Any heritage resource identified in a heritage survey (author / date / grading)	No	NA
Any other heritage resources (describe)	No	NA

Summarised recommended impact management interventions

NHRA S (3)2 Heritage resource category	SITE	IMPACT SIGNIFICANCE Cultural significance rating		Impact management	Motivation
		Cultural significance	Impact significance		
Buildings / structures of cultural significance	Yes	Yes	Yes	Mitigation	House older than 60 years
Areas attached to oral traditions / intangible heritage	No	None	None	-	-
Historical settlement or townscape	No	None	None	-	-
Landscape of cultural significance	No	None	None	-	-
Geological site of scientific/ cultural importance	No	None	None	-	-

NHRA S (3)2	SITE	IMPACT SIGNIFICANCE		Impact management	Motivation
		Cultural significance rating			
Archaeological sites	No	None	None	-	-
Grave / burial grounds	No	No	None	-	-
Areas of significance related to labour history	No	None	None	-	-
Movable objects	No	None	None	-	-

ACT	COMPONENT	IMPLICATION	RELEVANCE	COMPLIANCE
NHRA	S 34	Impact on buildings and structures older than 60 years	Original farmhouse built in 1955/56	Mitigation proposed
NHRA	S35	Impacts on archaeological heritage resources	None present	None
NHRA	S36	Impact on graves	None present	None
NHRA	S37	Impact on public monuments	None present	None
NHRA	S38	Developments requiring an HIA	Development is a listed activity	Full HIA
NEMA	EIA regulations	Activities requiring an EIA	Development is subject to an EIA	HIA is part of EIA

G. STATEMENT OF SIGNIFICANCE & EVALUATION OF HERITAGE RESOURCES

Section 38 of the NHRA, rates all heritage resources into National, Provincial or Local significance, and proposals in terms of the above is made for all identified heritage features.

- **Evaluation methods**

Site significance is important to establish the measure of mitigation and / or management of the resources. Sites are evaluated as *HIGH (National importance)*, *MEDIUM (Provincial importance)* or *LOW, (local importance)*, as specified in the NHRA. It is explained as follows:

- **National Heritage Resources Act**

The National Heritage Resources Act no. 25, 1999 (NHRA) aims to promote good management of the national estate, and to enable and encourage communities to conserve their legacy so that it may be bequeathed to future generations. Heritage is unique and it cannot be renewed, and contributes to redressing past inequities.⁶⁹ It promotes previously neglected research areas.

All archaeological and other cultural heritage resources are evaluated according to the NHRA, section 3(3). A place or object is considered to be part of the national estate if it has cultural significance or other special value in terms of:

- (a) its importance in the community, or pattern of South Africa's history;
- (c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- (g) its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- (h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.⁷⁰

- **The significance and evaluation of the archaeological and cultural heritage features in the study area, can be summarised as follows:**

Site no	Cultural Heritage features	Significance	Measures of mitigation
Gouveia farmhouse	Farmhouse built in 1955/56, and is older than 60 years	Cultural value – significance Low – local importance.	House must be documented and preserved/management plan; OR documented, and an application put in for destruction.

⁶⁹ National Heritage Resources Act, no. 25 of 1999. p. 2.

⁷⁰ National Heritage Resources Act, no. 25 of 1999. pp. 12-14

- **Field rating:**

The field rating is viewed in terms of the NHRA (25, 1999) sections 3 (3) a, c & h. The Gouveia farmhouse has not been compromised over the years and although in a derelict state, still has its original layout and material. Cultural value is attached to the historical house of the Gouveia family which was built during 1955 /56, and is regarded as important to a certain family / community (NHRA 3.3a); It has potential to yield social and cultural information to a particular family / community which may contribute to an understanding of South Africa's cultural heritage (NHRA 3.3c & h), especially in the life of a family who is regarded as pioneers in the Lowveld district. The structure will be impacted upon by the proposed development and therefore mitigation measures are recommended.

K1 H. RECOMMENDATIONS & CONCLUSION

The proposed project site, on the remainder of portions 8 & 13 and portion 14 of the farm MALELANE ESTATE A no. 140JU, is situated on entirely disturbed agricultural land. The original farmhouse of the Gouveia family is the only feature with historical significance on the property. It is recommended that the house be documented and preserved with a possibility of restoring it for future use in the proposed development. A management plan will be drawn up to ensure its long-term preservation. (Examples for its use may be the establishment of a museum which depicts the history of the Gouveia family or the immediate surroundings such as the town of Malelane, or it may be utilized as a tearoom etc.).

The owners/applicants also have the option to apply for a destruction permit for the farmhouse after a Phase 2 documentation report was done on the historical house, should they not be interested in preserving it, and develop the site.

Based on the survey and the findings in this report, Adansonia Heritage Consultants state that there are no compelling reasons which may prevent the proposed development to continue, apart from the conditions as set out above. The applicants must be made aware that distinct archaeological material or human remains may only be revealed during the agricultural operation and other development activities, and earthmoving activities must be monitored by a qualified archaeologist. An assessment should be made if any archaeological material or graves are revealed.

Adansonia Heritage Consultants cannot be held responsible for any archaeological material or graves which were not located during the survey.

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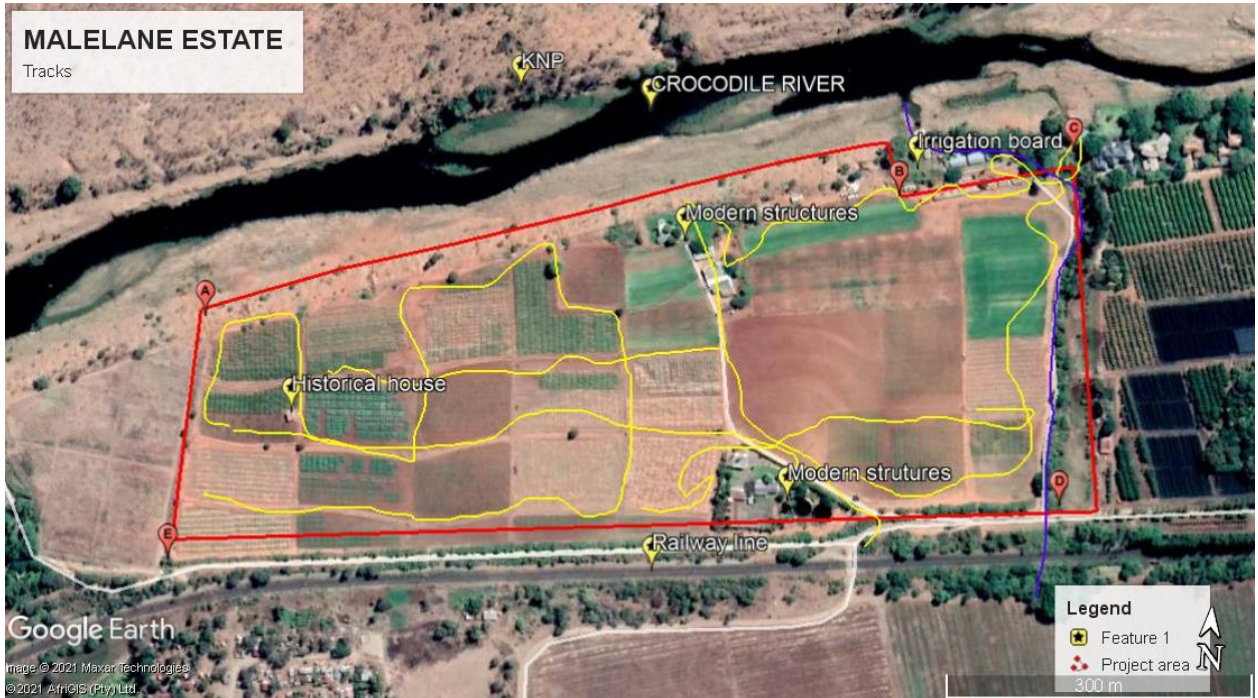
K3 PERSONAL INFORMATION

- Personal communication: Mr. G. Gouveia, Previous owner, 2021-02-09.
- Personal communication: Dr. M.S. Schoeman, University of Pretoria, 2008-03-27.
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APPENDIX 1
TRACKS & PATHS



Tracks used during the survey.

APPENDIX 2: PHOTOGRAPHIC DOCUMENTATION MALELANE ESTATE

Western section (Remainder of portion 8)



Fig. 1: The western boundary of the project area facing the Crocodile River (north). The cultivated lands and earth canal is visible in the foreground.



Fig. 2: The western section facing south-east of the railway line (red line), and farm residence (arrow). The (fallow) cultivated lands are visible in the foreground.



Fig. 3: The western section, facing east. The historical building is visible in a distance.



Fig. 4: The western section facing north east. The cultivated lands and historical building are visible.



Fig. 5: The historical building (Tin Shack) in the western section.
Middle section (Portion 14)



Fig. 6: The middle section in the west, facing east towards the farm residence. The canal follows the road contour and is visible to the left (red line).



Fig. 7: The middle section in the east, facing north-west. The Crocodile River is indicated by the blue line.



Fig. 8: A general view of the middle section (facing west) which consist entirely of cultivated lands.



Fig. 9: A general view of the middle section (facing east), towards the sheds.



Fig. 10: A general view of the middle section (facing east), towards the farm residence.



Fig. 11: The middle section, with the earth canal visible next to the road.



Fig. 12: Another view of the middle section facing west, the earth canal is to the right of the road.



Fig. 13: The middle section facing south towards the railway line. An earth canal is visible (red line).



Fig. 14: Several sluices are visible within the earth canal to regulate water, on the study area.

Eastern section (Remainder of portion 13)



Fig. 15: A general view of the eastern section (facing east).



Fig. 16: A general view of the eastern section (facing north towards the Crocodile River and Kruger National Park).



Fig. 17: A general view of the eastern section, in the south (facing east).



Fig. 18: The farm residence is situated in the southern section of the study area.



Fig. 19: Large water reservoirs are visible next to the farm residence.



Fig. 20: The infrastructure of a water pump.



Fig. 21: Another pump for use on the farm.



Fig. 22: The earth canal in the eastern section is visible next to the gravel road, facing east.



Fig. 23: A few small weirs are visible near the farm residence, to regulate water into the canals.



Fig. 24: View towards the north (NKP). Farm infrastructure is visible in the north together with workers accommodation.



Fig. 25: The farm sheds in the north, and near the banks of the Crocodile River.



Fig. 26: Workers accommodation on the banks of the Crocodile River in the north.



Fig. 27: Previous farm workers accommodation (compound) in the northern section, which is now derelict.



Fig. 28: The back of the farm workers accommodation in the eastern section of the study area (facing west).



Fig. 29: The eastern section of the farm. A drainage line is visible in the foreground, with a concrete bridge to cross over to the other side. A Middle Stone Age implement was found within the drainage line.



Fig. 30: A small section in the north-east still belongs to the Malelane Irrigation board and is currently excluded from the study area.

APPENDIX 4.4.5.
VIEW SHED ANALYSIS

Viewshed Analysis: Malelane Estate No. 140-JU [Project No.: VS-BioGIS-21|02]
Final Report: Property development risk assessment

Advanced ViewShed Analysis for Kruger Malelane Agri Estate (KMAE)

Visibility Report Malelane Estate No. 140-JU

**Sandra MacFadyen
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EXECUTIVE SUMMARY

BioGIS was contracted to run a visibility or 'viewshed' analysis to assess the visual impacts of proposed developments in the new Kruger Malelane Agri Estate (KMAE) on the surrounding landscape. Specifically, to identify areas within the Kruger Malelane Agri Estate (KMAE) with the potential to impact existing wilderness qualities inside the Kruger National Park (Kruger). This analysis forms part of the larger KMAE Environmental Impact Assessment (EIA) produced by Rhengu Environmental Services, and aims to ensure any future KMAE developments do not impact Kruger's tourist experience. Overall the visual impact of KMAE is minimal, provided heights of any future developments remain under 7.5m. Under such conditions, KMAE infrastructure and lights should only be visible from some higher lying areas including Khandizwe, Nsikazi, Mangwato and Tlhalabye outcrops, as well as Malelane satellite camp, specific locations along the S110 (totalling 2km) and a jeep track (totalling 8.7km) along the Crocodile River used by Wolhuter and Bushman Trails. Results are detailed in this report and available as an interactive 3D terrain and viewshed model upon request.

INTRODUCTION

A visibility or 'viewshed' analysis, to identify areas with the potential to impact existing wilderness qualities in the Kruger National Park (hereafter Kruger), was undertaken in accordance with the National Environmental Management: Protected Areas Act (57/2003): Biodiversity Policy and Strategy for South Africa: Strategy on Buffer Zones for National Parks (Gazette No. 35020 – Notice 106). Similarly, Kruger Malelane Agri Estate's (KMAE) Architectural and Building Guidelines (Annexure E) state that single storey buildings will be encouraged to preserve the natural aesthetics of KMAE and Kruger's environment. Any double storey building will be held to the following strict standards: i) Lighting control; ii) Low pitched mono-pitch or V-roofs will be encouraged; iii) A Professional Land Surveyor must confirm the natural ground level, contours and height of all structures; iv) No part of the dwelling (incl. roof or chimney) may be more than 7m above ground level (a.g.l). The viewshed analysis herein therefore assesses the visibility risk of KMAE developments at maximum heights of 7.5m, 6.0m and 5.0m.

METHODS

Study Area

The proposed KMAE development is situated in the Mpumalanga province of South Africa between latitudes -25.4985 to -25.5026 and longitudes 31.4692 to 31.4782. Bisected by 1:50 000 mapsheets 2531AD (Gutshawa) and 2531CB (Kaapmuiden), it covers an area of ± 27.82 ha and falls within the Savanna-Granite portion of the Lowveld Bioregion of South Africa (Mucina and Rutherford 2006). The underlying geology consists of predominantly ultramafic to felsic lavas and pyroclastic rocks of the Barberton Greenstone Belt with Haplic Cambisols (Hartmann and Moosdorf 2012; Council for Geoscience 2016). Long-term average temperatures range from 16 °C in winter to 27 °C in summer and rainfall



falls predominately in summer, concentrated particularly between November and February (MacFadyen et al 2018). Topography slopes gently downward from $\pm 312\text{m a.s.l}$ to $\pm 291\text{m a.s.l}$ (south to north), ending in the Crocodile River floodplain (Van Niekerk 2012). The area is classified as an Ecological Support Area by the Mpumalanga Biodiversity Sector Plan (Lötter et al 2014) and harbours a tiger fish support area nearby according to the South African Inventory of Inland Aquatic Ecosystems (van Deventer 2018). KMAE borders Kruger to the north, along the Crocodile River. Vegetation inside Kruger (i.e. on the opposite bank), is classified as Malelane Mountain Bushveld in which granitic mountains and *Combretum apiculatum* bush savannah is typical (Venter 1990). Significant granitic outcrops in the area include Khandizwe (841m a.s.l), less than 5km from KMAE, it is the tallest topographic feature in Kruger (MacFadyen et al 2018). Other outcrops, in order of altitude, include Mangwato (755m a.s.l); Nsikazi (755m a.s.l); Mangakikop (703m a.s.l); Newu (668m a.s.l); Maqili (667m a.s.l); Mubhaba (647m a.s.l); Tlhalabye (631m a.s.l); Skatkoppie (568m a.s.l) and Klokwani (567m a.s.l) (NGI 2009).

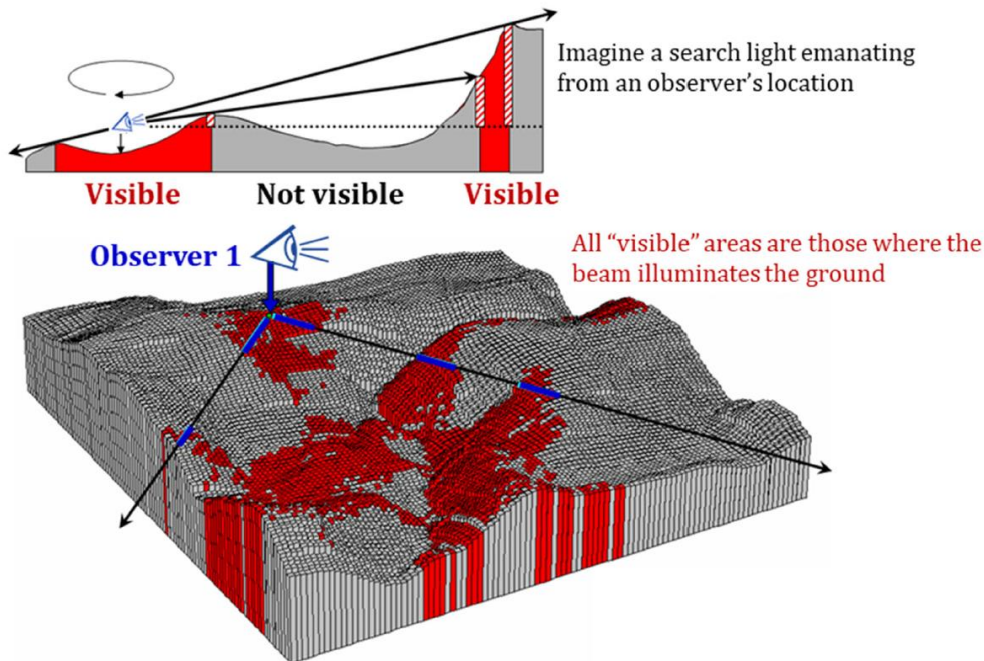


Figure 1: Example of how a viewshed analysis incorporates topographic information with observer locations to identify areas seen (red) and not seen (grey) from different points in the landscape (adapted from Berry 2013).

Viewshed Analysis

The viewshed analysis was carried out using Quantum GIS (QGIS 2021) and plugins - *Visibility Analysis* (Čučković 2016) and *Qgis2threejs* (Akagi 2021). First observer points were located within KMAE by creating 121 equally spaced (50m) grid-points within the KMAE development boundary. Viewpoints were then created using these observer points and a Digital Elevation Model (DEM) reflecting ground elevation at 5m intervals (van Niekerk 2012). The maximum distance for visibility testing was set to 40km (radius of analysis) to ensure adequate coverage. Observer and target heights were initially set to 7.5m and 2.0m above ground level respectively. The area's small size negates the need to account for the earth's curvature or light refraction, so no additional parameters were set. Using the resulting viewpoints, a binary viewshed analysis was conducted where visibility (Y/N or 1/0) is calculated for each observer point over the DEM. A visibility map is then produced by combining all visible points (1) into a cumulative viewshed model (Figure 1). Results were overlaid with all tourist infrastructure in Kruger and presented using *Qgis2threejs* (Akagi 2013) to produce a 3D visualization of KMAE's DEM and viewshed (Figure 2). Final results are further summarised by proposed property/subdivision boundaries 1 to 25 (Figure 3).

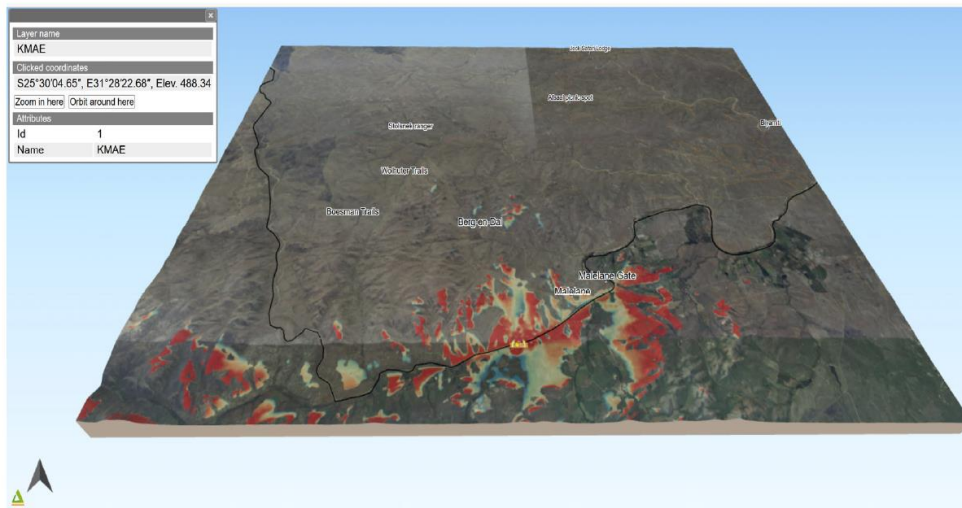


Figure 2: A 3D visualisation of Kruger Malelane Agri Estate's (KMAE) topography and areas identified as potentially sensitive to developing visual impacts to tourists in the Kruger National Park (ranging from pink to dark red in order of risk). Existing tourist infrastructure in Kruger is represented by different icons (camps or picnic spots) and lines (Kruger boundary and roads) on the map. KMAE is visible roughly in the middle of the map (houses icon). To interact with the map: i) use the mouse wheel to zoom in or out; ii) hold down the left mouse button to pivot the map in any direction and ii) hold down the Ctrl key on your keyboard and the left mouse button to pan in any direction. Left mouse click once anywhere on the map to get the clicked coordinates. A yellow circle will be placed on the map where you clicked and a control panel will appear in the top-left corner. Click "Zoom in here" to zoom to the yellow circle or "Orbit around here" to start an orbital animation. Click on any layer (e.g. camps) to get more information about the other features added to the map. See interactive pages for full 3D visualisation.

RESULTS

The maximum distance from KMAE to the furthest point visible in Kruger's landscape was 15km. KMAE developments of 7.5m, 6.0m and 5.0m will be visible from Khandizwe, Mangwato and Tlhalabye outcrops, although these points are not generally accessible to tourists. However, there are a number of sites along the S110 (adding up to 2km) and a jeep track (adding up to 8.7km) running along the Crocodile River which is used by Wolhuter and Bushman Trails, from which KMAE developments 7.5m high or higher will be visible. Developments may also be visible from Malelane satellite camp and surrounding tourist and staff roads. These results can be better visualised using the interactive 3D product described in Figure 2 below. Reducing the maximum allowable heights of all developments down to 6.0m or 5.0m, only reduces the visual impact by 2% or 3% respectively. The viewshed results are further summarised by the proposed property/subdivision boundaries 1 to 25 to visualise development risk for each subdivision (Figure 3). Subdivisions 15 and 16 have the highest risk of future developments being visible to Kruger's tourists, followed by 23 and 14 (Figure 3a). In most cases however, visibility risk does vary spatially within each subdivision (Figure 3b).

CONCLUSION

The viewshed analysis presented here assessed the visual impacts of KMAE on the surrounding landscape in Kruger with specific emphasis on the sensitivity of all existing tourism infrastructure to potential visual impacts associated with developments in KMAE. Results show KMAE will be visible from selected granitic outcrops and from certain sections of road S110. However, a number of other developments already exist along the Crocodile River outside Kruger, including other residential estates, agricultural fields and sugar-cane factories. Also, the viewshed analysis has been done using ground elevation and does not take into account vegetation (like tall trees) which may help hide certain infrastructure. Therefore the visibility risk KMAE poses to Kruger is minimal, provided all developments do not exceed 7.5m in height. Visual impacts can however be further reduced by 1) restricting developments heights further to 6.0m or 5.0m, which will reduce the visual impacts down by 2% or 3%; 2) Plant indigenous tall trees to help hide roof-tops etc.

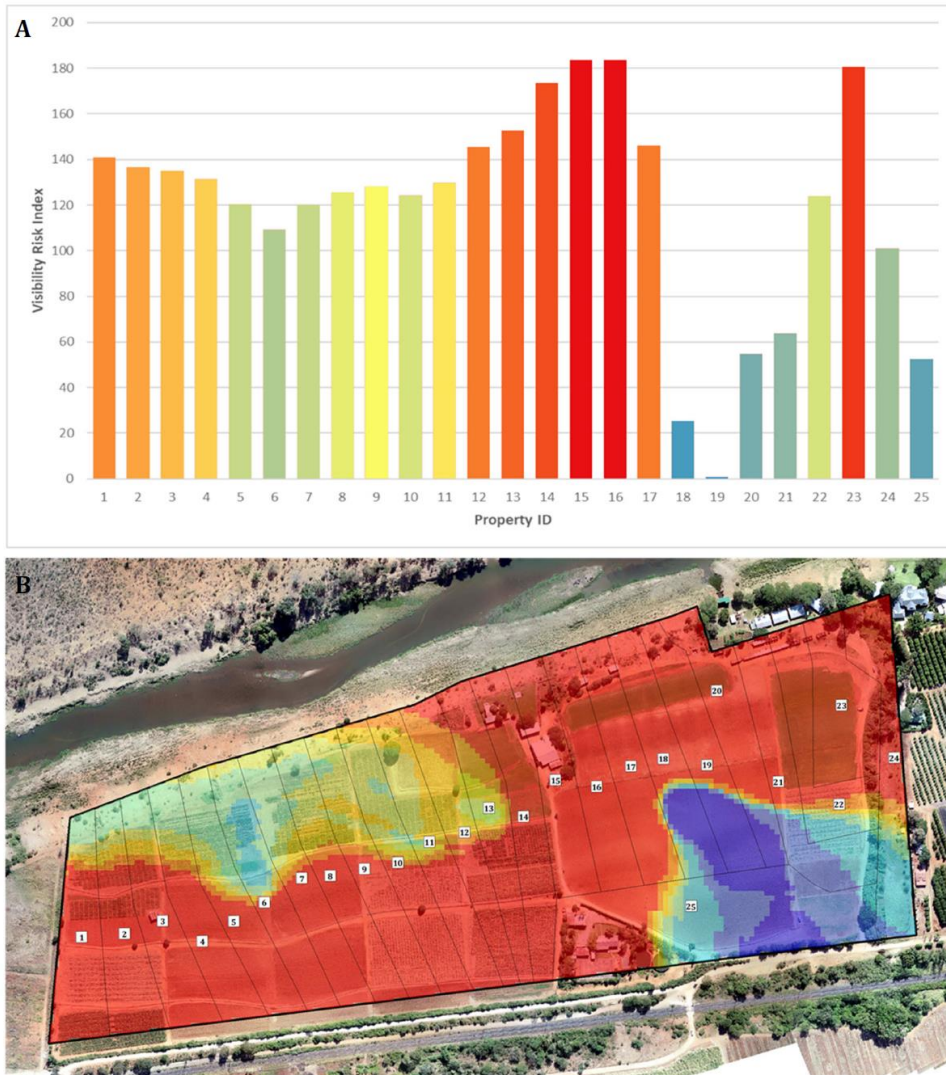


Figure 3: Risk of future developments (7.5m in height) in Kruger Malelane Agri Estate's (KMAE) being visible to tourists in the Kruger National Park. A) Boxplot showing the range of visibility risk by property/subdivision boundaries. B) Map of KMAE, showing the visibility risk of properties spatially. Colours represent the level of risk from low (blue), medium (yellow) and high (red).

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APPENDIX 5:
ENVIRONMENTAL MANAGEMENT PROGRAMME



**DEVELOPMENT OF AN AGRICULTURAL ESTATE ON REMAINDER PORTIONS
8, 13, 14 AND 20 OF MALELANE ESTATE 140 JU:
MALELANE, MPUMALANGA**

**1. ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr): DEVELOPMENT
ACTIVITIES**

1.1. The environmental management programme will address the development phase of the proposed activity. This will include the installation of services (sewerage, water, power and the upgrading of the access bridge/dam) by contractors and agricultural specialists. Furthermore, it will include the preparation of the orchards and the installation of services (irrigation) including the development of each residential unit.

1.2. The EMPr will primarily be used by the applicant/construction teams under the guidance of the ECO. For this purpose the EMPr must serve a number of functions. These are:

- Instructions and conditions included in the EMPr must be written in a clear, down to earth language.
- All aspects of the EMPr must be practical and unambiguous.
- Instructions and conditions must be concise and to the point.
- Aspects of the EMPr must reflect the recommendations and mitigation measures listed in the Environmental Impact Assessment Report/s.
- Aspects of the EMPr must reflect the recommendations and mitigation measures listed in the Specialist Studies and the comments by Interested and Affected Parties/Government Departments. See **Appendix 2** and the recommendations in the EIR.
- The EMPr must be used to monitor compliance to the conditions stipulated in the Environmental Authorisation of the Project as issued by DARDLEA.
- Aspects of the EMPr can be referred to in an Operational Management Programme (OMPr) during future Environmental Audit Assessments.
- The EMPr must ensure the protection of the natural environment and cover all aspects of rehabilitation/sustainable preparation of the impacted sites.
- The EMPr will guide the process from initiation until sign off the project.
- **Note:** The EMPr will remain a dynamic document which can be updated with the approval by DARDLEA.

1.3. The implementation of the EMPr will be guided by an Environmental Control Officer (ECO).

- The applicant/developer is responsible for the appointment of the ECO.
- The name and contact details of the ECO must be submitted to DARDLEA once the project commences.
- All Interested and Affected Parties (I&AP's) must be informed of the name and contact details of the ECO.

1.4. Monitoring and Auditing

The Environmental Control Officer (ECO) will ensure that all the **conditions** as set out in the **Environmental Authorisation (EA) and any other requirements as issued by DARDLEA or any other applicable Department, e.g. DWS**, are met and implemented as stipulated.

The ECO must submit to DARDLEA, a **quarterly audit report (or as determined by DARDLEA as appropriate)** on the activities of the development. Quarterly audit reports will be made available to I&AP's on request.

The role of the ECO and independent audit teams are well defined within the framework of Integrated Environmental Management (IEM). The developer, together with the ECO will ensure **compliance** in terms of this process.

1.5. Initial Role-players: Contact Details:

- | | |
|--|------------------------|
| 1. Developer/Applicant Representative: Andre De Zwardt | Cell: 082 820 4228 |
| 2. ECO: To be appointed | Cell: To be confirmed. |
| 3. EAP: Ralf Kalwa | Cell: 082 414 7088 |

2. DEVELOPMENT PHASE: ENVIRONMENTAL MANAGEMENT PROGRAMME (EMP)

This programme must be read in conjunction with the **Contract Documents** for the project. This environmental management programme will address the development/preparation phases of the proposed development as described in Environmental Impact Assessment Report.

KEY ISSUES: EMPr

This programme is designed for the entire development period and includes the rehabilitation of areas where development/storage activities took place. The Contractor/Applicant together with the Environmental Control Officer (ECO) will be responsible to ensure that all construction workers, sub-contractors, suppliers and relevant personnel associated with the development:

- Understand the contents of the Environmental Management Programme (EMPr).
- Ensure that all the construction personnel are fully aware of all environmental issues relating to the development activities.
- Adhere to all the precautionary and mitigating measures described in the EMPr.
- Ensure that all the construction personnel understand the implications and stipulations of the Environmental Rules and Regulations described in the Development Contract.
- The ECO shall instruct the Applicant/Developer to suspend the works if the Contractor and/or any Sub-Contractors do not comply with the contents of the EMPr.
- The ECO will submit quarterly audit reports to DARDLEA, the Contractor and the Developer.
- The EMPr describes the responsibilities of all the staff during the development phase.
- The ECO will oversee the operations and ensure compliance with the EMPr.

Non Compliance: The Contractor/Applicant is deemed NOT to have complied with the EMPr, the Environmental Authorisation and the EIA if:

- Within the boundaries of the site, site extensions and haul/access roads there is evidence of contravention of the Specification/Conditions of the EMPr;
- Environmental damage ensues due to negligence;
- The Contractor fails to comply with corrective or other instructions issued by the ECO within a specific time;
- The Contractor fails to respond adequately to complaints from the public;

Prior to construction: The Contractor/Applicant, in liaison with the ECO will submit a **final layout plan** of the development site indicating all of the following: storage areas, hazardous substances storage area (if applicable), different stockpile areas, material stores, waste disposal areas, on site offices, workshops, ablutions, access roads, no go areas etc. This construction site layout plan must be submitted to DARDLEA and the ECO prior to site establishment. Once the layout is approved by the ECO the Contractor will be required to sign acceptance of the EMPr and commence with the development. **Note:** Contractor = Installer of Irrigation Systems (pump houses, valve chambers) or construction of Bridge/Residential Construction sites etc.

2. DEVELOPMENT PHASE: ENVIRONMENTAL MANAGEMENT PROGRAMME: The ECO will monitor compliance of this EMPr		
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
1. Site Establishment and Logistics.	<p>1. Site Office and Logistics: Establish a site office for the development. The Farmhouse can serve this purpose. The following procedures and equipment must be made available at the office:</p> <ul style="list-style-type: none"> • Copies of the EIA (Final BAR) and the EMPr. • Copy of the Environmental Authorisation. • Copies of the Development/Site Layout Plan. • A Complaints Register. • A Corrective Actions and Site Instruction Register. • An Emergency/Evacuation Procedure. • A Monitoring- and Audit Register. • Emergency Contact Numbers including but not limited to telephone contact details for medical doctors; hospitals; emergency helicopters; emergency fire management; the ECO and Project/Site Manager. • Fire Extinguishers. • First Aid Kit. • A register of all applicable Standard Operational Procedures and Method Statements (e.g. handling of hazardous materials) of materials and equipment that are used and stored on site. 	Contractor
	<p>2. Final Walk Inspection (Pre-Construction): A final walk through the site with the ECO to point out the presence sensitive areas, e.g. Special Plants/Habitat/Drainage Line/Floodline/Buffer Zones, or any other aspect which requires protection has to be undertaken prior to site establishment.</p>	
	<ul style="list-style-type: none"> • All staff must be trained to respect the importance of rare/conservation significant plants and cultural artefacts. This is specifically applicable to the no go area around the drainage lines and buffer areas. 	
	<ul style="list-style-type: none"> • Special features (large indigenous trees; rivers; wetland; etc.) must be indicated on the development map and demarcated on site prior to construction. Damage to such features must be rehabilitated to the satisfaction of the ECO and the developer. 	
	<ul style="list-style-type: none"> • All drainage lines must be demarcated to ensure that all machinery is kept out of these zones. 	
	<ul style="list-style-type: none"> • Timing: All development should preferably take place in the period March-September. 	
	<p>3. Demarcation: Demarcate the boundaries of the total development site for management purposes using steel droppers/standards spaced at regular intervals with a combination of nylon rope/barrier tape/shade cloth curtains between the droppers. This will be required on all building sites and especially in the vicinity of the riparian zones and sites with special plants of concern.</p>	

	<ul style="list-style-type: none"> • The Contractor shall maintain the demarcation line and ensure that materials used for construction on site do not blow on or move outside the site or pose a threat to any neighbours or adjoining property owners. 	
	<ul style="list-style-type: none"> • Where applicable, structures must be located in such a manner as to reduce visual intrusion and minimal disturbance to neighbouring properties. Make use of coloured netting or corrugated cladding to hide unsightly features. 	
	<ul style="list-style-type: none"> • Construction activities are restricted within these boundaries, thus all construction equipment, materials and personnel will remain within this demarcated area at all times. 	
	<ul style="list-style-type: none"> • Ensure that access to the site including related infra-structure and machinery is restricted to authorised personnel only. 	
	<p>4. Site Control: Limit the construction/development site to existing infrastructure and or to disturbed areas.</p>	
	<ul style="list-style-type: none"> • Ensure that only approved workers and Sub-Contractors are accommodated and allowed access to the site. • Ensure that all activities required by the Irrigation Board staff are allowed to continue unhindered and without delay. 	
	<p>5. Site Facilities: The construction site and storage areas must be safeguarded against fire.</p>	
	<ul style="list-style-type: none"> • Ensure that each Contractors Site is fully functional in terms of water- and sewerage supply (temporary toilets) prior to the contractors coming on site. 	
	<ul style="list-style-type: none"> • Contractor to be held responsible for providing construction-, drinking- and washing water for all the activities on site. 	
	<p>6. Access Routes and Control: No temporary access routes and haul roads are required for this activity.</p>	
	<ul style="list-style-type: none"> • No vehicle movement outside demarcated areas/routes/existing roads is permitted without authorisation from the ECO. 	
	<ul style="list-style-type: none"> • Dust control measures, i.e. dampening access routes with water, must be implemented where necessary. 	
	<ul style="list-style-type: none"> • Damage to any existing roads as a result of construction activities will be repaired to the satisfaction of the ECO and the Developer. 	

7. Storage- and Material Laydown Areas: Irrigation piping, pumps, cement, re-inforced steel, bricks etc. will require a site, e.g. farm yard, when these materials are delivered and until these items are installed/used.

- All equipment, materials; pipelines etc. must be stored at the farm maintenance centre or on the residential building site under construction.

8. Site Closure: Once the development period e.g. bridge crossing site/residential unit is completed the following conditions will apply:

- The Contractor shall ensure that all temporary structures/facilities, equipment, materials and waste used for construction activities are removed after completion of development.
- The contractor shall clear and clean the construction site to the satisfaction of the ECO and the developer upon completion of the development.
- Remove all components of demarcation when the development phase is completed.
- Rehabilitate disturbed areas. This will include but not be limited to:
 - Break up any hardened soil surfaces allowing seeds and rainwater an opportunity to penetrate the soil surface.
 - Brush pack/landscape bare areas and reduce the potential run off of water.
 - Shape/level off any unnatural areas to fit in with the surrounding landscape and the lie of the land.

Site Closure: Should the site be closed for a period of more than one week (Christmas break), a report on compliance will be lodged with the ECO, and the following will be confirmed:

- Stores will be left at as low a volume as practically possible with no leaks.
- The storage area will be secure and locked.
- Fire extinguishers will be serviced and accessible.
- The area will be secure from accidental damages.
- Emergency- and contact numbers will be available and prominently displayed.
- Toilets will be empty and secured.
- Refuse bins will be empty and secured.
- Access to the site must be limited to authorised personnel only.
- Security staff will patrol and guard the site.

ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
<p>2. Site Biodiversity Management. (The ECO must be consulted at all times during this process).</p>	<p>1. Vegetation Management: Vegetation clearing must be undertaken in a judicious and responsible manner. The following approach will apply:</p>	<p>Contractor and ECO where applicable.</p>
	<ul style="list-style-type: none"> • Where applicable, six weeks prior to the vegetation being cleared all Protected Tree Species must be clearly marked by the ECO and DAFF/MTPA Permits must be obtained to ensure permitted removals and translocations. • The Biodiversity Specialist has recommended that should any tree require translocation that it should be replanted on site. If this cannot be achieved for whatever reason, then the above statement will apply. 	
	<ul style="list-style-type: none"> • Vegetation Clearing: As per the contents of the Biodiversity Report very little natural vegetation is found on the project site. The following will however apply where some vegetation clearance will be required: <ul style="list-style-type: none"> • During the clearing of vegetation in the project area most vertebrates will move away from the project site. • During this activity the project team may encounter slow moving reptiles and smaller mammals. • These animals should be allowed to move away unharmed or be assisted and allowed to enter the Kruger National Park on the northern boundary of the project site. 	
	<ul style="list-style-type: none"> • Riparian Corridor: All drainage lines and riparian zones as identified by the Biodiversity Specialist/Project Ecologist will be kept intact. The riparian zones will act as a corridor for migrating fauna. 	
	<p>2. Alien Invader Plants (Also from the SANParks Guideline): Control of alien invasive species will be undertaken on the development footprint in line with the requirements of the Conservation of Agricultural Resources Act. The ECO will identify plants (where applicable) which require removal and management. The applicant has commenced with this process as part of a Best Practice philosophy.</p>	
	<ul style="list-style-type: none"> • Alien invasive plant material will be preferentially removed through mechanical means (e.g. chainsaw, hand-pulling of smaller specimens). 	
	<ul style="list-style-type: none"> • Chemical control is only required as a last resort or as a support mechanism to control coppicing and sprouting. 	
	<ul style="list-style-type: none"> • All exotic plants must be identified and earmarked for removal. The ECO will assist with identifications (where applicable). 	
	<ul style="list-style-type: none"> • A number of workers must be used to remove the vegetation i.e. 4/6 workers. ECO to monitor. • If during the establishment period, any noxious or excessive weed growth occurs, such vegetation will be removed by the contractor. 	

<p>3. Fauna and Flora Management (Also from the SANParks Guideline): Collection of firewood/seeds/fruit/plants/animals or any biological material (where applicable) is strictly prohibited.</p>
<ul style="list-style-type: none"> • No animals including snakes should be killed or injured by workers during the construction- and or the operational phases of the project.
<ul style="list-style-type: none"> • No poaching will be allowed on site.
<ul style="list-style-type: none"> • No interaction with animals inside the Kruger National Park is allowed. This includes the provision of game licks, water points and providing fodder.
<ul style="list-style-type: none"> • No luring or calling of animals is allowed.
<ul style="list-style-type: none"> • The Contractor is not allowed to deface, paint or mark and/or damage natural features/vegetation on the site.
<p>4. Topsoil Protection: Topsoil will have to be removed/moved from all areas where pipelines etc. are to be installed.</p>
<ul style="list-style-type: none"> • Topsoil to be handled twice only; once to strip and stockpile (in low heaps of 1m) in the Right of Way (ROW) next to the trench, and secondly to replace along the contour, level, shape and scarify.
<ul style="list-style-type: none"> • The topsoil must be replaced as soon as possible.
<ul style="list-style-type: none"> • Topsoil may not be compacted, nor should any object be stored or stockpiled upon it.
<ul style="list-style-type: none"> • No vehicle traffic will be allowed on the topsoil.
<ul style="list-style-type: none"> • The Contractor shall prevent pollution incidents on the topsoil. ECO to monitor.
<p>5. Biodiversity Protection: See Appendix 4.4.2. Refer to applicable maps in Appendix 1.</p>
<ul style="list-style-type: none"> • Ecological Corridors/Buffer Zones/Riparian Areas: The corridors created by buffers and the delineation of the riparian areas connect and protect the sensitive areas on the project site which link up to the Kruger National Park.
<ul style="list-style-type: none"> • This network of sensitive areas will provide viable corridors (from south to north and vice versa) and dwellings for smaller animals/birds undertaking a range of movements, including daily or regular movements, seasonal and migratory movements, dispersal movements and range expansion.
<ul style="list-style-type: none"> • The protected network, which includes the drainage line to the east of the project site will function as a sanctuary for both animals and plants.

- Summary of **Impact Mitigation on Biodiversity Components: ECO to monitor and control:**
 - See **Appendix 4.5.2** for detail on all aspects of the biodiversity associated with the Project Area.
- The potential impacts of the project on the biodiversity of the study area are assessed under the following broad categories, namely:
- **Activity 1: Construction of the residential units:**
 - **Impact 1.1: Stormwater and erosion/siltation.**
 - **Applicable Activity:** Surface flows from residential areas will be released as stormwater into the receiving environment, which may cause erosion and siltation.
 - **Nature of Impact:** A development, such as the KMAE project implies that areas of natural/agricultural vegetation are replaced with housing units, roads and other forms of impervious surfaces in the residential areas.
 - The effect of this is that water runs from the new hard ground surfaces and enters streams or watercourses in greater volumes and over a shorter period of time. However, the KMAE development can be considered as a very low-density development which directly implies that runoff will not **increase impermeable areas significantly.**
 - **Mitigation Recommendation:** It is proposed that soakaways be used within the residential sites to lessen the impact of runoff from the roofs combined with permeable paving.
 - Another source control which could be considered is rainwater harvesting (ConSolv, 2020). It is further proposed that swales be constructed adjacent to all the access roads as the primary local control.
 - Should water be channelled in any event from the property, it is suggested that the water should be slowed down before it reaches the KNP fence/boundary with a slowdown system such as infiltration trenches.
 - It is envisaged that the current open, erosion prone fallow lands will rapidly be transformed into lush gardens of local indigenous vegetation as soon as construction is completed.
 - Some indigenous trees have already been planted as part of the initial rehabilitation. These gardens will each also act as slowdown systems for stormwater generated by paved surfaces and roofs on the unit.

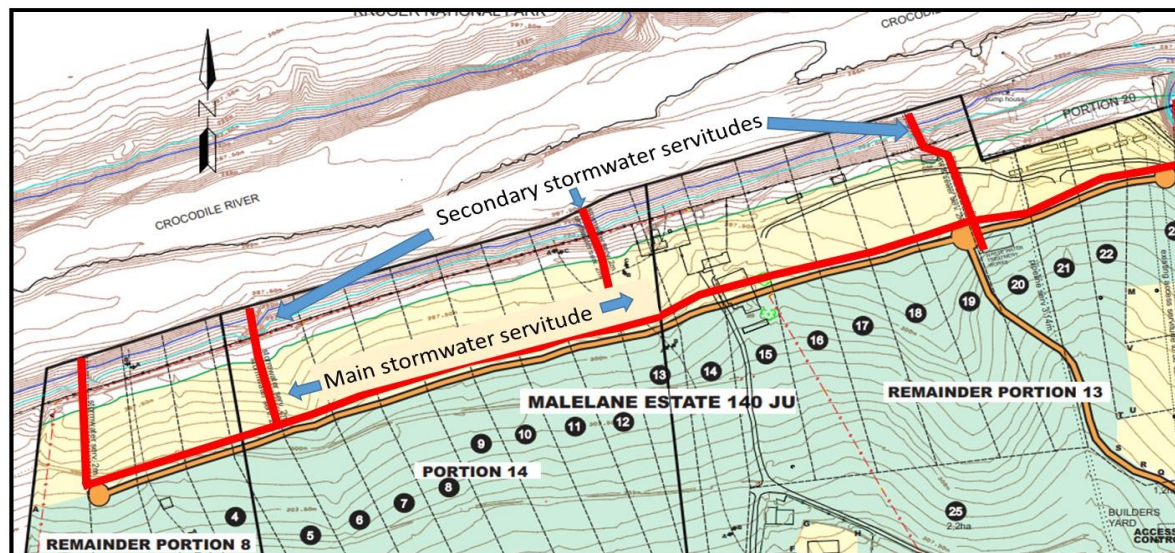
- **Impact 1.2 Pollution: 1.2.1 Sewerage:**
- **Applicable Activity:** Wastewater treatment.
- **Nature of Impact:** Poorly maintained septic tanks can result in nutrient-rich runoff being discharged. These waste waters create unfavourable conditions for natural vegetation and encourage growth of weeds. When nutrients such as nitrogen and phosphorus are discharged from septic systems into the groundwater, they represent a potentially important nonpoint source of pollution to the Crocodile River.
- This could also negatively affect the unnamed watercourse on the eastern boundary due to inter alia inadequately treated effluent, a risk associated with the passive biological treatment process of septic tanks.
- **Mitigation Description of Impact 1.2.1:** A waterborne sewerage system will thus be installed (no septic tanks) with a Maskam Fusion Waste Water Treatment Plant package.
- The outflow from this system must conform to General DWS Standards and will be used for irrigation of the macadamia orchards. One pump station (situated on proposed portion 19) will feed the treatment plant.
- All the sewerage from the reticulated sites within the development will be treated at the treatment plant. The Wastewater Treatment Plant will be constructed next to the water treatment plant and the treated water will be used for irrigation.
- The treated effluent must comply with the general standards required by the Department of Water and Sanitation and must be of such quality that the treated water can be used for irrigation purposes.
- The project area drains towards the north-east, and the lowest point is next to the Crocodile River. It is proposed that the sewer lines be placed **outside the riparian buffer**.
- No reticulation lines will be constructed within the 1:100-year flood line.

- **Impact 1.2 Pollution:** 1.2.2 Hazardous substances associated with construction activities.
- **Applicable Activity:** Alterations to water quality due to pollution from hazardous chemicals released through effluents, storm water runoff or accidental spillages from the project area into the receiving aquatic environment.
- **Nature of Impact: Potential Substances:** Oil, fuel, lime-containing (high pH) construction materials (concrete, cement and grouts), and chemicals such as hydrocarbons, carbonaceous sediments, flushed-out pesticides, house-hold detergents.
- A range of hazardous chemicals, some of which are lethal to in-stream biota (fish and invertebrates) could contaminate the watercourses during various stages of this project if due precautions are not taken. Hazardous chemicals can leak or be accidentally spilled by construction vehicles during construction and might contaminate the soil, ground water and receiving wetlands. It is essential to prevent pollution of the waters of the Kruger National Park and the resulting poisoning of fish, birds and other animals.
- **Mitigation Description of Impact 1.2.2:** The buffer boundaries for the water courses as assessed with the DWS buffer tool must be implemented between the development and surrounding environment. These buffers around the riparian zones and wetlands were calculated as follows:
 - Crocodile River: 23m wide.
 - Small stream on the eastern boundary (valley bottom wetland): 10m wide.
- **These buffers will protect the riverine area from the following potential sources of pollution:**
 - Construction camps, storage areas, soil stockpile areas and laydown areas must be located outside the riparian or wetland buffer zones.
 - Prohibit the dumping of waste material within the riparian or wetland buffer zones. Spoil material must be appropriately disposed of at a registered waste disposal facility.
 - Portable toilets must be located outside the riparian- or wetland buffer zones.

	<ul style="list-style-type: none"> • Impact 1.2 Pollution (Also from the SANParks Guideline): 1.2.3 Solid waste. • Applicable Activity: Solid waste disposal and management. • Nature of Impact: Improper solid waste disposal and management causes all types of pollution: air, soil, and water. Uncontrolled burning of solid waste and improper incineration contributes significantly to urban air pollution. • Health and safety issues also arise from improper solid waste management. Insect and rodent vectors are attracted to the waste and can spread diseases. The availability of household trash can alter the composition of wildlife communities by providing food for animal populations that thrive on trash (such as rats, baboons and monkeys) to the detriment of those that do not, e.g., small mammals and birds. • Mitigation Description of Impact 1.2.3: Refuse removal functions will be provided by the KMAE Management. Waste will be collected weekly by the Nkomazi Municipality. See Appendix 6.6, which confirms the removal of solid waste. • It is proposed that solid waste be taken daily in municipal refuse bags to a holding facility (fenced in cage with welded mesh and concrete floor) at the entrance gate of the development. • A surfaced area with screening walls will be constructed at the entrance gate to accommodate a number of “skips”. • The holding facility must be constructed with brick and concrete. The facility will include a concrete floor, washing- and drainage facilities. • The KMAE Management Team must implement a green waste management and recycling approach as per good governance and best practice principles. 	
	<ul style="list-style-type: none"> • Activity 2. Construction of a dam at an existing bridge crossing in an unnamed drainage line. • Impact 2.1: Inundation of the stream. • Applicable Activity: Drowning of a section of the riparian zone. • Nature of Impact: This impact refers to the permanent loss of untransformed habitat, especially the interruption of the riparian corridor. • Mitigation Description of Impact 2.1: Very little mitigation will be available during the flooding of the riparian zone. • Establish a 10m buffer zone (established with the DWS Buffer Tool) around the full-water mark and replant some of the key riparian tree species from the basin onto the dam margin boundary. • Currently there are some intact riparian zones upstream and downstream of the proposed dam basin along the stream banks of the drainage line. • The riparian zone of the designated drainage line should be protected and excluded from any further development in order to maintain and support the integrity of the remaining riparian corridor. 	

- **Activity 3:** Establishment of the orchards.
- **Impact 3.1:** Stormwater and erosion/siltation
- **Applicable Activity:** Erosion and siltation due to channelled and thus concentrated stormwater flowing from the orchards.
- **Nature of Impact:** Whether the stormwater arrives via non-point sources or via storm-water systems, it inevitably discharges directly into the receiving waters without any prior treatment. Even moderate runoff volumes and velocities give rise to a wide variety of water quality problems that are linked to flooding and wash-off. The typical categories of problems that arise are sedimentation, erosion (channel widening and streambed alteration) and habitat changes, as well as loss of aquatic- or riparian habitats.
- It is clear, that historical land uses resulted in concentrated stormwater channelling between croplands and where this channelled water was released on the other side of the KNP fence, visible erosion took place, leaving the scars of erosion dongas on the floodplain.
- It is also clear by the colour of the soil below the property on the KNP side of the fence that sheet erosion through the years transported a great deal of soil from the agricultural lands into the Park.
- Both the loss of good agricultural soil and the deposition of washed-out alluvial sediment into the KNP must be considered a significant adverse impact.
- **Mitigation Description of Impact 3.1:** Proper stormwater management is essential to ensure protection of life and property from flood hazards and that the natural environment is protected.
- The **objectives of stormwater management** can be summarised as follow:
 - to provide a stormwater drainage system for the protection of the property from damage by runoff from frequent storms;
 - to prevent loss of life and reduce damage of the property from severe storms;
 - to prevent land and watercourse erosion;
 - to protect water resources from pollution;
 - to preserve natural watercourses and their eco-systems;
 - to achieve the foregoing objectives at optimal total cost.
- The stormwater channels and structures will be designed for a 1:2-year storm recurrence, except at the piped crossings where a 1:5-year storm recurrence is catered for. The infrastructure will be located within the road servitudes. (See Service Report in **Appendix 6.1**).
- The introduction of efficient stormwater drainage systems to deal with the erosion and siltation problem implies that the runoff must be conveyed as efficiently as possible to the natural watercourses. This has the effect of decreasing the time runoff takes to reach the natural watercourses. The result is a **reduction of overland flow**, meandering watercourses and the like, through a system which drains runoff to the watercourses as quickly as possible. The flood problem is therefore transferred downstream.
- It is suggested that Best Practice Guidelines and Specifications relating to stormwater management should be used to implement measures to slow down flows channelled through the orchards, right from where the orchards start at the southern boundary.

- The layout below illustrates the proposed stormwater servitudes in the project area. It is clear that this system will mainly serve the agricultural stormwater emanating from the orchards. It therefore comes down to the fact that each residential unit must be able to manage the stormwater on its own property.
- The main stormwater servitude runs parallel along the east to west road servitude, and five secondary stormwater servitudes run from the main stormwater servitude directly to the northern boundary of the project area. The most eastern line will release its volume of stormwater into the unnamed drainage line, a natural drainage system for rainwater.
- This layout predicts that the main stormwater line will collect most of the stormwater draining from the orchards, and then release the flow via the secondary stormwater lines into the Crocodile River floodplain.
- It is clear that if all the stormwater is released equally through the secondary stormwater lines, the impact of erosion will not be alleviated. The dongas will remain or even deteriorate due to the concentrated stormwater flows during high rainfall events. To **mitigate for this impact**, the following are suggested:
- The main stormwater channel should be a few centimetres deeper than the secondary stormwater channels, in order for most of the initial inflows to be diverted to the natural stream outlet and no erosion is expected to occur here;
- It may be appropriate to release the stormwater below the dam wall in order to protect the structure from higher than usual flood peaks;
- When the main stormwater channel fills up, more water will be released into the secondary stormwater channels and the water diverted towards the northern boundary of the project area and the KNP fence;
- In order to prevent high volumes of stormwater being released straight into the downstream environment, it is suggested that the stormwater channels first let the water flow into a system of drains and rock-filled sumps to slow down the flows and then dissipate the released water **over gabion mattresses** to prevent further erosion and siltation on the KNP section of the fence.



- **Impact 4 (Also from the SANParks Guideline):** Human Wildlife Conflict.
- **Applicable Activity:** Human-animal conflict.
- **Nature of Impact:** Human-animal conflict is often caused by learned behaviour. The eradication of the problem animal is often the result.
- Situations might arise where certain animals and their behaviour become problematic to the management of a place bordering a wilderness area or so close to a Big Five location (Kruger Park).
- It is therefore important to design the facilities in a way that prevents this undesirable learnt behaviour. The most common problem animals in this regard are: elephants, hyaena, baboons, vervet monkeys and badgers.
- Although there is a strong barrier between the KMAE and the park, animals are opportunists and will sometimes find a way to get past the barrier. Smaller species such as baboons, vervet monkeys and badgers can easily climb through or over the fence.
- **Mitigation Description of Impact 4:** It will be expected from the KMAE management to implement the necessary preventative measures to avoid the development of problem animals. A **Problem Animal Policy** for the owners may include the following strategy:
 - **Potential food sources:** It is important to avoid the animals associating humans with easy food, therefore food should never be left visible, unattended and/or accessible.
 - Educate and sensitise contractors, owners, guests and visitors on the issues related to problem animals.
 - Fences around waste storage facilities must be functional.
 - It must be made clear to owners and their guests that the feeding of any animals, even birds, is unacceptable.
 - Fruit trees, such as oranges, should not be planted. Plant indigenous trees.
- **Interfering with biota:** No person shall disturb or destroy any fauna or flora.
 - Do not disturb any animal inside the project area.
 - Do not remove, cut or damage an indigenous plant inside the project area.
 - No snake (poisonous or non-poisonous) may under any circumstances be killed unless a human life is at stake.
 - No trapping, snaring, hunting, fishing or killing of any animal may occur inside the project area.
 - Baiting of wildlife to enhance viewing is not permitted.
- **General Conditions:** Strict lighting controls will be enforced to limit light pollution. No floodlights and open lighting will be allowed for night lighting. The number and wattage of outdoor lights will be limited/low key and shields must be used to direct lighting downwards.
 - No fires may be lit except in designated areas.
 - No loud noise or disturbance will be permitted.

ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
3. Project Specifics and Excavation Management: Trenching; Backfilling and Levelling.	1. Excavation: During excavation topsoil has to be stockpiled as specified in low 1m heaps next to the trench in the ROW.	Contractor and ECO where applicable.
	<ul style="list-style-type: none"> • Excavation of soil to solid ground to be done carefully and to ensure proper drainage. 	
	<ul style="list-style-type: none"> • Remove soil/sand and debris and expose all rocky material. 	
	<ul style="list-style-type: none"> • Excess (spoil) excavated rocky material (rock and boulders) to be used for erosion control/cladding/gabions where applicable or for purposes of landscaping. 	
	2.Backfilling: All soils must be returned into the trench in the sequence in which they were excavated.	
	<ul style="list-style-type: none"> • Soil will be excavated and used for re-filling trenches using the rollover method, i.e. progressive re-instatement: This entails the following approach: 	
	<ul style="list-style-type: none"> • Soil from the first trench section will be stockpiled. 	
	<ul style="list-style-type: none"> • Soil excavated from subsequent trench lengths will be used to backfill once the pipelines have been laid on an ongoing basis. 	
	<ul style="list-style-type: none"> • The final trench length will be re-filled using the originally stockpiled soil. 	
	3. Levelling: Excess sand/soil (after construction) must be filled in and landscaped into natural sandbanks blending in with the topography of the surroundings.	
	<ul style="list-style-type: none"> • Excess stockpiled building material must be removed completely and all areas levelled. 	
	<ul style="list-style-type: none"> • Excess sand and soil resulting from levelling activities of the work area to be stored in low heaps on the access road/or already disturbed areas. 	
	<ul style="list-style-type: none"> • Excess topsoil to be spread evenly over the area in a manner that blends in with the natural topography. 	
<ul style="list-style-type: none"> • When the bulk of material stockpiles have been cleared, the disturbed areas are to be levelled and cleared of any unnatural foreign material manually using shovels and rakes. 		
4. Trenching: This activity is limited to the pipeline installations to the new orchards and all service lines to the residential units.		
<ul style="list-style-type: none"> • Trenching will be minimised through the use of single trenches. 		
<ul style="list-style-type: none"> • Planning and selection of trench routes will be indicated on the Site Development Layout Plan. 		
<ul style="list-style-type: none"> • Trench routes with permitted working areas will be clearly defined and marked with painted stakes prior to excavation. 		

- All trenches must be clearly marked (Flags; coloured posts; reflective banners; lights) in order to alert people to the potential hazard thereof.
 - All open trenches must be patrolled on a minimum of a daily basis to ensure that animals, e.g. lizards, small rodents, have not become trapped. Such animals will be removed and released. A log must be placed at strategic spots each afternoon to allow any animal that accidentally falls into the trench an opportunity to escape.
 - Stripping and separation of topsoil will occur as stipulated in the EMPr above.
 - Trench lengths will be kept as short as practically possible.
 - Trenches will be re-filled to the same level as, or slightly higher to allow for settlement of the surrounding land surface to minimise erosion. Excess soil will be stockpiled in an appropriate manner.
 - Immediately after refilling, the disturbed areas will be stabilised.
 - The Contractor will not pollute any eco-system as a result of construction activities. All cement mixing activities must take place on an impermeable layer, e.g. metal sheet or plastic cover.
 - **NB:** No mixing of cement may take place directly on the soil surface.
- 5.Irrigation Methods/Equipment:**
- The efficient use of water and the implementation of a site-specific irrigation system will go a long way towards the sustainable use of irrigation water on the new orchards.
 - It is therefore essential that a cost-effective system is used which optimises the use of water and prevents run-off and erosion. For this reason, the **Low Flow Irrigation System (LFIS)** must be implemented:
- Advantages of the LFIS:**
- **Broader water distribution:** As water enters the ground at a slow pace, it spreads around the sides of the plant rather than seeping downward.
 - **Better nutrient utilisation:** Since water stays closer to the area where the roots are most active, more nutrients are available to the plant with fewer ground pollutants.
 - **Larger and enhanced yields:** Since the in-ground air-water ratio at any given moment is higher, crop yields are larger and of a better quality.
 - **Lower nutrient usage:** As all the fertiliser is distributed at the active root-zone level, the plant receives a high percentage of the amount distributed, leading to lower quantities of applied fertiliser.
 - **Water saving:** Irrigation is placed underneath the agricultural fabric; the low flow drip ensures no over irrigation.

ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
4. Waste Management: Solid Waste.	1. Litter and Builders Waste (Also from the SANParks Guideline): All waste to be disposed of off-site at an approved landfill site as per the local Nkomazi Municipal regulations.	Contractor
	<ul style="list-style-type: none"> Contractor not to dispose of any waste and/or construction debris through burning or by burying. 	
	<ul style="list-style-type: none"> Contractor to supply tamper proof waste bins throughout the site at locations where construction workers are working. 	
	<ul style="list-style-type: none"> Tamper-proof refuse bins to be emptied on a daily basis. Refuse bins not to be used for any other purpose. 	
	<ul style="list-style-type: none"> Contractor has to designate specific areas for staff to enjoy their lunches and tea and he must provide for access to adequate refuse bins at these sites. 	
	<ul style="list-style-type: none"> All litter must be removed off site daily and deposited at the designated waste collection point near the Waste Holding Facility. 	
	<ul style="list-style-type: none"> Waste includes cigarette boxes, cigarette butts, paper, plastic bags, tin, glass, wires, cable ties, and organic waste e.g. peels and bones. 	
	<ul style="list-style-type: none"> Under no circumstances will cigarette butts be discarded anywhere on the development site. 	
	<ul style="list-style-type: none"> No waste of any kind or type is allowed to pollute the Kruger National Park. 	
<ul style="list-style-type: none"> Once operational all residential units must be equipped with locked waste cages (welded mesh) including tamper proof dustbins. 		
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
5. Waste Management: Liquid Waste.	1. Construction Water: Construction water refers to all water affected by construction activities.	Contractor
	<ul style="list-style-type: none"> No River/Stream/Natural Drainage Line must be used for cleaning of tools and equipment. This includes the washing of clothes and bathing/recreational purposes. 	
	<ul style="list-style-type: none"> All washing of equipment to be undertaken at the designated facilities in the Site Yard (near the farmhouse). 	
	<ul style="list-style-type: none"> Water from any other cleaning operations in the Site Yard to be collected in a “conservancy” tank removed from site and disposed of in the agreed manner. 	
	<ul style="list-style-type: none"> Water and slurry to be contained to prevent the pollution of the ground surrounding the mixing and/or disposal points. 	
	<ul style="list-style-type: none"> No spills to be channelled into natural environment. Contractor to take reasonable precautions to prevent pollution of the ground and water resources. 	
<ul style="list-style-type: none"> Contractor to ensure that no fuels (petrol/diesel), oils, lubricants and/or other chemicals are discarded onto the ground. Use drip trays in all potentially risky situations, e.g. refuelling a mobile generator. 		

	<p>2. Sewerage Management: Adequate temporary (e.g. Enviro-loos) ablution facilities to be put in place on sites located near to working areas.</p> <ul style="list-style-type: none"> • 1 Enviro-loo per 10 workers. • Toilet paper must be provided by the contractor. • All toilets must be checked daily and serviced accordingly by an accredited service provider. • No spillages into the surrounding environment will be allowed. • The entrances to the toilets must be adequately screened from public view. 	
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
<p>6. Waste Management: Hazardous Waste (The use of hazardous materials are not envisaged during the development phase, however unforeseen events may occur which are not known to the EAP at this stage of the process. This aspect is therefore included as a precautionary measure).</p>	<p>1. Hazardous Waste Process: The EAP has not been made aware of any hazardous substances that may be used during the development construction process. To ensure that the EMPr maximises the implications of the precautionary approach the following conditions are included in the event that substances such as fuel (mobile generator); paints; varnishes; chemicals for alien plant control etc. are used at any stage of the development.</p> <ul style="list-style-type: none"> • A Contractor staff member must be designated to manage this process. • Contractor to comply to all national, regional, and local legislation with regards to the storage, transport, use and disposal of petroleum, chemicals, harmful and hazardous materials and substances. • Contractor to provide the ECO with a list of all petroleum, chemical, harmful and hazardous materials and substances on site, together with all the storage, handling and disposal procedures for these materials. A register must be kept at the site office containing all the written/prescribed handling procedures. • Contractor to be responsible for training and education of workers that will be working with these materials. Training to include the proper use, handling and disposal of the substances. • Storage of chemicals to be safe, tamper proof (under lock and key) and under strict control. • Storage and handling of fuels, lubricants, chemicals and other hazardous substances to be protected by placing an impermeable liner, e.g. bund beneath the above ground storage containers in order to prevent accidental contamination of the soil. • The contractor will ensure that there is a supply of absorbent material (or absorption blankets) readily available on site to absorb, break down and where possible control any spillages that may occur. The amount and type of absorbent material must be appropriate to the volumes of hazardous liquids on site. • Any accidental chemical/fuel spills to be addressed and reported immediately to the ECO. The ECO will inform the applicable authorities and initiate a containment- and control programme as applicable. 	<p>Contractor</p>

	<ul style="list-style-type: none"> • Contractor to be responsible for establishing an emergency procedure for dealing with spills/releases of fuels, chemicals, hazardous substances and medical emergencies. • All spills/accidents to be recorded (in the Incident Register) and reported to the ECO. • The cleanup of spills and any damage caused shall be for the Contractor's account. 	
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
7. Access Roads.	<p>1. Existing Roads: The farm is well serviced with all-weather farm roads to the various sections and facilities on the property. The proposed project and all deliveries will make use of these access routes. These routes will however be formalised with stormwater control measures and engineering road design protocols.</p> <ul style="list-style-type: none"> • Adhere to the local speed limit on the farm (40km/h) at all times. • Contractors to limit the number of deliveries where possible through appropriate advance planning. • Contractors will be required to submit a delivery timetable to the ECO. • Construction personnel should only use authorised paths and roads. • Any damage caused by the construction activities to any access or public roads must be rehabilitated thoroughly upon completion of the construction. 	Contractor
	<p>2. New Roads (Less than 3.5m wide): Implement the Road Design Protocols in Appendices 6.1, 6.2 and 6.5: All orchard roads created for the purposes of the development must be designed and planned in advance with the ECO.</p> <ul style="list-style-type: none"> • Access will be required to each orchard. Orchard roads must be designed to incorporate adequate drainage and water attenuation structures. • Where applicable the road must be stabilised with all-weather gravel (patch gravelling). • A designated roads contractor must oversee this aspect of the development process. • Stabilise/All Weather Access: Although these farm roads will not carry significant loads of traffic on a daily basis access to the orchards will be required during the harvesting process. The road surfaces must thus be stabilised for all weather use. • Prevention of Erosion: Erosion problems on roads must be addressed immediately as and when these occur. This must be done by installing humps across the roads at regular intervals, in order to redirect the water away from the road or track. • Humps must be large enough to withstand stormwater events. They must be constructed across the entire width of the road (from side to side and into the adjoining vegetation). The humps must be at least 50cm higher than the surrounding ground level. This will ensure that run-off of water is directed out of the road and not down the road. 	

ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
8. Construction Staff	<ul style="list-style-type: none"> • Mitre Drain: All water run-off from the roads must be channelled into mitre drains. These drains must be kept open (free of vegetation and blockages). All drains must be opened by the end of September annually. <p>1. Staff Management (Also from the SANParks Guideline): The Code of Conduct for Contractors as described in the Tender Document will apply to all Construction Staff.</p> <ul style="list-style-type: none"> • The EMPr must be included as a condition of the Tender Document. • Contractors must adhere to all conditions of the Occupational Health and Safety Act. • A Safety Plan must be submitted to the ECO prior to the commencement of construction. • No contractor staff will be housed on the development site. • All contractor staff will abide with the Rules and Regulations of the KMAE Development. This includes all aspects to gain entrance and to exit the property. • All staff must use the water- and sewerage facilities judiciously and keep these facilities neat and clean. • All staff must remain within the development footprint and behind the demarcated boundaries. • No open fires will be allowed for cooking- and or heating purposes. • Staff must supply their own lunches and refreshments. No cooking will be allowed on site. • Staff must respect the surrounding environment and prevent all littering and damage to fauna and flora. • Site Specifics: Induction Courses (Contractor to conduct): All staff will undergo an intensive induction course on worker safety and safety procedures for the various sections of the site. • EMPr: The conditions of the Environmental Management Programme must be explained to all workers and staff on site. • All staff on site must sign an acceptance of understanding the EMPr form prior to being allowed on site. 	Contractor

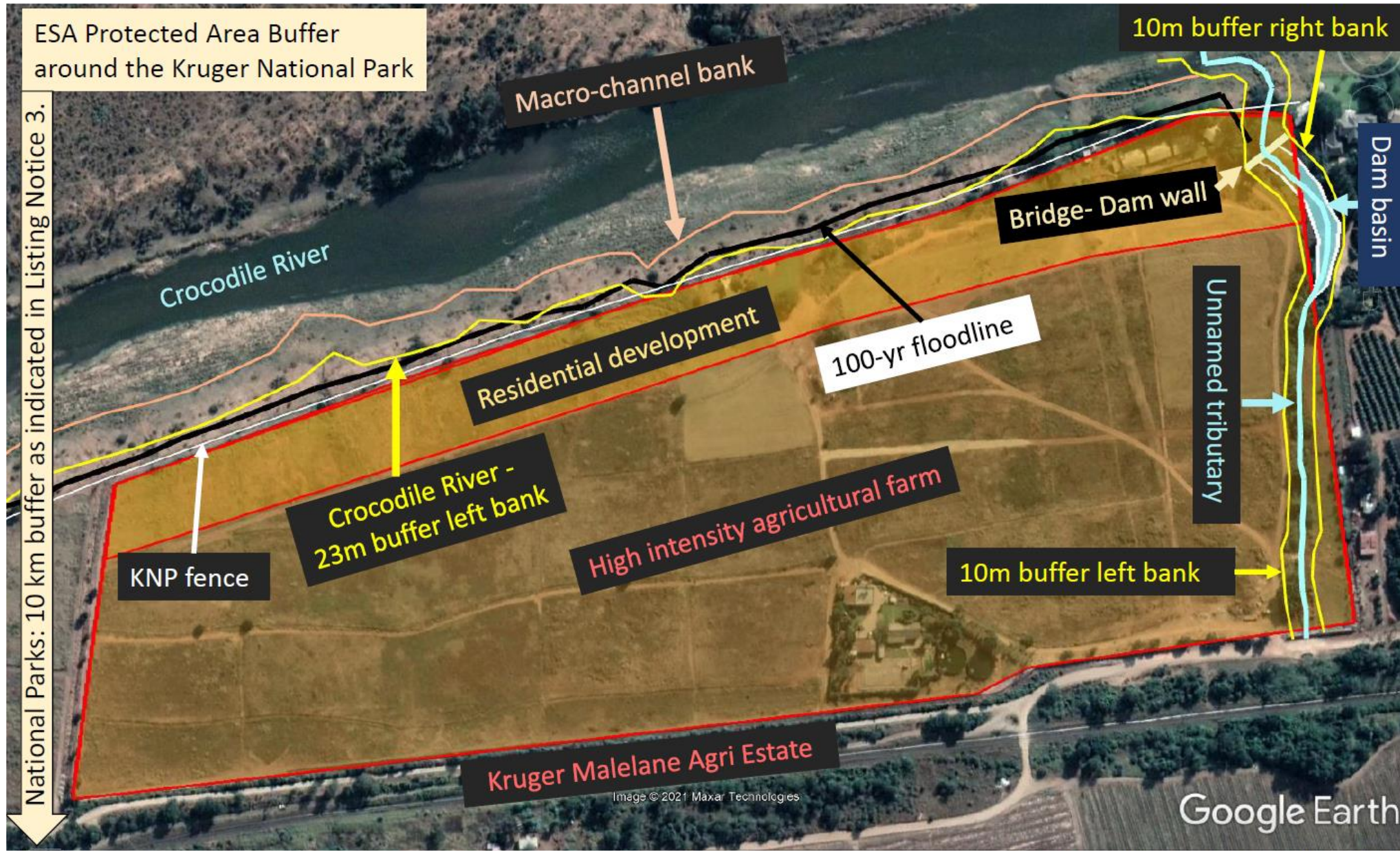
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
9. Fire.	1. Fire Management (Also from the SANParks Guideline): Contractor to take all the necessary precautions to ensure that no fires are caused as a result of activities on site. <ul style="list-style-type: none"> • A Contractor staff member must be designated to manage this process. 	Contractor
	<ul style="list-style-type: none"> • Contractor to supply all facilities, site offices, workshop areas, storage areas, with approved fire-fighting equipment. This aspect must be carried over into the operational phase of the project. 	
	<ul style="list-style-type: none"> • All staff on site will be made aware of general fire prevention and control methods and the name of the responsible person to alert to the presence of a fire. 	
	<ul style="list-style-type: none"> • The Contractor will advise the relevant authority of a fire outside of a demarcated area as soon as it starts and will not wait until he can no longer control it. 	
	<ul style="list-style-type: none"> • All fire-fighting equipment to be maintained in good operating order. 	
	<ul style="list-style-type: none"> • No open fires for heating or cooking are allowed on site. 	
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
10. Accidents.	1. Staff Safety: Contractor to comply with the Occupational Health and Safety Act (OHASA) and any other labour regulations with regard to safety on site.	Contractor
	<ul style="list-style-type: none"> • Contractor to provide an Occupational Health and Safety Management Plan to the ECO for approval prior to the commencement of works in terms of the Construction Regulations. 	
	<ul style="list-style-type: none"> • A Contractor staff member must be designated to manage this process. 	
	<ul style="list-style-type: none"> • Fencing and barriers will be in place in accordance with the Occupational Health and Safety Act (Act No. 85 of 1993). 	
	<ul style="list-style-type: none"> • Applicable notice boards and hazard warning notices will be put in place and secured. Night hazards, e.g. open trenches, will be suitably indicated (e.g. reflectors, lighting, and traffic signage). 	
	<ul style="list-style-type: none"> • No unauthorised firearms or weapons of any kind will be permitted on the site. 	
	<ul style="list-style-type: none"> • Contractor to ensure that all staff are familiar with all the emergency procedures. 	
	<ul style="list-style-type: none"> • All staff must undergo a basic First Aid Course. • Contractor to ensure that lists of all emergency telephone numbers/contact people are available and are posted at relevant locations, e.g. site office, at all times and that they are updated regularly. • Contractor to be responsible for establishing an emergency procedure for dealing with medical emergencies. All incidents to be recorded (in the Incident Register) and reported to the ECO. 	

ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
11. Adverse Weather Conditions and Erosion Protection.	1. Wet Weather: Overflows and Erosion Protection: Development on this project will preferably take place during the period March-September.	Contractor
	<ul style="list-style-type: none"> Contractor to set up a procedure for rapidly emptying any collection points to prevent them filling with rainwater. 	
	<ul style="list-style-type: none"> Contractor to ensure that no sumps (where applicable) are emptied unnecessarily. Special care to be taken during rainy periods/adverse weather conditions to prevent contents from overflowing. 	
	<ul style="list-style-type: none"> Contractor to ensure that a procedure is established for dealing with potentially polluted rainwater. Procedures/method statements must be filed in the register in the site office. 	
	<ul style="list-style-type: none"> Stockpiles of fine material such as sand, topsoil, etc. to be protected from rain run-off and wind. 	
	<ul style="list-style-type: none"> During construction, Contractor to protect all areas susceptible to erosion by installing all the necessary temporary and permanent drainage works ASAP. Contractor must also prevent water scouring of the slopes, embankments (where applicable) and any other areas. Correct any cause of erosion at the onset thereof through the most appropriate mechanism. Discuss any remedial actions with the resident ECO. 	
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
12. Noise, Visual and Dust Impacts.	1. Noise Impacts (Also from the SANParks Guideline): Contractor to use the equipment that is appropriate to the task in order to minimise the extent of damage to the environment and minimise the noise levels.	Contractor
	<ul style="list-style-type: none"> The provisions of SABS 1200A will apply to all areas within audible distance of the site. 	
	<ul style="list-style-type: none"> Noise levels to be kept within acceptable limits for a conservation/agricultural area, and not to be of such a nature as to detract from the experience of persons in the area. 	
	<ul style="list-style-type: none"> No amplified music will be allowed. 	
	<ul style="list-style-type: none"> Construction activities generating output levels of 85dB or more will be confined to the hours 07h00 to 17h00 Mondays to Fridays. 	
	2. Dust: Dust to be controlled on site at all times.	
	<ul style="list-style-type: none"> Dust emissions may occur during the clearing of vegetation and delivery of equipment and supplies on the farm roads to the project area. Contractor must control dust emissions using a water tanker as and when the impact arises. 	

ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
13. Cultural Artefacts.	1. Handling of Unexpected Cultural Finds: The proposed project does not traverse, impact and or influence aspects of historical value, however the following conditions are listed in the event that an unexpected find or artefact is unearthed. <ul style="list-style-type: none"> An accredited archaeologist must oversee the clearance of vegetation and trenching process. 	Contractor
	<ul style="list-style-type: none"> Sensitise the Contractor/labourers to be aware of the importance of cultural artefacts/fossils and implement the recommended procedure below in the event that such a discovery is made accidentally during construction. 	
	<ul style="list-style-type: none"> Should any artefact, historical site or fossil be discovered during excavations for irrigation trenches as well as in future, all works must cease with immediate effect. A buffer of 30m must be established around the find. 	
	<ul style="list-style-type: none"> The find must be reported to the ECO and the Project Manager for the project. These representatives will initiate an Action Plan in conjunction with an accredited archaeologist/palaeontologist (Contact SAHRA) to address the management and handling of the find. 	
	2.Existing Farmhouse (Stand 25): The existing farmhouse may not be demolished without permission as it is older than 60 years. ECO to advise where applicable.	
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
14. SANParks Additional Guidelines.	1.Gates and Fence: No gates are allowed in the Kruger National Park boundary fence. The fence alignment cannot be changed and or amended without SANParks (KNP) approval. <ul style="list-style-type: none"> At no stage may persons enter the KNP over/through the boundary fence. 	Contractor and or Applicant
	2.Visual Impact: Earthy Colours: All structures must be naturally coloured and blend in with the surrounding environment and landscape. <ul style="list-style-type: none"> Windows: All glass panes must be UV resistant with non reflective glass. Lights and Solar Panels: All outdoor lights must face downwards (45 degrees) and not higher than 3m from the ground level. No floodlights are allowed. No lights may be directed onto the watercourse in the KNP. Only use hand-held spotlights at night. Solar Panels angled towards the KNP are not allowed. Height: All buildings must not exceed 7m above ground level. 	
	3.Design or Layout Changes: Changes in the project layout and design (or the approved project description) must be discussed with the SANParks (KNP) for approval. <ul style="list-style-type: none"> All new developments or extensions must be discussed SANParks (KNP) for approval. 	

	<p>4. Water Consumption and Use: Water consumption must be minimised at all times.</p> <ul style="list-style-type: none"> The development will use 57.5kl of water per day and all residential properties will be restricted to 1.3-2.0 kl/day/unit. 	
ACTIVITY	MANAGEMENT/MITIGATION ACTION	RESPONSIBLE PERSON
15. Site Clean Up and Closure.	<p>1. Removal and Clearance (Also from the SANParks Guideline): Contractor to ensure that all temporary structures, materials, water and waste facilities used for construction activities are removed upon completion of the project.</p>	Contractor
	<ul style="list-style-type: none"> All signs of disturbance and contractor activity must be rehabilitated to a state as on day of site handover. 	
	<ul style="list-style-type: none"> All toilets must be removed. 	
	<ul style="list-style-type: none"> All left over stock and bits and pieces of materials must be removed. 	
	<ul style="list-style-type: none"> All waste bags must be deposited at the waste management facility. 	
	<p>2. Rehabilitation: It is not envisaged that major rehabilitation efforts will be required, however applying the precautionary approach the following conditions are placed on record:</p>	
	<ul style="list-style-type: none"> All re-seeding activities will be undertaken at the end of the dry season to ensure optimal conditions for germination and rapid vegetation establishment. 	
	<ul style="list-style-type: none"> When ripping for rehabilitation the contractor will rip to refusal or a minimum of 300 mm. 	
	<ul style="list-style-type: none"> The rehabilitated and seeded areas must be harrowed after spreading the topsoil and fertiliser uniformly. 	
	<ul style="list-style-type: none"> Inspect rehabilitated area at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures. 	
<ul style="list-style-type: none"> Take appropriate remedial action where vegetation establishment has not been successful or erosion is evident. 		
<ul style="list-style-type: none"> Only indigenous vegetation commensurate with the Malelane landscape is to be used in any landscaping/reseeding which may be undertaken. 		
<p>3. Project Sign Off: The ECO must sign off the works and the site during a Final Audit Assessment. The Final Audit Report will be submitted to DARDLEA for approval and verification.</p>		

**FINAL DEVELOPMENT MAP: FIGURE BIODIVERSITY REPORT: AGRICULTURAL ESTATE ON REMAINDER PORTIONS 8,
13, 14 AND 20 OF MALELANE ESTATE 140 JU**



Kruger Malelane Agri Estate - unique lifestyle gated community inside a high intensity agricultural farm (28.4 ha) in the Greater Malelane Town Area, Mpumalanga Province.

High intensity agricultural farm – Agriculture lease area (20 ha); currently fallow lands; economical irrigation unit with 12.4 ha listed water.

Residential development - consist of 25 subdivisions; 8.4 ha.

KNP fence – Fence on southern boundary of the Kruger National Park.

100-yr flood line: 1:100 yr flood line of the Crocodile River.

Macro-channel bank: Used to establish the ecological buffer in the absence of a defined riparian zone.

Crocodile River - 23m buffer left bank: Riverine buffer.

Unnamed tributary - non-perennial drainage feature.

10m buffers on left and right bank of Unnamed tributary.

Bridge- Dam wall – Proposed dam small dam wall that will also serve as a river crossing; approximately 650m long.

Dam basin – of proposed dam.



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ACCEPTANCE OF EMPr:
AGRICULTURAL ESTATE ON REMAINDER PORTIONS 8, 13, 14 AND 20 OF
MALELANE ESTATE 140 JU:

DECLARATION

I/We, the undersigned as the proponent/s/person/s responsible for the above-proposed activity undertake to abide by the above-designated EMP and associated conditions.

Name: _____

Signature: _____

Date: _____

Name: _____

Signature: _____

Date: _____

CHECKED BY ENVIRONMENTAL CONTROL OFFICER

Name: _____

Signature: _____

Date: _____