ENVIRONMENTAL IMPACT ASSESSMENT

REPORT

SOUTH AFRICA HAPPY ISLAND

WATER WORLD

COMMENT PERIOD: 12 JANUARY 2017 – 13 FEBRUARY 2016

Proponent:

South Africa Happy Island Water World

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Project Reference:
21613 – Water Park
Report date:
January 2017
Report Reference:
21613_DEIR.0

DOCUMENT PROGRESS

Distribution List

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Amendments on Document

Date	Report Reference Number		Description of Amendment
06/01/2017	21613_EIR_0	21613_DEIR_1	Minor Amendment

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1 INTRODUCTION

According to the Mogale City Local Municipality (MCLM) Integrated Development Plan (IDP), the Municipality's tourism programme aims to expand tourism in the area which will have numerous economic spin-offs (MCLM IDP, 2016). In addition, as tourism is a labour-intensive-peoples-based industry, increased tourism and recreational facilities will also increase both direct and indirect employment in the area. It is for this reason that the LED Strategy includes a specific focus on tourism development in the region.

The area currently has numerous tourism and recreational facilities. These include:

- The Cradle of Humankind which is one of the world's richest sources of knowledge about the development of man, was declared as a World Heritage Site by UNESCO in December 1999. The Cradle includes the Sterkfontein Caves as well as Maropeng;
- The Wondercave which is located in the Kromdraai Valley, near Sterkfontein. The Wondercave is famous for its stalagmites and stalactites which are up to 16m high;
- The Crocodile River Arts and Crafts Ramble which offers more than 100 artists and craftspeople original paintings, sculptures and art objects;
- Magalies Meander is a collection of artist studios, farm stalls and restaurants that lies below the southern ridge of the Magaliesburg mountains. There is a wide variety of accommodation on offer supplemented by activities such as rock climbing, horse riding, fly fishing, hot-air ballooning and microlighting;
- Kromdraai HikingTrails which can be taken through the spectacular Kromdraai Conservancy, which lies in the Cradle of Mankind world heritage site. In addition to the beautiful surroundings the trail passes along a gold mine, the Rainbow Trout Farm and the Wondercaves;
- Paddle Power provides adventure activities including canoeing, horse riding, mountain biking and hiking along the river and mountain trails; and
- The Magaliesburg Express which is a relaxing train ride from Johannesburg to Magaliesburg on the first Sunday of every month.

However, despite the existing tourism in the Municipality, the MCML IDP notes the need for "Product rejuvenation/innovation" which aims to improve and link different tourism facilities, including attractions, leisure activities, accommodation and complementary products to create a more varied "package" of products can be presented to potential markets.

Waterparks (amusement parks that feature water play areas) as a tourism/recreational industry are relatively new in South Africa with only two main waterparks occurring in the country (Valley of the Waves in Sun City and UShaka Marine World). For this reason, they represent an opportunity to add to the existing tourism/recreational attractions in the MCLM area.

In line with the above, **South Africa Happy Island Water World (Pty) Ltd** proposes to develop a recreational waterpark on Portion 169, 170, 173 and 174 of the farm Rietfontein 189 IQ situated in the

Mogale City Municipality. The proposed development involves the development of a number of recreational waterpark facilities on approximately 35 hectares of land which is currently zoned as Agricultural. The development area of the site is approximately 26 hectares. A number of recreational waterpark facilities will be put in place including:

- A number of pools such as an Adult Swimming Pool, Baby Pool, Children's Pool and Wave Pool;
- Slides and Rides such as Aqua Loop, Speed Twister, Lazy River, Super Tube and Tornado Ride; and
- Recreational areas such restaurants and cafés will also be included as part of the development.

Some examples of the proposed Waterpark attractions are provided below:

Figure 1- 1. Proposed Waterpark attractions

In addition, the proposed development also involves the provision of all necessary services to the development including water, sanitation, stormwater and roads.

South Africa Happy Island Water World (Pty) Ltd has appointed **Prism Environmental Management Services** (Prism EMS) as the independent Environmental Assessment Practitioner (EAP) to undertake the required integrated environmental authorisation processes required by a host of environmental legislation. Such process referred to as an ***Environmental Authorisation process*** and the details of which are discussed and described in the contents of this report.

1.1 Process to Date

1.1.1 Initial Registration

An Interested and Affected Party (I&AP) database was compiled and included adjacent landowners, businesses, and authorities. A Background Information Document (BID) was developed and included information on the proposed development. I&APs were provided with a copy of the BID via email or hand delivery and were provided with 30 days to register as an I&AP (from 12 April 2016 – 12 May 2016). An advert was also placed in the Cosmo City Chronicle on 12 April 2016. In addition, site notices were placed at three locations around the site. All comments received were added to the Comments and Response Report.

1.1.2 Application

An application for the Environmental Authorisation was lodged with the competent authority on the 21th September 2016, and acknowledgement of receipt of the application with instruction to proceed was issued on the 22th September 2016, under the following reference number:

- **Gaut: 002/15-16/E0273**

1.1.3 Scoping Report

A Scoping Report was compiled in line with the requirements contained in Appendix 2 of the EIA Regulations, 2014 promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended. The Scoping Report was available for public review between 27 September 2016 and 27 October 2016. All comments received were included in the Final Scoping Report which was submitted to the Gauteng Department of Agriculture and Rural Development (GDARD) on 01 November 2016. The Scoping Report (including the Plan of Study for the Environmental Impact Assessment (EIA) Report was subsequently approved by the Department on 23 November 2016.

1.2 EIA Report Requirements and Outline

According to Section 2 of Appendix 3 of the 2014 EIA Regulations, the objective of the EIA process is to, through a consultative process-

> *(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;*
>
> *(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;*
>
> *(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;*
>
> *(d) determine the--*
>
> > *(i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and*
> >
> > *(ii) degree to which these impacts-*

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources, and

(cc) can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

(g) identify suitable measures to avoid, manage or mitigate identified impacts; and

(h) identify residual risks that need to be managed and monitored.

The EIA process for the proposed Water Park Developments aims to ensure that the objectives described above are met. In line with this, an outline of the EIA Report (and its relationship to the requirements to Appendix 3 of 2014 EIA Regulations) is provided in Table 1-1 below.

Table 1-1: Required contents of the EIA Report.

Chapter Number	Chapter Name	Requirements included in Appendix 3 of 2014 EIA Regulations
1.	Introduction	3(u) an indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation.
2.	Environmental Assessment Practitioner	3(a) details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae
3.	Legislative Framework	3(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context
4.	Project Description	3 (b) the location of the activity, including: (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;

Chapter Number	Chapter Name	Requirements included in Appendix 3 of 2014 EIA Regulations
		3 (c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken; 3 (d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development.
5.	Description of the Receiving Environment	3(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.
6.	Need and Desirability	3 (f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;
7.	Alternatives	3(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (i) details of the development footprint alternatives considered 3(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.

Chapter Number	Chapter Name	Requirements included in Appendix 3 of 2014 EIA Regulations
8.	Public Participation	3(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.
9.	Summary of Specialist Studies	3(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.
10.	Impact Assessment	3(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on

Chapter Number	Chapter Name	Requirements included in Appendix 3 of 2014 EIA Regulations
		the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and 3(l) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures. 3(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated.
11.	Environmental Impact Statement	3(h) a full description of the process followed to reach the proposed development footprint within the approved site, including:

Chapter Number	Chapter Name	Requirements included in Appendix 3 of 2014 EIA Regulations
		(x) a concluding statement indicating the preferred alternative development location within the approved site. 3(g) a motivation for the preferred development footprint within the approved site. 3(l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives. 3(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorization. 3 (n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment; 3(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation. 3(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed; 3(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation; 3(r) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;

Chapter Number	Chapter Name	Requirements included in Appendix 3 of 2014 EIA Regulations
		3(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts; 3(v) any specific information that may be required by the competent authority; and 3(w) any other matters required in terms of section 24(4)(a) and (b) of the Act.
12.	EAP Undertaking	3(s) an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and l&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.
13.	References	-
14.	Appendices	3(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.

In addition to the above, the Regulations also note that the EIA process must be undertaken in line with the approved plan of study for environmental impact assessment. To this end, a summary of how the EIA Process is in line with the Approved Plan of Study is provided in Table 1-2.

Table 1-2: Alignment with Plan of Study

Item	Plan of Study Requirement	Reference in Report
1.	Specialist Studies – • Ecological Impact Assessment; • Wetland Delineation Assessment; • Aquatic Impact Assessment; • Phase 1 Heritage Impact Assessment;	Chapter 9 Chapter 15

	• Hydrologeological Baseline Assessment and 2D Model; and • Noise Impact Assessment. Technical Reports/Input • Outline Scheme Report; • Geotechnical Assessment; and • Traffic Impact Assessment.	
2.	Impact Assessment Methodology	Chapter 10
3.	Public Participation	Chapter 8

Section 3(u) of Appendix 3 of the 2014 EIA Regulations notes that the EIA Report should provide an indication of any deviation from the approved scoping report. **No deviation from the Plan of Study for the EIA however has been undertaken.**

In addition to the above, the EIA Report aims to ensure that GDARD's comments on the Scoping Report (as part of the acceptance of the Scoping Report) are addressed. The table below provide a summary of these comments, as well as where they have been addressed in the report.

Table 1-3: GDARD requirements for the EIA Report

Item	GDARD Comment – 23 November 2016	Reference in the Report	Comment
1.	According to the department information system, in particular GIS (Conservation Plan Version 3.3), certain areas of the proposed development have been identified as an Ecological Support Area (ESA) as well as being characterised by sensitive environmental features such as non-perennial rivers and a class 3 ridge. The specialist studies outlined in the Scoping Report must be conducted in accordance with GDARD's minimum requirements for biodiversity assessments.	Section 9 and Section 14	Specialist studies identified in the Scoping Report were undertaken in line with the Department's requirements. A summary of the specialist studies is provided as well as a full copy of each study. In addition, the development has taken into account sensitive environments and the delineated wetland and 32m wetland buffer have been incorporated.
2.	Detailed motivation as to the compatibility of the proposed development with the surrounding land uses and sense of place within the area considering environmental sensitivities should be provided.	Section 6 and Section 10	The need and desirability provided in Section 6 as well as the impact assessment in Section 10 notes that noise, visual and sense of place impacts can be satisfactorily mitigated.

Item	GDARD Comment – 23 November 2016	Reference in the Report	Comment
3.	Should the proposed activity affect any watercourses, comments from Department of Water and Sanitation must be provided and included in the EIAR.	Section 14.5.	No comments have been received from DWS as of yet however a site visit (as part of the WULA process) has taken place. In addition, copies of the Scoping Report and EIA Report have been provided. Comments on the EIA Report by DWS will be included in the updated EIA Report submitted to GDARD.
4.	Comments from Johannesburg Roads Agency (JRA) with regards to traffic impacts must be attached to the EIA Report.	Section 14.6.9.	The proposed development does not occur in City of Johannesburg however comments from Gauteng Provincial Department of Roads and Transport were provided in the Traffic Impact Assessment and are included as part of that report.
5.	Legible proof of newspaper adverts and site notices must be included in the EIA Report.	Section 14.5	Noted.
6.	Comprehensive public participation including adequate responses and addressing all issues raised by interested and affected parties, especially any concerns, objections and queries raised by them.	Section 14.5.	Please see the comments and responses report included in Section 14.5. In addition, one on one stakeholder meetings will be undertaken during the EIA Phase. Minutes of such meetings will be included in the updated EIA Report which will be submitted to the GDARD.
7.	A layout plan (A3) that will inform the proposed development with a sensitivity map overlay indicating all the existing and proposed activities must form part of the EIA Report. All maps must be in colour, to scale, legible with a legend clearly corresponding with activity components on the layout plan. Naturally occurring and the most sensitive areas should be zoned for use as open space systems.	Section 11.1.	Please see the sensitivity map (which includes sensitive features identified by various specialists) in Section 11.

Item	GDARD Comment – 23 November 2016	Reference in the Report	Comment
8.	Heritage and archaeological impact assessment report must be submiited to the Provincial Heritage Resources Agency of Gauteng (PHRA-G) and such comments must form part of the full EIR.	Section 14.5.	The EIA Report has been uploaded to SAHRIS to obtain comment from PHRA-G. Comments will be included in the final EIA Report submitted to GDARD.
9.	A comparative assessment of alternatives must be done in relation to the nature of the activity, location of activity components on site, as influenced by the nature of the receiving environment and surrounding existing activities.	Section 10.3. and Section 10.6	The comprehensive impact assessment was undertaken for each alternative in order to allow a detailed comparison of potential impacts. In addition, a separate sub-section which compares the various alternatives has also been included.
10.	A comprehensive Environmental Management Programme that includes measures to manage stormwater runoff during construction and operation must be included in the Full EIAR.	Section 14.8.	A detailed EMPr which includes mitigation measures for both construction and operation has been provided.
11.	It must be noted that this proposed activity will be utilising a substantial volume of water in a country that is water scarce and drought prone as is the case at present. Attention must be given to the exact volumes of water that will be required for these activities and to provide a comprehensive plan on the most efficient use of water with minimal water wastage and complete reuse of recycling. Portable water should be used as a last resort here.	Section 4.4. and Section 9.7.	Much effort has been placed by the developer to ensure that the development is sustainable from a water perspective. As such, the project includes the following: • Rainwater harvesting; • Recycling and reuse of backwash water; • Treatment and use of effluent (for irrigation); • Use of borehole water; and • Use of municipal water.

1.3 Public Participation as part of the EIA Phase

In order to ensure that all I&APs have an opportunity to review and comment on the EIA Report and Integrated Water Use License Application (IWULA), all registered I&APs (as identified as part of the process described in Section 1.1. above) were notified by email or SMS of the review of the EIA Report and IWULA which takes place between **12 January 2017 to 13 February 2017**.

As part of this review, a hard copy of the report is available at the project site (Portion 170 and 174 of Farm Rietfontein 189 IQ - 26°02'18.5"S 27°53'36.9"E). In addition, an electronic copy of the report was uploaded to Dropbox and a link to download this electronic version was included in the notification emails.

An additional advert was also placed in the Cosmo City Chronicle on 12 January 2017. The aim of this advert, was to inform I&APs of changes to listed activities as well as notify them of the review period.

1.4 Authorities

The following competent authority are involved in the decision-making process:

- GDARD with reference to activities under the:
  - EIA Regulations and Listing Notices, 2014 (NEMA)
- The Department of Water and Sanitation (DWS) in reference to Section 21 Activities in terms of the National Water Act (NWA) (Act No 36 of 1998). A copy of the IWULA is appended in Section 14.10.

It should be noted that an integrated process is being undertaken and as such public participation will be undertaken together for both the EIA and IWULA process.

1.5 Applicant

The applicant is the entity that will assume responsibilities as the holder of the environmental authorisation if granted. Details of the applicant and landowner are contained in Table 1-4.

Table 1-4.: Details of the Applicant.

Applicant:	South Africa Happy Island Water World (Pty) Ltd
Landowner:	South Africa Happy Island Water World (Pty) Ltd
Trading Name:	As above
Contact Person:	Zou Xingxing
Address:	45 Clifford Road, Chancliff, Krugersdorp, 1738
Tel:	0734585769/ 0632648040
Fax:	None
Email:	109206629@qq.com / 306156745@qq.com

2 ENVIRONMENTAL ASSESSMENT PRACTITIONER

Prism EMS have been appointed to undertake the required Environmental Authorisation and IWULA process in terms of the required Environmental Impact Assessment (EIA) Regulations and National Water Act, 1998, respectively. Details and expertise of the Environmental Assessment Practitioner (EAP) who prepared the EIA Report and IWULA is provided in Table 2-1 and Curriculum Vitae is appended in Section 14.1.

Table 2-1.: Details of the EAP.

EAP:	Vanessa Stippel
Company:	Prism Environmental Management Services
Qualifications:	MSc. Ecology, Environment and Conservation
Experience:	5 years
Affiliation/ Registration	Professional Member of Southern African Institute of Ecologists and Environmental Scientists SACNASP Pr.Sci.Nat. (116221)
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Designation	**Name**	**Qualification**	**Professional Registration**	**Specialist Assessment**
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Senior Environmental Assessment Practitioner	Ronaldo Retief	MSc Zoology BSc.Hons (Zoology) BSc (Natural & Environmental Science)	SACNASP Pr. Sci. Nat. (400134/10)	Environmental Impact Assessment Review
Senior Environmental Assessment Practitioner	Candis Lubbe	BSc. (Hons) Ecology, Environment and Conservation	SACNASP Registration in process	Environmental Impact Assessment Review
Principal EAP	De Wet Botha	MA. Environmental Management PHED	SACNASP Registration in process	Project Management

3 LEGISLATIVE FRAMEWORK

Section 3(e) of Appendix 3 of the 2014 EIA Regulations requires that the EIA Report includes a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context. In line with this, this section aims to provide an overview of key policy, legislation, plans, guidelines, and municipal development planning frameworks triggered by the proposed project. The requirements set out in these Act's and Regulations will be adhered to through the scoping and impact assessment phases of the project.

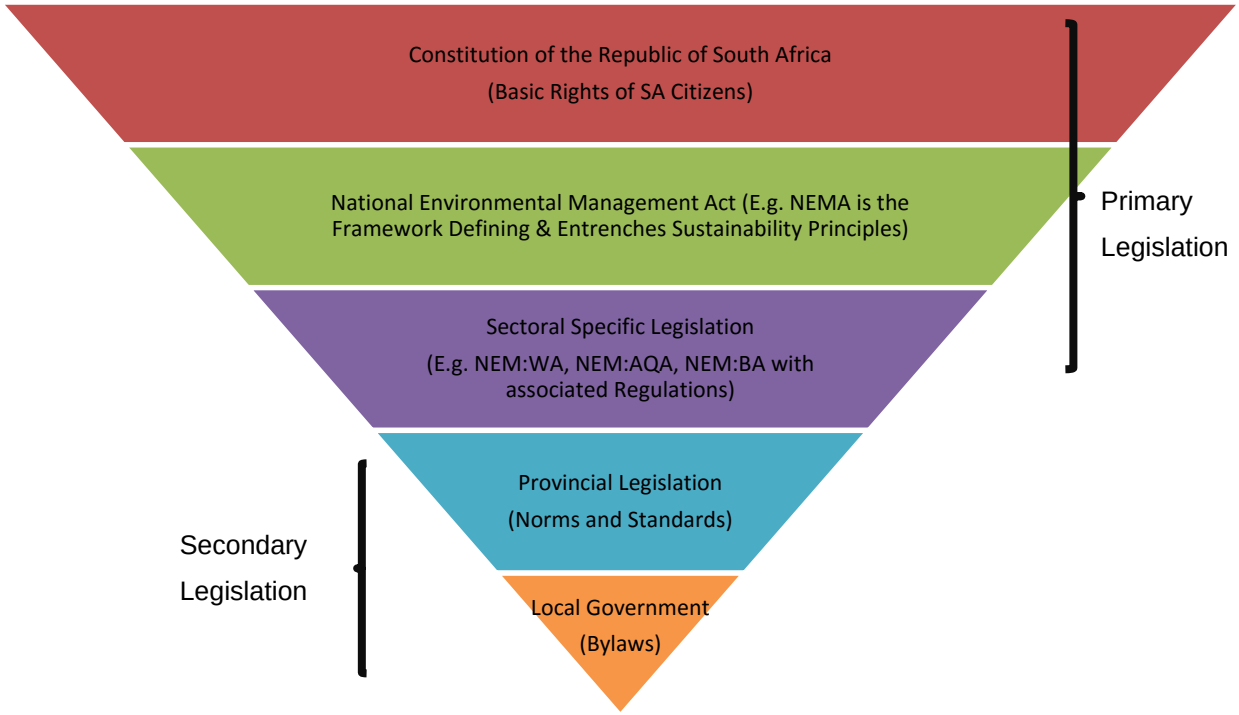


Figure 3-1: South African Environmental Legislation Hierarchy.

The following Acts, Regulations, By-Laws and Guidelines are applicable to the proposed Water Park development.

3.1 Constitution of the Republic of South Africa

Section 24 of the Constitution states that –

"Everyone has the right to -

a) an environment that is not harmful to their health or well-being; and

b) have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

(i) Prevent pollution and ecological degradation;

(ii) Promote conservation; and

(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

3.2 National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998)

The NEMA is the umbrella framework for all environmental legislation primarily to assist with implementing the environmental rights of the Constitution (refer to Section 3.1). The NEMA provides fundamental principles required for environmental decision making and to achieve sustainable development. It also makes provision for duty of care to prevent, control and rehabilitate the effects of significant pollution and environmental degradation, and prosecute environmental crimes. These principles must be adhered to, and taken into consideration during the impact assessment phase.

NEMA defines "environment" as –

"the surroundings within which humans exist and that are made up of –

(i) the land, water and atmosphere of the earth;

(ii) micro-organisms, plants and animal life;

(iii) any part or combination of (i) or (ii) and the interrelationship among and between them; and

(iv) the physical, chemical, aesthetic and cultural, properties and conditions of the foregoing that influence human health and well-being."

Section 24D and 24(2) of the NEMA makes provision for the publication of list and associated regulations containing activities identified that may not commence without obtaining prior environmental authorisation from the competent authority. These regulations are referred to as the EIA Regulations and are interpreted hand in hand with the various listed activities discussed further below.

3.2.1 Environmental Impact Assessment Regulations, 2014 (GN R 982 of 4 December 2014)

The EIA regulations were promulgated in terms of Section 24 of the NEMA, for the purpose of providing methodologies and specific requirements for the undertaking of an EIA. The Regulations stipulate that any proposed activity listed in the associated notices must undertake either a Basic Assessment (BA) or Scoping & Environmental Impact Report (S&EIR) in order to obtain an environmental authorisation (if granted by the competent authority) before the commencement of the specified listed activity. The EIA Regulations provide the minimum requirements for appointing an EAP and for undertaking the relevant Public Participation Process (PPP) as required. They also detail the contents of the impact assessment reports and all other aspects associated with BA and/or EIAs.

The following listed activities have been identified in terms of the subsequent Government Notices:

3.2.1.1 Listing Notice 1: GN R 983 of 4 December 2014

Activities listed under this process require a Basic Assessment process to be undertaken. Refer to Section 4.2 for a description of the specific listed activities that pertain to this project.

3.2.1.2 Listing Notice 2: GN R 984 of 4 December 2014

Activities listed under this process require Scoping and EIA to be undertaken. Refer to Section 4.2 for a description of the specific listed activities that pertain to this project. Due to the fact that Activity 15 of Listing Notice 2 is triggered, a S&EIR process will be undertaken for the proposed Waterpark development.

3.2.1.3 Listing Notice 3: GN R 985 of 4 December 2014

Activities listed under this process require a Basic Assessment process to be undertaken but only in specified geographic areas. Refer to Section 4.2 for a description of the specific listed activities that pertain to this project.

3.3 National Water Act (NWA) (Act No. 36 of 1998)

The NWA is the primary regulatory legislation; controlling and managing the use of water resources as well as the pollution thereof and is implemented and enforced by the Department of Water and Sanitation (DWS[1]). Section 21 of the NWA lists water uses that must be licensed unless it is listed in the schedule (existing lawful use) and/or is permissible under a general authorisation, or if a responsible authority waives the need for a Water Use Licence. Section 21 water uses include:

- Section 21(a): taking water from a water resource
- Section 21(b): storing water
- Section 21(c): impeding or diverting the flow of water in a watercourse
- Section 21(d): engaging in a stream flow reduction activity contemplated in section 36
- Section 21(e): engaging in a controlled activity as identified in Section 37 (1) or declared under Section 38 (1).
- Section 21(f): discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall, or other conduit.
- Section 21(g): disposal of waste (i.e. effluent from sewage works) in a manner which may detrimentally impact on a water resource;
- Section 21 (h): disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process.
- Section 21 (i): altering the bed, banks, course or characteristics of a watercourse.
- Section 21 (j): removing, discharging, or disposing of water found underground if it necessary for the efficient continuation of an activity or for the safety of people.
- Section 21(k): using water for recreational purposes.

Applicable definitions included in the NWA include watercourse which is defined as "*(a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse (and a reference to a watercourse includes, where relevant, its bed and banks).*

[1] Previously referred to as the Department of Water Affairs

The Act also defines a wetland as "*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".*

The recently published General Authorisation in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or section 21(i) (GN 509 of 2016) also defines the regulated area of a watercourse as meaning: *(a) The outer edge of the 1 in 100 year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; (b) In the absence of a determined 1 in 100 year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or (c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.*

Due to the fact that the proposed development involves construction related activities on the existing dam walls and within the regulated area of the watercourse, Section 21 (c) and (i) water uses require a Water Use Licence in terms of Section 21 of the NWA.

In addition, the proposed development also includes abstraction of groundwater and storage of water and thus Section 21 (a) and (b) water uses are triggered.

Lastly, the proposed development includes treatment of wastewater in a sewerage package plant as well as use of treated water for irrigation purposes. As such, Section 21 (e) and (g) water uses are also triggered.

Initially it was determined that Section 21 (k) – Using water for recreational purposes is also triggered however as no water activities will take place on the existing watercourses, this activity is not longer applicable.

Therefore, the following listed water uses that require a Water Use License according to Section 21 of the NWA are triggered for the proposed project:

- Section 21(a): taking water from a water resource
- Section 21(b): storing water
- Section 21(c): impeding or diverting the flow of water in a watercourse
- Section 21(e): engaging in a controlled activity as identified in Section 37 (1) or declared under Section 38 (1).
- Section 21(g): disposal of waste (i.e. effluent from sewage works) in a manner which may detrimentally impact on a water resource;
- Section 21 (i): altering the bed, banks, course or characteristics of a watercourse.

An IWULA has been compiled and is appended in Section 14.10. Public participation for the IWULA process will be combined with the S&EIA process.

3.4 National Heritage Resource Act (NHRA), 1999 (Act No. 25 of 1999)

The NHRA provides for the protection and management of South Africa's heritage resources. The South African National Heritage Resources Agency (SAHRA) is the administering authority in regards to all matters relating to heritage resources. A heritage resource refers to any historically important feature such as graves, trees, archaeology, culturally significant symbols, spaces, landscapes and fossil beds as protected heritage resources. In terms of Section 38 of the NHRA, SAHRA can call for a Heritage Impact Assessment (HIA)(also known as an Archaeological Impact Assessment or AIA) for certain categories of development. The NHRA also makes provision for the assessment of heritage impacts as part of an EIA process and indicates that if such an assessment is deemed adequate, a separate HIA is not required.

Section 38 (1) of the NHRA notes that the relevant heritage authority should be notified provided with details such as location, nature and extent of the following developments:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50 m in length;

(c) any development or other activity which will change the character of a site—

(i) exceeding 5 000 m2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

An AIA has been undertaken and is appended in Section 14.6.5. Further, a summary of the AIA is included in Section 9.5.

3.5 National Environmental Management: Biodiversity Act (NEM:BA), 2004 (Act No. 10 of 2004)

The NEM:BA aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. The purpose of the NEM:BA is to protect ecosystems and the species within as well as the promoting of sustainable use of indigenous biodiversity. During any environmental authorisation process the following regulations are considered and researched if at any stage the following regulations are applicable:

- Alien and Invasive Species Regulations;
- Alien and Invasive Species List;
- Lists of Critically Endangered, Endangered, Vulnerable and Protected Species; and
- Threatened or Protected Species Regulations.

An Ecological Habitat and Threatened Species Assessment was undertaken and is summarised in Section 9.1. It is also appended to Section 14.6.1. The Study found that a single floristic species of concern (numerous individuals at multiple locations), *Hypoxis hemerocallidea,* was observed on the property.

Mitigation measures to protect the species include integration into the development or relocation to a suitable habitat. No other species of concern or listed, threatened species (faunal and floral taxa) were observed on the site during the assessment.

3.6 National Environmental Management: Waste Management Act (NEM:WA), 2008 (Act No. 59 of 2008)

The NEM:WA aims to regulate waste management in South Africa in order to protect health and the environment through the provision of reasonable measures for the prevent pollution and ecological degradation.

The Act includes regulations which provide a list of waste management activities that require a waste management licence terms of NEM:WA (GN 921 of 29 November 2013). Activities related to treatment of effluent, wastewater or sewage are however excluded and do not require a waste management licence.

Based on the above, no waste management licence is required for the proposed Water Park. Waste will be collected by municipal waste collectors and disposed of at the municipal landfill.

Storage Facilities in excess of 100m^3 (general waste) or 80m^3 (hazardous) (if required) will comply with the Norms and Standards for the Storage of Waste.

Waste will be collected in line with the requirements of Mogale City Local Municipality. Should no waste collection services occur in the area, a 3rd party contractor will be appointed to transport waste to the municipal landfill. Separation of waste at the source to enable recycling will also be undertaken.

3.7 National Environmental Management: Air Quality Act (NEM:AQA), 2004 (Act No. 39 of 2004)

The aim of NEM:AQA is to regulate air quality in order to protect the environment from pollution and ecological degradation.

The proposed Waterpark development does not trigger any activities that require an Air Emissions Licence. Dust produced during the construction phase will be managed through the implementation of mitigation measures has been included in the Environmental Management Programme (EMPr).

3.8 Other Legislation and Guidelines

3.8.1 Bylaws

The following By-laws have been published by MCLM to provide a framework for its operation and management and must be adhered to by the proposed development.

3.8.1.1 Mogale City Local Muncipality: Water Services By-laws

This bylaw prescribes and elaborates on the use and related activities of water in the MCLM and must therefore be considered during any EIA process in the area.

The by-laws note that should an EIA be required before the provision of services can be approved, the applicant will be responsible for carrying out such EIA. It also notes that once environmental approval has been granted and the provision of water services has been approved by the Municipality, it is the responsibility of the applicant to ensure that all laws and conditions affected by the provisions of water services and relating to environmental management and control are complied with. Failure to comply with Section 24g of the NEMA may result in a fine and/or imprisonment.

In addition, the by-laws note that any developments which may, directly or indirectly, have an influence on the natural water balance and/or water quality in the Cradle of Humankind World Heritage Site, must be approved in writing by the Executive Manager: Infrastructure of the Municipality or his successor in title. Such developments include, but are not limited to, boreholes, French drains, conservancy tanks, septic tanks, VIP latrines, and all works associated with water installations and sanitation installations.

The by-laws also provide requirements for the use of boreholes, storage tanks, discharge into wastewater, treatment of sewerage, and stormwater.

3.8.2 Guidelines

The following guidelines have been adopted by the applicant in the pursuit of best practice and sustainable development and are considered in the management measures and mitigation of impacts identified.

- Guidelines on Need and Desirability (DEA&DP, 2010);
- Guidelines on Alternatives (DEA&DP, 2010);
- Guidelines on Public Participation (DEA&DP, 2011);
- IEMS Guidelines series (DEA&DP, 2014);
- Gauteng Spatial Development Framework (SDF);
- Gauteng Provincial Environmental Management Framework (EMF); and
- National Development Plan 2030.

4 PROJECT DESCRIPTION

The Appendix 3 of the 2014 EIA Regulations requires that the following information is provided in the EIA Report:

3 (b) the location of the activity, including:

(i) the 21-digit Surveyor General code of each cadastral land parcel;

(ii) where available, the physical address and farm name; and

(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;

3 (c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-

(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken;

(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;

3 (d) a description of the scope of the proposed activity, including-

(i) all listed and specified activities triggered and being applied for; and

(ii) a description of the associated structures and infrastructure related to the development.

In line with this, Section 4.2. provides information on the listed activities triggered, Section 4.3., provides information on the project location and Section 4.4., provides information on the proposed development (including associated infrastructure).

Please note that A3 copies of maps and drawings are appended in Section 14.4.

4.1 Environmental Authorisation

An "Environmental Authorisation" means an authorisation granted by the competent authority of a listed activity in terms of Section 24 of the National Environmental Management Amendment Act, (Act No. 107 of 1998).

An application for Environmental Authorisation (EA) has been submitted to GDARD and the following reference number has been issued: **Gaut: 002/15-16/E0273.**

4.2 Listed Activities

In terms of the EIA Regulations and Listed Activities, 2014 (introduced in Section 3.2.1), the activities that are triggered under the Listing Notices for this proposed development are provided in Table 4-1.

Table 4-1.: Description of the Listed Activities.

Listing Notice	Activity	Description of Listed Activity	Interpretation
NEMA: Listing Notice 1 (require Basic Assessment)			
GN R 983 4 December 2014	19 (i)	*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-* *(i**) a watercourse;*** *(ii) the seashore; or* *(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater but excluding where such infilling, depositing , dredging, excavation, removal or moving-* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.*	The proposed development involves construction within a watercourse and will thus involve excavation of more than 5 cubic metres from the watercourse as well as the infilling of more than 5 cubic metres of material into the watercourse.
NEMA: Listing Notice 2 (require Scoping and EIR)			
GN R 984 4 December 2014	15	*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for the undertaking of a linear activity; or maintenance purposes undertaken in accordance with a maintenance management plan.*	The proposed development involves the development of approximately 34 hectares of land.
NEMA: Listing Notice 3 (require Basic Assessment)			
GN R 985 4 December 2014	12 (a)	*The clearance of an area of 300m^2 or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *(a) In Eastern Cape, Free State, Gauteng, Limpopo, North West,, and Western Cape provinces.* ***i. Within any critically endangered or endangered ecosystem listed in terms of Section 52 of NEMBA or prior to the publication of such list, within an area that has been***	The proposed development involves the development of approximately 34 hectares of land. Part of the site falls within an ESA area.

Listing Notice	Activity	Description of Listed Activity	Interpretation
		identified as critically endangered in the National Spatial Biodiversity Assessment, 2004. *ii. Within critical biodiversity areas identified in bioregional management plan. plans;* *iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; or* *iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.*	
	14 (b)	*The development of-* *(i) canals exceeding 10 square metres in size;* *(ii) channels exceeding 10 square metres in size;* *(iii) bridges exceeding 10 square metres in size;* *(iv) dams, where the dam, including infrastructure and water surface area, exceeds 10 square metres in size;* *(v) weirs, where the weir, including infrastructure and water surface area, exceeds 10 square metres in size;* ***(vi) bulk storm water outlet structures exceeding 10 square metres in size;*** *(vii) marinas exceeding 10 square metres in size;* *(viii) jetties exceeding 10 square metres in size;* *(ix) slipways exceeding 10 square metres in size;* ***(x) buildings exceeding 10 square metres in size;*** *xi) boardwalks exceeding 10 square metres in size; or* ***(xii) infrastructure or structures with a physical footprint of 10 square metres or more;*** *where such development occurs-* ***(a) within a watercourse;*** *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -* *excluding-*	The proposed development involves the development of infrastructure, buildings and stormwater outlet structures within 32m of a watercourse that falls within an ESA area.

Listing Notice	Activity	Description of Listed Activity	Interpretation
		(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; *(b) In Gauteng* *i. A protected area identified in terms of NEMPAA excluding conservancies.* *ii. National Protected Area Expansion Strategy Focus Areas;* *iii. Gauteng Protected Area Expansion Priority Areas;* *iv.* ***Sites identified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans; -*** *v. Sites identified within threatened ecosystems listed in terms of the National Environmental Management Act: Biodiversity Act (Act No. 10 of 2004);* *vi. Sensitive areas identified in an environmental management framework adopted by relevant environmental authority;* *vii. Sites or areas identified in terms of an International Convention* *viii. Sites managed as protected areas by provincial authorities, or declared as nature reserves in terms of the Nature Conservation Ordinance (Ordinance 12 of 1983) or the National Environmental Management: Protected Areas Act (Act No. 57 of 2003);* *ix. Sites designated as nature reserves within municipal SDFs; or* *x. Sites zoned for conservation or public open space or equivalent zoning.*	

Based on information obtained from the project team and specialists, several activities (Activity 9, 11, 12 and 24 of Listing Notice 1) are no longer applicable. An amended application for environmental authorisation was submitted together with the Scoping Report. The activities removed from the application form are tabulated in Table 4-2 together with information on why the activity is not applicable.

Table 4-2: Listed Activities Removed from the Application for Environmental authorisation

Listing Notice	Activity	Description of Listed Activity	Reason for Removal
NEMA: Listing Notice 1 (require Basic Assessment)			
GN R 983 4 December 2014	9	*The development of infrastructure exceeding 1000 metres in length for*	According to the MCLM, the proposed development occurs within an urban area and as

Listing Notice	Activity	Description of Listed Activity	Reason for Removal
		the bulk transportation of water or storm water- *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or* ***(b) where such development will occur within an urban area.***	such this activity is not applicable.
	11	*The development of facilities or infrastructure for the transmission and distribution of electricity-* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.*	The scope of the proposed development excludes the development of electricity transmission lines and thus this activity is no longer applicable.
	12	*The development of-* *(i) canals exceeding 100 square metres in size;* *(ii) channels exceeding 100 square metres in size;* *(iii) bridges exceeding 100 square metres in size;* *(iv) dams, where the dam, including infrastructure and water surface area, exceeds 100 square metres in size;* *(v) weirs, where the weir, including infrastructure and water surface area, exceeds 100 square metres in size;* *(vi) bulk storm water outlet structures exceeding 100 square metres in size;* *(vii) marinas exceeding 100 square metres in size;* *(viii) jetties exceeding 100 square metres in size;* *(ix) slipways exceeding 100 square metres in size;* *(x) buildings exceeding 100 square metres in size;* *xi) boardwalks exceeding 100 square metres in size; or* *(xii) infrastructure or structures with a physical footprint of 100 square metres or more**;*** *where such development occurs-* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32*	According to the MCLM, the proposed development occurs within an urban area and as such this activity is not applicable.

Listing Notice	Activity	Description of Listed Activity	Reason for Removal
		metres of a watercourse, measured from the edge of a watercourse; - *excluding-* *(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* ***(dd) where such development occurs within an urban area; or*** *(ee) where such development occurs within existing roads or road reserves.*	
	24	*The development of-* *(i) a road for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding-* *(a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or* ***(b) roads where the entire road falls within an urban area.***	According to the MCLM, the proposed development occurs within an urban area and as such this activity is not applicable.

The activities in Table 4-1 trigger both a basic assessment **and** scoping and impact assessment reporting processes, therefore a consolidated assessment process is required to be undertaken where the more detailed/thorough impact assessment process is to be followed i.e. **Scoping and EIR** (detailed in Figure 4-1 below).

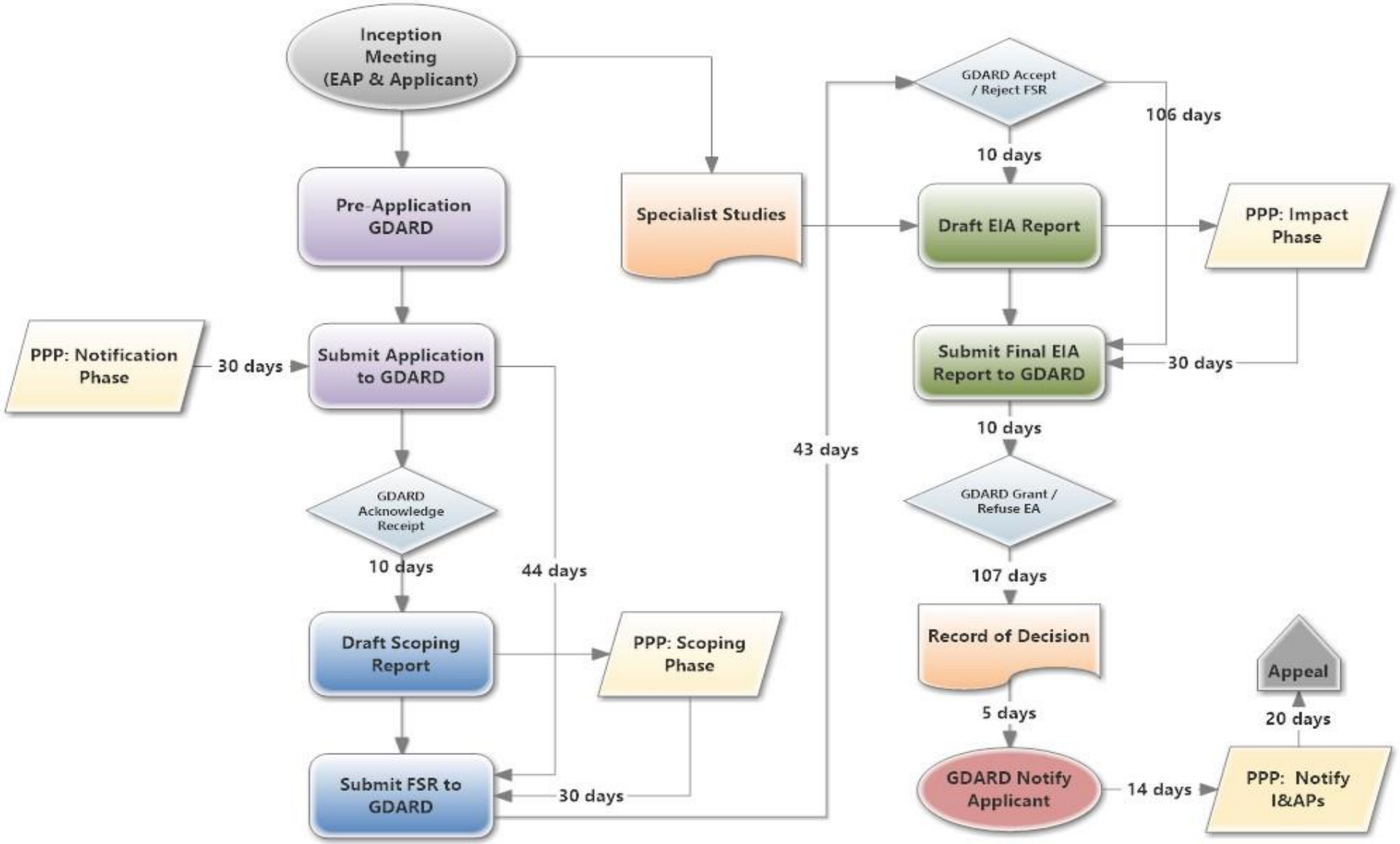


Figure 4-1: Proposed environmental authorisation process.

4.3 Project Location

The site is collectively situated on Portion 169, 170, 173 and 174 of the farm Rietfontein 189 IQ situated in Ward 23 of MCLM. The site is situated east and adjacent to Lake View Drive and west and adjacent to Valley Drive, in the Muldersdrift area. Access is easiest gained for Mulderdrift Road, via Valley Drive. The site is currently developed with residential units and some outbuildings. The corner point coordinates of the site are indicated in Table 4-3.

Table 4-3.: Corner Point Coordinates

Corner	Coordinates
1	26° 2'12.28"S; 27°53'34.24"E
2	26° 2'3.72"S; 27°54'1.88"E
3	26° 2'16.01"S; 27°54'8.45"E
4	26° 2'25.18"S; 27°53'38.52"E

The Surveyor General 21-digit diagram numbers for the affected properties are provided in Table 4-4 below.

Table 4-4.: Surveyor General Diagram Numbers.

Portion	Surveyor General Diagram number
169	T0IQ000000000018900169
170	T0IQ000000000018900170
173	T0IQ000000000018900173
174	T0IQ000000000018900174

In addition to the above, the proposed development also involves the upgrade and widening of certain access roads leading to the site. These upgrades in themselves do not trigger any environmental authorisation as they occur within an urban area however where the road crosses the watercourse, Activity 19 of Listing Notice 1 and Activity 14 of Listing Notice 3 are triggered. The coordinates of these points are provided in Table 4-5. Please note that no surveyor general information has been provided as the roads to be upgraded occur within the existing road and do not enter any private properties. Refer to Figure 4-2 below for a visual indication of the location of the proposed development. The delineated wetland and wetland buffer have also been included.

Table 4-5.: Coordinates of Road Upgrades Crossing Watercourses

ID	Coordinates	Details
Watercrossing 1	27° 53’ 53.07”; 26° 2’ 46.11”	1 x 3600mm x 1200mm Box culvert
Watercrossing 2	27° 53’ 36.82”; 26° 2’ 20.29”	5 x 3600mm x 1200mm Box culvert
Erosion Protection (Lakeview Road)	26° 2'12.28"S;27°53'34.24"E to 26°2'25.18"S;27°53'38.52"E	Erosion protection measures to be put in place along Lakeview road

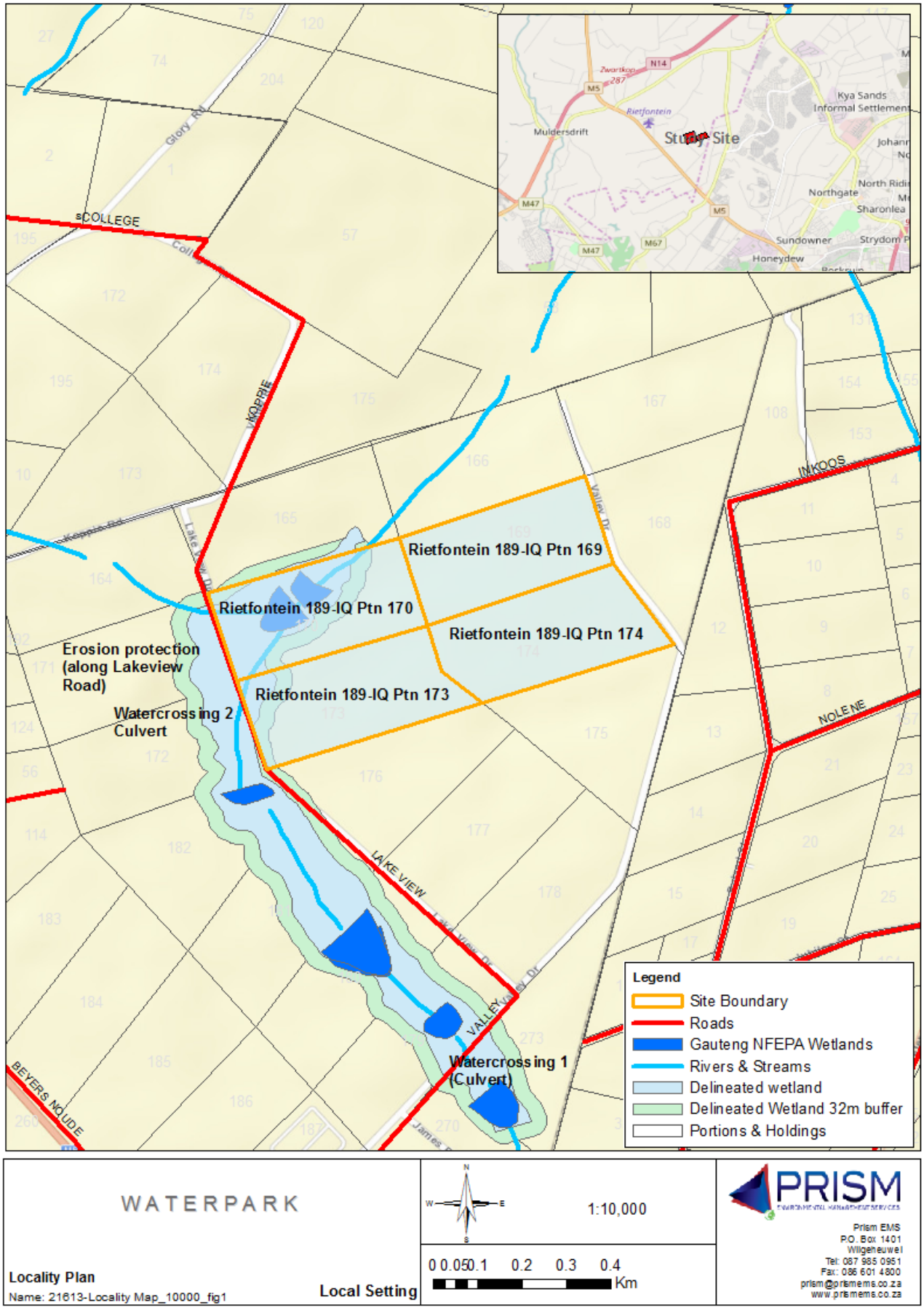


Figure 4-2: Locality map of the site.

4.4 Description of Project Activities

The proposed development involves the development of recreational facilities related to the proposed Water park as well as associated services. An overview of the various facilities is provided in the subsections that follow. **Please note that A3 copies of the maps provided below are provided in Section 14.4. The maps provided below aim to provide context only**.

4.4.1 Recreational facilities

Several recreational waterpark facilities will be put in place including:

- A number of pools such as an Adult Swimming Pool, Baby Pool, Children's Pool and Wave Pool; and
- Slides and Rides such as Aqua Loop, Speed Twister, Lazy River, Super Tube and Tornado Ride.

In addition, recreational areas such restaurants and cafés will also be included as part of the development.

Much of the site will be maintained as green areas (approximately 70%) while only approximately 2% of the site will be developed as new buildings. Apart from the green areas, the largest land use will be the proposed parking area which will take up approximately 13% of the site. Existing trees on site will be utilised as part of the landscaping for the proposed facility. The table below provides an overview of the proposed recreational facilities and their associated heights. No recreational activities will take place on the existing watercourses.

Table 4-6: Recreational facility heights

Recreational Facility	Height
Typhoon Slide	18.20m
Monster Bowl Slide	18.20m
High and Quick Speed Slide	15.0m
Big Circle Slide	17.0m
Dragon Slide	9.0m
Rainbow Slide	15.0.m
Spiral Combo Slide	12.0m
Other Small Slides	1.90m

4.4.2 Access and Parking

Proposed entry to the Water Park will be provided from Lakeview Road with a one-directional dual lane internal road which will lead to the parking facilities. An exit road will be provided onto Valley Road (Figure 4-2).

A Traffic Impact Assessment has been undertaken and in line with the requirements of the report, the developer will undertake a number of upgrades in order to cater for the proposed development. These include:

- Upgrades to Beyers Naude and Valley Road:
  - Signalization of the intersection;
  - A 30m slip lane (yield) on the north approach;
  - An additional dedicated right turn lane (60m) on the south approach; and
  - A shared slip lane (yield) and through lane (30m) on the east leg of the intersection.
- Upgrade of Beyers Naude and Rocky Ridge Road:
  - A shared left and through lane on the north approach;
  - A dedicated right turn lane (60m) on the north approach;
  - An additional receiving lane on the north leg of the intersection;
  - A shared left and through lane on the south approach;
  - A dedicated right turn lane (60m) on south approach; and
  - An additional receiving lane of the south leg of the intersection.
- Upgrade of Beyers Naude and College Road:
  - Signalisation of the intersection;
  - A dedicated right turn lane (60m) on the north approach;
  - An additional receiving lane on the north leg of the intersection;
  - A dedicated right turn lane (120m) on the south approach;
  - An additional through lane of the south approach; and
  - An additional receiving lane on the south leg of the intersection.
- Rehabilitation of Valley Road and Lakeview Road:
  - Widening of Valley Road and Lakeview Road to 7m.

The upgrades described above will be augmented by additional upgrades that will be undertaken by Gauteng Department of Roads and Transport (GDRT).

Figure 4-2 to Figure 4-9 below illustrates the various upgrades and rehabilitation that will be undertaken. It should be noted that the upgrades to the roads themselves do not trigger any listed activities in terms of NEMA. However, in Valley Road and Lakeview Road are in close proximity to the watercourse and as such trigger Activity 19 of Listing Notice 1 and Activity 14 of Listing Notice 3. Where these roads cross the watercourse, box culverts will be put in place. In addition, erosion protection measures will also be implemented alongside Lakeview road (adjacent to the watercourse). The details of these are provided in Table 4-7.

Table 4-7: Culvert details

ID	Details
Watercrossing 1	1 x 3600mm x 1200mm Box culvert
Watercrossing 2	5 x 3600mm x 1200mm Box culvert
Erosion Protection (Lakeview Road)	Erosion protection measures to be put in place

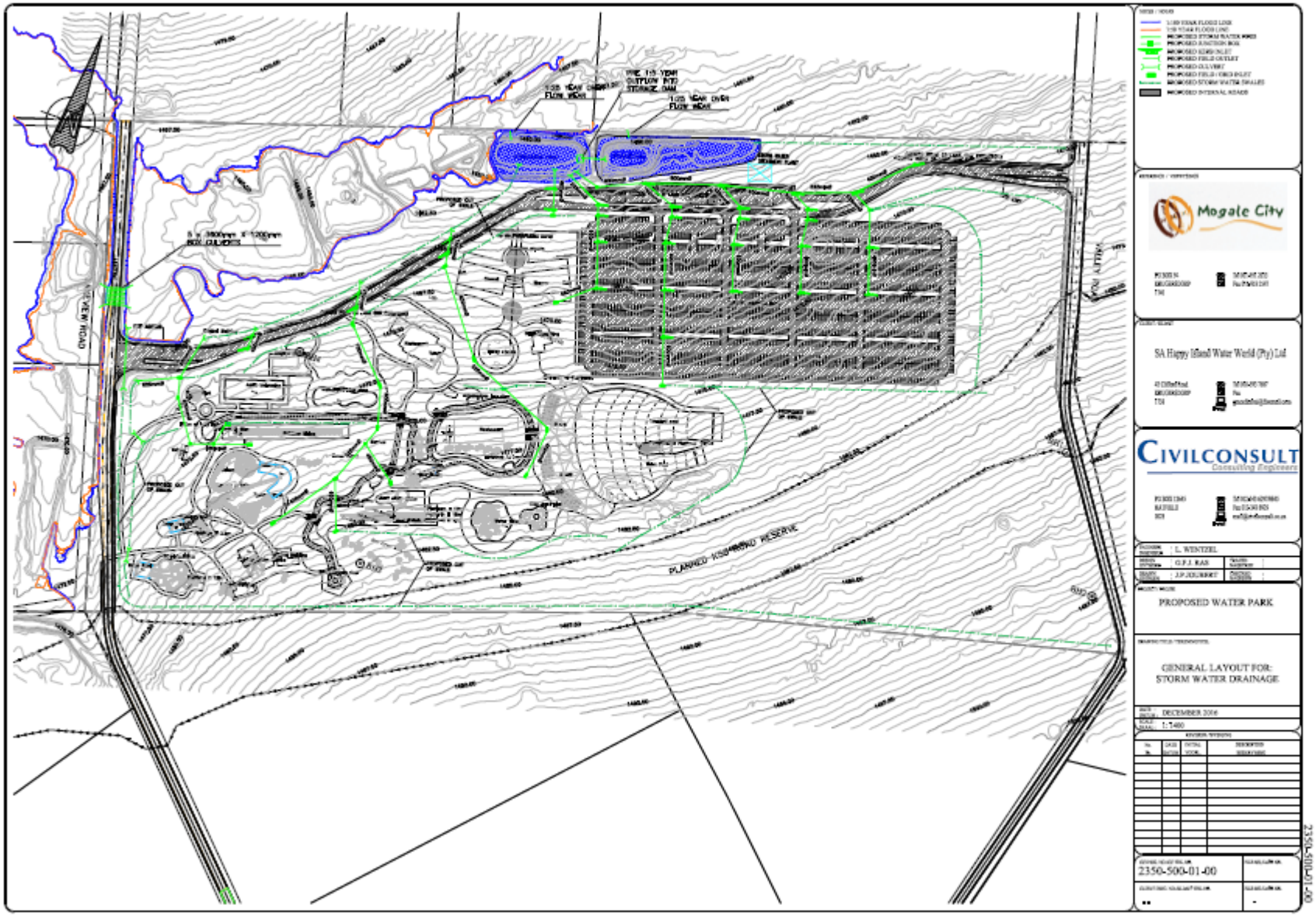


Figure 4-2: Internal entry and exit roads, parking and associated stormwater

Figure 4-3: General layout of proposed road upgrades

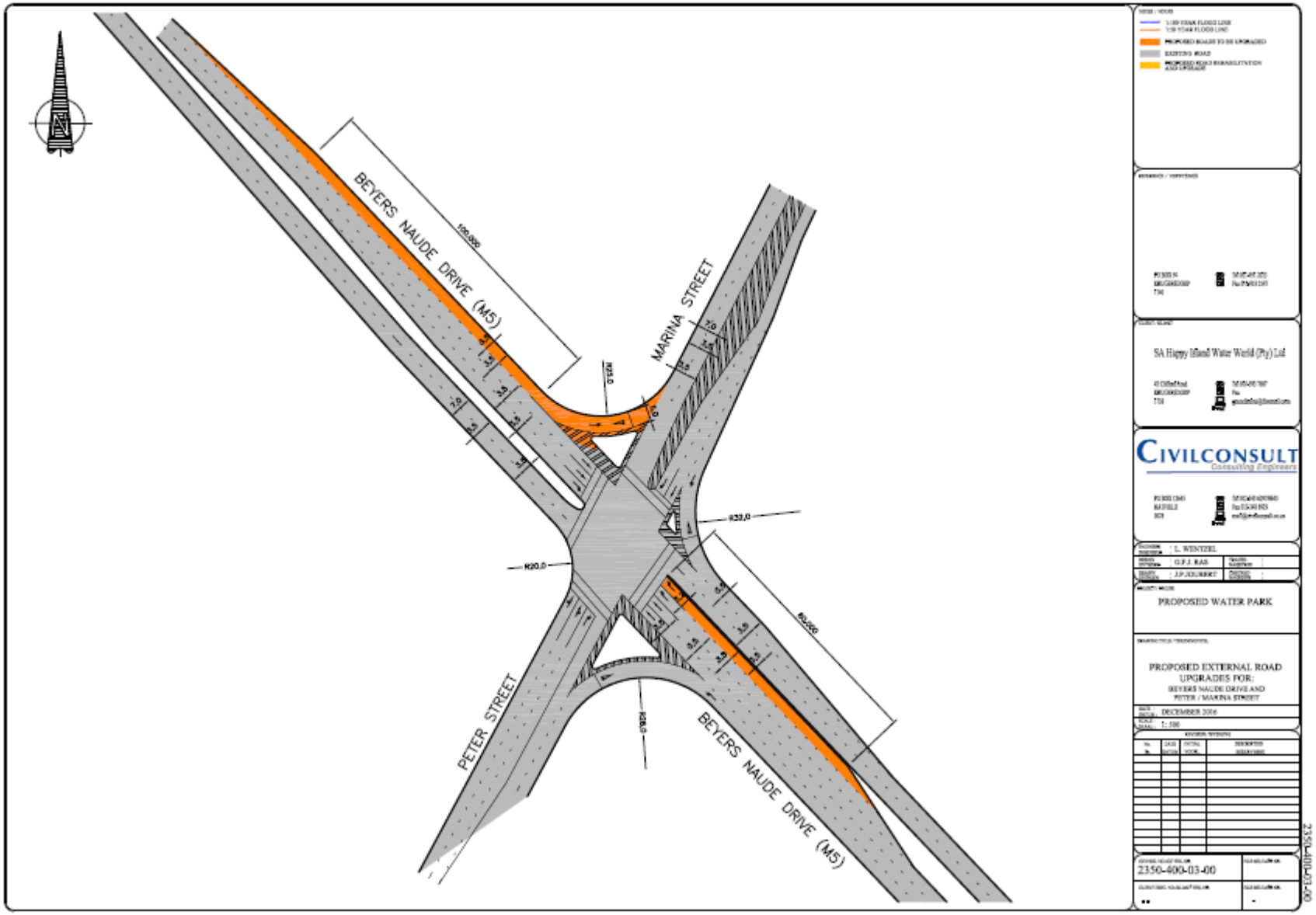


Figure 4-4: Proposed road rehabilitation and upgrades – Beyers Naude and Marina Drive

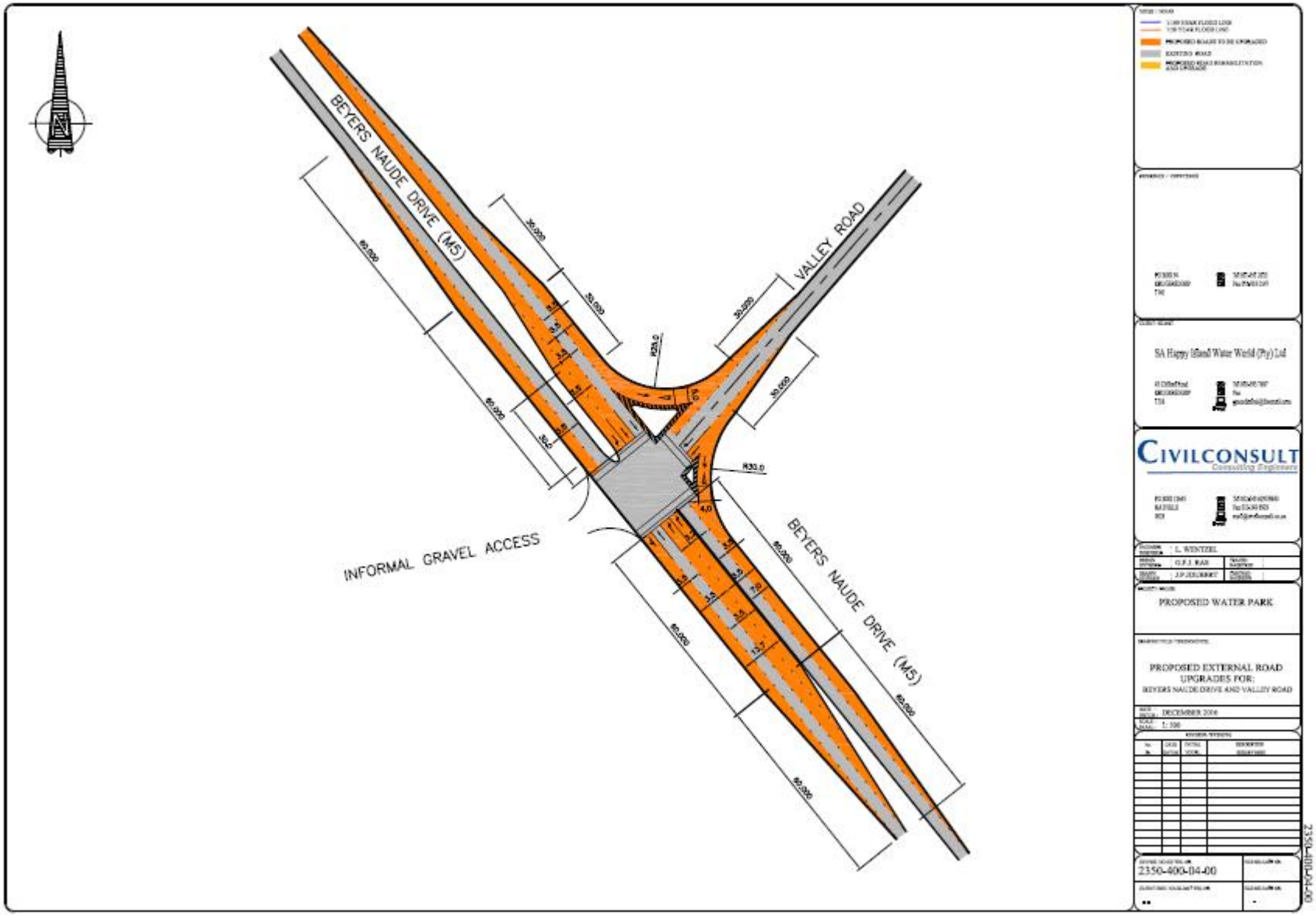


Figure 4-5: Proposed road rehabilitation and upgrades – Beyers Naude and Valley Road

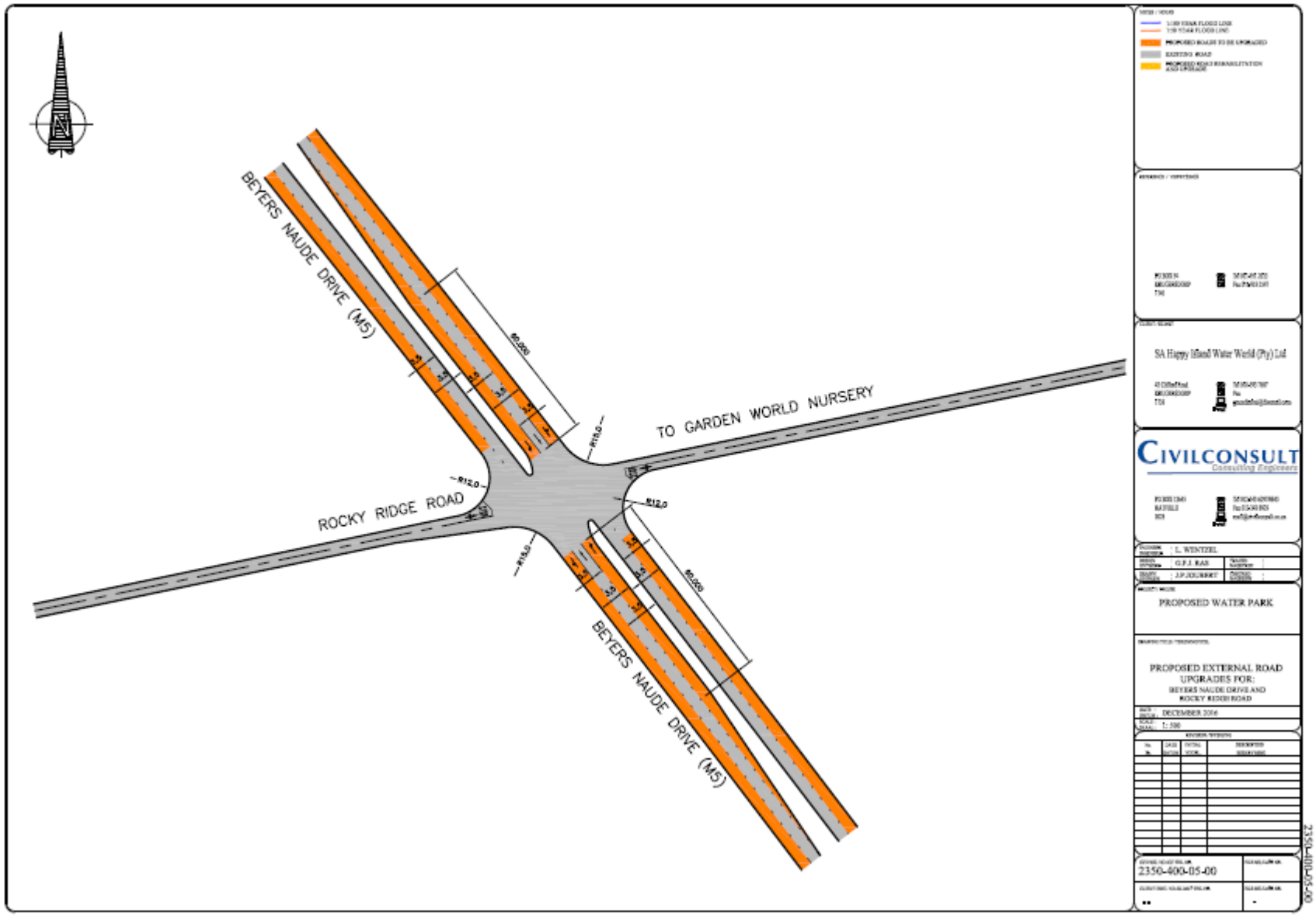


Figure 4-6: Proposed road rehabilitation and upgrades – Beyers Naude and Rocky Ridge Road

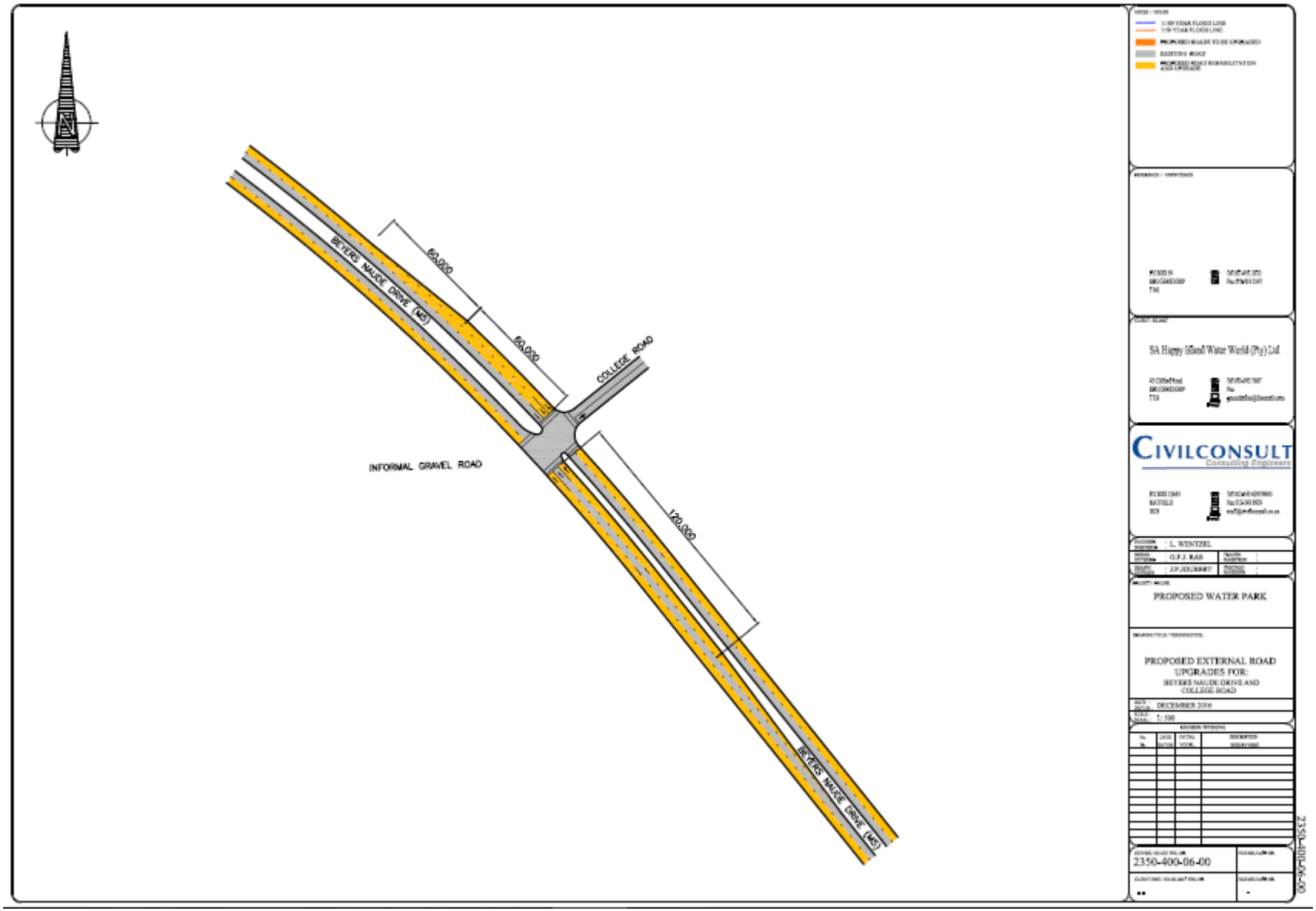


Figure 4-7: Proposed road rehabilitation and upgrades – Beyers Naude and College Road

Figure 4-8: Valley Road Watercrossing and post development floodlines

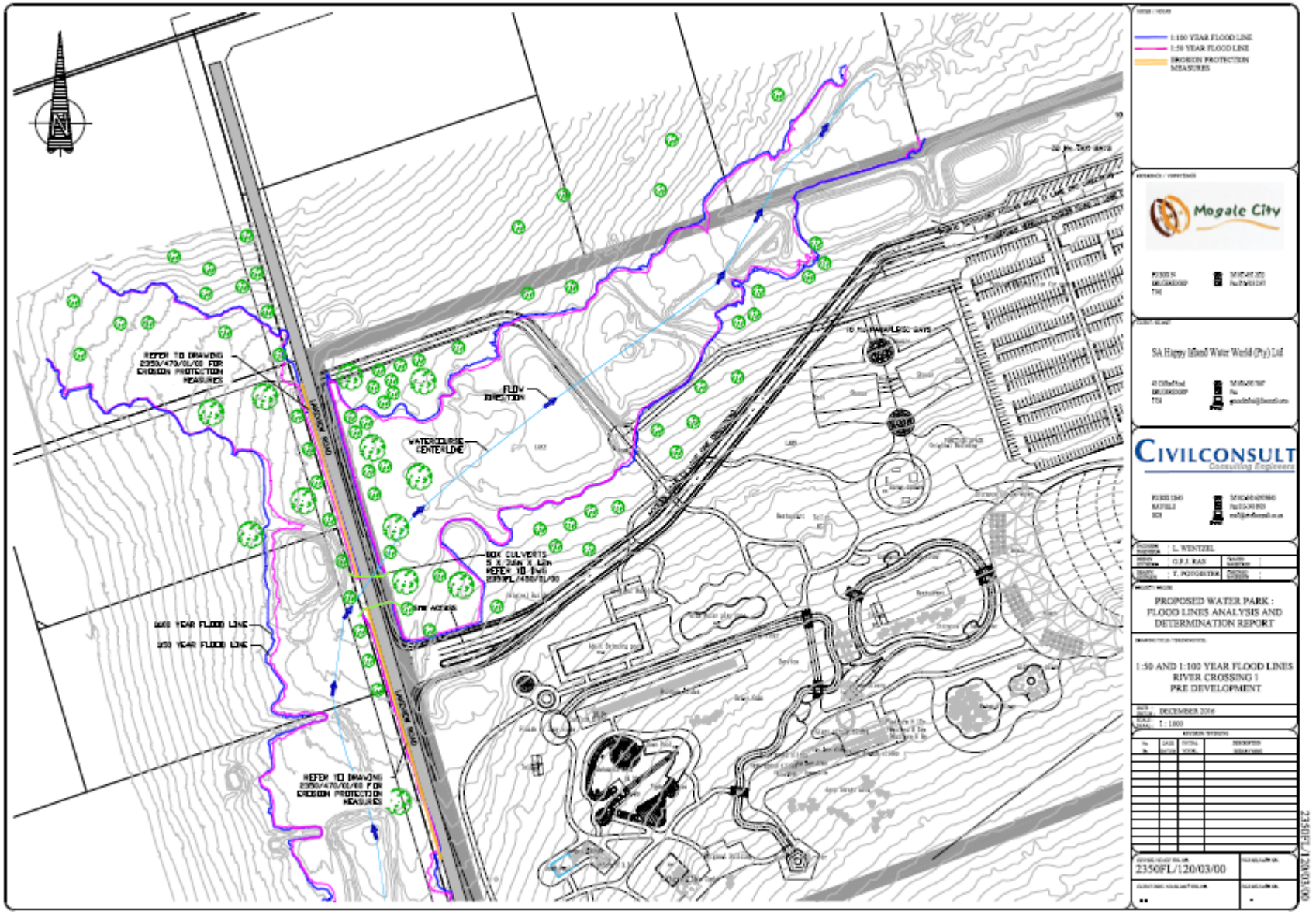


Figure 4-9: Lakeview Road Culvert and post development floodlines

4.4.3 Water

4.4.3.1 Estimated Water Demand

According to the Outline Scheme Report compiled by Civilconsult, there are a number of factors that need to be taken into account in determining the water demand. Firstly, municipal water will be required to fill the rides at the project start up. The volume of water required for the first fill is provided in Table 4-8.

Table 4-8: Volume required for the first fill

Water activities and features	Water demand (kl) – First fill
Waves	7200
Water house	364
Kids playing pool 1	96
Kids plating pool 2	96
Tornado slide	135
Behemoth bowl	288
Typhoon slide	288
The twin slides	99
Children slides	180
Adult pool	80
Rainbow slides	80
Lazy river	400
The water spray square	20
High speed slide	80
Fast slide	80
Big circle	80
Dragon slide	80
Total	**9546 kl**

In addition to the water required for the first fill, potable water will be required for offices, restaurants, and day visitors. Table 4-9 provides an overview of this water demand.

Table 4-9: Potable Water Demand

Zoning	Total Potable Water Demand		
	Floor area (m^2)/ Visitors	Average Annual Daily Demand (AADD)	Water Demand (Kl/day)
Offices	2000m^2	0.8kl/100m^2	16.0
Restaurant	2000m^2	0.8kl/100m^2	16.0
Daily Visitors	820 visitors	20l/person	16.3
		Total	**48.3 kl/day**

Due to the extensive water activities and features on site, an additional water use that must be taken into account is evaporation and backwash of the various pools (Table 4-10).

Table 4-10: Water losses (evaporation and backwash)

Item	Water losses - Evaporation	Water Losses - Backwash
Water activities and features	71.23 kl/day	95.2 kl/day

4.4.3.2 Water Supply

Various water supply sources will be utilised to supply the proposed development with water. These include:

- Municipal water;
- Borehole water; and
- Rainwater harvesting.

4.4.3.2.1 Municipal Water Supply

A standard bulk water connection will be provided from the existing 110mm diameter watermain in Valley road. This water will be used to provide potable water to the development and will service the office buildings, reception areas, change rooms and restaurants. It will also provide water for the fire flow. If necessary, a booster pump will be put in place to ensure sufficient municipal pressure. In addition, a reservoir with a storage capacity of 8 hours of the average annual daily demand (AADD) will be put in place. If necessary, the reservoir will include storage capacity for fireflow.

An overview of the water reticulation is provided in Figure 4-10. The design criteria for the water network is provided in Table 4-11.

Table 4-11: Water design criteria

Design element	Criteria
Maximum state head	90m
Minimum residential head under conditions of peak flows	24m
Maximum linear flow velocity under conditions of peak flows	2.0m/s
Pipe type	uPVC pressure pipes
Minimum pipe class	Class 12
Fireflow at any one hydrant under the condition of peak flows (at one hydrant at a time)	25l/s
Total fireflow	100l/s
Maximum linear flow velocity under conditions of firefighting	2.0m/s

Figure 4-10: Proposed Water Reticulation

4.4.3.2.2 Groundwater

In addition to municipal water, four boreholes occur on the site and will be utilised for supplementing water losses due to evaporation, splashes and backwashing. A hydrogeological baseline and 2D model was undertaken and found that the current abstraction rates of the boreholes on site was 7665m^3/a. However, based on the assumed yield, the future abstraction rate was determined to be 6750 m^3 per annum (per borehole). The 2D model showed that based on this abstraction rate, there would be no significant drawdown (and associated impacts on adjacent landowners).

In line with this, the IWULA for the proposed development will apply for an abstraction rate of 27 000m^3 per annum (6750 m^3 per annum x 4). However, to be conservative, the park only plans to use the current volume (7665m^3 per annum). The full volume will only be used in emergency situations. In addition, the borehole yield has been confirmed at 11400 litres per hour is a combined yield for all 4 boreholes instead of 700litres per hour. Thus, the available yield is much greater and comparatively only a small portion of the groundwater will be used.

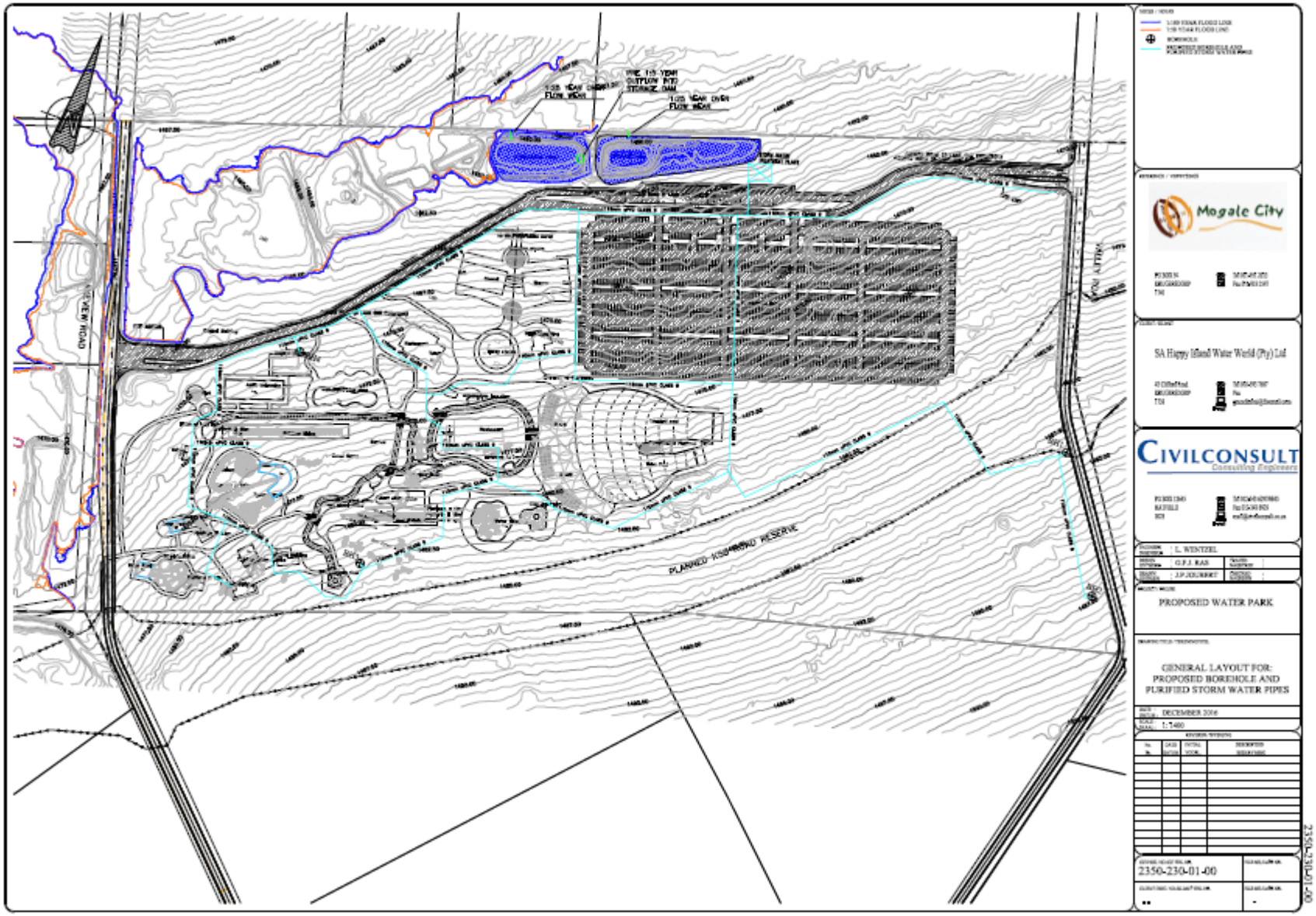


Figure 4-11: Proposed borehole and purified stormwater pipes

4.4.3.2.3 Rainwater Harvesting

In addition to borehole and municipal water, rainwater harvesting will also be undertaken. As part of this, stormwater runoff from the site (south of the natural watercourse) will be collected with grid inlets, kerb inlets, swales and stormwater pipes which will drain into the attenuation dam. From the attenuation dam, water will drain into the storage dam which will be line with 2,0mm HDPE liner. The storage water will be treated and recycled before it will be pumped back to supplement water losses in the water park caused by evaporation and operational losses.

Please note that no stormwater run-off from outside the development footprint will be used to harvest rainwater.

In terms of the potential volume of annual rainwater harvesting, the estimated mean annual rainfall from the Summerhill rainfall station was used to determine the potential volume of animal rainwater harvesting for the development (Table 4-12).

Table 4-12: Potential volume of annual rainwater harvesting for the dam before evaporation

Area	**Area (km^2)**	**Mean Annual Precipitation**	**Run-off co-efficient**	**Storage dam capacity (m^3)**
Area south of the natural watercourse	0.313	659	0.454	93 645

However based on the evaporation rate for the area (2600mm/year) and the area of the storage dam (5000m2), approximately 13 000 kl/annum will be lost to evaporation. As such, 80 645 kl per year of rainwater will be available for harvesting.

In order to allow rainwater harvesting, a storage dam is required. The dam is designed to have a total storage capacity equal to the 1:20 year runoff volume based on a 24-hour storm event. Details of the proposed storage dam is provided in Table 4-13

Table 4-13: Proposed Storage Dam

Area	**Area (km^2)**	**Rainfall Depth 1:20 years (mm)**	**Run-off co-efficient**	**Storage dam capacity (m^3)**
Area south of the natural watercourse	0.313	108	0.454	15 347

An existing earth dam will be used for the storage dam. The details of the dam are as follows:

- The storage dam will be lined with 2,0mm HDPE liner;
- The storage section of the dam will be designed to have a total storage capacity equal to the 1:20 year run-off volume based on a 24 hour storm event;
- The storage capacity will be 15 347 $^{m3;}$
- The dam will be 4,5m deep;

- The inflow pipe from the attenuation pond will be 1.5m from the top of the dam;
- The embankment of the dam wall will be 1:3;
- The water will be treated and re-cycled before it will be pumped back to supplement water lost in the water park due to evaporation and operational losses; and
- The storage dam will be located outside the 1:100 year floodline.

A weir overflow structure will be provided which will drain into the natural watercourse. The weir will be designed for the post development 1:25 year flood and will have energy dissipation structures to dissipate the energy to prevent erosion.

No changes to the existing instream dams will be undertaken as part of this authorisation process. The only other dam that will be put in place is the attenuation dam, which is described in more detail in Section 4.4.5.

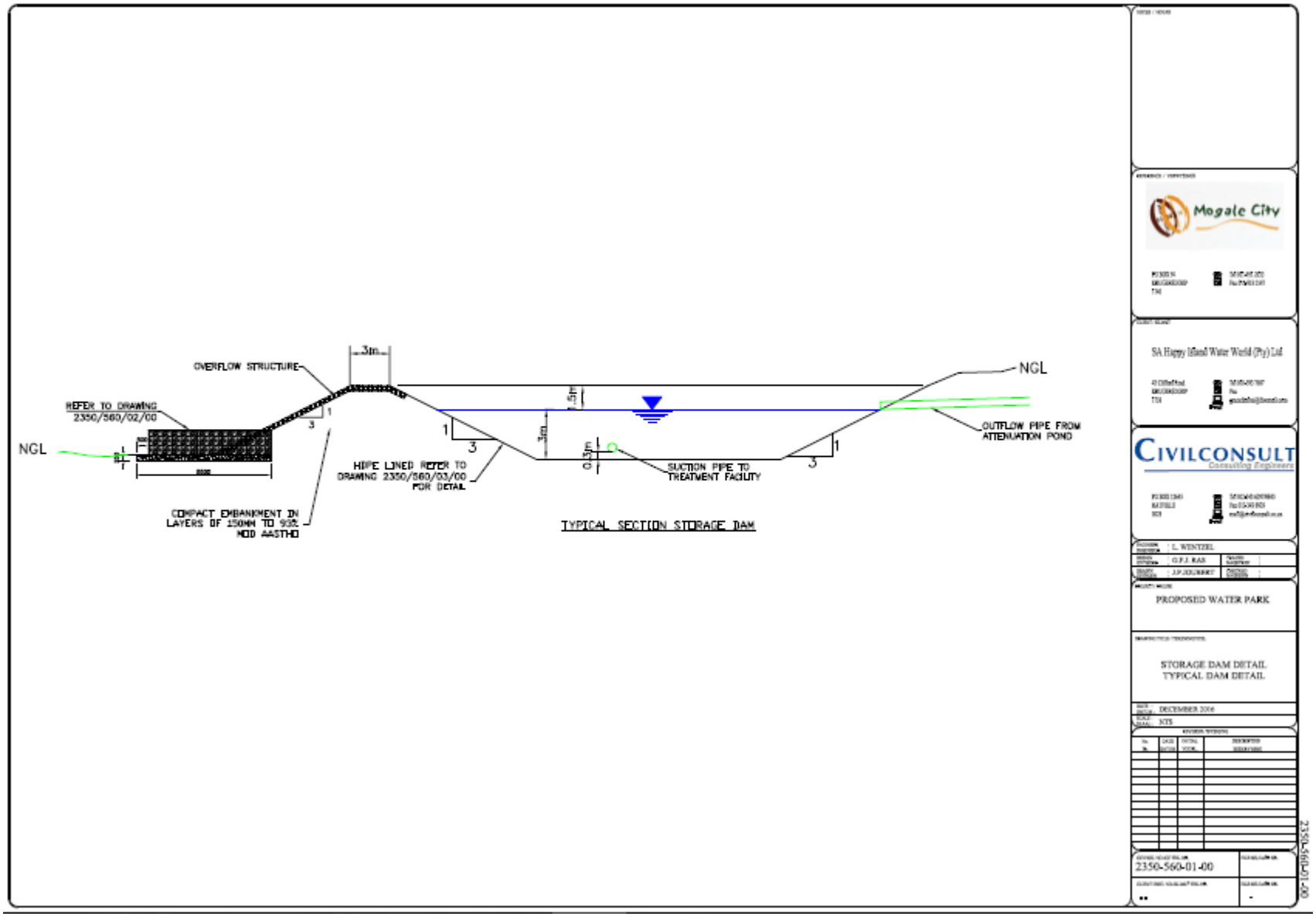


Figure 4-12: Storage Dam

4.4.3.2.4 Water Recycling

Water from water resources will also be recycled and reused to supplement the water losses at the water park due to evaporation and operational activities. The following waste water will be recycled:

- Backwash water from water activities and features; and
- Sewage effluent.

Separate treatment facilities will be provided to purify these two streams.

4.4.3.2.4.1 Backwash water

All backwash water from the water park will be recycled and purified to be used to supplement water demand. The average backwash of an Olympic sized pool (2500m^3) is 23.9kl per day (without the use of a special filter) and backwash from the park was assumed to be similar to Olympic sized pool. Based on this assumption, 95.2kl/day of water will be generated by backwashing. Water from backwashing will follow the following process:

- Pre-screening
- Buffer of equalization tank;
- Lamella clarifier;
- Tertiary filtration and sterilization;
- Final water storage tank;
- Pressure pumps to distribute clean water back to the various pools for use as top up water.

In addition, it is recommended that efficient swimming pool filters will be put in place on all pools. This will reduce the volume of backwash produced.

Figure 4-13: Proposed backwash pipes

4.4.3.2.4.2 Treated Sewage Effluent

All sewage effluent will be treated and used for irrigation purposes. The water will conform to DWS standards. The estimated volume of treated effluent available is provided in Table 4-14.

Table 4-14: Estimated volume of treated effluent available for irrigation

Item	**Estimated volume of treated effluent available for irrigation**		
	Floor area (m2)/ Number of visitors	**Average annual daily flow (AADF)**	**Waste water for irrigation (kl/day)**
Offices	2000m^2	0.8 kl/100m^2	16
Restaurant	2000m^2	0.8kl/100m^2	16
Visitors per day	820	20kl/person	16.4
Total			48.1
Estimated losses in treatment plant (20%)			9.62
Total available			**38.48**

4.4.3.3 Water Balance

Based on the above, a water balance has been calculated for the development. The water balance takes into account the numerous forms of recycling that have been instituted to ensure that the proposed water park is sustainable (in light of the fact that South Africa is an arid country).

Table 4-15: Water Balance Summary

	Supply (m^3/a)	**Details**	**Usage and losses (m^3/a)**	**Details**	**Balance (m^3/a)**
Water Park facilities	135 963	Borehole, rainwater harvesting and recycling	126 465	Splash out, evaporation and backwash	**+9 498**
Potable water requirements	94 608	Mogale City Municipal supply	17 666	Sewage/Effluent	**+76 942**
Total Water Balance					
Total Supply (m^3/a)		**Total Usage and Losses (m^3/a)**		**Total Balance (m^3/a)**	
230 571 m^3/a		144 131 m^3/a		**+86 440m^3/a**	

4.4.4 Sewer

The estimated brown and grey waste water for the proposed development is provided in Table 4-16.

Table 4-16: Estimated volume of sewage

Item	Estimated volume of sewage		
	Floor area (m2)/Visitors	**Average Annual Daily Flow (AADF)**	**Waste water for irrigation (kl/day)**
Offices	2000m^2	0.8 kl/100m^2	16
Restaurant	2000m^2	0.8kl/100m^2	16
Visitors per day	820	20kl/person	16.4
Total before seepage			48.4
Percentage infiltration (15%)			7.26
Total			**55.66**

The design criteria used to design the sewage network is provided in Table 4-17.

Table 4-17: Sewer design criteria

Design element	Criteria
Peak factor	2.5
Allowance for infiltration	15%
Capacity of sewer	Pipes may run full at the total design flow which includes the peak and infiltration flows
Sewer pipe type	Maincore Class 400
Minimum velocity	0.6m/s
Minimum pipe diameter	160mm
Minimum depth of cover	1.0m

Figure 4-14: Proposed sewer reticulation

Two alternative package sewage treatment plants have been investigated as part of the EIA process and are described in more detail in Chapter 7.2. Based on the assessment of alternatives, the Bio Rotor Sewage Plant has been identified as the preferred option. As part of this option, effluent will flow to a Balance Tank (or equalisation tank) as the peak flow is too high to go directly to a treatment plant. The Balance Tank can either be constructed as part of the AM BIOROTOR or can be a separate unit that can be buried. The Balance/ Septic Tank is fitted with duty and standby submersible pumps. The effluent will be pumped into a single BR4000 Blivet all-in-one package sewage treatment plant/s. From the Blivet the treated effluent is disinfected in a flow proportional chlorinator and then flows through a 30minute contact tank. It can then be discharged for irrigation or to a storage tank. If in future, there is an increase in the loads then one or more additional units can be installed in parallel.

The treated effluent will meet the following discharge quality parameters:

Table 4-18: Discharge quality parameters for reuse of effluent for irrigation

Parameter	Value
COD	75 mg/l
BOD	75 mg/l
SS	15mg/l
Total Fecal *E.coli*	0

4.4.5 Stormwater

4.4.5.1 Attenuation and Storage Dams

No existing stormwater reticulation is in place at the proposed development site and as such as part of the development, a stormwater system will be put in place. As part of this, stormwater from the site (south of natural watercourse) will be collected with grid inlets, kerb inlets, swales and stormwater pipes which will drain into an attenuation dam. From the attenuation dam, stormwater will drain into the storage dam where it will be treated and reused to supplement water losses in the park.

The attenuation pond will accommodate the post 1:25 year run-off and the outflow into the storage dam will be the pre-1:5 year flood.

The capacity for each dam will be as follows:

- Attenuation dam/pond - 4600 m^3; and
- Storage dam – 15 347m^3.

The details of the attenuation dam are as follows:

- The attenuation dam will be an earth grass lined dam;
- The attenuation dam will have a storage capacity to attenuate the difference between the pre-1:5-year development and post 1:25 year development run-off;
- The storage capacity will be 4600m^3;

- The dam will be 1.5m deep;
- The embankment of the dam will be 1:3;
- The overflow structure will be provided to discharge the 1:25 year flood; and
- The attenuation dam will be located outside the 1:100 year floodline.

The storage section of the dam will be designed to have a total storage capacity equal to the 1:20 year run-off volume based on a 24-hour storm event. The outflow structures of the storage dam and attenuation dam will discharge directly into the natural watercourse and will include energy dissipation structures to prevent erosion. The overflow structures will be designed for the post 1:25 year flood.

An existing earth dam will be used for the storage dam. The details of the dam are as follows:

- The storage dam will be lined with 2,0mm HDPE liner;
- The storage section of the dam will be designed to have a total storage capacity equal to the 1:20 year run-off volume based on a 24 hour storm event;
- The storage capacity will be 15 347 m3;
- The dam will be 4,5m deep;
- The inflow pipe from the attenuation pond will be 1.5m from the top of the dam;
- The embankment of the dam wall will be 1:3;
- The water will be treated and re-cycled before it will be pumped back to supplement water lost in the water park due to evaporation and operational losses; and
- The storage dam will be located outside the 1:100 year floodline.

A weir overflow structure will be provided which will drain into the natural watercourse. The weir will be designed for the post development 1:25 year flood and will have energy dissipation structures to dissipate the energy to prevent erosion.

No changes to the existing instream dams will be undertaken as part of this authorisation process. The only dams which will be developed as part of the proposed development are the attenuation and storage dam as discussed above.

4.4.5.2 Stormwater Drainage

A cut of swale will also be put in place along the southern boundary to prevent any stormwater from outside the development draining into the site. A culvert will be installed for stormwater to cross the entrance road.

The internal stormwater system will be designed for the 1:5 year flood return period for minor systems and for a 1:25 year flood return period for a major system. The design standards used for the drainage system are provided in Table 4-19.

Table 4-19: Stormwater design standards

Design element	Specification
Minimum pipe size	450mm diameter
Pipe type	Interlocking joint pipes Pipe class 50D 100D road crossings
Minimum pipe gradient	0.67%

The stormwater run-off which will be generated by the proposed development is shown in Table 4-20below. The rational method was used to calculate the run-off.

Table 4-20: Hydrology

Flood return period (years	Pre-development run-off (m^3/s)	Post development run-off (m^3/s)
1:5	1.00	2.875
1:20	1.617	4.463
1:25	2.077	5.518

It should be noted that Mogale City Local Municipality requested that Sustainable Urban Drainage System (SUDS) be implemented as part of the development. However, due to the fact that stormwater is being recycled and reused, a formal SUDS is not possible. However, as recycled water is being used for irrigation, groundwater recharge will occur. In addition, stormwater run-off will be captured and reused and therefore will reduce the volume of run-off entering the watercourse). The advantages of SUDS (namely, reducing stormwater run-off and flood risk, reducing pollution and recharging groundwater) will therefore be met through the implementation of recycling and reuse of water.

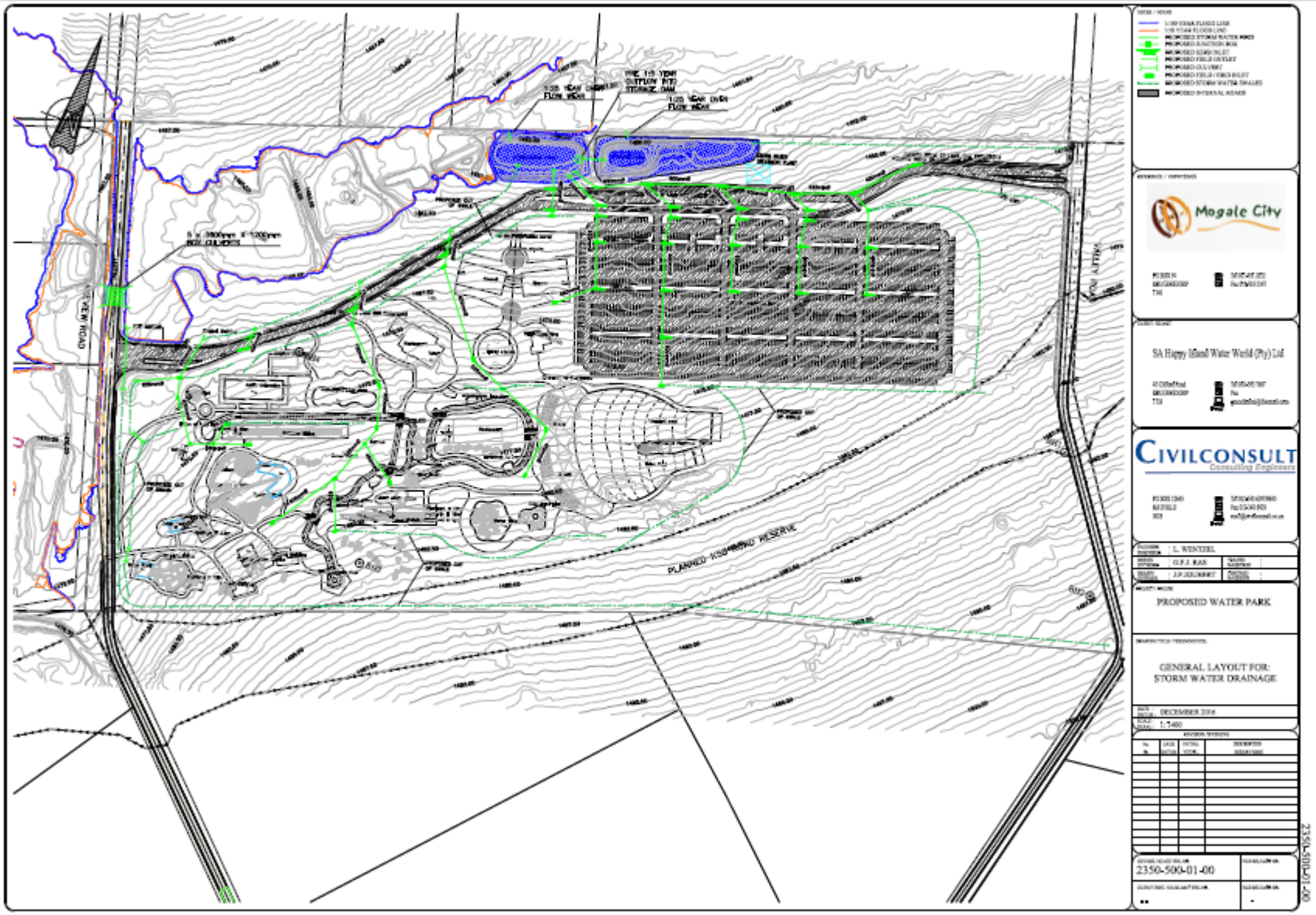


Figure 4-15: Proposed Stormwater

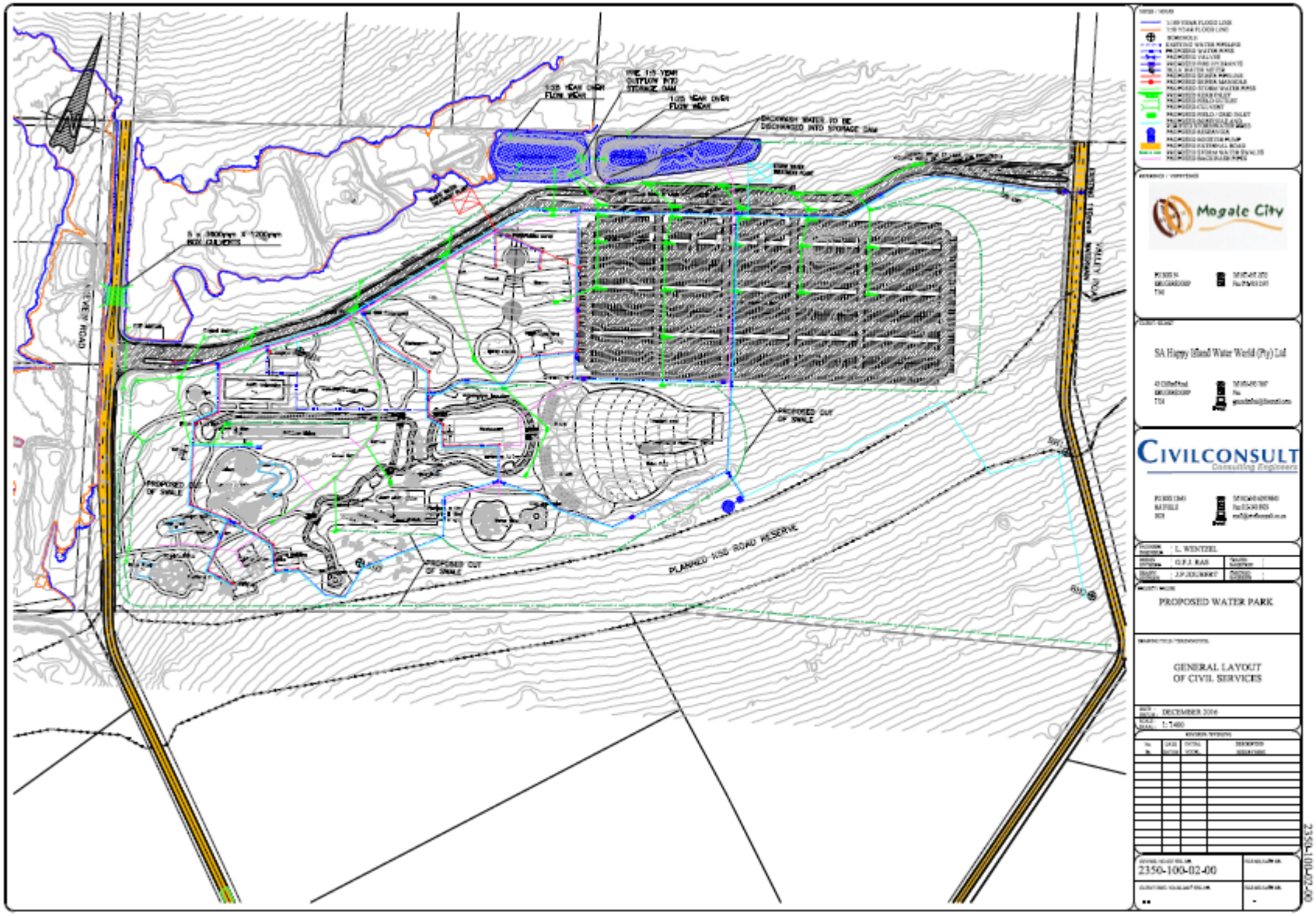


Figure 4-16: Proposed layout of the development

4.4.6 Timeframes

The proposed development will be constructed according to the following preliminary timeframes, see Table 4-21:.

Table 4-21: Operational hours for construction phases.

Period	Open	Close
Weekdays	07:00	18:00
Saturdays	07:00	15:00
Sunday	Only when required	
Public holidays	Only when required	

4.4.7 Ancillary Infrastructure Required for Construction

No major infrastructure is required on site for the construction of the development. The required ancillary infrastructure for the purposes of supporting services is discussed below.

4.4.7.1 Security

A construction camp will be erected on site for the duration of the construction. This camp will be fenced for security purposes. A security guard will also be posted on site during non-operational times. A wall will be erected around the property boundary as part of the development project.

4.4.7.2 Sanitation

During the construction phase of the project, chemical toilets will be placed on site for the duration of the construction phase. Where possible, existing toilets that occur on site already will also be used.

4.4.7.3 Construction Camp and Laydown Areas

Designated areas will be established during the construction phase for construction equipment and vehicles. This area will be outside all sensitive areas (delineated wetlands etc.).

4.4.8 Operational Activities

The proposed Water Park will be operated according to strict seasonal and daily times (Table 4-22).

Table 4-22: Operating times and seasons

	Opening Seasons/Times
Season	Summer (Mid-September to April)
Times	09h00-18h00 (Monday to Sunday)

A maximum of 840 visitors will be accommodated at one time. In addition, a number of noise reducing mechanisms will be put in place. These include:

- Pump stations will be underground;
- Only one speaker will be put in place on a platform in the center of the wave area; and

- A 2.5m boundary wall will be put in place.

4.5 Project Life-Cycle

To adequately consider the impacts associated with the proposed Water Park development, the major activities during each phase of the project life-cycle are listed below:

- Feasibility Studies
  - Technical, economic and environmental screening of alternatives;
  - Development of Outline Scheme Report;
  - Geotechnical Assessment; and
  - Environmental Authorization and WULA process.
- Pre-construction Phase
  - Detailed layouts and services designs;
  - Procurement process for Contractors;
  - VISA process for skilled workers from China; and
  - Procurement of other necessary materials.
- Construction Phase
  - Appointments and site camp set up:
    - Appoint Environmental Control Officer;
    - Set up site camp with temporary offices and administrative facilities;
    - Set up ablutions;
    - Set up access control, security; signage and lighting;
    - General materials storage and laydown areas
    - Construction employment;
    - Change-houses, chemical toilets and showering facilities (linked to conservancy tanks – removal of contents by exhauster vehicle and disposal at permitted facility); and
    - Temporary waste storage areas; these shall be established and managed in accordance with EMPr requirements.
  - Sourcing of construction materials and equipment:
    - All bulk materials (aggregate, cement, steel etc.) will be sourced from existing lawful commercial sources; there will be no direct mining, harvesting or extraction of natural resources.
  - Excavation and earthworks
    - Removal of existing surfacing material where necessary (concrete, asphalt etc.) which could involve excavation below ground level;
    - Levelling and compaction using heavy machinery / earthmoving equipment.
    - Potential for excavations and trenching in order to lay of below ground level equipment (cables, pipes, sumps, drainage etc.);
    - Construction work within the existing dams;
    - Potential for excavation dewatering in the event of water-table interception;

        - Use of general mechanical equipment within construction areas (generators, cutting and welding equipment, compressors etc.).

- Operation Phase:
    - Operation of service facilities;
    - Maintenance of infrastructure;
    - Recreational use of Water Park by Visitors.
- Decommissioning Phase
    - Decommissioning of the Waterpark and associated services is not envisioned. However, should decommissioning be required the activity will need to comply with the appropriate environmental legislation and best practices at that time.

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

Section 3(h) of Appendix 3 of the 2014 EIA Regulations, requires that the EIA Report includes information on the *environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects*. In line with this, and in order to understand how the environment will be affected by the proposed Water Park, the following section provides an overview of the receiving environment. Where necessary, this section includes information obtained from the specialist studies on the baseline conditions.

5.1 Local Climate

The climatological data for the Muldersdrift area is provided below.

5.1.1.1 Temperature

The average recorded temperatures range from 3°C (average minimum) - 26°C (average maximum) (Figure 5-1.). Information from the MCLM Baseline Assessment Report (Mogale City Local Municipality, 2013) notes that high temperatures are usually experienced between the months of October to March. The highest maximum temperature of 36.10C was measured in January 1973.

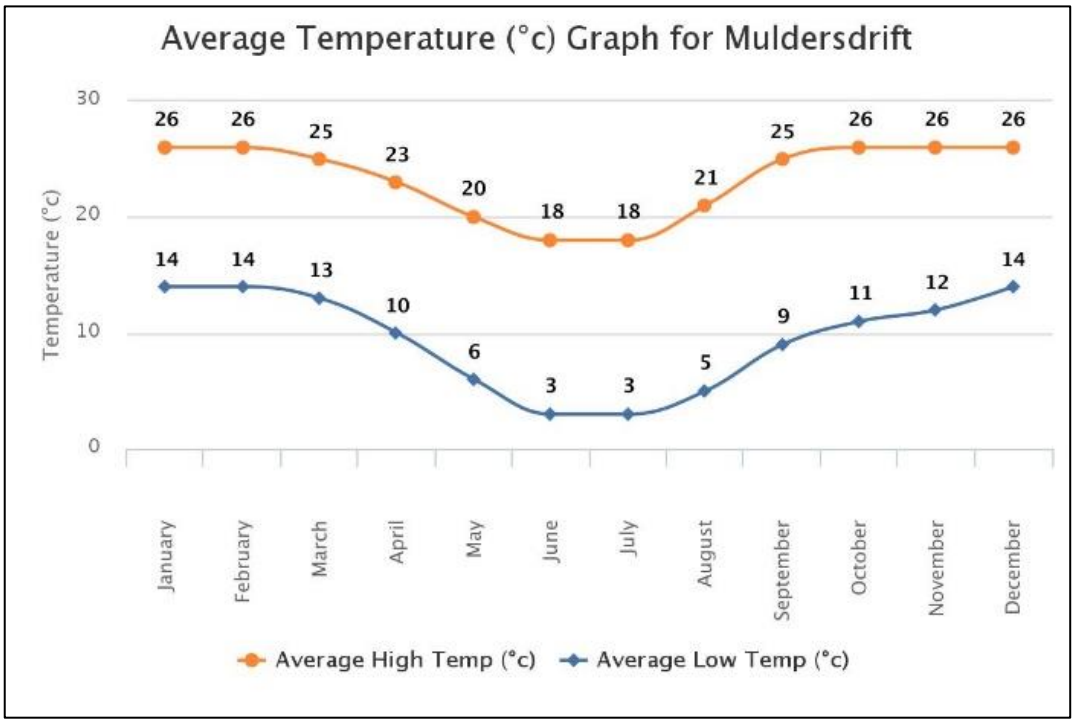


Figure 5-1: Average Temperature data for Muldersdrift (World Weather Online)

5.1.1.2 Rainfall

The average annual rainfall in the area is between 0 and 150mm per month. According to the MCLM Baseline Assessment Report (Mogale City Local Municipality, 2013), the highest monthly maximum in 29 years was 440 mm recorded in 1978.

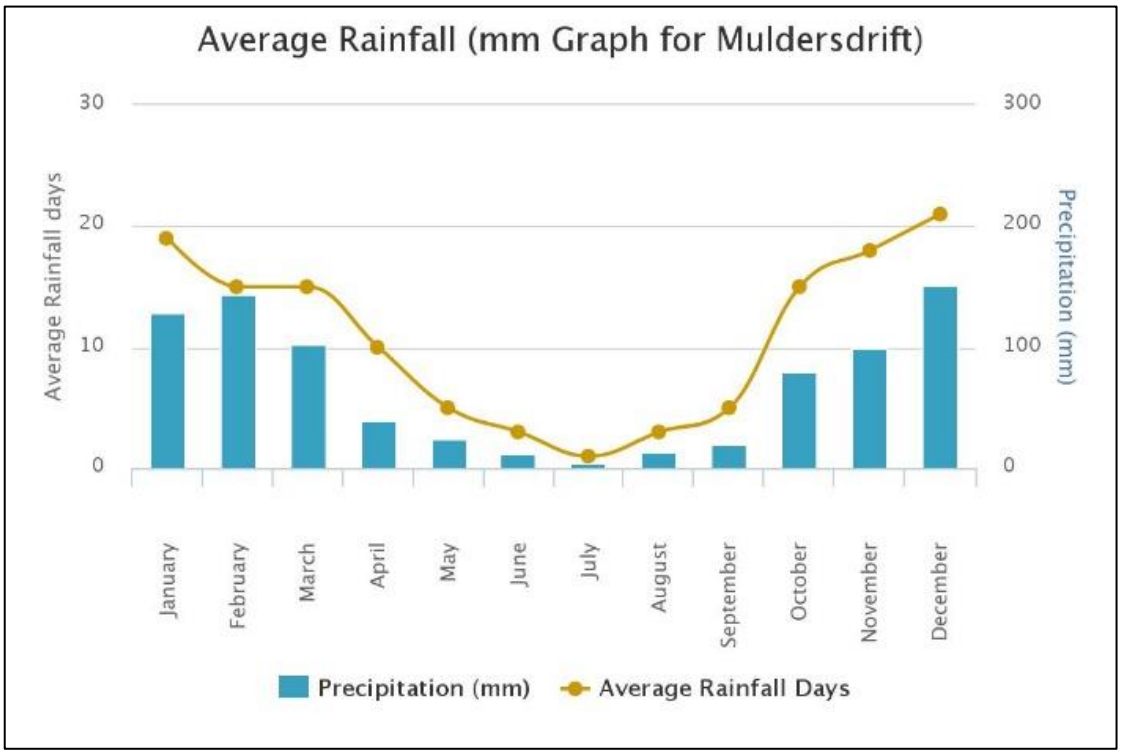


Figure 5-2: Average Rainfall data for Muldersdrift (World Weather Online)

During the public review of the Scoping Report, an I&AP raised concerns that the rainfall data utilised was outdated. They also raised concerns regarding the impact of the drought. A more detailed annual rainfall chart was obtained from the South African Weather Service and shows the rainfall for 2015 was well below the annual average (Figure 5-3).

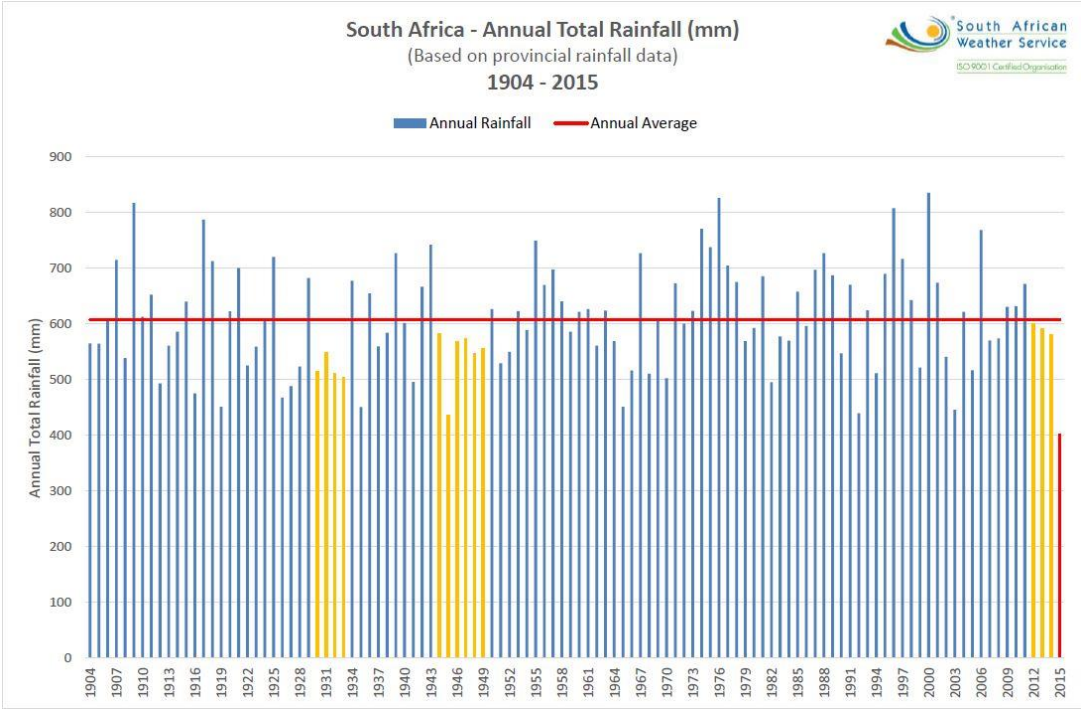


Figure 5-3: Annual rainfall for South Africa between 1904 and 2015

In addition, information from DWS (https://www.dwaf.gov.za/hydrology/Provincial%20Rain/Default.aspx) shows that summer rainfall in 2015/2016 was below normal (Figure 5-4). However, some recovery was seen, with a slight above normal rainfall in the winter months.

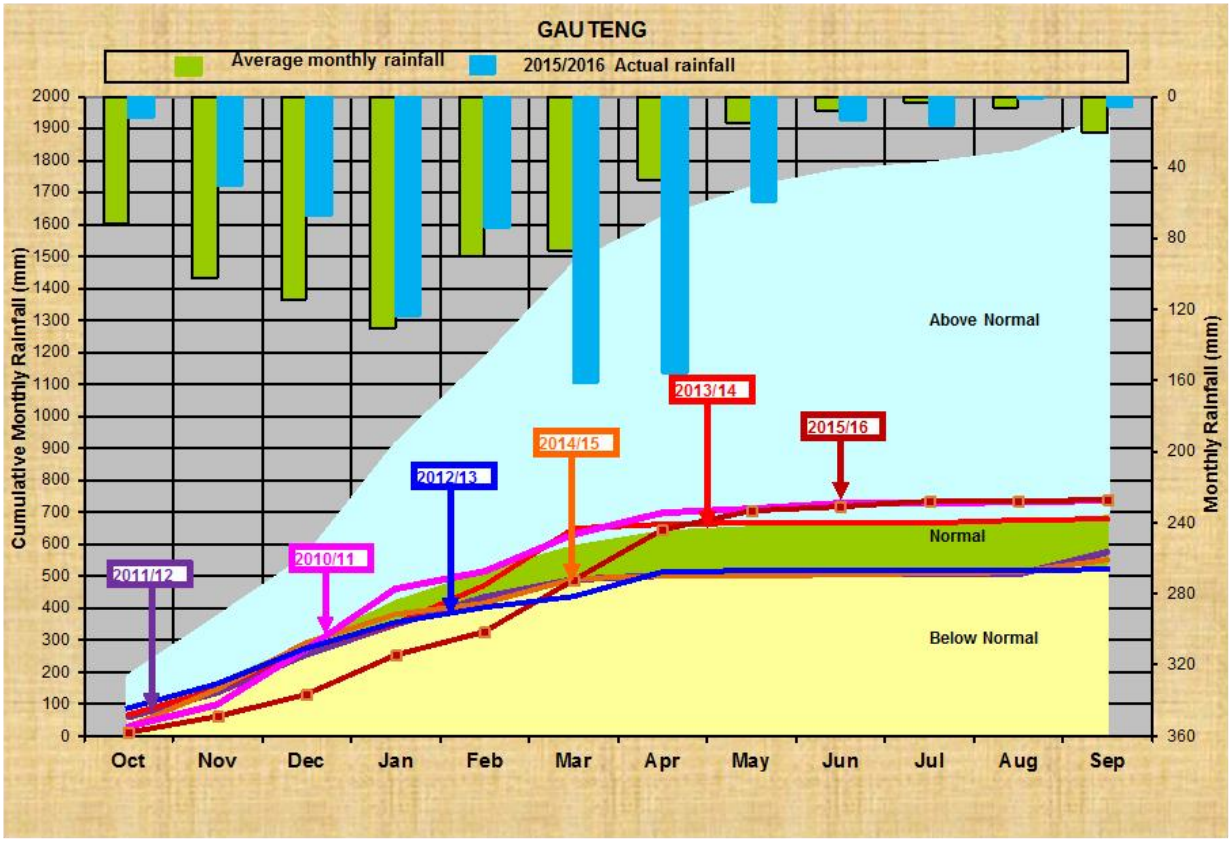


Figure 5-4: Gauteng rainfall 2011-2015

The DWS also released a drought status report which shows that the country is currently affected by drought (Figure 5-5). The report shows that the Northwest, Free State, Mpumalanga, Northern Cape and Limpopo are the most affected.

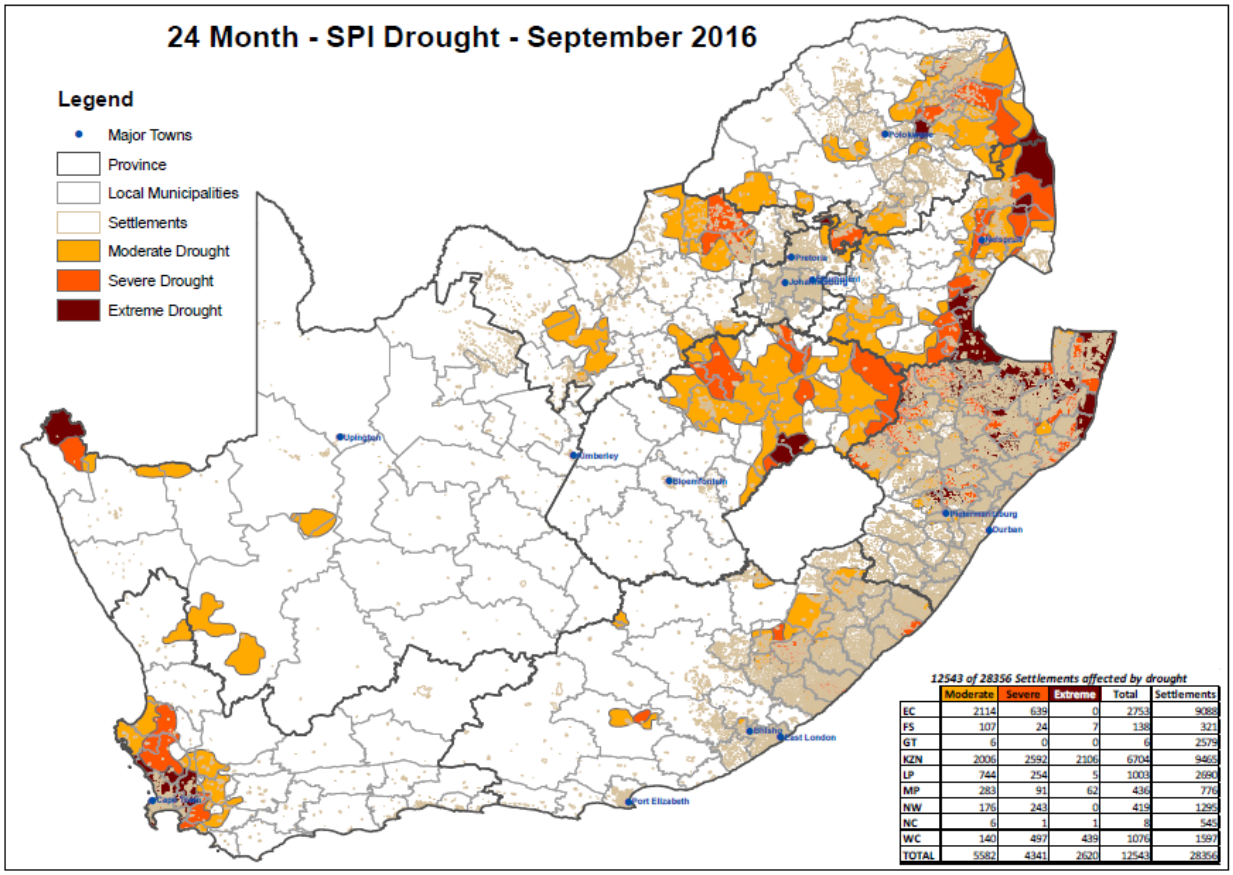


Figure 5-5: Drought Status

The South African Weather Service has also released a Seasonal Climate Watch Report for the period of November 2016 to March 2017. The Report highlights that the country is still in a drought but notes that there is potential for above normal rainfall conditions in the coming months due to La Niña conditions (Figure 5-6).

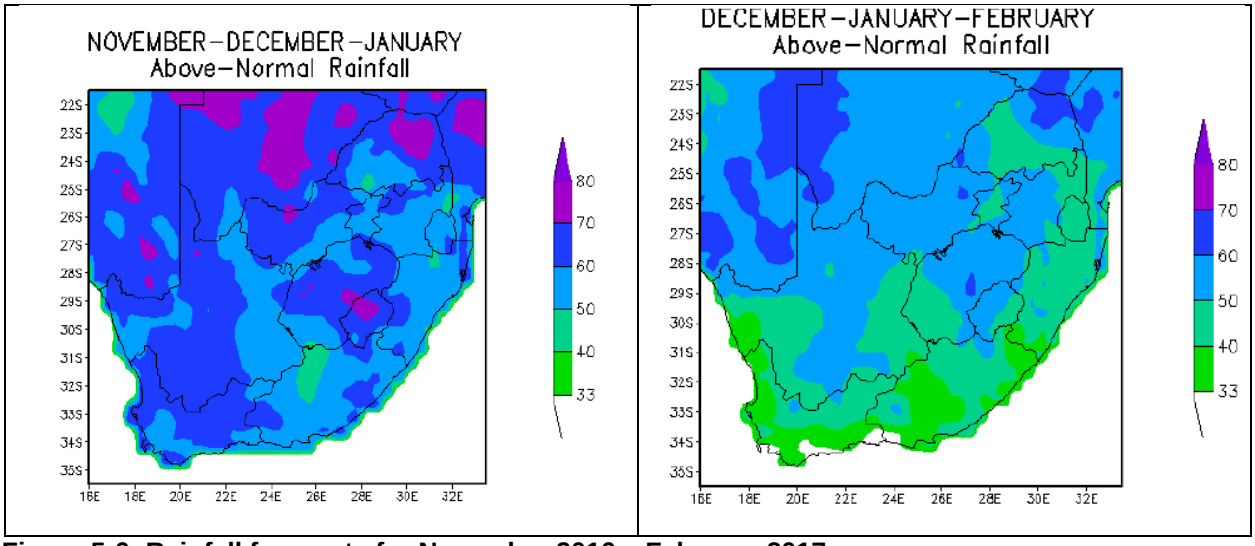


Figure 5-6: Rainfall forecasts for November 2016 – February 2017

5.1.1.3 Wind

According to the MCLM Baseline Assessment Report (Mogale City Local Municipality, 2013), historic data on wind movement for the municipality is not available. Data for the closest meteorological station in the adjacent City of Johannesburg provides a good source of information for the area with the average annual wind movement recorded at the Johannesburg Botanical Gardens meteorological station revealing that the dominant wind direction between 2007 and 2012 was North North-West (NNW). The strongest winds (2.5 – 5.6 m/s) blowing from the east. Maximum wind speed has been recorded at 11.5 m/s.

5.2 Topography

The site has an even slope in a north-westerly direction. The average gradient of the site is 7.1% (1 to 14). There are no ridges present on the site. However, there are several ridges outside the site. These are as follows:

- 1 x Class 2 Ridge approximately 752m East of the site;
- 2 x Class 3 Ridges approximately 362m and 824 m to the North West and North East respectively; and
- 2 x Class 4 Ridges approximately 358m and 587m to the North and West respectively.

The GDARD Ridge Policy (as amended in 2006) does not prescribe buffers for ridges but notes that only low impact development will be permitted on Class 2 ridges.

GDARD however requested that the Ecological Impact Assessment undertaken for the proposed Water Park specifically deal with the potential impacts to ridges. As such, the impacts to the adjacent ridges have been discussed by the Ecological Specialist.

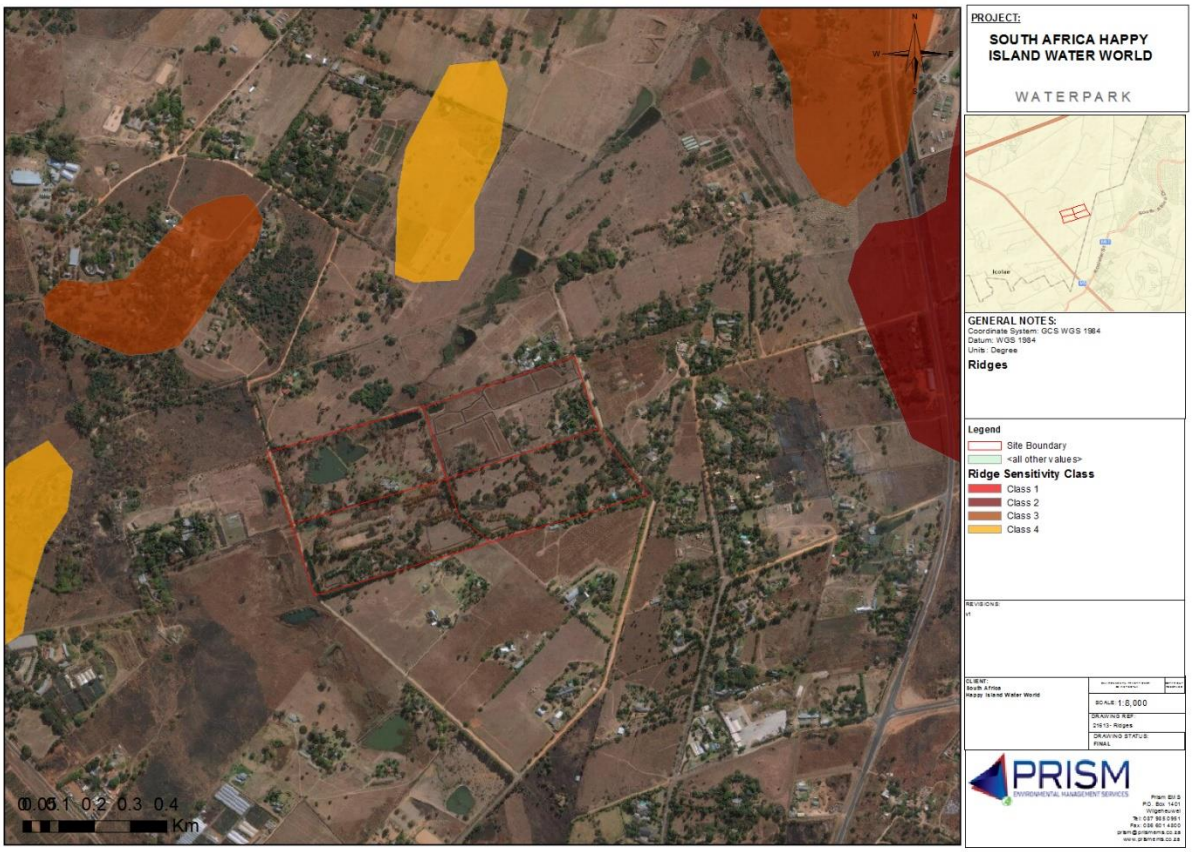


Figure 5-7.: Ridges

5.3 Geology and Soils

According to the Simplified Geological Map of South Africa, the proposed development is underlain by geology of the Bokkeveld Group.

The Biodiversity Geographic Information System (BGIS) notes that the soil on the site is an association of Classes 1 to 4 (undifferentiated structureless soils). Soils are red, yellow and / or greyish with low to medium base status and have restricted soil depth, excessive or imperfect drainage and potential high erodibility.

The Geotechnical Assessment undertaken for the proposed development also noted the following:

The site is covered by a thin to moderate horizon of transported sandy and gravelly soils which are underlain by residual soils developed over weathered granite (strictly speaking homogenous medium-grained porphyritic granodiorites according to Anhaeusser) belonging to the Halfway House Granite Dome of Archaean age. Scattered outcrops of granite bedrock occur in isolated areas across the eastern portion of the property.

Four main soil zones were identified by the Geotechnical Assessment. These can be summarised as follows:

- Soil Zone “A” covers the central portion of the site and includes moist, light grey, loose, intact, silty coarse SAND containing roots; colluvium in the shallow layers followed by slightly moist, dark orange speckled white and stained black on joints, dense becoming very dense, relict jointed, clayey coarse SAND; residual granite deeper down. From 1,0-1,2, the soil is moist, dark orange mottled black, very dense, relict jointed, clayey coarse SAND; residual granite.
- Soil Zone “B” covers the eastern portion of the site and includes moist, greyish brown, loose, intact, gravelly SAND containing roots; colluvium as well as slightly moist, dark orange, dense, voided, gravelly clayey coarse SAND containing tree roots; colluvium in the deeper down. In addition, between 1,2 – 2,0, the soil is dry, light orange blotched black and orange, very dense, partially ferruginised, silty coarse SAND; residual granite. This horizon extends to depths ranging from 1,0m to >3,0m below surface.
- Soil Zone “C” occupies the western low-lying area and is characterized by a northerly draining non-perennial drainage feature containing several small earth dams and possibly a surrounding wetland area.
- Soil Zone “D” covers an area of disturbed ground in the eastern part of the site where construction material had been removed in the past, resulting in a disused borrow pit, some 2m to 3m deep and covering an area of less than 0,5 hectares.

5.4 Land Use

The site is collectively situated on Portion 169, 170, 173 and 174 of the farm Rietfontein 189 IQ situated in Ward 23 of MCLM. The properties are zoned as “Agricultural” in terms of the Krugersdorp Town Planning Scheme 1980. The site is currently developed with residential units and some outbuildings. There are also a number of dams to the north west of the property as well as numerous exotic trees. The land use around the site is mixed and includes the following uses:

- Equestrian Estate;
- Churches;
- Country Estates;
- Agriculture;
- A nursery and garden centre;
- Truck and car sales businesses;
- A children’s play facility;
- Specialist embroiders;
- Commercial and storage uses;
- Housing complexes;
- Gas sales;
- Cottages;
- Conference and function centres; and
- Normal dwelling houses with associated uses.

5.5 Agricultural Potential

As mentioned in Section 5.4., the site is currently zoned as agricultural land however according to Agricultural Geo-Referenced Information System (AGIS), the area has only marginal agricultural potential. In addition, the site is not currently used for agriculture.

In addition, although no agriculture currently occurs on site, agricultural uses are still practiced by numerous landowners in the area.

5.6 Existing Services

According to the Outline Scheme Report for the proposed development, the following existing services occur in close proximity to the site:

- There is an existing municipal 110mm diameter watermain in Valley Road to the east of the site;
- There is an existing 335mm diameter watermain to the west of the property on Lakeview road;
- There are 4 boreholes;
- There is no sewerage reticulation in close proximity to the site;
- There is no formal stormwater drainage system in the area; and
- Lakeview road is a rural road with an asphalt surface (to the west of the site) and Valley Road (to the east) is a gravel road.

5.7 Availability of Services

The Outline Scheme Report has noted that there is water available for the proposed development. This will be augmented by the 4 boreholes on site, rainwater harvesting and reuse of effluent and grey water for irrigation purposes and recycling of backwash. More information on water requirements and how these will be met by the development is included in Section 4.4 above. However, in summary, the water balance for the proposed development shows that with the implementation of rainwater harvesting, recycling and reuse and use of both borehole and municipal water, the water balance for the development is sustainable (Table 5-1).

Table 5-1: Water Balance Summary

Total Water Balance		
Total Supply (m^3/a)	**Total Usage and Losses (m^3/a)**	**Total Balance (m^3/a)**
230 571 m^3/a	144 131 m^3/a	**+86 440m^3/a**

In terms of sewage, no sewerage facilities are available and thus the proposed development includes a sewerage treatment plant.

In order to ensure electrical services are available to service the site, discussions have taken place with Eskom and Mogale City Local Municipality and a separate Basic Assessment process is currently underway for the installation of bulk underground electrical cables. These cables will provide the additional electrical

services required to the development. They will also service additional developments in the area (such as the nearby Greengate business park). Electrical services are therefore available for the development.

5.8 Roads

The proposed development occurs in close proximity to the following roads:

- Beyers Naude Drive (M5): This road is classified as a Class 2 road having an east west alignment extending from Auckland Park (City of Johannesburg Metropolitan Municipality) in the east to N14 national freeway to the west. The portion of Beyers Naude Drive between Boland Road (east) and Heritage View Drive (west) is an undivided carriageway comprising of a single lane per direction. The portion of Beyers Naude Drive west of Heritage View Drive towards N14 comprises of two lanes per direction with a centre median. The posted speed limit is 80km/h.
- Marina Street: This road is classified as a Class 4 access road having a north south alignment comprising of a single lane per direction. Marina Street connects with Beyers Naude Drive in the south to R114 to the north. Marina Street provides access to commercial, residential and agricultural land use components. Marina Street is regarded as an important north south link.
- Peter Road: This road is classified as a Class 4 access road having a north south alignment comprising of a single lane per direction. Peter Street connects with Beyers Naude Drive in the north to Hendrik Potgieter Road (M47) to the south. Peter Road provides access to commercial, residential and agricultural land use components. Similarly, to Marina Street, Peter Road is also an important north south link.
- Valley Road: This road is a 5m wide Class 5 road having a north south alignment. Valley Road alignment starts at Beyers Naude Drive in the south and ends in a cal-de-sac to the north just pass the site boundary. The first portion (1km) of Valley Road has an asphalt surface, whereas the remaining portion of its alignment (1.43km) has a gravel surface. The south leg of the intersection of Beyers Naude Drive/Valley Road is an informal gravel access road where access to a truck repair yard is taken. Further along it's alignment, this gravel road services large agricultural holdings.
- Lakeview Road: This road is a 5m wide Class 5 road located approximately 930m off Valley Road in the north and bounds the western portion of the site. Lakeview Road ends in a cal-de-sac towards the end of the site boundary. Lakeview Road has an asphalt surface;
- Rocky Ridge Road: This road is a 5m wide Class 5 road having a north south alignment.

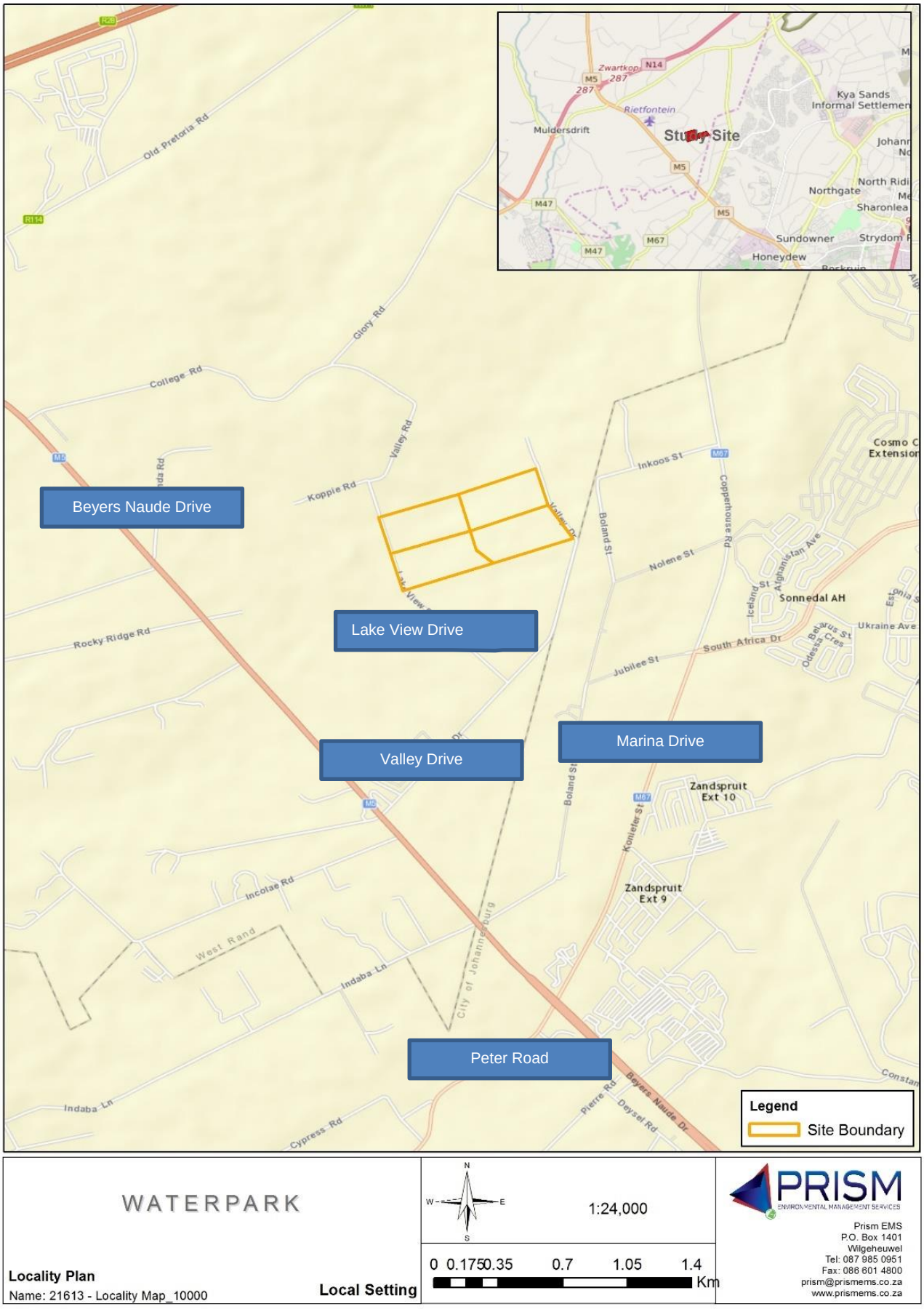


Figure 5-8: Existing Roads Around the Development

There are a number of roads planned through provincial and national road planning processes in the area. These include:

- K31: The 2010 Gauteng Strategic Road Network Planning illustrates the proposed K31 alignment planned on the existing Beyers Naude Drive (M5). The Gauteng Department of Roads and Transport (GDRT) have appointed ILIFA Africa Engineers to undertake a detail design for the proposed K31 alignment. It is planned that K31 be constructed during 2017/2018.
- K56: The 2010 Gauteng Strategic Road Network Planning illustrates the proposed K56 alignment planned approximately 950m west of the intersection of Beyers Naude Drive/Valley Road. It is not known as to when K56 will be constructed. It should be noted that the planned K56 alignment traverses the north eastern portion of the site. The road reserve required for K56 has not yet been expropriated by the GDRT.
- K52: The 2010 Gauteng Strategic Road Network Planning illustrates the proposed K52 alignment planned on the existing R114 which is located approximately 950m west of N14 eastern ramp terminal. It is not known as to when K52 will be constructed. Note that the road reserve required for K52 has not yet been expropriated by the GDRT.
- PWV5: The 2010 Gauteng Strategic Road Network Planning illustrates the proposed PWV5 alignment planned approximately 570m east of Beyers Naude Drive/Marina Street/Peter Road. PWV5 is not expected to be constructed in the near future.

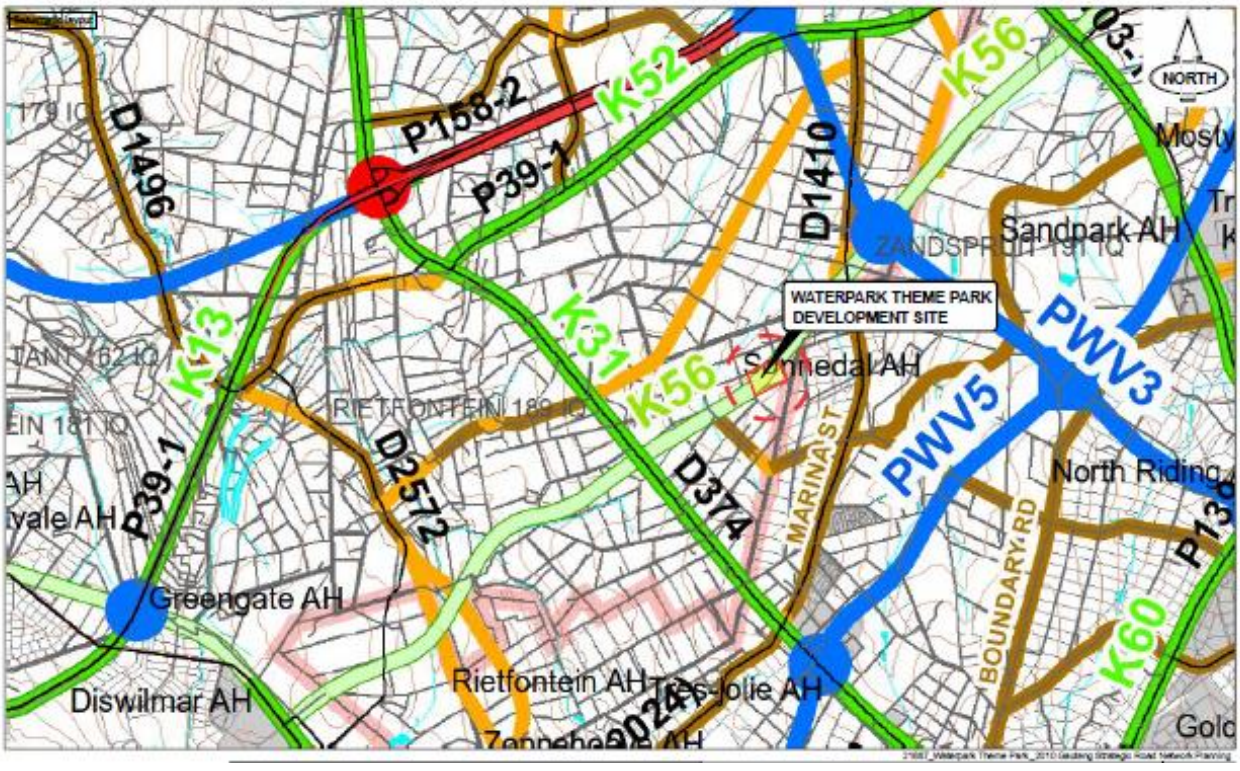


Figure 5-9: 2010 Gauteng Strategic Road Network Planning

5.9 Noise

There are no existing noise factors currently emanating from the proposed site. The surrounding areas are populated by low-density residential areas with small to medium size businesses. Some noise may emanate from the existing wedding and conference facility which is adjacent to the proposed site.

In terms of the baseline noise conditions, the Noise Impact Assessment found that the busy roads in the vicinity of the area (i.e. Beyers Naude Drive) contributed to the prevailing ambient noise levels of the area. In addition, aircraft flying to and from Lanseria airport flew over the study area on a regular basis. There were also animal noises which increased the prevailing noise level on an intermittent basis. The results of the baseline noise survey are provided in Table 5-2.

Table 5-2: Results of the noise survey

Position	Noise levels at the different measuring points in dBA											
	6/10/2016			7/10/2016			15/10/2016			17/10/2016		
	Leq	L_{max}	L_{min}	Leq	L_{max}	L_{min}	Leq	L_{max}	L_{min}	Leq	L_{max}	L_{min}
1	**64.0**	81.2	51.5	**61.0**	80.1	49.9	**61.6**	79.9	50.3	**60.7**	81.6	48.8
2	**58.9**	65.3	55.1	**52.2**	72.7	43.2	**51.3**	65.9	42.4	**55.8**	76.5	43.4
3	**43.7**	62.4	36.5	**44.4**	57.4	30.5	**45.3**	57.5	37.2	**36.5**	64.3	27.8
4	**44.1**	56.5	36.5	**46.5**	60.1	34.2	**47.6**	61.8	33.3	**39.9**	54.7	33.5
5	**39.0**	48.9	34.1	**40.7**	48.1	33.9	**40.8**	63.6	32.2	**37.4**	61.8	31.0
6	**40.2**	54.7	30.3	**54.9**	68.2	45.8	**45.3**	57.5	37.2	**39.5**	51.1	32.6

5.10 Socio-Economic Environment

According to Census 2011, Mogale City Local Municipality has a total population of 820 995 of people, of which 75,6% are black African, 21,0% are white, 0,8% are coloured, and 2,2% are Indian/Asian. Of those aged 20 years and older, 4,0% have completed primary school, 35,0% have some secondary education, 32,6% have completed matric, and 14,2% have some form of higher education (Figure 5-10).

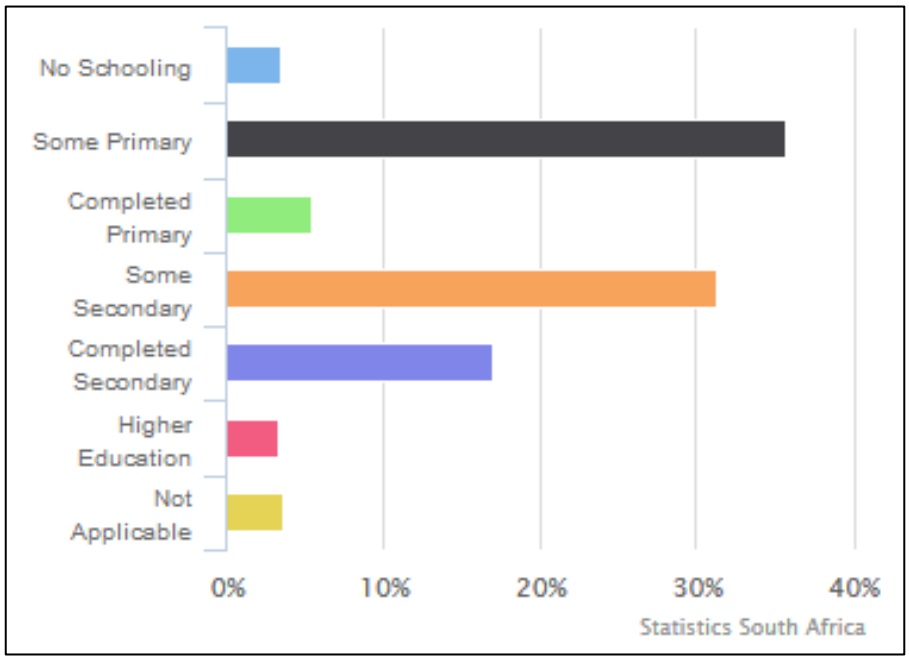


Figure 5-10: Highest level of Education in Mogale City (Statistics South Africa, 2011)

In terms of household number and size, there are 117 373 households in the municipality with an average of 2,9 persons per household. A total of 54,8% households have access to piped water in their dwelling, 32,5% have water in their yard, and only 2,9% households do not have access to piped water. More than 15% of households have no income (Figure 5-11).

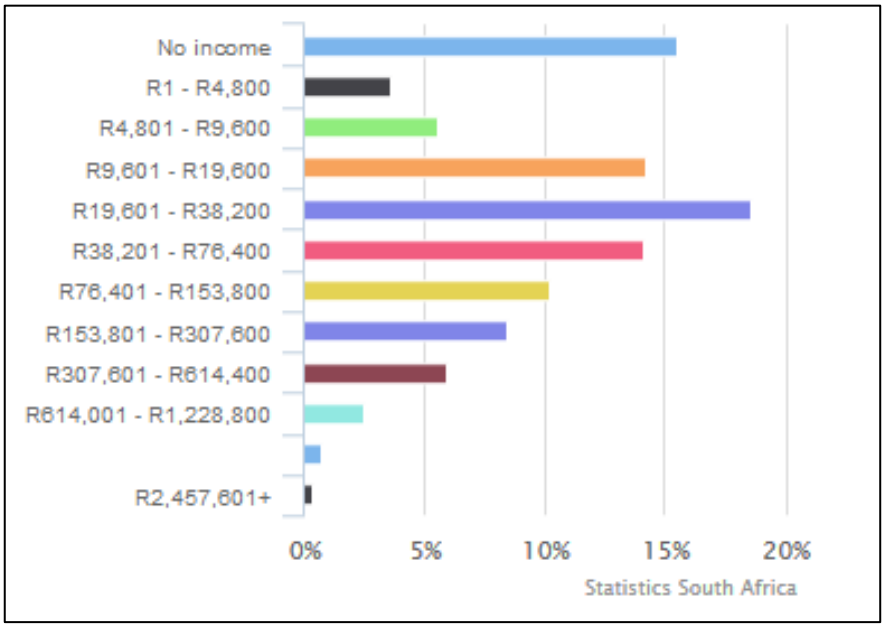


Figure 5-11: Average Household Income (Statistics South Africa, 2011)

In addition, according to Census 2011 data, 134 635 people are economically active (employed or unemployed but looking for work), and of these, 24,6% are unemployed. Of the 60 706 economically active youth (15–34 years) in the area, 32,3% are unemployed (Figure 5-12).

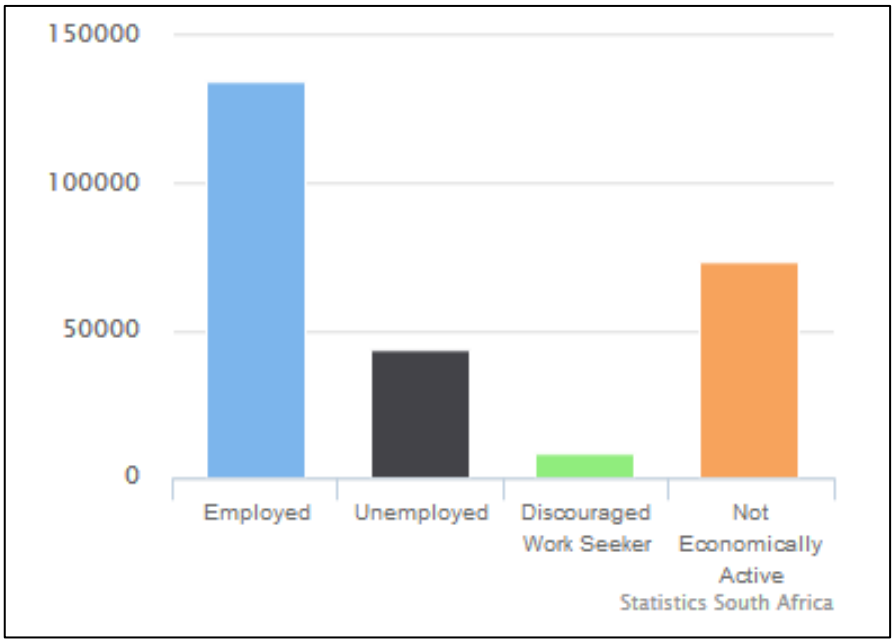


Figure 5-12: Employment for those aged 15-64 (Statistics South Africa, 2011)

5.11 Tourism

According to the MCLM Tourism Strategy Development Plan (DIT 500, 2013), tourism as an internationally traded services sector has become one of the world's major trade categories. Globally the overall tourism income generated exceeded R15 trillion. In addition, tourism trade accounts for more than 30% of the global exports of commercial services. In South Africa, the Direct Contribution of Travel and Tourism to GDP in 2011 was R79.5bn (2.7% of GDP).

Mogale City is situated about 60 km South West of Pretoria, about 40 km North West of Johannesburg, 35km from Sandton City and it is 20 minutes' drive from Lanseria Airport and 50 minutes' drive from O.R. Tambo Airport. The geographical location of Mogale City allows easy access to the major cities like Pretoria, Johannesburg and Rustenburg in the North West Province and thus provides opportunities for tourism.

The MCLM Tourism Strategy Development Plan (DIT 500, 2013) also notes that the area has a strong tourism product base in heritage sites and adventure venues, which are unique in Gauteng and South Africa. There are adequate accommodation facilities to cater for increased tourist volumes in the medium term and there is a high concentration of tourist attractions in Mogale City within the District. The area is also known to have the best wedding venues in Gauteng. In order to increase tourism in the area, the plan identified a number of opportunities. One of these was the concept of a unique theme park, with a water feature similar to Valley of Waves.

5.12 Biodiversity

5.12.1 Threatened Terrestrial Ecosystems

The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN 1002), 9 December 2011). The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value.

The proposed development occurs within the Egoli Granite Grassland which is classified as endangered. According to Mucina and Rutherford (2006), only about 3% of this unit is conserved in statutory reserves and a number of private conservation areas. More than two thirds of the unit have already undergone transformation mostly by urbanisation, cultivation or by building of roads.

It should however be noted that the site is already disturbed and has a large number of exotic trees and vegetation (Figure 5-13).

Figure 5-13: Vegetation on Site

An Ecological Habitat and Threatened Species Assessment was undertaken and found that the study site can be considered to be impacted, both historically and as a result of current land uses. A number of residential homes are located on the portions comprising the study site (mainly Portions 170 and 173). Extensive landscaping characterises the study site, with the exception of portion 169, and comprises a variety of exotic tree species (Oak, Planes, Chestnut etc.). Portion 169 has been fairly heavily grazed and subjected to periodic fires. Four distinct vegetation communities were observed (secondary grassland, wetland, rock outcrop and landscaped gardens dominated by exotic tree species).

5.12.2 Gauteng Conservation Plan

Gauteng Conservation Plan (C-Plan) 3.3. is based on the systematic conservation protocol developed by Margules & Pressey (2000) and is based on the principles of complementarity, efficiency, defensibility and flexibility, irreplaceability, retention, persistence and accountability.

The main purpose of C-Plan 3.3 is to serve as the primary decision support tool for the biodiversity component of the EIA process, to inform protected area expansion and biodiversity stewardship programmes in the province and to serve as a basis for development of Bioregional Plans in municipalities within the province.

According the Gauteng C-Plan, part of the proposed site falls within an Ecological Support Area (ESA). ESAs are an imperative part of C-Plan 3 to ensure sustainability in the long term.

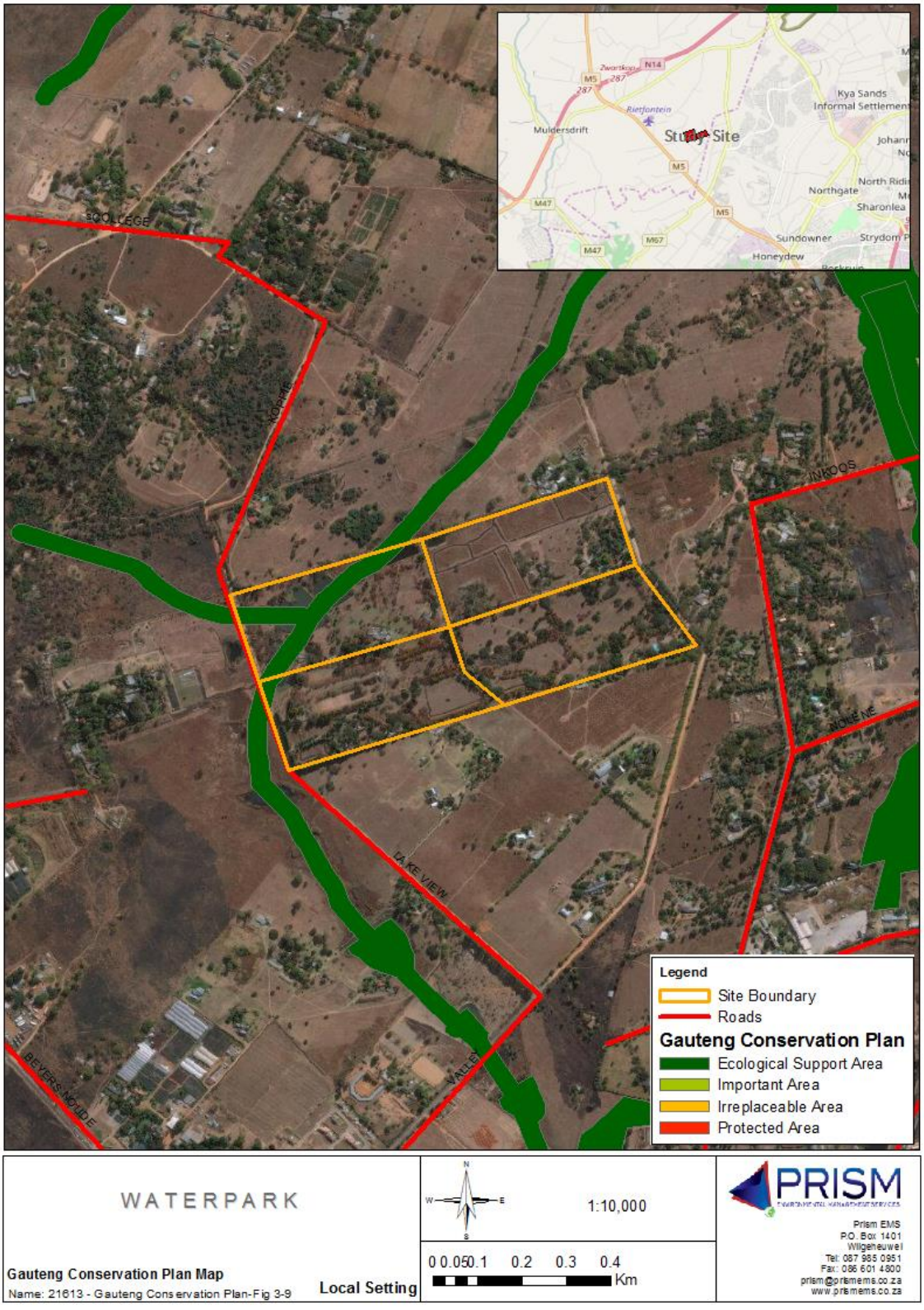


Figure 5-14: Ecological Support Areas

5.12.3 The Gauteng Provincial Environmental Management Framework (GPEMF)

The GPEMF is a legal instrument in terms of the Environmental Management Framework Regulations, 2010. The purpose of the regulations is to assist environmental impact management including EIA processes, spatial planning and sustainable development.

Most of the proposed development site occurs in Zone 1: Urban Development Zone. The intention with this zone is to streamline urban development activities in it and to promote development infill, densification and concentration of urban development, in order to establish a more effective and efficient city region that will minimise urban sprawl into rural areas.

Part of the site around the watercourse does fall within Zone 2 (High control zone within the urban development zone). This zone is sensitive to development activities. Only conservation should be allowed in this zone. Related tourism and recreation activities must be accommodated in areas surrounding this zone.

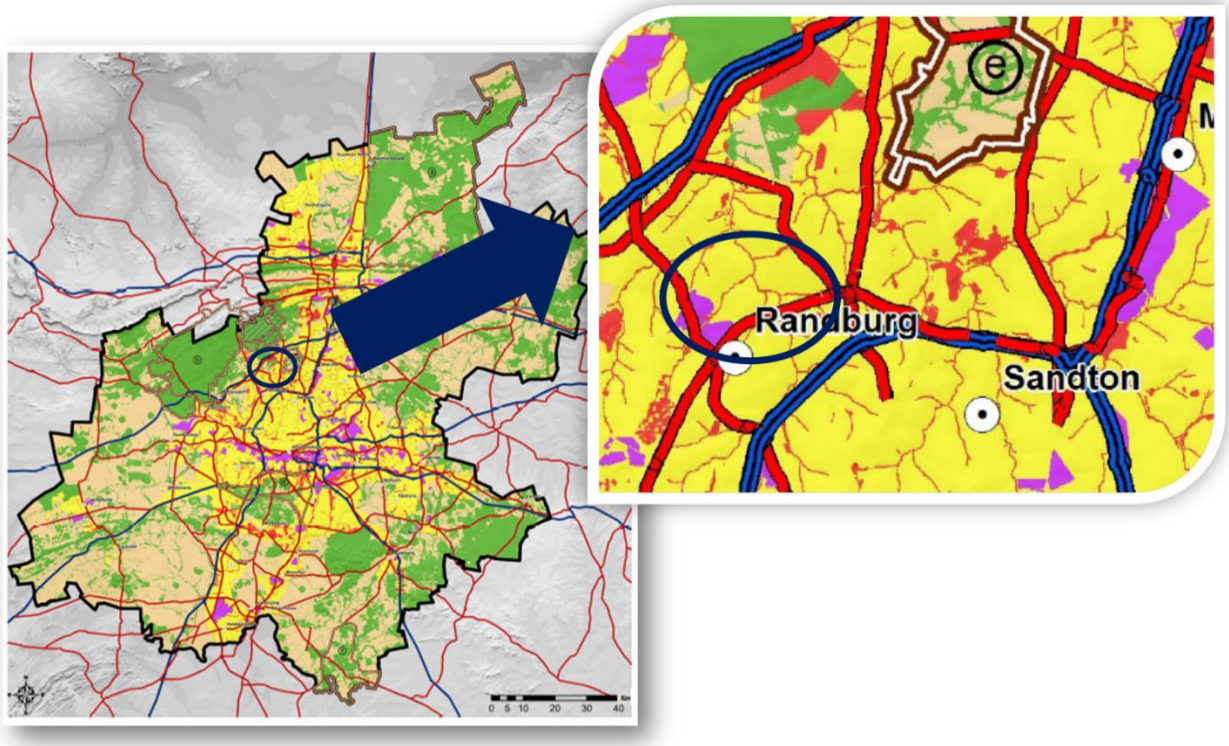


Figure 5-15: GPEMF

5.12.4 Important Bird Areas and Avifauna

The proposed development does not occur within any Important Bird Area (IBA). The closest IBA is the Magaliesburg which is approximately 5km to the west and 4km to the north.

The Ecological Habitat and Threatened Species Assessment found that in terms of avifauna, the bird species recorded on the study were considered diverse. This can be ascribed to the mix of habitats encountered on site; namely the extensive wooded areas, which included both indigenous and introduced tree species, open grassland habitat and presence of water on the study site. However, based on the initial habitat assessment, no listed or species of concern were encountered on the study site during the assessment. This can be ascribed to three main reasons, namely; outside of known range, marginal habitat match or habitat elements missing, prey species limited or absent, human activity etc.

5.12.5 Protected Areas

The proposed development does not fall within a protected area. The closest protected area Cradle of Humankind World Heritage Site which is approximately 15km to the north-west.

5.13 Surface Water

The site falls within Quaternary catchment area A21E, and is part of the new Limpopo Water Management Area (WMA) (previously Crocodile (West) and Marico WMA). A number of dams and a watercourse occur along the north-west corner of the site.

The wetlands indicated in Figure 5-16 are man-made dams associated with the Un-Channelled Valley Bottom Wetland (WP-UCVB). A Wetland Assessment was undertaken and is discussed in more detail in Section 9. However, in summary, it found that the wetland was largely modified due historical damming of the system both up and down stream. The assessment also noted that the wetland could be considered to be ecologically important and sensitive on a local scale. The biodiversity of this wetland is moderate with no red data species recorded. It is not sensitive to flow and habitat modifications. It plays a small role in moderating the quantity and quality of water of major rivers. The system drains into further downstream wetland and streams before reaching major rivers. The Ecological Importance and Sensitivity (EIS) for this system is thus considered to be Low.

In terms of the aquatic environment, the Aquatic Assessment found that there were a number of issues with the water quality at the site. The determinants that did not comply with either or both guidelines were colour, turbidity, clarity, TOC, *E. coli*, aluminium, iron, and manganese.

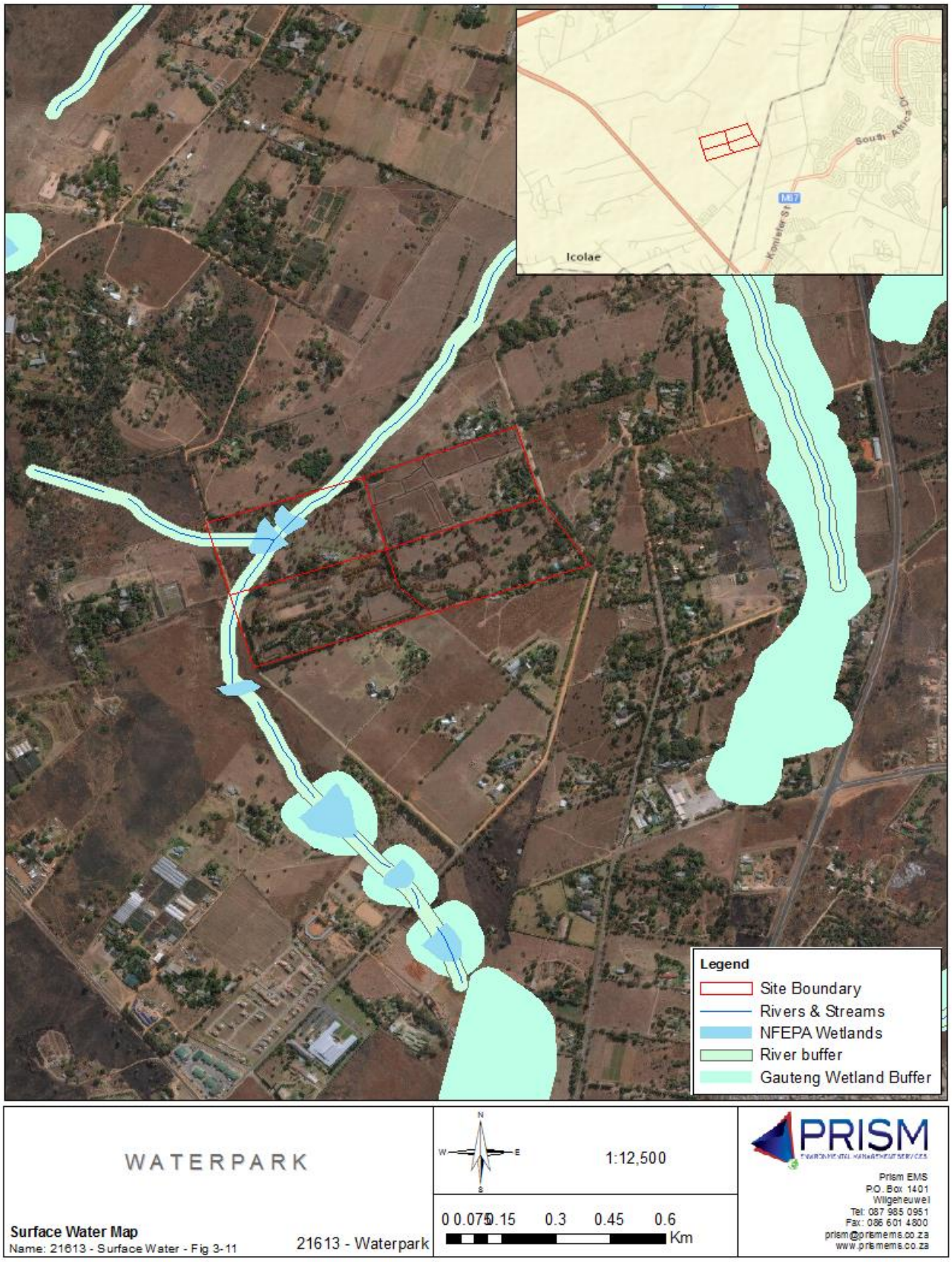


Figure 5-16: Surface Water

5.14 Groundwater

A Hydrogeological Baseline Assessment and 2D Model was undertaken as part of the EIA Process and provided information on the current state of the groundwater resources in the area. A summary is provided below. \

5.14.1 Aquifer System

The study area is underlain by the Johannesburg Dome's mafic and ultramafic plutonic rocks. The Johannesburg Dome rocks can be classified as a fractured hard rock aquifer. Crystalline material, such as the granitic gneiss, typically consist of (a) an unweathered and intact rock matrix with negligible matrix porosity and permeability, and (b) planes of discontinuity in the rock matrix, including both faults and joint planes (collectively referred to as fractures) often infilled by precipitates from late phase fluids (i.e. vein infill). The effective hydraulic conductivity is determined by fractures and openings, i.e. water is generally stored and transmitted in open fractures and fissures.

Fractured crystalline rocks are characterized by extreme heterogeneity in their hydraulic properties and the hydraulic conductivity can vary, within the same rock mass, by orders of magnitude and over short distances. Furthermore, the structural features are also extremely variable in nature with regard to frequency, spatial extent, aperture or interconnectedness within the relatively impervious crystalline rock mass.

According to the Hydrogeological Map (1:500 000) the regional hydrogeology is characterized by an 'intergranular and fractured aquifer'. The fractured aquifer, attributed to the presence of the Johannesburg Dome has a potential yield of 0.5 to 2.0 litres per second. A micro-fractured matrix in these aquifers provides the storage capacity with limited groundwater movements while secondary features such as fractures / faults and bedding planes enhance the groundwater flow. The intergranular aquifer is associated with the river alluvial and quaternary sand deposits.

Based on the aquifer classification map (Parsons and Conrad, 1998), the aquifer system underlying the site study area is regarded a "minor aquifer".

5.14.2 Groundwater Use

Groundwater resources were assessed on a national scale during the Groundwater Resource Assessment Phase II project (GRA II, DWAF 2004b). Based on the GRA II dataset existing use is approximately 0.2 Mm^3/a while the registered use based on the WARMS dataset is 946,950 m^3/a or (0.95 Mm^3/a).

5.14.3 Groundwater Quality

The description of the site-specific groundwater quality is based on the five boreholes sampled during the hydrocensus. These samples were submitted to a SANAS accredited laboratory Waterlab PTY Ltd. in Pretoria. The resulting parameters have been compared against the South African National Standards (SANS:241, 2011) drinking water quality limits, the South African Water Quality Guidelines by the Department of Water Affairs and Forestry (1996) for domestic use and the World Human Organisation

(2011) water quality guidelines. Guideline values have been determined for those chemical components that are considered to have significant potential to harm human health at concentrations above the specified limits.

Based on the results, the local groundwater quality is classified as neutral (pH in the range of 6.9 to 7.5) with generally low Total Dissolved Solids (TDS) contents ranging from around 200 to 264 mg/l. Other analysed inorganic chemical parameters are either below detection limit or within acceptable limits for human consumption.

5.15 Archaeology and Cultural Heritage

The presence and distribution of heritage resources define a 'heritage landscape'. In this landscape, every undisturbed sites are relevant and in addition, because heritage resources are non-renewable, heritage surveys need to investigate an entire project area, or a representative sample, depending on the nature of the project.

In terms of Mogale City, heritage is an important consideration as there are numerous important heritage sites throughout the area including site such as Sterkfontein, Swartkrans, Kromdraai within the Cradle of Humankind which was listed as a World Heritage Site in 1999. There are however no known sites occurring on the proposed development site.

In addition, the South African Heritage Resources Information System (SAHRIS) has instituted a PalaeoMap which indicates sites which may have palaeontological sensitivity. The proposed site occurs in an area which is zoned as 'insignificant' and thus no palaeontological study is required.

An AIA was undertaken to determine whether heritage resources would be impacted upon by the proposed development and provided an overview of the historical background of the area:

The AIA noted that the study is located not too far from the vicinity of the Melville Koppies, which is a Middle Stone-Age site. (Bergh 1999: 4) This area was also important to Iron Age communities, since these people had smelted and worked iron ore at the Melville Koppies site since the year 1060, by approximation. (Bergh 1999: 7, 87).

The Difaqane (Sotho), or Mfekane ("the crushing" in Nguni) was a time of bloody upheavals in Natal and on the Highveld, which occurred around the early 1820's until the late 1830's. (Bergh 1999: 10) It came about in response to heightened competition for land and trade, and caused population groups like gun-carrying Griquas and Shaka's Zulus to attack other tribes. (Bergh 1999: 14; 116-119) It seems that, in 1827, Mzilikazi's Ndebele started moving through the area where Johannesburg is located today. This group went on raids to various other areas in order to expand their area of influence. (Bergh 1999: 11).

During the time of the Difaqane, a northwards migration of white settlers from the Cape was also taking place. Some travellers, missionaries and adventurers had gone on expeditions to the northern areas in South Africa, some already as early as the 1720's.

It was however only by the late 1820's that a mass-movement of Dutch speaking people in the Cape Colony started advancing into the northern areas. This was due to feelings of mounting dissatisfaction caused by economical and other circumstances in the Cape. This movement later became known as the Great Trek. This migration resulted in a massive increase in the extent of that proportion of modern South Africa dominated by people of European descent. (Ross 2002: 39) By 1939 to 1940, farm boundaries were drawn up in an area that includes the present-day Johannesburg and Krugersdorp (Bergh 1999: 15).

The area has several significant historical sites. One of the most attractive buildings is the civic centre. The Earl of Selbourne, High Commissioner of the Transvaal and Orange Free State, unveiled the foundation stone of the original building in 1907. The JG Strijdom arch bust, designed by JH Labuschagne, was unveiled on 16 December 1966 by Susan Strijdom. It stands on gold-bearing rock. The arch was designed by T Pitout. Another interesting feature is the first stone of the cenotaph that was laid on 20 May 1922. It was unveiled by Sir Abe Bailey on 15 July 1922. The names of those who died in action during the World Wars were added in 1975.

More than 800 women and children were buried in the Concentration Camp Cemetery during the Boer War. The Memorial Avenue, which runs from Paardekraal to the hospital, commemorates those who died during the First World War. Several monuments are found in the area and include amongst others the Old Station Building, Voortrekkerpad Monument, Town Hall, Old Magistrate's Court Building, Paardekraal Monument, JG Strijdom Bust, Paul Kruger Statue, The Blockhouse, and The Concentration Camp.

6 NEED AND DESIRABILITY

In terms of Section 2 (f) of Appendix 2 of GN 921 of 4 December 2014, this section discusses the need and desirability of the project. The format contained in the Guideline on Need and Desirability (DEA&DP, 2009) has been used in Table 6-1.

However, in summary, there is a need for active recreation facilities in Gauteng. In addition, the proposed development is in line with the MCLM Tourism Strategy Development Plan (DIT 500, 2013) which identified the concept of a unique theme park, with a water feature similar to Valley of Waves as an opportunity to increase tourism in the area.

The location of the application site ensures that it can be considered accessible presently and in the future. It is very accessible from Road 374 [K31] whilst the future Road K56 will assist to provide additional access to the development in the future. This road should have access to the local areas every 600 m.

In terms of the "Precinct Plan for The Muldersdrift Development Zone, 2011" the properties are located in a "High Density Residential Development Zone" where high density residential, limited retail and social and community facilities are preferred. However, urban support facilities and uses related to the hospitality and tourism industry will also be supported in this development zone. This implies that the proposed development is in line with the development proposals for the area and can be supported. Also, work opportunities are urgently required for the population that is growing fast in the nearby areas in Mogale City and the region.

In terms of the desirability of the development on the proposed site, the following can be noted:

- The development will be situated on the periphery of the urban development in the area on a site that is large enough to be developed for the proposed water park.
- The proposed development is in line with the "Precinct Plan" for the area.
- The site to be developed already contains several houses, buildings, and facilities of which most will be retained. It will be utilized for purposes directly related to the water park.
- Trees have been planted over the whole of the site giving it a special character and the trees will be retained as far as possible.
- The wooded character of the site screens it from outside view and will also screen the proposed development.
- The required infrastructure already serves the existing development on the properties and can be utilized in the further development which will be "green" as far as possible.
- The site can be accessed from 2 sides and a collector road connects it to Beyers Naude Drive. It is therefore, accessible from its service area.
- The proposed water park will provide work opportunities to persons living in the area.
- The development will be based on existing examples overseas which are successful. Standards will be adapted to conform to local Municipal standards.

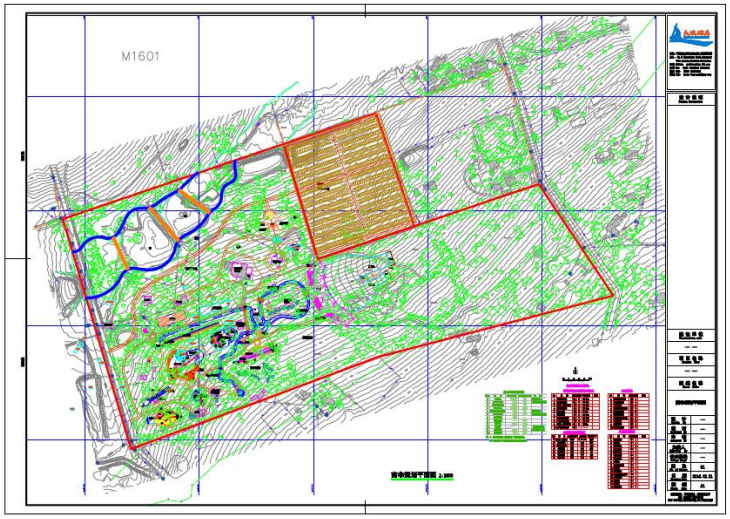
- It is expected that the development will broaden the tourism basis in the area and many other facilities may be stimulated by the development.
- The development will be undertaken under the control and supervision of a professional team ensuring that all the applicable standards will be met.
- The area lacks a facility for active recreation for the surrounding residential areas in Mogale City and the other Municipalities.

Table 6-1: Need and Desirability

No.	Question	Response
NEED ('timing')		
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority? (i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP).	Yes, the proposed aims to increase tourism in the area which is in line with the 2016 – 2021 MCLM IDP. It also falls within the urban development zone in the MCLM SDF. As mentioned above, in terms of the "Precinct Plan For The Muldersdrift Development Zone, 2011" the properties are located in a "High Density Residential Development Zone" where high density residential, limited retail and social and community facilities are preferred. However, urban support facilities and uses related to the hospitality and tourism industry will also be supported in this development zone. This implies that the proposed development is in line with the development proposals for the area and can be supported.
2.	Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?	Yes, the proposed development aims to provide recreational facilities in the area. It will also result in substantial investment in the area which will have economic benefits in the area. It will also provide a number of employment opportunities which are required in the area.
3.	Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority, but within a	Yes, tourism development is a focus in the MCLM IDP. Further, the MCLM Tourism Strategy Development Plan (DIT 500, 2013) identified the concept of a unique theme park, with a water feature similar to Valley of Waves as an opportunity to increase tourism in the area. In addition, tourism is a national priority and contributes significantly to economic development. The national tourism sector strategy provides a blueprint for the

No.	Question	Response
	specific local context it could be inappropriate)	sector to meet the growth targets contained in the new growth path.
4.	Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	An Outline Scheme Report has been compiled and has informed the proposed development. Where necessary services infrastructure will be put in place and will link to existing municipal services. A sewerage package plant will be put in place to deal with sewerage and to treat grey and brown water for reuse.
5.	Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services)?	The proposed development is not planned for by the MCLM but is in line with their initiates. An Outline Scheme Report has been compiled and has informed the proposed development. Where necessary services infrastructure will be put in place and will link to existing municipal services. A sewerage package plant will be put in place to deal with sewerage and to treat grey and brown water for reuse.
6.	Is this project part of a national programme to address an issue of national concern or importance?	The proposed development is not part of a national plan however as mentioned above, the proposed development is in line with local, provincial and national strategies to increase tourism development in the country.
DESIRABILITY ('placing')		
7.	Is the development the best practicable environmental option (BPEO) for this land/site?	In line with this, the recommendations of specialists, technical considerations and the concept of the BPEO, the recommended alternatives are as follows: • Alternative Layout 2; and • Treatment Alternative 2 (AM Biorotor BR4000). Alternative Layout 2 was selected for the following reasons: • The wetland delineation and wetland buffer have been taken into account in the layout; • The ESA area has been incorporated into the layout; and • The requirements of the Traffic Impact Assessment in terms of parking and access to the site are taken into account.

No.	Question	Response
		Treatment Alternative 2 was selected for the following reasons: • The AM Biorotor BR4000 inhibits the settled effluent from becoming anaerobic, which prevents malodour. • The AM Biorotor unit is covered which decreases noise. • The AM Biorotor unit includes an "Aerotor" which treats the effluent by a combination of "Active Aeration" and "Passive Contact" which results in very high treatment rates per area. The treatment sections are composed of drums with a very large surface area inside. The effluent is drawn in via holes in its periphery. Once inside it passes through the maze of surfaces. The combined effect of being actively mixed with air and passing over the bacterial surfaces provides an exceptionally efficient and robust treatment. • The AM Biorotor unit has built in sludge Storage at base of the units with approximately 12 weeks capacity provided. Desludging is carried out by 3rd party contractor suction-tanker and taken to a registered disposal facility. • The AM Biorotor is simple to operate and maintain and is therefore less likely to have incidents or spills. • The AM Biorotor has a low power consumption per cubic meter of sewage. • The AM Biorotor buried to deck level with locked lids and is therefore aesthetically more appealing than an alternative method or system. Based on the above, the proposed layout for the Water Park Development is provided in Figure 6-1.

No.	Question	Response
		 **Figure 6-1: Layout Diagram for BPEO for the Water Park Development** (Please refer to Section 14.3 for an A3 copy of the preferred alternative)
8.	Would the approval of this application compromise the integrity of the existing approved municipal IDP and Spatial Development Framework (SDF) as agreed to by the relevant authorities?	No, it is not anticipated that the proposed project will contradict or be in conflict with the municipal IDPs and SDFs as in both documents, as the proposed site occurs with the urban development zone. In addition, the proposed aims to increase tourism in the area which is in line with the 2016 – 2021 MCLM IDP. In terms of the "Precinct Plan For The Muldersdrift Development Zone, 2011" the properties are located in a "High Density Residential Development Zone" where high density residential, limited retail and social and community facilities are preferred. However, urban support facilities and uses related to the hospitality and tourism industry will also be supported in this development zone. This implies that the proposed development is in line with the development proposals for the area and can be supported.
9.	Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?	In terms of the GPEMF, the site occurs in Zone 1 and 2 and would thus not compromise the integrity of the EMF. In addition, a detailed impact assessment has been undertaken and is included in Section 10 below. The findings of the impact assessment indicate that the approval of the development would not have any significant negative impacts that cannot be satisfactorily mitigated.

No.	Question	Response
10.	Do location factors favour this land use (associated with the activity applied for) at this place? (this relates to the contextualisation of the proposed land use on this site within its broader context).	Yes, the proposed development is easily accessible. It will be situated on the periphery of the urban development in the area on a site that is large enough to be developed for the proposed water park. Furthermore, the development is in line with the "Precinct Plan" for the area and the proposed site already contains several houses, buildings, and facilities of which most will be retained. It will be utilized for purposes directly related to the water park.
11.	How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?	A detailed impact assessment has been undertaken and is included in Section 10 below. The findings of the impact assessment indicate due to the fact that the sensitive features (such as the ESA and wetland) will be conserved, the impact will not be significant.
12.	How will the development impact on people's health and wellbeing (e.g. i.t.o. noise, odours, visual character and sense of place, etc)?	A detailed impact assessment has been undertaken and is included in Section 10 below. The findings of the impact assessment indicate that potentially significant impacts such as noise and visual impacts can be mitigated through the use of walls, embankments and screening. A dedicated EMPr for the proposed has been compiled and is included in Section 14.8.
13	Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	The proposed development will not result in any unacceptable opportunity costs. In most cases, all impacts can be reversed if necessary and will be mitigated through the implementation of the project EMPr.
14	Will the proposed land use result in unacceptable cumulative impacts?	A detailed impact assessment has been undertaken and is included in Section 10 below. The impact assessment considers cumulative impacts. However, as the impacts associated with the development can be mitigated satisfactorily, cumulative impacts can be managed through the implementation of the project EMPr.

A number of I&APs have raised concerns regarding the viability/need and desirability of the proposed project. A copy of the business plan, feasibility assessment and labour plan for the development has therefore been appended to Section 14.9.

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7 ALTERNATIVES

According to the 2014 EIA Regulations, alternatives are defined as:

> *"Different means of meeting the general purpose and requirements of the activity, which may include alternatives to the-*
>
> *(a) property on which or location where the activity is proposed to be undertaken;*
>
> *(b) type of activity to be undertaken;*
>
> *(c) design or layout of the activity;*
>
> *(d) technology to be used in the activity; or*
>
> *(e) operational aspects of the activity;*
>
> *and includes the option of not implementing the activity"*

In line with the Regulations, a number of alternatives have been assessed for the proposed development. These include:

- Layout alternatives;
- Technology Alternatives; and
- The No -Go Option.

More information on each of these alternatives is provided below.

7.1 Layout Alternatives

Two layout alternatives have been developed. The first of these focused only on the development of Portion 170, 173 and 174 of Farm Rietfontein 189 IQ and included parking on and along the watercourses to the north of the properties (Figure 7-1).

With this alternative, access to the site is through the existing watercourse and the entrance facilities are in close proximity to the watercourse.

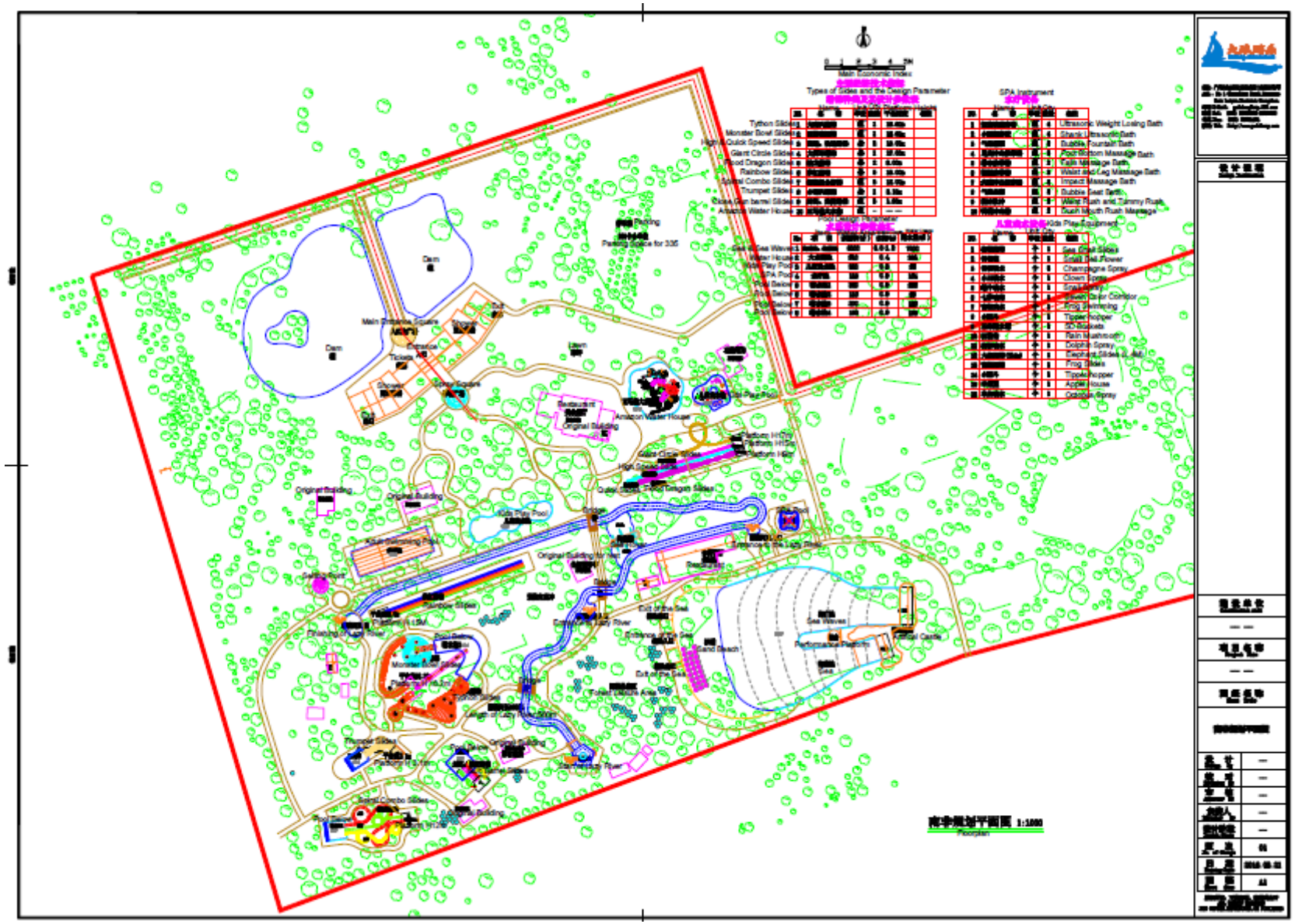


Figure 7-1: Layout Alternative 1

Layout Alternative 2 in contrast included the development of Portion 169 in addition to Portion 170, 173 and 174 of Farm Rieftfontein 189 IQ.

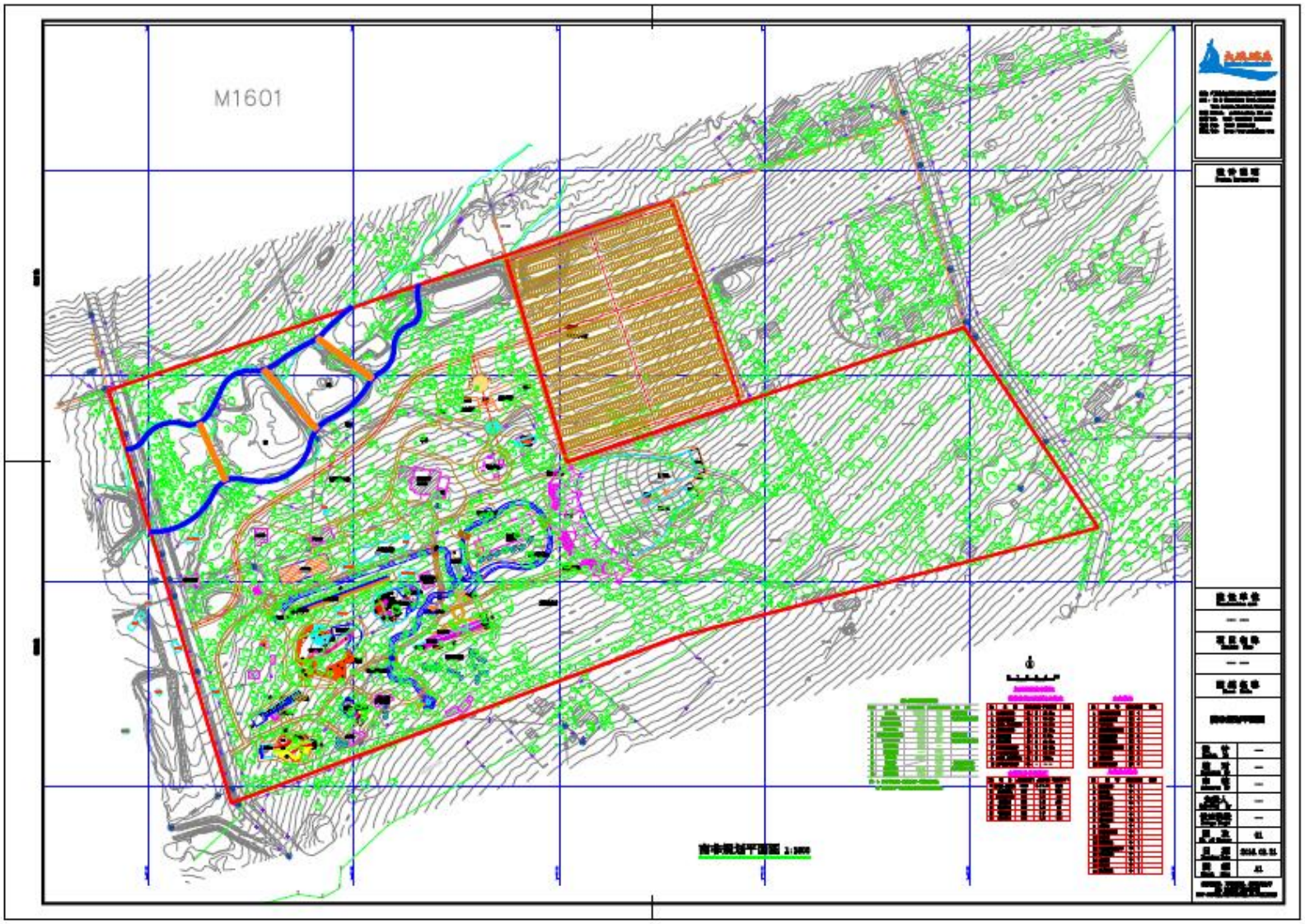


Figure 7-2: Layout Alternative 2

In this alternative, a parking area will be developed on Portion 169 leaving the existing dams and watercourse along the north of the properties intact as shown in Figure 7-2. In addition, with layout alternative 2, there is a dedicated entry and exist road for improved safety. The entry point and internal road is outside the 1:100 year floodline of the existing dams on site.

7.2 Technology Alternatives

As mentioned, a sewerage package plant is required on site to treat wastewater to acceptable levels for irrigation of the landscaped areas. Two potential alternatives are being assessed:

- MBBR Maxi SewaPak; and
- AM Biorotor BR4000.

Treatment Alternative 1 consists of the MBBR Maxi SewaPak. With this option, sewage is fed into the container from a constructed equalization tank, with Pre Screen area. From the equalization tank area, the sewage is pumped to the treatment plant.

The Maxi Plant consists of the following units:

- Two moving bed bioreactors in series where a sludge return pump feeds a small quantity of sludge back to the first reactor tank on a periodic basis. The reactor is filled with a large surface area plastic biomedia and has an overflow screen at the upper liquid level and into the second reactor.
- A clarifier - The inclined plate clarifier receives effluent from the second bioreactor and separates the sludge from the clear water. The sludge accumulates at the bottom of the inner cone and the clear water flows over the launder channel and out to a relay tank. The clarifier is drained via a valve at the base, and pumped via solids separation cyclone on a timer basis to an outside sludge tank on a preset time basis.
- An optional sterilising system using chlorine kills any bacteria in the effluent as it passes through on the discharge pipe. Ultra Violet sterilisation is also available.
- Normally the settled water is then filtered through a tertiary filtration process for further quality improvement. This is an option and is subject to the client's requirements.

Treatment Alternative 2 is the AM Biorotor BR4000. With this option, the effluent will flow to a Balance Tank (or equalisation tank) as the peak flow is too high to go directly to a treatment plant. The Balance Tank can either be constructed as part of the AM BIOROTOR or can be a separate unit that can be buried. The Balance/ Septic Tank is fitted with duty and standby submersible pumps. The effluent will be pumped into a single BR4000 Blivet all-in-one package sewage treatment plant/s. From the Blivet the treated effluent is disinfected in a flow proportional chlorinator and then flows through a 30minute contact tank. It can then be discharged for irrigation or to a storage tank. If in future, there is an increase in the loads then one or more additional units can be installed in parallel (Figure 7-3).

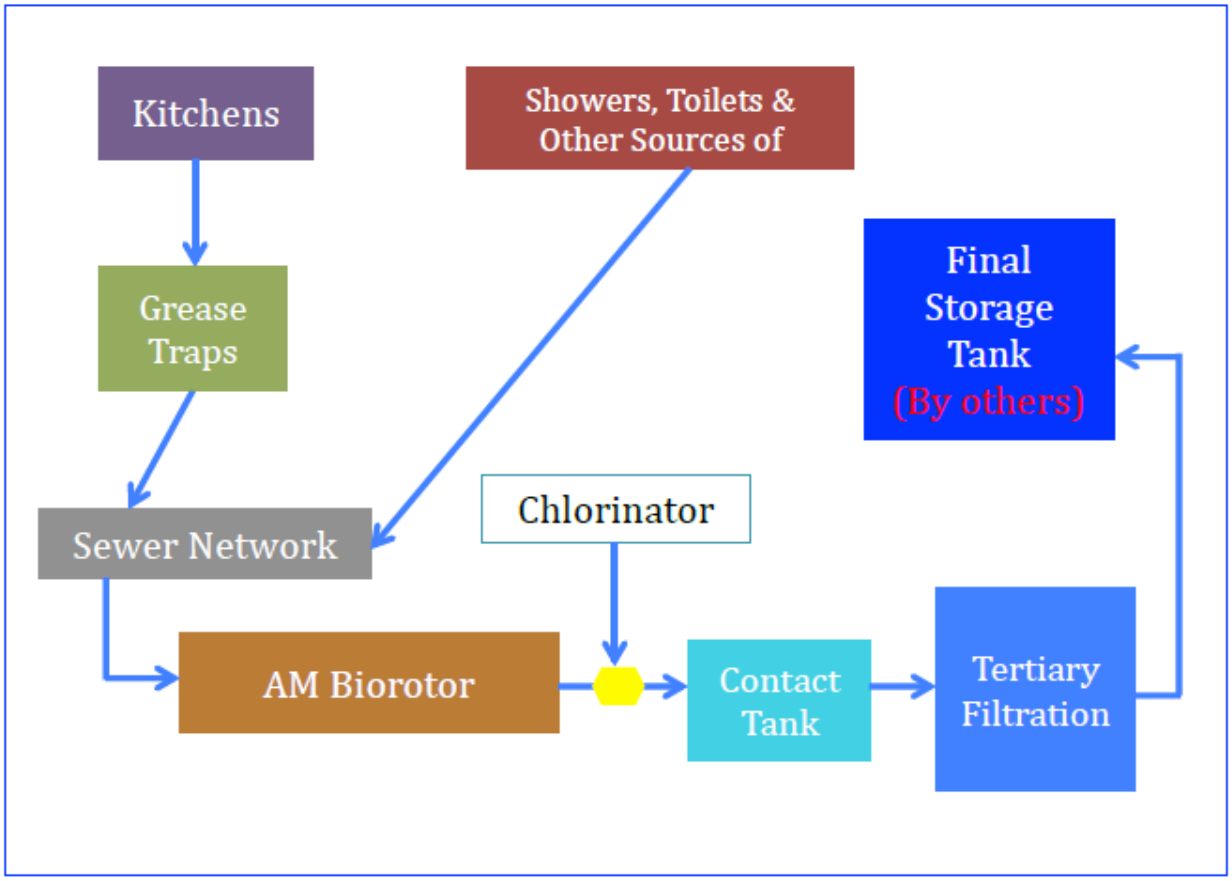


Figure 7-3: AM Biorotor BR4000 process

The AM BIOROTOR BR4000 is made up of the following units:

- Tertiary Filtration plant;
- Chlorinator;
- Chlorine contact tank (2.5 m^3); and
- Grease Traps AM OG50.

The unit is highly compact and utilises Lamella Plates in both the Primary and Secondary Zones along with the “Aerotor” results in a very compact unit. The Parallel plates reduce the settlement zones to approximately one quarter the required area of normal sedimentation tanks. The "Aerotor" treats the effluent by a combination of "Active Aeration" and "Passive Contact" which results in very high treatment rates per area required. Sludge storage is also provided in the base of each unit.

In addition, as the AM Bio Rotor utilises a combination of two types of treatment systems, "Active Aeration" (similar to activated sludge) and "Passive Contact" (similar to filter media/RBC systems) treatment. The treatment sections are composed of drums with a very large surface area inside. The effluent is drawn in via holes in its periphery. Once inside it passes through the maze of surfaces. The combined effect of being actively mixed with air and passing over the bacterial surfaces provides an exceptionally efficient and robust treatment. The unit is also unobtrusive aesthetically more appealing than an alternative method or system.

It is also simple to operate and has simple maintenance functions. Lastly, it has low power consumption per cubic meter of sewage.

7.3 No-go Option

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the project is included in the evaluation of the alternatives.

The main implication of the No Go Option is that should the development not proceed, there will be a loss of the economic benefits of the investment of approximately R340 million in the area. There will also be a loss of the 400 construction related employment opportunities and 550 operation related employment opportunities.

8 PUBLIC PARTICIPATION

8.1 Objectives and Purpose of Public Participation

The purpose of the public participation process is to provide information regarding the proposed project to any potentially interested and/or affected person for use and consideration throughout the environmental assessment process. The information usually involves a combination of the technical project scope, environmental attributes and sensitives, cultural and heritage aspects as well as socio-economic factors that may be potentially beneficial or problematic to various role players.

The dissemination of such information is intended to assist the public with understanding how the proposed project and/or development may impact them and the environment in either a positive and/or negative manner, and especially where impacts are determined or perceived as significantly high, how such impacts may be influenced by project changes (layout or design aspects) or management measures may be implemented to reduce or minimise the significance of any identified impacts.

As a registered I&AP, members of the public of any affiliation are awarded the opportunity to remain informed of the steps, actions and decisions made within the environmental impact assessment process and are able to actively participate by reviewing all information provided by the EAP to the I&AP's in a reasonable period in order to provide comments, objections, suggestions or any other information that will assist the project to develop in a favourable for all manner or contribute to the competent authority's knowledge in order to make an informed decision on the application for environmental authorisation.

8.2 Initial Notification

The public participation process commenced with identifying and notifying all potential Interested and Affected Parties (I&AP's). Background information documents and comment forms were provided as a basic source of information or notices were viewed and potential interested and/or affected members of the public were invited to register as I&AP's for the remainder of the Scoping and Environmental Impact Reporting phases of the process (refer to Section 8.3 and Section 8.4). All public participation was

conducted in English as it is the first language of 50% of the surrounding communities according to Stats South Africa.

8.2.1 Identified I&AP's

The following potential I&AP's were identified:

- Department of Water and Sanitation (DWS);
- MCLM: Environmental Planning and Coordination;
- MCLM: Department of Infrastructure;
- MCLM: Department of Planning;
- MCLM: Department of Roads and Transport;
- Ward Councillor 23 and 33;
- GDARD;
- Surrounding Landowners / Occupiers; and
- Surrounding businesses.

Refer to Section 14.5.1 for a detailed list of the interested and/or affected members of the public that were notified and/or subsequently registered as an I&AP.

8.2.2 Newspaper Notice

A notice was published in the Cosmo City Chronicle on the 12th April 2016. An overview of the distribution range of the newspaper is provided in Figure 8-1 and shows that it includes the general area in which the proposed development occurs (shown as a red circle).

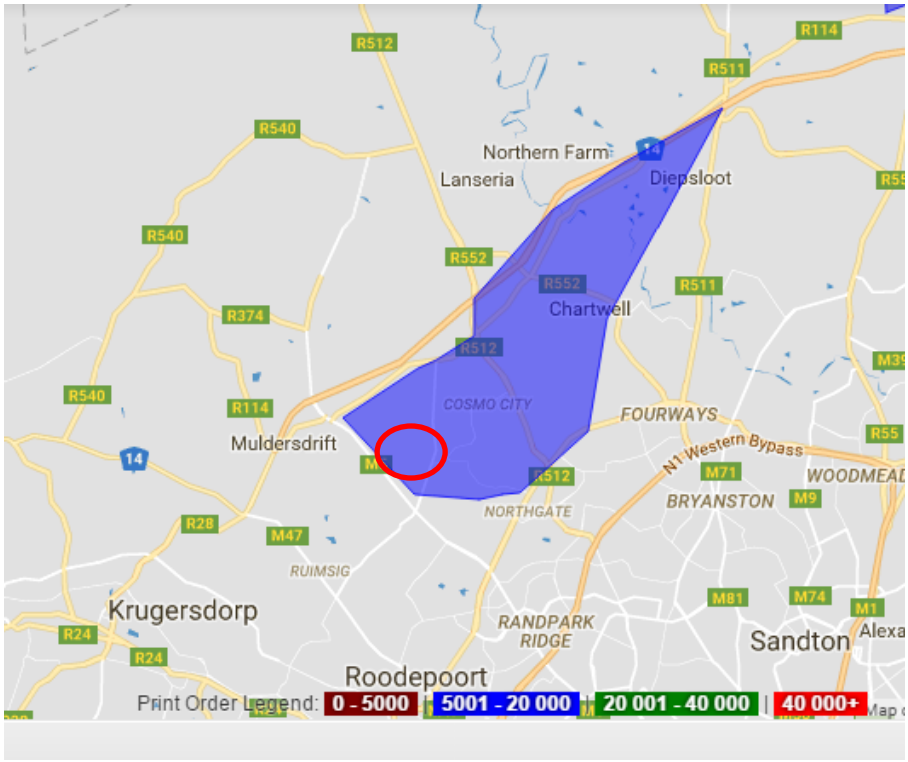


Figure 8-1: Cosmo City Chronicle Distribution range

Refer to Section 14.5.2.1 for proof of the initial newspaper notice.

8.2.3 Site Notice

Three site notices were placed around the proposed development site at the following locations:

- Outside of Portion 169 of Farm Rietfontein 189 IQ;
- Outside of Portion 173 of Farm Rietfontein 189 IQ; and
- Outside of Portion 174 of Farm Rietfontein 189 IQ.

Refer to Section 14.5.2.2 for proof of the notices placed on site during the initial notification.

8.2.4 Written Notifications

The surrounding landowners and/or occupiers and organs of state (listed in Section 14.5.1) were notified in writing via email or hand delivery and were issued with a copy of the Background Information Document (BID) to provide further information on the project. A copy of the initial BID is provided in Section 14.5.2.3.

Refer to Section 14.5.2.4 for proof of the Written Notifications and hand delivery of BIDs as part of initial notification.

8.2.5 Comments Raised by I&AP's during Initial Notification

As part of the initial notification/registration period, a number of comments were received and helped shape the subsequent Scoping Phase. Comments were included in the Comments and Response Report. In addition, all I&APs who commented or registered were added to the Registered I&APs Database. Copies of comments received during the initial registration period are included in Section 14.5.6.1.

8.3 Scoping Phase Public Participation

8.3.1 Public Review of the Scoping Report

Email notification was sent to all registered I&APs on the I&AP Database notifying them of the review of the Scoping Report on 27 September 2016. Proof of notification is appended in Section 14.5.3.1. A copy of the Scoping Report was uploaded to Dropbox and a link to download this electronic version was included in the notification email. In addition, a hard copy of the Scoping Report was made available at the project site. A 30-day public review period was provided between **27 September 2016 and 27 October 2016**.

8.3.2 Authority Review of the Scoping Report

In addition to the public review, copies of the Scoping Report were also provided to key commenting and/or decision-making authorities. These included:

- GDARD;
- DWS;
- MCLM; and
- Gauteng Provincial Department of Roads and Transport (GPDRT).

In addition, a copy of the Scoping Report was uploaded onto the South African Heritage Resources Information System (SAHRIS) to provide the Provincial Heritage Resources Agency-Gauteng (PHRA-G) an opportunity to comment on the Scoping Report.

Proof of delivery to authorities is included in Section 14.5.3.2.

A 30-day review period was provided between **27 September 2016 and 27 October 2016**.

8.3.3 Update of the Comments and Responses Report

All comments received during this period from authorities and the public were added to the Comments and Responses Report and included in the Scoping Report which was submitted to GDARD (contained in Section 14.5.5). Comments received after the submission of the Scoping Report are also included in the Comments and Responses Report. Copies of all comments received are included in Section 14.5.6.2.

In addition, some comments were received after the Scoping Report was submitted to GDARD. These comments are included in Section 14.5.6.3. and have been added to the comments and responses report.

8.4 EIA Phase Public Participation

8.4.1 Public Review of the EIA Report

Email notification was sent to all registered I&APs on the I&AP Database notifying them of the review of the EIA Report. A copy of the EIA Report was uploaded to Dropbox and a link to download this electronic version was included in the notification email. In addition, a hard copy of the EIA Report was made available at the project site. A 30-day public review period was provided between **12 January 2017 and 13 February 2017.** Proof of notification of registered I&APs is included in Section 14.5.4.3.

8.4.2 Advert and Site Notices

In addition, in order to ensure that all potential I&APs were aware of the review of the EIA Report and due to changes in the listed activities, a second advert was placed in the Cosmo City Chronicle on 12 January 2017. Two site notices were also placed around the site. Proof of the advert and site notices are included in Section 14.5.4.1. and Section 14.5.4.2 respectively.

8.4.3 Authority Review of the EIA Report

In addition to the public review, copies of the EIA Report were also provided to key commenting and/or decision-making authorities. These included:

- GDARD;
- DWS;
- MCLM; and
- GPDRT.

In addition, a copy of the EIA Report and AIA was uploaded onto the SAHRIS to provide the PHRA-G an opportunity to comment on the EIA Report.

Proof of delivery to authorities is included in Section 14.5.4.4.

A 30-day review period was provided between **12 January 2017 and 13 February 2017.**

8.5 Updated EIA Report and GDARD Decision

All comments received during the comment period discussed above will be considered and incorporated into the EIA Report and documented in the Comments and Response Report.

The EIA Report will then be submitted to GDARD for decision.

8.6 Outcome of the Decision

Registered I&AP's will be notified in writing of the outcome of the Department's decision within 12 days of the decision. The notification will include details of the process and timeframes in which to appeal the outcome of the decision made by the competent authority, GDARD.

8.7 Timeframes

An overview of the Scoping and EIA process undertaken to date is provided in Table 8-1.

Table 8-1: Proposed timeframes for the EIA process.

Responsible Role Player	Milestone Tasks	Required Time Period	Proposed Timeframes	Status
Application Phase				
PPP	Written, Newspaper, Site Notices & BID's	30 days	12 April 2016 – 12 May 2016	✓
EAP	Submit Application for EA	N/A	21 September 2016	✓
GDARD	Accept/Acknowledge Application for EA	10 days	22 September 2016	✓
Scoping Phase				
EAP	Compile SR	N/A	September 2016	✓
PPP	I&AP Comment Period on SR	30 days	27 September 2016 – 27 October 2016	✓
EAP	Review / Incorporate Comments	2 days	27 October 2016 - 31 October 2016	✓
GDARD	Review SR	43 days	October -November 2016	✓
Impact Assessment Phase				
Specialists	Ecology, Aquatic, Wetland, HIA, Noise	N/A	During appropriate season	✓
EAP	Compile EIA Report	N/A	November - December 2016	✓
PPP	I&AP Comment on EIA Report	30 days	January 2017 – February 2017	**In progress**
EAP	Review / Incorporate Comments	2 days	February 2017	✗

GDARD	Review EIA Report and Provide Decision	106 days	February 2017 – April 2017	✘
PPP	Notification of Decision / Appeal		12 days after decision is provided	✘

9 SUMMARY OF SPECIALIST STUDIES

One of the most important aspects of the Scoping Phase was the identification of specialist studies required for the EIA Phase.

The Specialist Studies triggered (*a trigger is "a particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an issue and/or potentially significant impact associated with that proposed development that may require specialist input*") included the following:

- Ecological Habitat and Threatened Species Assessment;
- Wetland Delineation Assessment;
- Aquatic Impact Assessment;
- Hydrogeological Baseline Assessment and 2D Model;
- AIA; and
- Noise Impact Assessment.

In addition, the following technical studies were also undertaken and have also been used to inform the EIA Report:

- Outline Scheme Report (including Stormwater Management Plan);
- Traffic Impact Assessment; and
- Geotechnical Assessment.

The *Guideline for the review of specialist input in EIA processes (Keatimilwe & Ashton, 2005)* was used to ensure that specialist input was incorporated into the EIA Report comprehensively. This included the incorporation of the following information:

- The assumptions and limitations identified in each study are included in Section 9.10.;
- A summary of each specialist study is provided below and includes information on the key findings and conclusions drawn;
- The Specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment contained in Section 10;
- Specialist information was used to assess alternatives and identify the BPEO (Section 10.6);
- Specialist input was obtained to address comments made by I&APs that related to specific environmental features; and
- Recommendations made by the specialists were taken forward to the EIA Conclusions and Recommendations and associated EMPr (Section 11 and Section 14.8).

9.1 Ecological Habitat and Threatened Species Assessment

The key issues and triggers identified during Scoping for the Ecological Assessment include:

- The presence of Threatened Terrestrial Vegetation within the proposed development footprint (Egoli Granite Grassland);
- The presence of ESA within the proposed development; and
- The presence of ridges within 1km of the proposed development.

The details of the Ecological Specialist are as follows:

- R.P. Mortimer
  - **Qualifications**: MSC.
  - **Experience:** 9 years' experience.
  - **Affiliations:** SACNASP (Registration pending for Ecology and Conservation); International Association of Impact Assessment: South Africa; Grassland Society of Southern Africa
- R. Retief (Document Review)
  - **Qualifications**: National Diploma: Nature Conservation
  - **Experience:** 25 Years' experience in Habitat assessment, Ecological assessment, Compilation of Environmental management plans, Environmental monitoring and rehabilitation
  - **Affiliations:** Professional Environmental and Zoological Scientist: SACNASP, Registration Number: 400134/10; Member of the Zoological Society of Southern Africa, Member of the International Association of Impact Assessment South Africa and Member of the Water Institute of Southern Africa).

The full Ecological Impact Assessment is appended in Section 14.6.1.

9.1.1 Key Findings

9.1.1.1 Objectives, Scope and Approach

The scope of the project includes:

- Desktop study of the development area on broad scale to determine areas, habitats and species of concern;
- A field survey to investigate key elements of vegetation communities, habitats and species on the site;
- An evaluation of the conservation importance and significance of the site with special emphasis on the current status of threatened species, habitats and communities as stipulated by Gauteng Department of Agriculture and Rural Development (GDARD);
- Identify potential ecological impacts that could occur as a result of the development; and
- Make recommendations to reduce or minimise impacts, should the development be approved.

The objectives of the ecological habitat assessment are the following:

- Determine the occurrence, or possibility of occurrence, of threatened species (both floristic and faunal taxa);
- Determine the sensitivity and conservation importance of the existing habitat in terms of local, regional or national biodiversity objectives;
- Evaluate the study area for the presence of species and characteristics associated with the endangered *Egoli Granite Grassland* vegetation type;
- Evaluating the site to determine the presence of ridges; and
- Determine the ecological condition of the site with respect to function, connectivity and status.

9.1.1.2 Methods of Investigation

A desktop literature study was conducted prior to fieldwork. The main purpose of this is the identification of relevant background data which facilitates an understanding of the study area, surrounding land uses and wider regional environmental factors potentially influencing / affecting the study site. The desktop assessment also provides input with respect to the potential for high conservation priority species, habitats and communities to occur as delineated within plans such as the GDARD C-Plan. The desktop study continues throughout the study, clarifying, confirming and expanding on information gained during the field assessment. The following comprised facets of the desktop study:

- Biomes, bioregions and vegetation communities (Vegetation map of South Africa, Mucina & Rutherford, 2006);
- Historical records with respect to floristic species recorded, including threatened species, for the applicable quarter degree grids (posa.sanbi.org);
- Applicable and relevant recorded biodiversity information relating to the specific study area (bgis.sanbi.org);
- Ecosystem classification and importance (GDARD Conservation Plan); and
- Historical digital satellite imagery (Google earth)

Field surveys were undertaken during March (Portions 170, 173 & 174) and April 2016 (Portion 169), satisfying the GDARD Biodiversity assessment requirements and making the most of the floristic growth season to facilitate identification.

9.1.1.3 Plant Community and Vegetation Characteristics

A number of residential homes are located on the portions comprising the study site (mainly Portions 170 and 173). Extensive landscaping characterises the study site, with the exception of portion 169, and comprises a variety of exotic tree species (Oak, Planes, Chestnut etc.). Portion 169 has been fairly heavily grazed and subjected to periodic fires. No evidence of previous agriculture, in the form of ploughed lands and planting of crops, was observed or deduced.

Taking into account the above observations, it was possible to map a broad-scale land classification which includes all the features on site including the four distinct vegetation communities observed (*secondary grassland*, *wetland*, *rock outcrop* and *landscaped gardens* dominated by exotic tree species) (see Figure 9-1).

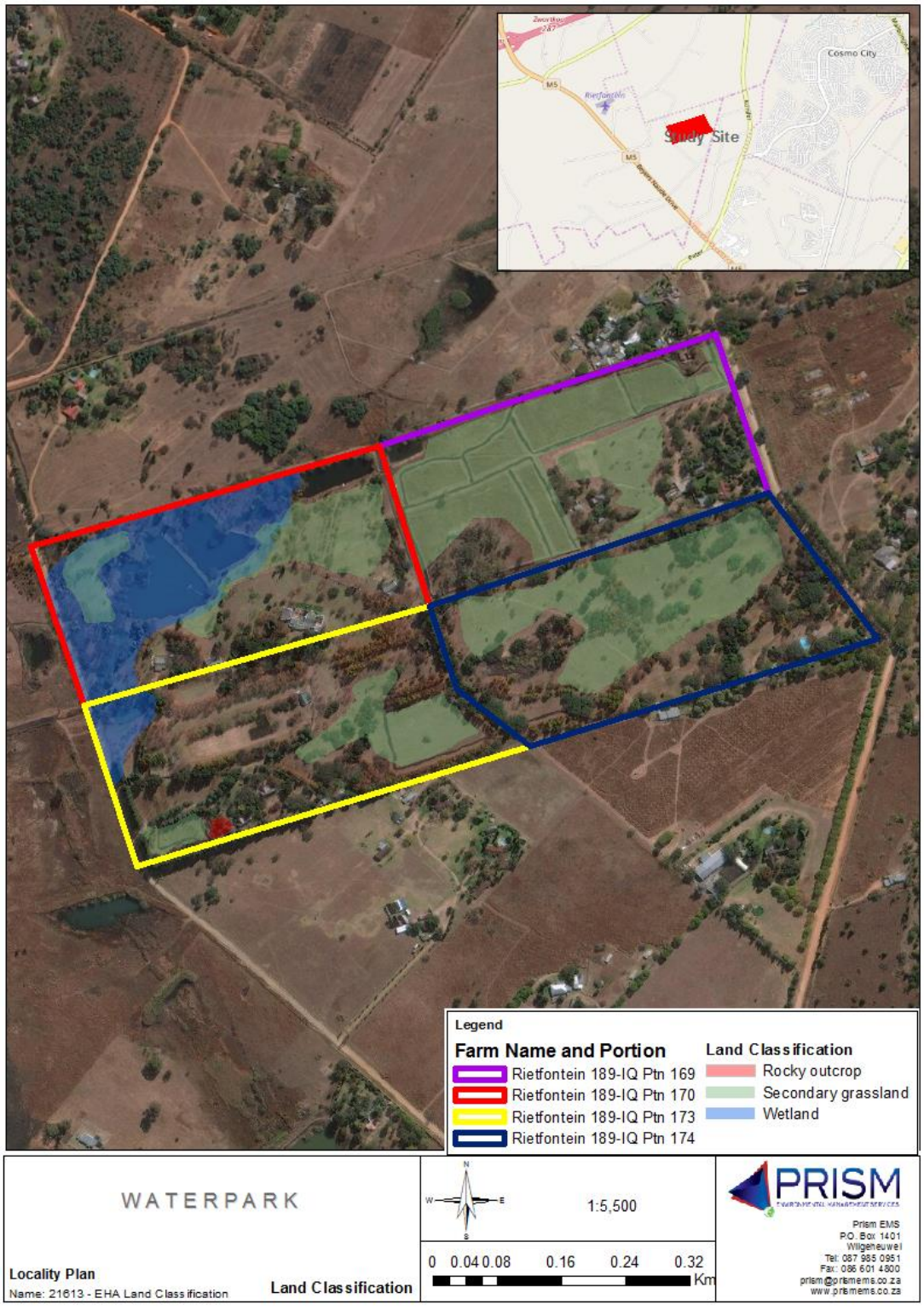


Figure 9-1: Satellite image depicting land classification (Green: secondary grassland; Brown: rocky outcrop; Blue: wetland habitats). Remaining areas are considered landscaped.

9.1.1.4 Assessment of Plant species of High Conservation Priority

No nationally protected tree species were observed on the study site during the assessment.

The study site was assessed for Gauteng province listed threatened and protected species and species of conservation value, historically recorded for the quarter degree grid. Historical floristic records (POSA, SANBI) indicate that a number of threatened species may have been present in the area. The only species of concern observed on the study site was *Hypoxis hemerocallidea* (see Figure 9-2 below).

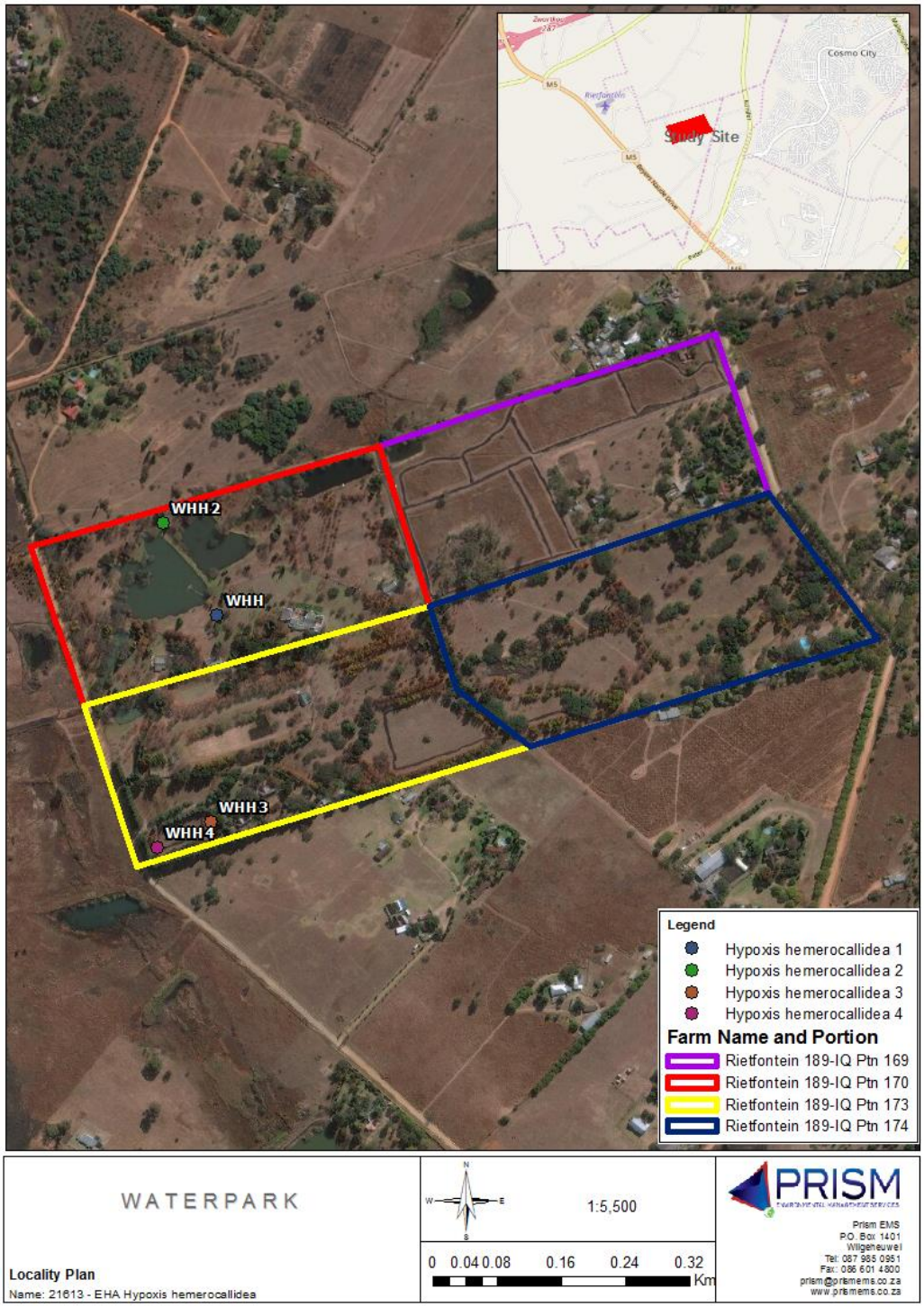


Figure 9-2: Location of *Hypoxis hemerocallidea* populations observed within the boundary of the study area.

9.1.1.5 Sensitivity Mapping

Based on the findings above, the following map depicts the sensitivities on the study site. Same must be utilised for forward planning of the development (see Figure 9-3 below).

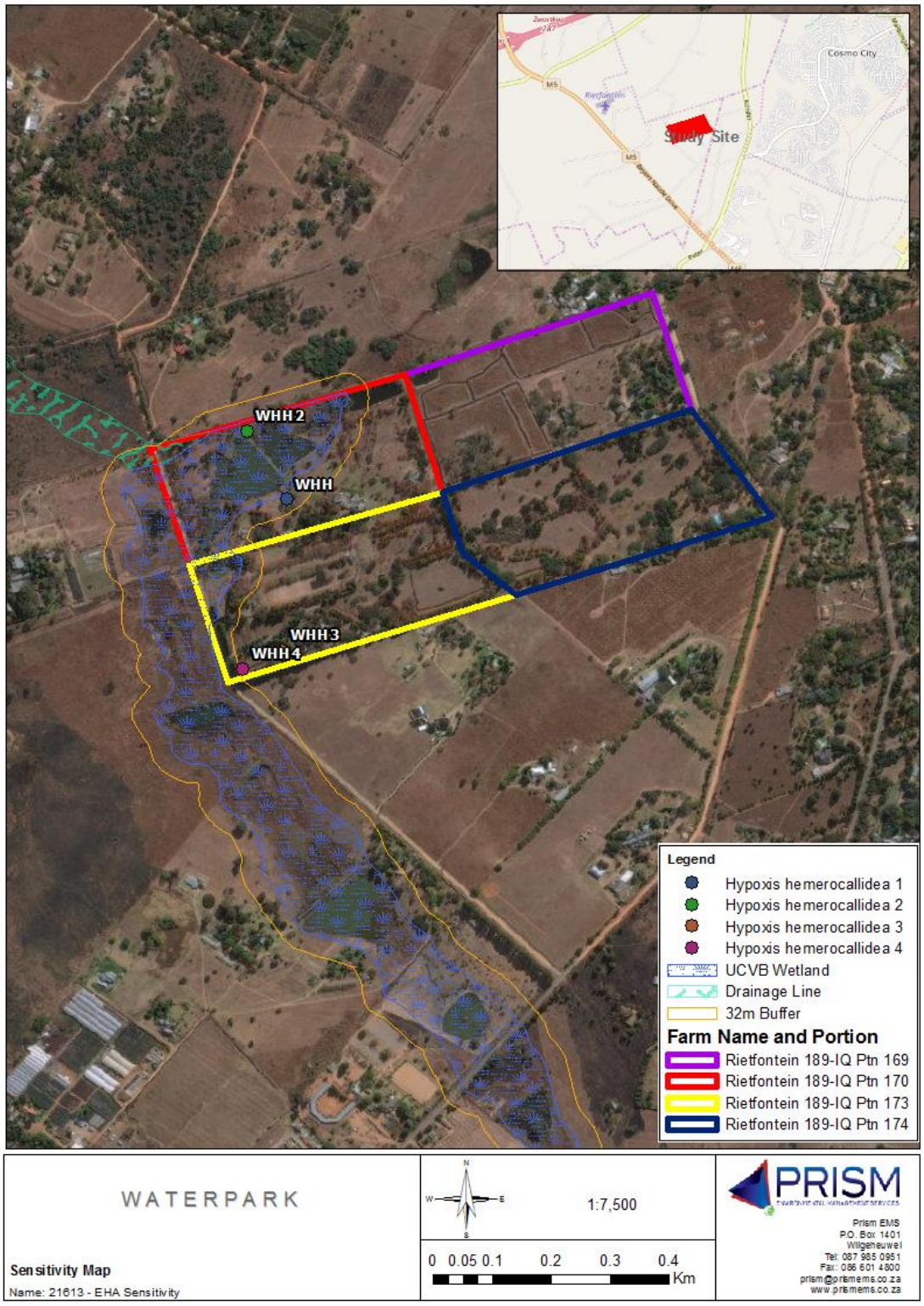


Figure 9-3: Sensitivity map for Portions 169, 170, 173 & 174, Rietfontein 189IQ.

9.1.2 Conclusion

The study area occurs within the footprint of the highly endangered but already impacted *Egoli Granite Grassland* and also features a delineated Ecological Support Area (ESA) in the form of a wetland habitat within the north-western corner of the study site. This habitat should be considered sensitive and mitigation measures include integrating the existing wetland into the development and creating benefits to the ecosystem downstream of the proposed development.

Assessment of the study site indicates that both vegetation and ecology can be considered to be impacted, both historically and as a result of current land uses. Landscaping and mowing of open grassland habits has significantly altered the natural ecological structure and function. Surrounding land uses (historic and current) also play a role in impacting on the ecological function, with especially linear structures such as roads playing a pivotal role in habitat and ecological fracture on both a local and regional scale.

Vegetation community composition indicates that the grassland is transformed and can be considered to be *Secondary grassland.* Furthermore, the floristic composition of the study site area represents an anthropogenic secondary, plagioclimax grassland, as described by Bredenkamp et al (2006), and can no longer be considered representative of *Egoli Granite Grassland*.

A single floristic species of concern (numerous individuals at multiple locations), *Hypoxis hemerocallidea,* was observed on the property. Mitigation measures to protect the species include integration into the development or relocation to a suitable habitat. No other species of concern or listed, threatened species (faunal and floral taxa) were observed on the site during the assessment.

In terms of alternatives, Alternative Layout 2 would be the preferred option from an ecological point of view. This alternative allows for the maintenance and minimal disturbance to the sensitive, wetland habitat and buffer zones (1:100 floodlines) with maintenance of ecological function also having implications for downstream habitats. However, as all treatment options result in water quality of acceptable levels (as required by the Department of Water and Sanitation), there is no preference for either treatment facilities.

Good planning and operational management of the proposed development has the potential to provide a beneficial impact to the wetland and downstream wetland habitats and ecosystems. Impacts to the grassland habitat are irreversible on the short term and large scale mitigation serves little purpose. Mitigation measures which may be effective include:

- Delineating and demarcating the wetland habitat to exclude it from potential construction impact. It is also advised that the development be planned around this habitat to ensure minimum disturbance; and
- Limiting access, intrusion into and development within the stream zone on the north-western boundary of the property.

9.2 Wetland Assessment

The key issues and triggers identified during Scoping for the Wetland Delineation Assessment include:

- The presence of watercourses (including wetlands and dams) to the north of the site.

The details of the Specialist are as follows:

- D. Botha
  - **Qualifications**: M.A. Environmental Management; B.A. Hons. Geography & Environmental Management; Wetland and Riparian Delineation (DWAF Accredited Short Course); Soil Classification and Wetland Delineation (Terrasoil Science Short Course) and Tools for Wetland Assessment (Cum Laude) (Rhodes University)
  - **Experience:** 13 years' experience.
  - **Affiliations**: Founding member of Environmental Practitioners Association of South Africa (EAPASA); Member of International Association of Impact Assessors (IAIAsa); Member of Gauteng Wetland Forum. Member of the South African Wetland Society

The full Wetland Delineation Assessment is appended in Section 14.6.2.

9.2.1 Key Findings

During the desktop investigation, two (2) possible areas where wetlands could occur were identified on or in close proximity to the study site that would be effected by the proposed development activities. The NFEPA wetlands were also consulted and several wetland areas were identified on or in close proximity to the study site that would be effected by the proposed development. These wetlands as indicated by the NFEPA wetland layer was further investigated on site.

The field investigations were undertaken during April, June, October and November 2016 to assess and confirm the delineated Wetland zones present on the survey area. The field investigations concluded that one natural wetland system and one drainage line could be recorded as per the DWAF, 2005 guidelines.

The wetlands were delineated by considering the following wetland indicators (DWAF 2005):

- Terrain unit indicator helps identifying those parts of the landscape where wetlands are most likely to occur. Wetlands occupy characteristic positions in the landscape and can occur on the following terrain units: crest, midslope, footslope, and valley bottom;
- Soil wetness indicator identifies the morphological signatures developed in the soil profile as a result of prolonged and frequent saturation; and
- The vegetation indicator identifies hydrophytic vegetation associated with frequently saturated soils.

9.2.1.1 Wetland Indicators

9.2.1.1.1 Terrain Unit Indicator

Terrain unit indicator helps identify those parts of the landscape where wetlands are most likely to occur. Wetlands occupy characteristic positions in the landscape and can occur on the following terrain units:

- crest,
- midslope,
- footslope, and
- valley bottom.

The wetlands identified were also assessed in respect to its location in the landscape. The wetland found:

- WP_UCVB was found on the valley floor draining towards the North turning North-East (Refer to Table 9-1 for the classification of the terrain unit.)

Table 9-1: Wetland Classification

Level 1: System	Level 2: Regional setting	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) unit	
Connectivity to open ocean	Ecoregion	Landscape setting	HGM type	Longitudinal zonation / landform
			A	B
INLAND	DWAF Level 1 Ecoregions	VALLEY FLOOR	Unchannelled valley-bottom wetland	Valley-bottom flat

9.2.1.1.2 Soil Form and Soil Wetness Indicator

Soil erodibility in hydrologically transformed environments contributes to the difficulties to precisely determining wetland boundaries on areas associated with the areas underlain by granite. This investigation focussed on the delineation of the wetland features based on soil hydro-morphology and landscape hydrology as observed in the catchment and on the site.

Soils were found to be of a low clay content in general. Mostly sandy soils were present especially in the top 250mm. The wetland seasonal and permanent zones reflected clayey soils. Typical halfway house granite geological formation and associated soils were observed.

Certain sections of the wetlands were highly impacted by historical impacts such as infilling and damming of the system. This further made it difficult to clearly identify the soil form and characteristics.

9.2.1.1.3 Vegetation Indicator

Upon the assessment of the area, the various wetland vegetation components were assessed and recorded. Dominant species were characterised as either wetland species or terrestrial species. Hydrophytic vegetation species were observed. Predominantly grass, rushes and sedge species were recorded. This unit was predominantly utilised to delineate the wetland.

Table 9-2: Wetland indicator species noted during the assessment.

Riparian / Wetland vegetation
Kyllinga species
Cyperus species
Imperata cylindrica
Typha capensis
Berkheya radula
Heteropogon contortus

Figure 9-4 serves to conceptually present the location of the wetlands that could be effected by the proposed development activities on the site. Figure 9-5 presents the conservation buffer zones that are applicable and should be considered during the development to ensure appropriate mitigation and management of the activities.

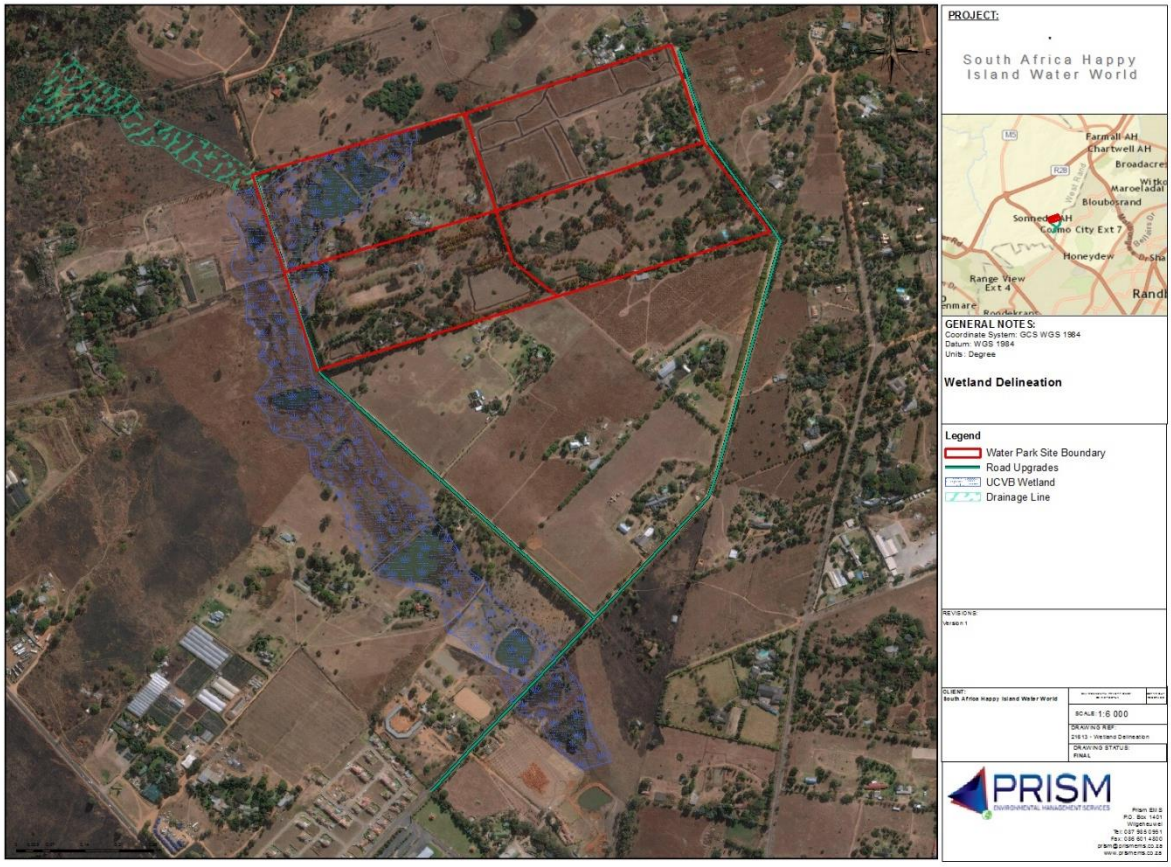


Figure 9-4: Wetland delineation

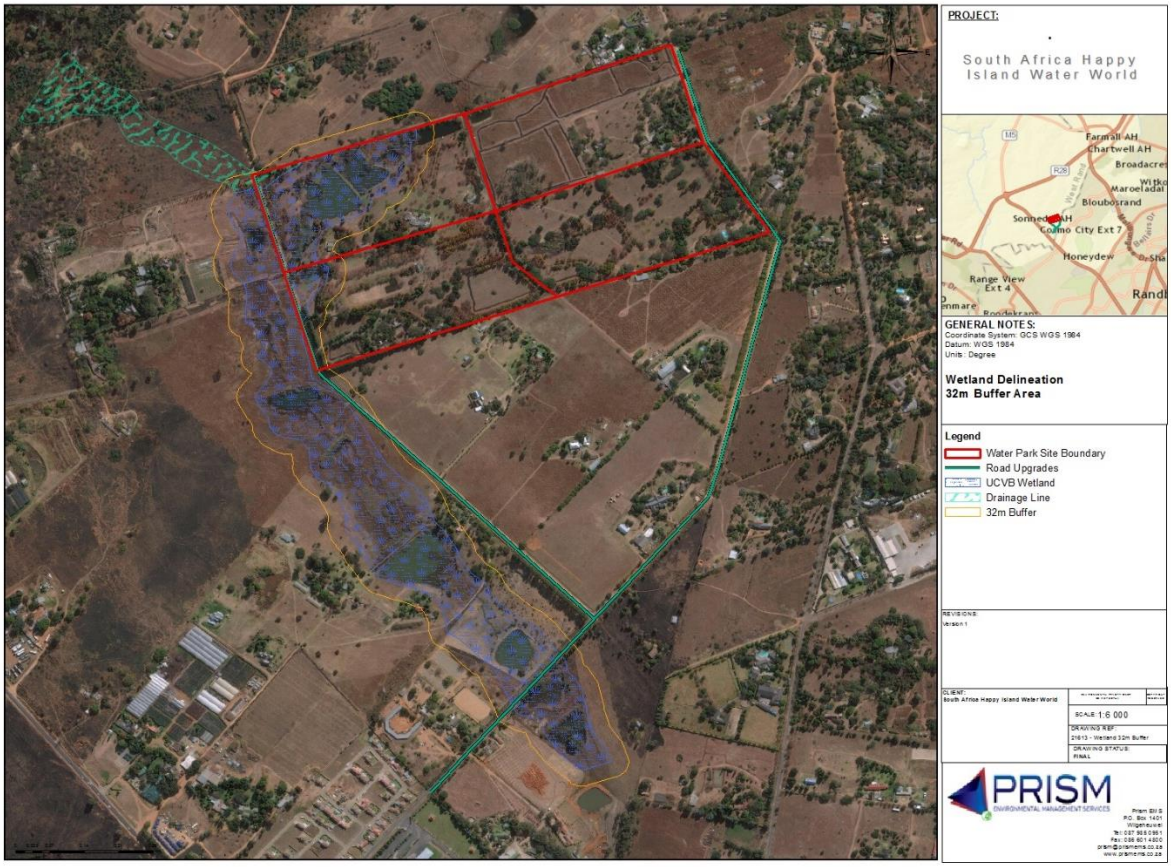


Figure 9-5: Wetland buffers

A 32m buffer was applied to the wetland that is in line with the National Environmental Management Act (NEMA) listed activities and Gauteng bio-diversity requirements. These wetlands are disturbed due to historical impacts and are of low ecological importance. Rehabilitation of the buffer area is required. This conservation buffer should be utilised as the control areas and will be adequate to assist with management and mitigation during the construction and operation phase.

9.2.1.2 Wetland Classification

SANBI's classification for wetlands was used to classify the wetland units within the study area (SANBI, 2009). The wetland units were classified up to level four, which includes the system, regional setting, landscape unit and Hydrogeomorphic (HGM) unit.

Three natural wetland entities were identified during the field investigation.

The following Hydrogeomorphic wetlands were identified during the site evaluation:

- WP_UCVB – Un-Channelled Valley Bottom Wetland

9.2.1.3 Present Ecological Status (PES)

A level 1 WET-health wetland assessment was undertaken to determine the PES of the wetland system.

WP_UCVB was found to be largely modified. A large change in ecosystem processes and loss of natural habitat and biota is great, however some remaining natural habitat features are still recognizable. (Table 9-3). This wetland system is highly impacted by historical damming of the system both up and down stream. It forms part of a larger wetland system. The trajectory of change of the wetland ecological status is predicted to decline slightly over the next 5 years without major intervention (Table 9-4).

Table 9-3: PES – WP_UCVB

Description	Combined impact score	PES Category
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	5,6	D

Table 9-4: Trajectory of change of WP_UCVB

Trajectory class	Description	Change score	Class Range	Symbol
Deterioration slight	Condition is likely to deteriorate slightly over the next 5 years	-0,4	-0.3 to -1.0	↓

9.2.1.4 Ecological Importance and Sensitivity (EIS)

The ecological importance and sensitivity assessment was conducted according to the guidelines as discussed by DWAF (1999). DWAF defines “ecological importance” of a water resource as an expression of its importance to the maintenance of ecological diversity and function on local and wider scales. “Ecological sensitivity”, according to DWAF (1999), refers to the system’s ability to resist disturbance and its capability to recover from disturbance once it has occurred. The Ecological Importance and Sensitivity (EIS) analysis provides a guideline for the determination of the Ecological Management Class (EMC).

The WP_UCVB, Un-Channelled Valley Bottom Wetland is considered to be ecologically important and sensitive on a local scale. The biodiversity of this wetland is moderate with no red data species recorded. It is not sensitive to flow and habitat modifications. It plays a small role in moderating the quantity and quality of water of major rivers. The system drains into further downstream wetland and streams before reaching major rivers. The Ecological Importance and Sensitivity (EIS) for this system is thus considered to be Low (Refer to Table 9-5).

Table 9-5: EIS - WP_UCVB

Score	EIS Category	Category Description	EMC
Score =1,4 ***Range (>1 and <=2)***	**Moderate**	Wetlands that are to be considered ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	**C**

9.2.1.5 Recommended Ecological Category (REC)

The Recommended Ecological Category (REC) is determined based on the results obtained from the Present Ecological State (PES), reference conditions and Ecological Importance and Sensitivity (EIS) of the aquatic resource. This is then followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

The wetland will be impacted by the proposed development activities. This impact will be localised and at the transitional point leading from the development and road infrastructure upgrades into the wetland buffer area and crossing a section of the wetland. It will in all likelihood regress slightly in terms of its current Ecological Category if not managed in specific during the construction period. Sub-soil drainage and stormwater management for the site is proposed. This will mitigate the impact on the wetland. Rehabilitation of the impacts and maintenance of the system will further mitigate the impacts and could improve the sustainability of the system. It is thus rated that the Recommended Ecological Category (REC) will fall into:

- Category C for WP_UCVB

Table 9-6: REC

Wetland Unit	Class (% of total)	Description
WP_UCVB	**C**	Moderately modified.

9.2.2 Conclusion

The Present Ecological Status (PES) for the wetland scored in the low ranges for the Un-Channelled Valley Bottom Wetland. The Ecological Importance and Sensitivity (EIS) falls in the moderate range and has some functionality in respect of bio-diversity conservation. The Recommended Ecological Category (REC) for the wetland was categorised as moderate. It will thus require some rehabilitation to enhance the ecological function of the system. It is not considered to be a very sensitive wetland.

For this reason, it can be supported that the development may go-ahead. The rehabilitation of the wetland is vital to recover the required ecological function. The wetland drivers must be enhanced as part of the

rehabilitation of the affected areas. In respect of the road construction, it is important to ensure that the required erosion protection measures linked to the crossing sections be carefully designed and installed.

The project can be supported should all the mitigation measures be implemented and monitored against.

The following monitoring programmes are recommended:

- It is recommended that a Water Use Licence Application (WULA) be submitted to the Department of Water Affairs, as the proposed activities will trigger sections of Section 21 of the National Water Act [NWA], 1998 (Act No. 36 of 1998) that will require such an application;
- Together with the WULA, a rehabilitation and monitoring plan will have to be compiled as supporting documents to the application;
- A wetland monitoring programme should be developed based on this baseline assessment and audited against on a bi-annual basis. Feedback from the monitoring should be used to measure and mitigate further negative impacts, if found;
- The wetland monitoring occurring on a bi-annual basis should be conducted by a skilled professional qualified in assessing and understanding the complex nature of wetlands and their associated drivers;
- It should be attempted to preserve partial to complete wetlands (current status) if at all possible.
    - Wetland drivers should be protected as far as possible.
    - Wetland release into downstream aquatic resources should be rehabilitated, enhanced and monitored.
    - Water quality preservation is key. Weekly *in situ* monitoring should take place during the construction phase.
- Mitigations for the proposed development activities should be implemented, managed and monitored according to:
    - The following wetland ecosystem impact assessment conclusions, based on the results of the baseline survey:
        - Runoff from the construction areas may result in contamination of wetland and downstream aquatic habitat;
        - On site storm water management, must be implemented.
    - Last out first in approach for stockpiling and re-filling of soil
        - The wetland, if any portion is to be excavated, must be filled according to the soil profiles
    - The following impacts may result in changes to the soil structure:

- Heavy construction vehicles moving within the wetland areas;
    - Ingress and Egress must be managed to minimise impacts in respect of compaction of the wetland soils.
    - Single entry and exit points must be established.
    - These areas must be scarified as part of the rehabilitation plan.
- Stock piling;
    - As first option - Stock piling must be located outside the delineated wetland and buffer boundaries.
    - As second option – Stock piling must be located upstream of the trench
- Spills from machinery;
- The mixing of concrete; and
- Clearing of vegetation for construction, and associated sedimentation and siltation.

- The following aspects may result in reduction of ecosystem habitat integrity:
    - Dust and sediment runoff from construction activities;
    - Diesel and oil spill from equipment and machinery; and
    - Higher and faster water flow from the site that could cause soil erosion.
- The following aspects may result in sedimentation of the associated aquatic systems:
    - Sedimentation due to increase runoff and dispensed soil particles and runoff from the affected areas; and
    - Increase in the velocity of the runoff from the exposed soil, due to construction.
- The proposed activities must be initiated and constructed in such a way to prevent the reduction of natural water flow into the wetland and downstream which, in essence, is the driving factor in terms of water provision.
    - An approved stormwater management plan must be implemented.
    - Subsurface drains must be installed to assist in the aquatic driver sustainability across the full width of the wetland.
    - Velocity dissipation structures (such as reno mattresses) must also be installed to prevent water flowing through culverts to gain velocity. An increase in velocity will lead to channelisation of the wetland and soil erosion.

- The wetland integrity should be improved during the rehabilitation phase. This may entail the following:
    - Removal of alien and invasive plant species during the construction and operational phases.
    - Re-vegetation and landscaping the wetland and buffer areas with indigenous wetland plant species.
    - Stabilisation of gullies and drainage lines to prevent erosion.
    - Planting of indigenous herbaceous plants on shallow banks and indigenous woody vegetation on steep banks to increase stability of banks, thereby preventing erosion.
    - Implementation of topsoil management (stockpiling, topography shaping) and erosion control (berms, geotextiling, silt fences, hay bales and gabion structures).

9.3 Water Quality Assessment

The key issues and triggers identified during Scoping for the Water Quality Assessment include:

- The presence of watercourses (including wetlands and dams) to the north of the site.

The details of the Specialist are as follows:

- P. Singh
    - **Qualifications:** Master of Science: Aquatic Health (Cum Laude); Bachelor of Science Honours, and Bachelor of Science (Zoology and Botany).
    - **Experience:** 5 years' experience.
    - **Affiliations:** SANAS accredited technical signatory for Ecotoxicological Testing and Analyses: 2013-2015; Golden Key International Honour Society: 2008 – current; SACNASP (pending final approval).

The full Aquatic Impact Assessment is appended in Section 14.6.3.

9.3.1 Key Findings

In situ water parameters were measured and two (2) water samples were collected and analysed to investigate any signs of contamination and to ascertain the fitness of use within/for the recreational facility. The potability of the water samples were determined in accordance with SANS regulations (SANS 241: 2015) at a SANAS accredited laboratory. The water samples were collected in October 2016. The location of the sampling points are indicated in Figure 9-6.

Figure 9-6: Sampling points

9.3.1.1 Results and Discussion

The water quality assessment encompassed laboratory analyses and an *in* situ water quality assessment. Two (2) monitoring sampling points were identified within the study site, WP 1 and WP 2. The field assessment was conducted on the 06th October 2016. The results of the laboratory analysis for potable water (SANS 241:2015) and *in situ* analysis are presented in Table 9-7 below.

Table 9-7: *In situ* and SANS 241:2015 analysis of WP 1 and WP 2 sampling points. Compliance with SANS 241:2015 and TWQR limits (Green); Exceeds SANS 241:2015 only (Yellow); Exceeds TWQR only (Orange); Exceeds SANS 241:2015 and TWQR (Red).

Sample Analysis (mg/ℓ, unless specified)	Risk*	SANS 241 (2015) Limits (mg/ℓ) unless specified	TWQR	WP 1		WP 2	
				Lab	*In Situ*	Lab	*In Situ*
pH – Value at 25°C	O	≥ 5 - ≤ 9.7	6.5 – 8.5	8.0	7.42	7.8	8.14
EC (mS/m at 25°C)	A	≤ 170	---	19.4	19.13	32.0	33.8
Temperature (°C)	---	---	---		20.6		20.2
Total dissolved solids at 180ºC	A	≤ 1200	---	122		228	
Colour in PtCo units	A	≤ 15	---	**21**		**71**	
Turbidity in N.T.U	O A	≤ 1 ≤ 5	---	**84**		**7.7**	
Clarity - Secchi Disk depth (5.07/ Turbidity NTU) (m)	F	---	>3.0	**0.06**		**0.66**	
Clarity - Clarity tube depth (m)	---	---			0.23		0.67

Chloride (Cl)	A	≤ 300	---	11		19	
Sulphate (SO_4)	Ac A	≤ 500 ≤ 250	---	12		5	
Fluoride (F)	C	≤ 1.5	---	0.4		1.0	
Nitrate (N)	Ac	≤ 11	---	0.1		0.2	
Nitrite (N)	Ac	≤ 0.9	---	<0.05		<0.05	
Combined Nitrate plus Nitrite	Ac	≤ 1	---	0.1		0.1	
Total Organic Carbon (C)	C	≤ 10	---	3.6		**14**	
***E. coli* (/100 mℓ)**	Ac	Not detected	0 - 130	**5**		**28**	
Dissolved oxygen (mg/L)	---				5.48		5.87
Dissolved oxygen (%)	---				48.1		64.7

* A – Aesthetic
Ac – Acute Health
C – Chronic health
O – Operational
F – Full contact

Table 3 contd.: SANS 241:2015 analysis of WP 1 and WP 2. Compliance with SANS 241:2015 and TWQR limits (Green); Exceeds SANS 241:2015 only (Yellow); Exceeds TWQR only (Orange); Exceeds SANS 241:2015 and TWQR (Red).

Sample Analysis (mg/ℓ, unless specified)	Risk*	SANS Limits (mg/ℓ) unless specified	TWQR	WP 1		WP 2	
				Lab	*In Situ*	Lab	*In Situ*
Aluminium as Al (µg/ℓ)	O	≤ 300	---	**670**		<100	
Antimony as Sb (µg/ℓ)	C	≤ 20	---	<20		<20	
Arsenic as As (µg/ℓ)	C	≤ 10	---	<10		<10	
Barium as Ba (µg/ℓ)	C	≤ 700	---	74		45	
Boron as B (µg/ℓ)	C	≤ 2400	---	<25		<25	
Cadmium as Cd (µg/ℓ)	C	≤ 3	---	<3		<3	
Total Chromium Cr (µg/ℓ)	C	≤ 50	---	<25		<25	
Copper as Cu (µg/ℓ)	C	≤ 2000	---	<10		<10	
Iron as Fe (µg/ℓ)	C A	≤ 2000 ≤ 300	---	**1 150**		**657**	
Lead (Pb µg/ℓ)	C	≤ 10	---	<10		<10	
Manganese (Mn µg/ℓ)	C A	≤ 400 ≤ 100	---	98		**267**	
Nickel (Ni µg/ℓ)	C	≤ 70	---	<25		<25	
Selenium (Se µg/ℓ)	C	≤ 40	---	<10		<10	
Zinc (Zn)	A	≤ 5	---	<0.025		<0.025	
Sodium (Na)	A	≤ 200	---	8		20	
Potassium (K)		---	---	2.4		6.4	
Calcium (Ca)		---	---	19		31	
Magnesium (Mg)		---	---	6		9	

* A – Aesthetic
Ac – Acute Health
C – Chronic health
O – Operational
F – Full contact

9.3.2 Conclusion

The aquatic resource can be concluded as contaminated and **unfit for use for recreational use**. This conclusion is based on the *in situ* and laboratory results and comparison to the SANS 241:2015 guidelines (SANS, 2015) and the TWQR of the South African Water Quality Guidelines (DWAF, 1996d).

The determinants that did not comply with either or both guidelines were colour, turbidity, clarity, TOC, *E. coli*, aluminium, iron, and manganese. Due to the importance of dissolved oxygen, this parameter will need to be monitored and mitigated as well. The aquatic resource thus poses aesthetic, operational and potential health risks if it is to be used for any recreational use. Purification and filtration of the aquatic resource should occur prior to the water being used for any recreational activity.

9.4 Hydrogeological Baseline Assessment and 2D Model

The key issues and triggers identified during Scoping for the Hydrogeological Baseline Assessment and 2D Model include:

- The proposed development involves the abstraction of groundwater to augment municipal water use. It is therefore important to understand the impact of this on groundwater resources and other groundwater uses; and
- Neighboring landowners are concerned about the impact of the proposed development on their groundwater resources.

The details of the Specialist are as follows:

- M. Holland
  - **Qualifications**: PhD. Engineering and Environmental Geology
  - **Experience:** 9 Years' experience in hydrogeology
  - **Affiliations:** SACNASP

The full Hydrogeological Baseline Assessment and 2D Model is appended in Section 14.6.4.

9.4.1 Key Findings

The scope of the Hydrogeological Baseline Assessment and 2D Model was as follows:

- Baseline study;
  - Data collation and review (national/regional (and local) hydrogeological and geological information); and
  - Hydrocensus and sampling.
- Development of a 2D groundwater flow model to simulate the extent of drawdown due to abstraction from the boreholes and the potential impact on the receiving environment; and
- Reporting (for inclusion into the EIA) and management/monitoring recommendations.

9.4.1.1 Aquifer Characterisation

According to the Hydrogeological Map (1:500 000) the regional hydrogeology is characterized by an 'intergranular and fractured aquifer'. The fractured aquifer, attributed to the presence of the Johannesburg

Dome has a potential yield of 0.5 to 2.0 litres per second. A micro-fractured matrix in these aquifers provides the storage capacity with limited groundwater movements while secondary features such as fractures / faults and bedding planes enhance the groundwater flow. The intergranular aquifer is associated with the river alluvial and quaternary sand deposits.

Based on the aquifer classification map (Parsons and Conrad, 1998), the aquifer system underlying the site study area is regarded a “minor aquifer”.

Therefore, the following aquifer systems can be distinguished for the area of interest:

- A shallow weathered aquifer;
- An alluvial aquifer system replacing or overlying the weathered aquifer in the vicinity of river courses; and
- A deeper fractured aquifer system within the Johannesburg Dome.

9.4.1.2 Groundwater Use

Groundwater resources were assessed on a national scale during the Groundwater Resource Assessment Phase II project (GRA II, DWAF 2004b) and is shown for quaternary catchment A21E in the table below. Based on the GRA II dataset, existing use is approximately 0.2 Mm^3/a while the registered use based on the WARMS dataset is 946,950 m^3/a or (0.95 Mm^3/a).

Table 9-8: Summary of groundwater resources for the quaternary catchment A21E (in Mm3/a).

Quat No.	Area (Km^2)	Baseflow	Recharge (Wet)	Recharge (Dry)	Harvest Potential*	GRA II (GW Use)
A21E	290	7.5	12.5	9.3	3.5	0.2

**The groundwater harvest potential is aimed at providing preliminary estimates on a national scale of the annual maximum volume of groundwater that can be practically abstracted (taking technical constraints into account) from a unit area on a sustainable basis.*

The yield of the four boreholes on site which will be used to augment the water use for the Water Park has not been confirmed but according to the engineer report the combined yield of the boreholes is around 3 000 litres per hour. Assuming a constant discharge rate this amount to 26 280 m^3/a which relates to 2.78% of the existing abstraction and less than 0.1 % of the Harvest Potential of quaternary drainage A21E. The area falls within the A21E quaternary catchment and is therefore excluded from General Authorisation (GA) applications in terms of the NWA, except if it is considered as Schedule 1 water uses or considered as a Small Industrial User (using not more than 20 m^3 per day) (Government Gazette, 2004).

9.4.1.3 Hydrocensus

A (borehole) hydrocensus was conducted was done on the 20th of October 2016 and again on the 1st of November 2016 to assess the status quo of the local groundwater levels and groundwater quality within the vicinity of study area. The hydrocensus identified borehole locations, status, depth, water levels, distribution, uses and owners. In addition, groundwater samples were collected at five selected boreholes and submitted to the accredited laboratory Waterlab PTY (Ltd) in Pretoria. The water samples were

analysed for major and trace elements as well as micro-biological tests to provide an evaluation of the ambient groundwater quality that serves as a baseline for current and future groundwater developments. The geosites (i.e. boreholes) visited during the hydrocensus are shown spatially in Figure 9-7.

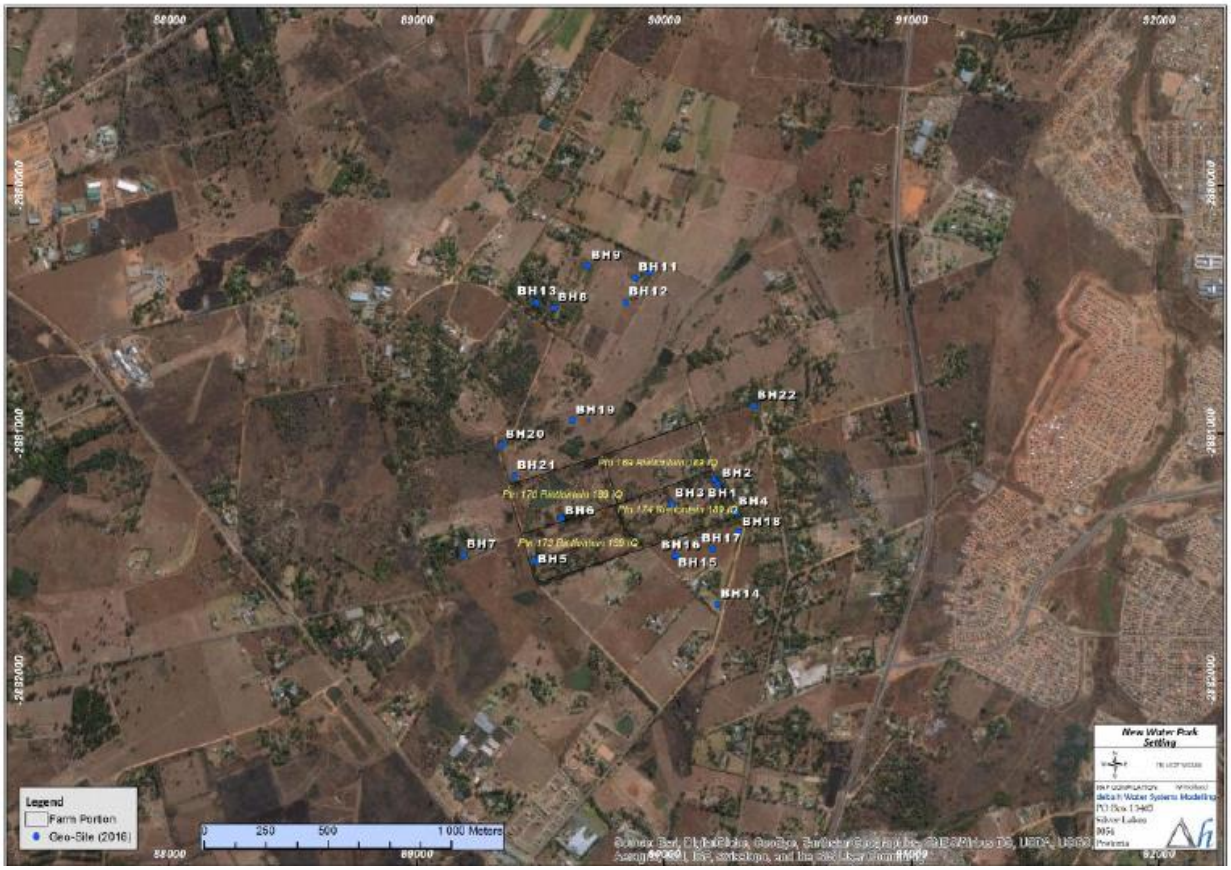


Figure 9-7: Borehole locations identified during the mini hydrocensus in a 1km around the study site

The study area is highly dependent of groundwater as a source. Groundwater users range from small scale rural domestic use to large scale commercial irrigation and industrial use. In summary:

- The proposed Water Park site is located on portions 169, 170, 173 and 174 of the Rietfontein farm 189. Six boreholes were identified on the portions. Two of the six boreholes are currently in use. The groundwater is mostly used for domestic and gardening purposes. Groundwater is pumped from each of these tow boreholes too different tanks for water supply. Two groundwater samples were collected at two selected boreholes, i.e. BH2 and BH6. Three groundwater levels were measured and range from 19.19 to 29.5 metres below ground surface.
- Random Harvest, are located approximately 1 km northwest of the Water Park. Random Harvest has six boreholes, which of five are currently used for domestic, gardening, irrigation and agricultural purposes. Only one groundwater level could be obtained at borehole BH8 (35m), due to inaccessibility of most of the boreholes. The groundwater level measured was 35 m. One groundwater sample was collected at Borehole BH13. Estimated groundwater volume abstractions range from 4500 litres per hour to 10 000 litres per hour per borehole.
- Car Bavarian, another groundwater user borders the Water Park to the south. Car Bavarian has five boreholes on site of which two are operational boreholes used for domestic and gardening

purposes. Three groundwater level were measured at borehole and range from 33.8 to 38.45 m. One groundwater sample was collected at borehole BH14.

- A number of private groundwater users were also identified in close approximation of the Water Park. These groundwater users use groundwater mainly for domestic and gardening purposes

9.4.1.4 Groundwater Levels and Flow Directions

The groundwater levels obtained during the hydrocensus and National Groundwater Achieve (database) within quaternary catchment A21E were used in the interpretation of groundwater flow. Utilising a total of thirty-three (33) measured groundwater table elevations in the wider area of interest from:

- Data (24 water levels) requested from the DWS's NGA (National Groundwater database), and
- Data (9 water levels) from the hydrocensus.

Based on the data, groundwater levels range from 8.3 mbgl to 43 mbgl, with an average of 24 mbgl. The correlation between surface topography and elevation of the hydraulic head for the study area is provided in Figure 9-8.

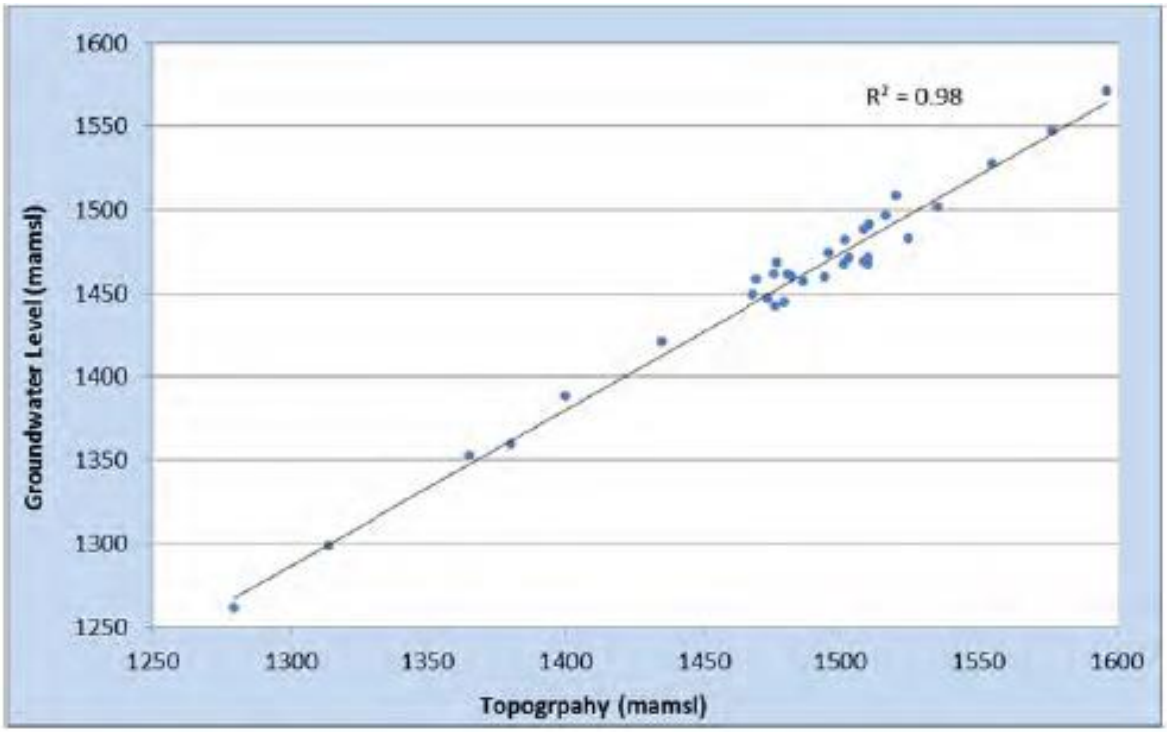


Figure 9-8: Correlation between surface topography and groundwater levels in the study area

A good correlation (R^2=0.98) between absolute surface and hydraulic head (water level) elevations in m above mean sea level (mamsl) is recognised. The potentiometric surface therefore mimics surface topography, and regional groundwater flow is from higher lying ground towards lower lying valleys, where it accumulates or surfaces in the alluvial and hill wash deposits and discharges ultimately into the Crocodile River. A regional north-easterly groundwater flow direction from higher lying ground in the west and south towards the Crocodile River therefore dominates the groundwater flow. At the site groundwater is expected to follow the topography and flow in a northerly direction towards the unnamed tributary of the Crocodile

River. Note that local flow patterns may differ due to the fractured nature of the aquifer in the Johannesburg Dome rocks.

9.4.1.5 Groundwater Quality

The description of the site specific groundwater quality is based on the five boreholes sampled during the hydrocensus. These samples were submitted to a SANAS accredited laboratory Waterlab PTY Ltd. in Pretoria. The resulting parameters have been compared against the South African National Standards (SANS:241, 2011) drinking water quality limits, the South African Water Quality Guidelines by the Department of Water Affairs and Forestry (1996) for domestic use and the World Human Organisation (2011) water quality guidelines. Guideline values have been determined for those chemical components that are considered to have significant potential to harm human health at concentrations above the specified limits.

Based on the results local groundwater quality is classified as neutral (pH in the range of 6.9 to 7.5) with generally low Total Dissolved Solids (TDS) contents ranging from around 200 to 264 mg/l. Other analysed inorganic chemical parameters re either below detection limit or within acceptable limits for human consumption.

9.4.1.6 Impact Assessment

A site specific 2D groundwater flow model was used to predict and assess potential impacts of the proposed development on the groundwater environment. The software code chosen for the numerical finite-element modelling work was the 3D groundwater flow model SPRING, developed by the delta h Ingenieurgesellschaft mbH, Germany (König, 2011).

The computational aquifer model developed was used to evaluate the impact of proposed abstraction from the f our on-site boreholes on the regional water. The impact of the simulated abstraction on water levels is shown as drawdown (base case piezometric level minus the piezometric level of the abstraction scenario) in Figure 9-9. No drawdown values below 1 meter are visualised to account for the expected seasonal variability of water table elevations. It is likely that any drawdown below 1 meter is within the range of natural water table fluctuations and therefore any potentially affected groundwater dependent ecosystem therefore adapted to it.

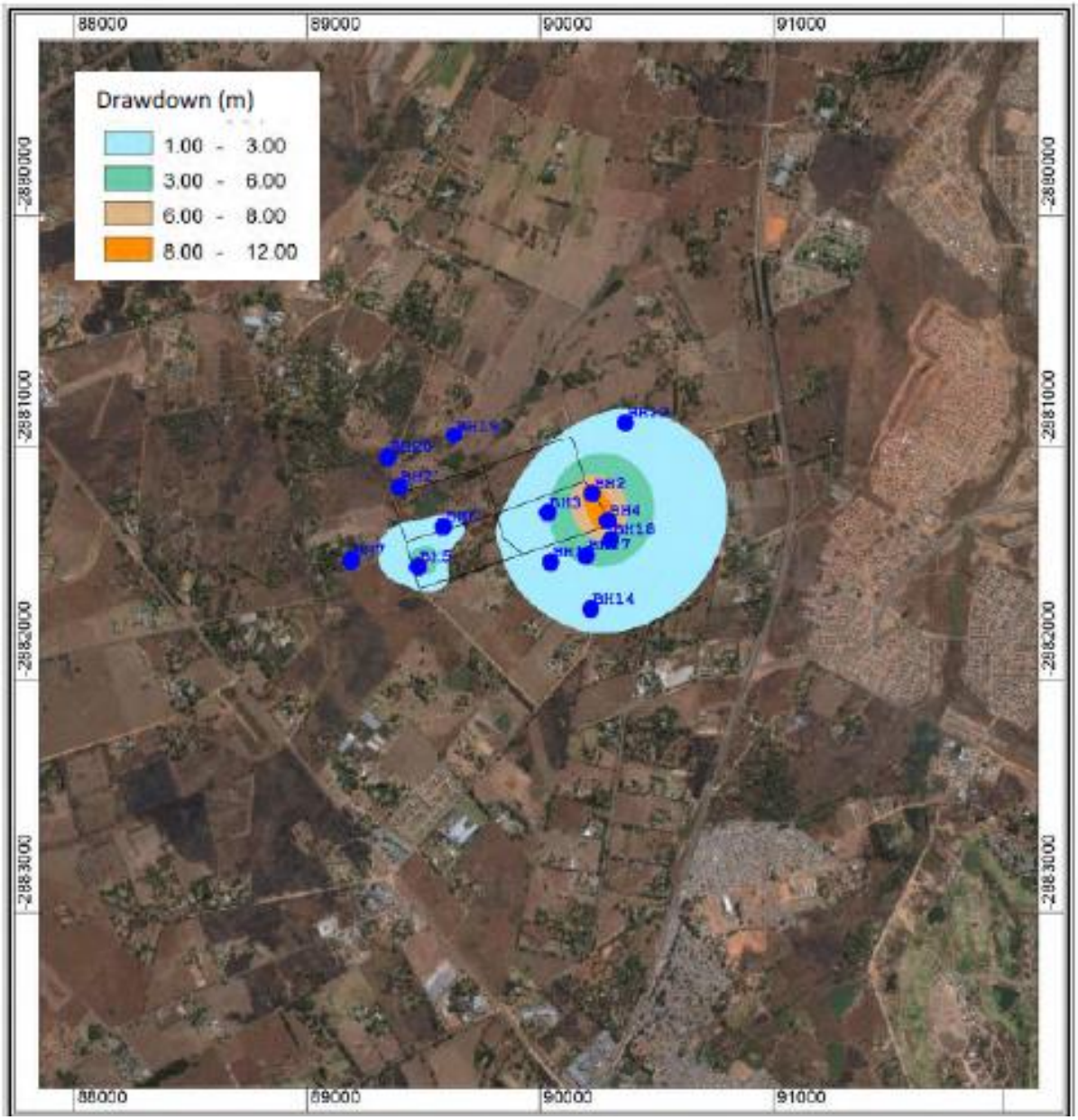


Figure 9-9: Simulated drawdown for future abstraction scenarios

9.4.1.6.1 Impact

With the exception of unintended spills (i.e. fuel etc.) or seepage of un-treated waste water, there are no activities expected that could impact on regional groundwater quality. Based on the simulation results the spatial extent of the radius of influence as a result of continuous abstraction is approximately 180 to 400 m. It must be noted that any abstraction applied to a steady-state groundwater model is likely an over-estimate of drawdown as it does not consider time-dependant recharge and aquifer storage.

Based on the resulting assessment of the proposed abstraction rates, the impact on the regional water balance is minimal. During pumping a dewatering cone will develop, however, the water table will rebound to pre-pumping conditions if the pumping is ceased (i.e. during non-working hours). The impacts on the local ambient groundwater environment related to groundwater abstraction can be summarised as follows:

- A low likelihood to occur.
- Significant drawdowns are localised to the immediate vicinity of the site boundary. The drawdown is reversible during non-pumping periods.
- If correct maintenance of the waste water treatment plant is in place, the Water Park will have negligible impact on the groundwater quality.
- High potential to mitigate negative impacts (alternative borehole position towards the centre of the site).
- Proper management of spills

9.4.2 Conclusion

The aquifers in the study area were conceptualised as a shallow weathered and deep fractured crystalline basement aquifers. A regional 2D groundwater model has been developed to determine the radius of influence of the abstraction from 4 boreholes to augment the water supply to the proposed Water Park.

The pumping rate was based on an assume yield of 700 l/h but should be verified with in-situ pumping test to determine the long term yield of the boreholes While the radius of influence on other groundwater users have been delineated. It must be emphasised the estimated drawdown is based on a conservative approach.

A quarterly monitoring protocol for groundwater quality and groundwater levels from the 4 abstraction boreholes of the proposed Water Park is recommended, to monitor any changes from baseline.

9.5 Archaeological Impact Assessment

The key issues and triggers identified during Scoping for the AIA include:

- The proposed development involves the re-zoning of a site exceeding 10 000 m^2 in extent and thus in line with the NHRA, a AIA (also known as a HIA) is required.

The details of the Specialist are as follows:

- J. Van Der Walt
  - **Qualifications**: BA [Masters]: Archaeology
  - **Experience**: 10 years' experience.
  - **Affiliations**: Professional Member of the Association of Southern African Professional Archaeologist (#159)

The full AIA is appended in Section 14.6.5.

9.5.1 Key Findings

9.5.1.1 Aim of the Study

The aim of the study was to identify cultural heritage sites, document, and assess their importance within local, provincial and national context. It serves to assess the impact of the proposed project on non-renewable heritage resources, and to submit appropriate recommendations with regard to the responsible cultural resources management measures that might be required to assist the developer in managing the discovered heritage resources in a responsible manner. It is also conducted to protect, preserve, and develop such resources within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999

9.5.1.2 Methodology

Two phases of the study were undertaken. In the first phase, a desktop exercise was undertaken where existing records where scanned for information on archaeological sites, historical sites, graves, architecture (structures older than 60 years) of the area. This included:

- Literature Search - This was conducted by utilising data stored in the national archives and published reports relevant to the area. The aim of this is to extract data and information on the area in question.
- Information Collection - SAHRIS was consulted to collect data from previously conducted CRM projects in the region to provide a comprehensive account of the history of the study area.
- Google Earth and Mapping Survey - Google Earth and 1:50 000 maps of the area were utilised to identify possible places where sites of heritage significance might be located.
- Genealogical Society of South Africa - The database of the Genealogical Society was consulted to collect data on any known graves in the area.

In addition, as part of the Phase 2, a field survey of the proposed development was conducted. The study area was surveyed by means of vehicle and extensive pedestrian surveys on the 16th of March and 18th of August 2016.

The survey was aimed at covering the proposed development footprint, focussing on specific areas on the landscape that would be more likely to contain archaeological and/or other heritage remains like drainage lines, rocky outcrops as well as slight elevations in the natural topography. These areas were searched more intensively, but many other areas were walked in order to confirm expectations in those areas. Track logs of the areas covered were taken (Figure 9-10).

Figure 9-10: Track logs of field surveys

9.5.1.3 Findings

The study area was assessed in terms of the archaeological component of Section 35 of the NHRA and no surface indicators of archaeological (Stone or Iron Age) sites were identified in the study area. In terms of the built environment no structures occurred in the study area in 1943, in 1954 the only structure indicated on the topographical map of the study area is a hut in the north eastern corner. During the survey of the study area it was confirmed that this structure was totally demolished and no evidence relating to this structure could be found.

The next edition of topographic maps of the study area date to 1977. From this map it appears that structure 8, 10 and 11 occurred at the time and it is therefore deducted that these three structures were constructed between 1954 and 1977. From this map it is also clear that the tree lined avenues were only planted after 1977. Today several buildings (approximately sixteen) occur in the study area (Figure 9-5). These are all residential dwellings with associated outbuildings like garages and service quarters. Based on the information obtained from topographical maps of the area these structures are all younger than 60 years and not protected by legislation and of no heritage significance, apart from structure 8, 10 and 11 that could be just over 60 years old but is unknown at this point.

Figure 9-11: Distributions of buildings on Site

9.5.2 Conclusion and Recommendations

In terms of the built environment of the area (Section 34), several structures occur in the study area consisting of residential dwelling and associated outbuildings like garages and servant's quarters. Based on information obtained from topographical maps of the study area these structures are all younger than 60 years and not protected by legislation and of no heritage significance, apart from structure 8, 10 and 11 that could be just over 60 years old as they were constructed between 1954 and 1977. As the exact age of these three structures are unknown it is recommended that if these three structures are impacted on by the development their age should be confirmed. If the structures are confirmed to be older than 60 years, a conservation architect should be appointed to assess the structures and apply for a demolition/ alteration permit.

In terms of Section 36 of the Act no burial sites were recorded. However, if any graves are located in future they should ideally be preserved *in-situ* or alternatively relocated according to existing legislation. Due to the subsurface nature of archaeological remains and the fact that graves can occur anywhere on the landscape, it is recommended that a chance find procedure is implemented for the project as part of the EMP:

Chance find procedure

This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below.

- If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease

work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.

- It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area.
- The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

From a heritage perspective, the proposed project is acceptable from a heritage point of view. If the above recommendations are adhered to and based on approval from SAHRA, HCAC is of the opinion that the development can continue as the development will not impact negatively on the archaeological record of the area. If during the pre-construction phase or during construction, any archaeological finds are made (e.g. graves, stone tools, and skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological material and graves the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded, but can be easily mitigated by preserving the sites in-situ within the development.

9.6 Noise Impact Assessment

The key issues and triggers identified during Scoping for the Noise Impact Assessment include:

- During operation, the proposed Water Park may increase noise in the area. This was a concern raised by many I&APs during the initial notification and registration phase as well as during the review of the Scoping Report.

The details of the Specialist are as follows:

- B. Van Der Merwe - dBAcoustics
  - **Qualifications**: MSc Environmental management, BSc Honours in Geography and Environmental Management – University of Johannesburg; National Diploma in Public Health, National Higher Diploma in Environmental Health, National Certificate in Noise Pollution, National Certificate in Air Pollution, National Certificate in Water Pollution
  - **Experience**: 14 years' experience
  - **Affiliations**: Member South African Acoustics Institute; Member of the South African Institute of Occupational Health

The full Noise Impact Assessment is appended in Section 14.6.6.

9.6.1 Key Findings

The prevailing ambient noise level in the vicinity of the proposed water park facility was determined by doing a noise survey at specific measuring points in the vicinity of the proposed water park and surroundings.

A site visit was carried out on 5 October 2016 to identify the activities in an around the proposed water park which contribute to the prevailing ambient noise level of the study area. Measuring points were identified in the vicinity and boundaries of the proposed water park to determine the prevailing ambient noise levels of the study area. The environmental noise survey was carried out on 6, 7, 15 and 17 October 2016 during the daytime. The noise measurements were done in terms of the prescribed local and international recommendations.

The following study methodology was followed:

- Identify all the noise receptors within the vicinity of the water park and to identify such by means of their spatial position on aerial imagery;
- Determine the prevailing ambient noise level at each of the above noise sensitive areas by means of the recommended noise measuring procedure in SANS 10103 of 2008;
- Calculate or determine the acceptable rating level for each noise receptor.

The different land uses in the vicinity of the proposed facility are illustrated in an aerial imagery of the area in Figure 9-12. Noise readings were done at the measuring points as illustrated in Figure 9-13. The measuring points were selected to be representative of the prevailing ambient noise levels of the study area.

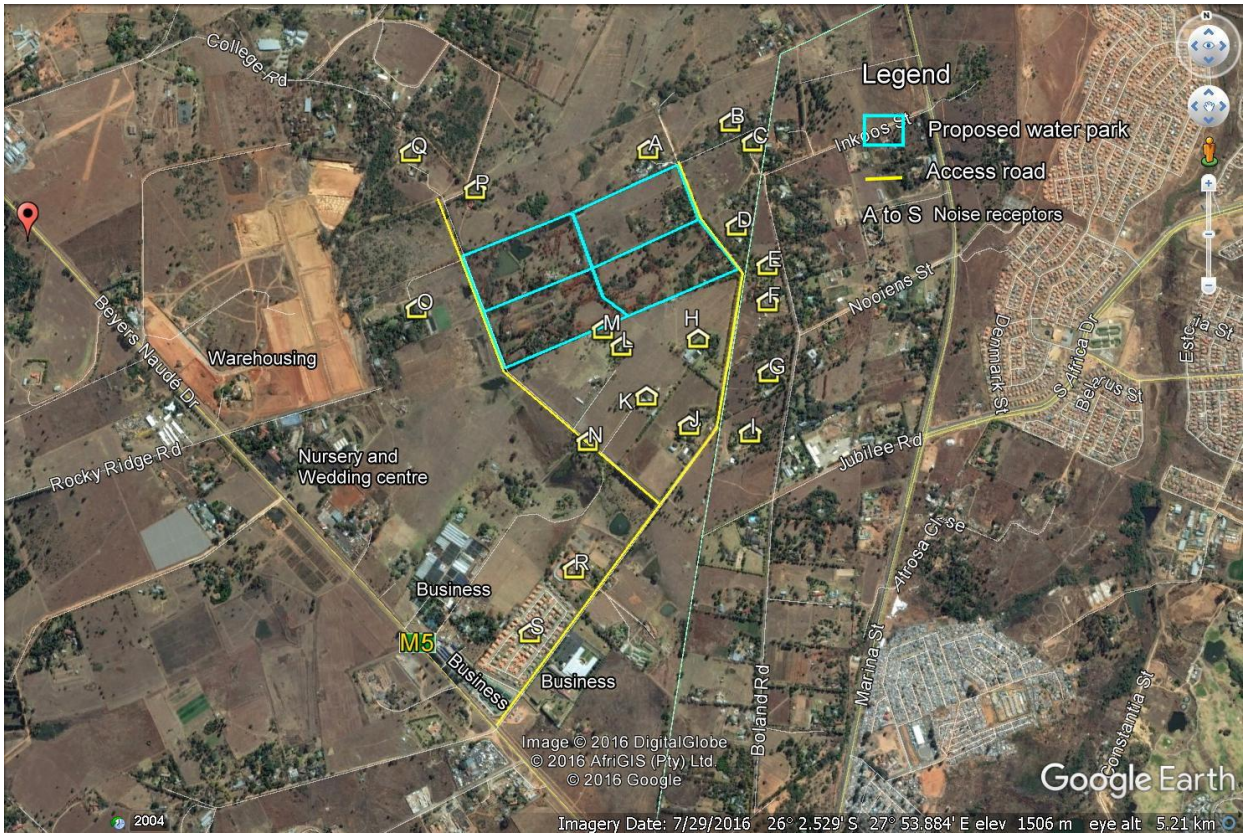


Figure 9-12: Land use in the vicinity of the water park

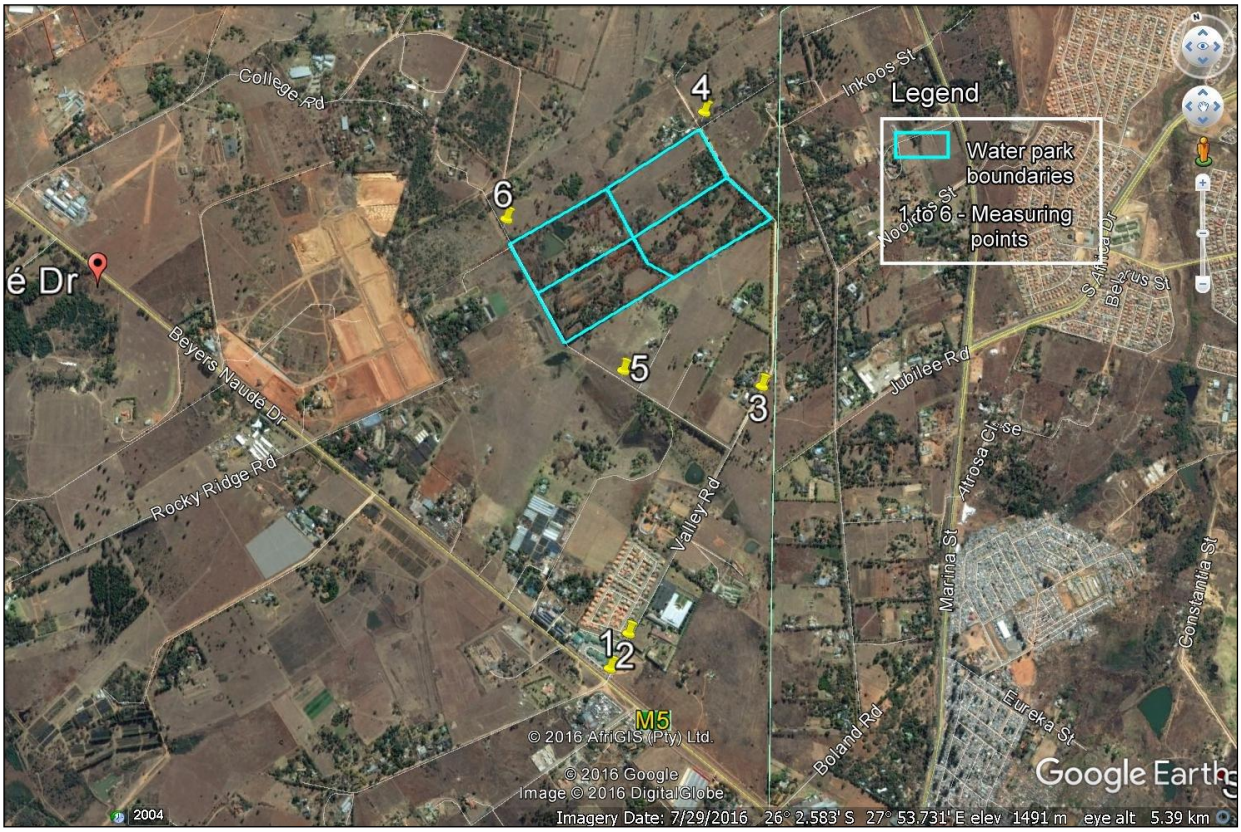


Figure 9-13: Noise measuring points

The prevailing ambient noise levels, as illustrated in Table 9-9, at each of the measuring points includes all the noise sources except for intermittent traffic noise as was found at each measuring point. The wind was blowing up to 2.8m/s on 6,7 and 15 October 2016 whereas the wind was below 1.0m/s on 17 October 2016.

Table 9-9: Results of the noise survey

Position	Noise levels at the different measuring points in dBA											
	6/10/2016			7/10/2016			15/10/2016			17/10/2016		
	Leq	L_{max}	L_{min}	Leq	L_{max}	L_{min}	Leq	L_{max}	L_{min}	Leq	L_{max}	L_{min}
1	**64.0**	81.2	51.5	**61.0**	80.1	49.9	**61.6**	79.9	50.3	**60.7**	81.6	48.8
2	**58.9**	65.3	55.1	**52.2**	72.7	43.2	**51.3**	65.9	42.4	**55.8**	76.5	43.4
3	**43.7**	62.4	36.5	**44.4**	57.4	30.5	**45.3**	57.5	37.2	**36.5**	64.3	27.8
4	**44.1**	56.5	36.5	**46.5**	60.1	34.2	**47.6**	61.8	33.3	**39.9**	54.7	33.5
5	**39.0**	48.9	34.1	**40.7**	48.1	33.9	**40.8**	63.6	32.2	**37.4**	61.8	31.0
6	**40.2**	54.7	30.3	**54.9**	68.2	45.8	**45.3**	57.5	37.2	**39.5**	51.1	32.6

9.6.1.1 Projected noise levels at the noise receptors

Two aspects are important when considering potential noise impacts of a project:

- The increase in the noise level because of the construction (temporary increase) and operational phases (more permanent of nature),
- The overall noise level produced by the activities at the water park which will include the playing of amplified music and people shouting; and
- Increase in the noise levels due to traffic.

The construction activities during the construction phase of the water park will increase the prevailing noise level along the immediate vicinity of the activity on a temporary basis. Engineering control measures and topography can have an influence on how the noise level is perceived by the receptor some distance away from the activities. The cumulative noise level at the abutting residential area during the construction phase of the project will be 49.5dBA when all the construction machinery will be operational. It is not planned for all this equipment to be used at one time and the construction phase noise level will therefore be much lower.

The noise levels to which the residents and other businesses will be exposed to during the operational phase of the project is illustrated in Table 9-10. The calculations are based on a noise level of 85.0dBA at 1meter from the activity and 80.0dBA at the boundary of the park.

Table 9-10: Projected noise levels at the different noise receptors

Residential	Amplified music – allowed noise level at the boundary of the property is 80.0dBA/ activity boundary	People shouting with a projected noise level of 70.0dBA at the boundary of the property/ activity boundary	Cumulative noise level - dBA
A	43.9	38.9	45.1
B	30.4	25.4	31.6
C	28.9	23.9	30.1
D	42.2	37.2	43.4
E	36.6	31.6	37.8
F	30.8	25.8	32.0
G	25.0	20.0	26.2
H	31.4	26.4	32.6
I	22.1	17.1	23.3
J	23.7	18.7	24.9
K	27.6	22.6	28.8
L	35.8	30.8	37.0
M	43.9	38.9	45.1
N	25.5	20.5	26.7
O	29.4	24.4	30.6
P	33.5	28.5	34.7
Q	25.9	20.9	27.1
R	19.1	14.1	20.3
S	19.0	14.0	20.2

In order to determine the noise intrusion level at the different residential areas (noise receptors) it will be required to determine the prevailing ambient noise levels at each measuring point and to calculate the increase in the noise level during the operational phase of the project.

The cumulative noise level at the different receptors was added in a logarithmic manner to determine the overall sound exposure at the receptor. The noise impact during day at the abutting noise receptors is given in Table 9-11

Table 9-11: Noise impact at the different noise receptors during the day

Noise receptor	Amplified music	People shouting	Cumulative noise level - dBA	Prevailing ambient noise level during the day - dBA	Cumulative ambient daytime noise level - dBA	Daytime noise intrusion - dBA
A	43.9	38.9	45.1	39.9	46.3	6.4
B	30.4	25.4	31.6	39.9	40.5	0.6
C	28.9	23.9	30.1	39.9	40.3	0.4
D	42.2	37.2	43.4	36.5	44.2	7.7
E	36.6	31.6	37.8	36.5	40.2	3.7
F	30.8	25.8	32.0	36.5	37.8	1.3
G	25.0	20.0	26.2	36.5	36.9	0.4
H	31.4	26.4	32.6	36.5	38.0	1.5
I	22.1	17.1	23.3	36.5	36.7	0.2
J	23.7	18.7	24.9	36.5	36.8	0.3
K	27.6	22.6	28.8	37.4	38.0	0.6
L	35.8	30.8	37.0	37.4	40.2	2.8
M	43.9	38.9	45.1	36.5	45.7	9.2
N	25.5	20.5	26.7	36.8	37.2	0.4
O	29.4	24.4	30.6	39.5	40.0	0.5
P	33.5	28.5	34.7	39.5	40.7	1.2
Q	25.9	20.9	27.1	39.5	39.7	0.2
R	19.1	14.1	20.3	55.8	55.8	0.0
S	19.0	14.0	20.2	55.8	55.8	0.0

SANS 10210 of 2004, the national standard for the calculating and predicting of road traffic noise was used to calculate the noise level to be generated by the traffic along the access road. The traffic will create an increased noise level in areas where there was no traffic as the normal traffic patterns which will be introduced along these routes. The calculation of the noise levels during the construction phase are based on 30 vehicles of which 10 vehicles will be motor vehicles and 20 vehicles will be construction vehicles and during the operational phase 265 vehicles during weekday peaks and 1 199 vehicles during week-end peaks. There will be vehicles entering and leaving the water park which will create intermittent noise increases of up to 60.0dBA at 25m from the road. The prevailing ambient noise level will be maintained when there is no traffic along Valley and Lake Roads.

The calculated traffic noise levels for the week day peaks and week-end peaks at set-back distances of 25m, 50m, 100m and 200m from the road are illustrated in Table 9-12.

Table 9-12: Calculated traffic noise levels along Valley and Lake Roads.

Location	Noise levels (dBA) at set-back distances during the week day peaks				Noise levels (dBA) at set-back distances during the week-end peaks			
	25m	50m	100m	200m	25m	50m	100m	200m
Valley Road	56.0	52.0	49.0	46.0	62.0	58.0	54.0	50.0
Lake Road	56.0	52.0	49.0	46.0	62.0	58.0	54.0	50.0

There will be a finite type noise increase when traffic makes use of the ring road to and from the water park. The noise levels along the feeder roads to and from the water park will return to the levels of the prevailing ambient noise levels when there is no traffic. The speed limit will be controlled to not exceed 60km/h for cars and 40km/h for delivery vehicles. The roads must be paved with an Ultra Thin Friction Coarse (UTFC) which is a very thin asphalt layer paved at between15 mm and 20 mm thick whilst spraying a thick tack-coat to the road surface all in one pass.

9.6.1.2 Impacts and Issues Identification

A standardised impact assessment methodology will be used to evaluate the impact during the construction, operational and maintenance phases of the project. The prevailing ambient noise levels during each of these phases will differ due to the location of these areas to other point and/or linear noise sources.

The following potential impacts were evaluated for the project:

- Construction phase:
  - Preparation of the foot print area;
  - Civil construction;
  - Grading and building of new roads;
  - Construction of buildings and water activity structures.
- Operational phase:
  - Playing of amplified music at the water park and restaurants;
  - Water park activities such as people shouting and screaming;
  - Water pumps and generators;
  - Wave making room;
  - Additional traffic to and from the water park.
- Rehabilitation Phase
  - Removal of structures and infra-structure;
  - Planting of rehabilitated area with grass and trees.

9.6.1.3 Recommendations for mitigation

The following impacts were identified to be moderate and should be addressed in order to comply with the Noise Control Regulations:

- Construction phase
  - Increased noise levels at the abutting noise receptors and at the boundary of the property during civil construction activities;
  - Increased noise levels along the boundary of the project site during construction of the different water activities.
- Operational phase
  - Increased noise levels during operational times when amplified music will be played;
  - Increased noise levels created by people using the water park slips and slides;
  - Increased noise levels along the feeder roads.

Table 9-13: Noise mitigatory measures

Objective	To comply with the Noise Control Regulations as promulgated under the Environment Conservation Act, 1989. Act No 73 of 1989; Put measures in place to align the operations with the provisions of South African National Standards; Environmental, Health and Safety (EHS) Guidelines, World Health Organisation (WHO, 2002).	Responsibility
Impacts:	Construction Impacts Increased noise levels during civil construction activities; Increased noise levels during the construction of the roads; Increased noise levels during building of the different water activities. Operational Impacts Increased noise levels during water activities; Increased noise levels during wave making, water pumping and/or generators; Playing of amplified music at the water park and restaurants; Increased noise levels along the feeder roads.	Site engineer
Mitigation measure(s):	Construction and operation 1. Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels. 2. Preparation of the foot print, civil construction activities and the construction of the roads should be limited to daytime only. 3. Amplified music not to be higher than 75.0dBA at each point source. 4. Speakers may not be higher than 3.0m from ground level. 5. Directional speakers with a throw not longer than 10m must be installed and facing to the inside of the park. 6. A noise limiter to be installed at the office and must be tamper proof. 7. The noise limiter must be calibrated at a sound level of 75.0dBA. 8. All platforms higher than 3.0m above ground level must be screened off from the abutting residential areas. 9. Slip slides on a raised level to be enclosed to restrict the screaming and shouting during the use of the apparatus and to be propagated outside the boundaries of the property. 10. A 3.0m to 3,5m high wall or soil earthberm covered with vegetation to be constructed along the foot print boundaries of the water park.	

	11. A 2.5m wall must be constructed along the entire remainder boundary of the water park. 12. All water pumps and generators must be encapsulated with a brick constructed building with a concrete slab roof. 13.All ventilation openings must be fitted with a double layer of acoustic louvres. 14. A wooden solid core door to be used instead of steel doors at all the door openings where high sound levels will be radiated from. 15.The wave making plant room for the tsunami and wave pools to be acoustically screened off and acoustic ventilation louvres to be provide at all openings; 16. All water pumps and generators must be encapsulated with a brick constructed building with a concrete slab roof. 17. The design of these areas must be done in conjunction with an acoustic engineer; 18. An earthberm to be erected along the sides of the wave making sections which must be planted with natural vegetation. 19. All the roads to and from the water park to be paved with UTFC asphalt; 20. Noise barriers to be constructed along the roads once the engineering designs of the roads are available. 21. The speed limit must not be higher than 60km/h for motor-cars and 40km/h for delivery vehicles. 22. A noise survey to be carried out on a monthly basis or when a noise complaint is received at the different point sources and at the boundary of the property to ensure that the sound limits are adhered to. 23. A sound management plan must be in place and record of the noise surveys to be kept in a safe place for a period of five years. 24. A noise compliance certificate to be issued once all the activities and subsequent noise levels comply with the Noise Control Regulations.	
Performance criteria	Conformance to the conditions of the Noise Control Regulations and SANS 10103 of 2008.	

9.6.2 Conclusion

The noise intrusion before the noise mitigatory measures will be in place will be from doubling of loudness of the sound to barely detected because of the locality of the noise receptors close to the water park and other some distance from the water park. The further the noise receptor is from the water park, the less sound will be audible.

There will be an increase in the environmental noise levels from the activities at the water park, but this can be managed by means of noise mitigatory measures. The noise mitigatory measures must be in place to ensure that the water park activities will be environmentally sustainable and will comply with the Noise Control Regulations.

There are a concern by some of the land owners that there animals will be affected by the increased noise level from the activities at the water park. Animals depend on acoustic signals for essential functions, some species have become threatened or endangered because of loss of habitat and further relocation as a result of noise disturbance is not possible. There is still an absence of understanding how observed behavioural and physiological effects translate into ecological consequences for wildlife. There are examples where increased noise levels and subsequent activities did not impact on the breeding and well-

fare of animals at places of entertainment. It was found that loud music at stables close to areas where there is traffic and amplified noise had no affect on thorough bred horses and their performance. A noise survey done inside the stables revealed that there were high noise levels inside the stables (higher than the environmental noise levels) due to stable hand activities, horses kicking doors and noise from the horses itself.

The following noise management plan must be implemented to identify any noise problems in a pro-active manner. This plan is illustrated in Figure 9-14.

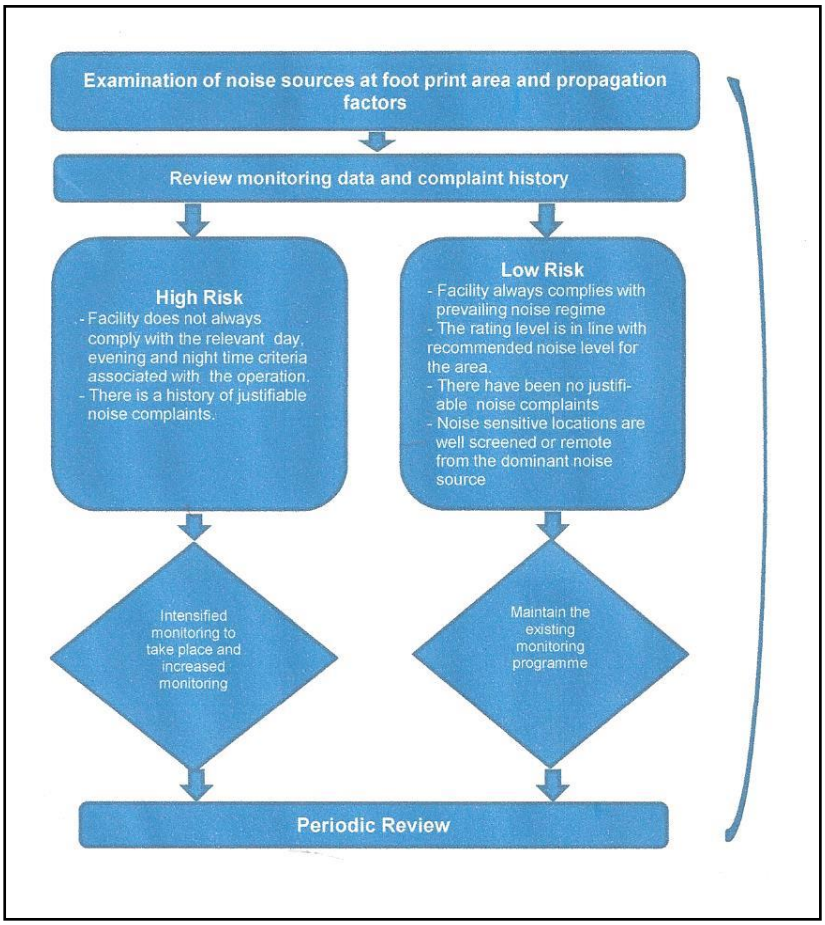


Figure 9-14: Noise management plan

The noise from the activities at the water park and the road can be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the Local Noise Control Regulations, and the International Finance Corporation's Environmental Health and Safety Guidelines.

9.7 Outline Scheme Report, Floodline Assessment and Storm Water Management Plan

The key issues and triggers identified during Scoping for the Outline Scheme Report include:

- Services will be required at the proposed Water Park and thus an Outline Scheme Report is required to understand service availability and requirements.
- In addition, during the initial notification and registration period, many I&APs raised concerns regarding the availability of services in the area.
- A number of watercourses occur within or next to the site and thus the floodlines for these are required.

In addition, a Stormwater Management Plan was compiled with the aim of meeting the attenuation requirements of Mogale City. In addition, I&APs during the Scoping Phase raised concerns regarding the impacts of the stormwater management from the site.

The details of the Specialist are as follows:

- Leon Wentzel– CivilConsult
  - **Qualifications**: Eng, B Proc, BSc Eng Hons
  - **Affiliations:** MSAICE; MWISA; MSAIMunE; A Arb; PMISA

The full Outline Scheme Report is appended in Section 14.6.7. Please note that where the Outline Scheme Report appended studies that were already included as annexures to the EIA report, these were not repeated (for example Traffic Impact Assessment and Geotechnical Assessments).

9.7.1 Key Findings

The Outline Scheme Report noted the following existing services which occur near the site:

- A municipal 110mm diameter watermain in Valley Road to the east of the site;
- A 335mm diameter watermain to the west of the property on Lakeview road;
- 4 boreholes;
- Lakeview road is a rural road with an asphalt surface (to the west of the site) and Valley Road (to the east) is a gravel road.

9.7.1.1 Access and Parking

Proposed entry to the Water Park will be provided from Lakeview Road with a one-directional dual lane internal road which will lead to the parking facilities. An exit road will be provided onto Valley Road (Figure 4-2).

A Traffic Impact Assessment has been undertaken and in line with the requirements of the report, the developer will undertake a number of upgrades in order to cater for the proposed development. These include:

- Upgrades to Beyers Naude and Valley Road:

  - Signalization of the intersection;
  - A 30m slip lane (yield) on the north approach;
  - An additional dedicated right turn lane (60m) on the south approach; and
  - A shared slip lane (yield) and through lane (30m) on the east leg of the intersection.
- Upgrade of Beyers Naude and Rocky Ridge Road:
  - A shared left and through lane on the north approach;
  - A dedicated right turn lane (60m) on the north approach;
  - An additional receiving lane on the north leg of the intersection;
  - A shared left and through lane on the south approach;
  - A dedicated right turn lane (60m) on south approach; and
  - An additional receiving lane of the south leg of the intersection.
- Upgrade of Beyers Naude and College Road:
  - Signalisation of the intersection;
  - A dedicated right turn lane (60m) on the north approach;
  - An additional receiving lane on the north leg of the intersection;
  - A dedicated right turn lane (120m) on the south approach;
  - An additional through lane of the south approach; and
  - An additional receiving lane on the south leg of the intersection.
- Rehabilitation of Valley Road and Lakeview Road:
  - Widening of Valley Road and Lakeview Road to 7m.

The upgrades described above will be augmented by additional upgrades that will be undertaken by Gauteng Department of Roads and Transport (GDRT).

9.7.1.2 Water Services

According to the Outline Scheme Report compiled by Civilconsult, there are a number of factors that need to be taken into account in determining the water demand. Firstly, municipal water will be required to fill the rides at the project start up. In addition to the water required for the first fill, potable water will be required for offices, restaurants, and day visitors. Due to the extensive water activities and features on site, an additional water use that must be taken into account is evaporation and backwash of the various pools.

Based on the above, a water balance has been calculated for the development. The water balance takes into account the numerous forms of recycling that have been instituted to ensure that the proposed water park is sustainable (in light of the fact that South Africa is an arid country).

Table 9-14: Water Balance Summary

	Supply (m^3/a)	**Details**	**Usage and losses (m^3/a)**	**Details**	**Balance (m^3/a)**

Water Park facilities	135 963	Borehole, rainwater harvesting and recycling	126 465	Splash out, evaporation and backwash	**+9 498**
Potable water requirements	94 608	Mogale City Municipal supply	17 666	Sewage/Effluent	**+76 942**
Total Water Balance					
Total Supply (m^3/a)		**Total Usage and Losses (m^3/a)**		**Total Balance (m^3/a)**	
230 571 m^3/a		144 131 m^3/a		**+86 440m^3/a**	

Various water supply sources will be utilised to supply the proposed development with water. These include:

- Municipal water;
- Borehole water; and
- Rainwater harvesting.

9.7.1.2.1 Municipal Water Supply

A standard bulk water connection will be provided from the existing 110mm diameter watermain in Valley road. This water will be used to provide potable water to the development and will service the office buildings, reception areas, change rooms and restaurants. It will also provide water for the fire flow. If necessary, a booster pump will be put in place to ensure sufficient municipal pressure. In addition, a reservoir with a storage capacity of 8 hours of the average annual daily demand (AADD) will be put in place. If necessary, the reservoir will include storage capacity for fireflow.

9.7.1.2.2 Groundwater

In addition to municipal water, four boreholes occur on the site and will be utilised for supplementing water losses due to evaporation, splashes and backwashing. A hydrogeological baseline and 2D model was undertaken and found that the current abstraction rates of the boreholes on site was 7665m^3/a. However, based on the assumed yield, the future abstraction rate was determined to be 6750 m^3 per annum (per borehole). The 2D model showed that based on this abstraction rate, there would be no significant drawdown (and associated impacts on adjacent landowners).

9.7.1.2.3 Rainwater Harvesting

In addition to borehole and municipal water, rainwater harvesting will also be undertaken. As part of this, stormwater runoff from the site (south of the natural watercourse) will be collected with grid inlets, kerb inlets, swales and stormwater pipes which will drain into the attenuation dam. From the attenuation dam, water will drain into the storage dam which will be line with 2,0mm HDPE liner. The storage water will be treated and recycled before it will be pumped back to supplement water losses in the water park caused by evaporation and operational losses.

9.7.1.2.4 Water Recycling

Water from water resources will also be recycled and reused to supplement the water losses at the water park due to evaporation and operational activities. The following waste water will be recycled:

- Backwash water from water activities and features; and
- Sewage effluent.

Separate treatment facilities will be provided to purify these two streams.

9.7.1.2.4.1 Backwash water

All backwash water from the water park will be recycled and purified to be used to supplement water demand. The average backwash of an Olympic sized pool (2500m^3) is 23.9kl per day (without the use of a special filter) and backwash from the park was assumed to be similar to Olympic sized pool. Based on this assumption, 95.2kl/day of water will be generated by backwashing. Water from backwashing will follow the following process:

- Pre-screening
- Buffer of equalization tank;
- Lamella clarifier;
- Tertiary filtration and sterilization;
- Final water storage tank;
- Pressure pumps to distribute clean water back to the various pools for use as top up water.

In addition, it is recommended that efficient swimming pool filters will be put in place on all pools. This will reduce the volume of backwash produced.

9.7.1.2.4.2 Treated Sewage Effluent

All sewage effluent will be treated and used for irrigation purposes. The water will conform to DWS standards. The estimated volume of treated effluent available is provided below.

Table 9-15: Estimated volume of treated effluent available for irrigation

Item	**Estimated volume of treated effluent available for irrigation**		
	Floor area (m2)/ Number of visitors	**Average annual daily flow (AADF)**	**Waste water for irrigation (kl/day)**
Offices	2000m^2	0.8 kl/100m^2	16
Restaurant	2000m^2	0.8kl/100m^2	16
Visitors per day	820	20kl/person	16.4
Total			48.1
Estimated losses in treatment plant (20%)			9.62
Total available			**38.48**

9.7.1.3 Sewer

The estimated brown and grey waste water for the proposed development is provided below.

Table 9-16: Estimated volume of sewage

Item	Estimated volume of sewage		
	Floor area (m2)/Visitors	**Average Annual Daily Flow (AADF)**	**Waste water for irrigation (kl/day)**
Offices	2000m^2	0.8 kl/100m^2	16
Restaurant	2000m^2	0.8kl/100m^2	16
Visitors per day	820	20kl/person	16.4
Total before seepage			48.4
Percentage infiltration (15%)			7.26
Total			**55.66**

Sewer will be treated on site by an on site treatment plant.

9.7.1.4 Stormwater

No existing stormwater reticulation is in place at the proposed development site and as such as part of the development, a stormwater system will be put in place. As part of this, stormwater from the site (south of natural watercourse) will be collected with grid inlets, kerb inlets, swales and stormwater pipes which will drain into an attenuation dam. From the attenuation dam, stormwater will drain into the storage dam where it will be treated and reused to supplement water losses in the park.

The attenuation pond will accommodate the post 1:25 year run-off and the outflow into the storage dam will be the pre-1:5 year flood.

The capacity for each dam will be as follows:

- Attenuation dam/pond - 4600 m^3; and
- Storage dam – 15 347m^3.

9.7.2 Conclusion

The services required for the proposed Water Park will be put in place as part of the development. Municipal sources of water are available. In addition, a number of additional sources of water will be used. In terms of sewer, a sewer treatment plant will be put in place at the site. A dedicated stormwater system will also be implemented.

9.8 Geotechnical Assessment

The key issues and triggers identified during Scoping for the Geotechnical Assessment include:

- It is necessary to understand the site soil conditions to ensure that the design and construction of the proposed Water Park is done properly and safely.

The details of the Specialist are as follows:

- Johan van der Merwe:
  - Qualifications: MSc, Engineering Geology
  - Experience: 32 year's experience
  - Affiliations: SACNASP (Pr.Sci.Nat – Geological Science)

The full Geotechnical Assessment is appended in Section 14.6.8.

9.8.1 Key Findings

The objective of the geotechnical investigation was to: -

- Determine the engineering properties of the site soils and bedrock including potentially expansive material, low bearing capacity soils, areas difficult to excavate, shallow ground water conditions and the quality of the in-situ soils in terms of road and platform construction; and
- Present appropriate recommendations for the construction of the new appurtenant structures and precautionary measures in accordance with the requirements of the local authorities.

As part of the site investigation, twenty-six test pits were excavated across the site by a Case 580 backactor. The pits were entered and inspected by a registered professional engineering geologist, who described the soil profile according to the methods advocated by Jennings et al (1973) e.g. moisture condition, colour, consistency, soil type, structure and origin (MCCSSO). Disturbed and undisturbed soil samples, representative of the site soils were taken and submitted to Geoplan's commercial soil laboratory in Industria for testing and analysis.

The site is covered by a thin to moderate horizon of transported sandy and gravelly soils which are underlain by residual soils developed over weathered granite (strictly speaking homogenous medium-grained porphyritic granodiorites according to Anhaeusser) belonging to the Halfway House Granite Dome of Archaean age. Scattered outcrops of granite bedrock occur in isolated areas across the eastern portion of the property.

The site has been apportioned into four generalized materials horizons, Soil Zones "A" to "D" as shown in Figure 9-15 below.

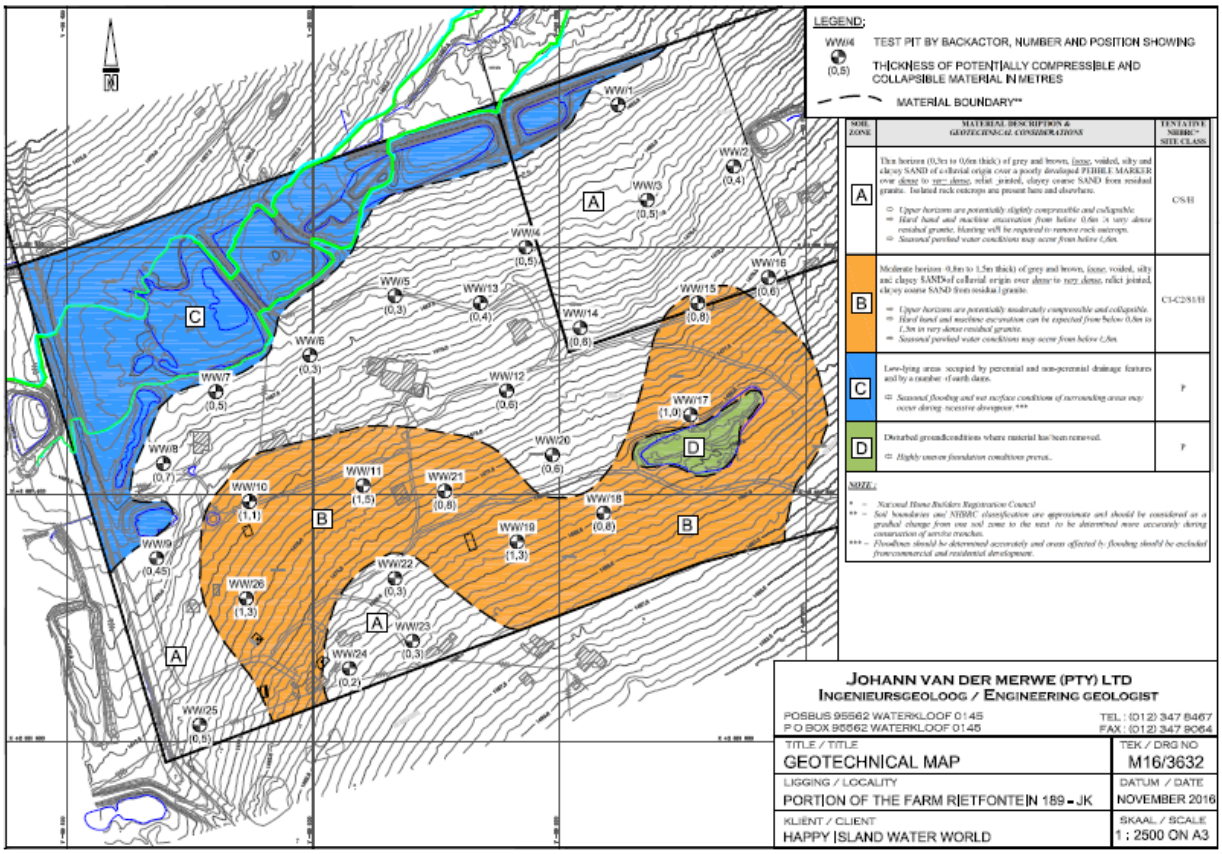


Figure 9-15: Geotechnical Map

These soils zones are as follows:

- Soil Zone “A” covers the central portion of the site and a generalized description of the typical soil profile that may be encountered here, is as follows: -
  - 0,0 – 0,4: Moist, light grey, loose, intact, silty coarse SAND containing roots; colluvium.
  - 0,4 – 1,0: Slightly moist, dark orange speckled white and stained black on joints, dense becoming very dense, relict jointed, clayey coarse SAND; residual granite.
  - 1,0 – 1,2: Moist, dark orange mottled black, very dense, relict jointed, clayey coarse SAND; residual granite.
- Soil Zone “B” covers the eastern portion of the site and a generalized description of the typical soil profile that may be encountered here, is as follows: -
  - 0,0 – 0,2: Moist, greyish brown, loose, intact, gravelly SAND containing roots; colluvium.
  - 0,2 – 1,2: Slightly moist, dark orange, dense, voided, gravelly clayey coarse SAND containing tree roots; colluvium.
  - 1,2 – 2,0: Dry, light orange blotched black and orange, very dense, partially ferruginised, silty coarse SAND; residual granite. This horizon extends to depths ranging from 1,0m to >3,0m below surface.
- Soil Zone “C” occupies the western low-lying area and is characterized by a northerly draining non-perennial drainage feature containing several small earth dams and possibly a surrounding wetland area.

- Soil Zone “D” covers an area of disturbed ground in the eastern part of the site where construction material had been removed in the past, resulting in a disused borrow pit, some 2m to 3m deep and covering an area of less than 0,5 hectares.

Slow excavation to gradual refusal of the backactor was experienced at depths ranging from 0,3m to 1,6m below across Soil Zone “A” and at depths ranging from 0,9m to more than 2,0m below surface across Soil Zone “B”. The water table, whether perched or permanent, was not encountered in any test pit during the investigation which was carried out during the end of a particularly dry season.

9.8.2 Conclusion

9.8.2.1 Expansive Soils

The sandy, silty and gravelly transported and residual soils which blanket the site are potentially “low” in the degree of expansiveness, based on the results of the laboratory tests carried out on similar material and according to the Van der Merwe (1964) method. A total surface heave of less than 7,5mm is predicted across the site, should the moisture condition of the soils change from a dry to a saturated state.

9.8.2.2 Compressible and Collapsible Soils

The blanketing colluvial soils are considered to be potentially moderate collapsible and compressible whereas the residual granite soils have a dense to very dense consistency and are considered to be intact and probably only slightly potentially collapsible and compressible. The potentially collapsible horizon extends down to an average depth range of 0,3m to 0,7m below surface across Soil Zone “A” and from 0,8m to 1,5m below surface across Soil Zone “B”.

9.8.2.3 Earthworks

Based on a visual appraisal of the materials encountered during the investigation, it is suspected that the colluvial and residual granitic soils should be suitable for use as fill underneath surface beds and for use in the construction of bulk fill, paved areas and roads (G7/G6 Quality). The potentially collapsible and compressible nature of the upper soil horizons should be taken into consideration in the design of roads and paved areas.

9.8.2.4 Ground Water and Soil Chemistry

No water seepages were encountered in any test pit during the investigation which was carried out during the early part of the wet season. The presence of a seasonal perched water table is considered likely due to the impermeable nature of the residual granite underlying the permeable colluvial soils. The necessary damp proofing precautions should be taken underneath structures and a subsoil drainage system may be considered below structures as well as along the upslope side of the proposed new structures. The site soils are considered to be chemically aggressive with regards to buried ferrous pipes and the use of non-ferrous metal pipes or plastic pipes should be considered for wet services and the foundation soils should be treated with an environment friendly insecticide to combat the termites.

9.8.2.5 Excavation Characteristics

Very hard machine excavation can be expected at depths ranging from below 0,3m to 1,6m below surface across Soil Zone “A” and from below 0,9m across Soil Zone “B”. The very dense residual granite that is present here will require the use of a more powerful machine than the Case backactor that was used during the investigation. Very hard excavation, the use of jackhammers and blasting will be required to remove the granite outcrops that occur sporadically across the eastern portion of the site.

The design and construction of raft foundations (whether soil or concrete) should be done in accordance with and under supervision of a civil or structural engineer. It is recommended that foundation trenches be inspected by a competent person during construction in order to determine the presence or not of disturbed ground conditions (old excavations, test pits, animal burrows etc.) and where present, the disturbed ground should be reinstated carefully prior to the construction of masonry structures

9.9 Traffic Impact Assessment

The key issues and triggers identified during Scoping for the Traffic Impact Assessment (TIA) include:

- The proposed development will involve the influx of visitors to the site (up to 12 000 per day) and thus may impact traffic in the area.
- During the initial notification and registration period, a number of concerns were raised regarding the state of the existing roads in the area as well as the impact of the proposed development on traffic in the area.

The details of the Specialist are as follows:

- C. Nair - WSP Parsons Brinckerhoff
  - **Qualification**s: MEng, BSc Civil Engineering
  - **Experience**: 9 years’ experience.
  - **Affiliations:** Engineering Council of South Africa (ECSA) (2003 701 33)

The full Traffic Impact Assessment is appended in Section 14.6.9.

9.9.1 Key Findings

The Traffic Impact Assessment included traffic counts which were used to estimate the traffic demand and traffic volumes for the proposed development. A classified traffic survey was commissioned by WSP on the 10th and 11th June 2016 (Friday and Saturday) at the following intersections:

- Beyers Naude Drive/Marina Street/Peter Road (Intersection 1);
- Beyers Naude Drive/Valley Road (Intersection 2);
- Beyers Naude Drive/Rocky Ridge Road (Intersection 3); and
- Beyers Naude Drive/College Road (Intersection 4).

In addition to the traffic counts, Mogale City Local Municipality was consulted and Greengate Extension 19 was identified as a latent development which needed to be incorporated into the Traffic Impact Assessment.

The study noted that the proposed development occurs in close proximity to the following roads:

- Beyers Naude Drive (M5): This road is classified as a Class 2 road having an east west alignment extending from Auckland Park (City of Johannesburg Metropolitan Municipality) in the east to N14 national freeway to the west. The portion of Beyers Naude Drive between Boland Road (east) and Heritage View Drive (west) is an undivided carriageway comprising of a single lane per direction. The portion of Beyers Naude Drive west of Heritage View Drive towards N14 comprises of two lanes per direction with a centre median. The posted speed limit is 80km/h.
- Marina Street: This road is classified as a Class 4 access road having a north south alignment comprising of a single lane per direction. Marina Street connects with Beyers Naude Drive in the south to R114 to the north. Marina Street provides access to commercial, residential and agricultural land use components. Marina Street is regarded as an important north south link.
- Peter Road: This road is classified as a Class 4 access road having a north south alignment comprising of a single lane per direction. Peter Street connects with Beyers Naude Drive in the north to Hendrik Potgieter Road (M47) to the south. Peter Road provides access to commercial, residential and agricultural land use components. Similarly, to Marina Street, Peter Road is also an important north south link.
- Valley Road: This road is a 5m wide Class 5 road having a north south alignment. Valley Road alignment starts at Beyers Naude Drive in the south and ends in a cal-de-sac to the north just pass the site boundary. The first portion (1km) of Valley Road has an asphalt surface, whereas the remaining portion of its alignment (1.43km) has a gravel surface. The south leg of the intersection of Beyers Naude Drive/Valley Road is an informal gravel access road where access to a truck repair yard is taken. Further along it's alignment, this gravel road services large agricultural holdings.
- Lakeview Road: This road is a 5m wide Class 5 road located approximately 930m off Valley Road in the north and bounds the western portion of the site. Lakeview Road ends in a cal-de-sac towards the end of the site boundary. Lakeview Road has an asphalt surface;
- Rocky Ridge Road: This road is a 5m wide Class 5 road having a north south alignment.

In addition, there are a number of roads planned through provincial and national road planning processes in the area. These include:

- K31: The 2010 Gauteng Strategic Road Network Planning illustrates the proposed K31 alignment planned on the existing Beyers Naude Drive (M5). The Gauteng Department of Roads and Transport (GDRT) have appointed ILIFA Africa Engineers to undertake a detail design for the proposed K31 alignment. It is planned that K31 be constructed during 2017/2018.
- K56: The 2010 Gauteng Strategic Road Network Planning illustrates the proposed K56 alignment planned approximately 950m west of the intersection of Beyers Naude Drive/Valley Road. It is not known as to when K56 will be constructed. It should be noted that the planned K56 alignment traverses the north eastern portion of the site. The road reserve required for K56 has not yet been expropriated by the GDRT.

- K52: The 2010 Gauteng Strategic Road Network Planning illustrates the proposed K52 alignment planned on the existing R114 which is located approximately 950m west of N14 eastern ramp terminal. It is not known as to when K52 will be constructed. Note that the road reserve required for K52 has not yet been expropriated by the GDRT.
- PWV5: The 2010 Gauteng Strategic Road Network Planning illustrates the proposed PWV5 alignment planned approximately 570m east of Beyers Naude Drive/Marina Street/Peter Road. PWV5 is not expected to be constructed in the near future.

9.9.1.1 Traffic Volumes

From the traffic count a common peak hour was determined (the busiest hour) for each counted period and was found to be:

- Weekday PM peak hour 16:00 – 17:00
- Saturday peak hour 11:30 – 12:30

The study also provided the information on the following intersections:

- Beyers Naude Drive/Marina Street/Peter Road (Intersection 1) - This intersection is signalised and has an overall LOS E and LOS B during the PM and Saturday peak hours. This intersection has approximately 3720vph and 2585vph during the PM and Saturday peak hours respectively with Beyers Naude Drive having the highest traffic volumes.
- Beyers Naude Drive/Valley Road (Intersection 2) - This intersection has a two-way stop control. Beyers Naude Drive has an overall LOS A during both the PM and Saturday peak hours. Valley Road has the worst LOS E and LOS C during the PM and Saturday peak hours respectively. The LOS E is due to the 11vph on the right turn movement on the east approach. This intersection has approximately 1670vph and 1260vph during the PM and Saturday peak hours respectively with Beyers Naude Drive having the highest traffic volumes.
- Beyers Naude Drive/Rocky Ridge Road (Intersection 3) - This intersection has a two-way stop control. Beyers Naude Drive has an overall LOS A during both the PM and Saturday peak hours. Rocky Ridge Road has the worst LOS E and LOS C during the PM and Saturday peak hours respectively. The LOS E is due to the very low traffic volumes on Rocky Ridge trying to access Beyers Naude Drive. This intersection has approximately 1570vph and 1110vph during the PM and Saturday peak hours respectively with Beyers Naude Drive having the highest traffic volumes.
- Beyers Naude Drive/College Road (Intersection 4) - This intersection has a two-way stop control. Beyers Naude Drive has an overall LOS A during both the PM and Saturday peak hours. College Road has the worst overall LOS E and LOS C during the PM and Saturday peak hours respectively. The LOS E is due to traffic trying to access Beyers Naude Drive from College Road. This intersection should be signalised in order to operate at an acceptable level of service. This intersection has approximately 1625vph and 1140vph during the PM and Saturday peak hours respectively with Beyers Naude Drive having the highest traffic volumes.

9.9.1.2 Estimated Trips Generated

The proposed development is expected to generate approximately 255 trips and 1 199 trips (in and outbound) during the Weekday PM and Saturday peak hours respectively on the external road network.

9.9.1.3 Proposed Entrance and Exit

It is proposed that the Water Park entrance be situated off Lakeview Road approximately 217m west from the planned K56 road reserve. This access point will allow for ingress only. However, it is proposed that an emergency exit lane be provided for vehicles such as fire trucks and ambulances. A proposed road reserve of 20m is required on Lakeview Road west from the planned K56 road reserve. This access point will allow for ingress only. However, it is proposed that an emergency exit lane be provided for vehicles such as fire trucks and ambulances. A proposed road reserve of 20m is required on Lakeview Road. The entrance will comprise of the following:

- A single 5m wide entrance lane (light vehicles and emergency vehicles);
- Two (2) x 3.5m wide entrance lanes (light vehicles);
- A single 5m wide exit lane (emergency vehicles only);
- A single 4m wide strip for security/gate house; and
- 1.5m wide sidewalks on each side of the access.

A queuing analysis was undertaken to determine the minimum stacking distance required at the entrance to the proposed development. The results show that the three (3) entrance lanes are required to be a minimum of 30m long from the road edge on Lakeview Road to the boom control position to provide adequate stacking distance

In terms of the exit, it is proposed that the Waterpark exit be situated off Valley Road located to the north-western end of the site. This exit position is to be provided at a minimum distance of 100m west from the planned K56 road reserve. This is an exit point only; however, it is proposed that an emergency entrance lane be provided for vehicles such as fire trucks and ambulances. A proposed road reserve of 20m is required on Valley Road. The exit will comprise of the following:

- A single 5m wide exit lane (light vehicles and emergency vehicles);
- One (1) x 3.5m wide exit lane (light vehicles);
- A single 5m wide entrance lane (emergency vehicles only);
- A single 4m wide strip for security/gate house; and
- 1.5m wide sidewalks on each side of the access.

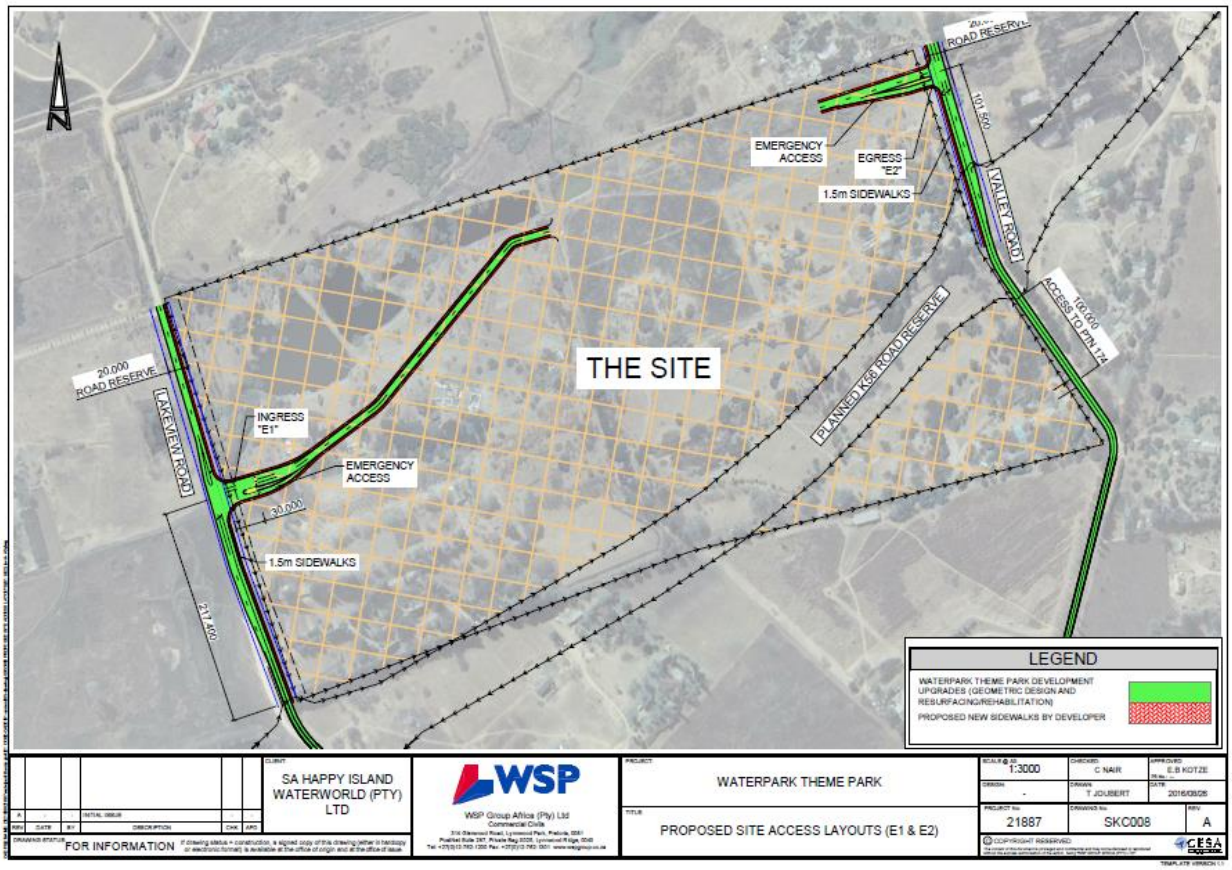


Figure 9-16: Proposed Entrance and Exit

9.9.1.4 Proposed Parking

The City of Johannesburg Town Planning Scheme (2011), was used to determine the minimum parking rates to be applied. The parking rates are as follows:

- Restaurants: 6 bays per 100m^2 GLA.
- Offices: 2 bays per 100m^2 GLA.
- Waterpark (activity/rides area): 10 bays per 100m^2.

Based on the above, the minimum parking bays required for light vehicles are 1 160 bays. It is proposed that 1 500 parking bays be provided to account for overflow and/or future subservient uses. The car park facility should be designed according to the requirements of the South African Parking Standards (DOT, 1985).

It is proposed that a taxi facility be provided on site to accommodate a minimum of 15 taxis. The facility should be designed according to the requirements of the South African Parking Standards (DOT, 1985).

It is proposed that a bus facility be provided on site to accommodate a minimum of 10 buses. The facility should be designed according to the requirements of the South African Parking Standards (DOT, 1985).

9.9.1.5 Vehicle Circulation

The proposed development is required to accommodate light vehicles, taxis, buses and emergency vehicles such as ambulances and fire trucks. The site accesses, internal parking areas, taxi and bus facilities as well as the drop-off area must be designed accordingly to provide sufficient manoeuvring for vehicles. It is a requirement by most Municipalities that a vehicle manoeuvring assessment be undertaken for a fire truck. The assessment was undertaken using the AutoTURN software. A fire truck (13m) was used as the design vehicle in the tracking simulation. The results show that the development will be able to accommodate a fire truck.

9.9.1.6 Traffic Volume Scenarios and Capacity Analysis Findings

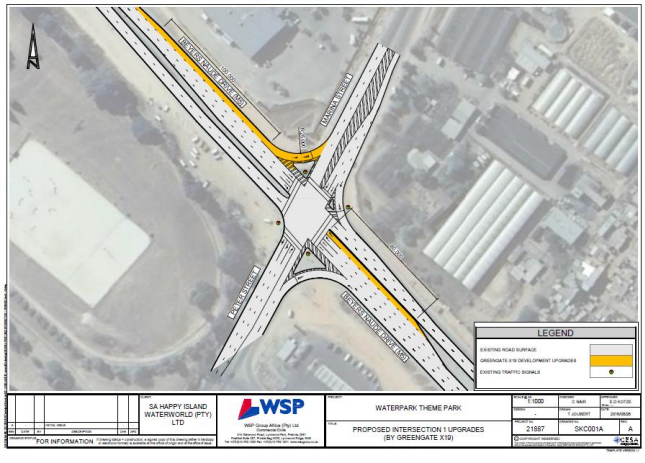
The existing 2016 peak hour traffic volumes were thus subjected to a 3% growth rate over five years; this is in line an average growth area. The following scenarios were analysed in this study:

- Scenario 1: 2021 background plus latent development (Greengate X19) peak hour traffic volumes (with latent development upgrades);
- Scenario 2a: 2021 background plus latent development (Greengate X19) plus Waterpark development generated peak hour traffic volumes; and
- Scenario 2b: 2021 background plus latent development (Greengate X19) plus Waterpark development generated peak hour traffic volumes (with upgrades if applicable).

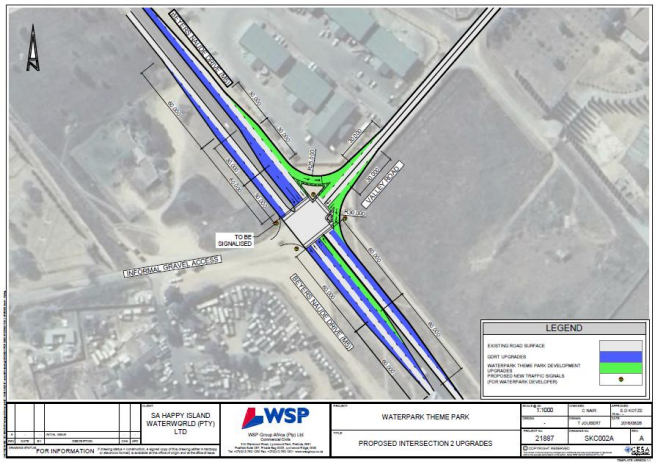
It is noted that the existing Intersections 1-4, Intersection A, Valley Road and Lakeview Road require upgrades to mitigate the impact of the 2021 background plus latent rights development plus Waterpark development generated peak hour traffic volumes.

The developer plans to construct the proposed development before September 2017 and the following upgrades are required in order to meet the acceptable operational level of service on the surrounding road network.

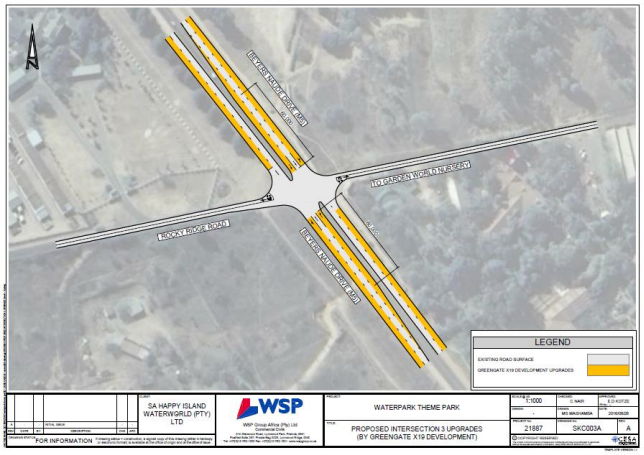
- Intersection 1 upgrades as illustrated on Drawing SKC001a (Latent upgrades)
- Intersection 2 upgrades as illustrated on Drawing SKC002a (Waterpark and GDRT upgrades)
- Intersection 3 upgrades as illustrated on Drawing SKC003a (Latent upgrades)
- Intersection 4 upgrades as illustrated on Drawing SKC004a (Latent upgrades)
- **Intersection A upgrades as on Drawing SKC005a (Waterpark upgrades)**
- **Valley Road: It is proposed that Valley Road be rehabilitated and widened in order to accommodate the development traffic. Refer to Drawing SKC006. (Waterpark upgrades)**
- **Lakeview Road: It is proposed that Lakeview Road be rehabilitated and widened in order to accommodate the development traffic. Refer to Drawing SKC007. (Waterpark upgrades)**



SKC001a



SKC002a



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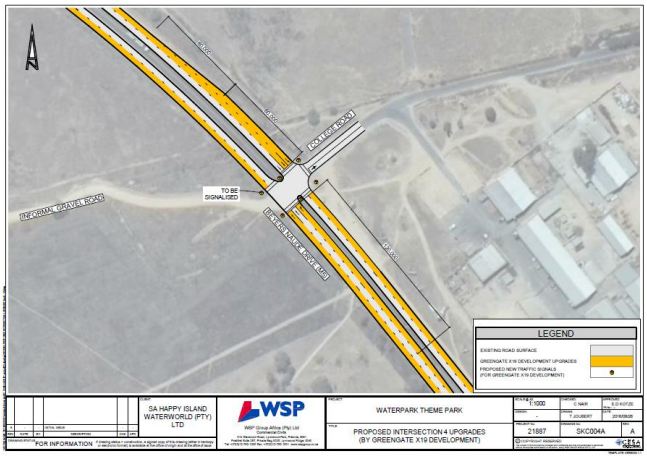

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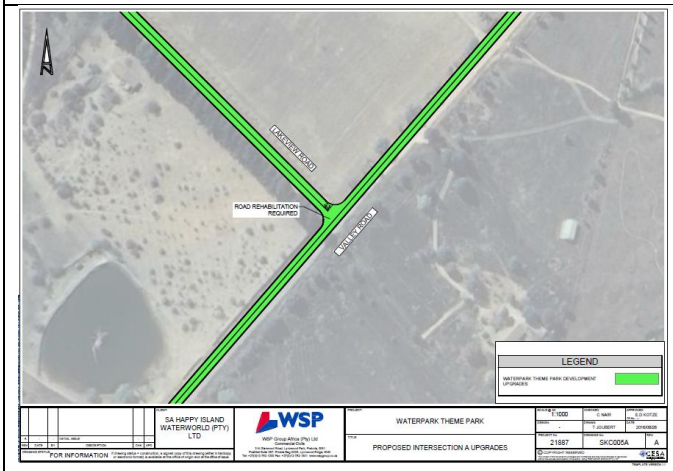

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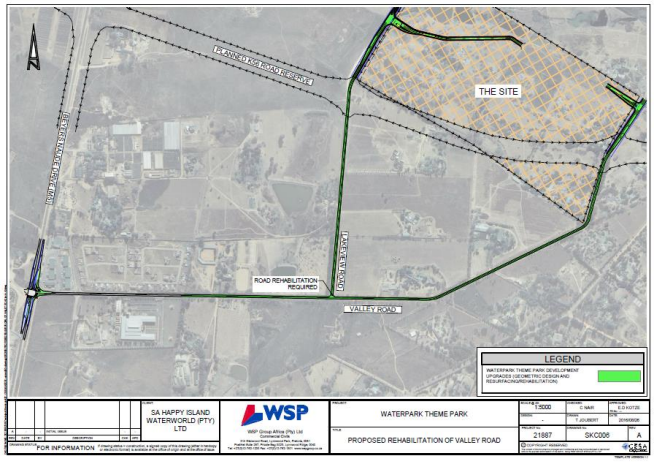

SKC005

**Figure 9-17: Proposed Road Upgrades ****Please note that upgrades shown in orange or blue are latent upgrades to be undertaken by GPDRT and/or Greengate Development. Only upgrades shown in green will be undertaken by the Water Park.*

9.9.2 Conclusion

The Traffic Impact Assessment had the following conclusions and recommendations:

- The proposed development is expected to generate approximately 255 trips and 1 199 trips (in and outbound) during the Weekday PM and Saturday peak hours respectively on the external road network.
- It is proposed that the Waterpark Theme park Site be served by the following accesses:
  - Ingress (E1): It is proposed that the Waterpark entrance be situated off Lakeview Road approximately 217m west from the planned K56 road reserve. It is proposed that an emergency exit lane be provided for vehicles such as fire trucks and ambulances.
  - Egress (E2): It is proposed that the Waterpark exit be situated off Valley Road located to the north-western end of the site. This exit position is to be provided at a minimum distance of 100m west from the planned K56 road reserve. It is proposed that an emergency entrance lane be provided for vehicles such as fire trucks and ambulances.
  - Access to Portion 174: It is proposed that an additional access be located to north eastern end of the site at Portion 174. This access is to be provided at a minimum distance of 100m east from the planned K56 road reserve.
- It is proposed that 1 500 parking bays for cars be made available on site.
- A vehicle maneuvering assessment was undertaken for the proposed development using the AutoTURN software. A fire truck (13m) was used as design vehicle in the tracking simulation. The results show that the development will be able to accommodate the fire truck.
- From the analysis performed, it was found that the impact of the proposed development can be mitigated by means of road and intersection improvements as discussed in this report.
- The cost of the upgrades due to the developer on municipal roads may be discounted against the engineering services contributions for the Waterpark development.
- The following are required in terms of Non-Motorised and Public Transport
  - It is recommended that the proposed development provide an on-site taxi facility in the form of dedicated parking bays to accommodate at least 15 taxis.
  - It is recommended that the proposed development provide an on-site bus facility in the form of dedicated parking bays to accommodate at least 10 buses.
  - It is further recommended that the above parking facilities be constructed according to the South African Parking Standards (DOT).
- In order to ease and formalise the movement of pedestrians between the site accesses, Lakeview Road and Valley Road, it is proposed that 1.5m wide paved (or dust free) sidewalks be constructed.

Based on the above, from a traffic engineering perspective, the proposed development is thus regarded as feasible and sustainable and is therefore supported

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9.10 Assumptions and Limitations Identified by Specialists

The impacts identified as part of the various specialist studies have heavily influenced the impact assessment included in the EIA. As such, it is important to note the assumptions and limitations identified by the various specialists:

- The following limitations with respect to the Ecological Habitat Assessment are applicable to this report:
  - Sampling, by nature, implies that not all species in a study area will be recorded due to factors such as plant phenology as affected by seasonality, seasonal climatic conditions, microhabitats and both historical and current management practices.
  - Field assessment notes are supplemented by making use of literature sources and existing data bases (SANBI/GDARD) and;
  - The main ecological and floristic observations, forming the basis for recommendations and / or any delineation, are, however, based on the field assessment observations.
- The following limitations with respect to the Wetland Assessment are applicable to this report:
  - The study was limited to a snapshot view during a few site visits. The field investigations were undertaken during April, June, October and November 2016 to assess and confirm the delineated Wetland zones present on the survey area. Weather conditions during the survey were favourable for recordings. The delineations were recorded by hand held GPS.
  - It must be noted that, during the process of converting spatial data to final output drawings, several steps are followed that may affect the accuracy of areas delineated. Due care has been taken to preserve accuracy. Printing or other forms of reproduction may also distort the scale indicated in maps. It is therefore suggested that the wetland areas identified in this report be pegged in the field in collaboration with the surveyor for precise boundaries.
  - It is unlikely that more surveys would alter the outcome of this study radically.
- The following limitations with respect to the Archaeological Impact Assessment are applicable to this report:
  - Due to the subsurface nature of archaeological artefacts, the possibility exists that some features or artefacts may not have been discovered/ recorded during the survey and the possible occurrence of unmarked graves and other cultural material cannot be excluded.
  - This report only deals with the footprint area of the proposed development as indicated in the location map. It is assumed that the information obtained from archival maps is accurate.
  - Although HCAC surveyed the area as thoroughly as possible, it is incumbent upon the developer to stop operations and inform the relevant heritage agency should further cultural remains, such as graves, stone tool scatters, artefacts, bones or fossils, be exposed during the process of development.

- The following limitations with respect to the Hydrogeological Baseline Assessment are applicable to this report:
  - The model development is in large parts based on aquifer data provided by others.
- The following limitations with respect to the Noise Impact Assessment are applicable to this report:
  - There were no noise data available of the prevailing ambient levels of the study area and the formal residential areas. Therefore, the results from the noise survey will be used to determine the possible noise impact of the water park on the abutting noise receptors.

10 IMPACT ASSESSMENT

10.1 Overall Impact Assessment

This section focuses on the potential environmental impacts that could be caused by the proposed Water Park development.

An 'impact' refers to the change to the environment resulting from an environmental aspect (or activity), whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity. From a qualitative perspective, impacts were identified as follows:

- Impacts associated with listed activities contained in GN 983-985 of 4 December 2014 (Listing Notice, 1, 2 and 3), for which authorisation has been applied for;
- An assessment of the project activities and components; and
- Issues highlighted by I&APs (both the general public and authorities).

In addition to the above more qualitative descriptions of impacts, a more detailed quantitative assessment of impacts is also provided and specifically takes into account impacts to the receiving environment (Section 5) and the findings from Specialist Studies (Section 9). This quantitative impact assessment uses the impact assessment methodology discussed in the approved Scoping Report and Plan of Study for the EIA. A summary of the methodology is provided below.

The **significance** of an impact is defined as the combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The nature and type of impact may be direct or indirect and may also be positive or negative, refer to Table 10-1: below for the specific definitions.

Table 10-1: Nature and type of impact.

	Nature and Type of Impact:		
IMPACT	**Direct**	Impacts that are caused directly by the activity and generally occur at the same time and place as the activity	✓/✖
	Indirect	Indirect or induced changes that may occur as a result of the activity. These include all impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity	✓/✖
	Cumulative	Those impacts associated with the activity which add to, or interact synergistically with existing impacts of past or existing activities, and include direct or indirect impacts which accumulate over time and space	✓/✖
	Positive	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will benefit significantly, and includes neutral impacts (those that are not considered to be negative	✓
	Negative	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will be comprised	✖

Table 10-2: presents the defined criteria used to determine the **consequence** of the impact occurring which incorporates the extent, duration and intensity (severity) of the impact.

Table 10-2: Consequence of the Impact occurring.

CONSEQUENCE		
	Extent of Impact:	
	Site	Impact is limited to the site and immediate surroundings, within the study site boundary or property (immobile impacts)
	Neighbouring	Impact extends across the site boundary to adjacent properties (mobile impacts)
	Local	Impact occurs within a 5km radius of the site
	Regional	Impact occurs within a provincial boundary
	National	Impact occurs across one or more provincial boundaries
	Duration of Impact:	
	Incidental	The impact will cease almost immediately (within weeks) if the activity is stopped, or may occur during isolated or sporadic incidences
	Short-term	The impact is limited to the construction phase, or the impact will cease within 1 - 2 years if the activity is stopped
	Medium-term	The impact will cease within 5 years if the activity is stopped
	Long-term	The impact will cease after the operational life of the activity, either by natural processes or by human intervention
	Permanent	Where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient
	Intensity or Severity of Impact:	
	Low	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are not affected
	Low-Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are modified insignificantly
	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are altered
	Medium-High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes are severely altered
	High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will permanently cease

The probability of the impact occurring is the likelihood of the impacts actually occurring, and is determined based on the classification provided in **Table 10-3**.

Table 10-3: Probability and confidence of impact prediction

PROBABILITY		
	Probability of Potential Impact Occurrence:	
	Improbable	The possibility of the impact materialising is very low either because of design or historic experience
	Possible	The possibility of the impact materialising is low either because of design or historic experience
	Likely	There is a possibility that the impact will occur
	Highly Likely	There is a distinct possibility that the impact will occur
	Definite	The impact will occur regardless of any prevention measures

The **significance** of the impact is determined by considering the consequence and probability without taking into account any mitigation or management measures and is then ranked according to the ratings listed in Table 10-4:. The level of confidence associated with the impact prediction is also considered as low, medium or high (Table 10-5:).

Table 10-4: Significance rating of the impact.

	Significance Ratings:	
SIGNIFICANCE	**Low**	Neither environmental nor social and cultural receptors will be adversely affected by the impact. Management measures are usually not provided for low impacts
	Low-Medium	Management measures are usually encouraged to ensure that the impacts remain of Low-Medium significance. Management measures may be proposed to ensure that the significance ranking remains low-medium
	Medium	Natural, cultural and/or social functions and processes are altered by the activities, and management measures must be provided to reduce the significance rating
	Medium-High	Natural, cultural and/or social functions and processes are altered significantly by the activities, although management measures may still be feasible
	High	Natural, cultural, and/or social functions and processes are adversely affected by the activities. The precautionary approach will be adopted for all high significant impacts and all possible measures must be taken to reduce the impact

Table 10-5: Level of confidence of the impact prediction

	Level of Confidence in the Impact Prediction:	
CONFIDENCE	**Low**	Less than 40% sure of impact prediction due to gaps in specialist knowledge and/or availability of information
	Medium	Between 40 and 70% sure of impact prediction due to limited specialist knowledge and/or availability of information
	High	Greater than 70% sure of impact prediction due to outcome of specialist knowledge and/or availability of information

Once significance rating has been determined for each impact, management and mitigation measures must be determined for all impacts that have a significance ranking of Medium and higher in order to attempt to reduce the level of significance that the impact may reflect.

The EIA Regulations, 2014 specifically require a description is provided of the degree to which these impacts:

- can be reversed;
- may cause irreplaceable loss of resources; and
- can be avoided, managed or mitigated.

Based on the proposed mitigation measures the EAP will determined a mitigation efficiency (Table 10-6:) whereby the initial significance is re-evaluated and ranked again to effect a significance that incorporates the mitigation based on its effectiveness. The overall significance is then re-ranked and a final significance rating is determined.

Table 10-6: Mitigation efficiency

MITIGATION EFFICIENCY	Mitigation Efficiency	
	None	Not applicable
	Very Low	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact. Positive impacts will remain the same
	Low	Where the significance rating reduces by one level, after mitigation
	Medium	Where the significance rating reduces by two levels, after mitigation
	High	Where the significance rating reduces by three levels, after mitigation
	Very High	Where the significance rating reduces by more than three levels, after mitigation

The reversibility is directly proportional the "Loss of Resource" where no loss of resource is experienced, the impact is completely reversible; where a substantial "Loss of resource" is experienced there is a medium degree of reversibility; and an irreversible impact relates to a complete loss of resources, i.e. irreplaceable (Table 10-7:).

Table 10-7: Degree of reversibility and loss of resources

DEGREE REVERSABILITY & LOSS OF RESOURCES	Loss of Resources:	
	No Loss	No loss of social, cultural and/or ecological resource(s) are experienced. Positive impacts will not experience resource loss
	Partial	The activity results in an insignificant or partial loss of social, cultural and/or ecological resource(s)
	Substantial	The activity results in a significant loss of social, cultural and/or ecological resource(s)
	Irreplaceable	The activity results in the complete and irreplaceable social, cultural and/or ecological loss of resource(s)
	Reversibility:	
	Irreversible	Impacts on natural, cultural and/or social functions and processes are irreversible to the pre-impacted state in such a way that the application of resources will not cause any degree of reversibility
	Medium Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if less than 50% resources are applied
	High Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if more than 50% resources are applied
	Reversible	Impacts on natural, cultural and/or social functions and processes are fully reversible to the pre-impacted state if adequate resources are applied

10.2 Qualitative Discussion of Impacts

10.2.1 Impacts Associated with Listed Activities

As mentioned, the project requires authorisation for certain activities listed in the 2014 EIA Regulations, which serve as triggers for the environmental assessment process. The potential impacts associated with the key listed activities are broadly stated in Table 10.8**.**

Table 10-8: Potential impacts associated with Listed Activities

Listing Notice	Activity	Description of Listed Activity	Potential Impact Overview
NEMA: Listing Notice 1 (require Basic Assessment)			
GN R 983 4 December 2014	19 (i)	*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-* *(i**) a watercourse;*** *(ii) the seashore; or* *(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater but excluding where such infilling, depositing, dredging, excavation, removal or moving-* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.*	• Potential adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features along the watercourse. • Erosion and siltation of watercourse.
NEMA: Listing Notice 2 (require Scoping and EIR)			
GN R 984 4 December 2014	15	*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for the undertaking of a linear activity; or maintenance purposes undertaken in accordance with a maintenance management plan.*	• Potential damage to species of conservation concern (eg. *Hypoxis*); • Disturbance to fauna and avifauna during construction. • Loss of available habitat.
NEMA: Listing Notice 3 (require Basic Assessment)			
GN R 985 4 December 2014	12 (a)	*The clearance of an area of 300m^2 or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *(a) In Eastern Cape, Free State, Gauteng, Limpopo, North West,, and Western Cape provinces.* ***i. Within any critically endangered or endangered ecosystem listed in terms of Section 52 of NEMBA or prior to the publication of such list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment, 2004**.* *ii. Within critical biodiversity areas identified in bioregional management plan. plans;* *iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an*	• Potential damage to species of conservation concern (eg. *Hypox*is); • Disturbance to fauna and avifauna during construction. • Loss of available habitat.

Listing Notice	Activity	Description of Listed Activity	Potential Impact Overview
		estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; or *iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.*	
	14 (b)	*The development of-* *(i) canals exceeding 10 square metres in size;* *(ii) channels exceeding 10 square metres in size;* *(iii) bridges exceeding 10 square metres in size;* *(iv) dams, where the dam, including infrastructure and water surface area, exceeds 10 square metres in size;* *(v) weirs, where the weir, including infrastructure and water surface area, exceeds 10 square metres in size;* *(**vi) bulk storm water outlet structures exceeding 10 square metres in size;*** *(vii) marinas exceeding 10 square metres in size;* *(viii) jetties exceeding 10 square metres in size;* *(ix) slipways exceeding 10 square metres in size;* *(**x) buildings exceeding 10 square metres in size;*** *xi) boardwalks exceeding 10 square metres in size; or* ***(xii) infrastructure or structures with a physical footprint of 10 square metres or more;*** *where such development occurs-* ***(a) within a watercourse;*** *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -* *excluding-* *(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(b) In Gauteng* *i. A protected area identified in terms of NEMPAA excluding conservancies.* *ii. National Protected Area Expansion Strategy Focus Areas;* *iii. Gauteng Protected Area Expansion Priority Areas;* *iv. **Sites identified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans; -*** *v. Sites identified within threatened ecosystems listed in terms of the National Environmental Management Act: Biodiversity Act (Act No. 10 of 2004);* *vi. Sensitive areas identified in an environmental management framework adopted by relevant environmental authority;*	• Potential adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features along the watercourse.

Listing Notice	Activity	Description of Listed Activity	Potential Impact Overview
		vii. Sites or areas identified in terms of an International Convention *viii. Sites managed as protected areas by provincial authorities, or declared as nature reserves in terms of the Nature Conservation Ordinance (Ordinance 12 of 1983) or the National Environmental Management: Protected Areas Act (Act No. 57 of 2003);* *ix. Sites designated as nature reserves within municipal SDFs; or* *x. Sites zoned for conservation or public open space or equivalent zoning.*	

10.2.2 Environmental Activities

In order to understand the impacts related to the project it is necessary to unpack the activities associated with the project life-cycle (refer to Section 4.5). The main project activities as well as high-level environmental activities undertaken in the various project phases are listed in **Table 10-9.**

Table 10-9: Project Activities

Pre-Construction	**Project Activities**
	Detailed layouts and services designs
	Procurement process for Contractors
	VISA process for skilled workers from China
	Procurement of other necessary materials
	Environmental Activities
	Appointment of Environmental Control Officer (ECO)
	Permits if heritage resources are to be impacted on and for the relocation of graves
	Permits if species of conservation importance are to be cut, disturbed, damaged, destroyed or removed
	Relocation of *Hypoxis* (where necessary)
	Barricading of sensitive environmental features
Construction	**Project Activities**
	Appointments and site camp set up: • Set up site camp with temporary offices and administrative facilities; • Set up ablutions • Set up access control, security; signage and lighting • General materials storage and laydown areas • Construction employment • Change-houses, chemical toilets and showering facilities (linked to conservancy tanks – removal of contents by exhauster vehicle and disposal at permitted facility) • Temporary waste storage areas; these shall be established and managed in accordance with EMPr requirements
	Sourcing of construction materials and equipment: • All bulk materials (aggregate, cement, steel etc.) will be sourced from existing lawful commercial sources; there will be no direct mining, harvesting or extraction of natural resources.

	Excavation and earthworks • Removal of existing surfacing material where necessary (concrete, asphalt etc.) which could involve excavation below ground level • Levelling and compaction using heavy machinery / earthmoving equipment • Potential for excavations and trenching in order to lay of below ground level equipment (cables, pipes, sumps, drainage etc.) • Construction work within the existing dams • Potential for excavation dewatering in the event of water-table interception • Use of general mechanical equipment within construction areas (generators, cutting and welding equipment, compressors etc.)
	Environmental Activities
	Diligent compliance monitoring of the EMPr, environmental authorisation and other relevant environmental legislation
	Continued consultation with I&APS (as required).
	Environmental awareness creation
Operation	**Project Activities**
	Operation of service facilities;
	Maintenance of infrastructure;
	Recreational use of Water Park by Visitors
	Environmental Activities
	Noise monitoring
	Monitoring of boreholes
	Water quality monitoring.

10.2.3 Environmental Aspects

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment and cause an impact. The following environmental aspects have been identified for the proposed Water Park which are linked to the project activities (note that only high level aspects are provided):

Table 10-10: Environmental Aspects

Pre-Construction	**Aspects**
	Inadequate consultation with landowners/occupiers of land
	Inadequate environmental and compliance monitoring
	Poor construction site planning and layout
	Absence of relevant permits (e.g. for species of conservation importance, heritage resources) – if required
	Lack of barricading of sensitive environmental features
	Poor waste management
	Absence of ablution facilities
Construction	**Aspects**
	Inadequate consultation with I&APs
	Inadequate environmental and compliance monitoring
	Lack of environmental awareness creation
	Indiscriminate site clearing
	Poor site establishment
Operation	**Aspects**
	Inadequate consultation with I&APs
	Inadequate environmental and compliance monitoring
	Lack of environmental awareness creation
	Lack of maintenance
	Inadequate management of rides
	Water conservation/re-use activities not implemented.

10.2.4 Issues raised by Environmental Authorities and IAPs

The issues raised by authorities (both regulatory and commenting) and I&APs received to date during the execution of the Scoping and EIA process are captured and addressed in the Comments and Responses Report (**Appendix 14.5.5**). The following potential impacts were identified:

- Impacts to sense of place;
- Impact to groundwater (and adjacent landowners reliant on boreholes in the area);
- Impact to Biodiversity and sensitive features;
- Availability of water supply;
- Availability of sewerage treatment;
- Noise pollution;
- Traffic and access;
- Concerns regarding security and safety; and
- Electrical Supply.

These issues helped identify specialist and technical studies required and thus contributed to the assessment of impacts in Section 10.3.

10.3 Quantitative Impact Assessment

Table 10-11 below provides a summary of the identified impacts and significance ranking (WOM = Without Mitigation) for the construction and operational phases of development. Impacts for each alternative (both layout and treatment alternatives) are also provided. Brief management measures have been provided for the purposes of assessing whether the implementation of recommended management measures may be sufficient to decrease the significance ranking (WM = With Mitigation).

The full impact assessment is appended in Annexure 14.7.

Table 10-11: Summary of impact assessment for the construction and operational phases

	IMPACTS					SIGNIFICANCE (WOM)	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	ALTERNATIVE	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
CONSTRUCTION PHASE											
Atmospheric Emissions	Direct	Dust emissions	Layout 1	Yes	Negative	*Low*	• A speed limit of 20km/h must be maintained on all dirt roads. • Dust suppression by means of either water or biodegradable chemical agent is required.	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
	Direct	Emissions from vehicles and equipment (CO_2, NOx, SOx, VOC's etc.)	Layout 1	Yes	Negative	*Low*	• In terms of transportation of workers and materials, collective transportation arrangements should be made to reduce individual car journeys where possible. • All vehicles used during the project should be properly maintained and in good working order. • All vehicles and other machinery should comply with road worthy requirements and comply with legislation in terms of allowable emissions	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
Noise	Direct	Noise increase due to construction activities	Layout 1	Yes	Negative	*Medium*	• Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels. • Construction activities should be limited to daytime only.	*Medium*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
Construction Impacts to Wetlands	Direct	Water quality	Layout 1	No	Negative	*Medium*	• Stock piling outside the wetland area, • Stormwater management, • Dry season construction, • Coffer damming and filtration. • Layout Alternative 2 is preferred as is takes into account the floodlines and wetlands.	*Very Low*	*Medium*	*Partial*	*High Degree*
			Layout 2			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
	Indirect	Silt	Layout 1	No	Negative	*Low-Medium*	• Stock piling outside the wetland area, • Stormwater management, • Dry season construction, • Coffer damming and filtration. • Layout Alternative 2 is preferred as is takes into account the floodlines and wetlands.	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
	Direct	Surface water run-off	Layout 1	No	Negative	*Low-Medium*	• Storm water management.	*Medium*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
	Indirect	Contamination of water from hazardous substances	Layout 1	No	Negative	*Low*	• Limited use of machinery in the wetland area. • No servicing of vehicles and equipment on site.	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
	Direct	Disturbance of natural system	Layout 1	No	Negative	*Medium*	• Stock piling outside the wetland area, • Stormwater management, • Dry season construction, • Coffer damming and filtration. • Layout Alternative 2 is preferred as is takes into account the floodlines and wetlands.	*Very Low*	*Medium*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
	Direct	Disturbance/pollution of sub-surface flow	Layout 1	No	Negative	*Medium*	• Stock piling outside the wetland area, • Stormwater management, • Dry season construction, • Coffer damming and filtration. • Layout Alternative 2 is preferred as is takes into account the floodlines and wetlands.	*Very Low*	*Medium*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
	Direct	Disturbance of aquatic ecological systems	Layout 1	No	Negative	*Medium*	• Stock piling outside the wetland area, • Stormwater management, • Dry season construction, • Coffer damming and filtration. • Layout Alternative 2 is preferred as is takes into account the floodlines and wetlands.	*Very Low*	*Medium*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
Discharge to Water (Surface and Groundwater)	Direct	Sewage	Layout 1	Yes	Negative	*Low-Medium*	• During the construction phase of the project, the existing infrastructure will be used where possible. Chemical toilets will also be placed on site for the duration of the construction phase • Toilets are to be secured to the ground, and must have a closing mechanism. • Certified contractors to maintain and remove chemical toilets regularly. • The contractor must ensure that spillage does not occur when toilets are cleaned/serviced and contents must be properly stored and disposed of properly.	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
	Indirect	Silt	Layout 1	Yes	Negative	*Medium*	• Stock piling outside the wetland area, • Stormwater management, • Dry season construction, • Coffer damming and filtration. • Layout Alternative 2 is preferred as is takes into account the floodlines and wetlands.	*Very Low*	*Medium*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
	Indirect	Surface water run-off	Layout 1	Yes	Negative	*Low-Medium*	• Storm water management	*Medium*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
	Indirect	Contamination of water from hazardous substances	Layout 1	No	Negative	*Low*	• Limited use of machinery in the wetland area. • No servicing of vehicles and equipment on site.	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*

	IMPACTS					SIGNIFICANCE (WOM)	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	ALTERNATIVE	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
	Direct	Disturbance of natural system	Layout 1	Yes	Negative	Medium	• Stock piling outside the wetland area, • Stormwater management, • Dry season construction, • Coffer damming and filtration. • Layout Alternative 2 is preferred as is takes into account the floodlines and wetlands.	High	Low	No Loss	Reversible
			Layout 2			Low-Medium		High	Low	No Loss	Reversible
			Treatment Option 1			Low-Medium		High	Low	No Loss	Reversible
			Treatment Option 2			Low-Medium		High	Low	No Loss	Reversible
	Indirect	Disturbance of aquatic ecological systems	Layout 1	Yes	Negative	Medium	• Stock piling outside the wetland area, • Stormwater management, • Dry season construction, • Coffer damming and filtration. • Layout Alternative 2 is preferred as is takes into account the floodlines and wetlands.	High	Low	No Loss	Reversible
			Layout 2			Low-Medium		High	Low	No Loss	Reversible
			Treatment Option 1			Low-Medium		High	Low	No Loss	Reversible
			Treatment Option 2			Low-Medium		High	Low	No Loss	Reversible
Impacts to Groundwater	Indirect	Impacts to groundwater quality	Layout 1	Yes	Negative	Low	• Proper management and storage of hazardous material (such as fuel) • Proper management of spills	High	Low	No Loss	Reversible
			Layout 2			Low		High	Low	No Loss	Reversible
			Treatment Option 1			Low		High	Low	No Loss	Reversible
			Treatment Option 2			Low		High	Low	No Loss	Reversible
Waste Generation	Indirect	Domestic waste	Layout 1	Yes	Negative	Low-Medium	• Waste recycling to be put in place. • Solid waste shall only be stored in the designated general waste storage area which must be enclosed and impermeable. All solid waste shall be disposed of by a certified contractor, off-site, at an approved landfill site if no municipal services is available. The Contractor shall supply the ECO with a certificate of disposal for auditing purposes.	Low	low	No Loss	Reversible
			Layout 2			Low-Medium		Low	low	No Loss	Reversible
			Treatment Option 1			Low-Medium		Low	low	No Loss	Reversible
			Treatment Option 2			Low-Medium		Low	low	No Loss	Reversible
	Direct	Construction waste	Layout 1	Yes	Negative	Low-Medium	• Litter (from outside the camp included) and concrete bags etc. must be collected and put into suitable closed bins on a daily basis. • Construction rubble must be disposed of at a registered landfill site	Low	Low	No Loss	Reversible
			Layout 2			Low-Medium		Low	Low	No Loss	Reversible
			Treatment Option 1			Low-Medium		Low	Low	No Loss	Reversible
			Treatment Option 2			Low-Medium		Low	Low	No Loss	Reversible
	Direct	Hazardous waste	Layout 1	Yes	Negative	Low-Medium	• The classification of waste determines the handling methods and the ultimate disposal of the material. The contractor shall manage hazardous waste that are anticipated to be generated by his operations as follows: Characterise the waste to determine if it is general or hazardous (Use the Appendix 1 of the Norms and Standards for the Classification of Waste for landfill to determine whether additional classification is required). Obtain and provide an acceptable container with a label. Place hazardous waste material in the container. Inspect the container on a regular basis Haul the full container to the licenced and correct disposal site. Provide documentary evidence of proper disposal of the waste. • Only temporary storage of waste is allowed (once of storage of waste for a period less than 90 days). The volume of material should be limited to less than 80m3 of hazardous waste. Should this be exceeded the Norms and Standards for the Storage of Waste will need to be complied with.	Low	low	No Loss	Reversible
			Layout 2			Low-Medium		Low	low	No Loss	Reversible
			Treatment Option 1			Low-Medium		Low	low	No Loss	Reversible
			Treatment Option 2			Low-Medium		Low	low	No Loss	Reversible
Soil Alteration	Direct	Loss of topsoil	Layout 1	No	Negative	Medium	• Top soil should be separated and used in landscaping and rehabilitation	Medium	Low	Partial	High Degree
			Layout 2			Medium		Medium	Low	Partial	High Degree
			Treatment Option 1			Medium		Medium	Low	Partial	High Degree
			Treatment Option 2			Medium		Medium	Low	Partial	High Degree
	Direct	Loss of land capability	Layout 1	Yes	Negative	Low-Medium	• The proposed site does not have a high agricultural potential nor is currently used for agriculture. No mitigation measures are therefore recommended or required.	None	Low-Medium	Substantial	Medium Degree
			Layout 2			Low-Medium		None	Low-Medium	Substantial	Medium Degree
			Treatment Option 1			Low-Medium		None	Low-Medium	Substantial	Medium Degree
			Treatment Option 2			Low-Medium		None	Low-Medium	Substantial	Medium Degree
	Direct	Alteration of topography	Layout 1	No	Negative	Low-Medium	• Changes to topography must be properly designed and landscaped. • Stormwater management measures must be implemented to ensure these changes to not impact on stormwater.	Medium	low	Partial	High Degree
			Layout 2			Low-Medium		Medium	low	Partial	High Degree
			Treatment Option 1			Low-Medium		Medium	low	Partial	High Degree
			Treatment Option 2			Low-Medium		Medium	low	Partial	High Degree
	Direct	Soil erosion	Layout 1	No	Negative	Low-Medium	• Instability and erosion of steep slopes must be stabilised immediately. Re-vegetation in consultation with landscape architect and ECO should be done if required. • To reduce the loss of material by erosion, disturbance must be kept to a minimum. • If clearing of slopes occur within the rainy season, earth berms must be created along the up-slope side of the construction area. • Where possible, natural vegetation should be retained to reduce the risk of erosion. • Should erosion occur due to negligence on the part of the Contractor to apply the above measures, the Contractor will be responsible for reinstatement of the eroded area to its former state at his own expense. Any surface water pollution occurring as a result of this negligence will be cleaned up by the Contractor or a nominated clean up organisation at the expenses of the Contractor.	Low	Low	Partial	High Degree
			Layout 2			Low-Medium		Low	Low	Partial	High Degree
			Treatment Option 1			Low-Medium		Low	Low	Partial	High Degree
			Treatment Option 2			Low-Medium		Low	Low	Partial	High Degree
	Direct	Soil pollution	Layout 1	No	Negative	Low	• All vehicle/equipment maintenance and washing must be done in the workshop area, equipped with a bund wall and grease trap oil separator. • Workshop area must be monitored for fuel and oil spills. • Spills must be cleaned up immediately and remediated to the satisfaction of the ECO and PM. • Spill kits must be comprehensive and available on site at all times. An adequate supply of absorbent material must be available to accommodate emergency spills.	Low	low	No Loss	Reversible
			Layout 2			Low		Low	low	No Loss	Reversible
			Treatment Option 1			Low		Low	low	No Loss	Reversible
			Treatment Option 2			Low		Low	low	No Loss	Reversible

	IMPACTS					SIGNIFICANCE (WOM)	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	ALTERNATIVE	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
Resource Consumption	Direct	Electricity consumption	Layout 1	Yes	Negative	*Low-Medium*	• Enforce electricity reduction strategies • Environmental awareness training	*Low*	*low*	*Partial*	*High Degree*
			Layout 2			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
			Treatment Option 1			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
			Treatment Option 2			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
	Direct	Water consumption	Layout 1	Yes	Negative	*Low-Medium*	• Enforce water saving strategies. • Environmental awareness training.	*Low*	*low*	*Partial*	*High Degree*
			Layout 2			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
			Treatment Option 1			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
			Treatment Option 2			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
	Direct	Fuel consumption	Layout 1	Yes	Negative	*Low-Medium*	• Record and monitor fuel consumption regularly • Reduce theft of fuel (increase security)	*Low*	*low*	*Partial*	*High Degree*
			Layout 2			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
			Treatment Option 1			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
			Treatment Option 2			*Low-Medium*		*Low*	*low*	*Partial*	*High Degree*
	Direct	Raw materials consumption	Layout 1	Yes	Negative	*Medium*	• Promote effective use of raw material.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
			Treatment Option 1			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
			Treatment Option 2			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
Effects on Biodiversity	Direct	Loss of habitat	Layout 1	yes	Negative	*Medium-High*	• Design the development and operations so as to avoid impacting on the wetland habitat (Layout Alternative 2)	*Very Low*	*Medium-High*	*Partial*	*High Degree*
			Layout 2			*Medium*		*High*	*low*	*Partial*	*High Degree*
			Treatment Option 1			*Medium*		*High*	*low*	*Partial*	*High Degree*
			Treatment Option 2			*Medium*		*High*	*low*	*Partial*	*High Degree*
	Direct	Loss of fauna	Layout 1	yes	Negative	*Low*	• If the development is approved, construction contractors, sub-contractors and operators must ensure that no fauna taxa are unduly disturbed, trapped, hunted or killed • All workers will undergo environmental awareness training to address potential human and wildlife interaction and the permissible reactions to this interaction	*Low*	*low*	*Partial*	*High Degree*
			Layout 2			*Low*		*Low*	*low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*Low*	*low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*Low*	*low*	*Partial*	*High Degree*
	Direct	Loss of flora	Layout 1	yes	Negative	*Medium-High*	• Integrate the Hypoxis populations into the development considering that the proposed development is water based. If integration into the design of the development is not feasible, relocation of the individual plants of the Hypoxis populations to a suitable area is recommended. This should be done by suitably qualified persons to ensure the success of the rescue effort. Permits for relocation are to be obtained form GDARD for the rescue effort.	*Medium*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Medium-High*		*Medium*	*Low-Medium*	*Partial*	*High Degree*
			Treatment Option 1			*Medium-High*		*Medium*	*Low-Medium*	*Partial*	*High Degree*
			Treatment Option 2			*Medium-High*		*Medium*	*Low-Medium*	*Partial*	*High Degree*
	Indirect	Degradation of ecological systems	Layout 1	Yes	Negative	*Medium*	• Maintain and integrate the wetland habitat (identified ESA) into the operation proposed development. This can, if done correctly, benefit the ecosystem on site and downstream.	*Very Low*	*Medium*	*Partial*	*High Degree*
			Layout 2			*Low-Medium*		*Medium*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low-Medium*		*Medium*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low-Medium*		*Medium*	*Low*	*Partial*	*High Degree*
	Indirect	Disruption of natural corridors	Layout 1	yes	Negative	*Medium*	• Maintain and integrate the wetland habitat (identified ESA) into the operation proposed development. This can, if done correctly, benefit the ecosystem on site and downstream.	*Very Low*	*Medium*	*Partial*	*High Degree*
			Layout 2			*Low-Medium*		*Medium*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low-Medium*		*Medium*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low-Medium*		*Medium*	*Low*	*Partial*	*High Degree*
Incidents, accidents and potential emergency situations	Direct	Pollution incidents	Layout 1	No	Negative	*Low*	• Spill kits to be located in strategic areas for when needed Environmental awareness training	*Medium*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
	Direct	Health and safety	Layout 1	No	Negative	*Low*	• 24 hour security and access control. • Health and Safety awareness training. • Contractor to submit a Health and Safety Plan, prepared in accordance with the Health and Safety Specification, for approval prior to the commencement of work. • A Safety Agent should be appointed • A Dedicated Occupational Health and Safety system to be implemented by Contractor's Safety Officer. To be monitored and audited by the Client's Safety Agent, in terms of the Construction Regulations (2003).	*Low*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Low*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Low*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Low*	*low*	*No Loss*	*Reversible*
	Direct	Storage of hydrocarbons	Layout 1	No	Negative	*Low*	• Best practice regarding storage of substances • Spill kits to be located in strategic areas for when needed • Environmental awareness training • Firefighting equipment must be accessible on site at all times. Display of emergency numbers	*Medium*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
	Direct	Fire	Layout 1	No	Negative	*Low*	• Adhere to the appropriate emergency procedures • Firefighting equipment must be accessible on site at all times. • Display of emergency numbers • The area is prone to veld fires. It is therefore recommended that discussions take place with fire association in the area to discuss emergency protocols in the event of a fire. Environmental awareness training should include a section of fire fighting and should highlight the seriousness of fire in the area. In addition, designated smoking areas should be provided and there should be zero tolerance to smoking outside these areas. Cooking over open flames is not allowed.	*Medium*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Medium*	*low*	*No Loss*	*Reversible*
Social	Direct	Visual impact	Layout 1	No	Negative	*Low-Medium*	• A suitable boundary wall should be put in place around the property. • No littering to be allowed. • Good housekeeping practices to be followed	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*Low*	*Low*	*No Loss*	*Reversible*

	IMPACTS					SIGNIFICANCE (WOM)	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	ALTERNATIVE	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
Economic	Direct	Safety and security	Layout 1	yes	Negative	Low	• Due to concerns raised by I&APs regarding crime in the area, it is recommended that discussions take place with local community organisations to increase patrols in the area during construction. • 24 hour access control to the site and 24 hour security. • Workers found to be engaging in activities such as excessive consumption of alcohol, drug use or selling of any such items on site must be disciplined.	Medium	Low	No Loss	Reversible
			Layout 2			Low		Medium	Low	No Loss	Reversible
			Treatment Option 1			Low		Medium	Low	No Loss	Reversible
			Treatment Option 2			Low		Medium	Low	No Loss	Reversible
	Direct	Traffic disruptions	Layout 1	yes	Negative	Medium	• Road upgrades on Valley Road and Lakeview Road must be done in accordance to requirements in the Traffic Impact Assessment. • The roads must be upgraded one lane at a time and traffic must be controlled with flags men and the necessary signage.	Low	Low-Medium	No Loss	Reversible
			Layout 2			Medium		Low	Low-Medium	No Loss	Reversible
			Treatment Option 1			Medium		Low	Low-Medium	No Loss	Reversible
			Treatment Option 2			Medium		Low	Low-Medium	No Loss	Reversible
	Direct	Loss of cultural heritage	Layout 1	No	Negative	Low	• No heritage resources were identified on site. Three buildings may be older than 60 years old. A conservation architect must be consulted to ensure that any changes to these buildings are permitted by the PHRA-G. • The chance find procedure in the EMPr must be adhered to.	Medium	Low	Partial	High Degree
			Layout 2			Low		Medium	Low	Partial	High Degree
			Treatment Option 1			Low		Medium	Low	Partial	High Degree
			Treatment Option 2			Low		Medium	Low	Partial	High Degree
	Direct	Loss of sense of place	Layout 1	No	Negative	Low	• A suitable boundary wall should be put in place around the property. • No littering to be allowed. • Good housekeeping practices to be followed.	Low	low	No Loss	Reversible
			Layout 2			Low		Low	low	No Loss	Reversible
			Treatment Option 1			Low		Low	low	No Loss	Reversible
			Treatment Option 2			Low		Low	low	No Loss	Reversible
	Direct	Decline/increase in economy	Layout 1	Yes	Positive	Medium	• Local contractors and suppliers to be used during the construction phase as far as possible.	Low	Medium-High	No Loss	Reversible
			Layout 2			Medium		Low	Medium-High	No Loss	Reversible
			Treatment Option 1			Medium		Low	Medium-High	No Loss	Reversible
			Treatment Option 2			Medium		Low	Medium-High	No Loss	Reversible
	Direct	Employment	Layout 1	Yes	Positive	Low-Medium	• Mogale' City Local Municipality's requirements for employment equity and BBBEEE requirements to be met. • Foreign skilled workers to be limited to 25 people at a time. • Approximately 400 jobs to be created (including building contractors and service delivery contractors during the construction phase).	Medium	High	No Loss	Reversible
			Layout 2			Low-Medium		Medium	High	No Loss	Reversible
			Treatment Option 1			Low-Medium		Medium	High	No Loss	Reversible
			Treatment Option 2			Low-Medium		Medium	High	No Loss	Reversible
OPERATIONAL PHASE											
Atmospheric Emissions	Direct	Dust emissions	Layout 1	Yes	Negative	Low	• Landscaping of all areas to prevent dust creation.	Medium	Low	No Loss	Reversible
			Layout 2			Low		Medium	Low	No Loss	Reversible
			Treatment Option 1			Low		Medium	Low	No Loss	Reversible
			Treatment Option 2			Low		Medium	Low	No Loss	Reversible
	Direct	Odour emissions from Sewage Treatment Plant	Layout 1	No	Negative	Not applicable	• The AM Biorotor BR4000 inhibits the settled effluent from becoming anaerobic, which prevents malodour.				
			Layout 2			Not applicable					
			Treatment Option 1			Low		Medium	Low	No Loss	Reversible
			Treatment Option 2			Low		Medium	low	No Loss	Reversible
	Direct	Emissions from vehicles and equipment (CO_2, NOx, SOx, VOC's etc.)	Layout 1	Yes	Negative	Low-Medium	• All vehicles and equipment used during the project should be properly maintained and in good working order. • All vehicles and other machinery should comply with road worthy requirements and comply with legislation in terms of allowable emissions	Very Low	low	No Loss	Reversible
			Layout 2			Low-Medium		Very Low	low	No Loss	Reversible
			Treatment Option 1			Low-Medium		Very Low	low	No Loss	Reversible
			Treatment Option 2			Low-Medium		Very Low	low	No Loss	Reversible
Noise	Direct	Noise increase due to playing of amplified music	Layout 1	Yes	Negative	Medium	• Amplified music not to be higher than 75.0dBA at each point source. • Speakers may not be higher than 3.0m from ground level. • Directional speakers with a throw not longer than 10m must be installed and facing to the inside of the park. • A noise limiter to be installed at the office and must be tamper proof. The noise limiter must be calibrated at a sound level of 75.0dBA. • A noise survey to be carried out on a monthly basis or when a noise complaint is received at the different point sources and at the boundary of the property to ensure that the sound limits are adhered to. • A sound management plan must be in place and record of the noise surveys to be kept in a safe place for a period of five years.	Medium	Low	No Loss	Reversible
			Layout 2			Medium		Medium	Low	No Loss	Reversible
			Treatment Option 1			Medium		Medium	Low	No Loss	Reversible
			Treatment Option 2			Medium		Medium	Low	No Loss	Reversible
	Direct	Noise increase due to people shouting and screaming.	Layout 1	Yes	Negative	Medium	• All platforms higher than 3.0m above ground level must be screened off from the abutting residential areas. • Slip slides on a raised level to be enclosed to restrict the screaming and shouting during the use of the apparatus. • A 3.0m to 3,5m high wall or soil earthberm covered with vegetation to be constructed along the foot print boundaries of the water park. • A 2.5m wall must be constructed along the entire remainder boundary of the water park. • A noise survey to be carried out on a monthly basis or when a complaint is received at the different point sources and at the boundary of the property to identify noise problems and to implement additional noise screening measures.	Medium	Low	No Loss	Reversible
			Layout 2			Medium		Medium	Low	No Loss	Reversible
			Treatment Option 1			Medium		Medium	Low	No Loss	Reversible
			Treatment Option 2			Medium		Medium	Low	No Loss	Reversible
	Direct	Noise due to water pumps, wave makers and generators.	Layout 1	Yes	Negative	Medium	• All water pumps and generators must be encapsulated with a brick constructed building with a concrete slab roof. • All ventilation openings must be fitted with a double layer of acoustic louvres. • A wooden solid core door to be used instead of steel doors. • A noise survey to be carried out on a monthly basis or when a complaint is received at the different water pumps and generator point sources and at the boundary of the property to identify noise problems and to implement additional noise screening measures. • The wave making plant room for the tsunami and wave pools to be acoustically screened	low	Low	No Loss	Reversible
			Layout 2			Medium		Low	Low	No Loss	Reversible
			Treatment Option 1			Medium		Low	Low	No Loss	Reversible
			Treatment Option 2			Medium		Low	Low	No Loss	Reversible

	IMPACTS					SIGNIFICANCE (WOM)	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	ALTERNATIVE	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
							off and acoustic ventilation louvres to be provide at all openings; • The design of these wave making room and areas must be done in conjunction with an acoustic engineer; • An earthberm to be erected along the sides of the wave making sections which must be planted with natural vegetation.				
	Indirect	Noise due to increased traffic.	Layout 1	Yes	Negative	*Medium*	• All the roads to and from the water park to be paved with UTFC asphalt; • Noise barriers to be constructed along the roads once the engineering designs of the roads are available. • The speed limit must not be higher than 60km/h for motor-cars and 40km/h for delivery vehicles. • A noise survey to be carried out on a monthly basis or when a complaint is received along the roads to identify noise problems and to implement additional noise screening measures.	*Medium*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*Medium*	*Low*	*No Loss*	*Reversible*
Wetlands	Direct	Water quality	Layout 1	No	Negative	*Low-Medium*	• Rehabilitation of construction impacted area, continuous monitoring.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Low*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Medium*	*Low*	*No Loss*	*Reversible*
	Indirect	Silt	Layout 1	No	Negative	*Low-Medium*	• Rehabilitation of construction impacted area, continuous monitoring.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Low*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Medium*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Medium*	*Low*	*No Loss*	*Reversible*
	Direct	Surface water run-off	Layout 1	No	Negative	*Medium*	• Rehabilitation of construction impacted area, continuous monitoring, storm water management.	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
	Indirect	Contamination of water rom hazardous substances	Layout 1	No	Negative	*Low*	• Rehabilitation of construction impacted area, continuous monitoring, storm water management.	*High*	*Low*	*Partial*	*High Degree*
			Layout 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
	Direct	Disturbance of natural system	Layout 1	No	Negative	*Low-Medium*	• Rehabilitation of construction impacted area, continuous monitoring.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
	Direct	Disturbance/pollution of sub-surface flow	Layout 1	No	Negative	*Low-Medium*	• Rehabilitation of construction impacted area, continuous monitoring.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
	Direct	Disturbance of aquatic ecological systems	Layout 1	No	Negative	*Low-Medium*	• Rehabilitation of construction impacted area, continuous monitoring.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
Discharge to water	Direct	Sewage	Layout 1	Yes	Negative	*Not applicable*	• Approved treatment plant to be used. • Management and maintenance of the sewage treatment works must be by a experienced and competent person. • Water quality monitoring to be undertaken. • Pre-screening mechanisms to ensure proper management of large influxes of debris. • Effluent filters must be put on the fat, oil and grease traps. Treated effluent must meet the requirements of the Department of Water and Sanitation.				
			Layout 2			*Not applicable*					
			Treatment Option 1			*Medium*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*High*	*low*	*No Loss*	*Reversible*
	Direct	Silt	Layout 1	Yes	Negative	*Low*	• Landscaping of all areas to prevent soil erosion and resultant siltation of water courses. • Stormwater management system to be implemented in line with stormwater management plan.	*High*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
	Direct	Surface water run-off	Layout 1	Yes	Negative	*Medium-High*	• Stormwater management system to be implemented to ensure that post-development run-off is not greater than the pre-development run-off.	*High*	*low*	*No Loss*	*Reversible*
			Layout 2			*Medium-High*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium-High*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium-High*		*High*	*low*	*No Loss*	*Reversible*
	Indirect	Contamination of water from hazardous substances	Layout 1	Yes	Negative	*Low*	• Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), the Occupational Health and Safety Act (No. 85 of 1993), relevant associated Regulations, and applicable SANS and international standards. • Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor. • All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material. • In the event of spillages of hazardous substances the appropriate clean up and disposal measures are to be implemented. • Necessary materials and equipment must be available on site to deal with spills of any hazardous materials present. Spill contingency plans must include the procedure to distinguish between spills which can be cleaned up by the operator/staff of the Water Park and those that require specialist input.	*Low*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Low*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Low*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Low*	*low*	*No Loss*	*Reversible*

	IMPACTS					SIGNIFICANCE (WOM)	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	ALTERNATIVE	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
							• The name and contact numbers of various clean up companies must be posted and visible at the construction camp and site office.				
	Direct	Disturbance of natural drainage lines	Layout 1	Yes	Negative	*Medium-High*	• Watercourses on site are already impacted by instream dams. The design and proposed changes to these dams must ensure that downstream flows are not impacted on. • The layout of the proposed Water Park must incorporate the floodlines and wetland buffer areas indicated by the specialist.	*Low*	*Medium-High*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
	Direct	Disturbance of aquatic ecological systems	Layout 1	No	Negative	*Low-Medium*	• Rehabilitation of construction impacted area, continuous monitoring.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*High*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*High*	*Low*	*Partial*	*High Degree*
Impacts to Groundwater	Direct	Impact to regional water balance	Layout 1	Yes	Negative	*Low*	• Significant drawdowns are localised to the immediate vicinity of the site boundary. The drawdown is reversible during non-pumping periods. • The pumping rate was based on an assume yield of 700 l/h but should be verified with in-situ pumping test to determine the long term yield of the boreholes • A quarterly monitoring protocol for groundwater quality and groundwater levels from the 4 abstraction boreholes of the proposed Water Park is recommended, to monitor any changes from baseline.	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
	Indirect	Impacts to groundwater quality	Layout 1	Yes	Negative	*Low*	• Correct maintenance of the waste water treatment plant to be implemented. • Proper management of spills	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
Waste generation	Direct	Domestic waste	Layout 1	Yes	Negative	*Medium*	• Recyclable waste streams must be separated from other waste streams. Waste to be separated into recyclable and non-recyclable waste. Waste separation needs to occur before waste is collected. • Solid waste shall only be stored in the designated general waste storage area which must be enclosed and impermeable. • All solid waste shall be disposed of by a certified contractor, off-site, at an approved landfill site if no municipal services is available. • Avoidance, reduction, re-use and recycling should be practiced wherever possible.	*Low*	*Low-Medium*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*Low*	*Low-Medium*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*Low*	*Low-Medium*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*Low*	*Low-Medium*	*No Loss*	*Reversible*
	Indirect	Construction waste	Layout 1	Yes	Negative	*Low*	• Some construction may occur during operation as part of ongoing maintenance and management of the facilities. All mitigation measures discussed under construction waste generation will apply during operation.	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
	Direct	Sewage sludge	Layout 1	No	Negative	*Medium*	• The AM Biorotor unit has built in sludge Storage at base of the units with approximately 12 weeks capacity provided. Desludging is carried out by 3rd party contractor suction-tanker and taken to a registered disposal facility.	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*Low*	*Low*	*No Loss*	*Reversible*
	Direct	Hazardous waste	Layout 1	Yes	Negative	*Low-Medium*	• The only hazardous waste which will be generated is empty containers which were used to store hazardous material. • These containers will be collected by a third party contractor and disposed of at a licenced hazardous facility.	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*Low*	*Low*	*No Loss*	*Reversible*
Soil alteration	Not Applicable	Loss of topsoil	Layout 1	None	None	*None*	• See impacts and mitigation measures under construction phase.	*None*	*None*	*No Loss*	*Reversible*
			Layout 2			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 1			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 2			*None*		*None*	*None*	*No Loss*	*Reversible*
	Direct	Loss of land capability	Layout 1	Yes	Negative	*Low-Medium*	• The proposed site does not have a high agricultural potential nor is currently used for agriculture. No mitigation measures are therefore recommended or required.	*None*	*Low-Medium*	*Substantial*	*Medium Degree*
			Layout 2			*Low-Medium*		*None*	*Low-Medium*	*Substantial*	*Medium Degree*
			Treatment Option 1			*Low-Medium*		*None*	*Low-Medium*	*Substantial*	*Medium Degree*
			Treatment Option 2			*Low-Medium*		*None*	*Low-Medium*	*Substantial*	*Medium Degree*
	Not Applicable	Alteration of topography	Layout 1	None	None	*None*	• See impacts and mitigation measures under construction phase.	*None*	*None*	*No Loss*	*Reversible*
			Layout 2			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 1			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 2			*None*		*None*	*None*	*No Loss*	*Reversible*
	Indirect	Soil erosion	Layout 1	No	Negative	*Low*	• Stormwater management system to be implemented to reduce erosion. • Landscaping to minimise soil erosion.	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
	Indirect	Soil pollution	Layout 1	No	Negative	*Low*	• Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), the Occupational Health and Safety Act (No. 85 of 1993), relevant associated Regulations, and applicable SANS and international standards. • Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor. • All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*Low*	*No Loss*	*Reversible*

	IMPACTS					SIGNIFICANCE (WOM)	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	ALTERNATIVE	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
							total volume of the stored hazardous material. • In the event of spillages of hazardous substances the appropriate clean up and disposal measures are to be implemented. • Necessary materials and equipment must be available on site to deal with spills of any hazardous materials present. Spill contingency plans must include the procedure to distinguish between spills which can be cleaned up by the operator/staff of the Water Park and those that require specialist input. • The name and contact numbers of various clean up companies must be posted and visible at the construction camp and site office.				
Resource consumption	Direct	Electricity consumption	Layout 1	Yes	Negative	*Medium*	• Promote effective electricity consumption and sustainable alternatives.	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*High*	*Low*	*No Loss*	*Reversible*
	Direct	Water consumption	Layout 1	Yes	Negative	*Medium*	• Promote effective water conservation measures. • Rainwater harvesting, treatment and reuse of grey water and effluent for irrigation purposes, combination of muncipal water and borehole water will be used.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
			Treatment Option 1			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
			Treatment Option 2			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
	Indirect	Fuel consumption	Layout 1	Yes	Negative	*Low*	• No mitigation measures recommended.	*None*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*None*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*None*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*None*	*Low*	*No Loss*	*Reversible*
	Indirect	Raw materials consumption	Layout 1	Yes	Negative	*Low*	• Promote avoidance and reduction in the use of raw materials.	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
Effects on Biodiversity	Not Applicable	Loss of habitat	Layout 1	None	None	*None*	• Impact related to construction - no management measures required	*None*	*None*	*No Loss*	*Reversible*
			Layout 2			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 1			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 2			*None*		*None*	*None*	*No Loss*	*Reversible*
	Indirect	Loss of fauna	Layout 1	No	Negative	*Low*	• The Water Park Operator must ensure that no fauna are unduly disturbed, trapped, hunted or killed. Environmental awareness training to this effect must be undertaken.	*Low*	*Low*	*Partial*	*High Degree*
			Layout 2			*Low*		*Low*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*Low*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*Low*	*Low*	*Partial*	*High Degree*
	Not Applicable	Loss of flora	Layout 1	None	None	*None*	• Impact related to construction - no management measures required	*None*	*None*	*No Loss*	*Reversible*
			Layout 2			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 1			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 2			*None*		*None*	*None*	*No Loss*	*Reversible*
	Not Applicable	Degradation of ecological systems	Layout 1	None	None	*None*	• Impact related to construction - no management measures required	*None*	*None*	*No Loss*	*Reversible*
			Layout 2			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 1			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 2			*None*		*None*	*None*	*No Loss*	*Reversible*
	Indirect	Disturbance of Fauna and Avifauna	Layout 1	Yes	Negative	*Low*	• Mitigation measures related to noise (see EMPr) must be implemented to minimise disturbance impacts to fauna and avifauna.	*Low*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*Low*	*Low*	*No Loss*	*Reversible*
	Not Applicable	Disruption of natural corridors	Layout 1	None	None	*None*	• Impact related to construction - no management measures required	*None*	*None*	*No Loss*	*Reversible*
			Layout 2			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 1			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 2			*None*		*None*	*None*	*No Loss*	*Reversible*
Incidents, accidents and potential emergency situations	Indirect	Pollution incidents	Layout 1	No	Negative	*Low*	• Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), the Occupational Health and Safety Act (No. 85 of 1993). • Sewage treatment plant must be operated by a skilled and experienced operator and in line with the design requirements. • Water quality monitoring must be undertaken to ensure treated water meets the relevant requirements.	*High*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
	Indirect	Health and safety	Layout 1	No	Negative	*Low*	• An operational health and safety plan should be developed and implemented to ensure proper management of the health and safety of visitors and staff.	*High*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
	Direct	Storage of hydrocarbons	Layout 1	No	Negative	*Low*	• Best practice regarding storage of substances • Spill kits to be located in strategic areas for when needed • Environmental awareness training • Firefighting equipment must be accessible on site at all times. • Display of emergency numbers	*High*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
	Indirect	Fire	Layout 1	No	Negative	*Low*	• Adhere to the appropriate emergency procedures • Firefighting equipment must be accessible on site at all times. • Display of emergency numbers	*High*	*low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*High*	*low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*High*	*low*	*No Loss*	*Reversible*

	IMPACTS					SIGNIFICANCE (WOM)	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	ALTERNATIVE	CUMULATIVE	NATURE					LOSS RESOURCE	REVERSABILITY
			Treatment Option 2			*Low*	• The area is prone to veld fires. It is therefore recommended that discussions take place with fire association in the area to discuss emergency protocols in the event of a fire. Environmental awareness training should include a section of fire fighting and should highlight the seriousness of fire in the area. In addition, designated smoking areas should be provided and there should be zero tolerance to smoking outside these areas.	*High*	*low*	*No Loss*	*Reversible*
Social	Direct	Visual impact	Layout 1	No	Negative	*Medium*	• A suitable boundary wall should be put in place around the property to screen water park activities. • Clean up of litter along Valley and Lakeview road to take place where necessary. • Dustbins to be provided along these routes. • The design of the Water Park should incorporate the existing trees to keep the visual environment similar to what it was pre-development. • Tall rides should be screened using trees so that they are not easily visible from neighboring properties.	*Medium*	*Low*	*Partial*	*High Degree*
			Layout 2			*Medium*		*Medium*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Medium*		*Medium*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Medium*		*Medium*	*Low*	*Partial*	*High Degree*
	Indirect	Safety and security	Layout 1	Yes	Negative	*Low*	• Due to concerns raised by I&APs regarding crime in the area, it is recommended that security for the proposed site include occasional patrols of Valley road and Lakeview road • 24 hour access control and security at the Water Park.	*Medium*	*Low*	*Partial*	*High Degree*
			Layout 2			*Low*		*Medium*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*Medium*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*Medium*	*Low*	*Partial*	*High Degree*
	Indirect	Traffic disruptions	Layout 1	Yes	Negative	*Low-Medium*	• Road upgrades on Valley Road and Lakeview Road must be done in accordance to requirements in the Traffic Impact Assessment.	*High*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*High*	*Low*	*No Loss*	*Reversible*
	Not Applicable	Loss of cultural heritage	Layout 1	None	None	*None*	• Potential losses to cultural heritage are related to the construction phase and are assessed above.	*None*	*None*	*No Loss*	*Reversible*
			Layout 2			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 1			*None*		*None*	*None*	*No Loss*	*Reversible*
			Treatment Option 2			*None*		*None*	*None*	*No Loss*	*Reversible*
	Direct	Loss of sense of place	Layout 1	No	Negative	*Medium*	• A suitable boundary wall should be put in place around the property to screen water park activities. • The design of the Water Park should incorporate the existing trees to keep the visual environment similar to what it was pre-development. • Tall rides should be screened using trees so that they are not easily visible from neighboring properties.	*Low*	*Low-Medium*	*Partial*	*High Degree*
			Layout 2			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
			Treatment Option 1			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
			Treatment Option 2			*Medium*		*Low*	*Low-Medium*	*Partial*	*High Degree*
	Direct	Change of land use	Layout 1	Yes	Negative	*Low-Medium*	• No mitigation measures are recommended. However, the proposed development does occur in an area which is earmarked for development.	*None*	*Medium*	*No Loss*	*Reversible*
			Layout 2			*Low-Medium*		*None*	*Medium*	*No Loss*	*Reversible*
			Treatment Option 1			*Low-Medium*		*None*	*Medium*	*No Loss*	*Reversible*
			Treatment Option 2			*Low-Medium*		*None*	*Medium*	*No Loss*	*Reversible*
Economic	Direct	Decline/increase in economy	Layout 1	Yes	Positive	*Medium*	• Maintenance and operation of the Water Park must make use of local companies and contractors as far as possible. • Mogale' City Local Municipality's requirements for employment equity and BBBEEE requirements to be met. • Foreign skilled workers to be limited to 25 people at a time. • Approximately 550 jobs to be created (including restaurants and service delivery).	*Medium*	*High*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*Medium*	*High*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*Medium*	*High*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*Medium*	*High*	*No Loss*	*Reversible*
	Indirect	Decline/increase in property value	Layout 1	No	Positive	*Low*	• No mitigation measures required.	*None*	*Low*	*No Loss*	*Reversible*
			Layout 2			*Low*		*None*	*Low*	*No Loss*	*Reversible*
			Treatment Option 1			*Low*		*None*	*Low*	*No Loss*	*Reversible*
			Treatment Option 2			*Low*		*None*	*Low*	*No Loss*	*Reversible*
	Indirect	Closure of existing businesses in the area	Layout 1	No	Negative	*Low*	• Businesses are only likely to close if there are significant visual, noise and traffic impacts. Mitigation measures recommended to manage these impacts must be implemented to ensure no negative economic impacts occur.	*Low*	*Low*	*Partial*	*High Degree*
			Layout 2			*Low*		*Low*	*Low*	*Partial*	*High Degree*
			Treatment Option 1			*Low*		*Low*	*Low*	*Partial*	*High Degree*
			Treatment Option 2			*Low*		*Low*	*Low*	*Partial*	*High Degree*
	Direct	Employment	Layout 1	Yes	Positive	*Medium*	• Mogale' City Local Municipality's requirements for employment equity and BBBEEE requirements to be met. • Foreign skilled workers to be limited to 25 people at a time. • Approximately 550 jobs to be created (including restuarants and service delivery).	*Low*	*Medium-High*	*No Loss*	*Reversible*
			Layout 2			*Medium*		*Low*	*Medium-High*	*No Loss*	*Reversible*
			Treatment Option 1			*Medium*		*Low*	*Medium-High*	*No Loss*	*Reversible*
			Treatment Option 2			*Medium*		*Low*	*Medium-High*	*No Loss*	*Reversible*

10.4 Description of Impacts

A discussion of impacts to various aspects is provided below. Impacts that have been identified as having a low-medium impact significance rating and higher (before mitigation) are discussed in more detail within the subsection in terms of their risks or concerns affecting the environment. A discussion on how mitigation measures are expected to decrease/increase the significance rating is also provided as well as input from specialists where this input was used to assess impacts.

In addition, it is important to assess the natural environment using a systems approach that will consider the cumulative impact of various actions. A Cumulative impact refers to "*the impact on the environment, which results from the incremental impact of the actions when added to other past, present and reasonably foreseeable future actions regardless of what agencies or persons undertake such actions*". Cumulative impacts can result from individually minor, but collectively significant actions or activities taking place over a period of time. Cumulative effects can take place frequently and over a period of time that the effects cannot be assimilated by the environment. Cumulative impacts are also discussed in the subsections that follow.

10.4.1 Atmospheric Emissions

10.4.1.1 Overview

In terms of atmospheric emissions, two potential impacts were identified during construction, namely, dust emissions and emissions from vehicles and equipment. Both impacts were identified as having a 'low' significance. Mitigation measures include ensuring that speed limits on dirt roads are maintained and that dust suppression measures are utilized. In terms of the emissions from construction vehicles, these will be mitigated by ensuring that all vehicles and other machinery comply with road worthy requirements and legislation in terms of allowable emissions.

During operation, three potential impacts were identified, namely, dust emissions, emissions from vehicles and equipment and odour from the sewage treatment plant. Dust emissions will be incidental as the Water Park will be landscaped and therefore will have few sources of dust. From an emission perspective, Water Park rides will be operated and will therefore result in additional emissions. This will result in a 'low-medium' significant impact. However, as during construction, proper maintenance and management of vehicles and equipment will result in the significance being reduced to 'low'. In terms of the odour, the AM Biorotor BR4000 inhibits the settled effluent from becoming anaerobic, which prevents malodour. Based on this, the impact was assessed as 'low' as the extent of the impact would be limited to the site and neighboring properties and the duration would be incidental. Proper maintenance and management of the treatment plant will ensure that odours are reduced.

10.4.1.2 Cumulative Impacts:

Both dust emissions and emissions from vehicles and equipment are cumulative in nature as they are compounded by existing activities in the environment. However, in general, these impacts are incidental in nature and are of a low intensity. Regardless, mitigation measures to reduce these impacts are vital and must be implemented. Odour is not viewed to be a cumulative impact.

10.4.2 Noise

10.4.2.1 Overview

A Noise Impact Assessment was undertaken and found that site and surrounding area was quiet. Identified impacts related to noise included:

- Noise due to construction related activities;
- Noise due to increased traffic;
- Noise due to water pumps, wave makers and generators;
- Noise increase due to people shouting and screaming; and
- Noise increase due to playing of amplified music.

During construction period, the cumulative noise level at the abutting residential area during the construction phase of the project will be approximately 49.5dBA when all the construction machinery will be operational. However, it is not expected that all equipment will be operational at one time and thus the expected noise is expected to be lower. Based on the expected noise levels and the baseline environment, the expected significance of the impact was assessed as 'medium'. However, several mitigation measures were recommended including:

- Ensuring that all equipment and machinery comply with the manufacturer's specifications; and
- Ensuring that construction activities must be limited to the day.

Based on these mitigation measures, the expected significance with mitigation is expected to decrease to 'low'.

In terms of traffic, the specialist found that noise levels on the Valley and Lakeview Roads would increase to approximately 56dBA during the week and approximately 62 dBA during the weekend (at 25m setback distance). Current noise levels around the roads are between 37.4 dBA and 64.0 dBA. Based on these changes, the impact without mitigation was assessed to be 'medium'. However, a number of mitigation measures have been recommended:

- All the roads to and from the water park to be paved with UTFC asphalt;
- Noise barriers to be constructed along the roads once the engineering designs of the roads are available.
- The speed limit must not be higher than 60km/h for motor-cars and 40km/h for delivery vehicles.
- A noise survey to be carried out on a monthly basis or when a complaint is received along the roads to identify noise problems and to implement additional noise screening measures

With the implementation of these mitigation measures, significance of the impact is expected to decrease to 'low'.

Noise will also increase during operation due to visitor noise, music and equipment. The change in dBA at different receptors was assessed and of the 19 receptors assessed, the majority (16) would not have an intrusion that was readily noticeable (greater than 5 dBA). Based on this, operational noise was assessed to be of a 'medium' significance. A number of mitigation measures are therefore required. These include:

- A 2.5m wall must be constructed along the entire remainder boundary of the water park.
- A 3.0m to 3,5m high wall or soil earthberm covered with vegetation to be constructed along the foot print boundaries of the water park.
- A noise limiter to be installed at the office and must be tamper proof.
- A noise survey to be carried out on a monthly basis or when a complaint is received at the different water pumps and generator point sources and at the boundary of the property to identify noise problems and to implement additional noise screening measures.
- A sound management plan must be in place and record of the noise surveys to be kept in a safe place for a period of five years.
- A wooden solid core door to be used instead of steel doors.
- All platforms higher than 3.0m above ground level must be screened off from the abutting residential areas.
- All ventilation openings must be fitted with a double layer of acoustic louvres.
- All water pumps and generators must be encapsulated with a brick constructed building with a concrete slab roof.
- All water pumps and generators must be encapsulated with a brick constructed building with a concrete slab roof.
- Amplified music not to be higher than 75.0dBA at each point source.
- An earthberm to be erected along the sides of the wave making sections which must be planted with natural vegetation.
- Directional speakers with a throw not longer than 10m must be installed and facing to the inside of the park.
- Slip slides on a raised level to be enclosed to restrict the screaming and shouting during the use of the apparatus.
- Speakers may not be higher than 3.0m from ground level.
- The design of these areas must be done in conjunction with an acoustic engineer;
- The noise limiter must be calibrated at a sound level of 75.0dBA.
- The wave making plant room for the tsunami and wave pools to be acoustically screened off and acoustic ventilation louvres to be provide at all openings.

10.4.2.2 Cumulative Impacts:

Recent developments in the area have increased the noise levels in the area slightly (although the general noise level is still low). This was taken into account by the Noise Specialist in determining the

impact of the development. The impact was still assessed as 'low' with the implementation of the mitigation measures. Mitigation measures included in the EMPr must be implemented.

10.4.3 Impacts to Surface Water/Wetlands

10.4.3.1 Overview

The Wetland Assessment found that three natural wetlands and one drainage line was identified in the study area. In terms of Present Ecological State (PES), the wetlands attained a low overall score:

- GG_UCVB1 - PES = D. Largely modified. A large change in ecosystem processes and loss of natural habitat and biota is great, however some remaining natural habitat features are still recognizable. This wetland is highly impacted by historical infilling and illegal dumping.
- GG_UCVB2 - PES = D. Largely modified. A large change in ecosystem processes and loss of natural habitat and biota is great, however some remaining natural habitat features are still recognizable. This wetland system is highly impacted by historical damming of the system both up and down stream.
- GG_CVB1 - PES = D. Largely modified. A large change in ecosystem processes and loss of natural habitat and biota is great, however some remaining natural habitat features are still recognizable. This wetland is impacted by historical damming and alien infestation.

The wetlands also attained a Low Ecological Importance and Sensitivity (EIS) score.

- GG_UCVB1 - EIS = D. Un-Channelled Valley Bottom Wetland is not considered to be ecologically important or sensitive. The biodiversity of this wetland is low with no red data species recorded. It is not sensitive to flow and habitat modifications. It plays an insignificant role in moderating the quantity and quality of water of major rivers. The system drains into further downstream wetland and streams before reaching major rivers.
- GG_UCVB2 - EIS = D. Un-Channelled Valley Bottom Wetland is not considered to be ecologically important or sensitive. The biodiversity of this wetland is ubiquitous with no red data species recorded. It is not sensitive to flow and habitat modifications. It plays an insignificant role in moderating the quantity and quality of water of major rivers. The system drains into further downstream wetlands and streams before reaching major rivers.
- GG_CVB1 - EIS = C. Channelled Valley Bottom Wetland is considered ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.

Potential impacts to surface water/wetlands in the area include the following:

- Water quality;
- Silt;
- Surface water run-off;
- Contamination of water from hazardous substances;
- Disturbance of natural system;

- Disturbance/pollution of sub-surface flow; and
- Disturbance of aquatic ecological systems.

These impacts range from 'low' to low-medium' in significance (without mitigation). With mitigation, these impacts decreased to a 'low' significance. Mitigation measures included:

- Rehabilitation of construction impacted area;
- Continuous monitoring;
- Proper storm water management;
- Stock piling outside the wetland area;
- Dry season construction;
- Coffer damming and filtration;
- Limited use of machinery in the wetland area; and
- No servicing of vehicles and equipment on site.

In addition to the above, the design of the proposed development took into account the wetlands on site which minimises the impact to these resources.

The impact of sewage on the surface water in the area was also assessed and during construction, impacts would be related to the use of chemical toilets (which may be required in addition the existing infrastructure which occurs on site). Since sewage may impact water quality in the general area (not just limited to the site), the impact was assessed as 'low-medium' (before mitigation). Mitigation measures however will be implemented and include:

- During the construction phase of the project, the existing infrastructure will be used where possible. Chemical toilets will also be placed on site for the duration of the construction phase
- Toilets are to be secured to the ground, and must have a closing mechanism.
- Certified contractors to maintain and remove chemical toilets regularly.
- The contractor must ensure that spillage does not occur when toilets are cleaned/serviced and contents must be properly stored and disposed of

Based on this, the significance of the impact after mitigation was assessed as being 'low'.

During operation, a sewage treatment plant will be used to treat grey water and effluent on site. This treated water will then be used to irrigate the site. As effluent will be treated on site, there is potential for impacts with a 'medium' significance (before mitigation) to occur. However, a number of mitigation measures will be implemented to reduce these impacts to 'low'. These include the use of an approved treatment plant as well as the proper management and maintenance of the plant by an experienced and competent person. Water quality monitoring will also be undertaken and the treated effluent will meet the requirements of DWS.

10.4.3.2 Cumulative Impacts:

Due to the existing overall PES and EIS as well as the poor water quality in the watercourses, any impact to surface water can be seen to be cumulative in nature. However, a number of mitigation measures have been suggested and must be implemented. The most of important of these, is the incorporation of the wetland area into the development as well as the proper management of the sewage treatment plant.

10.4.4 Groundwater Impacts

10.4.4.1 Overview

The two potential impacts to groundwater are as follows:

- Impact to regional water balance; and
- Impacts to groundwater quality.

A Hydrogeological Baseline Assessment and 2D Model was undertaken and found that both impacts have a low likelihood to occur. In terms of drawdown, drawdown will occur but will be limited to the immediate vicinity of the site. It will be reversible during non-pumping periods (i.e. will recharge). In terms of water quality, the two potential sources of contamination are spills and seepage of untreated waste water however as long as proper mitigation measures are implemented, there will be a negligible impact on groundwater quality.

10.4.4.2 Cumulative Impacts

Both water quality and drawdown are cumulative impacts. However, the 2D model took into account existing groundwater abstraction and existing water quality and impacts are not thought to be significant.

10.4.5 Waste Generation

10.4.5.1 Overview

The proposed development will produce waste during both the construction and operational phases. During construction, impacts are expected to be ‘low-medium’ (before mitigation) and ‘low’ (after mitigation). Mitigation measures related to the construction phase include:

- Waste recycling to be put in place.
- Solid waste shall only be stored in the designated general waste storage area which must be enclosed and impermeable.
- All solid waste shall be disposed of by a certified contractor, off-site, at an approved landfill site if no municipal services is available. The Contractor shall supply the ECO with a certificate of disposal for auditing purposes.
- Litter (from outside the camp included) and concrete bags etc. must be collected and put into suitable closed bins on a daily basis.
- Construction rubble must be disposed of at a registered landfill site
- General wastewater on site to be collected and disposed of at a registered communal facility.
- The classification of waste determines the handling methods and the ultimate disposal of the material. The contractor shall manage hazardous waste that are anticipated to be generated by

his operations as follows: Characterise the waste to determine if it is general or hazardous (Use the Appendix 1 of the Norms and Standards for the Classification of Waste for landfill to determine whether additional classification is required). Obtain and provide an acceptable container with a label. Place hazardous waste material in the container. Inspect the container on a regular basis Haul the full container to the licenced and correct disposal site. Provide documentary evidence of proper disposal of the waste.

- Only temporary storage of waste is allowed (once of storage of waste for a period less than 90 days). The volume of material should be limited to less than 80m3 of hazardous waste. Should this be exceeded the Norms and Standards for the Storage of Waste will need to be complied with.

During operation, the volume of domestic waste will increase and without mitigation would result in a 'medium' significant impact. Some hazardous waste will be produced (but in low volumes – for example, empty containers) and is expected to have a 'low-medium' impact. Mitigation measures related to the operation phase include:

- Recyclable waste streams must be separated from other waste streams. Waste to be separated into recyclable and non-recyclable waste. Waste separation needs to occur before waste is collected.
- Solid waste shall only be stored in the designated general waste storage area which must be enclosed and impermeable.
- All solid waste shall be disposed of by a certified contractor, off-site, at an approved landfill site if no municipal services is available.
- Avoidance, reduction, re-use and recycling should be practiced wherever possible.
- The only hazardous waste which will be generated is empty containers which were used to store hazardous material. These containers must be collected by a third-party contractor and disposed of at a licensed hazardous facility.

These mitigation measures will decrease the impacts by one level (i.e. to 'low-medium' or 'low').

10.4.5.2 Cumulative Impacts:

All waste generated will add to the waste generated by existing and future developments as such waste generation is cumulative in nature. Minimization and recycling of waste must be undertaken to reduce this impact.

10.4.6 Soil Alteration

10.4.6.1 Overview

In terms of soil alteration, impacts related to loss of topsoil, loss of land capacity, alteration of topography, soil erosion and soil pollution were assessed.

10.4.6.1.1 Loss of Topsoil

In terms of topsoil, much of the site will be maintained as green areas (approximately 70%) while only approximately 2% of the site will be developed as new buildings. Apart from the green areas, the largest land use will be the proposed parking area which will take up approximately 13% of the site. Existing trees on site will be utilised as part of the landscaping for the proposed facility. Mitigation measures include separating and stockpiling topsoil separately so that it can be used for landscaping and rehabilitation of the site. Based on this, the impact was assessed as 'low' after mitigation.

There will also be a loss of land capability due to the proposed development. However, as the site has a low agricultural potential, this impact was assessed as 'low-medium'.

10.4.6.1.2 Alteration of Topography

During construction, landscaping of the site will take place which will result in changes in the topography. The topography of the site is overall very flat in nature, however, in some areas, levelling out will be required for the development. This will change the topography of the site. However, as the site does not occur on a ridge, this change is not expected to be highly significant. Changes to topography must be properly designed and landscaped and include proper stormwater management. With the implementation of these mitigation measures, the expected impact is 'low' in significance.

10.4.6.1.3 Loss of Land Capability

Land capability is defined as the inherent capacity of land to be productive under sustained use and specific management methods. By developing the area will result in a loss of land capability in terms of the natural area and soil. The site is however altered and thus the capability of the area was already degrading. Based on this, the impact is seen to be of a 'low-medium' significance.

10.4.6.1.4 Soil Erosion

Soil erosion is another potential impact, however with proper mitigation, this impact can be sufficiently mitigated. Much of these mitigation measures will be implemented as part of the landscaping of the site which will stabilise any disturbed areas and prevent soil erosion.

10.4.6.1.5 Soil Pollution

Lastly, in terms of soil pollution, impacts may occur but would be incidental in nature and if cleaned properly, will result in a very low significance impact. Mitigation measures include:

- All vehicle/equipment maintenance and washing must be done in the workshop area, equipped with a bund wall and grease trap oil separator.
- Workshop area must be monitored for fuel and oil spills.
- Spills must be cleaned up immediately and remediated to the satisfaction of the ECO; and
- Spill kits must be comprehensive and available on site at all times. An adequate supply of absorbent material must be available to accommodate emergency spills.

10.4.6.2 Cumulative Impacts:

Loss of land capability can be seen to be cumulative as developments in the Gauteng area have reduced the available land that can be productive. No mitigation measures are possible for this impact however it should be noted that the site is already impacted and thus this impact is not seen to be highly significant.

10.4.7 Resource Consumption

10.4.7.1 Overview

Four types of resource consumption were assessed, namely, water, electricity, raw materials and fuel. During construction, all resource consumption was assessed to be at a 'low-medium' level except raw materials which was assessed as a 'medium' significance. Mitigation measures during construction include the following:

- Enforce electricity reduction strategies;
- Environmental awareness training;
- Enforce water saving strategies;
- Environmental awareness training;
- Record and monitor fuel consumption regularly;
- Reduce theft of fuel (increase security); and
- Promote effective use of raw material.

Based on these mitigation measures, the impacts are expected to decrease to a 'low' or 'low-medium' level.

However, during operation, more excessive resource consumption is expected. In terms of water consumption, the first-time water requirement for each of the rides is as follows:

- The Waves---7200m^3;
- The Water House---364m^3;
- The Kids Playing pool--96m^3 (two will be in place);
- The Tornodo Slides--135m^3;
- The Behemoth Bowl and Typhon Slides---288m;
- The Twin slides--99m^3;
- The Children Slides---180m^3;
- Adults Pool--80m^3;
- Rainbow slides--80m^3;
- Lazy River--400m^3;
- The Water Spray Square--20m^3; and
- The Slides (High speed, Fast slides, Big Circle, and dragon slides)---80m^3.

Once the rides are filled, the losses from the system will be through evaporation (6-8% per day). However a number of recycling measures will be put in place including:

- Rainwater harvesting;
- Recycling of backwash; and
- Recycling of effluent for irrigation use.

The following mitigation measures will be implemented:

- Promote effective water conservation measures; and
- Rainwater harvesting, backwash water recycling; treatment and reuse of grey water and effluent for irrigation purposes, combination of municipal water and borehole water will be used.

Based on this, the impact was assessed to be 'low-medium'. Further, Mogale City Local Municipality has confirmed that municipal water sources will be available to the development.

Electricity will also be used during operation however effective electricity consumption will be promoted. Based on this, the impact was assessed to be 'low-medium'. Eskom however has confirmed that electricity is available for the development and has initiated a separate EIA process which is being undertaken by Hydro Science on their behalf for the proposed installation of a set of ESKOM power cables (11KVA) to service the Greengate Ext 19 and the Water Park.

During operation, the use of raw materials and fuel was assessed to be at a low level.

10.4.7.2 Cumulative Impacts:

All four types of resource consumption (water, electricity, raw materials and fuel) have a cumulative impact as they add to the existing and future use of resources. In particular, water consumption may place additional burden on resources. It is for this reason that the design of the Water Park has included a number of water conservation strategies to reduce water consumption.

10.4.8 Effects on Biodiversity

10.4.8.1 Overview

In order to assess the various potential impacts on biodiversity, an Ecological Habitat Assessment was undertaken and found that the study area occurs within the footprint of the highly endangered but already impacted *Egoli Granite Grassland* and also features a delineated ESA in the form of a wetland habitat within the north-western corner of the study site.

Assessment of the study site indicates that both vegetation and ecology can be considered to be impacted, both historically and as a result of current land uses. Landscaping and mowing of open grassland habits has significantly altered the natural ecological structure and function. Surrounding land uses (historic and current) also play a role in impacting on the ecological function, with especially linear structures such as roads playing a pivotal role in habitat and ecological fracture on both a local and regional scale.

A single floristic species of concern (numerous individuals at multiple locations), *Hypoxis hemerocallidea,* was observed on the property. Mitigation measures to protect the species include integration into the development or relocation to a suitable habitat. No other species of concern or listed, threatened species (faunal and floral taxa) were observed on the site during the assessment.

In terms of alternatives, Alternative Layout 2 would be the preferred option from an ecological point of view. This alternative allows for the maintenance and minimal disturbance to the sensitive, wetland habitat and buffer zones (1:100 floodlines) with maintenance of ecological function also having implications for downstream habitats.

Good planning and operational management of the proposed development has the potential to provide a beneficial impact to the wetland and downstream wetland habitats and ecosystems. Impacts to the grassland habitat are irreversible on the short term and large scale mitigation serves little purpose. Mitigation measures which may be effective include:

- Delineating and demarcating the wetland habitat to exclude it from potential construction impact. It is also advised that the development be planned around this habitat to ensure minimum disturbance; and
- Limiting access, intrusion into and development within the stream zone on the north-western boundary of the property.

Based on the above, the impacts to the following aspects were assessed as follows:

- Loss of habitat – 'medium' (without mitigation);
- Loss of Fauna – 'low' (without mitigation);
- Loss of Flora 'medium -high' (without mitigation);
- Degradation of ecological systems – 'medium' (without mitigation);and
- Disruption of natural corridors 'medium' (without mitigation).

However, with the mitigation measures discussed above, these impacts will decrease by one to two levels and thus after mitigation, these impacts were assessed to be 'low' to 'low-medium'.

Most of these impacts will occur during construction, during operation, the fact that the ESA area has been conserved and that many of the existing trees will be retained on site will ensure that the operational impacts are all low.

10.4.8.2 Cumulative Impacts:

Impacts to biodiversity can be seen to be cumulative in nature as development is prolific in Gauteng. However, based on the GPEMP, the site occurs in the urban development area and thus is in line with

development priorities in the province. Furthermore, Alternative Layout 2 takes into account the ESA area which is the main sensitive feature.

10.4.9 Incidents, accidents and potential emergency situations

10.4.9.1 Overview

Four main impacts were assessed linked to incidents, accidents and potential emergency situations. These included:

- Pollution incidents;
- Health and safety;
- Storage of hydrocarbons; and
- Fire.

During construction, it was found that whilst these impacts could potentially have a medium/medium-high intensity, they are incidental in nature and thus were assessed to be of a 'low' significance (before mitigation). In addition, several mitigation measures will be implemented which will reduce the significance of these impacts even further. These include ensuring that a Safety Agent is appointed and that all staff undergo health and safety awareness training. In addition, pollution incidents and impacts associated with the storage of hydrocarbons will be mitigated through the proper storage of materials and by ensuring that spill kits are available to deal with any spills. In addition, hydrocarbons and hazardous material will be stored properly (in bunded areas) to ensure that any pollution incidents are contained.

I&APs raised concerns regarding the impacts of the proposed development on the occurrence of fire in the area. During both construction and operation, fires are possible but would be incidental and limited to the neighboring areas. Whist the intensity would be medium-high, the overall significance would be 'low'. In addition, a number of mitigation measures will be implemented. These include:

- The area is prone to veld fires. It is therefore recommended that discussions take place with fire association in the area to discuss emergency protocols in the event of a fire;
- Environmental awareness training should include a section of firefighting and should highlight the seriousness of fire in the area;
- In addition, designated smoking areas should be provided and there should be zero tolerance to smoking outside these areas. Cooking over open flames is not allowed; and
- Firefighting equipment must be accessible on site at all times.

10.4.9.2 Cumulative Impacts:

Impacts relating to incidents, accidents and potential emergency situations are not seen to be cumulative as they are limited to the specific site in question.

10.4.10 Social

10.4.10.1 Overview

From a social perspective, impacts to the following attributes were assessed:

- Visual impact;
- Safety and security;
- Traffic disruptions;
- Loss of cultural heritage;
- Loss of sense of place; and
- Change of land use.

These are discussed below.

10.4.10.1.1 Visual Impact

During construction, the visual impact will be limited and can be effectively mitigated through building a boundary wall. In addition, proper housekeeping will ensure that litter is kept to a minimum. During operation, the visual impact is more long term in nature however, the design of the proposed Water Park will incorporate the existing trees as well as 70% of the site will be utilized for open areas. Further, a suitable boundary wall (at least 2.5m in height) will ensure that the park is screened from adjacent neighbors. Based on this, the pre-mitigation impact which is 'medium' in significance, will be decreased to 'low'. It is also recommended that clean up of litter along Valley and Lakeview road to takes place where necessary and dustbins are provided along these routes to decrease litter in the area.

10.4.10.1.2 Safety and Security

From a safety and security perspective, numerous I&APs raised concerns regarding the impact of the Water Park on crime in the area. During construction, crime may increase due to the influx of workers into the area. This impact would be short-term in nature (i.e. limited to construction) and would potentially impact neighboring properties. Without mitigation, the potential impact would be 'medium'. However, a number of mitigation measures will be implemented. These include:

- Discussions take place with local community organisations to increase patrols in the area during construction;
- 24-hour access control to the site and 24-hour security; and
- Workers found to be engaging in activities such as excessive consumption of alcohol, drug use or selling of any such items on site must be disciplined.

Based on the above, and the fact that the construction employment will be managed by the relevant contractor (i.e. there will not be an employment desk on site), the impact is seen to be 'low'.

During operation, the potential impact will be incidental in nature. Due to concerns raised by I&APs regarding crime in the area, it is recommended that security for the proposed site include occasional patrols

of Valley road and Lakeview road. Additional mitigation measures include 24-hour access control and security at the Water Park. Based on this, the impact is thought to be 'low'.

10.4.10.1.3Traffic Disruptions

In terms of traffic, the operation of the Water Park would potentially have a significant impact however a Traffic Impact Assessment was undertaken and determined that some upgrades would be required. In line with this, the proposed development includes the upgrades of the Valley and Lakeview Road and the impact on traffic will be mitigated to 'low' during operation. However, in order to undertake these upgrades, there will be traffic disruptions during the construction phase. These however will be short-term (limited to construction). Mitigation measures include upgrading one lane at a time as well as ensuring traffic with flag men and signage. Based on this, the impact will be 'low-medium' during construction.

10.4.10.1.4Loss of Cultural Heritage

In terms of heritage, the AIA for the proposed development noted that in terms of the built environment of the area (Section 34), several structures occur in the study area consisting of residential dwelling and associated outbuildings like garages and servant's quarters. Based on information obtained from topographical maps of the study area these structures are all younger than 60 years and not protected by legislation and of no heritage significance, apart from structure 8, 10 and 11 that could be just over 60 years old as they were constructed between 1954 and 1977. As the exact age of these three structures are unknown it is recommended that if these three structures are impacted on by the development their age should be confirmed. If the structures are confirmed to be older than 60 years, a conservation architect should be appointed to assess the structures and apply for a demolition/ alteration permit.

In terms of Section 36 of the Act no burial sites were recorded. However, if any graves are located in the future they should ideally be preserved *in-situ* or alternatively relocated according to existing legislation. Due to the subsurface nature of archaeological remains and the fact that graves can occur anywhere on the landscape, it is recommended that a chance find procedure is implemented for the project as part of the EMP:

Based on the findings of the AIA, no significant loss of heritage resources is envisioned. With the implementation of the chance find procedure and the use of a conservation architect, the impact during construction will be mitigated to 'low'. During operation, no impacts are envisioned.

10.4.10.1.5Loss of Sense of Place

The proposed development will impact the sense of place of the area as it results in a change of land use. This impact is more intense and extends for a longer duration during the operational phase. The sense of place is mainly impacted by changes in the visual environment, traffic disruptions and noise impacts associated with the operation of Water Park. Without mitigation, this impact is 'medium' however by mitigating the various impacts related to the visual environment, traffic and noise, it is possible to decrease the impact on the sense of place to 'low'. The main mitigation measures include:

- A suitable boundary wall should be put in place around the property;
- No littering to be allowed;
- Noise mitigation measures to be implemented;
- Traffic upgrades to be undertaken to ensure minimal traffic disruptions to the area; and
- Good housekeeping practices to be followed.

10.4.10.1.6Change in Land Use

The proposed development will result in a change in land use (from agricultural to special). No mitigation measures are available to reduce this impact. The impact will be limited to the development footprint and can be seen as long-term. However, as the site does not have a high agricultural potential, the expected impact is 'low-medium'.

10.4.10.2 Cumulative Impacts:

Safety and security, traffic disruptions and change in land use are all cumulative in nature.

From a safety and security perspective, the area already has a high crime rate. However, a number of mitigation measures have been suggested. The impact is also short-term in duration and should not have a significant impact.

In terms of traffic disruption, current traffic as well as traffic increases due to the new Greengate development were considered and by the Traffic Impact Assessment. Cumulative impacts have therefore been catered for.

Change in land use can be seen to be cumulative as developments in the Gauteng area have reduced the agricultural land that is available. No mitigation measures are possible for this impact however it should be noted that the site has a low agricultural potential and is not currently used for agriculture and thus this impact is not seen to be highly significant.

10.4.11 Economic

10.4.11.1 Overview

Two major positive benefits related to both the construction and operation of the proposed Water Park is the increase in the local economy and increase in temporary and permanent employment.

In terms of estimated CAPEX investment, the business case for the Water Park estimated that R384 million would be invested which will result in a 'medium' positive significant benefit to the local economy. South Africa Happy Island Water World (Pty) Ltd is certified as a Level 1 B-BBEE company. It is also committed to employing local contractors with Level 1 or 2 BEE certifications. Whilst some foreign Chinese workers will be used for putting the equipment together (which is a specialized activity), this will be limited to 25 foreign workers at any one time.

In addition, in terms of employment, approximately 400 temporary jobs will be created during construction and 550 permanent jobs during operation. This will have positive impact in the area due to the existing low employment.

In order to ensure that these benefits are increased as much as possible, the following mitigation measures have been put in place:

- Local contractors and suppliers to be used during the construction phase as far as possible;
- Mogale' City Local Municipality's requirements for employment equity and BBBEEE requirements to be met;
- Foreign skilled workers to be limited to 25 people at a time;
- Approximately 400 jobs to be created (including building contractors and service delivery contractors during the construction phase);
- Maintenance and operation of the Water Park must make use of local companies and contractors as far as possible; and
- Approximately 550 jobs to be created (including restaurants and service delivery).

With the implementation of these mitigation measures, the significance of these benefits will be increased to ‘medium-high’ and ‘high’.

I&APs raised concerns regarding the potential for the development to result in a close of some of the existing businesses in the area. Should businesses close in the area, there would be a negative economic impact however, the development would only indirectly result in these closures if the mitigation measures discussed in the subsections above to reduce potential impacts were not successful. It is therefore unlikely that the development will result in business closure.

10.4.11.2 Cumulative Impacts:

Increases in economy and increase in the economy are both cumulative in nature and will thus have a compounded positive impact. In light of the fact that the fact that there is a high unemployment in the area, this is very important.

10.5 Mitigation

According to the EIA Regulations, 2014, “mitigation" means to “*anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible*”. Based on this definition, it possible to see that a mitigation hierarchy exists.

At the bottom of this hierarchy is the most preferred option which includes **prevention (1).** These mitigation measures aim to avoid impacts completely. Some mitigation measures suggested for the proposed Water Park are at this level (for example, designing the Water Park around the existing ESA and watercourses).

The second level of mitigation is **reduction (2)** which involves mitigation measures that minimise impacts. Most of the mitigation measures suggested for the proposed Water Park fall into this level.

Mitigation measures for the proposed Water Park also include **remediation measures (3)** for environmental impacts. These measures focus on remediating or rehabilitating areas after they have been impacted.

Compensation (4) involves compensating the loss of an entire feature. In the case for the environment, this usually means consideration of an off-set associated with rehabilitation and mitigation. No offsets or compensation measures are included in the mitigation measures for the proposed development.

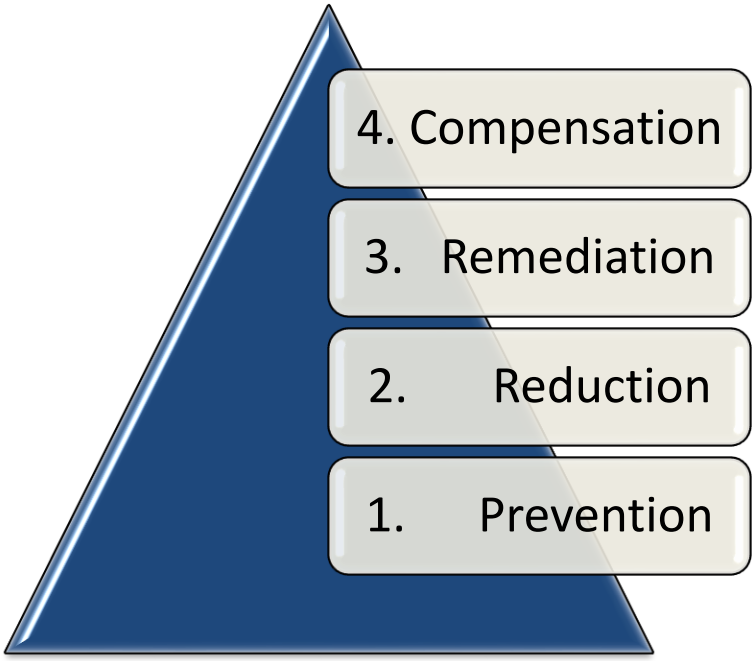


Figure 10-1: Mitigation Hierarchy

An EMPr will be developed based on the findings of the impact assessment of the EIA and in line with the requirements of Appendix 4 of GN 982 of 4 December 2014. The EMPr represents a detailed plan of action and includes site-specific mitigation measures for all medium to high (significant) impacts. The mitigation and management measures will include a combination of the following:

- Physical environmental management structures.
- Monitoring and compliance of pollution and regulatory requirements.

All liability for the implementation of the EMPr (as well as the EIA findings and environmental authorisation) lies with the project applicant which in this case is the **South Africa Happy Island Water World (Pty) Ltd.**

10.6 Assessment of Alternatives

According to the EIA Regulations, 2014, alternatives can be defined as:

"Different means of meeting the general purpose and requirements of the activity, which may include alternatives to the-

(a) property on which or location where the activity is proposed to be undertaken;

(b) type of activity to be undertaken;

(c) design or layout of the activity;

(d) technology to be used in the activity; or

(e) operational aspects of the activity;

and includes the option of not implementing the activity;

The EIA Regulations, 2014 also require that the EIA Report undertake "*a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment"*. The aim of this process is to identify the most ideal location for the activity within the preferred site based on the "*lowest level of environmental sensitivity"* identified during the assessment.

10.6.1 Comparative Assessment based on Receiving Environment and Impact Assessment

In line with the above, this section aims to provide a comparative analysis of the alternatives based on the receiving environment and impact assessment (Section 5 and Section 10.3. respectively). The aim of this comparative assessment is to identify the Best Practicable Environmental Option (BPEO). Münster (2005) defines BPEO as the alternative that "*provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term*".

Table 10-12 provides the comparative analysis of layout alternatives and shows that Alternative layout 2 is preferred for two main reasons, namely:

- The wetland and ESA area is incorporated into the layout and thus the sensitive areas are preserved; and
- A parking area is provided as well as a one-way entry and exit system which reduces traffic impacts.

Table 10-12: Comparative Analysis Between Layout Alternatives (black shaded blocks show preference, if any)

	Layout Alternative 1	**Layout Alternative 2**	**Reason**
Atmospheric Emissions	*No preference*		• In terms of dust and vehicle and equipment emissions, there is no difference between the two layout alternatives.
Noise	*No preference*		• Both alternatives involve the construction of a 2.5m boundary wall which will reduce noise pollution. • Both alternatives will retain trees which will shield rides.

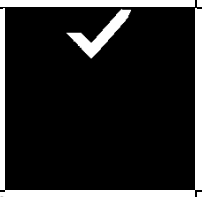
Surface Water	X 	• Alternative layout 2 takes into account the wetland and existing dams on site and is thus preferred.
Groundwater	*No preference*	• From a groundwater perspective, there is no difference between the two alternatives.
Waste Generation	*No preference*	• Both alternatives will result in waste being generated. As such, there is no difference between alternatives.
Soil Alteration	X 	• Alternative layout 1 requires that a road be built through the existing dam areas. This would likely increase soil erosion. Layout Alternative 2 is therefore preferred.
Resource Consumption	*No preference*	• Both alternatives require resources. There is therefore no preference.
Effects on Biodiversity	X 	• Alternative layout 2 is preferred as it incorporates the ESA area around the existing watercourse.
Incidents and Accidents	X 	• Alternative layout 2 is preferred from a traffic safety point of you as it has a one-way entry and exit point.
Social	X 	• Alternative layout 2 is preferred as it has a separate parking area and the flow of traffic minimises traffic impact.
Economic	*No preference*	• From an economic perspective, there is no preference between alternatives.

Table 10-13 provides the comparative analysis of the technical (treatment) alternatives. Treatment alternative 2 (AM Biorotor BR4000) is preferred in terms of almost all environmental attributes. The main reasons for this are:

- The AM Biorotor BR4000 inhibits the settled effluent from becoming anaerobic, which prevents malodour.
- The AM Biorotor unit is covered which decreases noise.
- The AM Biorotor unit includes an "Aerotor" which treats the effluent by a combination of "Active Aeration" and "Passive Contact" which results in very high treatment rates per area. The treatment sections are composed of drums with a very large surface area inside. The effluent is drawn in via holes in its periphery. Once inside it passes through the maze of surfaces. The combined effect of being actively mixed with air and passing over the bacterial surfaces provides an exceptionally efficient and robust treatment.
- The AM Biorotor unit has built in sludge Storage at base of the units with approximately 12 weeks capacity provided. Desludging is carried out by 3rd party contractor suction-tanker and taken to a registered disposal facility.

- The AM Biorotor is simple to operate and maintain and is therefore less likely to have incidents or spills.
- The AM Biorotor has a low power consumption per cubic meter of sewage.
- The AM Biorotor buried to deck level with locked lids and is therefore aesthetically more appealing than an alternative method or system.

Table 10-13: Comparative Analysis Between Technical Alternatives (black shaed blocks show preference, if any)

	Treatment Alternative 1 - MBBR Maxi SewaPak	**Treatment Alternative 2 -AM Biorotor BR4000**	**Reason**
Atmospheric Emissions	X	✓	• The AM Biorotor BR4000 inhibits the settled effluent from becoming anaerobic, which prevents malodour.
Noise	X	✓	• The AM Biorotor unit is covered which decreases noise.
Surface Water	X	✓	• The AM Biorotor unit includes an "Aerotor" which treats the effluent by a combination of "Active Aeration" and "Passive Contact" which results in very high treatment rates per area. • The treatment sections are composed of drums with a very large surface area inside. The effluent is drawn in via holes in its periphery. Once inside it passes through the maze of surfaces. The combined effect of being actively mixed with air and passing over the bacterial surfaces provides an exceptionally efficient and robust treatment.
Groundwater	X	✓	
Waste Generation	X	✓	• The AM Biorotor unit has built in sludge Storage at base of the units with approximately 12 weeks capacity provided. Desludging is carried out by 3rd party contractor suction-tanker and taken to a registered disposal facility.
Soil Alteration	X	✓	• The AM Biorotor unit includes an "Aerotor" which treats the effluent by a combination of "Active Aeration" and "Passive Contact" which results in very high treatment rates per area. • The treatment sections are composed of drums with a very large surface area inside. The effluent is drawn in via holes in its periphery. Once inside it passes through the maze of surfaces. The combined effect of being actively mixed with air and passing over the bacterial surfaces

	Treatment Alternative 1 - MBBR Maxi SewaPak	Treatment Alternative 2 -AM Biorotor BR4000	Reason
		✓	provides an exceptionally efficient and robust treatment. • The AM Biorotor is simple to operate and maintain and is therefore less likely to have incidents or spills.
Resource Consumption	X	✓	• The AM Biorotor has a low power consumption per cubic meter of sewage.
Effects on Biodiversity	X	✓	• The AM Biorotor unit includes an "Aerotor" which treats the effluent by a combination of "Active Aeration" and "Passive Contact" which results in very high treatment rates per area. • The treatment sections are composed of drums with a very large surface area inside. The effluent is drawn in via holes in its periphery. Once inside it passes through the maze of surfaces. The combined effect of being actively mixed with air and passing over the bacterial surfaces provides an exceptionally efficient and robust treatment.
Incidents and Accidents	X	✓	• The AM Biorotor is simple to operate and maintain and is therefore less likely to have incidents or spills.
Social	X	✓	• The AM Biorotor buried to deck level with locked lids and is therefore aesthetically more appealing than an alternative method or system.
Economic	✓		• The MBBR Maxi Sewer Pak has a lower capital cost and is thus more affordable.

10.6.2 Input from Specialist Studies

Specialist studies are an important aspect of the EIA process. In the case of the proposed Water Park development, specialists had numerous requirements for the proposed development. The two sets of alternatives are assessed in terms of how well they meet these requirements in Table 10-14 below. Both environmental and technical specialist inputs are included.

Alternative Layout 2 incorporated the requirements of the Ecological Habitat Assessment, Wetland Assessment and Traffic Impact Assessment and is thus preferred. From a treatment perspective, there was no preferences between the two treatment alternatives.

Table 10-14: Comparative Analysis Between Alternatives taking into account Specialist Requirements (black shaded blocks show preference, if any)

	Specialist Study Requirements	Layout Alternative 1	Layout Alternative 2	Treatment Alternative 1 - MBBR Maxi SewaPak	Treatment Alternative 2 -AM Biorotor BR4000
Ecological Habitat Assessment	• ESA to be incorporated into the development footprint.	X	✓	*No preference*	
Wetland Assessment	• Wetland and 32m buffer to preserved.	X	✓	*No preference*	
Aquatic Assessment	• N/A	*No preference*			
Hydrogeological Baseline Assessment and 2D Model	• N/A	*No preference*			
Archaeological Impact Assessment	• If building, 8, 9 and 11 to be impacted on then Conservation architect to be used. • Permits from PHRA-G to be in place.	*No preference*			
Noise Impact Assessment	• Boundary wall. • Embankment.	*No preference*			
Outline Scheme Report	• N/A	*No preference*			
Stormwater Management Plan	• N/A	*No preference*			
Geotechnical Assessment	• N/A	*No preference*			
Traffic Impact Assessment	• Separate entry and exit. • One way thoroughfare, • Parking area.	X	✓	*No preference*	

10.6.3 "No-Go" Option

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the project is included in the evaluation of the alternatives. The 'no go' alternative is not supported due to the following reasons:

- According to MCLM Tourism Strategy Development Plan (DIT 500, 2013), there is a need for optimization of tourism with MCLM. The concept of a unique theme park, with a water feature similar to Valley of Waves was identified as an opportunity to increase tourism in the area. Should the development not proceed, this opportunity would be lost.
- In terms of the "Precinct Plan for The Muldersdrift Development Zone, 2011" the properties are located in a "High Density Residential Development Zone" where high density residential, limited retail and social and community facilities are preferred. However, urban support facilities and uses related to the hospitality and tourism industry will also be supported in this development zone. This implies that the proposed development is in line with the development proposals for the area. Should the development not go ahead, development in line with the Precinct plan would not take place.
- The main implication of the No Go Option is that should the development not proceed, there will be a loss of the economic benefits of the investment of approximately R340 million in the area. There will also be a loss of the 400 construction related employment opportunities and 550 operation related employment opportunities. This would be a significant negative impact as 24,6% of economically active people in the Municipality are unemployed. In addition, approximately 32,3% of the economically active youth (15–34 years) in the area are also unemployed. The no-go alternative would result in a loss of these positive economic benefits.

10.7 Motivation for the Preferred Development Footprint/BPEO

The EIA Regulations, 2014 require that the EIA Report include a "*a concluding statement indicating the preferred alternative development location within the approved site*" as well as a "*a motivation for the preferred development footprint within the approved site*". In line with this, the recommendations of specialists, technical considerations and the concept of the BPEO, the recommended alternatives are as follows:

- Alternative Layout 2; and
- Treatment Alternative 2 (AM Biorotor BR4000).

Alternative Layout 2 was selected for the following reasons:

- The wetland delineation and wetland buffer have been taken into account in the layout;
- The ESA area has been incorporated into the layout; and
- The requirements of the Traffic Impact Assessment in terms of parking and access to the site are taken into account.

Treatment Alternative 2 was selected for the following reasons:

- The AM Biorotor BR4000 inhibits the settled effluent from becoming anaerobic, which prevents malodour.
- The AM Biorotor unit is covered which decreases noise.

- The AM Biorotor unit includes an "Aerotor" which treats the effluent by a combination of "Active Aeration" and "Passive Contact" which results in very high treatment rates per area. The treatment sections are composed of drums with a very large surface area inside. The effluent is drawn in via holes in its periphery. Once inside it passes through the maze of surfaces. The combined effect of being actively mixed with air and passing over the bacterial surfaces provides an exceptionally efficient and robust treatment.
- The AM Biorotor unit has built in sludge Storage at base of the units with approximately 12 weeks capacity provided. Desludging is carried out by 3rd party contractor suction-tanker and taken to a registered disposal facility.
- The AM Biorotor is simple to operate and maintain and is therefore less likely to have incidents or spills.
- The AM Biorotor has a low power consumption per cubic meter of sewage.
- The AM Biorotor buried to deck level with locked lids and is therefore aesthetically more appealing than an alternative method or system.

Based on the above, the proposed layout for the Water Park Development is provided in Figure 10-2.

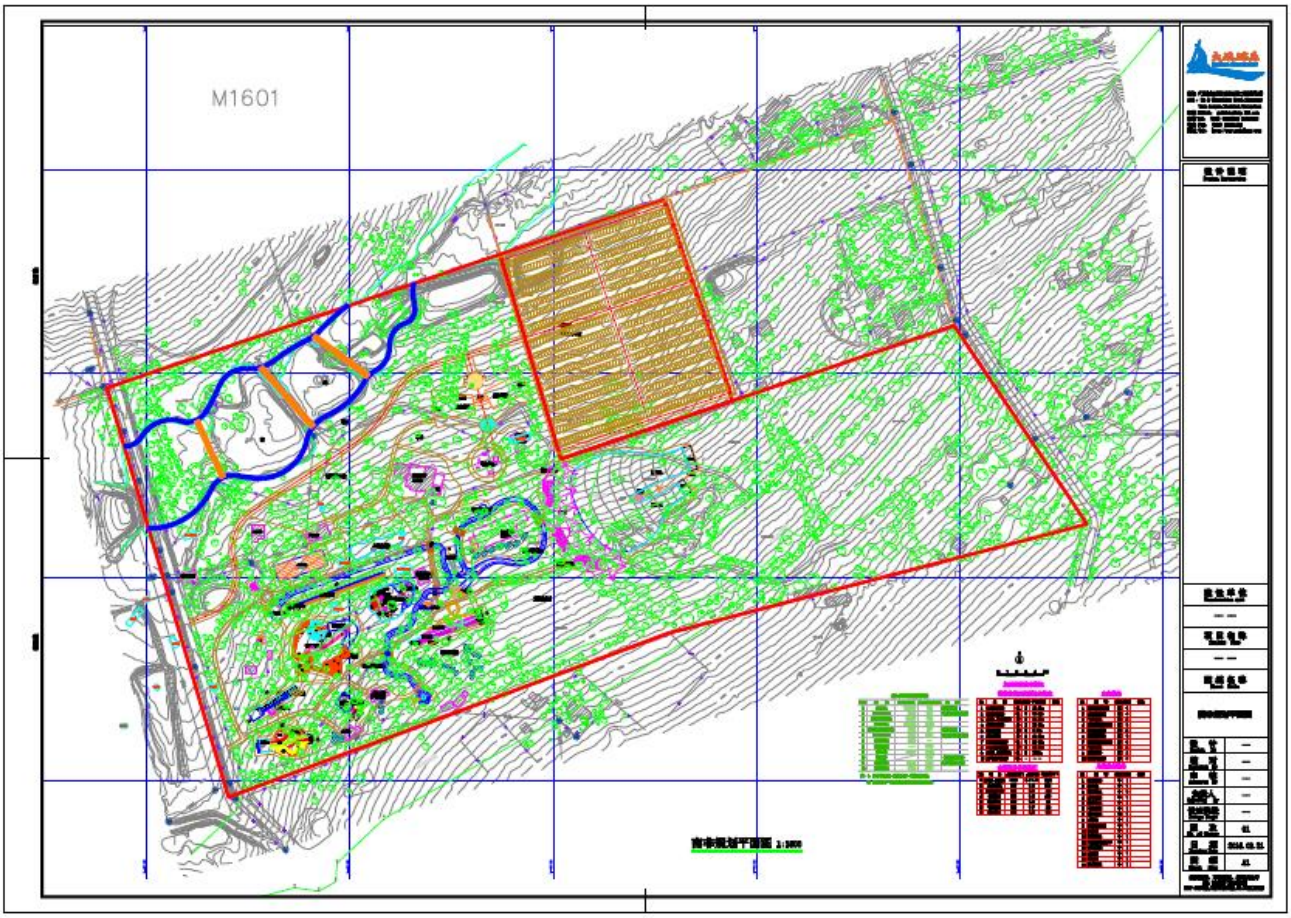


Figure 10-2: Layout Diagram for BPEO for the Water Park Development

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11 ENVIRONMENTAL IMPACT STATEMENT

The EIA Regulations 2014 require that the EIA Report include an Environmental Impact Statement that includes the following:

- *A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers;*
- *A summary of the key findings of the environmental impact assessment; and*
- *A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.*

In addition, the EIA Report must include the following:

- *Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorization.*
- *The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;*
- *Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.*
- *A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;*
- *A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;*
- *Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;*
- *Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;*
- *Any specific information that may be required by the competent authority; and*
- *Any other matters required in terms of section 24(4)(a) and (b) of the Act.*

In order to ensure that the Impact Statement is comprehensive and includes all the requirements of the Regulations, this section aims to meet the abovementioned requirements.

11.1 Sensitive Environmental Features

Figure 11-1 provides an overview of sensitive features that should be taken into account during construction and operation of the Proposed Water Park. These features include:

- **One species of conservation importance (Orange Listed plant), *Hypoxis hemerocallidea* (African potato)** – these species should be incorporated into the development as much as possible. If necessary to relocate them, all necessary permits must be obtained and these species must be relocated prior to construction.
- **Building 8,9 and 11** – The age of these buildings must be confirmed prior to any changes or alterations. Should they be older than 60 years old, a conservation architect must be employed and all necessary permits must be obtained from PHRA-G. These buildings should be demarcated and the contractor and applicant must be made aware of their sensitivities.
- **Wetlands and 32m wetland buffer (ESA)**– this area must be demarcated and only construction related to linear services can occur within this area.
- **Adjacent landowners/community** - communication channels need to be duly respected and adhered to when engaging with the community. Livestock and unauthorised access to the construction domain needs to be prevented. Excavations to be adequately safeguarded.
- **Water resources** – water use must be limited through the implementation of water conservation mechanisms such as rainwater harvesting and treatment and reuse of effluent etc.

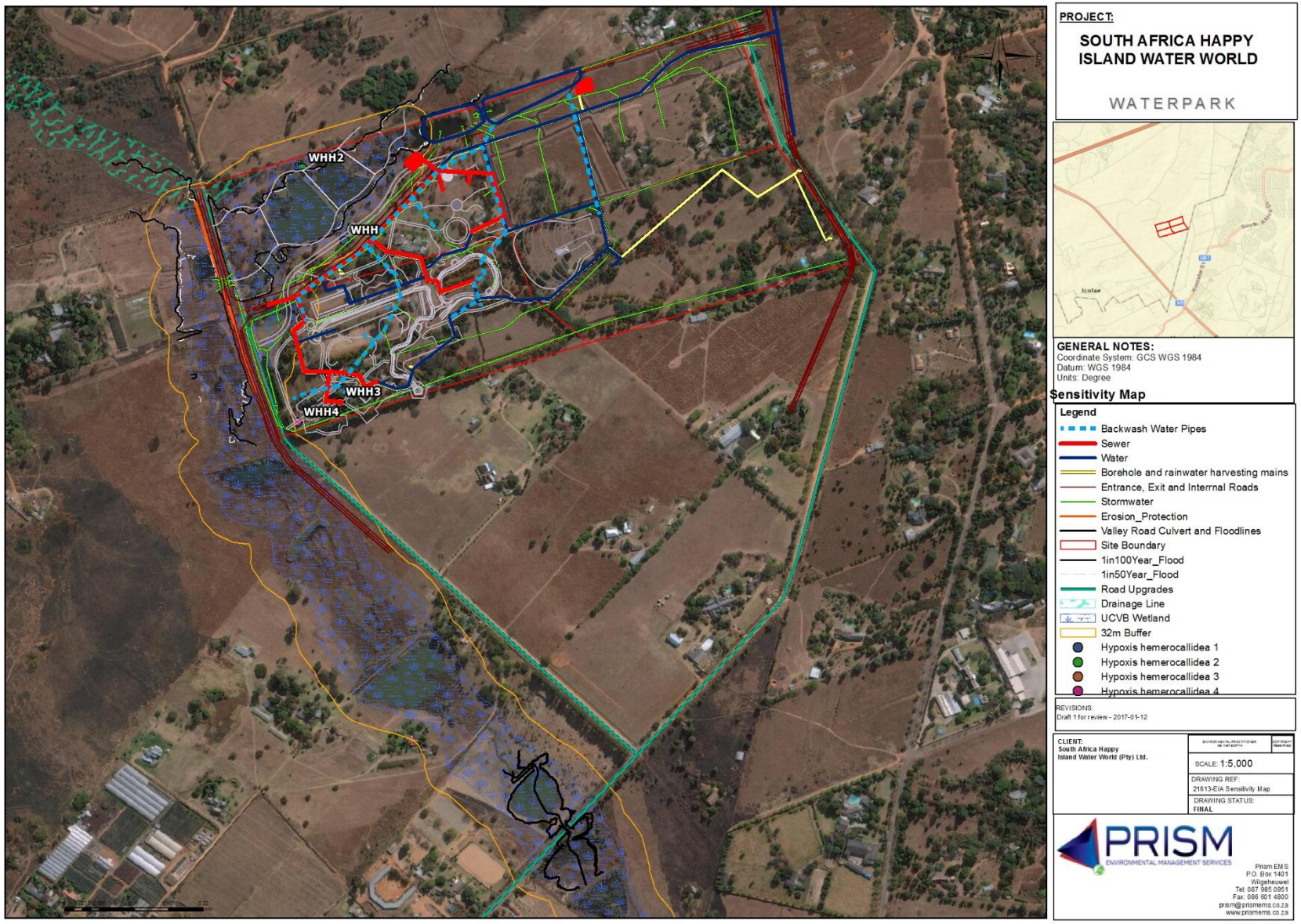

Figure 11-1: Sensitivity Map overlaid with Alternative Layout 2 (BPEO)

11.2 Summary of Impacts

A detailed discussion on impacts is provided in Section 10.3 and 10.4 however in summary, all impacts can be satisfactorily mitigated to low or low-medium significance. A summary of impacts is provided in Table 11-1.

Table 11-1: Summary of Impacts

	Potential Impacts
Atmospheric Emissions	• In terms of atmospheric emissions, two potential impacts were identified during construction and operation, namely, dust emissions and emissions from vehicles and equipment. • In addition, during operation, odour from the sewage treatment plant was another potential impact. • Impacts could be reduced to 'low' through the implementation of mitigation measures.
Noise	• During construction, noise impacts will be associated with construction equipment and vehicles. Activities will be limited to the day and all equipment must comply with manufacturers specifications. Based on this, the impact would be low. • During operation, a number of activities will result in noise impacts (for example, music, noise from water park visitors, traffic noise, noise from pumps etc.). Several mitigation measures will be implemented. In particular, a 2.5m wall must be out in place. The specialist also includes requirements for speakers and water pumps. Based on the implementation of mitigation measures, all impacts would be low.
Surface Water	• Potential impacts to surface water/wetlands in the area include the following: Water quality, Silt, Surface water run-off, Contamination of water from hazardous substances, Disturbance of natural systems, Disturbance/pollution of sub-surface flow; and Disturbance of aquatic ecological systems. These impacts range from 'low' to low-medium' in significance (without mitigation). With mitigation, these impacts decreased to a 'low' significance. • In addition to the general mitigation measures, the proposed alternative (Layout Alternative 2) take into account the wetlands on site which minimises the impact to these resources. • The impact of sewage on the surface water in the area was also assessed and during construction, impacts would be related to the use of chemical toilets (which may be required in addition the existing infrastructure which occurs on site). Since sewage may impact water quality in the general area (not just limited to the site), the impact was assessed as 'low-medium' (before mitigation). Mitigation measures however will be implemented and reduce the significance of these impacts. • During operation, a sewage treatment plant will be used to treat grey water and effluent on site. This treated water will then be used to irrigate the site. As effluent will be treated on site, there is potential for impacts with a 'medium' significance (before mitigation) to occur. However, a number of mitigation measures will be implemented to reduce these impacts to 'low'. These include the use of an approved treatment plant as well as the proper management and maintenance of the plant by an experienced and competent person. Water quality monitoring will also be undertaken and the treated effluent will meet the requirements of DWS.
Groundwater	• Impacts to groundwater quality. • Drawdown of groundwater resources.

	Potential Impacts
Waste Generation	• The proposed development will produce waste during both the construction and operational phases. During construction, impacts are expected to be 'low-medium' (before mitigation) and 'low' (after mitigation). Mitigation measures include waste recycling and proper storage and disposal of waste. • During operation, the volume of domestic waste will increase and without mitigation would result in a 'medium' significant impact. Some hazardous waste will be produced (but in low volumes – for example, empty containers) and is expected to have a 'low-medium' impact. Mitigation measures related to the operation phase also include recycling and proper management and disposal of waste.
Soil Alteration	• In terms of soil alteration, impacts related to loss of topsoil, loss of land capacity, alteration of topography, soil erosion and soil pollution were assessed. • In terms of topsoil, much of the site will be maintained as green areas (approximately 70%) while only approximately 2% of the site will be developed as new buildings. Apart from the green areas, the largest land use will be the proposed parking area which will take up approximately 13% of the site. Existing trees on site will be utilised as part of the landscaping for the proposed facility. Mitigation measures include separating and stockpiling topsoil separately so that it can be used for landscaping and rehabilitation of the site. Based on this, the impact was assessed as 'low' after mitigation. • There will also be a loss of land capability due to the proposed development. However, as the site has a low agricultural potential, this impact was assessed as 'low-medium'. • During construction, landscaping of the site will take place which will result in changes in the topography. The topography of the site is overall very flat in nature, however, in some areas, levelling out will be required for the development. This will change the topography of the site. However, as the site does not occur on a ridge, this change is not expected to be highly significant. Changes to topography must be properly designed and landscaped and include proper stormwater management. With the implementation of these mitigation measures, the expected impact is 'low' in significance. • Land capability is defined as the inherent capacity of land to be productive under sustained use and specific management methods. By developing the area will result in a loss of land capability in terms of the natural area and soil. The site is however altered and thus the capability of the area was already degrading. Based on this, the impact is seen to be of a 'low-medium' significance. • Soil erosion is another potential impact, however with proper mitigation, this impact can be sufficiently mitigated. Much of these mitigation measures will be implemented as part of the landscaping of the site which will stabilise any disturbed areas and prevent soil erosion. • Lastly, in terms of soil pollution, impacts may occur but would be incidental in nature and if cleaned properly, will result in a very low significance impact.
Resource Consumption	• Four types of resource consumption were assessed, namely, water, electricity, raw materials and fuel. During construction, all resource consumption was assessed to be at a 'low-medium' level except raw materials which was assessed as a 'medium' significance. Based on the implementation of mitigation measures, the impacts are expected to decrease to a 'low' or 'low-medium' level. • During operation, more excessive resource consumption is expected. In terms of water consumption, once off water to fill rides will be required. In addition, once the rides are filled, the losses from the system will be through evaporation (6-8% per day). Water will be splashed out of the rides but will go into the grey water system and will be treated and reused. It is expected that 88m^3 per day of waste water will be recycled per day. Effective water conservation measures

	Potential Impacts
	including rainwater harvesting and treatment and reuse of grey water will be implemented. Based on this, the impact was assessed to be 'low-medium'. Further, Mogale City Local Municipality has confirmed that municipal water sources will be available to the development. • Electricity will also be used during operation however effective electricity consumption will be promoted. Based on this, the impact was assessed to be 'low-medium'. Eskom however has confirmed that electricity is available for the development and has initiated a separate EIA process which is being undertaken by Hydro Science on their behalf for the proposed installation of a set of ESKOM power cables (11KVA) to service the Greengate Ext 19 and the Water Park. • During operation, the use of raw materials and fuel was assessed to be at a low level.
Effects on Biodiversity	• In terms of biodiversity, the following impacts were assessed: o Loss of habitat – 'medium' (without mitigation); o Loss of Fauna – 'low' (without mitigation); o Loss of Flora 'medium -high' (without mitigation); o Degradation of ecological systems – 'medium' (without mitigation);and o Disruption of natural corridors 'medium' (without mitigation). • However, with the mitigation measures, these impacts will decrease by one to two levels and thus after mitigation, these impacts were assessed to be 'low' to 'low-medium'. • Most of these impacts will occur during construction, during operation, the fact that the ESA area has been conserved and that many of the existing trees will be retained on site will ensure that the operational impacts are all low.
Incidents and Accidents	• Four main impacts were assessed linked to incidents, accidents and potential emergency situations. These included: Pollution incidents, Health and safety; • Storage of hydrocarbons; and Fire. • During construction, it was found that whilst these impacts could potentially have a medium/medium-high intensity, they are incidental in nature and thus were assessed to be of a 'low' significance (before mitigation). In addition, several mitigation measures will be implemented which will reduce the significance of these impacts even further. These include ensuring that a Safety Agent is appointed and that all staff undergo health and safety awareness training. In addition, pollution incidents and impacts associated with the storage of hydrocarbons will be mitigated through the proper storage of materials and by ensuring that spill kits are available to deal with any spills. In addition, hydrocarbons and hazardous material will be stored properly (in bunded areas) to ensure that any pollution incidents are contained. • I&APs raised concerns regarding the impacts of the proposed development on the occurrence of fire in the area. During both construction and operation, fires are possible but would be incidental and limited to the neighbouring areas. Whist the intensity would be medium-high, the overall significance would be 'low'. In addition, a number of mitigation measures will be implemented.
Social	• From a social perspective, impacts to the following attributes were assessed: Visual impact; Safety and security; Traffic disruptions; Loss of cultural heritage; • Loss of sense of place; and Change of land use. • During construction, the visual impact will be limited and can be effectively mitigated through building a boundary wall. In addition, proper housekeeping will ensure that litter is kept to a minimum. During operation, the visual impact is more long term in nature however, the design of the proposed Water Park will incorporate the existing trees as well as 70% of the site will be utilized for open areas. Further, a suitable boundary wall (at least 2.5m in height) will ensure that the park is screened from adjacent neighbors. Based on this, the pre-mitigation

	Potential Impacts
	impact which is 'medium' in significance, will be decreased to 'low'. It is also recommended that clean up of litter along Valley and Lakeview road to takes place where necessary and dustbins are provided along these routes to decrease litter in the area. • From a safety and security perspective, numerous I&APs raised concerns regarding the impact of the Water Park on crime in the area. During construction, crime may increase due to the influx of workers into the area. This impact would be short-term in nature (i.e. limited to construction) and would potentially impact neighboring properties. Without mitigation, the potential impact would be 'medium'. Based implementation of recommended mitigation measures. and the fact that the construction employment will be managed by the relevant contractor (i.e. there will not be an employment desk on site), the impact is seen to be 'low'. During operation, the potential impact will be incidental in nature. Due to concerns raised by I&APs regarding crime in the area, it is recommended that security for the proposed site include occasional patrols of Valley road and Lakeview road. Additional mitigation measures include 24-hour access control and security at the Water Park. Based on this, the impact is thought to be 'low'. • In terms of traffic, the operation of the Water Park would potentially have a significant impact however a Traffic Impact Assessment was undertaken and determined that some upgrades would be required. In line with this, the proposed development includes the upgrades of the Valley and Lakeview Road and the impact on traffic will be mitigated to 'low' during operation. However, in order to undertake these upgrades, there will be traffic disruptions during the construction phase. These however will be short-term (limited to construction). Mitigation measures include upgrading one lane at a time as well as ensuring traffic with flag men and signage. Based on this, the impact will be 'low-medium' during construction. • In terms of heritage, the AIA for the proposed development noted that some structures (structure 8, 9 and 11) could be just over 60 years old as they were constructed between 1954 and 1977. No burial sites were however recorded. Based on the findings of the AIA, the impact during construction will be mitigated to 'low'. During operation, no impacts are envisioned. • The proposed development will impact the sense of place of the area as it results in a change of land use. This impact is more intense and extends for a longer duration during the operational phase. The sense of place is mainly impacted by changes in the visual environment, traffic disruptions and noise impacts associated with the operation of Water Park. Without mitigation, this impact is 'medium' however by mitigating the various impacts related to the visual environment, traffic and noise, it is possible to decrease the impact on the sense of place to 'low'. • The proposed development will also result in a change in land use (from agricultural to special). No mitigation measures are available to reduce this impact. The impact will be limited to the development footprint and can be seen as long-term. However, as the site does not have a high agricultural potential, the expected impact is 'low-medium'.
Economic	• Two major positive benefits related to both the construction and operation of the proposed Water Park is the increase in the local economy and increase in temporary and permanent employment. • In terms of estimated CAPEX investment, the business case for the Water Park estimated that R384 million would be invested which will result in a 'medium' positive significant benefit to the local economy. South Africa Happy Island Water World (Pty) Ltd is certified as a Level 1 B-BBEE company. It is also committed to employing local contractors with Level 1 or 2 BEE certifications. Whilst some foreign Chinese workers will be used for putting the equipment

	Potential Impacts
	together (which is a specialized activity), this will be limited to 25 foreign workers at any one time. • In addition, in terms of employment, approximately 400 temporary jobs will be created during construction and 550 permanent jobs during operation. This will have positive impact in the area due to the existing low employment. • I&APs raised concerns regarding the potential for the development to result in a close of some of the existing businesses in the area. Should businesses close in the area, there would be a negative economic impact however, the development would only indirectly result in these closures if the mitigation measures included in the EMPr to reduce visual, traffic and noise impacts were not successful. It is therefore unlikely that the development will result in business closure.

11.3 Recommendations from Specialist Reports

An overview of the recommendations of the various environmental and technical specialists are provided in Table 11-2. Please note that only the main mitigation measures are provided. All mitigation measures are however included in the EMPr.

Table 11-2: Specialist recommendations

	Recommendations	Development to proceed
Ecological Habitat Assessment	• Integration of *Hypoxis* species into the development or relocation to a suitable habitat • Design the development and operations so as to avoid impacting on the wetland habitat. • Construction contractors, sub-contractors and operators must ensure that no fauna taxa are unduly disturbed, trapped, hunted or killed.	✓
Wetland Assessment	• A wetland monitoring programme should be developed based on this baseline assessment and audited against on a bi-annual basis. Feedback from the monitoring should be used to measure and mitigate further negative impacts, if found. • The wetland monitoring occurring on a bi-annual basis should be conducted by a skilled professional qualified in assessing and understanding the complex nature of wetlands and their associated drivers. • The wetland and 32m wetland buffer must be incorporated into the development. • The wetland should be rehabilitated to improve functioning.	✓
Aquatic Assessment	• Water quality monitoring to be undertaken. • Purification and filtration of the aquatic resource should occur prior to the water being used for any recreational activity.	N/A
Hydrogeological Baseline Assessment and 2D Model	• The pumping rate was based on an assume yield of 700 l/h but should be verified with in-situ pumping test to determine the long term yield of the boreholes. • A quarterly monitoring protocol for groundwater quality and groundwater levels from the 4 abstraction boreholes of the proposed Water Park is recommended, to monitor any changes from baseline	✓

	Recommendations	**Development to proceed**
Archaeological Impact Assessment	• If building, 8, 9 and 11 to be impacted on then Conservation architect to be used. • Permits from PHRA-G to be in place.	✓
Noise Impact Assessment	• Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels. • Preparation of the foot print, civil construction activities and the construction of the roads should be limited to daytime only. • Amplified music not to be higher than 75.0dBA at each point source. • Speakers may not be higher than 3.0m from ground level. • Directional speakers with a throw not longer than 10m must be installed and facing to the inside of the park. • A noise limiter to be installed at the office and must be tamper proof. The noise limiter must be calibrated at a sound level of 75.0dBA. • All platforms higher than 3.0m above ground level must be screened off from the abutting residential areas. • A 2.5m wall must be constructed along the entire boundary of the water park. In some areas, a 3.0m wall or earthberm will be required. • All water pumps and generators must be encapsulated with a brick constructed building with a concrete slab roof. • The wave making plant room for the tsunami and wave pools to be acoustically screened off and acoustic ventilation louvres to be provide at all openings; • A noise survey to be carried out on a monthly basis or when a noise complaint is received at the different point sources and at the boundary of the property to ensure that the sound limits are adhered to.	✓
Outline Scheme Report	• Designs provided by both reports must be implemented to ensure that required services are in place. This includes: o Rainwater harvesting; o Attenuation Dam; o Storage Dam; o Backwash treatment and reuse; o Effluent treatment and recycling; o Sewer treatment plant to be put in place; o Internal water, stormwater and sewer reticulation to be put in place.	N/A
Stormwater Management Plan		✓
Geotechnical Assessment	• N/A	N/A
Traffic Impact Assessment	• It is proposed that the Waterpark Theme park Site be served by the following accesses: o Ingress (E1): It is proposed that the Waterpark entrance be situated off Lakeview Road approximately 217m west from the planned K56 road reserve. It is proposed that an emergency exit lane be provided for vehicles such as fire trucks and ambulances. o Egress (E2): It is proposed that the Waterpark exit be situated off Valley Road located to the north-	✓

	Recommendations	Development to proceed
	western end of the site. This exit position is to be provided at a minimum distance of 100m west from the planned K56 road reserve. It is proposed that an emergency entrance lane be provided for vehicles such as fire trucks and ambulances. ○ Access to Portion 174: It is proposed that an additional access be located to north eastern end of the site at Portion 174. This access is to be provided at a minimum distance of 100m east from the planned K56 road reserve. • It is proposed that 1 500 parking bays for cars be made available on site. • From the analysis performed, it was found that the impact of the proposed development can be mitigated by means of road and intersection improvements as discussed in this report. • The cost of the upgrades due to the developer on municipal roads may be discounted against the engineering services contributions for the Waterpark development. • It is recommended that the proposed development provide an on-site taxi facility in the form of dedicated parking bays to accommodate at least 15 taxis. • It is recommended that the proposed development provide an on-site bus facility in the form of dedicated parking bays to accommodate at least 10 buses. • It is further recommended that the above parking facilities be constructed according to the South African Parking Standards (DOT). • In order to ease and formalise the movement of pedestrians between the site accesses, Lakeview Road and Valley Road, it is proposed that 1.5m wide paved (or dust free) sidewalks be constructed.	[redacted]

11.4 Impact Management Objectives and Outcomes

Impact management objectives and outcomes will be provided in the EMPr to ensure that the proposed development is sustainable and has not significantly negative impacts. A summary of these management objectives are provided below:

- Planning and layout of construction site is undertaken responsibly to ensure protection of sensitive environmental features.
- Environmental awareness creation and training is undertaken throughout the construction phase in order to minimise environmental impacts and ensure compliance to relevant legislation and authorisations
- Minimise environmental impacts associated with emergency procedures
- A safe working environment for contractors/construction workers and the public is provided.
- Proper management of site clearing is undertaken to ensure minimal environmental disturbance.
- Minimise environmental impacts associated with site establishment

- Ensure access to sensitive environmental features is restricted and proper access control is in place
- Minimal disturbances to traffic due to delivery of construction material.
- Proper management of labour force is undertaken to ensure that:
  - There are no security-related issues or disturbance to tenants or landowners outside the construction footprint.
  - There is optimal use of local labourers.
  - There is no disturbance to sensitive environmental feature
- Minimise environmental impacts associated with ablution facilities.
- Reduce the generation of waste by changing behaviours of contractors throughout the development
- Re-use waste generated by the construction where possible thereby resulting in decreased waste disposal volumes
- Waste separation and recycling must be undertaken as part of construction
- Waste generated during the Water Park Development to be disposed of at licenced landfills
- Minimal environmental impacts associated with waste
- Effective and safe management of hazardous and non-hazardous materials on site, in order to minimise the impact of materials on the environment.
- Minimal environmental impacts associated with the management of workshops and equipment
- Ensure that all possible causes of pollution are mitigated as far as possible to minimise impacts to the surrounding environment.
- Prevent polluted water from entering the surface water.
- Minimise noise disturbance to surrounding areas
- Preserve protected flora species outside of construction areas.
- Control alien plants and noxious weeds.
- Minimal impact to fauna species.
- To have no adverse impact on the historical inheritance of the area.
- The preservation and appropriate management of new findings should these be discovered during construction.
- Adequate reinstatement and rehabilitation of construction areas.
- Water conservation mechanisms to be implemented.
- Electricity reduction mechanisms to be implemented.

11.5 Assumptions, Uncertainties and Gaps in Knowledge

The following potential uncertainties have been identified:

- There are no similar operational Water Parks in the area and it is difficult to anticipate the exact degree and nature of the potential impacts on the surrounding area.
- The volume of groundwater which will be authorised by DWS as part of the WULA are not yet known.

- The proposed development will meet all the B-BBEE requirements of MCLM however the Municipality has not yet given an indication of these requirements.
- The exact age of building 8, 9 and 11 are not known.

11.6 Reasoned Opinion of EAP

11.6.1 Summary of EIA Report Findings

The Proposed Water Park development triggered a number of activities from Listing Notice 1, 2 and 3 of the EIA Regulations, 2014 As such a Scoping and EIA process was undertaken to assess the impacts of the proposed development and to ensure that the development was in line with the concept of sustainable development captured in NEMA.

The proposed development involves the development of recreational water park facilities such as rides and restaurants as well as the required associated services (including upgrades of access roads and parking). A WULA is also required as a number of water use activities require authorisation in terms of Section 21 of the NWA. Two layout alternatives were assessed together with two sewage treatment alternatives.

Public Participation was undertaken throughout the process and a number of concerns were raised by registered I&APs. In particular, concerns regarding the following were noted:

- Impacts to sense of place;
- Impact to groundwater (and adjacent landowners reliant on boreholes in the area);
- Impact to Biodiversity and sensitive features;
- Availability of water supply;
- Availability of sewerage treatment;
- Noise pollution;
- Traffic and access;
- Concerns regarding security and safety; and
- Electrical Supply.

Based on the concerns raised, listed activities and potential impacts associated with the development, a number of specialist studies were undertaken to assess the impacts associated with the development. Several technical studies were also undertaken and informed the EIA process. Specialist and technical studies included:

- Ecological Habitat and Threatened Species Assessment;
- Wetland Delineation Assessment;
- Aquatic Impact Assessment;
- Hydrogeological Baseline Assessment and 2D Model;
- AIA;
- Noise Impact Assessment;

- Outline Scheme Report (including Stormwater Management Plan);
- Traffic Impact Assessment; and
- Geotechnical Assessment.

The Ecological Habitat Assessment found that the whilst the study area occurs within the footprint of the highly endangered *Egoli Granite Grassland,* assessment of the study site indicates that both vegetation and ecology could be considered to be impacted and considered to be *Secondary grassland.* Furthermore, the floristic composition of the study site area represents an anthropogenic secondary, plagioclimax grassland, as described by Bredenkamp et al (2006), and can no longer be considered representative of *Egoli Granite Grassland*.

The delineated Ecological Support Area (ESA) in the form of a wetland habitat within the north-western corner of the study site was found to be sensitive and thus mitigation measures were recommended including the integration of the existing wetland into the development and creating benefits to the ecosystem downstream of the proposed development. In addition, a single floristic species of concern (numerous individuals at multiple locations), *Hypoxis hemerocallidea,* was observed on the property. Mitigation measures to protect the species include integration into the development or relocation to a suitable habitat. No other species of concern or listed, threatened species (faunal and floral taxa) were observed on the site during the assessment.

In terms of alternatives, Alternative Layout 2 would be the preferred option from an ecological point of view. This alternative allows for the maintenance and minimal disturbance to the sensitive, wetland habitat and buffer zones (1:100 floodlines) with maintenance of ecological function also having implications for downstream habitats. However, as both treatment options result in water quality of acceptable levels (as required by the Department of Water and Sanitation), there is no preference for either treatment facilities.

A Wetland Assessment was also undertaken and found that the PES for the wetland scored in the low ranges for the Un-Channelled Valley Bottom Wetland. The EIS fell in the moderate range and had some functionality in respect of biodiversity conservation. The REC for the wetland was categorised as moderate. It would thus require some rehabilitation to enhance the ecological function of the system. Based on this, the wetland was not considered to be a very sensitive wetland. For this reason, the development was supported. The study noted that the rehabilitation of the wetland is vital to recover the required ecological function. The wetland drivers must be enhanced as part of the rehabilitation of the affected areas. In respect of the road construction, it is important to ensure that the required erosion protection measures linked to the crossing sections be carefully designed and installed. The project can be supported should all the mitigation measures be implemented and monitored against.

An Aquatic Assessment was also undertaken and found that the aquatic resource can be concluded as contaminated and unfit for use for recreational use. This conclusion is based on the *in situ* and laboratory results and comparison to the SANS 241:2015 guidelines (SANS, 2015) and the TWQR of the South African Water Quality Guidelines (DWAF, 1996d). The determinands that did not comply with either or both

guidelines were colour, turbidity, clarity, TOC, *E. coli*, aluminium, iron, and manganese. Due to the importance of dissolved oxygen, this parameter will need to be monitored and mitigated as well. The aquatic resource thus poses aesthetic, operational and potential health risks if it is to be used for any recreational use. Purification and filtration of the aquatic resource should occur prior to the water being used for any recreational activity. No water will be abstracted for use from the Dams on site for use in the recreational facility. Water quality monitoring will be undertaken.

The AIA found that in terms of the built environment of the area, several structures occur in the study area consisting of residential dwelling and associated outbuildings like garages and servants quarters. Based on information obtained from topographical maps structure 8, 9 and 11 that could be just over 60 years old as they were constructed between 1954 and 1977. It is therefore recommended that if these three structures are impacted on by the development their age should be confirmed. If the structures are confirmed to be older than 60 years, a conservation architect should be appointed to assess the structures and apply for a demolition/ alteration permit. Further, the study found that no burial sites were recorded. However if any graves are located in future they should ideally be preserved *in-situ* or alternatively relocated according to existing legislation. Due to the subsurface nature of archaeological remains and the fact that graves can occur anywhere on the landscape, it is recommended that a chance find procedure is implemented for the project as part of the EMP. Based on the above, the study found that the proposed project is acceptable from a heritage point of view.

The Noise Impact Assessment noted that there will be an increase in the environmental noise levels from the activities at the water park, but this can be managed by means of noise mitigatory measures. The noise mitigatory measures must be in place to ensure that the water park activities will be environmentally sustainable and will comply with the Noise Control Regulations. Based on the implementation of mitigation measures, the specialist felt the development could proceed.

Due to the concerns raised by I&APs regarding the impact of the development on groundwater, a Hydrogeological Baseline Assessment and 2D Model was undertaken. The Study found that with the exception of unintended spills (i.e. fuel etc.) or seepage of un-treated waste water, there are no activities expected that could impact on regional groundwater quality. Based on the simulation results the spatial extent of the radius of influence as a result of continuous abstraction is approximately 180 to 400 m. It must be noted that any abstraction applied to a steady-state groundwater model is likely an over-estimate of drawdown as it does not consider time-dependant recharge and aquifer storage. Based on the resulting assessment of the proposed abstraction rates, the impact on the regional water balance is minimal. During pumping a dewatering cone will develop, however, the water table will rebound to pre-pumping conditions if the pumping is ceased (i.e. during non-working hours). The impacts on the local ambient groundwater environment related to groundwater abstraction can be summarised having a low likelihood to occur. Significant drawdowns are localised to the immediate vicinity of the site boundary. The drawdown is reversible during non-pumping periods. Further, if correct maintenance of the waste water treatment plant is in place, the Water Park will have negligible impact on the groundwater quality. A quarterly monitoring

protocol for groundwater quality and groundwater levels from the 4 abstraction boreholes of the proposed Water Park is recommended, to monitor any changes from baseline.

In terms of services, the Outline Scheme Report and Stormwater Management Plan found that the services required for the proposed Water Park will be put in place as part of the development. Municipal sources of water are available. In addition, a number of additional sources of water will be used. In terms of sewer, a sewer treatment plant will be put in place at the site. A dedicated stormwater system will also be implemented.

A Traffic Impact Assessment was also undertaken and found that the proposed development is expected to generate approximately 255 trips and 1 199 trips (in and outbound) during the Weekday PM and Saturday peak hours respectively on the external road network. The study recommended that the Waterpark Theme park Site be served by separate entry and exit points. In addition, parking for 1 500 cars must be made available on site. Upgrades or Lakeview and Valley Road are also required to mitigate impacts related to the development. Based on the above, from a traffic engineering perspective, the proposed development is thus regarded as feasible and sustainable and is therefore supported

In terms of the impact assessment undertaken as part of the EIA Report, a qualitative and quantitative approach was followed. From a qualitative perspective, impacts related to listed activities and raised by I&APs were assessed. This was then followed by a more detailed quantitative assessment which incorporated the findings of the specialists where possible. Overall all impacts could be mitigated satisfactorily. Alternatives were then compared and assessed based on their impact to environmental attributes as well as how well they incorporated the requirements of the various specialists. Based on this assessment, the recommended alternatives are as follows:

- Alternative Layout 2; and
- Treatment Alternative 2 (AM Biorotor BR4000).

The no-go option/alternative was not supported for a number of reasons, the most of important of which being that should the development not proceed, there will be a loss of the economic benefits of the investment of approximately R340 million in the area. There will also be a loss of the 400 construction related employment opportunities and 550 operation related employment opportunities. This would be a significant negative impact as 24,6% of economically active people in the Municipality are unemployed. In addition, approximately 32,3% of the economically active youth (15–34 years) in the area are also unemployed. The no-go alternative would result in a loss of these positive economic benefits.

11.6.2 Reasons for Decision

Based on the findings of the specialist studies and impact assessment and taking into account the successful implementation of the EMPr, it is felt that the Proposed Water Park Development should proceed. In summary, the following reasons form the basis of this opinion.

- The proposed development is in line with the MCLM Tourism Strategy Development Plan (DIT 500, 2013) which identified the concept of a unique theme park, with a water feature similar to Valley of Waves as an opportunity to increase tourism in the area.
- The location of the site has been considered as suitable as it is line with the Precinct Plan for The Muldersdrift Development Zone, 2011" which shows the properties in question being located in a "High Density Residential Development Zone" where high density residential, limited retail and social and community facilities are preferred. Urban support facilities and uses related to the hospitality and tourism industry will also be supported in this development zone. This implies that the proposed development is in line with the development proposals for the area and can be supported.
- The proposed footprint falls within the urban development zone of the GPEMF which favours infill and densification development. Part of the site does fall within an ESA however the proposed layout takes this into account.
- The location of the site ensures that it can be considered accessible presently and in the future. It is very accessible from Road 374 [K31] whilst the future Road K56 will assist to provide additional access to the development in the future.
- Whilst the site is currently located in an area zoned as 'agriculture', the site has low agricultural potential and is currently noted used for agriculture. No excessive opportunity costs are therefore envisioned.
- The site is currently impacted upon by existing land uses. Using this site therefore reduces the need for greenfields development elsewhere.
- Services required for the development are available or will be developed during the construction phase.
- No environmental or technical specialist study identified any fatal flaws related to the site selection for the proposed development
- In addition, all impacts identified as part of specialist studies and the impact assessment could be satisfactorily mitigated to 'low' or 'low-medium'. As such no significantly negative impacts are expected.
- The economic benefits of the proposed development include the investment of approximately R340 million in the area. This will have a positive economic impact in the area.
- Approximately 400 construction related employment opportunities and 550 operation related employment opportunities will be created through the development of the Water Park This results in a significantly positive impact as 24,6% of economically active people in the Municipality are unemployed and any employment opportunities are therefore important.
- The assumptions, uncertainties and gaps are such that the impact assessment is expected to be accurate.
- The mitigation measures included in the EMPr are thought to adequately mitigate impacts so that the impact management objectives can be met.
- The comparison of alternatives resulted in the selection of the BPEO for the site:
    - Alternative Layout 2; and

- Treatment Alternative 2 (AM Biorotor BR4000).

11.6.3 Proposed Conditions

A number of critical mitigation measures accompany this recommendation and should be included as conditions of the environmental authorisation (should it be granted). These include:

- An Environmental Control Officer (ECO) should be appointed to ensure compliance to the authorization and EMPr. Monthly monitoring together with six-monthly full environmental audits is recommended.
- The species of conservation importance (*Hypoxis)* should be integrated into the development where possible. In areas where this is not possible, relocation to a suitable habitat must be undertaken. All relevant permits must be in place prior to relocation.
- Construction contractors, sub-contractors and operators must ensure that no fauna taxa are unduly disturbed, trapped, hunted or killed.
- A wetland monitoring programme should be developed based on this baseline assessment and audited against on a bi-annual basis. Feedback from the monitoring should be used to measure and mitigate further negative impacts, if found.
- The wetland monitoring occurring on a bi-annual basis should be conducted by a skilled professional qualified in assessing and understanding the complex nature of wetlands and their associated drivers.
- The wetland and 32m wetland buffer must be incorporated into the development.
- The wetland should be rehabilitated to improve functioning.
- Water quality monitoring to be undertaken.
- Purification and filtration of the aquatic resource should occur prior to the water being used for any recreational activity.
- If building, 8, 9 and 11 to be impacted on then Conservation architect to be used. Permits from PHRA-G to be in place should this be the case.
- Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels.
- Preparation of the foot print, civil construction activities and the construction of the roads should be limited to daytime only.
- Amplified music not to be higher than 75.0dBA at each point source.
- Speakers may not be higher than 3.0m from ground level.
- Directional speakers with a throw not longer than 10m must be installed and facing to the inside of the park.
- A noise limiter to be installed at the office and must be tamper proof. The noise limiter must be calibrated at a sound level of 75.0dBA.
- All platforms higher than 3.0m above ground level must be screened off from the abutting residential areas.

- A 2.5m wall must be constructed along the entire boundary of the water park. In some areas, a 3.0m wall or earthberm will be required.
- All water pumps and generators must be encapsulated with a brick constructed building with a concrete slab roof.
- The wave making plant room for the tsunami and wave pools to be acoustically screened off and acoustic ventilation louvres to be provide at all openings;
- A noise survey to be carried out on a monthly basis or when a noise complaint is received at the different point sources and at the boundary of the property to ensure that the sound limits are adhered to.
- The stormwater management system included in the Stormwater Management Plan must be implemented and maintained.
- Water recycling and rainwater harvesting mechanisms included in the Outline Scheme Report must be implemented.
- Abstraction volumes from the boreholes must not exceed the authorized volumes which will be included in the WUL.
- The requirements of the Traffic Impact Assessment must be implemented. In particular, Valley Road and Lakeview Road must be upgraded.
- A quarterly monitoring protocol for groundwater quality and groundwater levels from the 4 abstraction boreholes of the proposed Water Park is recommended, to monitor any changes from baseline conditions.

11.6.4 Authorisation Validity

The proposed development includes operational activities and thus once construction has commenced, the authorization will be viewed to be permanently valid. The proposed period for which the environmental authorization should be valid prior to operation is 8 years with an option to extend if necessary. Should construction not commence within this period, the authorization will lapse and new authorization process would be required.

11.6.5 Management of Rehabilitation/Decommissioning

Decommissioning of the proposed Water Park and associated services is not envisioned. However, should decommissioning be required the activity will need to comply with the appropriate environmental legislation and best practices at that time.

Remediation and rehabilitation of the construction footprint will be undertaken prior to operation. Mitigation measures to ensure proper rehabilitation are included in the EMPr.

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12 EAP UNDERTAKING

I, **Vanessa Stippel**, as the Environmental Assessment Practitioner managing this application provide the following affirmation in relation to -

- the correctness of the information provided in the reports;
- the inclusion of comments and inputs from stakeholders and I&APs;
- the inclusion of inputs and recommendations from the specialist reports where relevant; and
- any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;

Designation: Senior Environmental Assessment Practitioner

Prism Environmental Management Services

Company

9 January 2017

Date

13 REFERENCES

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14 APPENDICES

14.1 Curriculum Vitae of EAP

14.2 Application Form for Environmental Authorisation

14.3 Alternatives

14.4 A3 Maps and Drawings

14.5 Public Participation

14.5.1 Interested and Affected Party Database

14.5.2 Proof of Initial Notification

14.5.2.1 Newspaper Notices

14.5.2.2 Site Notices

14.5.2.3 Background Information Document

14.5.2.4 Proof of Initial Notification

14.5.3 Proof of Notification of Review of Scoping Report

14.5.3.1 Proof of Notification of Registered I&APS

14.5.3.2 Proof of Delivery to Authorities

14.5.4 Proof of Notification of Review of the EIA Report

14.5.4.1 Newspaper Notice

14.5.4.2 Site Notices

14.5.4.3 Proof of Notification of Registered I&APs

14.5.4.4 Proof of Delivery to Authorities

14.5.5 Comments and Responses Report

14.5.6 Comments Received

14.5.6.1 Comments during Initial Notification

14.5.6.2 Comments during Review of Scoping Report

14.5.6.3 Comments received after submission of Scoping Report

14.5.7 GDARD Approval of Scoping

14.6 Specialist Studies

14.6.1 Ecological Impact Assessment

14.6.2 Wetland Delineation Assessment

14.6.3 Aquatic Impact Assessment

14.6.4 Hydrogeological Baseline Assessment and 2D Model

14.6.5 Phase 1 Heritage Impact Assessment

14.6.6 Noise Impact Assessment

14.6.7 Outline Scheme Report and Stormwater management Plan

14.6.8 Geotechnical Assessment

14.6.9 Traffic Impact Assessment

14.7 Impact Assessment

14.8 Environmental Management Programme

14.9 Business Case

14.10 Integrated Water Use Licence Application