APPLICATION 260122006930

OMEYA GOLF ESTATE WINDHOEK

INFRASTRUCTURE

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

ENVIRO DYNAMICS
Environmental Management Consultants

PROJECT NAME	Omeya Residential and Golf Estate Infrastructure
LISTED ACTIVITIES	Construction of public roads network (public roads for the estate) Construction of domestic waste water treatment plants Groundwater abstraction for domestic, industrial or commercial purposes (golf course) Facilities for waste sites, treatment and disposal of waste Construction of facilities for transmission and supply of electricity The construction of public roads
ECC DETAILS	6 Nov 2009 For the Omeya Golf Estate ECC NO: N/A
REPORT	Environmental and Social Management Plan
STAGE OF REPORT	Final
CLIENT	Omeya Infrastructure Company Attention: Rudolf Oostuizen, Manager Tel +264 813774092 omeyainfman@gmail.com
DATE OF RELEASE	February 2026
CONTRIBUTORS TO THE REPORT	Stephanie van Zyl

Contents

1. INTRODUCTION

1.1. BACKGROUND

The Omeya Golf and Residential Oasis[1] is a township that was approved in 2011 and developed thereafter, situated approximately 30km south of Windhoek. The development has 384 residential plots, and the development of some plots in Phase 3 are currently being planned. It has space for 14 townhouse developments (some developed), a retirement village with a frail care centre (partly developed), a private school (developed), a business village (with a basic shop so far) and an 18-hole Peter Matkovich signature designed golf course (developed and in operation).

Figure 1: Locality of Omeya Golf and Residential Oasis

The Environmental Clearance Certificate for the development was obtained in 2009 (See Appendix A), but no renewal applications were submitted. The EIA and EMP were however taken seriously during construction and the documents have been included into the current service agreement for the infrastructure.

The ECC was conducted on instruction of the Developer and Owner of the development at the time, namely Auasview Investment Trust. Currently, the structure of the estate is as follows (Figure 2):

[1] https://www.omeya.com.na/

Figure 2: Current Management Structure at Omeya

There have been transfers from the original owners and developers to the new companies shown in the above diagram. The infrastructure, including the roads, electricity infrastructure, water, and sewerage reticulation with waste water treatment facility (WWTF), has been transferred and is being managed by OIC. Whereas the original ECC was obtained in the name of Auasview Investment Trust, this application includes the transfer of the ECC to OIC, being the company responsible for the management of the infrastructure. The listed activities on the estate, in terms of the Environmental Management Regulations (2012), which need an ECC, renewed every three years, are the infrastructure as follows:

- Construction of public roads network (public roads for the estate)[2]
- Construction of domestic waste water treatment plants
- Groundwater abstraction for industrial or commercial purposes (golf course)
- Facilities for waste sites, treatment and disposal of waste
- Construction of facilities for transmission and supply of electricity

These activities at the estate are therefore the subject of this Environmental Management Plan.

At the time when the estate was planned, Environmental Impact Assessment and Environmental Management Plan was compiled, which is available on request.

This document falls under that Plan, but focusses on the operation and maintenance of the mentioned infrastructure.

[2] This list is compiled according to the listed activities as described in the Environmental Management Regulations (2012). Even though the act in some cases describes only the construction of the activities, it is interpreted and generally implemented to mean that the operation of the facilities should also be managed according to the EMP and renewal applications submitted every three years. A public road is considered to be a road to which the public has access.

2. INFRASTRUCTURE DESCRIPTION

A site layout of the estate is provided in Appendix A. The Estate has been developed as originally described in the EIA document (Appendix B). A google map of the estate showing key locations is presented below.

2.1. ROAD NETWORK

The road network has been designed according to engineering specifications and the main access point was approved by the Roads Authority. Road maintenance is done by OIC in line with engineering specifications[3][4], using constant visual inspections.

2.2. ELECTRICAL RETICULATION

Bulk electricity is supplied by NamPower from the 66kV substation (Leutwein Sub Station) situated approximately 400m east of the boundary of the development, while on site reticulation is underground.

2.3. WATER AND SEWAGE RETICULATION AND TREATMENT

2.3.1. Key components

Water is abstracted from two production boreholes on the site and a groundwater management plan is in place to steward the use of this water in a sustainable manner (Appendix C). The recommendations of that report are imperative for the water supply situated at Omeya.

A gravity sewage system transports the waste water to five collector sumps where it is pumped to the waste water treatment plant (WTTP), which includes a trickling filter plant.

The water and waste water reticulation systems work together as grey water is recycled for reuse on the golf course and the gardens. The sludge from the treatment plant is dried in lined ponds, collected by a third party and disposed of at the Kupferberg Waste Disposal site.

[3] CSIR, Human Settlement Planning and Design Volume 2

Figure 4: Map showing key locations at Omeya.

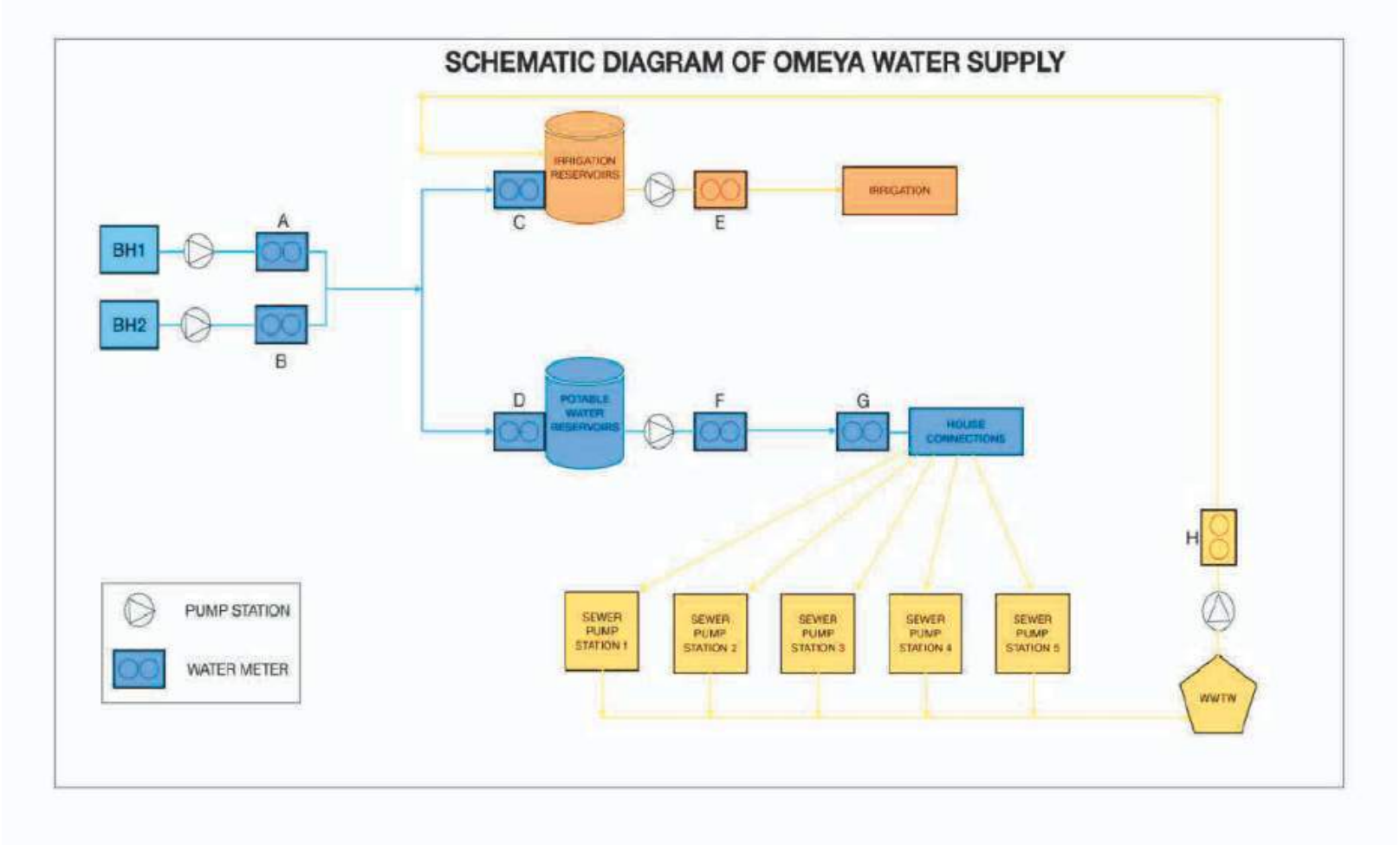


Figure 6: **Omeya water supply schematic**

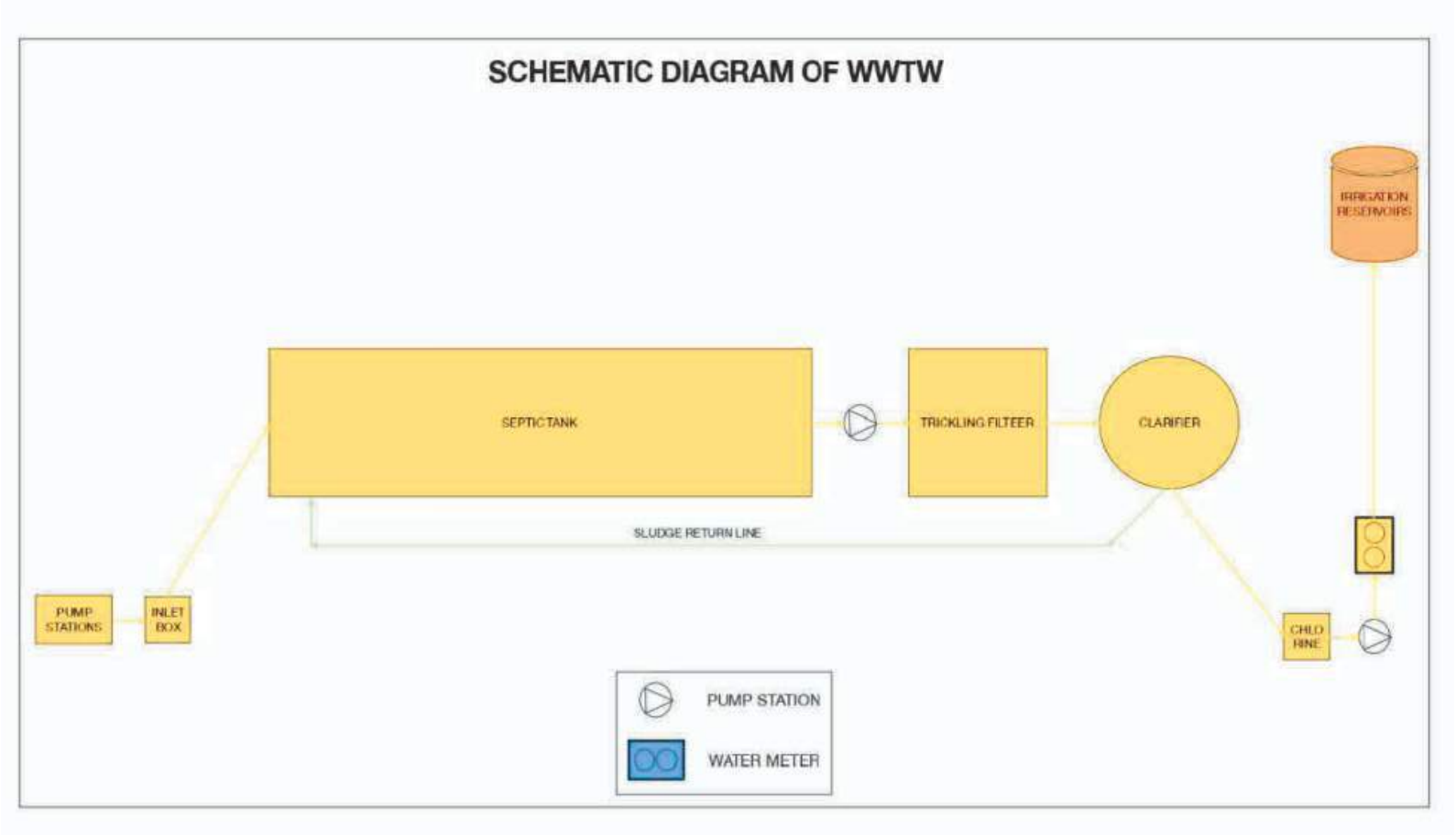


Figure 7: Schematic diagram of Waste Water Treatment Plant

Figure 8Figure 9: Schematic diagram of Waste Water Treatment Plant

2.3.2. Water supply and demand

The aquifer at Omeya was initially considered to be generally strong. The golf course, has a high demand for water and therefore a recycling system was incorporated, as explained previously. In 2011 when the development submitted the application for borehole abstraction, a total of 350,000m$^{3/}$annum was granted. Due to continued dropping of the water table coupled with periods of droughts, this figure was reduced to 280,000m$^{3/}$annum, with further reductions recommended. The situation with water use was reconsidered in 2024, with the outcome being a groundwater management plan (Appendix C). Details about the sustainability of the aquifer may be consulted there. The overall water balance for Omeya as at October 2022 to September 2023 is provided below (Figure 10). This was considered in the Groundwater Management Plan. For comparison purposes,

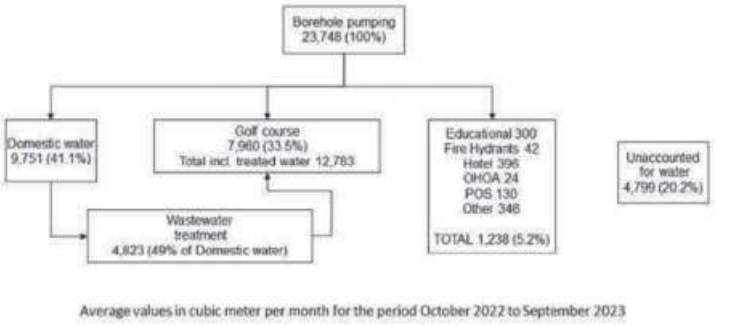


Table 1: Omeya water budget

Total water pumped	23,748	m³/month	100.0%
Homeowners cons.	9,751		41.1%
Educational	300		1.3%
Fire Hydrants	42		0.2%
Golf course	7,960		33.5%
Hotel	396		1.7%
OHOA	24		0.1%
POS consumption	130		0.5%
Other	346		1.5%
Unaccounted water	4,799		20.21%
	18,949	m³/month	79.8%
Water loss %	19%		
Sewerage Plant	4823	m³/month	
% of Homeowners cons.	49%		

Figure 10: Water balance of Omeya Oct 2022-Sept 2023 (Source: Namib Hydrosearch, 2024)

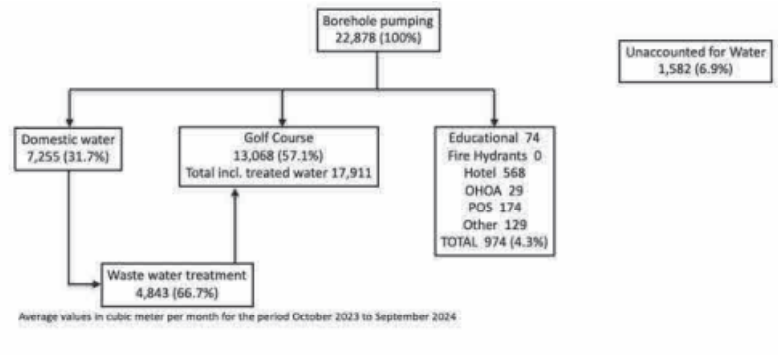
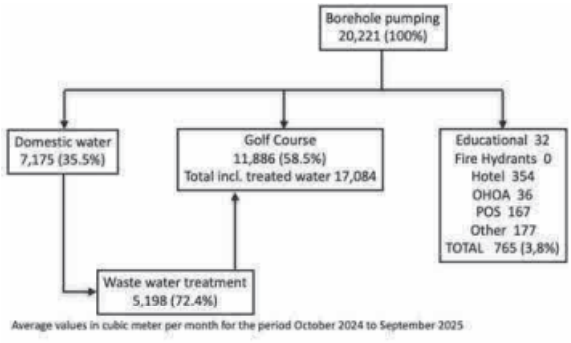


Table 2: Omeya water budget
Oct 23 to Sep 24

Total water from BH's	22,878	m³/month	100%
Home Owners cons.	7,255		31.7%
Educational	74		0.3%
Fire Hydrants	0		0.0%
Golf Course	13,068		57.1%
Hotel	568		2.5%
OHOA	29		0.1%
POS	174		0.8%
Other	129		0.6%
Unaccounted for water	1,582		6.9%
	21,296		93.1%
Water loss %	7%		
Sewerage Plant	4,843	m³/month	
% of Homeowners cons.	67%		

Figure 11: Water balance at Omeya Oct 23-Sept 24 (Source:OIC Data)



Unaccounted for Water
1,582 (6.9%)

Table 3: Omeya water budget
Oct 24 to Sep 25

Total water from BH's	20,221 m³/month	100%
Home Owners cons.	7,175	35.5%
Educational	32	0.2%
Fire Hydrants	0	0.0%
Golf Course	11,886	58.8%
Hotel	354	1.7%
OHOA	36	0.2%
POS	167	0.8%
Other	177	0.9%
Unaccounted for water	394	1.9%
Water loss %	2%	
Sewerage Plant	5,198	
% of Homeowners cons.	72%	

Figure 12: Water balance of Omeya Oct 24-Sept 25 (Source: OIC DATA)

The outcome of this study was that if the water usage is not strictly controlled and carefully considered with adjustments made, the current abstraction practice is not sustainable in the long term.

The final recommendations of the report, listed as items requiring urgent attention are as follows:

1) Water losses must be identified, rectified and reduced to below 10% (at the date of the report the percentage water loss was about 20%).

The graph below (Figure 13: % water loss at Omeya from August 2018 to Sept 2025

Figure 14) shows how the percentage water loss has been reduced from about 40% on average in 2018 to below 10% and closer to 0% currently.

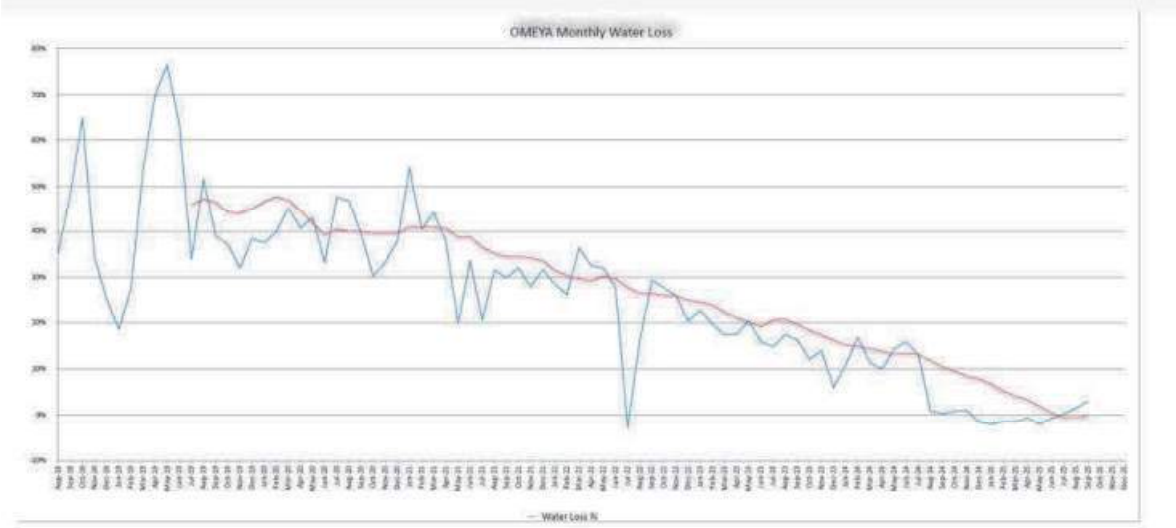


Figure 13: % water loss at Omeya from August 2018 to Sept 2025

2) Withdrawal from the aquifer must be maintained below 280,000m³ per year and be reduced to 250,000 m³ per year.

The water abstraction permit allowed a total of 280,000m³ for 2024/2025, but this has been reduced to 250,000 m³/per year for the 2025/2026 period. Management is working towards meeting this target, and current figures indicate that the abstraction volumes will achieve this. However, the rainy season is approaching, which is expected to cause an overall reduction in the demand.

3) Waste water treatment must be increased and the generation of greywater maximised.

   This condition was also included in the current water abstraction permit. From the data above it is clear that the greywater as a percentage being treated is increasing, and the average domestic consumption has also decreased. This means the goal of increasing the effectiveness of the waste water treatment is being realized.

4) Six balancing water meters has been installed to more accurately manage water losses within the water reticulation. The water meter measuring the irrigation water for the golf course has also been replaced as it was found this meter was not accurate any longer. It is clear from the graphs that water losses have been drastically reduced.

The report also recommends that medium- and longer-term alternative water sources be identified. With the development of further phases of Omeya, the Oanab Dam as an ultimate water source is put forward. Meanwhile Omeya is encouraged to find alternative groundwater sources on neighboring farms.

So far, an agreement is being negotiated with the owner of the Farm Oamites, to investigate a groundwater source for joint use with Omeya.

Further Recommendations in the Groundwater Management Plan include a sharpening of the water conservation practices at the estate. In this regard, there has been a deviation from the original proposal that water-wise gardens be developed. The OHOA Estate Rules currently state that an indigenous garden style should be adopted, and a plant list is provided. Non-indigenous plants are not permitted, unless specifically approved. An inspection indicates that some of the gardens have large lawns and water-thirsty vegetation, while others are water-wise. Many swimming pools are uncovered, as evidenced from aerial photography footage and this causes significant evaporation. While it is appreciated that water tariffs are charged on a sliding scale according to volumes used, which certainly plays a significant role in water conservation, this will not necessarily deter all owners from still using large

volumes of water. Further management initiatives especially enforcement of the current rules to ensure water conservation is optimised at the estate are required.

2.3.3. Water quality

Water quality parameters are monitored according to the permit issued for the water effluent treatment plant as well as permit requirements for the water abstraction from the boreholes (Appendix D and E). Sampling of both domestic water as well as inflow and outflow of the sewerage plant are in place since the beginning of the Estate.

Water quality monitoring indicates that all parameters are being met for the various categories of water usage. Hardness classifies the water in Group B (acceptable water quality, suitable for human consumption), while all other values are in Group A (Excellent water quality). The elevated hardness is typical of groundwater from carbonate aquifers[5]. There are no other trends in the data that are of concern. Samples are also taken of the sewerage inflow and outflow and these meet the requirements for irrigation use.

2.4. WASTE DISPOSAL AND REMOVAL

The estate has the normal bin system and is collected by Rent-a-drum. Garden refuse and building rubble is disposed of at a designated area (see Figure 1). Building rubble is currently used as fill to form part of the berm along the road. The garden refuse was historically burnt but this practice has been terminated on instruction of the City of Windhoek.

3. MANAGEMENT STRUCTURE

This ESMP is submitted for the purpose of the renewal and transfer of obtaining Environmental Clearance and will be a contract with the Ministry of Environment, Forestry and Tourism. This implies that its contents will also be legally binding on all parties involved, including the OIC, and sub-contractors.

What is an Environmental and Social Management Plan (ESMP)?

An ESMP is a register of management actions and guidelines needed to ensure that undue or reasonably avoidable adverse impacts of the planning, construction, operation, and decommissioning of a project are prevented; and that the positive benefits of the project are enhanced. It assigns responsibilities and is used as a checklist to monitor compliance.

[5] Namib Hydrosearch, Groundwater Management Plan, 2024.

The overall development has an ESMP, which was adhered to during construction of the infrastructure and is being implemented overall.

This ESMP is a sub-set of the overarching one, focusing on the infrastructure and the water demand and supply and water quality management.

What are the legal implications and my obligations under this Plan?

The implementation of an ESMP is required in terms of the Environmental Management Act of 2007 and its Regulations of 2012. Therefore, OIC is under a legal obligation to adhere to the recommendations in the Environmental and Social Management Plan.

Stages of the development covered

Since the project is already operational, this ESMP focusses on the operation and maintenance of the infrastructure. Any construction happening within the estate falls under the overall ESMP and is being controlled by it.

Responsibilities

The overall responsibility for the implementation of this ESMP lies with the OIC. Any staff or contractors appointed by OIC will adhere to the provisions of this ESMP, depending on their designations. It is the responsibility of OIC to ensure all aspects in this document are assigned to staff who have the technical proficiency and experience to carry out its requirements.

While the OHOA is not the owner of the infrastructure, and therefore not directly responsible for this ESMP, it does manage the use of the water and in this sense should comply with the standards set by OIC for water supply, specifically water conservation standards. In this regard it is recommended that the Steering Committee include the communication of the relevant aspects in this ESMP in its forums.

4. LEGAL AND PERMIT REQUIREMENTS

Table 1 below contains a list of the legal requirements that need to be adhered to during the operation of the water supply, effluent treatment, roads, and waste disposal at Omeya. These requirements are the environmentally focused ones and do not include all legal requirements pertaining to the infrastructure.

Table 1: Relevant legislated permit requirements

THEME	LEGAL INSTRUMENT	MANAGEMENT REQUIREMENTS	CONTACT PERSON
Environmental	Environmental Management Act 7 of 2007 EIA Regulations (EIAR) GN 57/2007 (GG 3812)	The amendment, transfer or renewal (after three years) of the Environmental Clearance Certificate (EIAR s19 & 20). The conditions of the ECC are to be implemented and normally include 6-monthly monitoring reports.	Ms Saima Angula Tel: 061 284 2751
Labor	Labor Act 11 of 2007 Health and Safety Regulations (HSR) GN 156/1997 (GG 1617).	Adhere to all applicable provisions of the Labor Act and the Health and Safety regulations.	Labor Law Advice: Tel: 061 309 957
Water	Water Act 54 of 1956 Water Resources Management Act 13 of 2013 (came into force August 2023). City of Windhoek Drought Response Plan	Water abstraction licenses are required for water abstraction and use – under the jurisdiction of the City of Windhoek A permit is required for any water treatment facility. The City of Windhoek has is the custodian of water under their jurisdiction. They issue effluent treatment licenses according to exemption granted to them in terms of the act. Depending on water supply and demand situation at the time of development, water restrictions are applicable depending the drought situation.	S Husselman 2903067 L! Goases 2903367
Traffic	Road Traffic and Transport Act 1999	• The entire act is applicable including the registration of vehicles, driving licenses, transport of workers, etc.	

5. MANAGEMENT DETAILS

The following table provides an overview of all the major environmental management themes pertaining to both general and site-specific construction mitigation details. This table serves to act as quick reference, for the detailed mitigation details that follow below, for the implementation of the construction component of this ESMP.

The details provided here for the construction phase are indicative and need to be revised before the construction phase is to commence.

Table 4: Environmental management actions for the construction phase

THEME	OBJECTIVE	SECTION
Waste management	Sustainable waste management practices at Omeya	Section 5.1
Gravel and Sand Extraction	Ensure sustainable extraction and with the necessary permits.	Section 5.2
Health and safety	Safeguard health and safety of laborers.	Section 5.3
Dust and noise	Avoid and where not possible minimise dust and noise associated with maintenance and construction activities.	Section 5.4
Environmental training and awareness	Awareness raising and training regarding the provisions of the EMP as well as importance of safeguarding environmental resources.	Section 5.5
Environmental conservation	Resource efficiency particularly water and energy.	Section 5.6
Stakeholder communication	Provide a platform for stakeholders to raise grievances and receive feedback and hence minimise negative conflict	Section 5.7

5.1. POLLUTION PREVENTION, SOLID WASTE MANAGEMENT AND EFFLUENT TREATMENT

ASPECT	MITIGATION MEASURE
1. Pollution prevention	1. This section has in mind the high vulnerability of the Omeya terrain to groundwater pollution. The Omeya EIA and EMP contain the groundwater vulnerability area where pollution should especially be prevented. All vehicles, roads, sewerage structures, pipelines, etc. should be kept away from this zone. This section however applies to the entire Omeya. 2. All heavy vehicles and equipment on site should be provided with a drip tray or should be parked on a concrete surface with an oil trap. 3. Drip trays are to be transported with vehicles wherever they go. 4. Drip trays should be cleaned daily and spillage handled, stored and disposed of as hazardous waste. 5. All heavy construction vehicles should be maintained regularly to prevent oil leakages. 6. Maintenance and washing of heavy vehicles should take place only at a designated workshop area. 7. The workshop area should be lined with concrete. 8. The workshop should have an oil-water separator to collect run-off from washing. 9. All hazardous substances (e.g. fuel, paints, chemicals etc.) should be stored in an enclosed room which is locked and separate from the ground. 10. All hazardous waste should be stored in a bunded area or skip before removal from the site. The hazardous waste should be disposed of at an approved hazardous waste disposal site (currently the Kupferberg Waste Disposal Site is the only nearest facility to Omeya). Also see General waste section below regarding contractors. 11. A spill clean-up kit should be kept on site, staff trained to use it and applied in case of a spill. Cleaned up spill to be treated as hazardous waste.

ASPECT	MITIGATION MEASURE
2. Effluent treatment	1. The effluent treatment plant is to be monitored and managed according to the Effluent Permit issued by the City of Windhoek 2. Effluent standards will likely change to those of the Water Resources Management Act (2013). These changes should be noted for their potential effect on the operations, if any, discussed with the authorities and plans incorporated as may be necessary. A summary of the water quality results should be submitted to the DEA with the bi-annual monitoring reports. These results should include the same parameters as the Effluent Permit, clearly indicating incidences or patterns of non-compliance, the reasons for non-compliance as well as steps taken to rectify the same.
3. Water collection and disposal	1. General waste management and disposal at Omeya is to comply with the stands, principles and guidelines in the Windhoek Waste Management Regulations (2011), which shall take preference as far as waste management is concerned. 2. Waste is to be dealt with according to the principles of integrated waste management which is structured according to the levels of the mitigation hierarchy, namely reduce, reuse, repurpose, recycle and disposal. Should the waste collection be outsourced, then these principles should be the priority. The contract should include strict adherence to all applicable legislation, pertaining to the transport, storage and disposal of the waste. 3. Medical waste is to be collected and disposed of as approved by the Ministry of health and Social Service and the City of Windhoek. (compliance with the Public and Environmental Health Act 1 of 2015) and the Windhoek Waste Management Regulations, 2011). 4. The garden waste disposal area is to be constantly managed to ensure it remains clear of other wastes, which includes awareness raising of the residents. It should be fenced and protected from wind to prevent windblown material as needed. The contents should be managed and treated to facilitate re-use and decomposition as feasible, e.g. leaves and softer material separate for composting and/or mulching and wood separated for firewood. The area should have good drainage. Smaller stockpiles will ensure easy turning, to discourage rodents and reptiles. The HOA and OIC should consider making the wood available to the community in the area who can use it for firewood. 5. Building rubble should be clear of all other wastes, involving constant awareness raising and reminders among residents. This material, provided it contains no hazardous waste or any contaminants, may be used as fill material, provided geotechnical standards apply where buildings or structures are planned. If used on open areas, it should be flattened, shaped, and covered preferably with topsoil retained separately.

5.2. GRAVEL AND SAND EXTRACTION

ASPECT	MITIGATION MEASURE
1. Gravel and sand extraction	1. All sand and gravel required for any building and maintenance works on the estate will come from a commercial source. The operator/owner of such sources should have an Environmental Clearance Certificate (ECC) in place for such abstraction activities, identifying the specific sites where the material is abstracted and managed strictly according to the conditions of the ECC issued. 2. Should Omeya wish to abstract its own sand or gravel, the site/s should be identified according to sound environmental principles and an ECC is required for such activities.

5.3. HEALTH, SAFETY AND LABOUR

ASPECT	MITIGATION MEASURE
1. Health Safety and Labor	1. OIC and all contractors appointed shall adhere to the Labor Act in terms of Health and Safety. 2. OIC should ensure that the provisions of the Labor Act are applied to its workforce.
2. Road Safety	1. Demarcate roads clearly. 2. Off-road driving should not be allowed. 3. All vehicles that transport materials to and from the site must be road worthy. 4. Drivers that transport materials should have a valid driver's license and should adhere to all traffic rules (The Road Traffic and Transport Act, 1999). Note specifically also regulations pertaining to the transport of workers e.g. no workers to be transported on the back of an open truck. 5. Loads upon vehicles should be properly secured to avoid items falling off the vehicle. 6. All drivers (OIC personnel and contractors) are to be free from the influence of alcohol.

5.4. DUST AND NOISE

ASPECT	MITIGATION MEASURE
1. Dust	1. Dust suppression measures should be made applicable where there is a risk to nearby communities and the workforce. 2. Place all stockpiles, screening activities and other dust producing activities downwind from sensitive receptors such as already built residences, businesses, etc. In cases where this is not possible, apply semi-purified or grey water to dust generating surfaces in windy conditions.
2. Noise	1. Work hours should be restricted to between 08h00 and 17h00 where construction involving the use of heavy equipment, power tools and the movement of heavy vehicles is less than 500 m from residential areas, unless the community agrees to extended working hours and the circumstances require a different schedule. Sundays are traditionally rest days in Namibia and should be respected by not allowing any work.

5.5. ENVIRONMENTAL TRAINING AND AWARENESS

ASPECT	MITIGATION MEASURE
1. Environmental Induction (Training)	1. All workers are to undergo environmental induction (training) which should include as a minimum the following: • Explanation of the importance of complying with the ESMP. In case of construction works, refer to the HOA ESMP which is also applicable • Discussion of the potential environmental impacts of construction, operation and maintenance activities. • Employees' roles and responsibilities, including emergency preparedness, spills clean-up, etc. • Explanation of the mitigation measures that must be implemented when particular work groups carry out their respective activities. • Explanation of the specific mitigation measures within this ESMP especially unfamiliar provisions. • This training must be undergone by all new workers before they may commence with work and should be repeated, with constant re-enforcement as necessary. • A signed copy is to be kept for every worker that this course was attended. Workers need to be made aware of disciplinary actions and/or penal measures and procedures in case of non-conformance. 2. Works should also receive health and safety training according to the Health and Safety Regulations and as may be applicable.

5.6. RESOURCE CONSERVATION

ASPECT	MITIGATION MEASURE
1. Water conservation	1. The conditions of the Groundwater Abstraction approval from the City of Windhoek dated 17/06/2024 should be adhered to, and renewed by 30 June 2026. 2. The Groundwater Management Plan should be implemented as a continual process, including monitoring. 3. Joint management of water sources with neighboring stakeholders: It is recommended that OIC communicate to the City of Windhoek their past endeavors to meet this requirement, which has been to no avail due to a reluctance of neighboring stakeholders to cooperate. The City of Windhoek needs to convene the meetings. 4. Ensure the rules regarding gardens, and pool covers, etc. are enforced. Lawns are to be limited, only water wise gardens planted and pools covered.
2. Conservation of vegetation	1. Mindfulness of and adherence to vegetation conservation according to the HOA ESMP with any construction or maintenance works where trees are present, remains applicable. .
3. Materials camp and lay-down areas	1. In case of maintenance or new construction, ensure materials camps and laydown areas are away from and downwind from residences. Select an area that has been disturbed where possible, or where there is no significant vegetation to be removed. Rehabilitate the area by reshaping and covering with topsoil that was kept beforehand.
4. Energy efficiency	1. Installations with a high energy demand within the control of OIC are to be identified and energy consumption monitored. 2. Installations such as pumps should be fit for energy requirement and when replaced, with improvement energy efficient units. 3. Solar as an alternative energy source should be considered where feasible.

5.7. STAKEHOLDER ENGAGEMENT

ASPECT	MITIGATION MEASURE
GENERIC MITIGATION DETAILS	
1. Stakeholder engagement	• 6-monthly disclosure to the Omeya community with regards to water consumption targets, awareness raising, etc. in conduction with OHOA. • Engagement with neighboring stakeholders with regards to the aquifer, as per 5.6.1.3 • Engagement with authorities as may be required.

6. COMPLIANCE AND ENVIRONMENTAL MONITORING

The following table is a quick reference of the monitoring requirements of OIC.

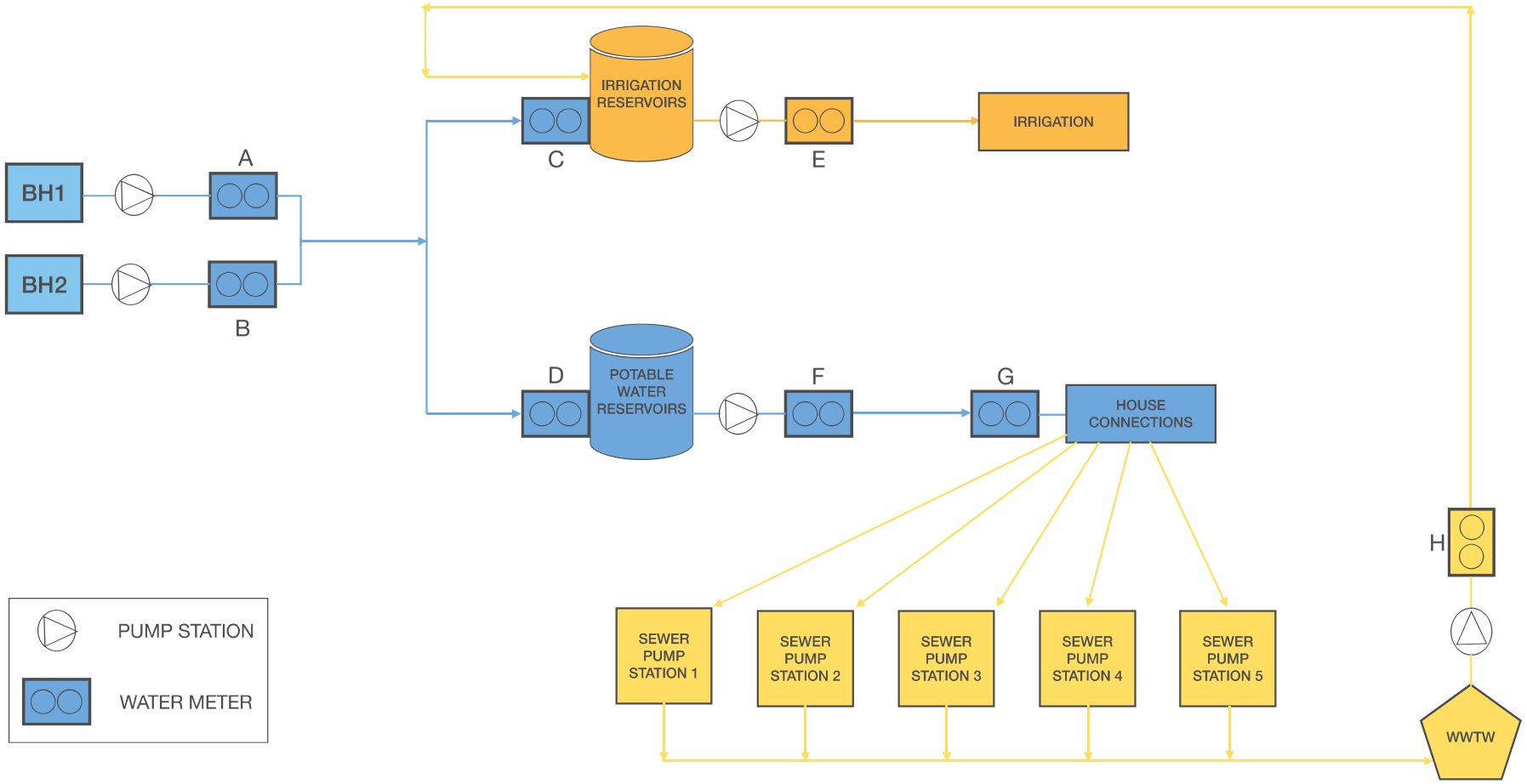
Table 5: Operation and maintenance phase mitigation measures

ASPECT	MONITORING	FREQUENCY
ECC, Abstraction permit, effluent permit renewals	ECC expiry date …… Effluent permit expiry date 11 May 2026 Abstraction permit expiry date 17 June 2026	Three-year cycles – see date, Summaries of below monitoring submitted bi-annually According to dates
Water quality	Inflow and outflow of WWTP	Monthly sampling, submitted annually
	Raw waste water and final effluent	Bi-annual sampling, submitted annually
	Water Demand Management Plan	Submitted annually
Water demand and supply	Groundwater abstraction against permit conditions	Monthly submitted annually
	Groundwater levels compare with baseline levels	Monthly submitted annually
	Raw sewage volumes	Monthly

APPENDIX A:


OMEYA
GOLF & RESIDENTIAL OASIS
SITE MAP
School
Residential Plots
Townhouse Plots
Driving Range
Golf Academy
Main Gate
Retirement
Railroad
Station
Rehoboth
Windhoek 30 km

SCHEMATIC DIAGRAM OF OMEYA WATER SUPPLY



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FINAL

ENVIRONMENTAL IMPACT ASSESSMENT

PLANNING, CONSTRUCTION AND OPERATIONAL PHASE

OF

PROPOSED OMEYA GOLF AND RESIDENTIAL OASIS

(PORTION 20 OF FARM GROSS HAIGAMAS NO. 447)

KHOMAS REGION

Prepared for:

AUASVIEW INVESTMENT TRUST

Prepared by:

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ENVIRONMENTAL MANAGEMENT CONSULTANTS

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July 2009

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ABBREVIATIONS

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CoW	City of Windhoek
DEA	Directorate of Environmental Affairs
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ENE	East North East
ESE	East South East
GIS	Global Imaging System
HIV/AIDS	Human Immune Virus/Acquired Immune Deficiency Syndrome
I&AP	Interested & Affected Parties
IBA	Important Bird Area
kV	Kilovolt
MAWF	Ministry of Agriculture Water and Forestry
NAMPAB	Namibia Planning and Advisory Board
NamWater	Namibia Water Corporation Ltd
NGOs	Non-Governmental Organisation

APPENDICES:

Appendix A: Layout Plan for the proposed Golf and Residential Estate.

Appendix B: Stakeholders List.

Appendix C: Letter from MAWF supporting the groundwater abstraction.

Appendix D: Letter from MAWF acknowledging receipt of application for construction of waste water and effluent disposal treatment system.

Appendix E: Aqua Services & Engineering (Pty) Ltd. – Final effluent from Sewage treatment plant.

Appendix F: Letter of approval for solid waste dumping – Rehoboth Town Council.

Appendix G: Letter of approval – Roads Authority.

Appendix H: Minutes of the meeting – 8 April 2009.

Appendix I: Issues and Response Trail.

Appendix J: Geopollution Technologies Report.

Appendix K: Aerial photograph of Portion 20 indicating sensitive areas.

Appendix L: EIA – Geohydrology (Specialist Report).

Appendix M: NamWater's approval for water supply from the Nauspoort Scheme or the Oanob Dam.

Appendix N: Long duration test pumping data interpretation & estimation of sustainable yield, Auas View Golf Course.

Appendix O: Letter from Aqua Services & Enginering (Pty) Ltd regarding treatment of Helminth Eggs.

1. INTRODUCTION

1.1. BACKGROUND

Auasview Investment Trust intends establishing a Golf and Residential Estate (Omeya Golf and Residential Oasis) on Portion 20 of the Farm Gross Haigamas no. 447, situated adjacent to the B1, 30 km to the south of Windhoek (***Figure 1***). Portion 20 falls within the area covered by the Aris Town Planning Scheme and is zoned Rural Residential. The owner applied for rezoning of this Portion to Nature Estate with the primary use of Residential Estate.

Enviro Dynamics (Pty) Ltd (the Consultant) has been appointed to conduct the EA Process of the proposed Golf and Residential Estate on behalf of the Developer. A Scoping Phase was undertaken to identify and assess key environmental and social concerns related to the project. During July 2008 the Consultant communicated with a range of stakeholders to determine these issues and concerns.

A Scoping report was submitted together with the application for a Needs and Desirability of the proposed development to Namibia Planning and Advisory Board (NAMPAB) after which a re-submission was requested with an EIA addressing the following issues as requirement:

- Approval by MAWF of the proposed sewage system;
- Public consultation with stakeholders in connection with the increased number of erven;
- Acceptance of the requirements as set by Roads Authority; and
- Approval of the Environmental Impact Assessment by Directorate of Environmental Affairs addressing the following:
    - Water availability and abstraction permit for the total development;
    - Public input on total development; and
    - Environmental Management Plan (EMP).

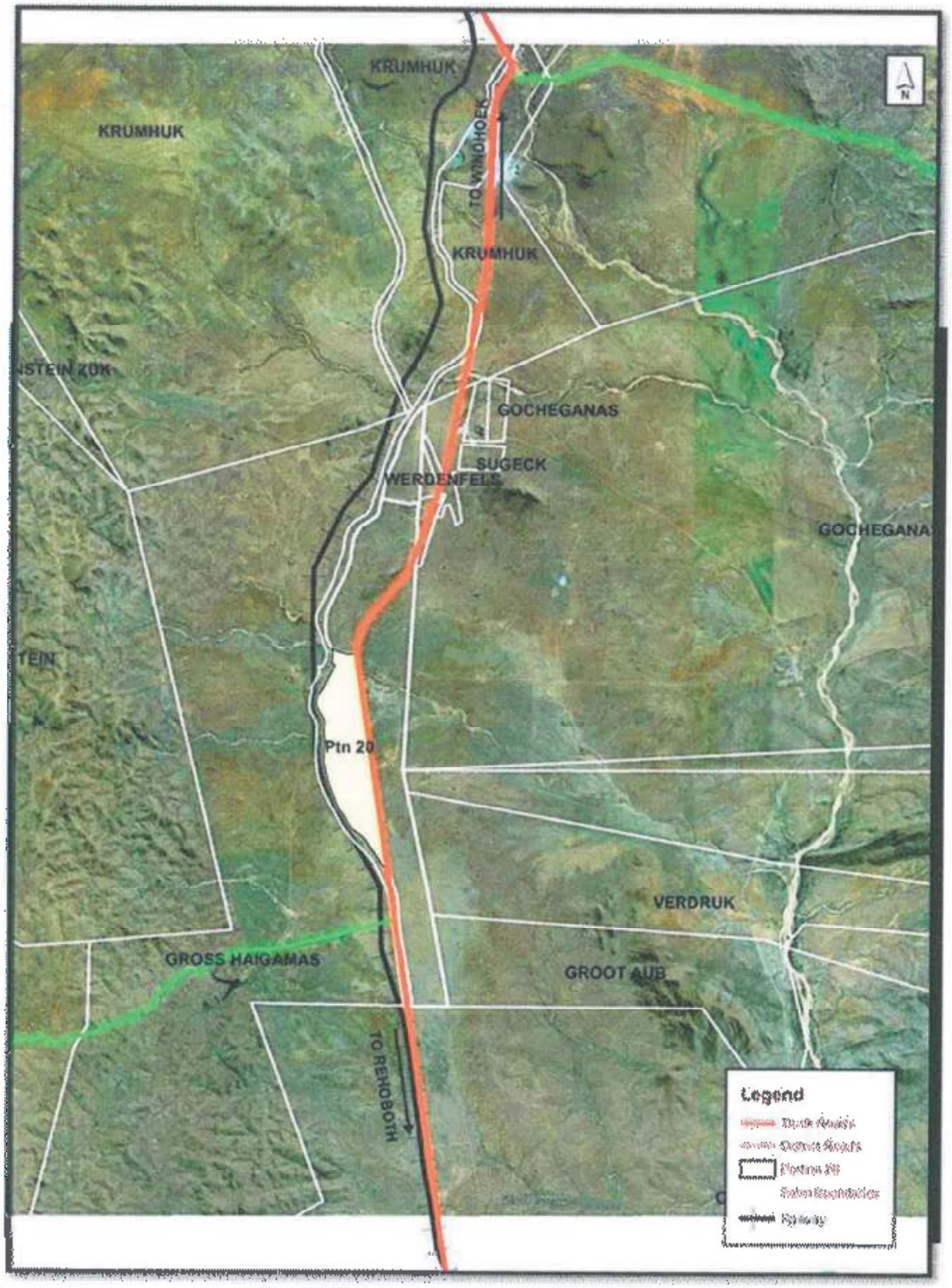


Figure 1: Locality of Portion 20 of the Farm Gross Haigamas.

1.2. TERMS OF REFERENCE

Enviro Dynamics initially followed an Environmental Scoping Process (***Figure 2***) to identify key issues of concern. Since the number of erven was drastically increased from the initial proposal, and since water demand and the sustainable yield of the aquifer from which the development is to obtain its water was identified as matters of concern, further investigations followed as well as a second round of stakeholder consultation. The Environmental Assessment procedure followed complies with Namibia's Environmental Assessment Policy (1995) and Environmental Management Act (No 7 of 2007).

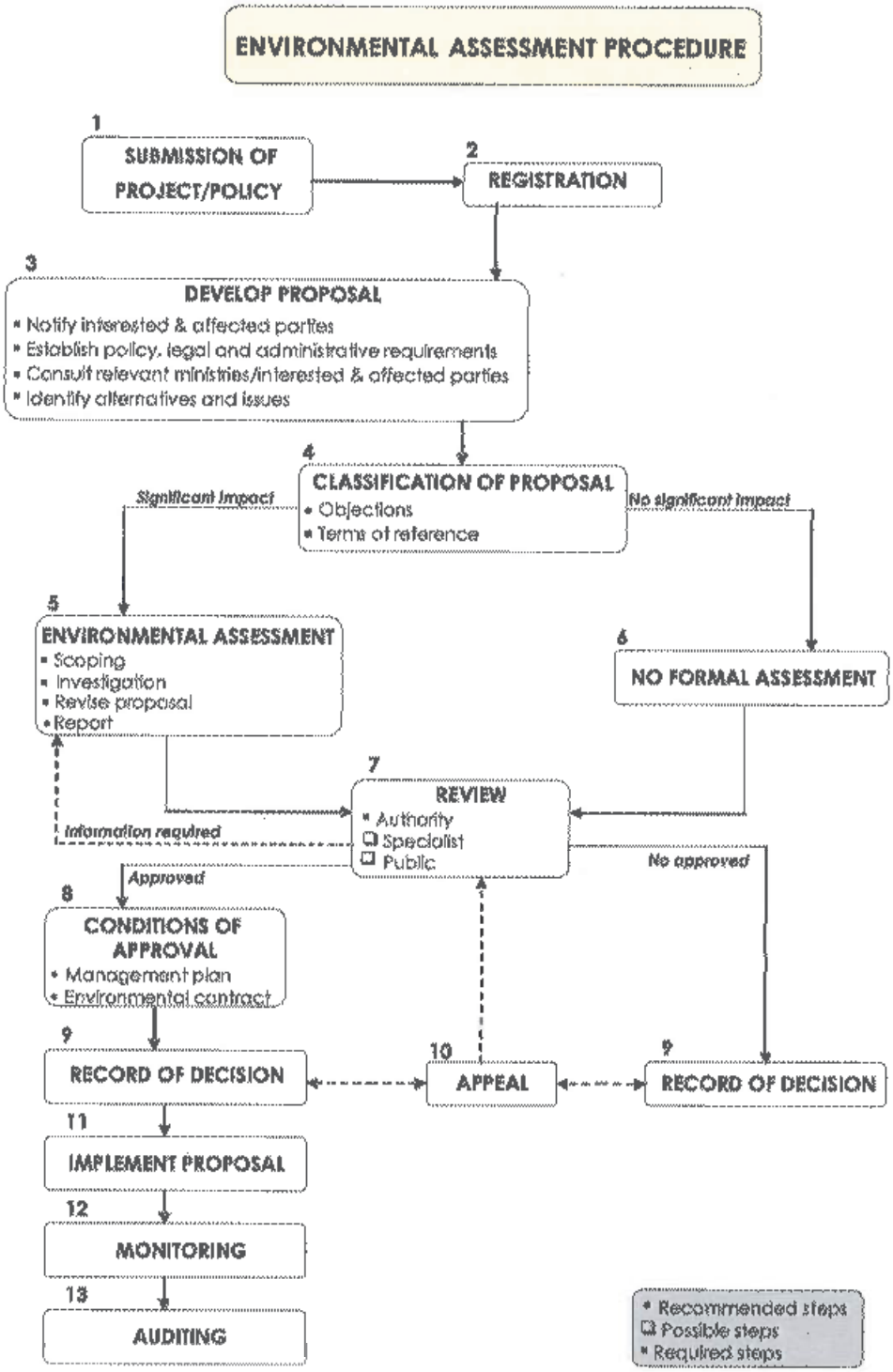


Figure 2: ***The Environmental Assessment Process of Namibia.***

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1. LOCALITY

The proposed Golf and Residential Estate on Portion 20 of the Farm Gross Haigamas no. 447, is situated adjacent to the B1, 30km to the south of Windhoek (see ***Figure 1***) and covers an area of ± 245ha.

2.2. PROJECT RATIONALE

Portion 20 of Portion 1 of the farm Gross Haigamas no.447 falls within the area covered by the Aris Town Planning Scheme (IDC, 2006) and is zoned for Rural residential with the approved consent use of Nature Estate. The owner however has applied for rezoning to Nature estate with the consent use of Residential Estate. The Aris Town Planning Scheme therefore needs to be amended to accommodate this change.

Box 1: Definition of Nature Estate in terms of the Aris Town Planning Scheme.

Nature Estate means land under private ownership managed by a homeowner's association and includes Wildlife Estates, Residential Estates, Equestrian Estates, Golf Estates, and Retirement Villages.

1. Residential Estate means nature estate as defined above of which the primary lifestyle theme is related to the conservation and utilisation of the natural environment and may include activities based on and land uses incidental to the primary theme.
2. Equestrian estate means a nature estate as defined above of which the primary lifestyle theme is related to the keeping and riding of horses and may include activities and land uses incidental to the primary theme.
3. Golf Estate means a nature estate as defined above of which the primary lifestyle theme is related to the playing of golf and may include activities and land uses incidental to the primary theme.
4. Wildlife Estate means a nature estate as defined above of which the primary lifestyle theme is related to wildlife and may include activities and land uses incidental to the primary theme.

Portion 20 lies to the west of the B1 Main Road and is bordered on the eastern side by the railway line; it is therefore isolated from the larger portion of the Farm Gross

Haigamas and unsuitable for agricultural purposes. The proposed development can serve as a buffer zone between the road and the larger portion of the farm Gross Haigamas.

Urban developments such as Nature Estates provide privacy, security, and a more relaxed lifestyle in a tranquil natural environment. In most cases, developments are associated with strict development guidelines and a strong sense of conservation and sustainable use of natural resources. They strive towards creating a harmonious environment where human intervention has as little impact as possible on the natural environment and unique ecosystems.

2.3. HISTORIC ACTIVITIES

Portion 20 of the Farm Gross Haigamas was previously used for agricultural purposes, specifically cattle farming. The area is however not utilised at this time.

2.4. PROPOSED ACTIVITIES AND FACILITIES

2.4.1. The development

The Developer, Auasview Investment Trust, intends developing an 18-hole Golf Course and 384 residential erven ranging between 3000m² and 500m² each and 14 general residential erven ranging between 250 and 500m². These will be clustered in groups between the greens (***Appendix A***). The number of erven was increased to be able to still keep the prices of the erven relatively low and at the same time ensure the feasibility of the development.

Apart from the 18-hole golf course and 398 erven, the Developer also plans to offer the following:

- Clubhouse;
- Boutique hotel with 10 - 15 rooms, plus 5 rooms to accommodate staff;
- Spa;
- Golf Driving range;
- Tennis courts;

- Commercial centre;[1]
- Chapel (to accommodate 50 people);
- Pre-primary (30 pupils) and Primary school (140 pupils);
- Equestrian facilities on the neighbouring Out of Nature;
- Game drives on the neighbouring farm, Gross Halgamas; and
- Hiking trails and mountain biking trails.

2.4.2. Associated Infrastructure

2.4.2.1. Water

Water will be required for:

- Irrigation of the golf course; and
- Domestic supply to the commercial and residential units.

Domestic water from the boreholes will be stored in a ground reservoir which will be designed and placed in a non-prominent position to blend in with the natural environment of the development.

The estimated annual water demand of the development is as follows:

Golf course irrigation:	255 000m³ /annum (26 ha of Desert type of golf course design. No open water).
Residential units:	186 500m³ /annum (392 erven with various sizes of houses. No gardens will be allowed, the Developer intends establishing indigenous gardens throughout the estate).
Club House:	6 000m³/annum (30 000 visitors/annum).
Commercial centre:	4800m³/annum (small shops, offices, 40 bed hotel, guardhouse).

[1] The commercial centre will only consist of 3 erven and will be small enterprises to serve the community's needs.

School: 1400m³/annum (170 pupils).

The total water required from the boreholes is therefore approximately 454 200m³ per annum (this includes the recycled portion).

Since all waste water from residential and commercial units will be treated and recycled to the golf course irrigation system, the water balance will therefor be as follows:

Residential and Commercial units	
Component	**Annual water consumption**
Total water consumption	198 700m³/annum
Water treatment works (estimated)	178 000m³/annum
Water available for recycling (estimated):	142 000m³/annum
Golf Course:	
Component	**Annual water consumption**
Irrigated demand	255 000m³/annum
Golf Course excluding Recycled component	113 000m³/annum
Actual demand (Total - recycled amount)	**311 700m³/annum**
Permit granted for abstraction by MAWF(Appendix B)	**350 000m³/annum**

2.4.2.2. Electrical Services

Bulk electricity will be supplied by NamPower from the 66kV substation situated approximately 400m east of the boundary of the development, while onsite reticulation will be by means of underground cables.

2.4.2.3. Sewerage Disposal

A conventional gravity sewerage system will collect all waste water on the development and transport it to the sewerage treatment plant which will be situated at the southern most part of the site area (***Appendix A***). A Trickling Filter Plant (***Figure 3***) will be constructed by Aqua Services & Engineering (largest and most experienced Namibian water Treatment Company).

Figure 3: ***The Trickling Filter System (Source: Aqua Services & Engineering (Pty) Ltd).***

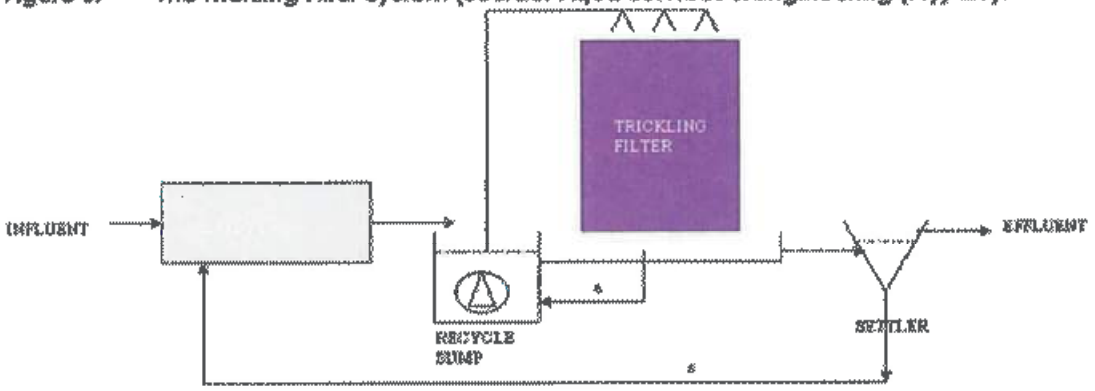
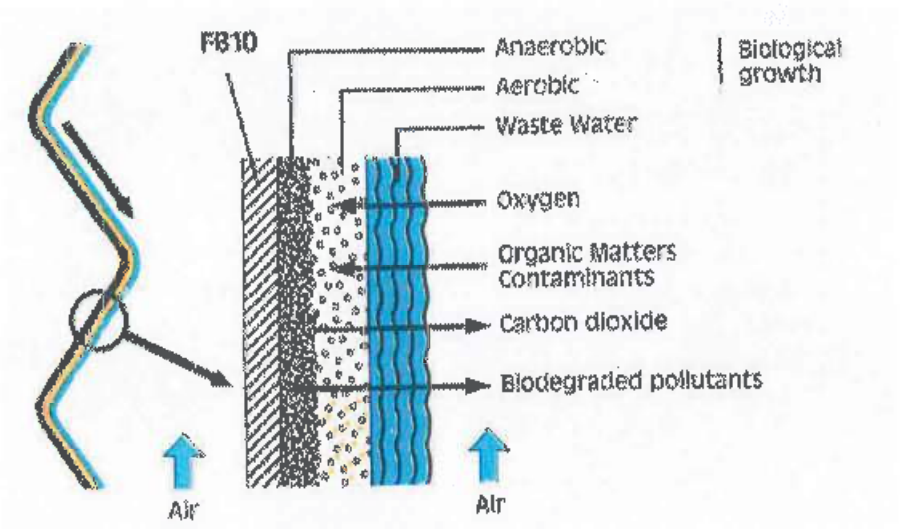


Figure 4: ***Diagrammatic presentation of the Trickling Filter Technology (Source: Aqua services and Engineering).***



This is a robust, compact, and low-maintenance sewage plant which is based on attached growth biological treatment (***Figure 4***). An application for the construction of the waste water and effluent disposal treatment system was submitted to the Ministry of Agriculture, Water, and Forestry. A letter (10/4/2/21B) received from the Ministry of Agriculture, Water and Forestry (the Department of Water Affairs and Forestry -DWAF) has indicated that it has no objection to the proposed project plan and wastewater treatment system. The developer needs to apply for a wastewater permit. However the developers need to submit a Solid Waste Management Plan to MAWF (***Appendix D***).

The waste water treatment system is located ± 2 kilometres from the production boreholes that will be used for water consumption, the distance between the water consumption source and the waste water disposal site comply with DWAF requirements (See Lay out Plan, ***Appendix A***).

The final effluent, after treatment, will conform to current Namibian legislation for effluent discharge into the environment and will be re-used for gardening and irrigation of the Golf course. The final effluent will be comparable to drinking water of a quality similar to a Group D classification (water unsuitable for human consumption) from Namwater. The sludge from the treatment plant will be dried in sludge drying beds and will be re-used for compost (***Appendix E***).

2.4.2.4. Waste Removal

Refuse at all residential units, the club house, and the spa will be sorted in order to recycle it and all waste that cannot be recycled will be transported to the approved dumping site for household refuse at Rehoboth. Approval to use the solid waste dumping site of the Rehoboth Town Council was granted on 17 April 2009 (***Appendix F***).

2.4.2.5. Roads

The high order access roads will be constructed with interlocking bricks with suitable kerbs and storm water structures while minor access roads leading to individual houses will be gravelled and treated with a suitable dust suppressing agent.

2.4.2.6. Access

Access to the development will be from the B1. Approval for access point 1 and 3 (***Appendix G***) has been granted by Roads Authority, subject to the following conditions:

- Detail design drawings need to be submitted and approved before any construction activities may start.
- The developer is responsible for the construction and alteration of the accesses and lanes as well as the required road signs.
- The construction to the intersections must be completed prior to any other construction development.
- The title deeds of all portions within the 100m building restriction of Trunk Road (1/5) need to be endorsed to the effect that no business may be conducted or direct access from the trunk road will be permitted.
- Roads Authority needs to be consulted before the erection of a security fence since approval for the upgrading of the existing fence is required in terms of the Roads Ordinance, Ordinance 17 of 1972.
- A 100m building restriction line from the centre line of the trunk road is maintained.
- The general public should be allowed to use road F1426 unrestricted.

3. POLICY AND LEGAL FRAMEWORK

This section, in table format, describes the legal environmental framework of the project.

LEGISLATION/GUIDELINE/POLICY	APPLICABLE CLAUSE/POLICY	COMMENTS
Namibia's Environmental Assessment Policy (1995)	List of activities that require EA	Golf estates, recreational facilities, residential developments need to be assessed in terms of the impact on the natural and social environment and resources.
Environmental Management Act (no 7 of 2007)	Section 3 and 55 Principles of Environmental Management	Conduct Environmental assessments of projects that may affect the environment or use of natural resources : Rezoning, Sewerage Plant, Golf course, Township development.
Aris Town Planning Scheme(2006)	Applications for Nature estates.	EA to be carried out for developments that may adversely affect the environment. The constitution of the Homeowner's Association should address the management of environmental issues.
Public Health Act no 36 of 1919	Control nuisances' i.e. offensive smells, effluvia and requires prevention of pollution of public waters.	Consider appropriate conditions to the developer and future erf owners.
Labour Act No 54 of 1956	Contains the Health and Safety Regulations and regulations for handling of waste.	Health and Safety conditions to be adhered to during construction and operation.
Water Resources Management Act No 24 of 2004	Control of disposal of sewerage, the purification of effluent, the prevention of surface and groundwater pollution, and the sustainable use of water resources. Permits are obtained from the Department of Water	Developers need to develop a satisfactory plan for sewage disposal and recycling of grey water in order not to pollute the groundwater. Permits are required for waste water treatment and disposal. The area does not fall within a water control area, but will

LEGISLATION/GUIDELINE/POLICY	APPLICABLE CLAUSE/POLICY	COMMENTS
	Affairs	become one in the new regulations. An abstraction permit will then be required for the use of the groundwater.
Forestry Act No 27 of 2004	The act affords protection to certain indigenous plant species (see ***Table 8***) and any intention to remove such species would have to be legalised through a permit from the Forestry Department: Ministry of Agriculture, Water, and Forestry.	Camel Thorn (*Acacia erioloba*) is protected tree species and may not be removed without a permit. The following species are also protected: *Albizia anthelmintica* *Aloe littoralis* *Boscia albitrunca* *Maerua schinzii* *Ozoroa crassinervia* *Rhus lancea* *Ziziphus mucronata*
National Heritage Act No 27 of 2004	Potential cultural and archaeological sites to be identified and protected/mitigated before development may continue.	The owner is not aware of any archaeological material on the site, but this should be confirmed with further development.
Roads Ordinance, Ordinance 17 of 1972	Fences adjacent to trunk roads	Consultation with Roads Authority for approval of upgrading of existing fence and access points
International treaties and agreements		
Convention on Biological Diversity (CBD)	Namibia is obliged under international law to conserve its biodiversity (Barnard ed., 1998)	Projects should refrain from causing any unnecessary damage to the country's biodiversity.
Convention to combat Desertification	Namibia, is bound to prevent excessive land degradation that may threaten livelihoods	This is a general requirement to be considered in all projects.

4. STAKEHOLDER AND COMMUNITY CONSULTATION

The purpose of public participation is to provide an opportunity for people and organisations to register as Interested and Affected Parties (I&AP), in order to voice their concerns and to give their input on matters relating to the intended development.

Communication with stakeholders about this proposed Golf and Residential Estate was facilitated through the following means:

a) Key stakeholders were identified from previous lists of similar projects in Windhoek, from contacts of the project team, experience of the Windhoek administrative and political environment, and searches on GIS databases and telephone directories for the contact details of neighbouring property owners(***Appendix B***);

b) Notices were placed in the press for two consecutive weeks, briefly explaining the project and its locality and inviting people to register as stakeholders;

c) A Background Information Document on the proposed development was sent via e-mail and fax to all Interested and Affected Parties;

d) A public meeting was held on Wednesday 16 July 2008 at Out Of Nature (opposite the proposed development) during which the Environmental Assessment process and the project was described. The geohydrologist also gave an explanation of their findings of the survey;

e) An Authority meeting was held on Thursday 17 July 2008 to provide the project information and solicit authority issues regarding the development;

f) Discussions were held with the developers, Auas view Investment Trust, the geohydrologist, Mr. F. Bockmuhl, Namibia Hydrosearch and Dr. Tordiffe from the Department of Water Affairs.

g) Since a number of additional proposals transpired a second round of stakeholder consultation was initiated. All registered stakeholders were again invited via e-mail to attend a meeting held at NICE Restaurant on 8 April 2009. The minutes of the meeting are attached as ***Appendix H.*** At the meeting the Developer presented the changes to the proposed project (i.e. increased number of erven) as well as additional information that has become available since the previous meeting.

h) The Stakeholders were invited to present their comments on the information provided to Enviro Dynamics.

l) The Draft Environmental Impact Assessment Report will also be sent for review to all I&AP and a Comments and Responses trail will then be compiled and submitted with the final EIA Report.

An issues and responses trail presented in ***Appendix I*** includes all comments/questions raised from stakeholders at the consultation meetings and in writing since the start of the environmental process in July 2008. The summary also provides a response of how these comments are being addressed during the environmental assessment process.

The following section serves as a summary of the issues and concerns that were raised by the Interested and Affected Parties (***Figure 3***). The purpose of presenting the issues raised by participants in this section is simply to:

- Ensure transparency regarding the concerns that have been expressed;
- Ensure that all issues raised are properly addressed in the EIA, EMP and mitigation measures proposed; and
- Identify all key issues (**Indicated in red**) that needed further consideration/investigation or for which answers were still sought.

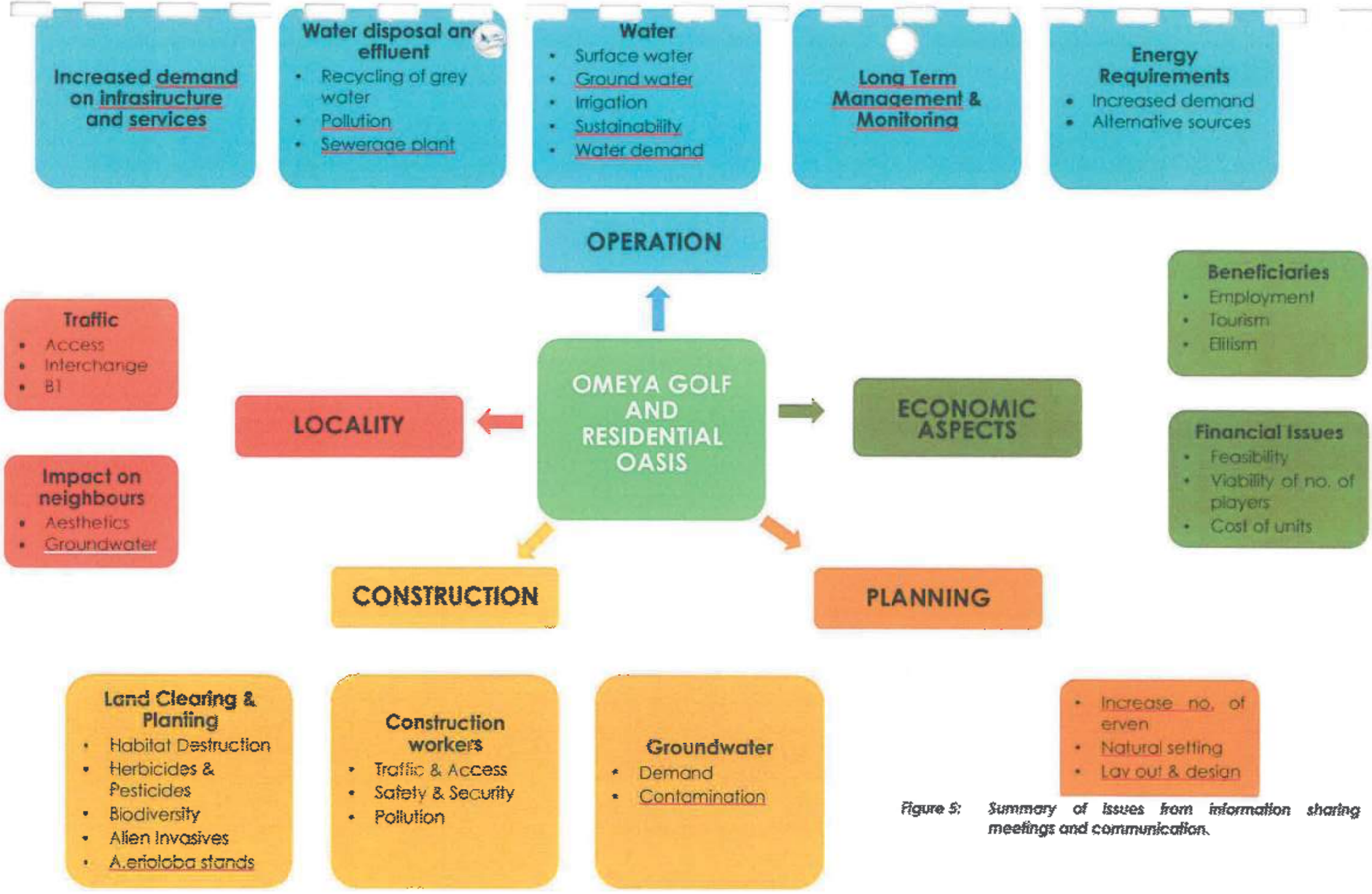


Figure 5: Summary of issues from information sharing meetings and communication.

5. IMPACTS IDENTIFIED

5.1. INTRODUCTION

The implementation of the proposed Omeya Golf and Residential Oasis Development will have an impact on its receiving socio-economic and biophysical environment. In Section 5, the EA Team sets out to explain what those key impacts are likely to be. The impact assessment is based on the project information described in Section 2 and the baseline information provided for the environment given in Section 5. The impact assessment also takes cognisance of the applicable international and local regulatory framework, as presented in Section 3. The impact assessment focuses on those key issues (**indicated in red**) as identified in Section 4, ***Figure 5***. All other issues identified are dealt with in the Environmental Management Plan (EMP).

Besides a discussion of each expected impact, this Section also includes recommendations for mitigation.

Recommendations to avoid, minimise, or mitigate the identified impacts through management and monitoring is addressed in the Environmental Management Plan (EMP) and presented as a separate report.

5.2. METHODOLOGY EMPLOYED FOR THE IMPACT ASSESSMENT

The following criteria were used to describe and determine the significance of the impacts identified for the Omeya Golf and Residential Oasis Project.

Table 1: Criteria used to describe impacts.

	Description
Nature	Reviews the type of effect that the proposed activity will have on the relevant component of the environment and includes "what will be affected and how?"
Extent	Indicates whether the impact will be site specific; local (limited to within 15 km of the area, including Aris); regional (limited to ~100 km radius); national (limited to the coastline of Namibia); or international (extending beyond Namibia's boarders).
Duration	Reviews the lifetime of the impact, as being short (days, <1 month), medium (months, <1 year), long (years, <10 years), or permanent (generations, or >10 years).

	Description
Intensity	Establishes whether the magnitude of the impact is destructive or innocuous and whether or not it exceeds set standards, and is described as none (no impact); low (where natural/ social environmental functions and processes are negligibly affected); medium (where the environment continues to function but in a noticeably modified manner); or high (where environmental functions and processes are altered such that they temporarily or permanently cease and/or exceed legal standards/requirements).
Probability	Considers the likelihood of the impact occurring and is described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of prevention measures).
Degree of Confidence in Predictions	Is based on the availability of specialist knowledge and other information.

The application of the above criteria to determine the significance of potential impacts uses a balanced combination of duration, extent, and intensity/magnitude, modified by probability, cumulative effects, and confidence. Significance is described as follows:

Table 2: Significance Criteria.

Significance Rating	Criteria
Low	Where the impact will have a negligible influence on the environment and no modifications or mitigations are necessary for the given project description. This would be allocated to impacts of any severity/ magnitude, if at a local scale/ extent and of temporary duration/time.
Medium	Where the impact could have an influence on the environment, which will require modification of the project design and/or alternative mitigation. This would be allocated to impacts of moderate severity/magnitude, locally to regionally, and in the short term.
High	Where the impact could have a significant influence on the environment and, in the event of a negative impact the activity(ies) causing it, should not be permitted (i.e. there could be a 'no-go' implication for the project, regardless of any possible mitigation). This would be allocated to impacts of high magnitude, locally for longer than a month, and/or of high magnitude regionally and beyond.

5.3. BIO-PHYSICAL IMPACTS

5.3.1. Geology, Soils and Drainage

5.3.1.1. Baseline description

The study area falls within the Howeharte Complex (Schneider, 2004). A South dipping (40 – 50°C) fault is exposed on a small hillock with a grey marble outcrop (***Figure 6***). The fault zone is ±50m wide. Granite gneiss is exposed to the north and southern contact of the marble unit. Lineament density maps indicate high density of lineaments in the proposed development area. Lineaments coinciding with the fault location were traced on aerial photos and satellite imagery and the fault could be a large scale structure (Bockmuhl, 2008).

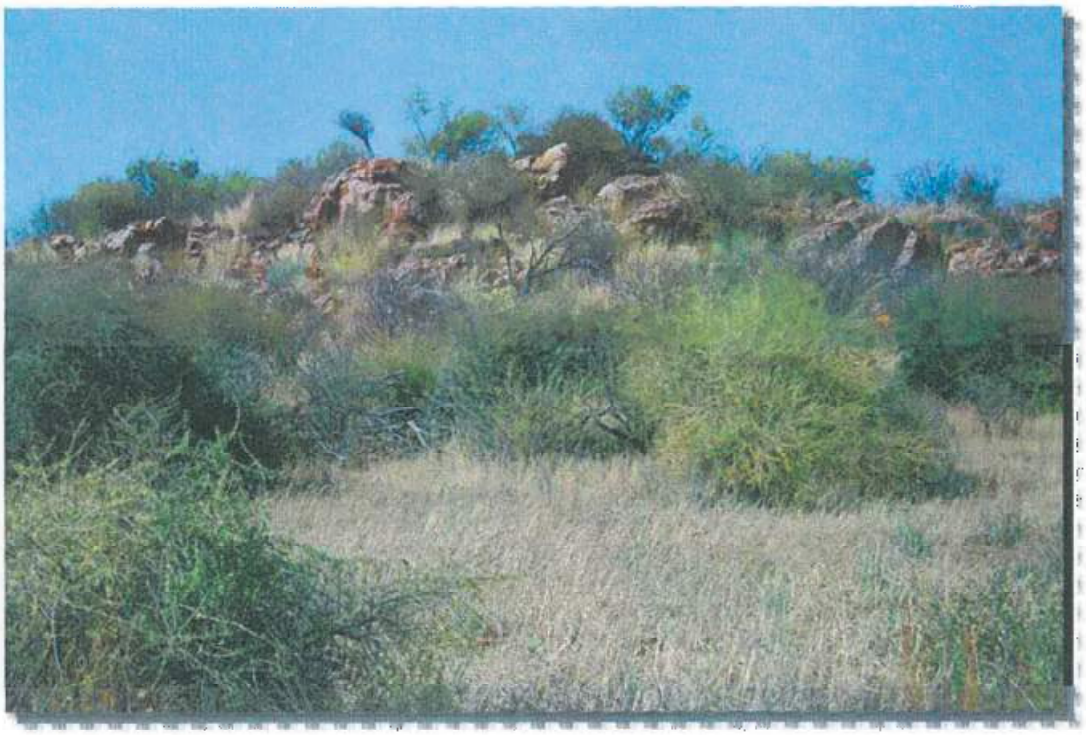


Figure 6: ***A single marble outcrop exists on the site.***

The soil cover in the area has been derived from the underlying lithologies and is classified as 'leptosol' (Mendelsohn, *et al* 2002) referring to shallow soil cover over hard rocks. Ephemeral drainages emanating from the topographically higher areas to the west underlain by the Chuos Group bring in sedimentary load and deposits clay rich material on a wider area while sand accumulates along the actual

channels (***Appendix L***). These clay rich areas indicated by green polygons (***Figure 7***) were demarcated using Aster data (Bockmuhl, 2008). Remaining area is predominantly sandy with a good infiltration rate.

Figure 7: ***Clay rich areas indicated in green (Source: Geo-hydrological report, Bochmuhl 2008).***

Main drainage of the site is in a south easterly direction towards the Schaap River.

5.3.1.2. Impacts description

Areas cleared of vegetation during the construction phase will increase the occurrence of erosion. The thick sediments found in the main drainage lines are subject to erosion, particularly if there is a change to the local gradients through construction, or the removal of the protective vegetation cover. Erosion is due mainly to flash flooding that takes place at the end of the summer season.

Visual quality impacts related to dust would likely be of medium significance due to construction activities and can be attributed to the following aspects:

- Presence of large earth moving equipment;
- General construction works;
- Dust; and
- Material stockpiles.

Dust from cleared areas and stockpiles could be a nuisance in more windy conditions. Borrow pits on site have a negative visual impact.

Increased dust deposition on vegetation related to dust generated by construction activities can also pose an impact.

From the lay out plan it is obvious that the development has steered clear from the main drainage line(s) to the north of the project area and followed effective contour planning principles.

The rocky outcrop area (***Appendix L***) is seen as sensitive in terms of erosion and possible groundwater pollution; it should be avoided for development and maintained in its natural state. According to the Lay out Plan this area has been zoned as a private open space (***Appendix A***) and would therefore remain in its natural state.

5.3.1.3. Mitigation

- The developers need to keep the area as natural as possible and only remove vegetation where absolute necessary.
- The area of soil that is disturbed should be kept as small as possible to reduce potential impact of erosion by both wind and water.

- Storm water runoff from the high order access roads constructed from interlocking bricks as well as parking areas and pavements should be channelled into a planned drainage system and not directly into the natural drainage lines. This will have the effect of regulating the volume of water flowing in the drainage lines, and minimise the erosion risk. Areas surrounding buildings should be kept as natural as possible, i.e. not paved/covered with impermeable layers.
- Regular spraying with suitable dust suppressing agent for dust control during the construction phase.
- Borrow pit(s) need to be rehabilitated after construction to the existing standards.
- Home owners on Erven 102 – 109 and 110 (***Appendix A***) surrounding one of the main drainage lines as well as Erven 322, 387 – 401 surrounding the open space area 418 (***Appendix A***) should be restricted from building or excavating too close (<100m) from the centre of the drainage line to prevent erosion and possible surface water pollution. A clause needs to be added to their title deeds to prevent building or excavating.
- Residential erven 38 -46, 49, 50, 321, 396, and 397 have quite a number of large trees on the erven. The design should incorporate these large trees as far as possible. If not possible permits would be required to remove these trees. Each tree that is removed need to be replaced after construction (***Appendix A & K***).
- Residential erven 81-84 needs to be removed from the Layout Plan since these fall within the restricted fault zone area (***Appendix A & K***).
- Erven 404 and northern portion of erf 36, zoned for business needs to be removed from the Lay out Plan. These fall within one of the sensitive main drainage areas (***Appendix A & K***).
- Erven 66, 70, 102 and 140 zoned general residential with a higher density also need to incorporate large trees in the design as far as possible. If trees need to be rem***Appendix A & K***).
- The Town Planner also needs to consider the width of the access streets since a large number of trees would be influenced. Consider to wind the streets between the trees in order to retain most of these trees and the rural "sense of place".
- A large number of trees also occur within the 100m building restriction line. These trees also need to be considered if lines for services are placed in this area (***Appendix A & K***).

5.3.1.4. Summary

It must be noted that the impacts described in **Table 3** consider the nature of the potential impact ***with the mitigation measures as set out in Section 5 and the EMP in place.***

Table 3: Summary Geology, Soils, and Drainage Impacts (pre mitigation).

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
Construction							
Increased storm water runoff and erosion generated by construction activities	Negative effect on topsoil through clearing and paving	Site specific	Medium, i.e. construction period only.	Low.	Probable.	Medium.	Medium
Reduced visual quality related to dust generated by construction activities.	Negative effect on general visual visibility through suspension.	Site specific.	Medium, i.e. construction period only.	Low.	Probable.	Medium.	Medium
Increased dust deposition on vegetation related to dust generated by construction activities.	Negative effect on vegetation through deposition.	Site specific.	Medium, i.e. construction period only.	Low.	Probable.	Medium.	Medium
Borrow Pits	Negative effect through visual impact	Site specific	Medium, i.e. construction period only.	Low	Probable	Medium	High

Table 4: Summary Geology, Soils, and Drainage Impacts (post mitigation).

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
Construction							
Increased storm water runoff and erosion generated by construction activities	Negative effect on topsoil through clearing and paving	Site specific	Medium, i.e. construction period only.	Low.	Probable.	Medium.	Low provided mitigation plan is adhered to.
Reduced visual quality related to dust generated by construction activities.	Negative effect on general visual visibility through suspension.	Site specific.	Medium, i.e. construction period only.	Low.	Probable.	Medium.	Low provided mitigation plan is adhered to.
Increased dust deposition on vegetation related to dust generated by construction activities.	Negative effect on vegetation through deposition.	Site specific.	Medium, i.e. construction period only.	Low.	Probable.	Medium.	Low provided mitigation plan is adhered to.
Borrow Pits	Negative effect through visual impact	Site specific	Medium, i.e. construction period only.	Low	Probable	Medium	Low provided mitigation plan is adhered to.

5.3.2. Surface and Groundwater Hydrology

5.3.2.1. Baseline description

The amount of water golf courses use varies greatly depending on the region, but on average they use about 10 800 000 litres of water per year according to the Golf Course Superintendents Association (Enviroadmin, 2005). In essence each golf course uses enough water to provide at least 1200 people with their basic water needs for a year. Namibia is a dry country and water demand remains an issue. The site falls within a moderately productive aquifer with drainage towards the south east towards the Stampriet aquifer (Mendelsohn *et al*, 2002).

In the project area groundwater is hosted in secondary fracture zones and weathered horizons along faults. Isolated deep faults display minimal weathering and have groundwater circulation to depths and yield mineralised water at elevated temperature (eg. at Gocheganas). In contrast, faults that are often highly weathered are the main source of groundwater in the basement rocks (***Appendix L***).

Average borehole yields in the area are between 1 and 2m³/h, but yield in excess of 10m³/h are known (Farms Krumhuk, Aris, Aris School, Gocheganas etc). Most high yielding boreholes on record have long production history, and apparently are utilized sustainably (***Appendix L***).

The boreholes (***Figure 8***) drilled in Portion 20 of the farm Gross Haigamas with exceptional yield were located on a dipping (40 to 50°), thin, faulted, pale grey marble horizon within the Hohewarte Complex. The ENE trending fault zone is about 50m wide and is marked by secondary silicification (chert and opaline silica). Granitic gneiss is exposed to the north and southern contact of the marble unit. The marble unit is exposed locally on a small hillock in the northern part of project area (***Figure 8***). Two ephemeral streams emanating from the elevated areas to the west, flow to the north and south of the outcrop and possibly across the horizon. The alluvial deposits from the streams cover most of the surrounding area making it difficult to trace the continuity of the marble band. However lineaments with roughly ESE and ENE orientation are coincident with the fault direction and can be traced on aerial photos and satellite imagery. This suggests that the fault is a large-scale structure and continues on farms to the east and west of Portion 20 (***Appendix L***).

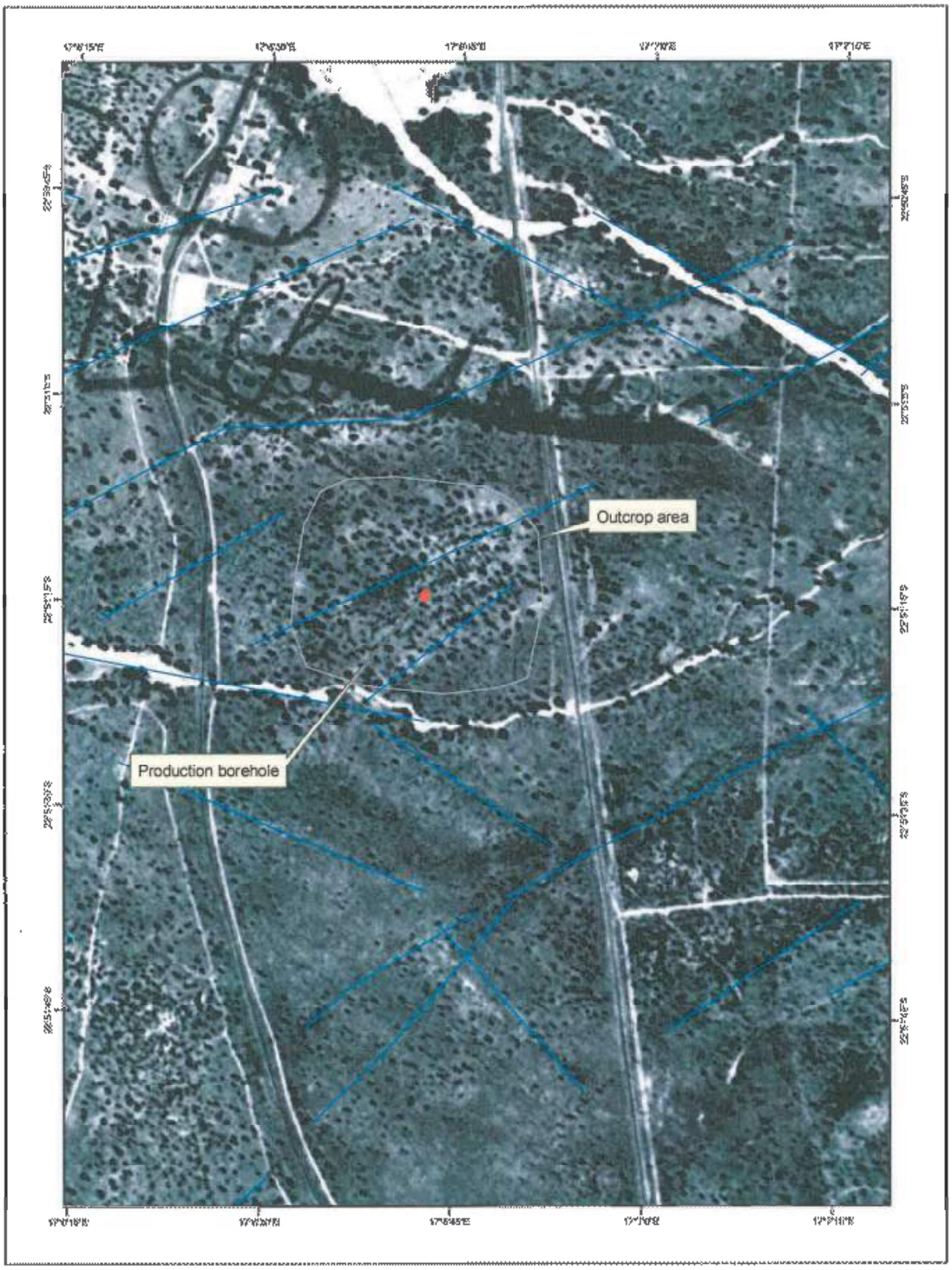


Figure 8: ***Aerial photograph showing faulted limestone outcrop and production borehole position.***

5.3.2.2. Impact description

The two main concerns regarding possible impacts on groundwater from the proposed development are:

1. Effect of abstraction on the general groundwater situation and on neighbours using groundwater; and
2. Possible pollution from activities during construction and operation of the facility.

5.3.2.3. Sustainability of groundwater

A long-term sustainable yield was assessed from the test pumping of the production boreholes in two separate programmes. The results of the test pumping were also used to assess the influence of pumping on the aquifer and suggest adequate protection of the aquifer zone (protection zones) (***Appendix L***).

Two constant rate tests were carried out – an initial program included a step drawdown test, a constant rate test (3 days) and recovery test. Following this program a long duration (14 days) constant rate test and recovery monitoring was done. Drawdown was recorded during the test and water level recovery was monitored for 44 days on completion of the test. Two observation boreholes at distance of 47m and 1400m were monitored. The longer duration pumping test was done to confirm the aquifer parameters, monitor influence of pumping on observation boreholes and any barrier boundary effects (***Appendix L***).

Although the recommended abstraction rate is calculated in a conservative manner it will only be possible to quantify based on monitoring of water level, abstraction, and quality over a production period of a year or more.

Groundwater usage in the area has apparently increased with new developments following the rezoning according to the Aris Town Planning Scheme (IDC, 2006). In general, the area was used for normal rural residence at a density of 1 unit per 5ha. Consent use exists for nature estate developments where density of 1 unit per 1ha is permitted. Although a recent hydrocensus of the area is lacking, it is known that several groundwater schemes exist in the area. A few are noted here:

- Supply of water to the Agricultural Training Centre at Aris from Farm Krumhuk.
- Supply of water to the Aris School from Farm Krumhuk.
- Supply to the Peralin paint factory.

- Supply to the Gocheganas milk farm.
- Supply to Aqua Splash Mineral Water factory.
- New resorts to the south of the proposed golf course.

Details on the current usage, such as, abstraction rate, abstraction volume, and particulars of user's permits are not known. The change in occupancy and landuse in the area requires an assessment of the current water usage and water supply situation in the entire area. Therefore a complete picture of water usage in the area cannot be given at this stage.

The actual water demand could have an impact on the sustainability of the water resource. From ***Table 5*** it is clear that the total water required from the boreholes is approximately 454 200m³ per annum (This includes the recycled portion). Since all waste water from residential and commercial units will be treated and recycled to the golf course irrigation system, the actual water balance will therefor be 311 700m³/annum (total - recycled component) which is less than the 350 00m³/annum permitted by MAWF (***Appendix C***).

Table 5: Water demand and balance of the proposed development.

Residential and Commercial units	
Component	**Annual water consumption**
Total water consumption	198 700m³/annum
Waste water treatment works (estimated)	178 000m³/annum
Water available for recycling (estimated):	142 000m³/annum
Golf Course:	
Component	Annual water consumption
Irrigated demand	255 000m³/annum
Golf Course excluding Recycled component	113 000m³/annum
Actual demand (Total - recycled amount)	311 700m³/annum
Permit granted for abstraction by MAWF(Appendix B)	350 000m³/annum

The abstraction of water may have an impact on water resources on neighbouring farms. DWA's policy on groundwater usage for development is usually on a "first come first serve basis ". Groundwater is State property and cannot be claimed. All bulk users (e.g. Namwater, CoW etc) have to use water that is recharged elsewhere. The permit issued to this development will however be renewed every 5 years and quarterly reports on monitoring need to be provided to MAWF (**Appendix C**).

Naturally regular groundwater monitoring will be the only means at this stage of confirming the sustainability of this resource and should any negative effects result then the water abstraction will be curtailed which poses a risk to the developers.

Should the groundwater resource prove to be unsustainable in the long term or its use affect the neighbouring properties, then the Developer must enter into a Memorandum of Agreement with NamWater to supply water from the Oanob Dam and Oanob water scheme. NamWater has already confirmed that this would be possible (***Appendix M***).

5.3.2.4. Contamination

Irrigation for the proposed development (golf course and gardens) will be supplied in the form of grey water from the sewage effluent, pre-treated to remove algae and solids and will conform to current Namibian legislation for effluent discharge into the environment (***Appendix E***).

A relatively simple and not very expensive post treatment process can be applied to the final effluent from the trickling filter system to remove and/or inactivate helminth eggs before irrigation takes place (**Appendix O**). The treatment includes the following:

- Sand filtration to remove fine suspended solids.
- UV disinfection to disrupt cell material.
- GAC (granular activated carbon) filtration for organics removal.
- Final disinfection by chlorination to ensure residual disinfection capacity in all distribution pipelines.
- The above treatment will ensure that the irrigation water will not pose a health hazard, even if it comes accidently into contact with humans.

Sludge from the treatment plant will be dried in sludge drying beds and will be reused for composting.

Possible contamination sources are sewerage line and sewer treatment facility, and percolation of irrigation (fertigation) water. Although, the planned sewer treatment plant is located at an approximate distance of 1,500m in the southern extremity of the property and is not likely to have an effect on the aquifer, irrigation, and fertigation could contaminate the aquifer. The distance between the water consumption source and the waste water disposal site is within DWAF requirements.

The exposed fault zone is however vulnerable to pollution from any contaminant at surface. The fault zone represents an unconfined aquifer and surface contaminant is likely to travel rapidly into the groundwater table.

5.3.2.5. Mitigation

- The recommended production pumping rate is limited to 50m³/h (1,200m³/day) calculated for an available drawdown of 5m. Monitoring of water level, water quality, and abstraction rates is strongly recommended in the pumping borehole. Three other observation boreholes are available and it is recommended these boreholes be included for water level monitoring. The data should be analysed at the end of every year of production or if high drawdown (greater than 5m) is recorded so that the actual drawdown achieved can be compared to the simulated figures. Abstraction rate can be adjusted on the basis of monitoring data analyses.
- Although the effect of production pumping is difficult to predict as the full extent of the aquifer is not known, water level monitoring and analyses would give enough evidence of declining groundwater levels and possible detrimental effects to the aquifer. To manage production pumping on the long term, a hydrocensus of the area would be necessary. The location of other production boreholes would have to be known to interpret monitoring results and evaluate any affect on them.
- To avoid any surface contaminant reaching the water table the exposed fault zone would need protection.
- Two protection zones are recommended around the production boreholes. Protection zone 1 has a radius of 20m around the borehole to be delineated with a fence to prevent any activity immediately around the borehole. A sanitary seal is recommended around the wellhead. Protection zone 2 has a radius of 120m around the borehole according to the test pumping interpretation. Zone 2 is proposed for protection of the groundwater against viruses, microbial and nitrate pollution. Many studies have shown that bacteria die off within 30 - 50 days which, for simplicity, is equated to a distance of 50m.

- The fault zone is exposed at surface and this protection zone may not be adequate in the fractured aquifer as once the pollutant reaches the fracture zone, travel is accelerated, and the possibility of attenuation of the pollutant is reduced. Within the protection zone developments that could result in leakage of waste, particularly seepage is to be avoided. Heavy fertigation of this area should also be avoided. Therefore any solid or liquid waste (sewer lines, septic tanks, etc.) or fertigation should be avoided in the entire outcrop area of the fault zone as demarcated in ***Figure 8***.
- In addition rainfall and water quality is to be observed. Water quality is to be monitored by periodic sampling (once every six months) for inorganic and microbiological content.
- If the production boreholes are utilised during construction, protection and monitoring conditions as given above will apply during abstraction.
- Should the groundwater resource prove to be unsustainable in the long term or its use affect the water sources on neighbouring properties the additional water source i.e. Nauspoort Scheme or the Oanob Dam should be used.
- Using water-saving measures can cut the water use by a third, the golf course is a desert type of golf course design, with no open water and will use recycled sewage effluent to water the greens and fairways.
- No gardens will be permitted at the residential units. All gardens and landscaping will be done by the developers and irrigated using recycled sewage effluent.

Table 6: Summary Surface and Groundwater Hydrology Impacts (pre mitigation).

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
Construction							
Contamination of ground water.	Potable groundwater.	Local	Long	Medium to high	Probable	Medium	High
Operation phase							
Increased Water demand.	Potable groundwater resource.	Site specific	Medium, i.e. construction period only	Low	Probable	Medium	High.
Pollution of underground water resources.	Potable groundwater resource.	Local	Long	Medium to high	Probable	Medium	High.
Effluent Waters.	Potable groundwater resource.	Local	Permanent	High	Probable	Medium	High
Storage of Hazardous Material.	Potable groundwater resource.	Local	Long	Medium to High	Probable	Medium	High
Dewatering of aquifer.	Potable groundwater resource.	Local	Generations	High	Probable	Medium	High
Impact on water resources on neighboring farms.	Potable groundwater resource.	Local	Permanent	High	Probable	Medium	Medium
Cumulative							
Groundwater Utilization	Potable groundwater resource	Local	Generations	High	Probable	Medium	High

Table 7: Summary Surface and Groundwater Hydrology Impacts (post mitigation).

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
Construction							
Pollution of Groundwater	Potable groundwater resource	Local	Long	Medium to High	Improbable	Medium	Low
Operation phase							
Increased Water demand	Potable groundwater resource.	Site specific.	Medium, i.e. construction period only	Low	Probable	Medium	High
Pollution of underground water resources	Potable groundwater resource.	Local.	Long	Medium to high	Probable	Medium	Medium
Effluent Waters	Potable groundwater resource	Local	Generations	High	Low likelihood	Medium	Low
Pollution of Groundwater	Potable groundwater resource	Local	Long	Medium to High	Improbable	Medium	Low
Storage of Hazardous Material	Potable groundwater resource	Local	Long	Medium	Low likelihood	Medium	Low
Dewatering	Potable groundwater resource	Local	Generations	High	Improbable	Medium	Low
Impact on water resources on neighboring farms	Potable groundwater resource	Local	Permanent	High	Improbable	Medium	Medium
Cumulative							
Groundwater Utilization	Potable groundwater resource	Local	Generations	High	Improbable	Medium	High
Operation of infrastructure							
Pollution of Groundwater	Potable groundwater	Local	Long	Medium to	Improbable	Medium	Medium

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
	resource			High			

5.3.3. Flora and Biodiversity

5.3.3.1. Baseline description

The study area is classified as Highland Savanna (Giess, 1971) with the following species characterising the tree strata: *Acacia erioloba, Combretum apiculatum* subsp. *apiculatum, Acacia hereroensis, A. mellifera* (subsp. *detinens*), *A. reficiens*, and *A. Erubescens* (**Figure 9**). Towards the major drainage lines *Ziziphus mucronata* is found. Aloes species are protected under CITES and are also conserved under the Red Data List. Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora is a convention established in 1973 that regulates or prohibits the international trade of plant and animal species that are believed to be harmed by or that may be harmed by international trade. The authority to implement this is under section 8 of the Endangered Species Act. The Red Data List is a list that includes all the plant taxa that have been assessed according to their risk of extinction in the near future.

Grasses vary according to the soil type and/or current and past farming activities, but usually represented by palatable climax species such *Anthephora pubescens, Brachiaria nigropedata* and *Digitaria eriantha* (Mendelsohn *et al.* 2002).

Barnard (1998) points out that the Highland Savanna is badly underrepresented (0-2% coverage) when it comes to formal protection, this type of development can therefore create a situation whereby the vegetation can be protected through a set of management guidelines.

None of the tree & shrub species that are found in the proposed development site are endemic although a few are protected under the Forestry and/or Nature Conservation laws or are on the Red Data or CITES list (**Table 8**).

Table 8: Legal and conservation status of large woody plant species.

Species	Protected	Red Data	CITES
Acacia erioloba	F		
Albizia anthelmintica	F		
Aloe littoralis	NC	LR-lc	C2
Boscia albitrunca	F		
Maerua schinzii	F		
Ozoroa crassinervia	F		

Species	Protected	Red Data	CITES
Rhus lancea	F		
Ziziphus mucronata	F		

Note the following use of abbreviations:

1. *Protected under Namibian legislation:*

   F = Forestry ordinance No. 37 of 1952 and/or Forest Act No. 72 of 1968

   NC = Nature Conservation ordinance No. 4 of 1975

2. *Red data status* (Curtis & Mannheimer, 2005):

   LR-lc = lower-risk, least concern

3. *CITES protection:*

   C2 = CITES, Appendix 2

Figure 9: Large Acacia erioloba trees are prominent throughout the area.

A total of 16 different grasses were identified in the area. None of the grasses that are found in the proposed development site are endemic to Namibia.

At least 77 species of mammals are expected to occur in the Aris/Windhoek area of which 3 species (4%) are endemic to Namibia.

Overall terrestrial diversity – all species – is relatively high in the Windhoek area (Mendelsohn *et al.* 2002). The overall abundance and diversity of large herbivorous mammals is high (7-8 species) in the Windhoek area with Kudu and Oryx having the highest density of the larger species (Mendelsohn *et al.* 2002). The overall abundance and diversity of large carnivorous mammals is relatively high (3 species) in the Windhoek area with Leopard and Cheetah having the highest density of the larger species (Mendelsohn *et al.* 2002). Rodents (23 species) represent at least 30% of the mammalian fauna that are expected to occur in the Aris/Windhoek area. Carnivores (22% - 17 species) and bats (17% - 13 species) are also well represented in the area. Important habitats often not realised and/or neglected include rivers (including ephemeral drainage lines) and their associated vegetation. Habitat alteration and over utilization are the two primary processes threatening most mammals (Griffin, 1998c).

The overall reptile diversity and endemism in the Windhoek area is estimated at between 71-80 species and 13-16 species, respectively (Mendelsohn *et al.* 2002). At least 78 species of reptiles are expected to occur in the Aris/Windhoek area with 21 species being endemic – i.e. 27% endemic. These consist of at least 36 snakes (3 blind snakes, 1 thread snakes, 2 pythons, 5 burrowing snake & 25 typical snakes), 8 of which are endemic (22%) to Namibia, 2 tortoises and 1 terrapin and 34 lizards, 13 (38%) of which are endemic to Namibia. Namibia with approximately 129 species of lizards (*Lacertilia*) has one of the continents richest lizard fauna (Griffin, 1998a). Geckos have the highest occurrence of endemics in the Aris/Windhoek area with 8 species or 89% of all the geckos (38% of all endemics) expected and/or known to occur in the area, being endemic to Namibia.

Fourteen species of birds are endemic or near endemic to Namibia with the majority of Namibian endemics occurring in the savannas (30%) of which ten species occur in a north-south belt of dry savanna in central Namibia (Brown *et al.* 1998). Bird diversity is high in the Windhoek area with >230 species (this would include migrant species) estimated (Mendelsohn *et al.* 2000).

At least 173 species of terrestrial ["breeding residents"] birds could occur around the Aris/Windhoek area at any time (Maclean, 1985). Obviously rainfall (or lack thereof) would affect bird species distribution and abundance. This however excludes all aquatic species (freshwater & marine), migrant and vagrant species that could also be found in the area depending on rainfall and temporary pools in the area and season or food availability. At least 8 endemic species can or are likely to occur in the general Aris/Windhoek area either permanently or environmental conditions

allowing. The study area does not fall within an Important Bird Area (IBA) (Simmons, 1998).

5.3.3.2. Impact description

The general study area is undeveloped and a rural "sense of place" prevails on the site.

Large *Acacia erioloba* trees on residential erven can be threatened during construction. *Acacia erioloba* trees are protected by Forestry legislation and may only be removed once a permit has been obtained from Department of Forestry.

The large *Acacia erioloba* trees play a vital role as keystone species in the ecosystem and removal of these species can lead to an alteration of the ecological integrity.

Other legally protected indigenous trees (***Table 8***) may also be threatened during construction of the golf and residential estate.

From ***Appendix K*** it is clear that most large trees are associated with the main drainage lines on Portion 20. The trees are also more concentrated to the northern area of the portion.

The Golf course and open public space occupies 1406292m² which constitutes 62% of the total project area. The lay out has taken main drainage lines with associated large trees into consideration as far as possible. It would however be important to also incorporate large trees and associated vegetation as part of the design of the Golf course to preserve the rural "sense of place".

The addition of any nutrients to the system, for example through using fertilizers, impacts upon surrounding ecosystems. Increased nutrients and disturbance may encourage alien species to invade and discourages indigenous vegetation.

While the use of sewage water for irrigation may solve the water problem, it adds even more nutrients to the system, compounding the negative environmental impacts of using fertilisers.

Pesticides and herbicides kill off insects and weeds within the confines of the golf course estate. However these can spread into nearby ground water or river systems. The use of pesticides may affect species higher up the food chain by either reducing the amount of food available, or through the accumulation of persistent poisons in their bodies. Insects also provide important ecosystem functions such as

pollination and seed dispersal. Their removal may have serious long-term implications for habitat viability.

The introduction of Kikuyu (*Pennisetum clandestinum*) grass, due to its invasive character can affect the surrounding natural habitats.

5.3.3.3. Mitigation

- Prevent and discourage fires – especially during the construction phase(s) – as this could easily cause runaway veld fires affecting the local flora and fauna, but also causing problems (e.g. loss of grazing & domestic stock mortalities, etc.) for the neighbouring farmers.
- An environmental consultant should mark all medium and large *Acacia erioloba* trees as well as all other indigenous trees indicated in **Table 8** in order to protect these trees as far as possible.
- Indigenous species that could be under threat should be removed before any development starts and the area rehabilitated after construction.
- All deeds of sale should include a clause that addresses the preservation of indigenous trees. Design of residential and other buildings should incorporate medium and large indigenous trees as far as possible.
- Indigenous grasses e.g. *Paspalum vaginatum* or *Cynodon dactylon* or any other species that has been tested and found to be suitable must be used for fairways and greens.
- A conservation management plan should be developed in conjunction with the environmental consultant as part of the house rules for the Home owners' association and indicate goals and strategies to preserve biodiversity and a monitoring and record-keeping system should be in place for priority issues.

Table 9: Summary Flora, Fauna, and Biodiversity Impacts (pre mitigation).

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
Construction and Operation							
Removal of indigenous vegetation	Negative effect on vegetation coverage through clearance	Site specific.	Medium, i.e. construction period only.	Medium	Probable.	Medium.	High
Impact on *Acacia erioloba* community	Negative effect on the *Acacia erioloba* community through removal	Site specific.	Permanent	High	Highly Probable.	Medium.	High
Increased spread of invasive alien plants through increased disturbance and nutrient levels	Negative effect on indigenous vegetation	Site specific	Long	Medium	Probable.	Medium.	High

Table 10: Summary Flora, Fauna, and Biodiversity Impacts (post mitigation).

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
Construction and Operation							
Removal of indigenous vegetation	Negative effect on vegetation coverage through clearance	Site specific.	Medium, i.e. construction period only.	Medium	Probable.	Medium.	Low provided mitigation plan is adhered to.
Impact on Acacia erioloba community	Negative effect on the Acacia ericloba community through removal	Site specific.	Permanent	High	Highly Probable.	Medium.	Medium provided mitigation plan is adhered to.
Increased spread of invasive alien plants through increased disturbance and nutrient levels	Negative effect on indigenous vegetation	Site specific	Long	Medium	Probable.	Medium.	Low provided mitigation plan is adhered to.

5.4. SOCIO ECONOMIC STATUS QUO

5.4.1. Introduction

Golf course estates are not necessarily for golfers. On average, only 50% of residents are golf players, the remainder choose to live there because of the secure environment, and because they like the idea of staying in a natural environment (Enviroadmin, 2005). This may possibly be extended to the golfing tourist industry, as we have reason to believe that a substantial number of tourists on these golf tours do not play golf at all. This is an important factor to consider when addressing the environmental and social issues and, perhaps more importantly, when trying to find solutions and alternatives. The enthusiastic drive for golf course estates amongst local authorities appears to be linked to perceived economic growth, and job creation, through golfing tourism.

5.4.2. Baseline Description

5.4.2.1. Regional Profile

As mentioned, the proposed development is located 30km south of Windhoek on the B1. This road forms an important part of Namibia's road network since it links South Africa and the southern areas of Namibia to the capital (***Figure 1***). In addition, the B1 is used by many people who daily commute between Rehoboth and Windhoek. Consequently, many taxis are found on this road providing transport to the commuters.

Based on its locality, the proposed development falls within the Khomas Region. This region has been divided into seven constituencies: six constituencies fall within the Windhoek City confines while another one, known as the Windhoek Rural constituency, includes the rural areas beyond the city borders. The proposed development falls within the latter constituency.

According to the Khomas Regional Poverty Profile (2007), an estimated 13.6% of Namibia's population is found in this region. This region has a population of 250,262 with the largest part of this figure (93.3%) residing in Windhoek. Furthermore, compared to the national population density of 2.1 persons per km², the Khomas Region has a relatively high population density with an estimated 6.8 persons per km². This difference in population density can be attributed to the rural-urban migration pattern.

This phenomenon occurs for various reasons, but mainly due to the potential employment opportunities that Windhoek poses to migrants. In addition, the city has good municipal infrastructure, a developed industrial and economic sector, and a functioning education, health, and institutional network.

However, the impact of HIV/AIDS is also evident in this region as the life expectancy at birth has seen a decrease for both men and women between 1991 and 2001. The HIV/AIDS prevalence rate amongst women between the 15 and 49 years of age is estimated as 27%. Evidently, the economic active part of the population is affected the most whether it is by increasing health and funeral related costs or by a loss of income.

The main source of income within this region is wages and cash, and even though the average annual household income of this region is higher than the national average, it does not disclose the income disparity that exists within the Khomas Region. An estimated unemployment rate of 27.6% exists for economically active part of this region which is high, but not as high as the national rate of 33.8%.

5.4.2.2. Windhoek Rural Constituency Profile

The project falls within the Windhoek Rural Constituency. The population for this area is 20,212, i.e. an estimated 8.08% of the regional population. This constituency has an unemployment rate of approximately 22%, which is lower than the national average.

An estimated 92.5% of the households in this constituency have access to safe water. However, access to health services is limited and long distances have to be travelled to clinics.

5.4.2.3. Economic Activities

The community which will be impacted by this development are comprised of various segments. It ranges from the direct neighbours of the development, i.e. the commercial farmers and their workers, some residents of Windhoek to the inhabitants of the informal settlements within the vicinity of the proposed development.

The land uses in this area vary from activities such as game farming, Gocheganas Hydro and Spa, water bottling enterprise at Gocheganas, tourism, Nature Estates such as retirement villages and residential estates and mining activities in the vicinity of Aris.

As for the informal settlements, about 9km east of the development the Kranzneus Settlement is found which is located within the previously known "Baster Reserve". Another settlement, Groot Aub, is found about 20km to the South-East of the development. The land to the south of the proposed Development is communal land with impoverished settlements at Onesimus and Oamites. In addition, Aris is only 9km away from Omeya and is situated along the B1 to Windhoek. About two years ago Aris has been upgraded from a settlement to a village. An agricultural training centre and school exists at Aris.

It can be concluded that the community affected by this project is heterogeneous and complex. The following table presents the various segments of the community:

Community	Name of community
Commercial Farmers and their employees	Gross Haigamas, Krumhuk, Lichtenstein, Waldeck,
Conservancy	Namatanga
Informal settlements/villages	Kranzneus, Groot Aub, Aris, Oamites, Onesimus
Retirement villages	Ziveli Retirement Village
Tourism and Nature Estate	Gocheganas, Crinium Lake, Out of Nature

5.4.3. Impacts Description

5.4.3.1. Job creation for local community

Due to the size of the proposed development and the diverse range of job requirements, a perceived strength of this project is job creation. As mentioned, the development envisions the inclusion of a pre-primary and primary school creating jobs for an estimated seven teachers. Furthermore the envisioned clinic will employ one permanent sister and a doctor who will visit this facility periodically. An estimated thirty people can be employed in the hotel and clubhouse, while twenty-five workers will be responsible for the maintenance of the golf course. Skilled individuals such as teachers, nurses, and chefs along with blue-collared workers such as those involved during construction can benefit people across the spectrum of the community. The table below summarises the number of employment opportunities that can arise from the development during operational phase.

However, whether the members from the surrounding informal settlements will benefit is debatable. It is likely that the contractors employed during the construction phase already have employees who reside in the City. In addition, since many of the future residents of the development are likely to come from

Windhoek, it is expected that they will continue the employment of their current domestic workers who reside in the City, thus limiting employment opportunities for the surrounding informal settlements as domestic workers. Furthermore, it is expected that the skilled labourers will come from Windhoek and not the impoverished areas since people from the latter communities often lack experience and the necessary qualifications.

Type of Job	Level of Skills Required	Number of Jobs
Domestic Workers	Unskilled	300
Garden Services	Unskilled	20
Maintenance of Golf Course	Semi-skilled	25
Sewerage	Skilled/Unskilled	5
Security	Unskilled	20
Hotel and Restaurant	Semi-skilled and skilled	30
Teachers	Skilled	7
Clinic	Skilled	2

5.4.3.2. Increased Economic Activities

A major potential spin-off effect of this development is the increased number of tourists to this area since the development makes provision for not only permanent residents, but also for holiday makers. Surrounding farms could optimize on this opportunity by, for example, marketing game viewing trips as well as hunting expeditions.

The increased number of people to this area could also stimulate the business activities of Gocheganas Hydro and Spa across the road from the development. Being creative, this organization can offer goods and services to visitors who are less interested in golfing activities, but who are residing on the development.

Furthermore, by using contractors and goods and services suppliers, economic activities will be increased.

5.4.3.3. Influx of job seekers

As mentioned, the Khomas Region has a high rural-urban migration rate due to the region's urban character. Many flock to this region in search of employment opportunities. This new development can potentially act as a pull factor which in

turn can lead to an influx of workers settling in the communities nearby. The rural communities might not have the resources and capacity to accommodate these people, placing even more pressure on the available existing resources. This in turn can spark conflict over resources and employment opportunities and in the end, it will be the rural community that bears the brunt of the influx of workers brought about by the potential benefits such a development can bring to an area.

Furthermore, family members of neighbouring farm workers might be tempted to reside with their families on the farms while pursuing employment opportunities at the new development. This in turn can lead to conflict between the farm owners and their employees.

5.4.3.4. Livelihood

Water is a scarce commodity in Namibia. The value of water to this region should also not be under-estimated since it sustains the livelihoods of many people. Farmers are directly dependent on the water source for crop, game, and livestock farming. Furthermore, a water bottling enterprise also has its operations based in this region. Thus, any disturbance to the aquifers within this region can impact negatively on the livelihood strategies of the surrounding communities. This development might therefore be perceived as a potential threat.

In addition to the disturbance to livelihoods, future development efforts might also be limited should the availability of water be compromised.

5.4.3.5. Elitism

Various comments were made on the elitist nature of the proposed development. Since the target market is people from the higher income groups, other people, including the local communities, might be excluded from this development, only some benefiting from the employment opportunities. However, it should be realised that this might only be another display of the income disparities that exist within the region, and is not a result of the proposed development.

5.4.4. Mitigations

5.4.4.1. Locals First Policies

Often, the perceived benefits and opportunities that arise from a development land in the hands of outsiders, depriving the local community of the opportunity to improve their circumstance. For this reason, the Consultant reiterates the

importance of adopting a 'local first' focus, involving the local community in the project to the extent where they too can benefit from it.

'Local' refers to the surrounding farming communities and informal settlements as well as Windhoek. The developer has undertaken to use Namibian companies are far as possible.

One way of involving the local community is to give preference to them when recruiting employees. This can contribute to optimizing the positive social impact of this project on the local community. As for this project, the developers envisage to employ people from the surrounding informal settlements as well as from Windhoek. Chefs trained in Windhoek, waiters and people working in the hotel and clubhouse, as well as garden technicians will be recruited from the surrounding communities. This will ensure that the benefits of the project will remain in the local communities. In addition, it might also serve as a buffer for the possible influx of workers to the area.

Another way of applying the idea of locals first, is to make use of Namibian goods and services. For example, only Namibian contractors should be used during the construction phase of the development. As for the operational phase, Namibian security companies can be used as well as local transport such as taxi's travelling on the B1.

Transport should be provided for the people working on the development to and from Windhoek. This can limit the number people wanting to relocate to one of the settlements more close by. Already being committed to employing local people first, transport will also be provided to and from the three nearby settlements.

5.4.4.2. Skills training and development

Skills training and the development of the local communities is a very important aspect since this can greatly influence the sustainability of various aspects of this development. It will not only be beneficial for the project, but also for the various communities as this can empower them.

The developers, already recognizing the importance of this aspect, have come into agreement with the Golf Estate construction company to render training to the employees. The training will be conducted for a three year period. However, to ensure sustainability, ongoing training after the period of three years should also be ensured due to the possible negative impact of HIV/AIDS on the workforce.

In addition, training of the chefs, waiters, and gardeners will be trained in Windhoek. On a more practical note, the training should be made accessible for the local community members by assisting them with transport needs to and fro from the training at Aris and the City.

5.4.4.3. HIV/AIDS Awareness Raising

This epidemic is a reality and a great concern for any development. This disease impacts on the sustainability of any development since the most economic active part of the society is affected, directly or indirectly. For this reason, it will be important to raise awareness amongst the employees of the development on the prevention of and coping with HIV/AIDS. The importance of the inclusion of this component in the development's strategies should not be underestimated.

Various NGOs specialise in the education of HIV/AIDS. The developers can approach some of these NGO's in order to assist them in this venture. In addition, this will also strengthen the idea of 'locals first' since the services of local NGO's can be utilized.

5.4.4.4. Gender equality

Gender equality is an important component of the fairness and equity of any development. In order to avoid the marginalisation of women, equal employment opportunities for both men and women should be available.

5.4.4.5. Marketing and awareness raising

Optimizing the business opportunities arising from the increased number of tourists to the area depends on the surrounding communities themselves. However, the developers could assist the local communities, especially the informal settlements by informing them on various ways in which they can assist the development. For example, growing and selling vegetables to the restaurant on the development.

5.4.4.6. Housing

The Consultant supports the idea that the contractors used during the construction phase will reside at Out of Nature, thus limiting also the environmental impact of housing workers on site. Proper sanitation facilities for labourers will be provided at "Out of Nature" during and after construction to avoid ground water pollution. During the operational phase, the developer envisions to provide housing on a "warm-bed" system to the employees of the restaurant facilities at the

development. In other words, sleeping quarters will be available for people during their shift only, thus limiting the number of workers permanently residing at the development.

5.4.5. Impacts description

5.4.5.1. Landscape and visual impacts

The proposed development will result in a visual intrusion and a significant alteration in the rural nature of the study area (sense of place) both of which will be almost impossible to mitigate. Visual intrusion is a measure of the compatibility of the proposed development with the existing character of the landscape. This is dependent on both the proposed development and the existing landscape.

The significance of this however also needs to be considered in context of the existing visual fragmentation along the B1 in the Aris area due to the increased number of developments according to the proposed zoning within the Aris Town Planning Scheme (IDC, 2006).

The Aris Town Planning Scheme was done without a strategic assessment of the Aris Area and the development of a structure plan for the area.

Apart from the 18-hole golf course and 392 erven, the Developer also plans to offer the following:

- Clubhouse;
- Boutique hotel with 10 - 15 rooms, plus 5 rooms to accommodate staff;
- Spa;
- Golf Driving range;
- Tennis courts;
- Commercial centre;
- Chapel (accommodate 50 people); and
- Pre-primary (30 pupils) and Primary school (140 pupils).

The following Table indicates the footprint of each proposed facility:

Proposed facility	Footprint (m^2)	Comments
Overall area of the site	2259364	Portion 20 of the Farm Grass Halgamas no. 447,
Residential erven	468479	390 erven Erven range in size from 547 to 3243m2 Density 1 dwelling per erf
General residential	102008	14 erven Erven range in size from 3392 to 9207m^2 Density 1 dwelling per 250m^2 or 1 dwelling per 500m^2
Education	61908	1 erven
Clinic	1826	1 erven
Business	74432	3 erven
Roads	144419	Surfaced roads
Fenced perimeter		Area will be fenced on eastern side by palisade fence of 2.2m. Western and northern sides fenced with an electrical security fence.

Due to the size of the development it will be highly visible from the B1 and the adjacent Auasview development. A height restriction of a single storey will however be endorsed on all erven.

Artificial landscaping can result in open uniform fairways and greens that will be in contrast to the character "sense of place" of the site.

5.4.5.2. Infrastructure and Services

Since the development consist of clusters of 398 housing units, or more, which in effect is creating a small town in a semi-rural area where infrastructure does not exist it may place an added burden on the regional council for example, through increased traffic congestion and demand for services.

This development will have an impact on water demand, waste disposal, and sewage services, especially since a strategic environmental assessment has not

been planned for. As these are housing developments for the upper end of the market, where are the resources to be found for the lower end, disadvantaged communities' development?

During the construction and operational phase an increased amount of waste will be produced e.g. Construction waste (e.g. wire, cement, etc.) as well as household waste such as glass, plastics, paper but also organic waste and even hazardous waste including oil etc. that would need to be removed.

The amount of waste to be generated by the residential estate during the operational phase of the development will amount to: 398erven x 4 x 1.5kg = 2388kg/day x 7 = 16716kg/week.

Considering the current shortage of electricity experienced in Namibia and neighbouring countries, as well as the huge cost and environmental impact to generate in the ever growing demand for electricity, the development, will inevitably contribute to this growing demand and environmental impact locally as well as regionally.

There will also be an increase of traffic on the already busy B1. The Roads Authority however has no objections to the proposed development if the developers agree to the conditions set out (***Appendix G***).

5.4.6. Mitigation

5.4.6.1. Landscape and visual impact

Design a restrictive building code that promotes soft agriculture and naturally coloured and textured building materials. No structures should be painted white/similar light colours due to high reflectivity.

Contractors appointed should sign a contract in which they agree not to make any new access tracks, i.e. no grading.

Clumps of natural/indigenous vegetation should be used as visual screens along the perimeter of the site bordering the B1.

The developers have appointed an architect to plan and design the proposed residential component. The title deed should include a clause that prevents future buyers or homeowners to use different architects to ensure compliance with the design guidelines.

Perimeter fencing may affect surrounding land owners. Fencing on the eastern side would however be softened by the planting of indigenous shrubs and trees on a 2m high berm on the inside of the fence.

The density for General residential is one dwelling per 250m² or 1 dwelling per 500m² which may have an impact on the "sense of place" if strict design guidelines are not followed.

5.4.6.2. Infrastructure and services

An integrated waste management plan needs to be developed by the developers that contains the principles of reducing, re-using, and recycling of waste and should be implemented, including specifications to contractors.

It is proposed that alternative means of energy supply (solar power, gas, etc) be investigated to support conventional supply of energy. Using solar energy would complement the idea of being sensitive to environmental issues and nature in general.

By introducing clever designs that consider a home's surroundings, the need for heating or cooling by mechanical or electrical means can be substantially reduced, if not eliminated.

The developers will be responsible for the construction and alteration of all accesses and lanes of the B1 prior to the start of any construction of the proposed Golf and Residential Estate. This will ensure that congestion will be minimised.

Due to the increased number of developments in accordance with the Aris Town Planning Scheme (IDC, 2006) it is inevitable that a strategic assessment of the Aris Area is carried out and a structure plan for the area developed.

Table 11: Summary Socio economic Impacts (pre mitigation).

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
Construction							
Job Creation	Positive should local and Namibians be used.	Local Regional National	Medium	N/A	Highly Probable	Medium	Medium
Increased economic activities	Positive	Local Regional	Medium	N/A	Highly probable	Medium	High
Influx of Job Seekers	Negative, in direct competition with local communities.	Local	Medium	Medium	Probable	Medium	High
Operation							
Job Creation	Positive should local and Namibians be used.	Local Regional National	Permanent	N/A	Highly Probable	Medium	Medium
Increased economic activities	Positive	Local Regional	Permanent	N/A	Highly probable	Medium	High
Influx of Job Seekers	Negative, in direct competition with local communities.	Local	Permanent	Medium	Probable	Medium	High
Elitism	Negative	Local Regional	Permanent	Low	Probable	Medium	Low.

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
		National international					
Infrastructure and services							
Construction and Operation							
Increased burden on infrastructure and services in Aris.	Negative effect through increased number of developments	Local	Permanent	Medium.	Probable.	Medium.	High
Landscape and Visual Impact							
Construction and operation							
Visual intrusion and a significant alteration in the cultural landscape	Negative effect on the rural "sense of place"	Site specific.	Permanent	Low.	Probable.	Medium.	High

Table 12: Summary Socio economic impacts (post mitigation).

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
Construction							
Job Creation	Positive should local and Namibians be used.	Local Regional National	Medium	N/A	Highly Probable	Medium	Low
Increased economic activities	Positive	Local Regional	Medium	N/A	Highly probable	Medium	Low
Influx of Job Seekers	Negative, in direct competition with local communities.	Local	Medium	Medium	Probable	Medium	Low
Operation							
Job Creation	Positive should local and Namibians be used.	Local Regional National	Permanent	N/A	Highly Probable	Medium	Low
Increased economic activities	Positive	Local Regional	Permanent	N/A	Highly probable	Medium	Low
Influx of Job Seekers	Negative, in direct competition with local communities.	Local	Permanent	Medium	Probable	Medium	Low
Elitism	Negative	Local Regional	Permanent	Low	Probable	Medium	Low.

Impact	Nature	Extent	Duration	Intensity	Probability	Degree of confidence	Significance
		National International					
Infrastructure and services							
Construction and Operation							
Increased burden on infrastructure and services in Aris.	Negative effect through increased number of developments	Local	Permanent	Medium.	Probable.	Medium.	High
Landscape and Visual Impact							
Construction and operation							
Visual intrusion and a significant alteration in the cultural landscape	Negative effect on the rural "sense of place"	Site specific.	Permanent	Low.	Probable.	Medium.	Medium

6. CONCLUSIONS AND RECOMMENDATIONS

This Environmental Impact Assessment Report has addressed the key issues as identified in ***Figure 5***.

The following impacts scored high in terms of significance after mitigation:

- Sustainability of the water resource;
- Increased burden on infrastructure and services in Aris area; and
- Loss of protected trees.

It is however imperative to note that due to the change in occupancy and land use in the Aris area an assessment of the current water usage and water supply situation in the entire area is required. A Hydro census of the area that falls within the Aris Town Planning scheme needs to be carried out by MAWF. It also requires a strategic environmental assessment of the Aris area and the development of a structure plan that considers all future developments as set out in the Aris Town Planning Scheme to accommodate cumulative impacts on infrastructure and services as well as water demand. This however does not fall within the scope of this EIA Report.

In terms of the abstraction of groundwater the Ministry of Agriculture, Water and Forestry supports the abstraction of 350 000m³ per annum provided that groundwater monitoring boreholes are established and records submitted to the Ministry on a quarterly basis (***Appendix B***). The relevant correspondence confirms that the Ministry "has decided that a water abstraction permit will be issued to ensure that the aquifer is used on a sustainable basis".

Should the groundwater resource however prove to be unsustainable in the long term or its use affect the neighbouring properties, then the Developer will approach NamWater to supply water from the Oanob Dam and present Oanob water scheme. NamWater has already confirmed that this would be possible (***Appendix M***). A wastewater permite will be issued to the developer to allow Ministry to control and monitor the wastewater treatment and its disposal thereof for compliance with regulations.

6.1. RECOMMENDATIONS

It is imperative that the mitigation measures as set out in this report as well as those described in the EMP be implemented during the planning (layout design)

construction and operational phases to prevent unnecessary damage to the natural environment.

The EMP should be added to all contractors' agreements and be signed by such contractors.

A Set of Development Guidelines and Homeowner Association Rules need to be developed in association with the environmental consultant to guide and control the short and long-term activities.

The change in occupancy and land use in the area requires an assessment of the current water usage and water supply situation in the entire area. A Hydro census of the area that falls within the Aris Town Planning scheme needs to be carried out by MAWF. It also requires a strategic environmental assessment of the Aris area and the development of a structure plan that considers all future developments as set out in the Aris Town Planning Scheme to accommodate cumulative impacts on infrastructure and services as well as water demand.

Recommendations from the Environmental Impact Assessment report of the geo-hydrologist (***Appendix L***) should be incorporated into contracts with contractors and mitigation measures related to groundwater management should be followed to ensure the sustainability of the resource.

6.2. CONCLUSION

We conclude that the proposed development of Portion 20 of the farm Gross Haigamas no.447 is suitable for the purpose of a Golf and Residential Estate if the mitigation measures provided in this report and the management proposals as described in the EMP are implemented in order to mitigate the highly significant negative impacts to acceptable levels.

7. ACKNOWLEDGEMENTS

Mr. Frank Bockmuhl and Namib Hydrosearch for information on the geohydrology of the site area.

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Frank Bockmuhl.	Geo-hydrologist
Diganta Sarma	Namibia Hydrosearch CC.
Dr Eric Tardiffe	Department of Water Affairs

APPENDICES:

Appendix A: Layout Plan for the proposed Golf and Residential Estate.

Appendix B: Stakeholders List.

Appendix C: Letter from MAWF supporting the groundwater abstraction.

Appendix D: Letter from MAWF acknowledging receipt of application for construction of waste water and effluent disposal treatment system.

Appendix E: Aqua Services & Engineering (Pty) Ltd. – Final effluent from Sewage treatment plant.

Appendix F: Letter of approval for solid waste dumping – Rehoboth Town Council.

Appendix G: Letter of approval – Roads Authority.

Appendix H: Minutes of the meeting – 8 April 2009.

Appendix I: Issues and Response Trail.

Appendix J: Geopollution Technologies Report.

Appendix K: Aerial photograph of Portion 20 indicating sensitive areas.

Appendix L: EIA – Geohydrology (Specialist Report).

Appendix M: NamWater's approval for water supply from the Nauspoort Scheme or the Oanob Dam.

Appendix N: Long duration test pumping data interpretation & estimation of sustainable yield, Auas View Golf Course.

Appendix O: Letter from Aqua Services & Engineers (Pty) Ltd regarding treatment of Helminth Eggs.

Appendix A: Layout Plan for the proposed Golf and Residential Estate.

Appendix 8: Stakeholders List.

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TOWN AND REGIONAL PLANNING

PROPOSED SUBDIVISION OF PORTION 20 OF THE FARM GROSS HAIGAMAS NO. 447

STAKEHOLDERS LIST

Auasview Golf Estate on

Portion 20 of Farm Gross Haigamas No. 447

Name	Organisation	Dept/Position/Affiliation
Developers		
A. Van der Walt	Auasview Golf Estate	Developer
W. Van Zijl	Auasview Golf Estate	Developer
P. Du Plessis	Out of Nature	Owner
EIA Team		
S. Van Zyl	Enviro Dynamics	EIA Manager
Carla Blewenga	Enviro Dynamics	Communication Officer
C. Steenkamp	Enviro Dynamics	Environment Consultant
City of Windhoek		
B. Mutrifa	City of Windhoek	Town Planner
U.L. Karimbue-Mupaine	City of Windhoek (Planning, Urbanisation & Environment)	Strategic Executive
P. Du Pisani	City of Windhoek (Infrastructure Water & Technical Services)	Strategic Executive
C. De Waal	City of Windhoek (Bulk & Waste Water Division & Technical Support Division	Section Engineer
J. Shilonga	City of Windhoek (Environment Department)	Officer
F. Kaujo	City of Windhoek (Environment Department)	Manager
D. Reed	City of Windhoek (Roads & Storm Water Division)	Section Engineer
C. Jendrissek	City of Windhoek	Chief: Geomatics
L. Hanekom	City of Windhoek	Strategic Executive: Electricity
Regional Councillors		
F. Haindonga	Khomas Regional Council	Chief Regional Councillor
Ministry of Regional and Local Government and Housing		
P. Gerds	Ministry of Regional & Local Government and Housing	Forward Planning
D. Brand	Ministry of Regional & Local Government and Housing	Planner (Khomas)
Ministry of Works, Transport and Communication		

Name	Organisation	Dept/Position/Affiliation
U. Trümper	Roads Authority	Engineer
A. Helmich	Roads Authority	Div. Man. Planning
P. Kilyala	Road Fund Admin	CEO
Ministry of Environment and Tourism		
Dr. M. Lindeque	Ministry of Environment and Tourism	Permanent Secretary
Dr. F. Sikabongo	Ministry of Environment and Tourism	Directorate of Environmental Affairs – Development Planning, EIA Division Government Review of EIA
S. Angula	Ministry of Environment and Tourism	Directorate of Environmental Affairs Development Planning, EIA Division - Government Review of EIA
T. Nghithika	Ministry of Environment and Tourism	Directorate of Environmental Affairs
Ministry of Agriculture, Water and Forestry		
Mr. Kahuure	Ministry of Agriculture, Water and Forestry	Permanent Secretary
Mathews Katjimune	Ministry of Agriculture, Water and Forestry	
Dr. S. de Wet	Ministry of Agriculture, Water and Forestry – Dept Water Affairs	Deputy Director Water Environment
L. Namene	Ministry of Agriculture, Water and Forestry	Head Water Quality
G. Christelis	Ministry of Agriculture, Water and Forestry	Deputy Director for Geohydrology Division
G. von Langenhoven	Ministry of Agriculture, Water and Forestry – Dept Water Affairs	Head – Hydrology Division
G. Maggs-Koeling	Ministry of Agriculture, Water and Forestry	Head of NBRI
Elise Mdonbeka	Ministry of Agriculture, Water and Forestry	
E. Tordiffe	Ministry of Agriculture, Water and Forestry	Geohydrologist
Specialist		
P. Tarr	SAIEA	Chairperson
J. Kinahan	GRS	Archaeologist
J. Pallett	DRFN	Chairperson
C. Mannheimer	NBRI	Consultant
Pierre Botha	Geo Pollution Technologies	Geohydrologist

Name	Organisation	Dept/Position/Affiliation
B. Strobach	NRBRI	Specialist
NamPower		
D. Louw	NamPower	Environmental Manager
G. De Beer	NamPower	Consultant
J. Langford	NamPower	Manager: Special Projects
NamWater		
N. P. Du Plessis	NamWater	Environmental Manager
O. Van Vuuren	NamWater	Geohydrologist
NGO's		
G. Grobbelaar	NAU (Namibian Agriculture Union & Agri Board)	N/A
Francois Swart	IDC	
Alex Bush	Aqua Services Engineering	
Gunter Lempert	Aqua Services Engineering	
A. Burke	Enviro Science	Director
M. Seely	DRFN	Consultant (Desert Ecologist)
B. Kohrs	Earthlife Namibia	Chairperson
B. Elmbeck	Wildlife Society	N/A
C. Brown	Namibia Nature Foundation	Director
F. Sibanda	Geological Survey	Environmental Manager
J. Irish	N/A	Private
D. //Naobeb	Namibia Tourism Board	Marketing
M. Orford	Greenspace	Chairperson
F. Bockmuhl	Namib Hydrosearch	Geohydrologist
T. Wassenaar	African Wilderness Restoration (AWR)	Ecologist
S. Diganta	Namib Hydrosearch	Geohydrologist
J. Krischnex		Geohydrologist
Intersted & Affected Parties		
C. Van Graan	Coen van Graan Architect	Director
G. Stuberrauch	SPC	N/A

Name	Organisation	Dept/Position/Affiliation
D. Potgieter	Out of Nature	Home Owner
T. Bekker	Out of Nature	Lesser
U. Stritter	Gocheganas	N/A
H. Stritter	Gocheganas	N/A
F. van der Walt	Cymru Trust	N/A
G. De Wet	Cymru Trust	N/A
A. Botha	Price Waterhouse Cooper	N/A
G. Ligthelm	N/A	N/A
Ms. Anthea	N/A	N/A
T. van Wyk	N/A	N/A
C. Allonga	M. Sc Environmental Science student	N/A

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND FORESTRY

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Enquiries : G Christelis
Reference : 12/13/8/1/2

Department of Water Affairs and Forestry
Private Bag 13193
Windhoek
NAMIBIA

27 November 2008

Khomas Regional Council
P. O. Box 3379
WINDHOEK

FOR ATTENTION: Mr Heindongo

Dear Sir,

AVAILABILITY OF WATER FOR THE PROPOSED DEVELOPMENT OF AUAS GOLF ESTATE

1. With reference to the concerns of the City of Windhoek regarding the sustainability of the water resources for the development of the proposed Golf Estate, an application for a water abstraction permit was directed to this Ministry. This Ministry initially supported the concerns of the City of Windhoek regarding the usage of groundwater for the development and its influence on the regional groundwater impacts towards the neighbours. Therefore the Ministry has decided that a water abstraction permit will be issued to ensure that the aquifer is used on a sustainable basis.

2. The Geohydrology Division of this Ministry was informed of the development during 2007 and did participate in performing a pumping test on the proposed production borehole during the first half of 2008. This was in order to obtain further information concerning the supposedly strong groundwater source that was observed. The results of the pumping test confirmed that the area has a potentially good groundwater potential with high yielding boreholes.

3. Based on the subsequent hydrogeological investigations that were undertaken by the hydrogeological consultants of the applicant, the results confirm the good potential of the groundwater resources and have provided good recommendations for a comprehensive groundwater monitoring scheme.

4. An application for permission for groundwater abstraction was directed to this Ministry on the 09/06/2008. Based on the results of the pumping test and the high-yielding pumping rate of the tested borehole the application was granted on the conditions that the amount of water requested (500 000 m^3/annum) was reduced to 360 000 m^3/annum provided that groundwater monitoring boreholes

are established within the outer perimeters of the development and that records concerning the rest water levels and production rates are forwarded to this Ministry on a quarterly basis. An application for effluent disposal will be evaluated by this Ministry and this will be granted on the condition that the effluent is treated to an acceptable quality and should be re-used where possible.

5. Judging from the results of the groundwater investigations and the initial results of the environmental scoping exercise, this Ministry does not have any objections regarding the development from a water perspective. Naturally regular groundwater monitoring will be the only means at this stage of confirming the sustainability of the resource and should any negative effects result then the groundwater abstraction will have to be curtailed and this is a risk to the developers. An alternative source of water will then be needed and this should be cleared as part of the initial planning of the development.

PERMANENT SECRETARY: MAWF

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REPUBLIC OF NAMIBIA

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P.O Box 260 78
WINDHOEK

SUBJECT: APPLICATION FOR CONSTRUCTION OF A WASTEWATER AND EFFLUENT DISPOSAL TREATMENT SYSTEM FOR OMEYA GOLF AND RESIDENTIAL OASIS.

The DWAF would like to acknowledge receipt of your application, dated 5 March 2009 for the construction of a wastewater and effluent disposal system at Omeya Golf and Residential Oasis at Aris Settlement in Gross Haigamas Farm No.447, about 30 kilometres south of Windhoek.

Based on the provided information, this department has already participated in the borehole test pumping in 2009 to ascertain the availability of water. On the 6 April 2009 a site visit to the farm was carried out to look at the proposed location of the wastewater treatment system, the location of the drilled boreholes and other services of interest to this Department.

In the meantime, a technical report for the construction of the wastewater treatment system will be compiled and when the construction phase starts, a temporary permit will be issued to Omeya Golf and Residential Oasis, to enable the legal disposal of the wastewater.

pp K Kahuure 15/4/09

PERMANENT SECRETARY

All official correspondence must be addressed to the Permanent Secretary.

At present, this Department has no objection with the proposed project plan and application to construct a wastewater treatment system as submitted. The system is located about 2 kilometres away from the production boreholes which will be used for water consumption, the distance between water consumption source and wastewater disposal site is within DWAF requirements.

However, DWAF still needs the information on the Solid Waste Disposal Management Plan of the development and the whole project proposed program. The program should indicate the different phases of the project, e.g when the construction is starting, and what does each phase entails.

AQUA SERVICES & ENGINEERING (PTY) LTD

VEOLIA WATER
Solutions & Technologies

6 April 2009

The Environmental Manager
International Development Consultancy
P.O. Box 20837
WINDHOEK

Attn.: Mr F Swart

Dear Sir,

AUAS VIEW DEVELOPMENT - FINAL EFFLUENT FROM SEWAGE TREATMENT PLANT

Our offer regarding for a sewage treatment plant to use New-Generation Trickling Filter technology for the above development refers. We hereby wish to confirm:

- The final effluent, after treatment, will conform to current Namibian legislation for effluent discharge into the environment;
- The final effluent is highly suitable for re-use for gardening and selected agricultural crops and will be reused for this purpose;
- There is no danger of polluting any underground aquifers – Namibian legislation is quite strict and the outflow quality parameters as prescribed suffice for protecting underground waters fully;
- The final effluent will be, if compared to drinking water, of a quality similar to a Group D Classification (= water with a higher health risk/unsuitable for human consumption) from NamWater. The water, although disinfected, is definitely not potable, mainly due to helminth eggs that may be present and are not removed nor inactivated in the treatment process;
- The sludge from the treatment plant will be dried in sludge drying beds and will be reused for composting.

Trust you will find this acceptable.

Yours faithfully

for Aqua Services & Engineering (Pty) Ltd

_____

Dr. G. G. Lempert
Technical Director

Northern Industrial Area
Windhoek
Namibia

Directors: C.D. Stöck; Dr. G.G. Lempert; A.C. Thomas (non-exec)

Tel No.: (061) 261143
Fax No.: (061) 257628
International: (+264 61)
P.O. Box 20714
Windhoek, Namibia
E-Mail: ase@ase.com.na

TOWN COUNCIL OF REHOBOTH

Tel: (062) 521581 Private Bag 2580, Fax (062) 522000, Rehoboth, Namibia, E-mail: rgowaneb@rehoboth.com.na

Enquiries: *Mr. J.J. Strauss*

OMEYA Golf Residential Oasis
P.O. Box 40749
Ausspannplatz
Windhoek

April 17, 2009

Tel: 081 127 4311
Fax: 061-302294
Email: andre@nampharm.com.na

Attention: **Mr. Pieter du Plessis**

PERMISSION TO USE SOLID WASTE DUMPING SITE

The request from OMEYA Golf & Residential Oasis to use the solid waste dumping site of the Rehoboth Town Council is herewith acknowledged and has special reference.

You are herewith informed that your request has been approved and the payment will be in accordance with the municipal tariffs that are promulgated in the government gazette.

For any additional information, please consult the official indicated for enquiries.

Sincerely yours

TOWN COUNCIL OF REHOBOTH
2009 -04- 17
PRIVATE BAG 2580
CHIEF EXECUTIVE OFFICER

J.J. Kaupi
Acting Chief Executive Officer

All official correspondence must be addressed to the Chief Executive Officer

ROADS AUTHORITY
Private Bag 12030
Ausspannplatz
Windhoek
NAMIBIA

Our Ref.:RA 14/19/1/1/5

Your Ref.:

Enquiries: U Trümper
Telephone: 061 2847027
Fax: 061 2847151
E-mail: trumperu@ra.org.na

Burmeister & Partners (PTY) Ltd
Consulting Engineers
P O Box 1496
WINDHOEK

11 March 2007

Attention: A C van der Merwe

Dear Sir

TRUNK ROAD 1/5: ACCESS TO PROPOSED SUBDIVISION OF OMEYA GOLF & RESIDENTIAL OASIS: FARM HEIGAMAS NO 447

1. Your application with regard to accesses to the above mentioned proposed sub division and development dated 20 February 2009, refers.

2. The Roads Authority has no objection to the proposed subdivision as indicated on the plan attached to your application (drawing no W600/CP-01) and subsequent development of a portion of the farm Heigamas for residential and golf purposes. Approval for the access point 1 and access point 3 is given subject to the following conditions:
   (a) Detail design drawings must be submitted and approved before any construction activities may start.
   (b) Your client will be responsible for the construction and alteration of the accesses and lanes as well as the required road signs at no cost to the Roads Authority.
   (c) The construction/improvements to the intersections must be completed prior to any other construction developments are started.

(d) The title deeds of all portions within the 100 meter building restriction of Trunk Road 1/5 are to be endorsed to the effect that no business may be conducted and that no direct access from the trunk road is permitted.

(e) That the developer consults the Roads Authority before the erection of a security fence is started as approval for the upgrading of the existing fence is required in terms of the Roads Ordinance, Ordinance 17 of 1972.

(f) That the 100 meter building restriction as measured from the centreline of the trunk road is maintained.

(g) That the general public may use the existing farm road no 1426 at all times unrestricted.

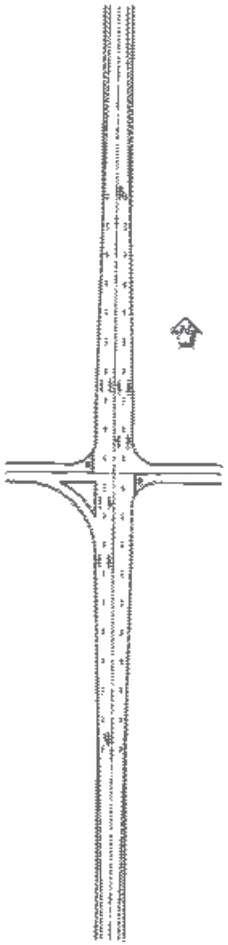
3. The above approval is subject to your client's acceptance of the above mentioned conditions.

Yours faithfully

11 March 2009

CHIEF EXECUTIVE OFFICER

I-Successgolfheigamas



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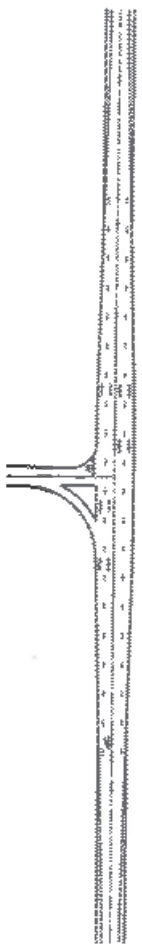

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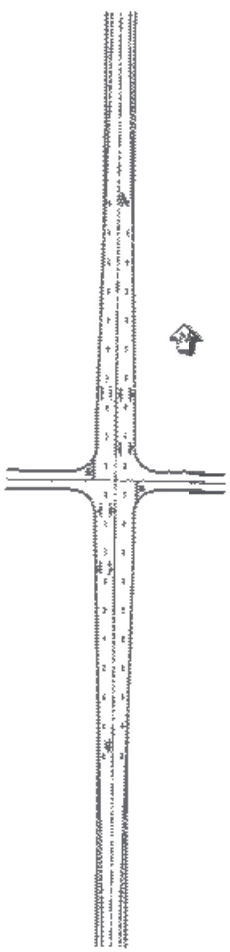

ACCESS TYPE C
SCALE 1 : 2000

BURMEISTER & PARTNERS (PTY) LTD
CONSULTING ENGINEERS

6 Eugene Marais street
PO Box 1498
WINDHOEK
NAMIBIA
Tel: 264-61-378000
Fax: 264-61-379021
admin@burmeister.com.na

PROJECT TITLE
OMEYA GOLF & RESIDENTIAL OASIS
Gross Hellgenlaw Farm, Windhoek
NAMIBIA

DRAWING TITLE
APPLICATION FOR ACCESS TO OMEYA GOLF & RESIDENTIAL OASIS

SCALE
AS SHOWN

DRAWING (Sheet) No.
WSDO/CP—01

Minutes: Second Meeting for the proposed Auas View Golf Estate.

Venue: NICE Restaurant
Date: 8 April 2009
Time: 14h00

1 Welcoming

The meeting was opened and facilitated by Ms. Carol Steenkamp. The agenda was presented and a map was displayed indicating the locality of the proposed development on Portion 20 of farm Haigamas.

Ms. Steenkamp explained that Enviro Dynamics is responsible for the Environmental Assessment (EA) in order to establish the scope of the environmental issues. The Directorate of Environmental Affairs (DEA) and NAMPAB will only approve the application and identify the need for extra information once they have studied the EA report.

The scoping process started in July 2008 with one meeting held with the public, one with the applicable authorities and a site visit. This was done in order to identify key biophysical and socio- and economic issues.

The need for a second round of public consultation arose since the number of erven increased from 108 to 392. Secondly the public has to be informed about the water source results and thirdly the MAWF required an effluent disposal application to be made. In the light of the above NAMPAB requires a re-submission following a second round of public consultation.

It was agreed that the date for the submission of comments by the public will be the 20th of April so that the report can be presented to the NAMPAB meeting that is scheduled for the 22nd April. This was however opposed by Mr. Heiko Stritter and his representatives.

2 Overview of the Project

Mr. André van der Walt gave a brief overview of the Project. About three years ago the developers bought the farm Haigamas and applied for rezoning. This was approved in 2007. Research was done on the water of the farm and five potential areas for boreholes were identified. However, with the first borehole a strong aquifer was struck and therefore only three boreholes were drilled. At this stage Water Affairs was involved. Pumping tests were done for three days in order to monitor the water levels. Namib Hydrosearch then interpreted these test results.

The strong water found at about 60-80 meters deep triggered the idea for a Golf Estate development. A renowned golf course designer, Mr. Matkovich from South Africa was consulted and appointed as the designer of this estate since he is experienced in this regard. Enviro Dynamics was appointed to conduct the EA.

The number of erven was increased from 108 to 392 in order to make this development more feasible and to attract more permanent residents and holiday makers. The development will include facilities such as a preprimary and primary school, a clinic, restaurant, golf course, clubhouse and hotel. House rules such as having no gardens will be established.

Against this background, some questions were asked and issues were raised. These are presented in the table below.

Person	Date	Comment	Response
Ms. Dorette Opperman	8 April 09	Why was there an increase in the number of erven from 350-390?	A piece of land became available within the layout of the development. In order to utilize the space, erven was also set out on the open piece of land, hence the increase. In addition, the initial erven was envisaged to be large plots, however, this would be expensive. Thus, the size of the plots was decreased in order to sell it at a lower price. Consequently the number of erven set out increased. The turnover is more or less still the same, but the number of families buying into the development will increase.
Mr. Heiko Stiffer	8 April 09	What will the house rules entail and how will it be enforced?	House rules will be determined by the Project team in consultation with the Environmental Consultants and will be enforced by the home owner's association. An EMP will also be developed. The house rules will also outline the conditions which have to be adhered to by potential buyers.
Mr. Heiko Stiffer	8 April 09	Who will set up the Home	The Environmental team

Person	Date	Comment	Response
		owner's association rules? Can these rules be changed?	along with the developers will be responsible for setting up rules which will be stipulated in a legal document. Due to the nature of the development there is a lack of authority, hence the home owner's association will be established who will be responsible for enforcing the rules.
Mr. Heiko Stritter	8 April 09	When will the EMP be drafted and who will be responsible for monitoring it?	No date has been fixed for the EMP yet. However, it should be presented along with the EIA to MET. The responsible parties will be indicated in the EMP and will depend on the type of activity.
Mr. Heiko Stritter	8 April 09	Who will enforce the EMP rules, the home owner's association?	The EMP will identify different people who will be responsible for the various components of the EMP.
Mr. Heiko Stritter	8 April 09	There are concerns about the water.	Water tests have been conducted and the water quality and quantity is monitored by MAWF.
Mr. Heiko Stritter	8 April 09	Who will be responsible for taking the measurements of the water which will be tested?	MAWF.
Mr. Heiko Stritter	8 April 09	There are concerns about the sewerage.	The permit for the sewerage works, i.e. effluent permit, can only be obtained after construction has been completed. MAWF will approve the system as outlined in the development proposal after which construction thereof will commence. Only after construction can the final permit is obtained if it complies with the regulations of MAWF.

3 NAMPAB

Mr. Francois Swart explained the role of NAMPAB. As mentioned, the number of erven was increased. The sizes of these erven also vary from between 500 to 3000 meter². An area has been put aside for housing of the people working at the Estate.

A Need and Desirability application has been submitted to NAMPAB and was recommended, subject to the following conditions:

- an EIA be done with reference to water availability and extraction amounts and endorsement by MET;
- an EMP be in place before submission to Townships Board
- the MAWF give permission for the sewerage disposal system
- additional public consultation be obtained with all relevant stakeholders on the revised development for the increase in the amount of erven
- the conditions from the Roads Authority be accepted

Since an objection addressing some of the above conditions was received just before the NAMPAB meeting, it was tabled together with the application. At the NAMPAB meeting, the application was referred back to first address the above conditions before re-submission to NAMPAB.

Comments regarding this presentation are presented in the table below.

Person	Date	Comment	Response
Mr. Heiko Stritter	8 April 09	Where will the solid waste be taken?	It will be transported to Rehoboth with a truck.
Mr. Barrie Watson	8 April 09	Will the workers be transported?	Some of the workers (15 permanent workers) will stay on the estate while the others will be transported to the estate daily or as needed.

4 Pumping Tests

Mr. Frank Bockmuhl and Diganta Sarma explained the role of Namib Hydrosearch. Namib Hydrosearch was appointed to point out where water can be found on the site. They identified three areas for boreholes. Mr. Bockmuhl commented on the conditions of the boreholes. Water flows in from the west and the surface drainage of the rivers disappears in the area of the development. Thus, the aquifer in that area shows good levels of water.

Sarma explained that two boreholes were drilled, one for pumping and the other for monitoring purposes. A pumping test of 14 days was conducted which revealed no affect on the water level at the monitored borehole. Based on this test, recommendations were made to the developer.

The results of the pumping tests and the interpretation thereof can be obtained from Enviro Dynamics. The comments and questions that were raised with regard to the water tests are presented in the table below.

Person	Date	Comment	Response
Mr. Heiko Stritter	8 April 09	Have tests been conducted for organic materials in the water? I.e. have organic samples been taken?	If organic materials has been detected in the water it means that the damage has already been done. For this reason mitigation measures are more important.
Mr. M. Kafjimune	8 April 09	When the tests were conducted, did you consider what was going on upstream?	Inorganic samples have been taken upstream.
Mr. Barrie Watson	8 April 09	As we see, water comes in from the west draining into the aquifer. What is happening to the water flowing in and where is its outflow, other farms possibly?	Pumping of the water will definitely influence the groundwater table should there be no recharge. There can also only be a recharge if there is a flow down. Since Namibia has such an intricate groundwater network drawing water from one place can affect your neighbors. However, groundwater is protected by the Water Act since water permits are only issued for 5years after which it has to be applied for again. Water will flow down to the lowest point. The development falls outside a water-controlled area therefore no permit is required, only an EIA is required by the ministry.
Mr. Heiko Stritter	8 April 09	The neighbors will thus be affected by this development. What security is there for them?	According to the Water Act only some areas are demarcated as areas needing a water permit. However, the act is being amended in order to make the whole of Namibia a water-controlled area, but this still has to be approved

Person	Date	Comment	Response
			by Cabinet.
Mr. Heiko Stritter	8 April 09	There are concerns about the sustainability of the water.	What guarantee is there that Windhoek will always have water? Just so, what guarantee is there that their will always be water and a golf course? Thus, monitoring of the water has to be an ongoing process. Since one cannot say the development will be there forever, it will be a risk taken by the buyer. 4% of each sale will go into a fund which will be used for risk and disaster management.
Mr. Heiko Stritter	8 April 09	Isn't there an alternative water source?	No. While the borehole was being drilled it was found that the deeper you go the more pressure there is.
Mr. Heiko Stritter	8 April 09	The water you are going to draw will it not be the same underground water that the neighbors depend on?	For this reason we are applying for permits.
Mr. Heiko Stritter	8 April 09	What about doing tests on the properties of neighbors to see the effect on the water table when pumping water on the development?	A borehole on the development has been monitored while pumping at another one. The test showed no affect on the water table, and it is expected that the result will be the same on neighboring farms.
Ms. Carol Steenkamp	8 April 09	A lot of development has taken place to the East and the South of the City. Has the ministry taken a look at the accumulative affect of these developments on water?	Yes, the City of Windhoek is concerned about this. The development is planning on recycling its water to limit the effect such a development will have on the groundwater table.

5 The Proposed Sewage System

Mr. Alex Busch from Aqua Services Engineering explained the workings of the proposed sewage system to be used for the development. The most suitable bio-filtration system was found to be the Trickling Filter System. Similar plants have been constructed at Gocheganas, Bogenfells, Langstrand and Henties. The size of the system to be used at this development will be similar to that used at Langstrand.

The workings of this system and its components were discussed. In addition, the advantages of using this system was outlined such as its ability to take shock loadings, its high purification rates, low power consumption and low levels of maintenance. Stand-by pumps will be erected as back-ups should there be a breakdown. This system complies with the environmental standards.

The presentation of Mr. Busch can be obtained from Enviro Dynamics. Some comments were made which are presented below.

Person	Date	Comment	Response
Ms. Carol Steenkamp	8 April 09	Will the amount of phosphates and nitrates in the recycled water not be polluting?	No, it complies with the standards since the plant guarantees a specific measured outcome within the confines of the law.
Mr. Heiko Stritter	8 April 09	If understood correctly, the recycled water will be grey water. Will this not be polluting if it comes in contact with the groundwater?	Yes, the recycled water will be grey water. However, the ministry will only give a permit to the development if the grey water is found suitable and up to standard. The development plans to mix the grey water with clean water thus diluting it before distributing it to the gardens and golf course. The Country Club, for example, uses only grey water on their grass.
Mr. Barrie Watson	8 April 09	What fertilizers are to be used?	Grey water already contains fertilizers. If fertilizers are to be used it will be bio-degradable ones. The EIA also recommended that Kikuyu grass should not be used.
Ms. Dorette Opperman	8 April 09	In relation to the examples of other developments using the same filtering system, which compares with this	It will be the same size as Langstrand.

Person	Date	Comment	Response
		development?	
Ms. Carol Steenkamp	8 April 09	What will be done with the solid waste?	It will be made into compost and sold.
Ms. Carol Steenkamp	8 April 09	Do you need a permit to take solid waste to Rehoboth?	It is always good to have a copy of the agreement with the Municipality.
Ms. Dorette Opperman	8 April 09	Where will the compost heap be on the layout of the development?	The compost heap will be next to the sewage works. As mentioned the Ministry can issue a permit after the sewage works have been build, but based on the application they give their approval to go ahead.
Mr. Barrie Watson	8 April 09	Please identify the area where the workers will be accommodated.	95% of the workers will be transported in and out of the city or towns. Thus there will not be a staff quarters but only 10-15 rooms, not a big workers village.
Mr. Heiko Stritter	8 April 09	How did the Ministry arrive at the abstraction rate?	This is based on a 3day pumping test which was measured by probes which have been inserted into the boreholes.
Mr. M. Katjimune	8 April 09	Was a decrease of the water table in the boreholes of Gocheganas?	Best if Mr. Stritter brings his client to the Ministry in order for their questions to be answered.

6 The meeting closed at 16h20

ENVIRO DYNAMICS

ATTENDANCE LIST

AUASVIEW GOLF ESTATE ON PORTION 20 OF FARM GROSS HAIGAMAS NO. 447

Date: 08 April 2009
Place: Nice Restaurant, Windhoek

NAME	ORGANISATION/ AFFILIATION	POSITION	TELEPHONE	FAX	POSTAL ADDRESS	E-MAIL ADDRESS
C. Steenkamp	Enviro Dynamics	Env. Consultant	0812743458			carolsteenkamp@gmail.com.
C. Brevenga	Enviro Dynamics	Communication Officer	081 337 1166			Carla@enviro1.com
PT Paulus	DWAF	Asst. Hydrologist	208 4135	208 7160		
Alexander Wulf	Developer	Trustee				
Paul Bessis	Developer	Trustee	0811274321			
M. Katjimune	DWAF	Hydrogeologist	0812999659			
D. Sarah	NAMIB HYDROLOGICAL	HYDROLOGIST	220400	230934	BOX 11546 WINDHOEK	digenta@gcsnamibia.com
F. Bockhuhl	FERROMINE CONSULTANT	Geologist	0811278665	257490	Box 6999 WINDHOEK	bockmid@yahoomobile.com.na
L. Menge	DWAF	Hydrological Technician	0812739805	061-208 2160	Box 13193	

NAME	ORGANISATION/ AFFILIATION	POSITION	TELEPHONE	FAX	POSTAL ADDRESS	E-MAIL ADDRESS
Veronica Sitekela	DWAF	Hydrological technician	2087103	2087140	P.o.box 13193	Sitekelave@mawf.gov.na
[illegible]	MRLGHRD	Planner	297 5189			[illegible]
Dorette Opperman	MRLGHRD	Town Planner	297-5224	226049		dopperman@mrlgh.gov.na
Bernie Lobeb		Town Planner	0811402457	—	Box 5666	bpw@iafrica.com.na
Günter Gutschke	SPC	Town Planner	0811291609	232157	Box 1660 Swk	guenther@spc.iway.na
Heike Stritter	Engling Stritter & Partners	Attorney	081-124-1432	233672	Box 43, Wdk	heike.stritter@englingstritter.com.na
Koos van Greuning	Erongo Valley Development Consultants	Planner	0811279909	227146	Box 21143, Wdk.	Coen@iway.com.na
F. Swart	IDC	Engineer	304344	304343	Box 2321 Wdk	idcgse@iway.na
Marisa Hahne	Omega		081 1473831	400847	PO Box 26078	marisa@omegagolf.com
Wouter van Zyl	Header Group	Project Manager	081 128 5044	262 633	PO Box 26075	wouter@header.com
Alex Rusch	Aqua Envirotech	Project Engineer	081 3656338	257629	P.O.Box 20714	alex.rusch@aqua.com.na
Steven Paahle	EVDC	Partner	0818275711	264762	Box 80072	steven@evdc.com.na

Appendix I: Issues & Response Trail

The table below presents the issues raised by the stakeholders during the first and second phase of the EA. The trail excludes the issues presented by the specialists of the EIA team, but these are included in the summary of key issues presented in Section 5.

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
INCREASED NUMBER OF ERVEN AND VISUAL INTRUSION	Denis Moss Partnership	Written Comment 15 Sept 08	Proposed development will result in a visual intrusion and a significant alteration in the cultural landscape both of which will be almost impossible to mitigate	Visual fragmentation already exists along the B1. The developers and architect need to agree an Architectural design that is environmentally friendly and in harmony with the natural and cultural environment.
	Denis Moss Partnership	Written Comment, 15 Sept 08	Depending on the cost of land, bulk infrastructure, golf course construction and long-term maintenance and ancillary services it is doubtful whether the scale of the residential component will ensure the required economic feasibility and sustainability of the project.	The number of residential erven was increased from 108 to 398 to increase the economic feasibility of the project. See comment below.
	Ms. Dorette Opperman	Meeting, 8 April 09	Why was there an increase in the number of erven from 350-390?	A portion of land became available within the layout of the development. In order to utilize the space, erven were also set out on the open piece of land, hence the increase. In addition, the initial erven were

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
INCREASED NUMBER OF ERVEN	Stubenrauch Planning Consultants	Meeting, 8 April 09	The initial project scope presented to interested parties indicated that 108 erven were to be provided. Why was there an increase of the number of erven from the initial 108 to 350 and further to 392	envisaged to be large plots, however, this initial average size of the plots proved to be expensive and unviable, given the costs to service such large plots, vs. the current market situation. Thus, the size of the plots was decreased in order to them at a lower price. Consequently the number of erven set out increased. The turnover is more or less still the same, but the number of families buying into the development will increase.
	Stubenrauch Planning Consultants	Written objection 16 April 2009	Will additional open areas be used for further residential, commercial, or other development in future? Where will the cutoff be? In this case, the Golf Estate will no longer be with a natural area/setting as originally planned. Rather it will look like a normal township development.	NAMPAB and the Townships Board are to consider the maximum number of erven that may be allowed to ensure a natural setting, tranquil environment, and acceptable impact on the social and ecological fabric of the area. Even with the increased erven there is sufficient open space to ensure ecological balance and a relatively eco-friendly development. However, the environmental impact report will clearly state that the ceiling will now have to be placed on the total allowable number of erven to address the concerns raised.
HOUSE RULES AND EMP	CoW Environmental division	Written comment 11 Sep 08	In this draft report you suggest various management plans e.g. Integrated Waste Management Plan, Conservation Management Plan, and Energy Management Plan/Policy	A complete EMP will be developed as a follow up to the EIA in which all these issues will be addressed

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
			etc. From the readings, it sound like these Plans should be developed separately. I am of the opinion that all issues/activities to be addressed in these management plans could and with easiness be integrated and addressed in one Environmental Management Plan for the project	
	Mr. Heiko Stritter	Meeting ,8 April 09	What will the house rules entail and how will they be enforced?	House rules will be determined by the Project team in consultation with the Environmental Consultants and will be enforced by the home owner's association. An EMP will also be developed. The house rules will also outline the conditions which have to be adhered to by potential buyers.
HOUSE RULES AND EMP	Mr. Heiko Stritter	Meeting ,8 April 09	Who will set up the home owners' association rules? Can these rules be changed?	The Environmental team along with the developers will be responsible for setting up rules which will be stipulated in a legal document. Due to the nature of the development there is a lack of authority, hence the home owner's association will be established who will be responsible for enforcing the rules. The rules in the EMP, to be approved by MET can only be changed by resubmitting the document for reconsideration. The EMP should state which rules may be changed according to management arrangements and which may only be changed upon

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
				consultation with stakeholders and re-submission to MET.
	Mr. Heiko Stritter	Meeting ,8 April 09	When will the EMP be drafted and who will be responsible for monitoring it?	The EMP will be compiled by June 09. The overall responsible party will be the developer during the construction phase and the home owner's association during the operational phase. The Ministry of Environment and Tourism is responsible for ensuring that the EMP is implemented. Stakeholders have the right to a copy of the EMP and to ensure that the management actions contained therein are adhered to.
WATER ABSTRACTION AND WATER QUALITY	Dennis Moss Partnership	Written Comment 15 Sept 08	The impact on the water resources is the main issue of concern. It is questionable whether a sustainable water resource exists on site and whether the use of this resource on a golf course can be justified.	Pumping of the water will definitely influence the groundwater table should there be no recharge. There can also only be a recharge if there is a flow down. However, groundwater is protected by the Water Act since water permits are only issued for 5 years after which, a new application must be lodged.
	Dennis Moss Partnership	Written Comment 15 Sept 08	It is imperative that conclusive assurance be provided that the proposed abstraction will not result in irreversible detriment for other water users in the area.	It is recommended that a regional water census study be conducted by the MAWF and that all beneficiaries contribute to the costs.
	CoW Environmental	Written Comment	Which agent (City of Windhoek or the	The agent responsible for the long term

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
WATER ABSTRACTION AND WATER QUALITY	Division	11 Sept 08	developer) is responsible for conducting water sampling, monitoring etc.?	monitoring of boreholes will be identified in the EMP
	Mr. Heiko Stritter	Meeting ,8 April 09	There are concerns about the water.	Water tests have been conducted and the water quality and quantity will be monitored by MAWF.
	Mr. Heiko Stritter	Meeting ,8 April 09	Who will be responsible for taking the measurements of the water which will be tested?	MAWF.
	Mr. Barrie Watson	Meeting ,8 April 09	Water comes in from the west draining into the aquifer. What is happening to the water flowing in and where is its outflow, other farms possibly?	Pumping of the water will definitely influence the groundwater table should there be no recharge. There can also only be a recharge if there is a flow down. Since Namibia has such an intricate groundwater network drawing water from one place can affect your neighbors. However, groundwater is protected by the Water Act since water permits are only issued for 5 years after which, a new application must be lodged. This means that if aquifer recharge has been slower than the abstraction rate due to this project, the permit may be not be issued again and the developer instructed to make use of an alternative water source. Water will flow down to the lowest point.

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
WATER ABSTRACTION AND WATER QUALITY				It should be noted that the development falls outside a water-controlled area therefore no permit is required, only an EIA is required by the ministry. However, the developer will apply for a water permit in any case because of the new information about this aquifer, i.e. the extent of this aquifer was not previously known to MAWF. The EMP will also specify these conditions even though a permit is not legally required at this stage.
	Mr. Heiko Stiffler	Meeting ,8 April 09	The neighbors will thus be affected by this development. What security is there for them?	See comments above. According to the Water Act only some areas are demarcated as areas needing a water permit. However, the act is being amended in order to make the whole of Namibia a water-controlled area, but this still has to be approved by Cabinet.
	Mr. Heiko Stiffler	Meeting ,8 April 09	There are concerns about the sustainability of the water.	What guarantee is there that Windhoek will always have water? Just so, what guarantee is there that there will always be water and a golf course in this case? Thus, monitoring of the water has to be an ongoing process. Since one cannot say the development will be there forever, it will be a risk taken by the buyer. Four percent of each erf sale will be

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
WATER ABSTRACTION AND WATER QUALITY				dedicated to a fund which will be used for water risk and disaster management. The Developer has confirmed with NamWater that an alternative water source is available at the Oanob Scheme. A pipeline may be extended to supply this development of water if the groundwater source become unsustainable.
	Mr. Heiko Stritter	Meeting ,8 April 09	Isn't there an alternative underground water source?	No. While the borehole was being drilled it was found that the deeper you go the more pressure there is.
	Mr. Heiko Stritter	Meeting ,8 April 09	The water you are going to draw will it not be the same underground water that the neighbors depend on?	Yes it is very likely although the exact nature of the aquifer is not known at this stage. This is why the developer is applying for a permit from Water Affairs. The government must make decisions on the sustainable use of the aquifers, the numbers of users allowed to abstract water, the volumes of water to be abstracted by each user, etc.
	Mr. Heiko Stritter	Meeting ,8 April 09	Have tests been conducted for organic materials in the water? I.e. have organic samples been taken?	If organic materials has been detected in the water it means that the damage has already been done. For this reason mitigation measures are more important, i.e. to prevent future damage as a result of this development. The EMP will include a recommendation that monitoring commence before

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
WATER ABSTRACTION AND WATER QUALITY				construction in order to determine the baseline water quality.
	Mr. M. Katjimune	Meeting ,8 April 09	When the tests were conducted, did you (Namib Hydrosearch) consider what was going on upstream?	Inorganic samples have been taken upstream.
	Mr. Heiko Stritter	Meeting ,8 April 09	How did the Ministry arrive at the abstraction rate?	This is based on a 3 day pumping test which was measured by probes which have been inserted into the boreholes.
	Stubenrauch Planning Consultants	Written objection 16 April 2009		Agreed. The cumulative effects on the water resource need to be addressed. However the responsibility of addressing this issue lies with government. It is recommended by the Environmental Consult that the Ministry of Regional and Local Government, Housing and Rural development in conjunction with the Ministry of Agriculture, Water and Forestry, as a matter of urgency consider this issue – i.e. the overall characteristics of the aquifer, the overall sustainable yield, total abstraction for all developments in the area, overall pollution effects on the aquifer, combined with the total extent of this type of development to be allowed in the area not to cause unwanted ecological and social impact. The aquifer should also be included as a water control area.
	Engling, Stritter and	Written objection	The information presented to	See response from Ministry of Agriculture,

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
	Partners	8 May 2009	determine the permission for groundwater abstraction is flawed. (See entire report from Geopollution Technologies in **Appendix K**).	Water and Forestry in **Appendix B.**
	Engling, Stritter and Partners	Written objection 8 May 2009	Concerns exist, according to Geopollution Technologies, about the possible health hazard of helminth eggs in final effluent from sewage treatment plants, especially if the grey water is to be reused for golf green irrigation.	Post- treatment processes are available to remove and/or inactive the eggs before the water are used for irrigation. (See **Appendix E**). These mitigation measures will be included in the EMP.
SOLID WASTE AND EFFLUENT	Mr. Heiko Stritter	Meeting ,8 April 09	There are concerns about the sewerage.	The permit for the sewerage works, i.e. effluent permit, can only be obtained once its design has been completed. MAWF will approve the system as outlined in the development proposal after which construction thereof will commence.
SOLID WASTE AND EFFLUENT	Mr. Heiko Stritter	Meeting ,8 April 09	Where will the solid waste be taken?	It will be transported to Rehoboth with a truck.
	Ms. Carol Steenkamp	Meeting ,8 April 09	Do you need a permit to take solid waste to Rehoboth?	It is always good to have a copy of the agreement with the Municipality.
	Ms. Carol Steenkamp	Meeting ,8 April 09	Will the amount of phosphates and nitrates in the recycled water not be polluting?	No, it complies with the standards since the plant guarantees a specific measured outcome within the confines of the law.
	Mr. Heiko Stritter	Meeting ,8 April 09	If understood correctly, the recycled water will be grey water. Will this not	Yes, the recycled water will be grey water. However, the ministry will only

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
			be polluting if it comes in contact with the groundwater?	give a permit to the development if the grey water is found suitable and up to standard. The development plans to mix the grey water with clean water thus diluting it before distributing it to the gardens and golf course. The Country Club, for example, uses only grey water on their grass.
	Mr. Barrie Watson	Meeting ,8 April 09	What fertilizers are to be used?	Grey water already contains fertilizers. If fertilizers are to be used they will be bio-degradable ones. The EIA also recommends that Kikuyu grass should not be used.
	Ms. Carol Steenkamp	Meeting, 8 April 09	What will be done with the solid waste from the sewage treatment plant?	It will be made into compost and sold.
SOLID WASTE AND EFFLUENT	Ms. Dorette Opperman	Meeting ,8 April 09	Where will the compost heap be on the layout of the development?	The compost heap will be next to the sewage works. As mentioned the Ministry can issue a permit after the sewage works have been built, but based on this application they give their approval to go ahead.
WORK FORCE AND WORK FORCE ACCOMMODATION	Mr. Barrie Watson	Meeting ,8 April 09	Will the workers be transported?	Some of the workers (15 permanent workers) will stay on the estate while the others will be transported to the estate daily or as needed.
	Mr. Barrie Watson	Meeting ,8 April 09	Please identify the area where the workers will be accommodated.	95% of the workers will be transported in and out of the city or towns. Thus there will not be a staff quarters but only 10-15

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
				rooms, not a big workers village.
	Stubenrauch Planning Consultants	Written objection 16 April 2009	The development will require a large number of domestic workers. The practicality, sustainability, and personal responsibility for the workforce to travel on a daily basis needs to be considered with great care. If not, informal settlements areas may result near the development. This would have a negative social impact on the affected communities and the surrounding property owners.	The social responsibility for the workforce will be addressed in the EIA and EMP. Their accommodation arrangements need to be considered in light of this comment.
FINANCIAL CONTRIBUTION TO MUNICIPAL SERVICES IN WINDHOEK AND REHOBOTH	Stubenrauch Planning Consultants	Written objection 16 April 2009	There will be an increased burden on the Rehoboth Municipality to receive the waste from this development. The residents of this development will enjoy the services of the two nearby towns but will not contribute to them in terms of rates and taxes.	The distribution of even contribution to rates and taxes should be considered and levied by the Regional Authorities, in this case the Khomas Regional Council. Before a commitment is made to dispose of the waste at Rehoboth, the total volumes of waste to be generated should be assessed, and this confirmed with the Rehoboth Municipality, i.e. whether they are in a position to in fact receive this waste. The potential impact of reduced income and economic activity, but increased burden on services in the mentioned centres as a result of this and similar satellite developments should be considered at strategic level by the

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
				Regional Council. These issues, however, cannot be made the responsibility of the developer.
MUNICIPAL SERVICE PROVISION/	Stubenrauch Planning Consultants	Written objection 16 April 2009	The development falls outside a competent and properly consituted local authority area where quality control of the construction and maintenance of municipal services is guaranteed. There is a risk to buyers that the developer might fail to provide these services.	This risk will be every buyers' own, since it will be in the hands of the buyers collectively to form a homeowners association to take care of the maintenance, administration, and upkeep of the development, until such time as there is an established local authorities to assist in these matters. There should be enough financial transfer between during the transition from the developer to the homeowners association to ensure sustained maintenance of infrastructure and services. This will be included in the EMP. The Ministry of Regional and Local Government, Housing and Rural Development should however also take note of this issue and address this without delay.
LOSS OF TREES	Stubenrauch Planning Consultants	Written objection 16 April 2009	The buildings, roads, infrastructure, etc. will cause destruction of the trees that form part of the *Acacia erioloba* Forest, protected by law. The tranquility of the estate will be lost, the surface and underground water recharge will be affected, and additional trees will be lost due to	This issue will be addressed in the EIA, with mitigation proposed in the EMP to limit the destruction of trees to the absolute minimum.

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
			reduced water tables.	
INADEQUATE REPSONSEE TIME	Stubenrauch Planning Consultants	Written objection 16 April 2009	The response time for stakeholder to comment on the information presented at the meeting was too short.	The deadline for comments was extended on request by Mr Stritter. Their final comments, dated 8 May 2009, 3 weeks subsequent to the meeting date, have all been incorporated into this report and will be addressed more fully in the EIA and EMP.
LEGAL OBLIGATIONS	Stubenrauch Planning Consultants	Written objection 16 April 2009	All legal and policy obligations, including the Environmental Management Act and Draft Regulations, Environmental Assessment Policy, Forest Act, Nature Conservation Ordinance, Water Act and others need to be taken into consideration before development of this area.	The Scoping Report, EIA, and EMP will all take full cognizance of applicable legal obligations, including the ones mentioned. Permit and approval requirements will be stipulated in the EMP.
PUBLIC PARTICIPATION	Stubenrauch Planning Consultants	Written objection 16 April 2009	The follow up meeting was not advertised publically.	Best practice is to invite stakeholders to register as stakeholder at the outset of the environmental assessment process so that all ensuing communication may be set to them. This invitation duly appears in the initial advertisements (see Appendix H). For this reason it is not necessary to advertise the meeting of 8 April publically. Rather the invitation to the meeting was sent to all registered stakeholders. The invitation was sent personally to all neighboring property owners and we ensured that Mr

ISSUE	PERSON/ORGANISATION	METHOD	COMMENT/QUESTION	RESPONSE
				Stubenrauch's client was aware of and could attend the meeting. Furthermore, the comments period was extended for the sake of this stakeholder and the consultant is of the opinion that ample opportunity was created for stakeholder input.
PUBLIC PARTICIPATION	Engling, Stritter and Partners	Written Comment, 15 April 09	The meeting on 8 April 2009 was not advertised and we were not provided with any information and documentation	See above response. The available documentation was send via e-mail to Mr Stritter. All relevant issues were dealt with at the meeting by means of presentations by the relevant people. Ample time was given for questions at the meeting. Stakeholders could respond by means of written comments as well.

GEO Pollution Technologies Namibia

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To: **Mr. U. M. Stritter** **17 March 2009**
Chairman Goche Ganas

Re: **Proposed Development on Portion 20 of the Farm Gross Haigamas no. 447**

Dear Sir

The Draft Environmental Scoping Report: Proposed Golf Estate and Ancillary Facilities on Portion 20 of the Farm Gross Haigamas no. 447, with Appendices A, B, D, E, F and G, dated September 2008, prepared by Enviro Dynamics for Auasview Investment Trust, has reference and is hereafter called the Report.

The Report states in *Section 1.1. BACKGROUND* that the development was expanded from 180 erven, to 345 erven and that consultation conducted was done based on a proposal for 108 erven. It is further stated that follow-up work will be needed to complete the EIA process, including:

- updated communication with stakeholders;
- confirmation that the groundwater resource is sustainable,

In *Section 2.4.1. The development*, it is stated that the **minimum** number of erven required to make this a financially viable project, would be 345 erven. In this section it is further stated that the Developer intends developing an 18-hole Golf Course. The Developer also plans to offer the following:

- Clubhouse;
- Boutique hotel with 10 - 15 rooms;
- Spa;
- Golf Driving range;
- Tennis courts;
- Chapel;
- Pre-primary and Primary school (150-200 pupils);
- Equestrian facilities on the neighbouring Out of Nature;
- Game drives on the neighbouring farm, Gross Haigamas;
- Hiking trails and mountain biking trails; and
- Staff village (accommodating ± 50 staff).

In *Section 2.4.2. Associated Infrastructure*, the estimated water consumption of the development is given as follows:

- Golf course irrigation: 360,000m³/annum (of which approximately 43,000m³/annum will be from recycled, treated sewerage water from residential units, clubhouse and boutique hotel)
- The Clubhouse, spa and residential units: 50m³ per household per month, (345 x 50 = 17,250m³/month = 207,000m³/annum).

It is also stated in this section that The Ministry of Agriculture Water and Forestry has granted permission to extract 350,000m³/annum. This will leave a water deficit of (360,000 + 207,000 – 350,000) = 217,000m³/annum, if the usage of recycled water is excluded. With the usage of 43,000m³/annum of recycled water, the deficit will be 174,000m³/annum

A more detailed water demand is needed with a detailed breakdown for Clubhouse, spa, residential units, school, workers (staying 50 and commuting 100) and hotel. The water demand of 50m³ per household per month is considered to be high especially seen in the light of the various water saving recommendations made in the Report. A decrease in this demand figure would probably cause a decrease in the amount of available recycled water.

In *Section 6. CONCLUSIONS AND RECOMMENDATIONS*, it is stated that Golf Estates use large amounts of water and since the final layout and feasibility of the development has not been done, it is crucial that the water demand of the Estate be determined and the sustainability of the resource be re-

evaluated. This statement is very important from a water demand point and should be conducted to determine if the project would be feasible.

In *Section 5.2.1. Threats/Impacts* it is stated that the sustainability of the production borehole in terms of water demand is a concern. In the next paragraph it is stated that water extraction of the proposed development will exceed the proportionate recharge of the area on which the development is to be made. This places doubt on the sustainability of the groundwater abstraction as per the water demand.

In Appendix G, a letter (Ref 12/13/8/1/2) from the Ministry of Agriculture, Water and Forestry it is said that "Naturally regular groundwater monitoring will be the only means at this stage of confirming the sustainability of the resource and should any negative effects result then the groundwater abstraction will have to be curtailed and this is a risk to the Developer. Alternative sources of water will then be needed and this should be cleared as part of the initial planning of the development."

From the Report and attached Appendixes studied, it is clear that there is serious doubt on the sustainability of the groundwater as a source of sole water supply to the proposed development. The Report does however not indicate that there is any study underway to look at alternative water sources, as per the recommendation made in the letter contained in Appendix G. As the supply of water to such a development forms a vital part of the sustainability of the proposed development, an alternative water supply must be studied and committed to, to ensure that the impact on such water sourced is evaluated now. This will protect future homeowners and potentially affected parties.

The implications for sustainability and recharge -- can be described by a simple water balance equation (Lohman, 1972):

$R + \Delta R = D + \Delta D + Q + S\,\Delta h/\Delta t$
where:
R = virgin recharge (inflow from neighbouring areas + recharge from rain and runoff water)
ΔR = change in recharge caused by pumping
D = virgin discharge (outflow to neighbouring area and to springs etc.)
ΔD = change in discharge caused by pumping
Q = rate of abstraction
$S\,\Delta h/\Delta t$ = rate of change of storage

From this equation it is clear that the rate of abstraction from the boreholes will most likely influence the rate of inflow onto the property, from neighbouring properties and the rate of outflow onto neighbouring properties. Considering the relative small ground area of the proposed development and the increase runoff that can be expected from new roof areas and from paved areas, constructed during the development it would be highly unlikely that recharge from rainfall would be sufficient to equal the proposed abstraction. It thus becomes evident that the proposed abstraction would abstract water from neighbouring properties and from storage, putting a limitation factor on these neighbouring properties to be developed to the optimum, due to water abstraction that would most likely exceed the sustainable abstraction for the proposed development area.

Pollution from the proposed development is also a concern. This is also indicated as such in the Report. In *Section 5.1.1. Introduction*, it is stated that lineament density maps indicate a high density of lineaments in the proposed development area. This section further states that there is a clay rich area on part of the proposed development, while the remaining area is predominantly sandy with a good infiltration rate. This clearly indicates that the groundwater is at potential risk. The Report however specifies protection zones around the abstraction boreholes, but the high density of lineaments (potential preferred flow paths of pollutants to the groundwater) seems to be left unprotected.

Sincerely,
Geo Pollution Technologies

Pierre Botha
B.Sc.(Hons.) Hydrogeology

SPECIALIST REPORT

HYDROGEOLOGICAL IMPACT ASSESSMENT

OMEYA GOLF AND RESIDENTIAL OASIS

Assessed for:

ENVIRO DYNAMICS
ENVIRONMENTAL MANAGEMENT CONSULTANTS
P.O. Box 20837
Windhoek

Assessed by:

Namib Hydrosearch

May 2009

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FIGURES, TABLES AND BOXES

APPENDICES

Appendix 1: Test pumping data interpretation & estimation of sustainable yield

ACRONYMS AND ABBREVIATIONS

CRT	Constant rate test
SDT	Step drawdown test
m^3/h	Cubic metre per hour
m^2/day	Metre square per day

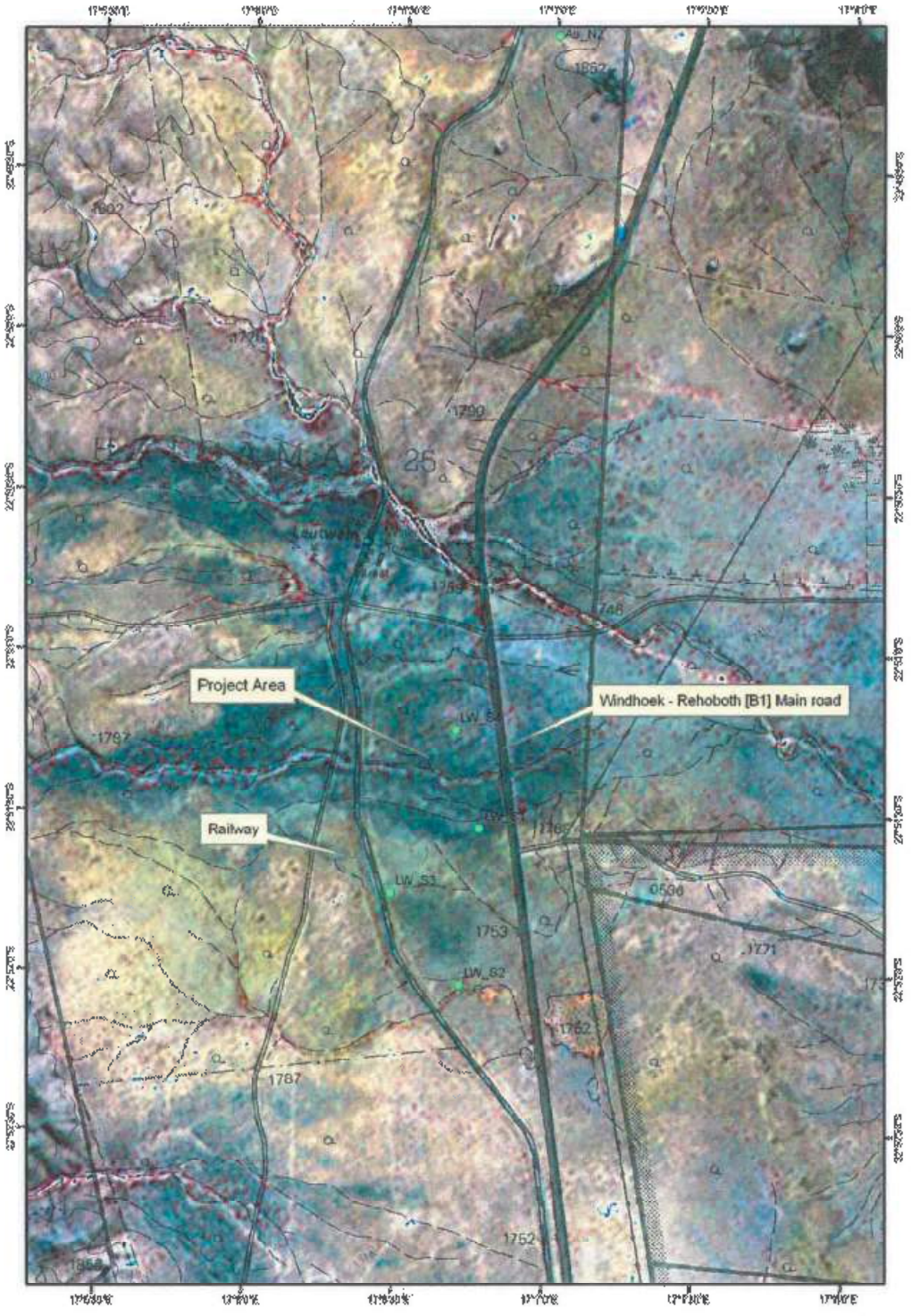
1: INTRODUCTION

Messrs Auas View Investment Trust initiated an Environmental Impact Assessment (EIA) for the purpose of establishing the current environmental conditions and assessing possible impacts from the development of a golf course in a part of Haigamas Farm. This report pertains to the hydrogeological component of the study. The location of the project area is shown in Figure 1.

For water supply to the golf course boreholes sites were selected and drilled on the Haigamas Farm (Bochmühl, 2008). Two pilot boreholes drilled into a fractured marble band at site LW-S4 and LW-S5 yielded approximately 100m³/h (blow out) each and the identified aquifer was selected for production purposes. A separate production borehole was drilled and test pumped.

The hydrogeology component of the EIA included the following tasks:

- test-pumping interpretation to estimate aquifer parameters, assess sustainable yield and potential affect of pumping
- Satellite image and aerial photographs interpretation compilation of a lineament map
- Mapping of the type of surfacial cover in the proposed development area using the satellite data
- Suggest protection zones around the production borehole



Namib Hydrosearch

2: LEGAL AND REGULATORY REQUIREMENTS

2.1 LEGISLATION ON WATER POLLUTION

This section reviews Namibian legislation, which focuses mainly on the conservation of water.

2.1.1 The Namibian Constitution

The Constitution of The Government of Namibia proclaims the following:

Article 100: Sovereign Ownership of Natural Resources

"Land, water and natural resources below and above the surface of the land and in the continental shelf and within the territorial waters and the exclusive economic zone of Namibia shall belong to the State if they are not otherwise lawfully owned."

All water resources in Namibia thus belong to the Namibia Government and as accordingly governed by The Ministry of Agriculture, Water and Forestry (MAWF).

2.1.2 The Water Act, Act No 54 of 1956

The Water Act (Act No. 54 of 1956) is still legally compulsory for Namibia. MAWF, on behalf of the Namibia Government, administer all water resources in Namibia and deals with all aspects of water management related to the utilization, control and conservation of this natural resource. The Water Amendment Act 22 of 1985 further enforces The Water Act by applying it to various conditions specifically occurring in Namibia.

2.1.3 The Water Resource Management Act, Act No 24 of 2004[1]

The Water Resource Management Act (Act No 24 of 2004) has been drafted to partly replace the old Water Act of 1956 and to elaborate on the functionality of the Water Act. Although the Water Resource Management Act has not been

[1] Not promulgated, but used as guideline.

promulgated, it is currently applied by MAWF with regard to water utilization and effluent disposal, both of which require a permit.

2.1.4 Other Legislation

The above-mentioned legislation mainly focuses on the protection and management of water resources. It should however be noted that The Petroleum Products and Energy Act (Act No. 13 Of 1990) governs the storage and handling of petroleum products and as such address the various aspects of petroleum licences and protection of the natural environment due to spillages or leakages.

3: DESCRIPTION OF NATURAL ENVIRONMENT

3.1 Geology

The para-gneiss and meta-sedimentary rocks of the *Hohewarte Complex* (age 1 800 Ma and older) are the predominant rock types in the area with minor intrusions of granites (*Gamsberg Suite*, 1 100 Ma) and isolated plugs of trachite and phonolite (32 to 39 Ma).

The para-gneiss and meta-sedimentary are generally highly weathered and decomposed close to surface, and along fracture zones. Fractures and faults often intruded by the younger trachites and phonolites, thereby to a certain degree destroying secondary porosity and thus the aquifer properties.

The soil cover in the area has been derived from the underlying lithologies and is classified as 'leptosol' (Atlas of Namibia, 2002) referring to shallow soil cover over hard rocks. Ephemeral drainages emanating from the topographically higher areas to the west bring in sedimentary load and deposits clay rich material on a wider area while sand accumulates along the actual channels.

3.2 Hydrogeology

In the project area groundwater is hosted in secondary fracture zones and weathered horizons along faults. Isolated deep faults display minimal weathering and have groundwater circulation to depths and yield mineralised water at elevated temperature (eg. at Gocheganas). In contrast, faults that are often highly weathered are the main source of groundwater in the basement rocks.

Average borehole yields in the area are between 1 and 2m³/h, but yield in excess of 10m³/h are known (Farms Krumhuk, Aris, Aris School, Gocheganas etc). Most high yielding boreholes on record have long production history, and apparently are utilized sustainable.

The boreholes drilled in Haigamas with exceptional yield were located on a dipping (40 to 50°), thin, faulted, pale grey marble horizon within the Hohewarte Complex. The ENE trending fault zone is about 50m wide and is marked by secondary silicification (chert and opaline silica). Granitic gneiss is exposed to the north and southern contact of the marble unit. The marble unit is exposed locally on a small hillock in the northern part of project area. Two ephemeral

streams emanating from the elevated areas to the west flow to the north and south of the outcrop and possibly across the horizon. The alluvial deposits from the streams cover most of the surrounding area making it difficult to trace the continuity of the marble band. However lineaments with roughly ESE and ENE orientation are coincident with the fault direction and can be traced on aerial photos and satellite imagery (Figure 2). This suggests that the fault is a large-scale structure.

The drilling information from the two boreholes, WW200684 and WW200683, drilled down dip of the fault zone is given in Table 1 and locations are shown in Figure 2.

	Borehole WW200683	Borehole WW200684
Depth	149m	179m
Depth to Water Strike (fracture zone)	Main water strike at 72m, 100m, 126m	Main water strike at 77m, 120m, 130m
Depth to Rest Water Level	61.94m	60.63m
Drilling Diameter		254 mm
Borehole construction	118m cased	127mm steel casing to 150m; 0.5mm slotted casing

Table 1: Borehole Information

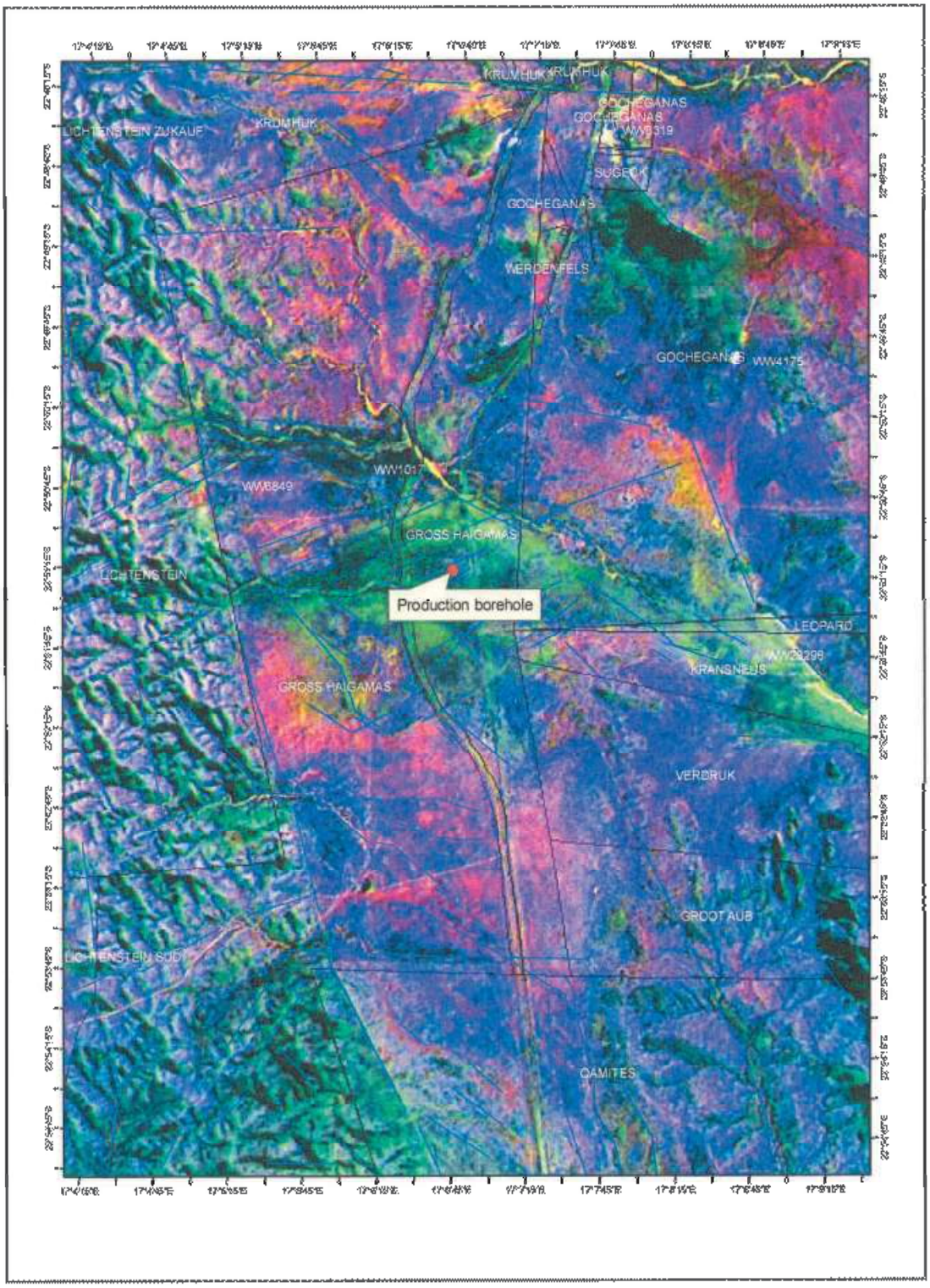


Figure 2: Aster image PC123 of bands 4, 8 and 1 with digitised lineaments

4: GROUNDWATER USAGE

Groundwater usage in the area has apparently increased with new developments following the rezoning according to the Aris Town Planning Scheme (15/02/2007). In general, the area was used for normal rural residence at a density of 1 unit per 5 Ha. Consent use exists for nature estate developments where density of 1 unit per 1Ha is permitted. Although a recent hydrocensus of the area is lacking, it is known that several groundwater schemes exist in the area. A few are noted here:

- Supply of water to the Agricultural Training Centre at Aris from Farm Krumhuk.
- Supply of water to the Aris School from Farm Krumhuk.
- Supply to the Peralin paint factory.
- Supply to the Gocheganas milk farm.
- Supply to Aqua Splash Mineral Water factory.
- New resorts to the south of the proposed golf course.

Details on the current usage, such as, abstraction rate, abstraction volume, and particulars of user's permits are not known. The change is occupancy and landuse in the area requires an assessment of the current water usage and water supply situation in the entire area. Therefore a complete picture of water usage in the area cannot be given at this stage. However, the boreholes listed on the DWA database is shown in Figure 2.

5: ASSESSMENT OF IMPACTS

5.1 METHODOLOGY EMPLOYED FOR THE IMPACT ASSESSMENT

The following criteria were used to describe and determine the significance of the impacts identified.

Table5-1: Criteria used to describe impacts.

	Description
Nature	Reviews the type of effect that the proposed activity will have on the relevant component of the environment and includes "what will be affected and how?"
Extent	Indicates whether the impact will be site specific; local (limited to within 15 km of the area, including Aris); regional (limited to ~100 km radius); national (limited to the coastline of Namibia); or international (extending beyond Namibia's boarders).
Duration	Reviews the lifetime of the impact, as being short (days, <1 month), medium (months, <1 year), long (years, <10 years), or permanent (generations, or >10 years).
Intensity	Establishes whether the magnitude of the impact is destructive or innocuous and whether or not it exceeds set standards, and is described as none (no impact); low (where natural/ social environmental functions and processes are negligibly affected); medium (where the environment continues to function but in a noticeably modified manner); or high (where environmental functions and processes are altered such that they temporarily or permanently cease and/or exceed legal standards/ requirements).
Probability	Considers the likelihood of the impact occurring and is described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of prevention measures).
Degree of Confidence in Predictions	Is based on the availability of specialist knowledge and other information.

The application of the above criteria to determine the significance of potential impacts uses a balanced combination of duration, extent and intensity/magnitude, modified by probability, cumulative effects and confidence. Significance is described as follows:

Table 5-1: Significance Criteria.

Significance Rating	Criteria
Low	Where the impact will have a negligible influence on the environment and no modifications or mitigations are necessary for the given project description. This would be allocated to impacts of any severity/ magnitude, if at a local scale/ extent and of temporary duration/time.
Medium	Where the impact could have an influence on the environment, which will require modification of the project design and/or alternative mitigation. This would be allocated to impacts of moderate severity/magnitude, locally to regionally, and in the short term.
High	Where the impact could have a significant influence on the environment and, in the event of a negative impact the

Significance Rating	Criteria
	activity(ies) causing it, should not be permitted (i.e. there could be a 'no-go' implication for the project, regardless of any possible mitigation). This would be allocated to impacts of high magnitude, locally for longer than a month, and/or of high magnitude regionally and beyond.

5.2 ASSESSMENT OF GROUNDWATER IMPACTS

The two main concerns regarding possible impacts on groundwater from the proposed development are:

1. Effect of abstraction on the general groundwater situation and on neighbours using groundwater, and
2. Possible pollution from activities during construction and operation of the facility.

To address point 1 above, a long-term sustainable yield was assessed from the test pumping of the production boreholes in two separate programmes. The results of the test pumping were also used to assess the influence of pumping on the aquifer and suggest adequate protection of the aquifer zone (protection zones).

Two constant rate tests were carried out – an initial program included a step drawdown test, a constant rate test (3 days) and recovery test. Following this program a long duration (14 days) constant rate test and recovery monitoring was done. Drawdown was recorded during the test and water level recovery was monitored for 44 days on completion of the test. Two observation boreholes at distances of 47m and 1400m respectively were monitored. The longer duration pumping test was done to confirm the aquifer parameters, monitor influence of pumping on observation boreholes and any barrier boundary effects.

The interpretation and results of the 3 day and 14 day test pumping data are given in Appendix 1.

The recommended abstraction rate was calculated based on the aquifer properties interpreted from on the long-duration test pumping data. The interpreted aquifer properties were used to simulate a 5-year drawdown curve at 50m³/h and at 60 m³/h. A barrier boundary was assumed at 500m from the borehole and available drawdown was restricted to 5m. No recharge to the aquifer is assumed during the simulated pumping period.

The model predicts 5m and 6m drawdown at the pumping rates of 50m³/h and 60m³/h respectively at the end of 5 years of pumping. Currently an available drawdown of 5m is assumed and the recommended pumping rate is 50m³/h (1,200m³/day). In carrying out this simulation the borehole is assumed to be

pumping continuously and no recharge to the aquifer is assumed. This estimate is comparable to sustainable yield calculated from a 3 day constant rate test pumping data from a nearby borehole in the same aquifer.

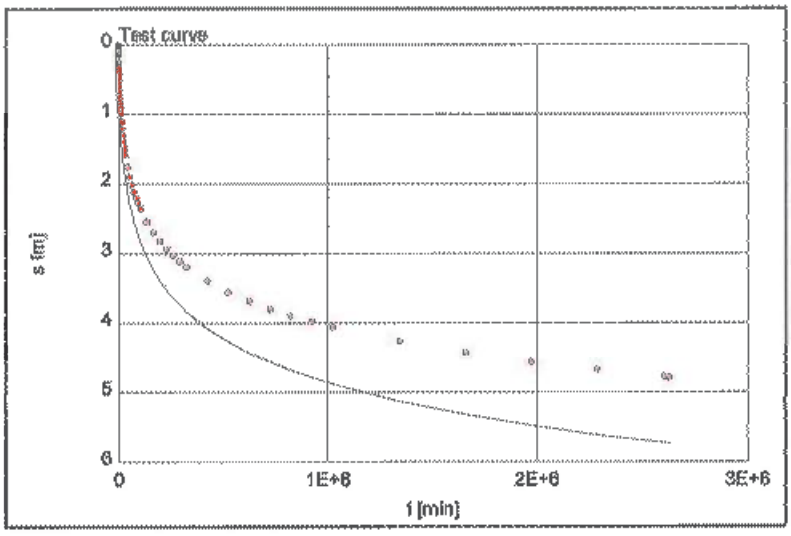


Figure 2: Simulated drawdown for 5 years pumping at 50m³/h (red dots) and 60m³/h (black line) assuming T = 250m²/day, S = 0.01, fracture half length = 535m and a barrier boundary at 500m.

Impacts:

Possible impacts on groundwater are listed below:

Although the recommended abstraction rate is calculated in a conservative manner it will only be possible to quantify based on monitoring of water level, abstraction and quality over a production period of a year or more.

Possible contamination sources are sewerage line and sewer treatment facility, and percolation of irrigation (fertigation) water. Although, the planned sewer treatment plant is located at an approximate distance of 1,500m in the southern extremity of the property and is not likely to have an effect on the aquifer, irrigation and fertigation could contaminate the aquifer.

The exposed fault zone is however vulnerable to pollution from any contaminant at surface. The fault zone represents unconfined aquifer and surface contaminant is likely to travel rapidly into the groundwater table.

Mitigation:

The following mitigation measures are recommended:

The recommended production pumping rate is limited to 50m³/h (1,200m³/day) calculated for an available drawdown of 5m. Monitoring of water level, water quality and abstraction rates is strongly recommended in the pumping borehole. Three other observation boreholes are available and it is recommended these boreholes be included for water level monitoring. The

data should be analysed at the end of every year of production or if high drawdown (greater than 5 m) is recorded so that the actual drawdown achieved can be compared to the simulated figures. Abstraction rate can be adjusted on the basis of monitoring data analyses.

Although effect of production pumping is difficult to predict as the full extents of the aquifer is not known, water level monitoring and analyses would give enough evidence of declining groundwater levels and possible detrimental effects to the aquifer. To manage production pumping on the long term, a hydrocensus of the area would be necessary. The location of other production boreholes would have to be known to interpret monitoring results and evaluate any affect on them.

To avoid any surface contaminant reaching the water table the exposed fault zone would need protection.

Any solid or liquid waste (sewer lines, septic tanks, etc.) or fertigation should be avoided in the entire outcrop area of the fault zone as demarcated in

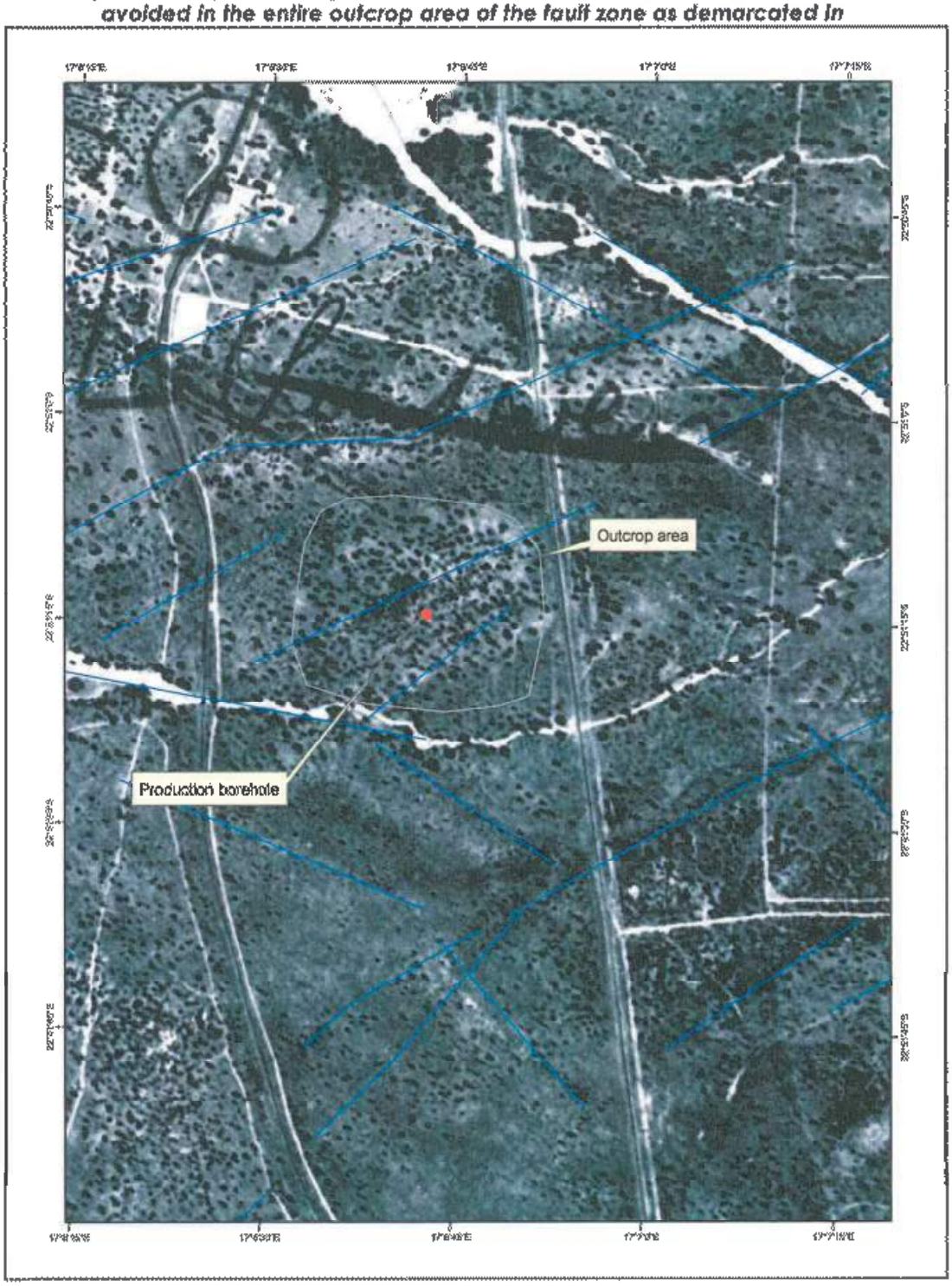


Figure 3.

Two protection zones are recommended around the production boreholes. Protection zone 1 has a radius of 20m around the borehole to be delineated with a fence to prevent any activity immediately around the borehole. A sanitary seal is recommended around the wellhead. Protection zone 2 has a radius of 120m around the borehole according to the test pumping interpretation.

In addition rainfall and water quality is to be observed. Water quality is to be monitored by periodic sampling (once every six months) for inorganic and microbiological content.

During construction if the production boreholes are utilised, protection and monitoring conditions as given above will apply during abstraction.

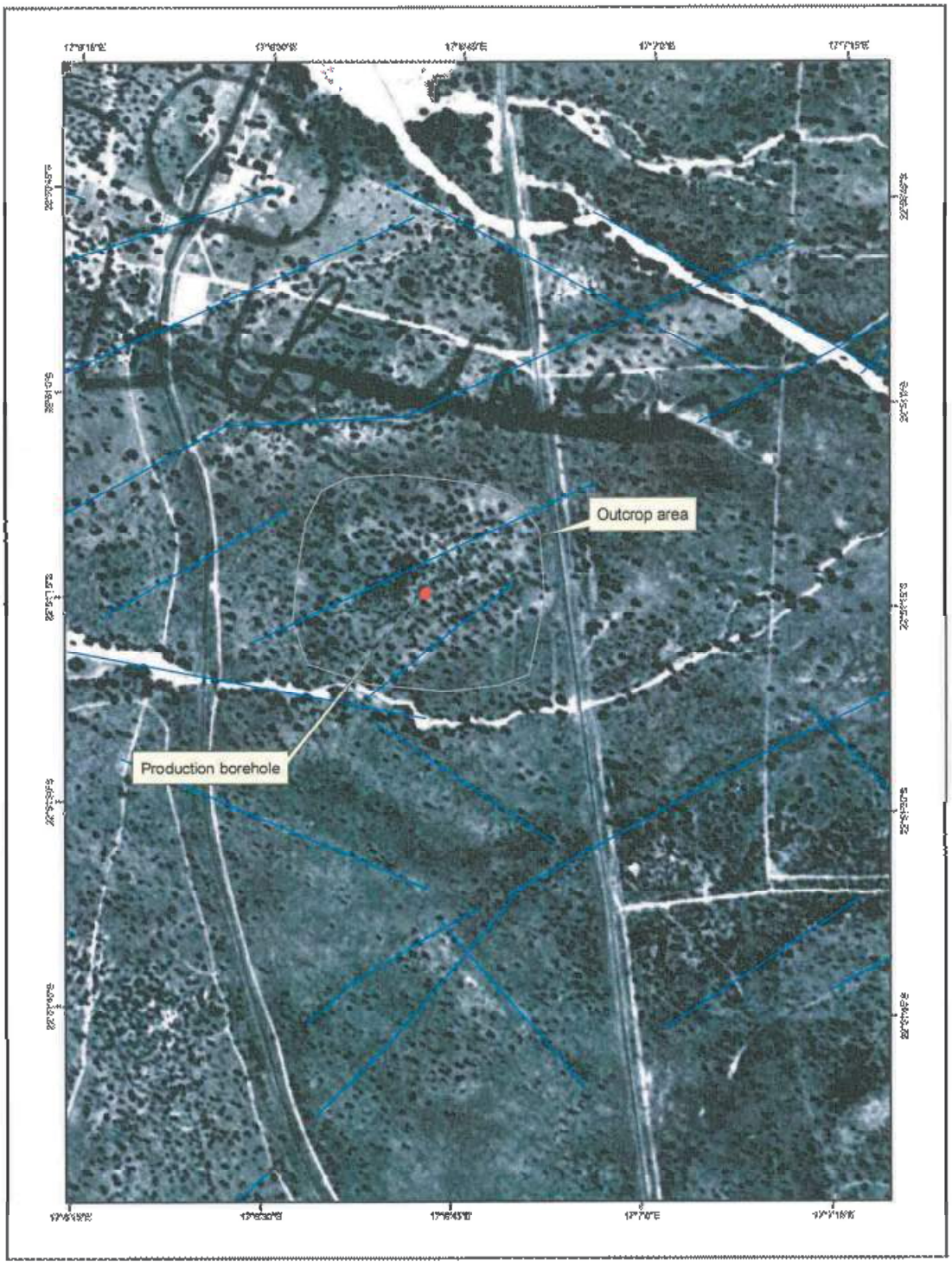


Figure 3: Aerial photograph showing faulted limestone outcrop

Table 2: Summary hydrogeological impacts before mitigation.

IMPACT	Nature	Extent	Duration	Intensity	Probability	Deg of Conf.	Significance
Construction phase							
Pollution of Groundwater	Potable groundwater resource	Local	Long	Medium to High	Probable	Medium	High
Operation phase							
Effluent Waters	Potable groundwater resource	Local	Generations	High	Probable	Medium	High
Pollution of Groundwater	Potable groundwater resource	Local	Long	Medium to High	Probable	Medium	High
Storage of Hazardous Material	Potable groundwater resource	Local	Long	Medium to High	Probable	Medium	High
Dewatering of aquifer	Potable groundwater resource	Local	Generations	High	Probable	Medium	High
Cumulative							
Groundwater Utilization	Potable groundwater resource	Local	Generations	High	Probable	Medium	High

Table 3: Summary hydrogeological impacts after mitigation.

IMPACT	Nature	Extent	Duration	Intensity	Probability	Deg of Conf.	Significance
Construction phase							
Pollution of Groundwater	Potable groundwater resource	Local	Long	Medium to High	Improbable	Medium	Low
Operation phase							
Effluent Waters	Potable groundwater resource	Local	Generations	High	Low likelihood	Medium	Low
Pollution of Groundwater	Potable groundwater resource	Local	Long	Medium to High	Improbable	Medium	Low
Storage of Hazardous Material	Potable groundwater resource	Local	Long	Medium	Low likelihood	Medium	Low
Dewatering	Potable groundwater resource	Local	Generations	High	Improbable	Medium	Low
Operation of Infrastructure							
Pollution of Groundwater	Potable groundwater resource	Local	Long	Medium to High	Improbable	Medium	Low
Cumulative							

IMPACT	Nature	Extent	Duration	Intensity	Probability	Deg of Conf.	Significance
Groundwater Utilization	Potable groundwater resource	Local	Generations	High	Improbable	Medium	Medium

6: RECOMMENDATIONS

The following recommendations are made:

- The production borehole is recommended for pumping at 50m³/h or 1,200m³/day.
- Monitoring of water level, water quality and abstraction rates is strongly recommended. The monitoring data is recommended for analyses at the end of every year of production and in case high drawdown. Abstraction rates may be adjusted on the basis of the monitoring data analyses.
- Protection zones are recommended around the production borehole. A sanitary seal is recommended around the wellhead.
- Within the outcrop area development that carries a risk of leakage of solid or liquid waste (sewer lines, septic tanks, etc.) and fertigation should be avoided.
- Recent data on groundwater use in the rezoned area under the Aris Town Planning Scheme is not available and a hydrocensus is recommended.

7: REFERENCES

Atlas of Namibia : A portrait of the Land and it's People. J Mendlesohn, A Jarvis, C Roberts & T Robertson. 2002 David Philip Publishers, Cape Town.

DWA, Borehole database. Ministry of Agriculture, Water and Forestry, Windhoek, Namibia.

8: Appendix 1

8.1 3-day test pumping data interpretation – Borehole WW200684

The borehole was subjected to a step drawdown test, 3 day constant rate test and recovery test. The pilot borehole at a distance of 36,6m was monitored during the tests.

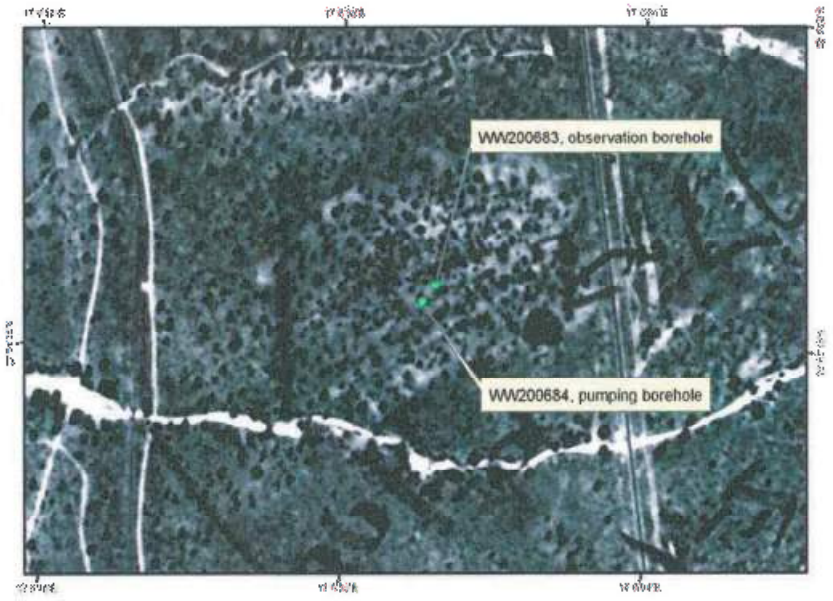


Figure 4: Location of borehole WW200683 and WW200684

8.2 Diagnostic plots

The drawdown data from the pumping and observation was plotted as semi-log and log-log graphs and on special plots. The pumping well data show the following features:

1. The data defines an almost horizontal drawdown curve at early time due to skin effect at the pumping well.
2. Linear flow period is identifiable at very early time from the linear drawdown vs. square root of time plot. Additional drawdown due to skin in the pumping borehole is recorded. In comparison with the derivative of the drawdown curve the additional drawdown is estimated as 1.6m. Skin

factor is estimated as 1.39 following method given in Bardenhagen (1999).

3. In early time, bi-linear flow is not detectable.
4. The radial acting flow regime is seen as a straight line of slope 0.46 at late time following a transition period after linear flow.

The diagnostic plots of the observation borehole show the following characteristics:

1. Linear flow during very early time is identifiable in the log drawdown vs. log time plot (log-log).
2. No skin effect is seen in the linear drawdown vs. square root of time plot, confirming that the skin is restricted to the pumping well.
3. The drawdown data plots as a straight line of 0.3 slope till the end of the test. The development of the radial flow regime is not seen.
4. The nature of the drawdown curve is similar in early time to that of the pumping well indicating that the fracture is conductive.

Based on the above, the Gringarten infinite conductivity and finite extent model is applied. The model is applicable to single fractures of high conductivity and finite extent. The drawdown curve usually shows linear flow characteristics in early time that develops into a radial acting flow after a transition period. At late time, when radial acting flow is developed in the pumping well Cooper-Jacob straight line method is applied.

8.3 Step drawdown test

A step drawdown test (SDT) was carried out in three steps and the results of the interpretation are given in Figure 5 and Table 4. The interpretation gives a formation loss co-efficient of 0.019 h/m^2 and a well loss co-efficient of 0.00008 h^2/m^5.

Step No	Discharge (m^3/h)	Hantush-Bierschenk's Method				Jacob's Method			
		Formation Loss, BQ (m)	Well Loss, CQ^2 (m)	Calculated Drawdown, BQ+CQ^2 (m)	Well Efficiency (%)	Formation Loss, BQ (m)	Well Loss, CQ^2 (m)	Calculated Drawdown, BQ+CQ^2 (m)	Well Efficiency (%)
1	25	0.48	0.05	0.53	91	0.48	0.05	0.53	91
2	50	0.97	0.19	1.16	83	0.97	0.19	1.16	83
3	75	1.51	0.47	1.98	76	1.51	0.47	1.98	76

Table 4: Step drawdown test interpretation, WW200684

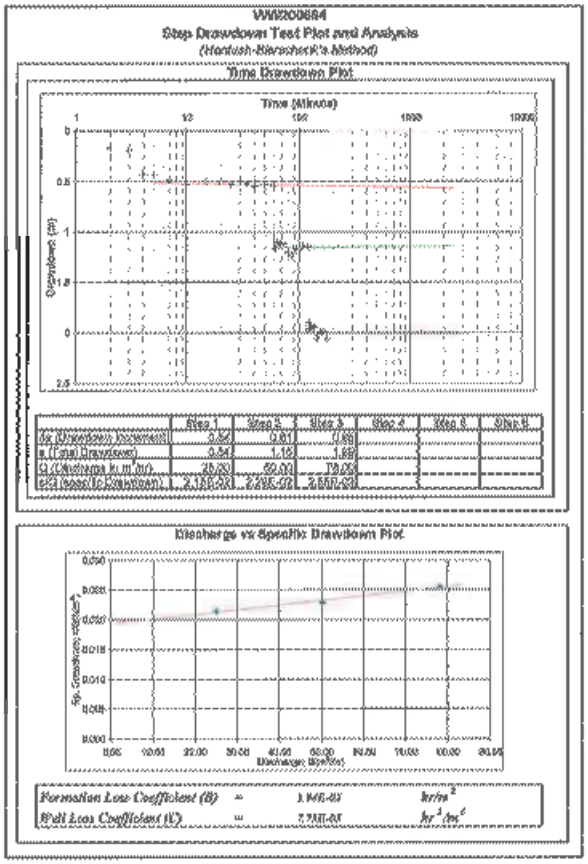


Figure 5: Step drawdown test, WW200684

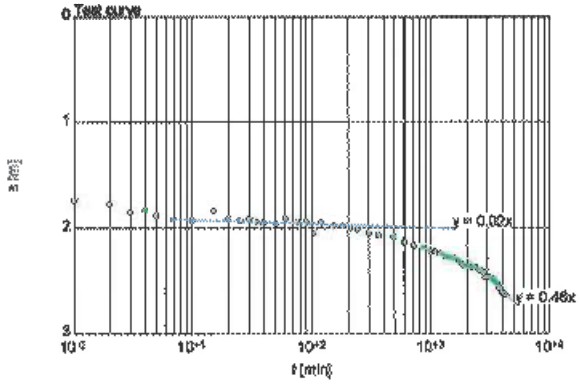


Figure 6: Linear drawdown and log time plot of the constant rate test data WW200684

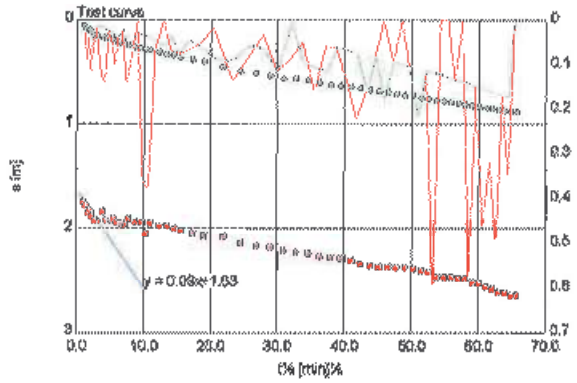


Figure 7: Linear drawdown and square root of time plot of constant rate test data WW200684 [red square] and WW200683 [green circles] and their derivatives

8.4 Constant rate and recovery tests

TPA (ver. 1) interpretation software was used to carry out type curve fitting. The late time pumping borehole drawdown data (radial flow) was interpreted using the Cooper-Jacob method. The straight line fit gave a transmissivity value of 257m²/day. The recovery data gave a higher transmissivity of 329m²/day. Cooper-Jacob or distance – drawdown method could not be applied to the observation borehole data as the radial flow regime is not developed.

The Gringarten infinite flux type curve fitting to drawdown and recovery data (Gringarten II) gave transmissivity values of 229m²/day and 220m²/day. The transmissivity values calculated are given in Table 2. The geometric mean of the transmissivity values is 278m²/day.

Method	Transmissivity (m²/day)
Gringaten II – drawdown data, pumping borehole	229
Gringaten II – recovery data, pumping borehole	220
Cooper – Jacob - drawdown data, pumping well late time	257
Cooper – Jacob - recovery data, pumping well late time	329
Gringaten II – drawdown data, observation borehole	392

Table 5: Transmissivity estimate from constant rate and recovery tests, WW200684

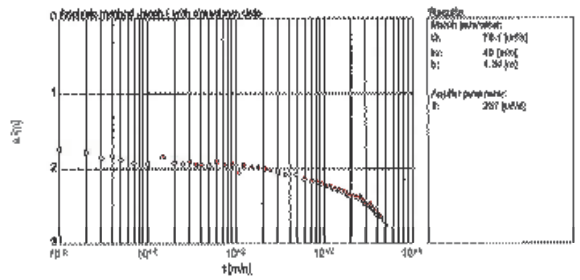


Figure 8: Estimation of transmissivity Cooper-Jacob Method, drawdown data, WW200684

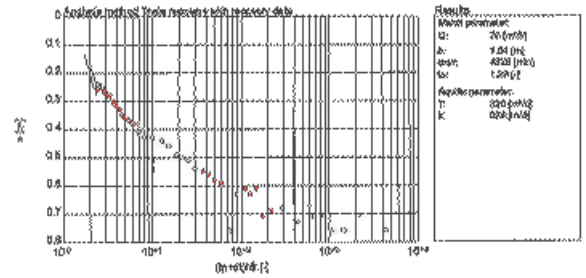


Figure 9: Estimation of transmissivity Cooper-Jacob Method, recovery data, WW200684

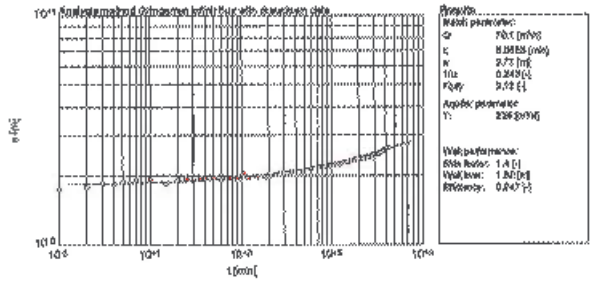


Figure 10: Estimation of transmissivity Gringarten I, drawdown data, WW200684

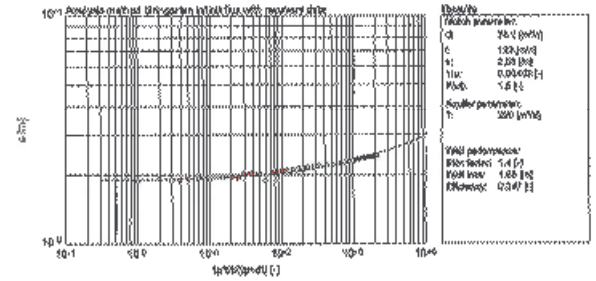


Figure 11: Estimation of transmissivity Gringarten II, recovery data, WW200684

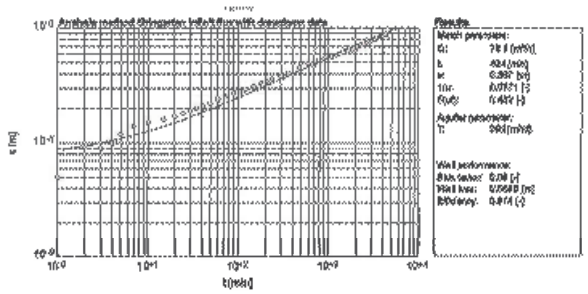


Figure 12: Estimation of transmissivity Gringarten II, drawdown data, WW200683

8.5 Sustainable Yield

To calculate the sustainable yield from the pumping borehole a Theis curve was fitted to late time data using the TestCurv program (DWA Botswana, 1999). The curve was extrapolated to 5 years after introducing a barrier boundary at the end of the data (i.e., the drawdown curve was extrapolated with double the slope). The available drawdown is usually calculated as the depth from the static water level to the main water strike. A series of water strikes were encountered in the borehole and to be safe the available drawdown is restricted to 5m.

Also, the FC-Method (Van Tonder *et al*, 1998) was used for estimating the sustainable abstraction rate for the borehole. This method uses a second order Taylor series expansion for extrapolating to the design period. The sustainable yield derived by this method is 50m³/h (14 l/s).

The Theis curve is extrapolated to 5 years assuming no recharge during this period. The sustainable yield from the borehole is 1040m³/day (or 43m³/h).

FC-METHOD : Estimation of the sustainable yield of a borehole			
0.00			
Extrapolation time in years = (enter)	5	2628000	Extrapol.time in minutes
Effective borehole radius (r_w) = (enter)	1.39		Est. r_w / From r(e) sheet
Q (l/s) from pumping test =	21.69444444	92.37	Est. r_e / Qualified guess
s_a (available drawdown), sigma_s = (enter)	5		Sigma_s from risk
Annual effective recharge (mm) =	5	10.00	s_available working drawdown(m)
t(end) and s(end) of pumping test =	4320	2.84	End time and drawdown of test
Average maximum derivative = (enter)	1.7	1.7	Estimate of average of max deriv
Average second derivative = (enter)	0.2	0.2	Estimate of average second deriv
Derivative at radial flow period = (enter)	1.5		Read from derivative graph
T-early(m^2/d) =		226.6#	Aqui. thick (m) / 30
T and S estimates from derivatives	T-late (m^2/d) =	308.11	Est. S-late = / 1.65E-03
(To obtain correct S-value, use program RPTSOLV)	S-late =	1.65E-03	S-estimate could be wrong
BASIC SOLUTION			
(Using derivatives + subjective information about boundaries)		Maximum influence of boundaries at long time	
(No values of T and S are necessary)	No boundaries	1 no-flow	2 no-flow / Closed no-flow
sWell (Extrapol.time) =	8.03	12.66	17.29 / 31.19
Q_sust (l/s) =	27.03	17.14	12.54 / 6.85
	Best case		Worst case
Average Q_sust (l/s) =	14.18		
with standard deviation=	8.60		

Table 6: Estimation of sustainable yield using FC method

8.6 Borehole protection zone

Pollution is a cost consideration and prevention is less expensive than remediation. This is especially true for water resources developed in fractured aquifer because of (a) technical problem expected in hard rock fractured aquifers; and/or (b) prohibitive costs. Once the threat of aquifer deterioration (in quantity or quality) has been recognised, protection measures can be taken.

The most severe threats to groundwater quality degradation are from sanitation practices, fuels and oils and fertilizers which may result in contamination of the groundwater. The amount of contaminants reaching the groundwater will depend not only on the amount of water introduced from sanitation but also on the prevailing hydrogeological conditions (aquifer vulnerability).

Three major protection zones are recommended around a borehole, these have been distinguished as Zones 1 and 2, and are described briefly below.

8.6.1.1 *Protection Zone 1*

This zone describes the immediate area around the borehole and prevents any activities taking place in the vicinity of the well head. The distance between the borehole and the fence is somewhat arbitrary with some literature, Van Tonder *et al* (1998) suggesting a distance of 5m. However a radius of 20 m from the borehole is more appropriate to be delineated by a fence. In addition, a sanitary seal around the borehole is necessary.

8.6.1.2 *Protection Zone 2*

Zone 2 is proposed for protection of the groundwater against viruses, microbial and nitrate pollution. Many studies have shown that bacteria die off within 30 - 50 days which, for simplicity, is equated to a distance of 50m.

The fault zone is exposed at surface and this protection zone may not be adequate in the fractured aquifer as once the pollutant reaches the fracture zone, travel is accelerated and the possibility of attenuation of the pollutant is reduced. Therefore the estimated width of the protection zone is estimated using BPZONE program (Van Tonder *et al*, 1998). The fault zone half width is estimated as 240m and as the water level is deep and the unsaturated zone is thick a 120m radius around the borehole is recommended for Zone 2 protection.

Within the protection zone developments that could result in leakage of waste, particularly septage is to be avoided. Heavy fertigation of this area should also be avoided.

8.7 Long duration test pumping data interpretation & estimation of sustainable yield, Auas View Golf Course

8.7.1 Introduction

Messrs Auas View Investment Trust carried out an Environmental Impact Assessment (EIA) including a hydrogeological study for the exploitation of groundwater resources for developing a golf course in a part of Haigamas Farm. One of the recommendations of the EIA was to carry out a long duration pumping test on the borehole intended for use for production purpose. The location of the project area is shown in Figure 1.

A constant rate test was carried out at a discharge rate of 91.5m³/h for a period of approximately 14 days while water level recovery was monitored for 44 days. Two observation boreholes at distance of 47m and 1400m were monitored. Automatic pressure transducers with data loggers were used to monitor the water levels.

Mr A van der Walt of Auas View Investment Trust and project hydrogeologist Mr F Bochmuhl appointed Namib Hydrosearch CC, Windhoek to carry out the interpretation of the test pumping data.

8.7.2 Data interpretation

8.7.2.1 Aquifer conditions

The production borehole and pilot boreholes were drilled into a faulted pale grey marble band hosted in granite gneiss that outcrops on the northern part of the Haigamas Farm. The exposed part of the fault zone is about 50m wide and is marked by secondary silicification (chert and opaline silica). Lineaments coinciding with the fault location can be traced on aerial photos and satellite imagery and the fault is a large scale structure.

The production borehole is positioned in the approximate centre of exposed the fault zone. In the production borehole water was first struck at about 61m below ground level and several more strikes encountered to a depth of 150m increasing the initial blow-out yield to more than 250m³/h. The fault zone can be traced along its length in an east-northeast direction for about 700m. The pilot borehole (observation borehole 1) monitored during the test is located 47m in the up dip direction. A second borehole (observation borehole 2) recorded no drawdown.

The location of the boreholes is shown in Figure 1.

Borehole construction detail	Pumping borehole	Observation borehole (WW200683)
Depth	161m	149m
Depth to Water Strike (fracture zone)	Main water strike at 61m to 150m	Main water strike at 72m, 100m, 126m
Depth to Rest Water Level	59.28m	63.24m
Drilling Diameter	330mm	

Table 7: Borehole information

8.7.3 Diagnostic plots

The pumping and observation borehole 1 data was plotted on diagnostic plots that allowed identification of flow and aquifer characteristics using TPA software. The main observations are given below.

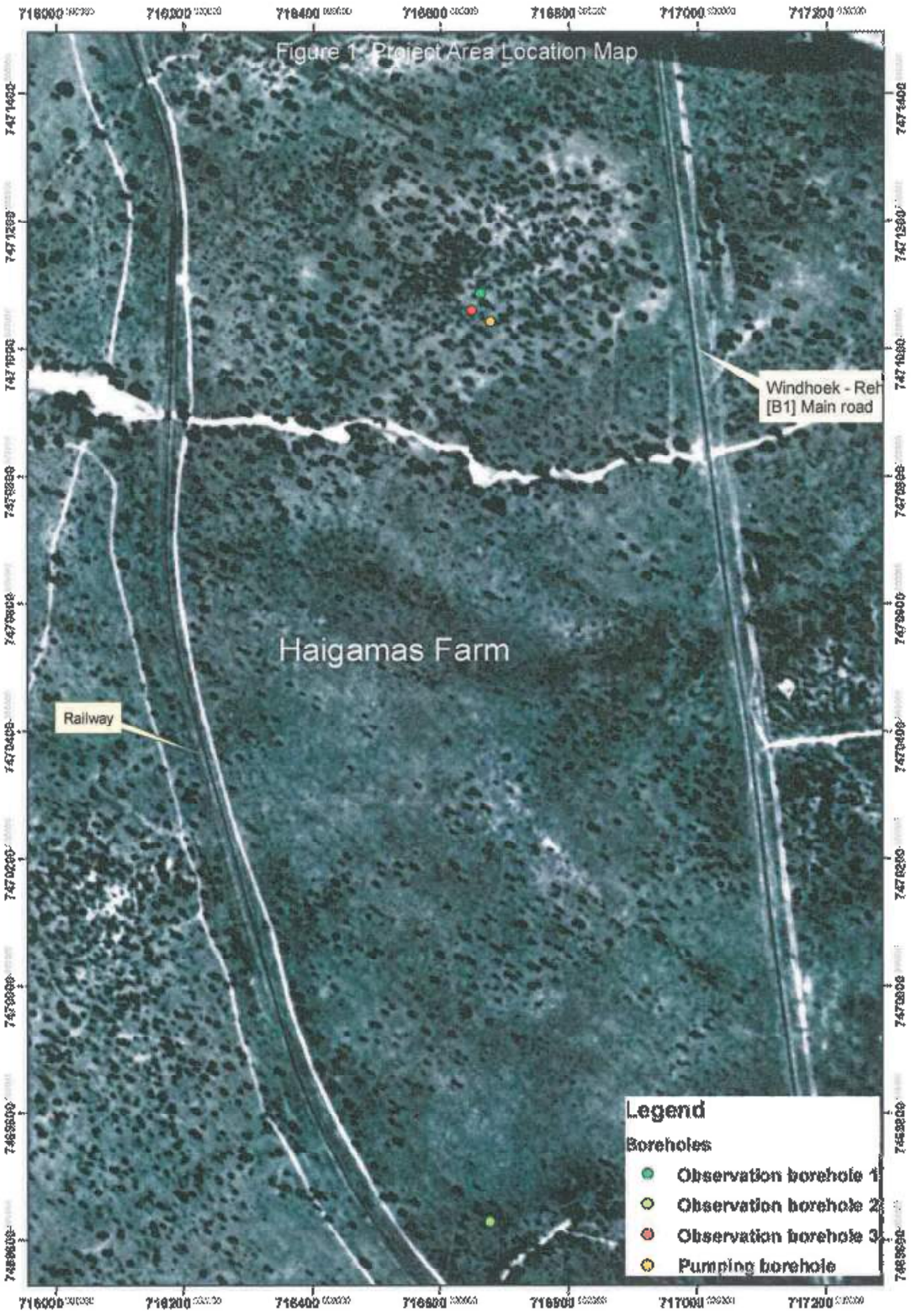


Figure 1: Project Area Location Map

5. The log time and linear drawdown plot showed

    a. that the nature of the drawdown curve is similar in early time to that of the observation borehole indicating that the fracture is conductive,
    b. that the late time drawdown data do not clearly define a straight line and so radial acting flow has not developed,
    c. an almost horizontal slope of the drawdown curve indicating skin effect on the pumping borehole and observation borehole.

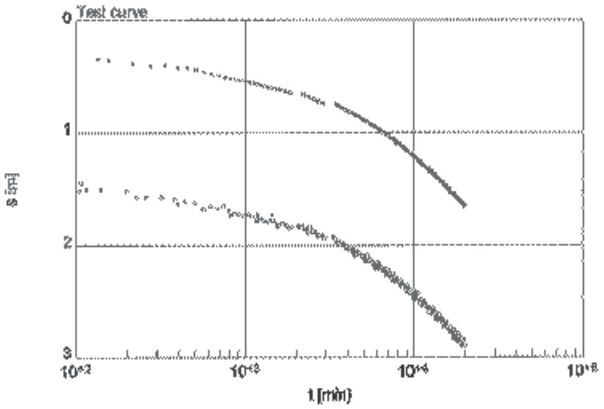


Figure 13: Semi-log plot of time drawdown data of the pumping borehole data (red squares) and observation borehole 1 data (green dots).

6. The log time – log drawdown plots (Figure 14 and Figure 15) defines an almost horizontal drawdown curve at early time due to skin effect at the pumping borehole. The first log derivative of the drawdown data of neither boreholes show flattening at late time as expected when radian acting flow becomes dominant.

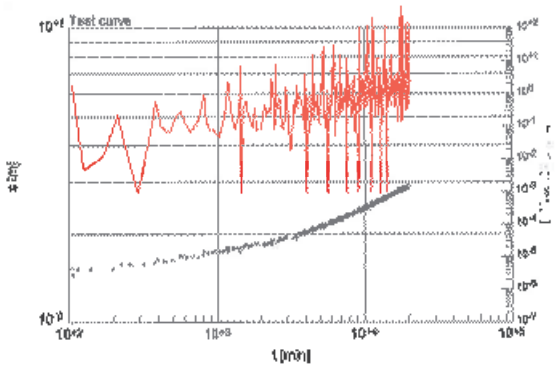


Figure 14: Log-log plot of the pumping borehole drawdown data with the first derivative curve

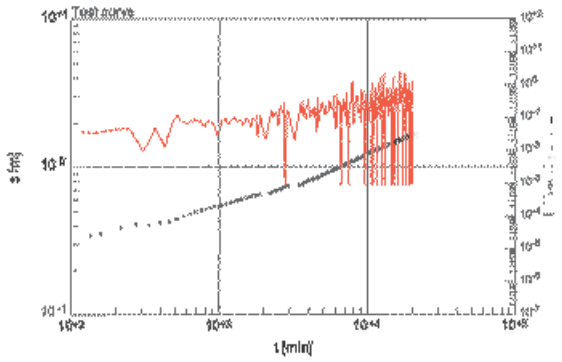


Figure 15: Log-log plot of the observation borehole drawdown data with the first derivative curve

7. In the linear drawdown vs. square root of time plot, the pumping and observation borehole data plot as straight lines with a positive intercept that has been used to estimate the additional drawdown due to skin effect following the method described by Bardenhagen (1999). The straight-line plots indicate linear flow during early time. The total skin on the pumping borehole is estimated as 1.2m and fracture skin on the observation borehole is 0.2m.

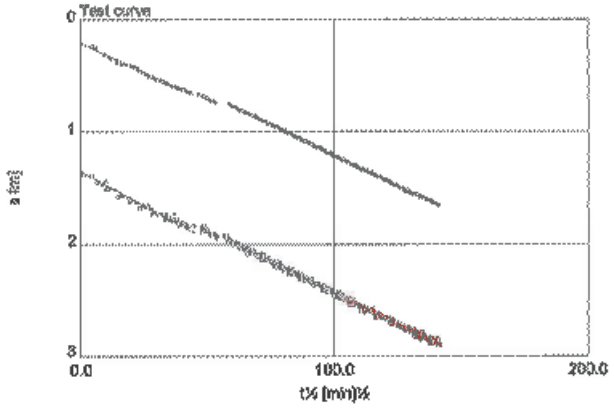


Figure 16: Diagnostic plot square root of time versus drawdown, (red squares pumping borehole data green circles observation borehole data)

8. The linear drawdown vs. fourth root of time plot of observation borehole 1 data shows the late time data plotting along a straight line that passes through the origin. The data indicates bi-linear flow during this period.

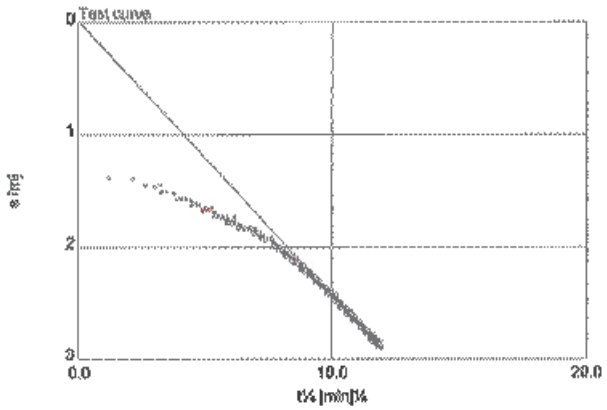


Figure 17: Fourth root of time versus drawdown plot of observation borehole 1 drawdown data

The diagnostic plots show that radial acting flow regime is not developed even though the test was conducted for 14 day and conventional techniques such as Theis and Jacobs solutions cannot be applied to the data. As the data shows that the fault zone is highly conductive and early linear, bilinear and transitional flow phases are only developed, Gringarten's solution for single vertical fracture with infinite conductivity and finite extend can be used.

8.7.4 Aquifer parameter estimation

The Gringarten uniform flux type curve fitting to (and simulation of) drawdown and recovery data gave aquifer parameters as summarised in Table 8. The mean of the transmissivity values is 305m²/day while the mean storativity is 0.014. The high storativity value is probably due to karstification of the faulted marble band. The observation borehole parameters were estimated by simulating the drawdown curves. The interpretation was done using TPA software.

Method	Transmissivity (m^2/day)	Storativity / fracture half length (m)
Gringaten uniform flux – drawdown data, pumping borehole	283	
Gringaten uniform flux – recovery data, pumping borehole	265	
Gringaten uniform flux – drawdown data, observation borehole	300	0.013 / 535
Gringaten uniform flux – recovery data, observation borehole	375	0.015 / 535

Table 8: Transmissivity estimate from constant rate and recovery tests

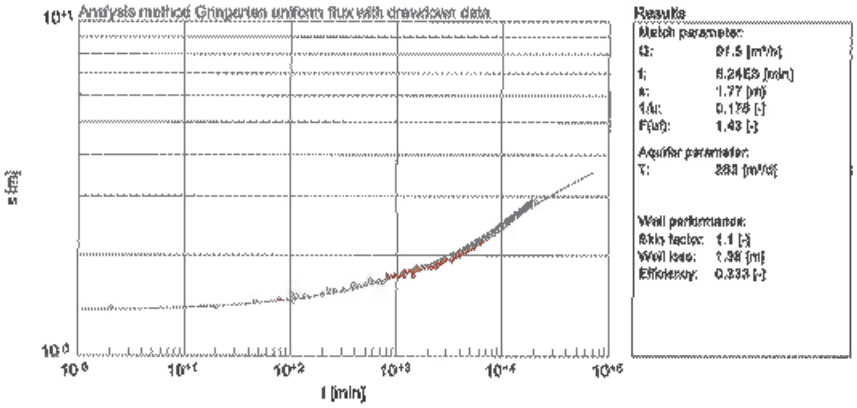


Figure 18: Type curve fitting to pumping borehole drawdown data [Gringarten's uniform flux]

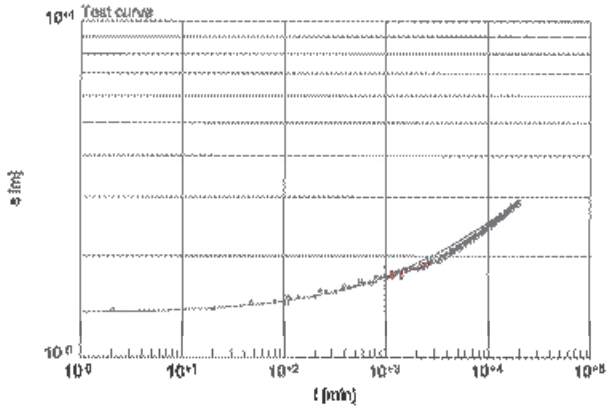


Figure 19: Simulation of pumping borehole drawdown data [Gringarten's uniform flux T= 285m²/day]

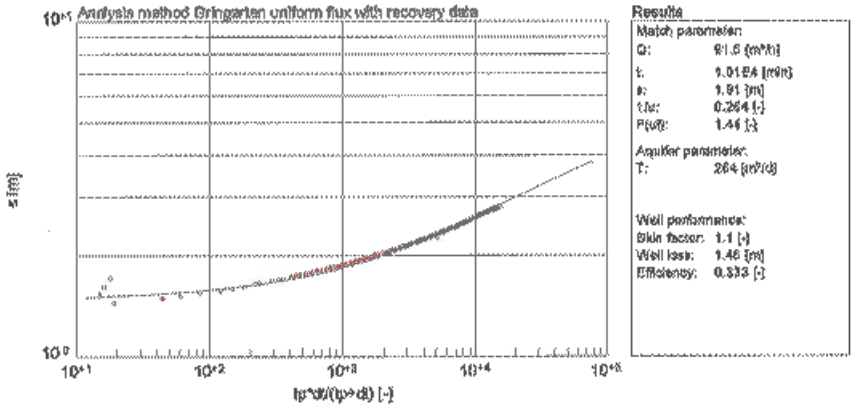


Figure 20: Curve fitting - pumping borehole recovery data - Gringarten's uniform flux

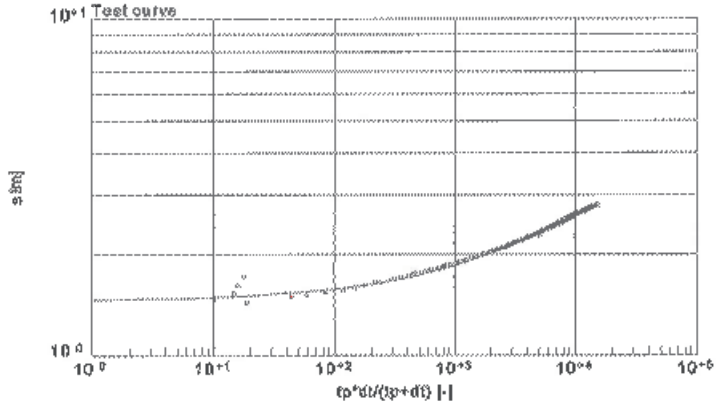


Figure 21: Simulation of pumping borehole recovery data [Gringarten's uniform flux T= 265m²/day]

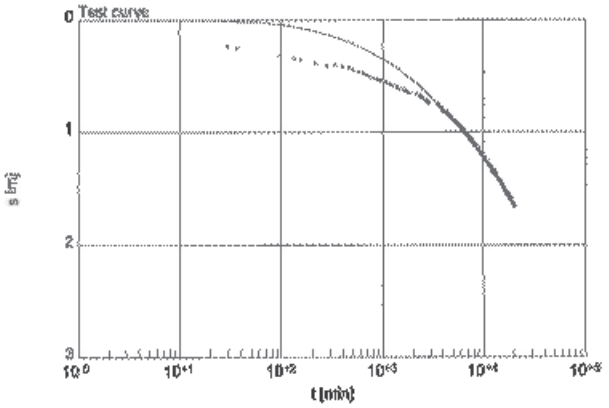


Figure 22: Simulation of observation borehole drawdown data [Gringarten's uniform flux, T = 300m²/day, S = 0.013, fracture half length = 535m]

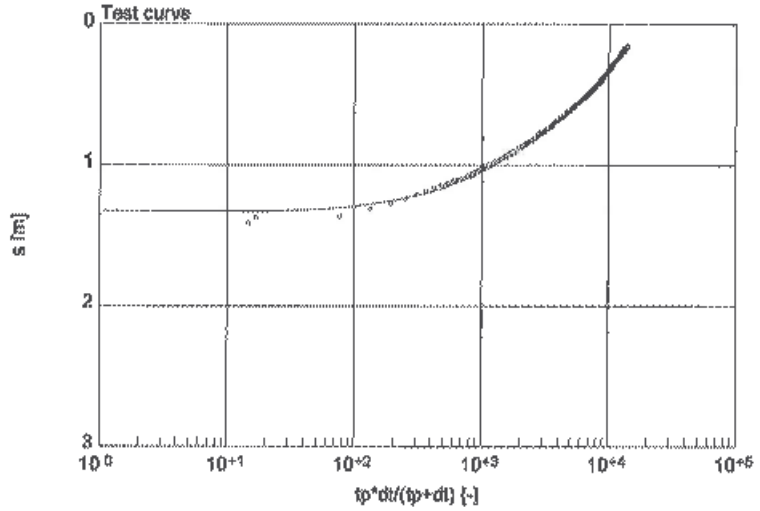


Figure 23: Simulation of observation borehole 1 recovery data [Gringarten's uniform flux, T = 375m²/day, S = 0.015, fracture half length = 535m]

8.7.5 Recommended abstraction and monitoring

The recommended abstraction rate is based on the interpreted aquifer properties. Conservative estimates were used to simulate a 5-year drawdown curve at 50m³/h and at 60 m³/h assuming a barrier boundary at 500m. The simulated data predicts 5m and 6m drawdown at the pumping rates respectively at the end of 5 years of pumping. Currently an available drawdown of 5m is assumed and the recommended pumping rate is therefore 50m³/h (1,200m³/day). In carrying out this simulation the borehole is assumed to be pumping continuously and no recharge to the aquifer is assumed. This estimate is comparable to sustainable yield calculated from constant rate test pumping data from a nearby borehole in the same aquifer.

Monitoring of water level, water quality and abstraction rates is strongly recommended in the pumping borehole. Also, three other observation boreholes are available and it is recommended these boreholes be included for water level monitoring (Figure 1). The data should be analysed at the end of every year of production or if high drawdown (greater than 5 m) is recorded so that the actual drawdown achieved can be compared to the simulated figures. Any increase in abstraction rate can be considered only on the basis of monitoring data analyses.

In addition rainfall and water quality is to be observed. Water quality could be monitored by periodic sampling (once every six months) for inorganic and microbiological content.

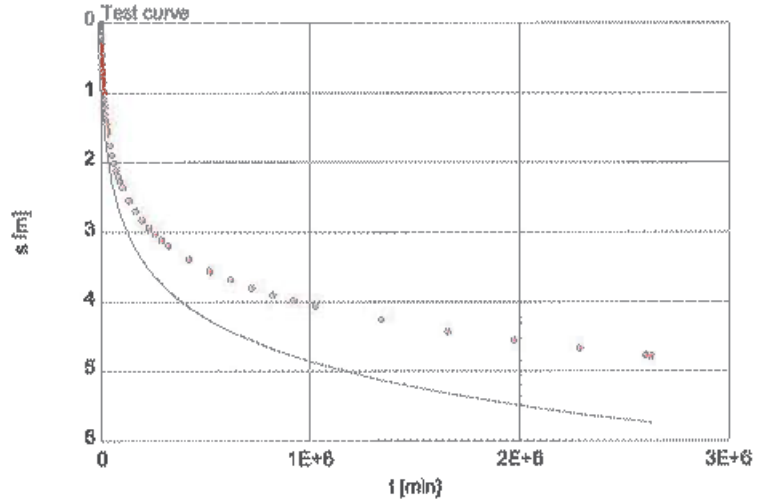


Figure 24: Simulated drawdown for 5 years pumping at 50m³/h (red dots) and 60m³/h (black line) assuming T = 250m²/day, S = 0.01, fracture half length = 535m and a barrier boundary at 500m.

NAMWATER

Namibia Water Corporation Ltd

Return Address: Namibia Water Corporation Ltd
Private Bag 13389, Windhoek, Namibia

Auas View Trust
P.O. Box 26078
Windhoek
Namibia

Our Reference:
Direct Phone: (+264-61) 71-2112
Direct Fax: (+264-61) 71-3801
E-mail Address: drewsh@namwater.com.na
Date: 18 May 2009

WATER SUPPLY TO OMEYA GOLF AND RESIDENTIAL ESTATE FROM OANOB DAM

Dear Sirs,

1. Your letter dated 23 April 2009 regarding supply of 300-350 000 m^3/a of water to the envisaged Omeya Golf and Residential Estate from Oanob Dam refers.

2. We would like to confirm that the Oanob dam and present Oanob water scheme currently and in the foreseeable future have sufficient spare capacity to supply above amounts of water to such development. This does not imply that the dam and scheme is the only or best source of water supply to the envisaged development. An application in this regard will however be considered.

3. Regarding the irrigation of the golf course, we would like to encourage you to investigate the feasibility of using recycled waste water from the residential estate for this purpose.

4. Supply of water to your project will require a considerable investment in bulk water supply infrastructure. For this, NamWater would have to undertake a planning investigation to determine the best technical and financial solution for supplying water to your development.

5. In order to be in a position to start with such investigation, it would be necessary that you enter into a Memorandum of Agreement with NamWater at your earliest convenience.

6. The contact person at NamWater for this project is Mr. Hanjörg Drews, Senior Manager Planning & Water Resources, Tel. 061 71 2112, Fax 061 71 3801, email DrewsHJ@namwater.com.na.

7. We are looking forward to working together with you and are confident that our relationship throughout the project will be an amicable one.

Yours faithfully

DR. K. TJIPANGANDJARA
GM: Engineering & Scientific Services

Long duration test pumping data interpretation & estimation of sustainable yield, Auas View Golf Course

1 INTRODUCTION

Messrs Auas View Investment Trust carried out an Environmental Impact Assessment (EIA) including a hydrogeological study for the exploitation of groundwater resources for developing a golf course in a part of Haigamas Farm. One of the recommendations of the EIA was to carry out a long duration pumping test on the borehole intended for use for production purpose. The location of the project area is shown in Figure 1.

A constant rate test was carried out at a discharge rate of 91.5m^3/h for a period of approximately 14 days while water level recovery was monitored for 44 days. Two observation boreholes at distance of 47m and 1400m were monitored. Automatic pressure transducers with data loggers were used to monitor the water levels.

Mr A van der Walt of Auas View Investment Trust and project hydrogeologist Mr F Bochmuhl appointed Namib Hydrosearch CC, Windhoek to carry out the interpretation of the test pumping data.

2 DATA INTERPRETATION

2.1 Aquifer conditions

The production borehole and pilot boreholes were drilled into a faulted pale grey marble band hosted in granite gneiss that outcrops on the northern part of the Haigamas Farm. The exposed part of the fault zone is about 50m wide and is marked by secondary silicification (chert and opaline silica). Lineaments coinciding with the fault location can be traced on aerial photos and satellite imagery and the fault is a large scale structure.

The production borehole is positioned in the approximate centre of exposed the fault zone. In the production borehole water was first struck at about 61m below ground level and several more strikes encountered to a depth of 150m increasing the initial blow-out yield to more than 250m^3/h. The fault zone can be traced along its length in an east-northeast direction for about 700m. The pilot borehole (observation borehole 1) monitored during the test is located 47m in the up dip direction. A second borehole (observation borehole 2) recorded no drawdown.

The location of the boreholes is shown in Figure 1.

Borehole construction detail	Pumping borehole	Observation borehole (WW200683)
Depth	161m	149m
Depth to Water Strike (fracture zone)	Main water strike at 61m to 150m	Main water strike at 72m, 100m, 126m
Depth to Rest Water Level	59.28m	63.24m
Drilling Diameter	330mm	

Table 1: Borehole information

2.2 Diagnostic plots

The pumping and observation borehole 1 data was plotted on diagnostic plots that allowed identification of flow and aquifer characteristics using TPA software. The main observations are given below.

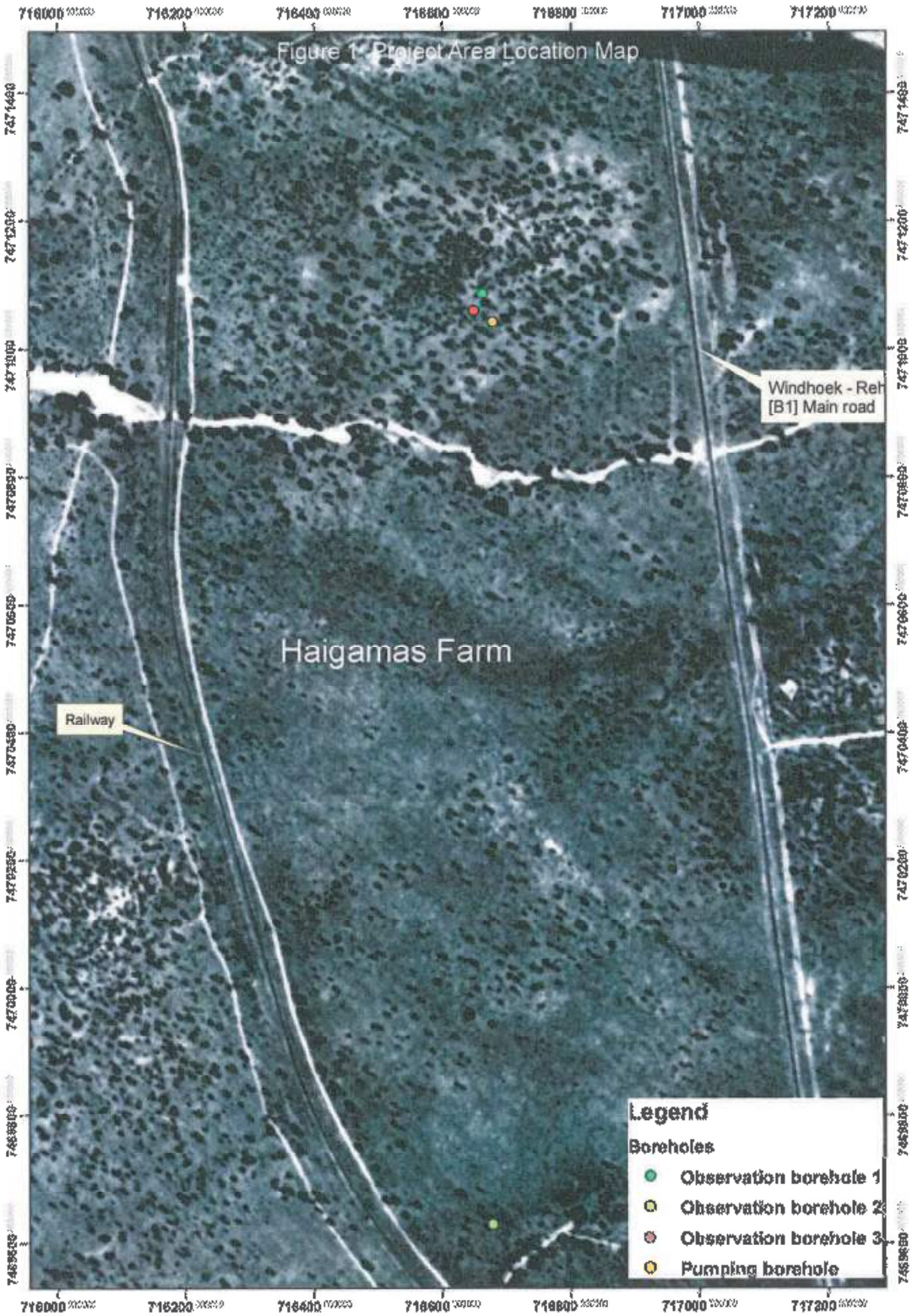


Figure 1: Project Area Location Map
Windhoek - Reh
[B1] Main road
Haigamas Farm
Railway
Legend
Boreholes
Observation borehole 1
Observation borehole 2
Observation borehole 3
Pumping borehole

1. The log time and linear drawdown plot showed
   a. that the nature of the drawdown curve is similar in early time to that of the observation borehole indicating that the fracture is conductive,
   b. that the late time drawdown data do not clearly define a straight line and so radial acting flow has not developed,
   c. an almost horizontal slope of the drawdown curve indicating skin effect on the pumping borehole and observation borehole.

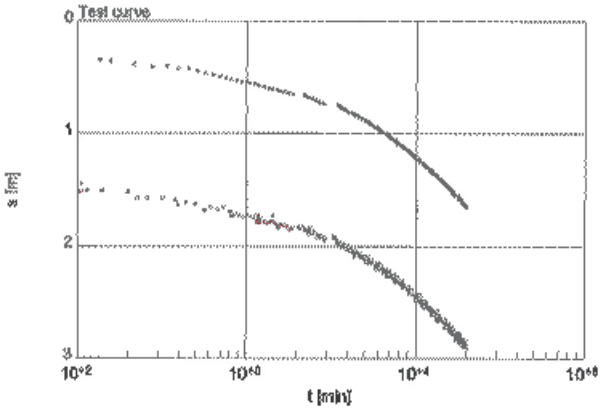


Figure 1: Semi-log plot of time drawdown data of the pumping borehole data (red squares) and observation borehole 1 data (green dots).

2. The log time – log drawdown plots (Figure 2 and Figure 3) defines an almost horizontal drawdown curve at early time due to skin effect at the pumping borehole. The first log derivative of the drawdown data of neither boreholes show flattening at late time as expected when radian acting flow becomes dominant.

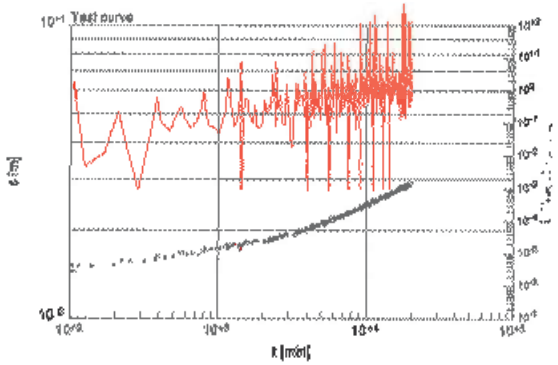


Figure 2: Log-log plot of the pumping borehole drawdown data with the first derivative curve

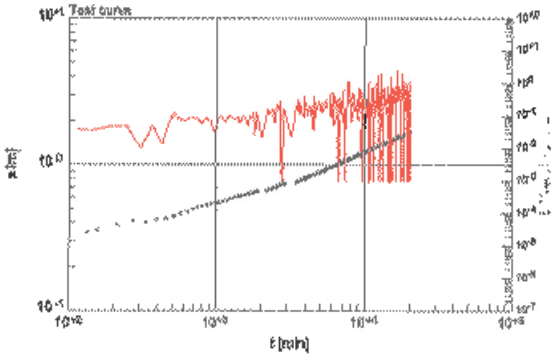


Figure 3: Log-log plot of the observation borehole drawdown data with the first derivative curve

3. In the linear drawdown vs. square root of time plot, the pumping and observation borehole data plot as straight lines with a positive intercept that has been used to estimate the additional drawdown due to skin effect following the method described by Bardenhagen (1999). The straight-line plots indicate linear flow during early time. The total skin on the pumping borehole is estimated as 1.2m and fracture skin on the observation borehole is 0.2m.

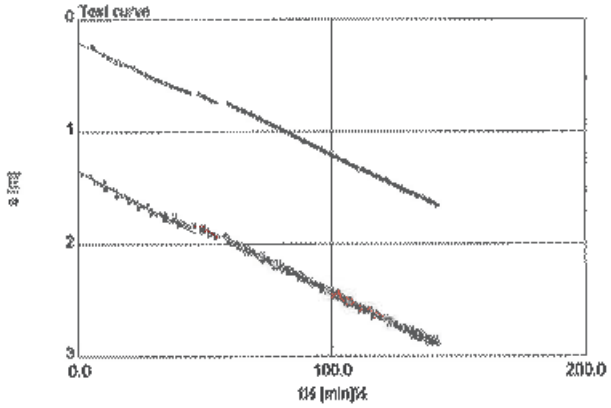


Figure 4:Diagnostic plot square root of time versus drawdown, (red squares pumping borehole data green circles observation borehole data)

4. The linear drawdown vs. fourth root of time plot of observation borehole 1 data shows the late time data plotting along a straight line that passes through the origin. The data indicates bi-linear flow during this period.

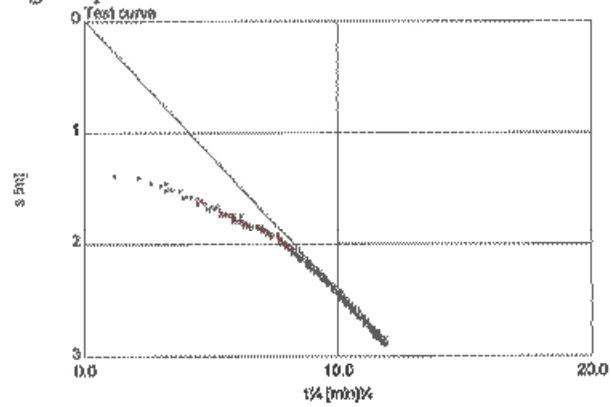


Figure 5: Fourth root of time versus drawdown plot of observation borehole 1 drawdown data

The diagnostic plots show that radial acting flow regime is not developed even though the test was conducted for 14 day and conventional techniques such as Theis and Jacobs solutions cannot be applied to the data. As the data shows that the fault zone is highly conductive and early linear, bilinear and transitional flow phases are only developed, Gringarten's solution for single vertical fracture with infinite conductivity and finite extend can be used.

2.3 Aquifer parameter estimation

The Gringarten uniform flux type curve fitting to (and simulation of) drawdown and recovery data gave aquifer parameters as summarised in Table 2. The mean of the transmissivity values is 305m^2/day while the mean storativity is 0.014. The high storativity value is probably due to karstification of the faulted marble band. The observation borehole parameters were estimated by simulating the drawdown curves. The interpretation was done using TPA software.

Method	Transmissivity (m^2/day)	Storativity / fracture half length (m)
Gringaten uniform flux -- drawdown data, pumping borehole	283	
Gringaten uniform flux -- recovery data, pumping borehole	265	
Gringaten uniform flux -- drawdown data, observation borehole	300	0.013 / 535
Gringaten uniform flux -- recovery data, observation borehole	375	0.015 / 535

Table 2:Transmissivity estimate from constant rate and recovery tests

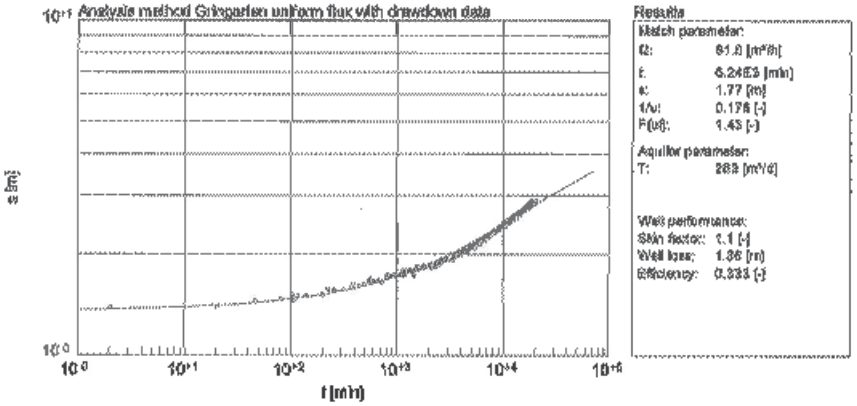


Figure 6: Type curve fitting to pumping borehole drawdown data [Gringarten's uniform flux]

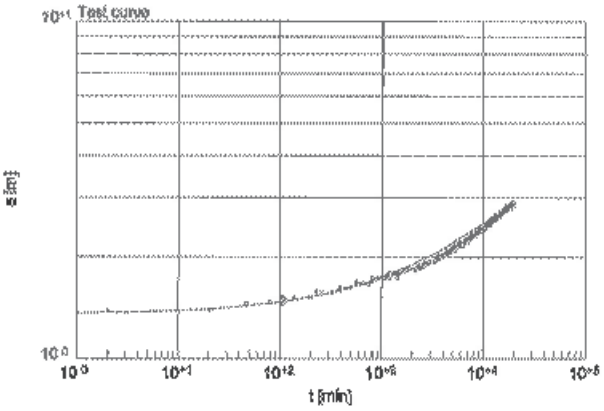


Figure 7: Simulation of pumping borehole drawdown data [Gringarten's uniform flux T= 285m^2/day]

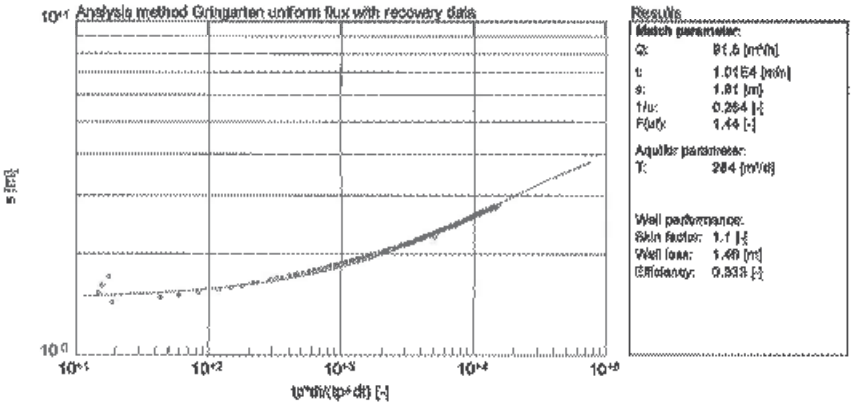


Figure 8: Curve fitting - pumping borehole recovery data - Gringarten's uniform flux

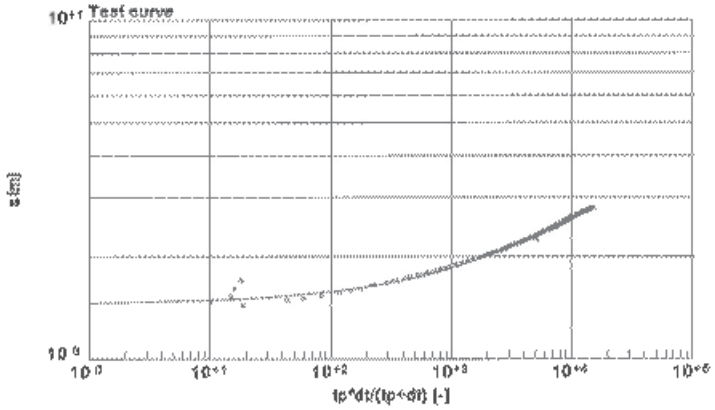


Figure 9: Simulation of pumping borehole recovery data [Gringarten's uniform flux T= 265m²/day]

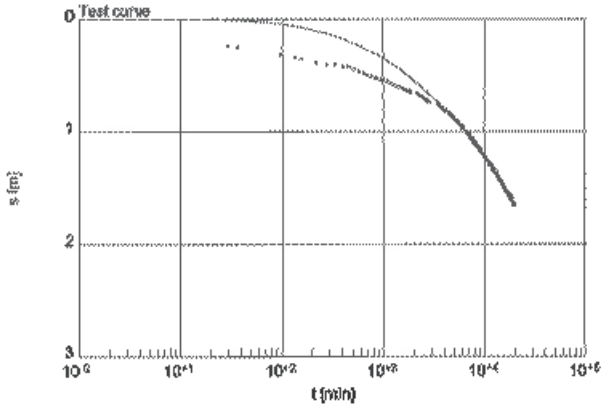


Figure 10: Simulation of observation borehole drawdown data [Gringarten's uniform flux, T = 300m²/day, S = 0.013, fracture half length = 535m]

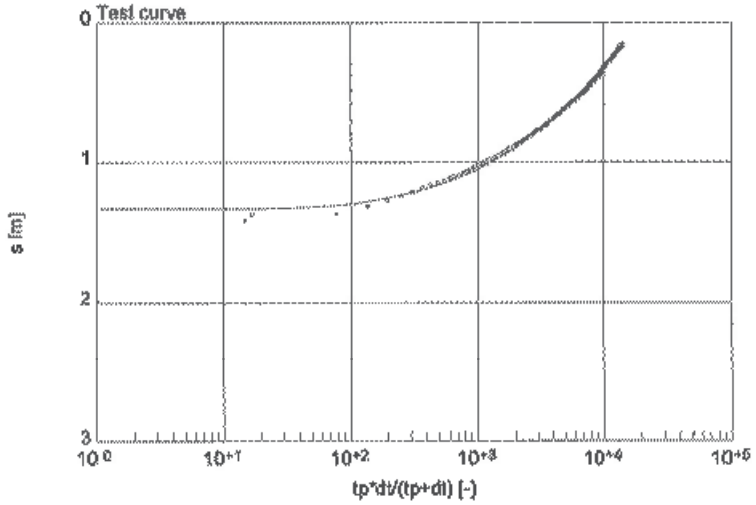


Figure 11: Simulation of observation borehole 1 recovery data [Gringarten's uniform flux, T = 375m²/day, S = 0.015, fracture half length = 535m]

3 RECOMMENDED ABSTRACTION AND MONITORING

The recommended abstraction rate is based on the interpreted aquifer properties. Conservative estimates were used to simulate a 5-year drawdown curve at 50m^3/h and at 60 m^3/h assuming a barrier boundary at 500m. The simulated data predicts 5m and 6m drawdown at this pumping rates respectively at the end of 5 years of pumping. Currently an available drawdown of 5m is assumed and the recommended pumping rate is therefore 50m^3/h (1,200m^3/day). In carrying out this simulation the borehole is assumed to be pumping continuously and no recharge to the aquifer is assumed. This estimate is comparable to sustainable yield calculated from constant rate test pumping data from a nearby borehole in the same aquifer.

Monitoring of water level, water quality and abstraction rates is strongly recommended in the pumping borehole. Also, three other observation boreholes are available and it is recommended these boreholes be included for water level monitoring (Figure 1). The data should be analysed at the end of every year of production or if high drawdown (greater than 5 m) is recorded so that the actual drawdown achieved can be compared to the simulated figures. Any increase in abstraction rate can be considered only on the basis of monitoring data analyses.

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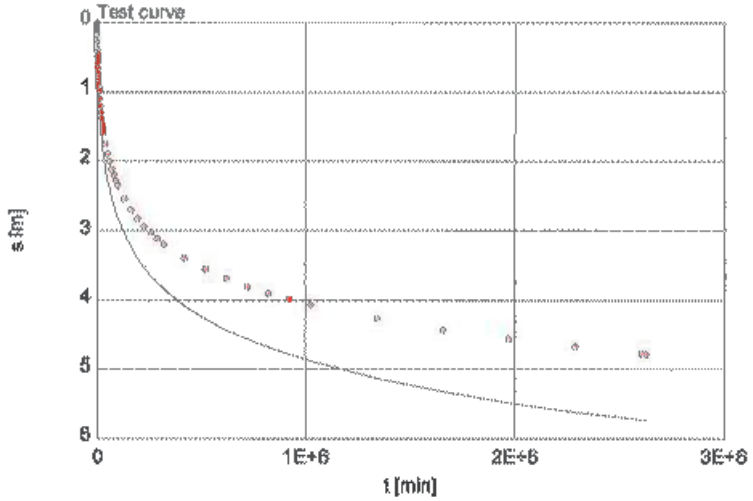

Figure 12: Simulated drawdown for 5 years pumping at 50m^3/h (red dots) and 60m^3/h (black line) assuming T = 250m^2/day, S = 0.01, fracture half length = 535m and a barrier boundary at 500m.

AQUA SERVICES & ENGINEERING (PTY) LTD

VEOLIA WATER
Solutions & Technologies

12 May 2009

The Enviro Dynamics
International Development Consultancy
P.O. Box 20837
WINDHOEK

Attn.: Mr Stephanie van Zyl

Dear Mrs Van Zyl,

AUAS VIEW DEVELOPMENT - HELMINTH EGGS IN FINAL EFFLUENT

Your letter of 11 May 2009 questioning the possible health hazard that helminth eggs in final effluent from sewage treatment plants pose, especially if the effluent is reused for golf green, refers. We hereby wish to answer this concern as follows:

If one wishes to reuse the final effluent of an advanced sewage treatment works (such as a trickling filter system) for irrigation of golf greens, one would apply relatively simple and not very expensive post-treatment processes to ensure that these eggs are removed and/or inactivated before the water is irrigated onto the fields. Proper treatment for removal and/or inactivation of these eggs includes:

- Sand filtration to remove fine suspended solids;
- UV disinfection to disrupt cell material;
- GAC (= granular activated carbon) filtration for organics removal;
- Final disinfection by chlorination to ensure residual disinfection capacity in all distribution pipelines (to the greens).

The above treatment will ensure that the irrigation water will not pose a health hazard, even if it comes accidentally into contact with humans.

Trust you will find this acceptable.

Yours faithfully
for Aqua Services & Engineering (Pty) Ltd

Dr. G. G. Lempert
Technical Director

No 19 Dr Kenneth Kaunda Street
Windhoek
Namibia

Directors: C.D. Sibeta, Dr. G.G. Lempert, A.C. Thomas (non-exec)

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