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ASTON BAY: SWAN LAKE ECO DEVELOPMENT

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## **JEFFREYS BAY**

### **ASTON BAY : SWAN LAKE ECO DEVELOPMENT**

### **FEASIBILITY REPORT**

### **BULK AND INTERNAL CIVIL AND ELECTRICAL SERVICES**

300952

OCTOBER 2018

**COMPILED FOR:**

**Arctismart (Pty) Ltd**

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**DRAWINGS**

300952/01	:	Proposed Swan Lake Development: Locality Plan
300952/02	:	Proposed Swan Lake Development: Layout Plan
300952/03	:	Proposed Swan Lake Development: Contour Plan
300952/04	:	Proposed Swan Lake Development: Existing Mains and Proposed Internal Water Reticulation /Proposed Connections
300952/05	:	Proposed Swan Lake Development: Existing Mains and Proposed Internal Sewer Reticulation /Proposed Connections
300952/06	:	Proposed Swan Lake Development: Proposed Internal Roads and Storm Water
300952/07	:	Proposed Swan Lake Development: Proposed Storm Water Surface Drainage
300952/08	:	Proposed Swan Lake Development: Proposed Internal and External Electricity Supply

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## **JEFFREYS BAY: ASTON BAY: SWAN LAKE ECO DEVELOPMENT**

### **FEASIBILITY REPORT**

#### **BULK AND INTERNAL CIVIL AND ELECTRICAL SERVICES**

**OCTOBER 2018**

#### **1. INTRODUCTION**

IX engineers were appointed by Arctismart (Pty) Ltd to prepare a services feasibility report for the proposed development of Swan Lake Eco Development in Aston Bay.

The engineering feasibility report is required for the amended EIA application and the updated Kouga Municipality's approval of the SDP, Building Plans and finalising of the required SLA. The report indicates an order of magnitude of the demand for civil and electrical services and minor changes to the layout plan should not affect the recommendations.

The location of Aston Bay: Swan Lake Eco Development is indicated on the attached Drawing 300952/01 and the proposed site layout indicated on Drawing 300952/02.

The site covers an area of approximately 35 ha.

The proposed development is split in a northern and a southern area. The Southern Area is adjacent to thick indigenous vegetation and the Northern Area is located around a lump of vegetation which includes milkwood and other indigenous bush.

The theme of the proposed development is based on eco-friendly principals – limited grid connections, reduced demand, recycling where possible, focus on renewable energy, and a limited footprint on the environment.

The consultants on the project are:

EIA Consultant	: Cape EA Prac
Town Planners	: VPM SA
Civil and Electrical Engineers	: IX engineers (IX)

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Surveyors : VPM SA

## **2 TERMS OF REFERENCE**

The report is based on the following:

- i) A meeting that was held to determine the requirements of this project between Arctismart and iX Engineers.
- ii) Meetings between representatives of the Developer, the Consultants, the DEA and the Kouga Municipality to discuss the feasibility of providing services to the proposed development.
- iii) A RoD for the proposed development was issued by the Department of Environmental Affairs in 2009, an extension of the RoD must however again be applied for at the Department of Environmental Affairs (DEA) based on the 2014 regulations.
- iv) The following are outstanding amongst others:
  - Engineering Services Reports (Civil and Electrical).
  - RoD.
  - Geotechnical Investigation.
  - SLA (Services Level Agreement).
  - SDP.
  - Building Plans.

## **3 LEVEL OF SERVICES**

The design parameters utilised to calculate the demand and requirements for civil services for this report are in accordance with the Guidelines for Human Settlement Planning and Design compiled by the Department of Housing and Construction Technology (2000) and other approved design specifications.

The above design parameters assumed for the development have been adapted based on the emphasis of the eco-development theme.

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The following eco-principals will be incorporated in the development:

- Rain water tanks at houses.
- Low demand shower heads.
- Minimal gardening, lawns etc.
- Solar panels / battery energy storage.
- Gas stoves / hobs / heaters.
- Gas / solar hot water systems.
- LED lights and street lights
- Central recycling systems.
- Separation of grey and black water.
- Re-use of grey water.
- Connection to electrical grid for emergency and storage purposes.

It must be noted that the above principals have been utilised to obtain an indication of the size of bulk and internal services only and they must therefore be confirmed through a preliminary and final design process to be commenced with after the RoD has been issued / extended.

## 4 PHASED DEVELOPMENT

The following phased development is proposed:

Phase 1:	Southern Area:	-	74 Formal sites adjacent to the existing residential area in Aston Bay ( $\pm 600 \text{ m}^2$ / site).
Phase 2:	Southern Area	-	12 Informal footprints.( $\pm 400 \text{ m}^2$ / site)
Phase 3:	Northern Area	-	11 Formal sites adjacent to the existing Dolphin Drive ( $\pm 560 \text{ m}^2$ / site).
Phase 4:	Northern Area	-	23 Informal footprints ( $\pm 400 \text{ m}^2$ / site).

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## **5 SPECIAL FEATURES**

The special features of this project are the indigenous bush in the development area and the focus on eco development specifications for the proposed project.

## **6 TOPOGRAPHICAL INFORMATION**

A detailed topographical survey (prepared by VPM SA) of the area is available at 1,0 m contours intervals.

The highest level on the site is  $\pm 24$  m msl. The lowest portion of the site ( $\pm 11,0$  msl) is in the north eastern and south western portions of the site.

A water shed is situated north of Phase 1 and 2 (Southern Area) and surface storm water drains to the north west and south east. Phase 3 and 4 (Northern Area) drains to the north east (refer to the contour and drainage Drawings No 300952/03 and 07).

## **7 GEOTECHNICAL INFORMATION**

A detailed geotechnical investigation for the site is not available at present.

The general profile of the geotechnical conditions in the area is dune sand on weathered shale layers. One and two story buildings are normally built on strip foundations in the area.

A detailed geotechnical investigation will be required to determine the soil classification, especially if NHBRC approvals will be required.

## **8 ECOLOGY / ENVIRONMENTAL INFORMATION**

A RoD for the proposed development was issued in 2009. An application for the extension based on the 2014 regulations of the RoD is being submitted by Cape EA Prac.

The ecology / environmental information of the area is included in the specialist reports submitted as part of the EIA application / extension.

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## **9 BULK SERVICES**

The following bulk services have been investigated in this feasibility report:

- water provision
- sanitation
- access
- storm water drainage
- solid waste disposal
- electricity
- telecommunications

Limited calculations to determine the demand for the various services were prepared to obtain preliminary designs of the bulk services. The actual sizes of the bulk services will be determined through a final design process required for the Services Level Agreement (SLA) to be signed between the Developer and the Kouga Municipality.

### **9.1 BULK WATER SUPPLY**

#### **9.1.1 Bulk Water Supply: Demand**

Details regarding the actual demand of the development can be calculated from the details on the layout plan.

The developer intends providing three sources of water, ie potable water for drinking, cooking and washing, treated effluent for firefighting and irrigation and rain water for limited irrigation and toilet flushing.

The following water consumption / unit is normally assumed:



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-	Unit Sizes	250 m <sup>2</sup>	=	700 ℓ/unit/day
-	Unit Sizes	200 m <sup>2</sup>	=	600 ℓ/unit/day
-	Unit Sizes	150 m <sup>2</sup>	=	500 ℓ/unit/day
-	Unit Sizes	100 m <sup>2</sup>	=	400 ℓ/unit/day
-	Unit Sizes	80 m <sup>2</sup>	=	375 ℓ/unit/day

Buyers in the proposed development can choose from proposed house plan designs varying from 150 m<sup>2</sup> to 250 m<sup>2</sup>.

The flowing house sizes are assumed to determine the bulk water demand:

-	Formal sites	-	200 m <sup>2</sup>
-	Footprints	-	150 m <sup>2</sup>

**9.1.1.1 Proposed Development: Annual Average Daily Demand**

The approximate Annual Average Daily Demand (AADD) for the development can be calculated as follows:

Phase 1 :	Formal units – 74 x 600ℓ/unit/day	=	44.4 Kℓ/d
Phase 2 :	Footprints – 12 x 500ℓ/unit/day	=	<u>6.0 Kℓ/d</u>
	Sub-Total Southern Area	=	50.4 Kℓ/d (0,58ℓ/s)
Phase 3 :	Formal units – 11 x 600ℓ/unit/day	=	6.6 Kℓ/d
Phase 4 :	Footprints – 23 x 500ℓ/d/unit/day	=	<u>11.5 Kℓ/d</u>
	Sub-Total Northern Area	=	18.1 Kℓ/d (0.20ℓ/s)
	Sub Total	=	68.5 Kℓ/d (0.8ℓ/s)
	Plus 10 % losses in reticulation	=	<u>6.9 Kℓ/d</u>
	Total Development	=	75.4 Kℓ/d (0.87ℓ/s)

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As stated above the Developer proposes to utilize separate water sources as follows:

- Potable water, from Kouga Municipality for drinking water, cooking and washing.
- Rain water from rain water tanks for toilet flushing, limited individual garden irrigation and washing.
- Treated grey water for irrigation on the formal units in the Southern Area.

Based on the above it is estimated that the mix of the AADD be as follows:

Potable Water: - 50%

Rain Water: - 20%

Treated Effluent - 30%

The above proposals will result in a number of reticulations:

- potable water reticulation
- grey water drainage system in the Southern Area
- sewage drainage reticulation with pump stations to pump to the municipal sewerage system
- grey water/ irrigation reticulation in the formal development of the Southern Area

#### 9.1.2 Proposed Development: Peak Flow Conditions for Potable Water

AADD	= 50% of 75 Kℓ/d (0.87 ℓ/s)
	= 37.5 Kℓ/d (0.43 ℓ/s)
Instantaneous Peak Flow Factor	= 11
Instantaneous Peak Flow	= 11 x 0.43ℓ/s
	= 4.7 ℓ/s

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**9.1.3 Proposed Development: Fire Fighting Requirements**

The development can be classified as a Low-Risk Group 2. The following requirements will therefore apply:

Design fire flow/hydrant	= 500 ℓ/min (8.3ℓ/s)
Duration of fire flow	= 1 h
Storage required for fire-fighting	= 30 Kℓ
Minimum residual head required	= 6 m
Location of hydrants	= 240 m apart

The following are proposed:

Location of hydrants (adjusted for risk due to vegetation)	= 120 m apart
Minimum pipe size for hydrants	= 75 mm dia

Access and main roads will be approximately 4m wide to ensure access for fire-fighting equipment.

**9.1.4 Bulk Water Supply: Source**

As stated above, the Developer intends providing potable water (from Kouga Municipality), rain water and treated effluent to the Development.

The following are proposed:

- Metered potable water connections to be provided to each unit (reticulation with bulk meter to be connected to the Kouga Municipality network).
- A minimum 5000 ℓ water tank to be provided at each unit to be used for limited irrigation and for toilet and washing water.
- Grey water in the Southern Area will be drained to a centrally located waste water treatment works where modular Lilliput systems will be used to treat the water. Treated effluent will be used for general on-site irrigation for the formal units in the Southern Areas.

The relevant details of the Jeffreys Bay bulk water supply system are the following:

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- Aston Bay presently obtains water from reservoirs situated near the, The Fountains Mall on the R102.
- The reservoirs are situated on  $\pm 90$  msl.
- Potable water for this proposed development will be supplied directly from the 200 mm dia water main in Dolphin Drive at the main access to the area.
- The demand created by the proposed development is relatively small. Upgrading of the Jeffreys Bay bulk water supply is therefore not proposed.

**9.1.5 Bulk Water Supply : Storage**

The required storage capacity must comply with the following requirements:

Potable - 48 hours (2 days) AADD required. = 2 x (50% of 75 Kl/d)

= 75 Kl

Fire Fighting - storage for 8,3 l/s for 1 h required. = 30 Kl

Total Storage Required. = 105 Kl

The estimated potable water demand and the storage required for the proposed development is relatively small and the provision of additional potable water storage specifically for this development is not proposed.

**9.1.6 Bulk Water Supply : Pressure**

The water pressure required for the proposed development should not exceed 90 m water head under normal static conditions and not be less than 24 m under instantaneous demand. The minimum residual head during instantaneous demand and fire flow conditions should not fall below 6 m.

The approximate average water level of the existing municipal reservoirs can be assumed as 90 msl.

The topographical levels of the proposed development vary between approximately 10 m msl to 24 m msl.

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The static water pressure will therefore be approximately between 66 and 80 m which will be more than adequate for potable water and fire water.

**9.1.7 Bulk Water Supply: Connection**

Instantaneous Peak Flow:	= 4.7 ℓ/s
Fire Water:	= 8.3 ℓ/s
Total Instantaneous Peak:	= 13.0 ℓ/s

It is proposed that the development be provided with water from the existing 200 mm main in Dolphin Road.

The following connection is proposed: = 160 mm dia Class 12

A full network analysis will be performed during the services detail design stage, but at this stage it is recommended that the above 160 mm diameter metered connection off the existing 200 mm diameter main in Dolphin Drive be provided.

Refer to Drawing 300952/04 for the proposed water connection.

**9.1.8 Bulk Water Supply: Fire Protection**

The fire-fighting requirements have been indicated under item 9.1.3 above.

Hydrants are proposed to be provided in the reticulation at 120 m spacing (less than the 240 m apart according to specifications). A separate fire reticulation system on which hydrants can be installed is not proposed. The minimum pipe size is 75 mm diameter.

The key requirements are that 8,3 ℓ/s must be available and specific storage of approximately 30 Kℓ is required for fire-fighting purposes. Both these requirements can be met by installing the proposed infrastructure.

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#### **9.1.9 Bulk Water Augmentation Fees**

The Developer will be liable for the applicable Bulk Water Augmentation Fees. The details will be finalised when the SLA is prepared.

### **9.2 SANITATION**

Various sanitation methods may be considered. They vary mainly from on-site sanitation systems to gravity waterborne sewers. The development however is situated in the existing sewerred Aston Bay Residential Area and based on the five main criteria (reliability, acceptability, appropriateness, affordability and sustainability) it is clear that the development must be provided with waterborne sewers.

As previously stated, the Developer wants to follow eco / renewable principals as far as possible by re-using treated, grey water for on-site irrigation for the formal sites of the Southern Area. A modular Lilliput Waste Water Treatment System (or similar approved) will be provided at a centrally located (Site 86) to treat the grey water. It has been agreed with the Kouga Municipality that the sewage effluent will be accepted and pumped to a connection point on the existing reticulation. The capacity of the existing sewer reticulation will be analysed to determine a final connection point. The flow is relatively small and will have a minimum effect on the existing system.

#### **9.2.1 Sanitation Augmentation Fees**

It is proposed that the development will be connected to the municipal sewage system and it is therefore assumed that the Developer will be required to pay an amount for the Sanitation Augmentation Fund. The amount will be determined when the SLA is being finalised.

### **9.3 ACCESS ROAD**

Access will be from the existing main road into Aston Bay (Dolphin Drive). Refer to the attached layout plan.

It is proposed that all main roads will be 4 m wide, secondary roads to be 3m wide, all roads to be grass block surfaced so as to reduce the impact on the environment to the minimum.

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### **9.3.1 ROADS AUGMENTATION FEES**

Traffic generated by this development will be utilizing the existing roads in Jeffreys Bay and Aston Bay and the developer will therefore be required to contribute to the Roads Augmentation Fund.

## **9.4 BULK STORM WATER DRAINAGE**

The proposed development will create more impervious areas (roads, roofs etc) compared to the existing situation and the storm water run-off from the proposed development will be increased.

All houses will however be fitted with a 5000 ℓ rain water tank and stormwater from the roofs will drain into these tanks. Overflow water from the Southern Area will drain into a detention pond on Erf 86 that will reduce the peak run-off to the pre-development peak run-off and from there to the existing storm water drainage system. The storm water from the Northern Area will drain into the existing drainage system.

The water tanks / proposed drainage system, together with the grass block roads will minimize run-off and surface storm water flow.

### **9.4.1 Bulk Storm Water Augmentation Fee**

It is expected that only a small percentage of additional storm water will be generated by the proposed development and it is proposed that 30 % of the Storm Water Augmentation Fee be paid by the Developer. The percentage will be agreed with the KM when the SLA is being finalised.

## **9.5 BULK SOLID WASTE DISPOSAL**

It is the intention of the Developer to collect all solid waste from the development and to recycle all the various components of the waste. Paper, plastic, metal etc will be sold and organic material will be used to create compost for gardening purposes.

Should there be solid waste from the proposed development that cannot be recycled it will have to be transported to the regional waste disposal site developed at Humansdorp.

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#### **9.5.1 Bulk Solid Waste Augmentation Fee**

It is suggested that the Developer be required to pay a small portion (20 %) of the Solid Waste Augmentation Fee. This percentage will be agreed when the SLA is being finalised

### **9.6 BULK ELECTRICAL**

Two options are proposed for the electrical network:

1. Municipal Grid Connected
2. Islanded Electrical Network

#### **9.6.1 Option 1: Municipal Grid Connected**

The Municipal Grid Connected electricity network option will be a conventional electricity reticulation network.

There is at present an 11kV overhead line crossing the site, ending at a pole structure near proposed Entrance A. This line is supplied from a 5MVA 22/11kV transformer at the Substation near Apies Draai to the north east of the Development. This 11kV line supplies electricity via a ring feed to the existing Aston Bay residential development.

The Municipality presently have access to maintain this line via a track under the line and would require access to continue maintaining the line as it supplies the Aston Bay area.

An 11kV bulk electricity meter for the Development will be required near Entrance A, with access for the Municipality from Dolphin Drive or similar suitable locality.

The electrical demand has been calculated based on each residential unit using gas for hot water, cooking and heating. Energy efficient lighting is mandatory.

The electrical bulk augmentation fee will be calculated on 120 equivalent residential units (ERU,s) as per the Kouga Municipality's Augmentation Policy based on a 45A single phase supply per unit.



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This electrical demand is estimated at:

45A x 230V x 120 units x 0.3 Diversity factor	=	372.6kVA
Internal Bollard Type LED Streetlights 40x10VA	=	0.4kVA
Internal Water and Sewage Pump Stations	=	<u>27kVA</u>
Total	=	400kVA

Transformer fees to the Municipality will not be applicable as the Developer will install transformers/ minisubs as part of the development.

#### 9.6.2 Option 2: Islanded Electricity Network

No bulk electricity connection is required / provided.

Electricity will be supplied via solar photovoltaic installations on the roofs of houses with rechargeable battery energy storage per house (and / or possibly other renewable energy sources such as wind turbines) with diesel generators as back-up. Gas will be used for cooking and hot water. Energy efficient lighting will be installed.

Large wind turbines (>1MW) similar to the wind turbines installed on the wind farms in the Kouga region would not be suited to this development. Smaller 100kW wind turbines from Turbex in Mossel Bay were investigated. Visual and noise impact studies would need to be undertaken as part of the Environmental process. The only suitable locality for a wind turbine of this size would be in the no-go area at the top of the ridge to the north west of the plots on the western side of the development. Due to the environmental issues and lack of a suitable site for wind turbines they were not considered further for this development.

Initial discussions with the Kouga Municipality indicated that a total off-grid electrical network is not an option.

#### 9.6.3 Recommended Bulk Electrical

It is recommended that a hybrid of option 1 and 2 for the bulk electrical connection be implemented, i.e. roof top photovoltaic solar panels with battery energy storage per house and energy efficient measures (gas cooking / hot water, LED lighting etc) together with a grid

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connection, single point of connection at 11kV based on 45A single phase for back-up and electrical supply to the pump stations etc.

**10. INTERNAL SERVICES**

Services will be placed in the same trenches to minimize the impact of services installations on the environment where possible. However water / sewers will not be in the same trench as electrical cables as this may result in safety risks during maintenance work.

Internal services for the Development are the following:

**10.1 INTERNAL SERVICES: WATER RETICULATION**

The AADD and instantaneous water demand for the residential development have been estimated at approximately 4.7 ℓ/s. The fire flow is approximately 8,3 ℓ/s. The main supply from the municipal source must therefore be able to deliver a minimum of approximately 13ℓ/s.

A proposed potable water reticulation system for the Development has been indicated on the attached Drawing 300952/04. A 160 mm dia connection will be made to the existing 200 mm Ø mains in Dolphin Drive and 110 / 75 mm diameter reticulation pipes with 15 / 25 mm erf connections are proposed. The potable water and irrigation reticulations will be HDPE pipes. Colour coding systems will be used to be able to differentiate between the various supply systems.

The pipes must be installed with a minimum cover of 800 mm to protect them from traffic and the heat of fires.

UPVC pipes for the main reticulation are recommended.

**10.2 INTERNAL SERVICES: SEWER RETICULATION**

uPVC gravity main sewers (160 mm diameter) with 110 mm diameter connection pipes to the units are proposed for the Development.

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A grey water drainage system is proposed in the Southern Area and effluent in this area will therefore be separated – grey water to the grey water drainage system and black water to the sewer reticulation.

The internal sewer reticulation will collect the sewage from the individual sites and drain it to the two low areas to the south and north of the site. Pump stations will be provided to deliver the sewage to the existing municipal sewer reticulation.

Refer to Drawing 300952/05: Proposed Internal Sewer Reticulation.

### **10.3 INTERNAL SERVICES: ROADS AND STORM WATER**

#### **10.3.1 Internal Roads**

Grass block roads, 4.0m wide for access roads (for firefighting purposes) and 3.0 m wide for internal roads with gravel passing areas at strategic positions are proposed for this eco development. Storm water will not be concentrated in the streets. Roads will follow the contours where practical and minimal cut and fill earthworks volumes will be required.

The following specifications are proposed:

Width	:	Access / Main Roads	4.0 m
	:	Internal Roads	3,0 m
Kerbing	:	None	
Surfacing	:	Grass Blocks	

#### **10.3.2 Storm Water Drainage System.**

The existing surface storm water drainage routes are indicated on Drawing 300952/07. Storm water will not be concentrated and will be allowed to flow overland. The volumes generated by the development will be reduced by the installation of rain water tanks (5000 ℓ/unit).

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The additional surface run –off generated by the development is estimated to be low. The area is very pervious and storm water will be encouraged to infiltrate into the soil.

**10.4 SOLID WASTE DISPOSAL**

Specific provision will be made for all solid waste will be accumulated for recycling.

**10.5 INTERNAL SERVICES: ELECTRICAL**

The proposed internal electrical reticulation is a hybrid between option 1 and 2 (refer to Items 9.6.3 and 10.5.2).

**10.5.1 Street Lighting**

Streetlighting will be minimal/ low glare and consist of bollard type streetlights approximately 1m high and spaced approximately 50m apart. Lighting levels will be designed to indicate the route of the road and not to any lighting guidelines.

**10.5.2 Municipal Grid Connected Internal Electrical Reticulation**

The internal electrical reticulation will consist of underground 11kV cables from the metering point near Entrance A on Dolphin Drive connected to two miniature substations (mini-subs). One mini-sub will connect the 34 units on the north eastern side of the development and the other the 86 units on the south western side.

The minisub on the north eastern side will be sized at 200kVA and the minisub on the south western side 315kVA, with spare capacity to cater for commercial facilities (pump station, WWTW etc), future growth and to suit the common sizes of minisubs used in the area. The low voltage side of the miniature substation on the center tap will be 230V (phase to neutral, 400V phase to phase) to accommodate voltage rise should solar PV installations be installed and power fed back into the grid.

Low voltage reticulation will be designed to cater for 60A single phase supply per unit on average, but with a service cable sized for 80A, i.e. 16mm<sup>2</sup> x 2 core cable. This will allow residents to increase their supply up to 80A single phase if required without having to excavate and install larger sized cables.

A drawing of the preliminary electrical layout is included.

**ARCTISMART (PTY) LTD**

**ASTON BAY: SWAN LAKE ECO DEVELOPMENT**

---

## **11. CONCLUSION**

The proposed development can be provided with Bulk and Internal Services without creating major construction or implementation problems.

It is trusted that the above information is sufficient for the requirements of the approval of the EIA, SDP, SLA etc.

W A HOFMEYR Pr Eng

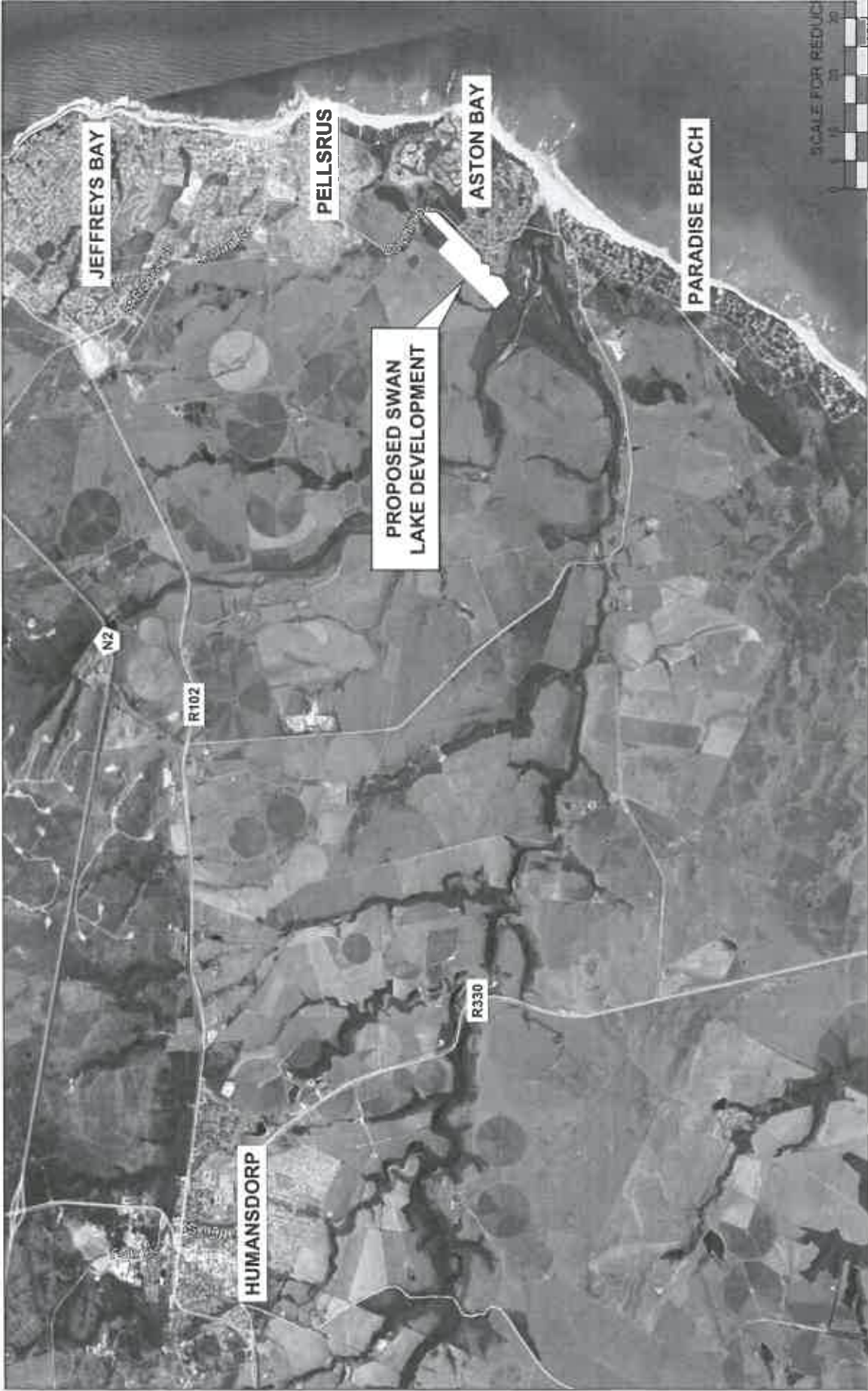
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## CLIENT

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## PROJECT

SWAN LAKE ECO ESTATE

## DRAWING DESCRIPTION

PROPOSED SWAN LAKE DEVELOPMENT :  
LOCALITY PLAN

## DESIGNED

WH

## DRAWN

ACB

## CHECKED

WH

## DATE

2018/08/02

## SCALE

N.T.S.

## DRAWING NUMBER

300952/01

## REV

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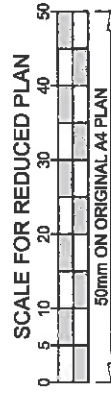
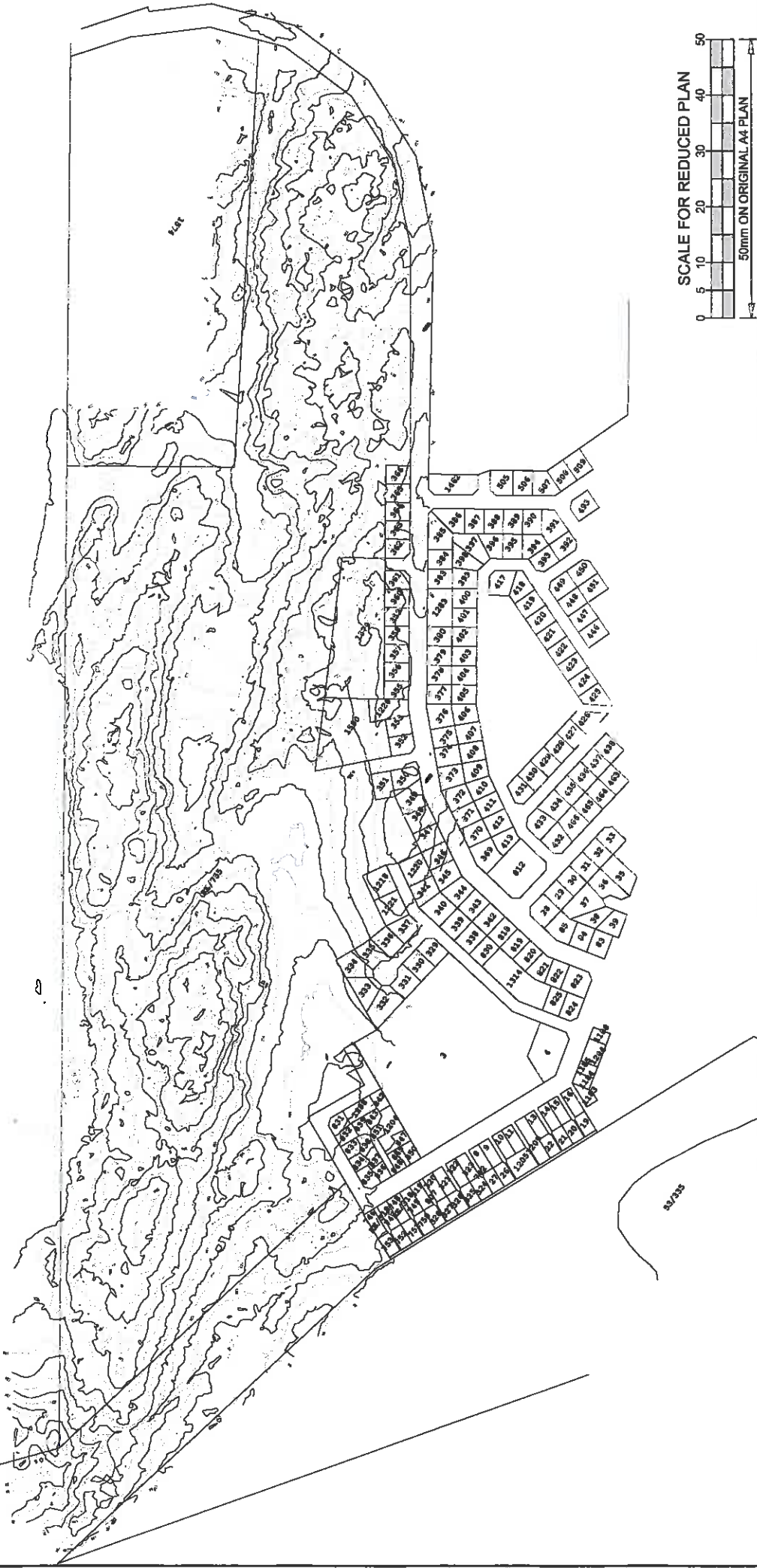




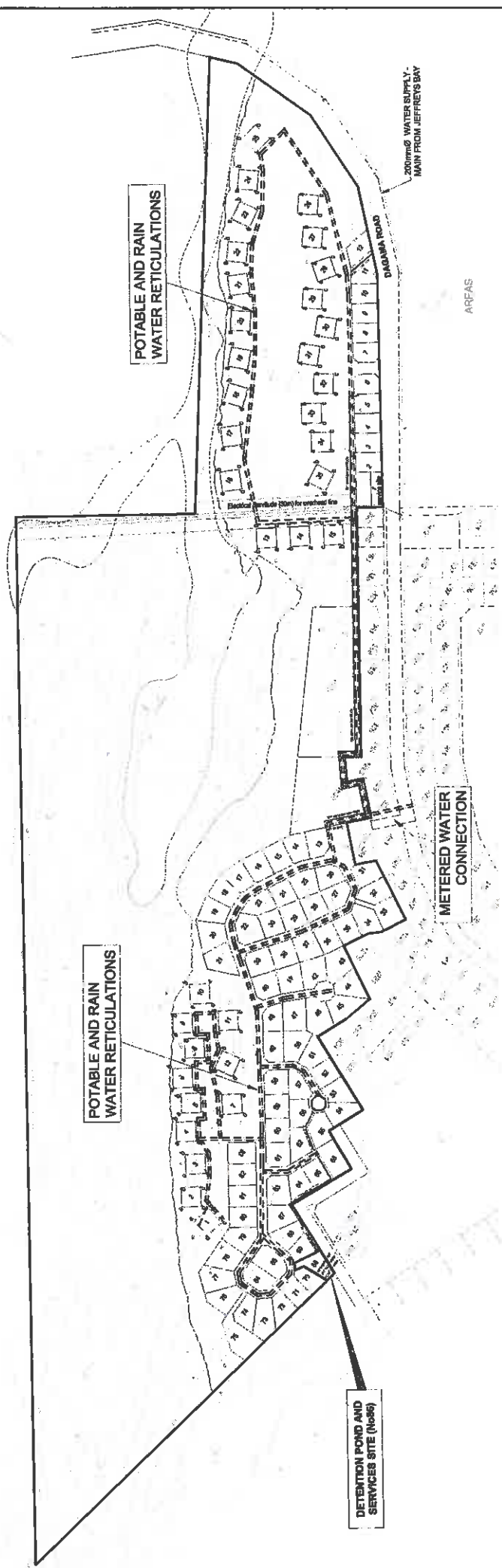




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		<p><b>ix engineers</b> Infrastructure Excellence Kings Court Cnr Buffelsfontein Rd &amp; Tiltan Rd   Walmer Heights   Port Elizabeth   6070 Tel: +27(0)41 351 8811 www.ixengineers.co.za</p>		DRAWING DESCRIPTION		DATE		SCALE		REV	
				PROPOSED SWAN LAKE DEVELOPMENT : CONTOUR PLAN		2018/10/09		N.T.S.		DRAWING NUMBER 30095/03	



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2	DATE				
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CONSULTANT		DATE	DESCRIPTION	BY	CHK
1	DATE	2018/10/09	Issued for discussion	ACB	WH
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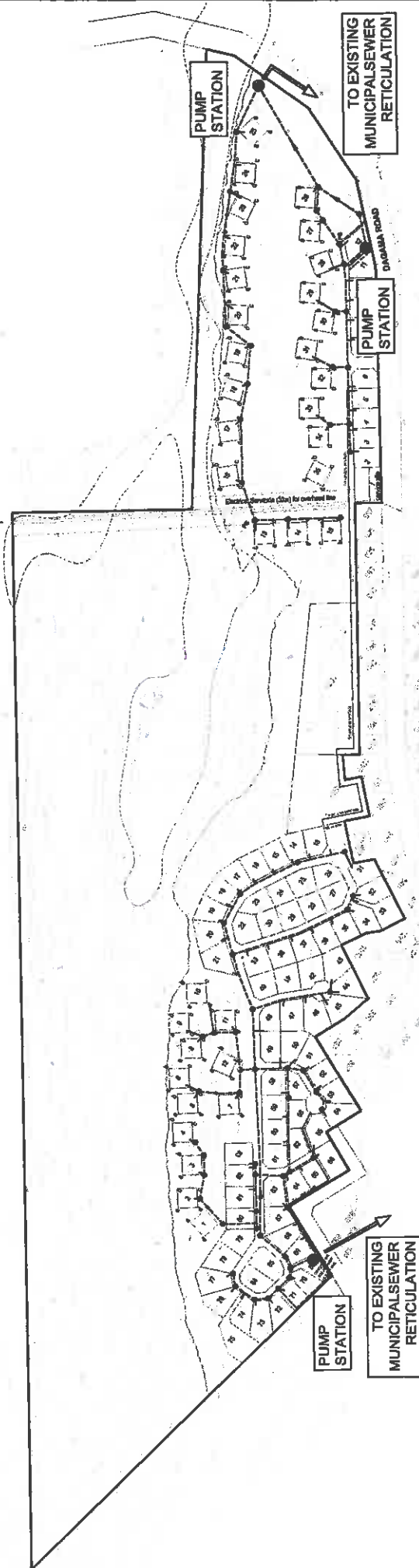
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**CLIENT**  
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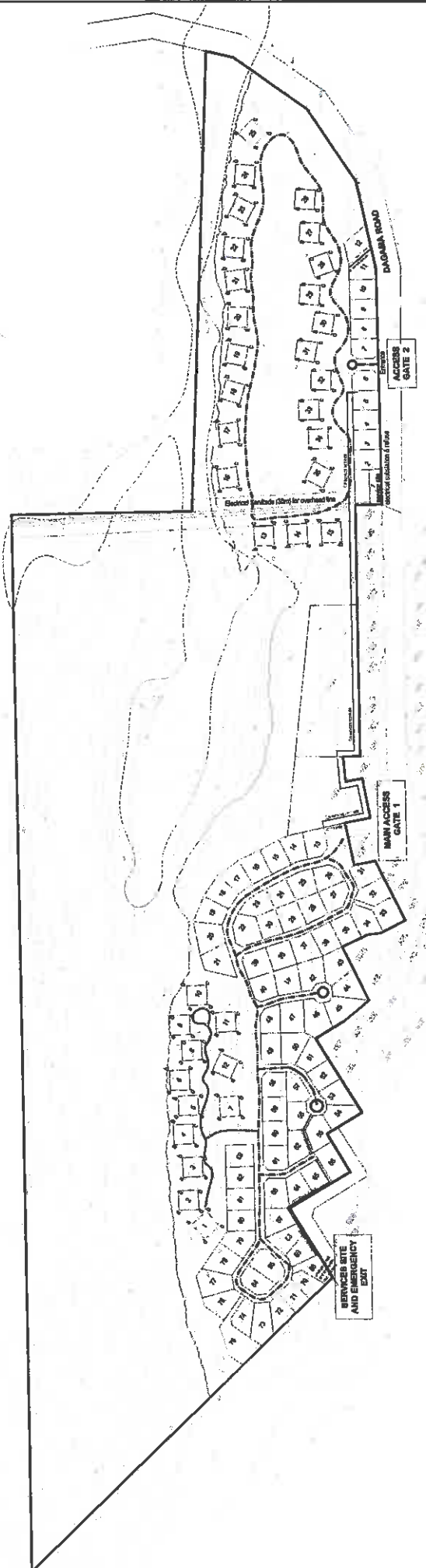
**PROJECT**  
SWAN LAKE ECO ESTATE

**DRAWING DESCRIPTION**  
PROPOSED SWAN LAKE DEVELOPMENT :  
EXISTING MAINS AND PROPOSED INTERNAL POTABLE WATER AND RAIN WATER RETICULATION  
REV 8

DATE	SCALE	ORIGINAL SIZE	REV
2018/10/09	N.T.S.	A1	A
DRAWING NUMBER			300952/04



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SCALE FOR REDUCED PLAN			
DATE	SCALE	N.T.S.	ORIGINAL SIZE
2018/10/09			A1
DRAWING NUMBER			300952/06
REV			A

DRAWING DESCRIPTION
PROPOSED SWAN LAKE DEVELOPMENT : PROPOSED INTERNAL ROADS LAYOUT REV 8

PROJECT
SWAN LAKE ECO ESTATE

CLIENT
Ardismart (Pty) Ltd



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CONSULTING ENGINEER			
DATE	BY	DATE	BY
18/10/18	84080	18/10/18	84080
CLIENT		CLIENT	
DESIGNED		CHECKED	
WH		WH	

REVISION SCHEDULE			
NO	DATE	DESCRIPTION	BY
A	18/10/18	Revised Rev 7 from VPM	ACH

**FOR DISCUSSION**

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