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## TUTUKA POWER STATION: CLASSIFICATION REPORT ON DISPOSAL SITES

# Classification of New and Current Tutuka Disposal Site

**Submitted to:**  
Zitholele Consulting  
P O Box 6001  
Halfway House  
1685

Attention: Konrad Kruger



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# TUTUKA POWER STATION: CLASSIFICATION ON DISPOSAL SITES

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# TUTUKA POWER STATION: CLASSIFICATION ON DISPOSAL SITES

## APPENDICES

### APPENDIX A

#### Document Limitations



## 1.0 INTRODUCTION

The overall objective of the new Tutuka Domestic Disposal Site (hereinafter referred to as the “Site”) project is to acquire the required authorisations for Tutuka Power Station to sustainably operate the Site to provide for general waste disposal over the operational life of the Power Station and to close the current Site within the requirements of its S. 20 Environment Conservation Act, 1989 (Act 73 of 1989) permit. The operational life of the Power Station and hence the ultimate life of the Site as per request from Tutuka Power Station is a further 50 years.

The Site was permitted by the previous Department of Water Affairs and Forestry (DWAf) on 18 January 1995. The Class II permit was issued in terms of Section 20(1) of the Environment Conservation Act, 1989 (Act 73 of 1989) using the old classification system of Class I to Class III. This classification has been superseded by the First Edition of the Minimum Requirements for Waste Disposal by Landfill by the Minister of Water Affairs and Forestry, which has been implemented since September 1994.

Since commencement of this project, the Environment Conservation Act, 1989 (Act 73 of 1989) was repealed by the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA). The National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA) became enforceable on 1 July 2009. Therefore an application to amend the existing Class II permit or to extend or altogether replace the current Site will now be performed in terms of the NEMWA as supported by the latest published edition of Minimum Requirements, 1998 (Second Edition).

In terms of these Minimum Requirements the Tutuka Site Classification (for both the current and new sites) needs to be done as a first step in the authorisation process in order to determine the requirements in respect of further investigations and specialist studies pertaining to the license authorisation process.

## 2.0 SITE CLASSIFICATION

The purpose of site classification is:

- To assess each waste disposal scenario in respect of waste class, waste stream size and potential for significant leachate generation; and
- **To use the landfill class to select the prescribed set of Minimum Requirements for the cost-effective investigation, design, operation and closure of a specific class landfills.**

Site classification system is done by determining:

- the class of waste disposed of;
- the size of the waste stream; and
- the potential for significant leachate generation.

### 2.1 Waste class

Waste is classed as either general or hazardous.

#### 2.1.1 General waste (G)

General waste includes domestic, commercial and inert waste and poses an insignificant threat to the environment if correctly managed. It may include Small amounts of hazardous substances normally found in domestic waste, for example, redundant medicines, domestic cleaning agents and batteries.

Since the waste that has been disposed of on the Tutuka Site (assumably from May 1993), originates from offices and hostels, it was assumed that no dedicated hazardous waste streams for example oils from workshops or chemicals reagents from laboratories were allowed onto the Tutuka Site. This assumption was also based on the data in the permit application forms that was submitted by SRK in 1991 which did not make any mention of hazardous waste received at the Site.



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Unfortunately this initial assumption has not been correct. The reason is that new data has been received from Tutuka since the first Site Classification Report was written. This data shows that although oil and steel are recycled at the Power Station, ash and coal have been allowed onto the Site at some stage during the period May 1993 possibly up to December 2008. The percentage of ash and coal is roughly calculated as 13% (v/v) of the total waste stream (excluding the two tons of steel) which is not significant, but cannot be ignored in the Site Waste Class classification. Coal and ash is both regarded as potentially hazardous specifically because the Chemicals of Concern that normally leaches from these two waste types are inherently hazardous.

Based on the above the **existing** Tutuka Site will **classify as General** since the ash and coal that have been disposed of in accordance with the first set of data received from Tutuka Power Station, were discarded in close proximity to this site, but at least 500 m to the east thereof.

The **new** Site will **classify as General** provide that no coal and ash is disposed of at the new Site (as has been the case since January to July 2009 as depicted in Table 6).

### 2.1.2 Hazardous waste (H or h)

Hazardous waste is material that can, even in low concentrations, have an unacceptable adverse effect on public health and/or the environment and if not properly managed cause mortality. This would be as a result of its inherent chemical and physical characteristics, such as toxic, ignitable, corrosive, carcinogenic or other properties.

Based on the available information of the coal and ash that have been disposed of according to the first set of data received from Tutuka, it appears that this waste has been discarded in an area 500 m east of the **existing** Site. Therefore, the existing Site as permitted by DWAF has not received any hazardous waste and therefore classified as a **G:S:B<sup>-</sup>** (based on MRD of 34.8 t/d; see Table 11 for average tons per day for 2008; please note that the MRD for January 2009 up to July 2009 has been calculated as 37.7 t/d).

### 2.1.3 Site class in respect of the waste class.

Based on the brief discussion in “2.1.1” and “2.1.2” above the **existing** Site **classifies as G:S:B<sup>-</sup>**.

Furthermore the new Site, if developed separately from the **existing** Site, will **classify as General** provided that no coal and ash are disposed of at such a Site.

In the case of an H:H or H:h class Site, the site size and climatic water balance is of no relevance and therefore need not to be determined.

## 2.2 Size of Tutuka waste disposal Site operation

The Tutuka site has been classified as a Class II disposal site at the time of having been permitted by the then Department of Water Affairs and Forestry in terms of Section 20(1) Environmental Conservation Act, 1989 (Act 73 of 1989). Class II has been based on the fact that the site receives general waste only, is a system no longer in use and has been superseded by the Minimum Requirements Classification system.

Based on the available information of the coal and ash that have been disposed of according to the first set of data received from Tutuka, it appears that this waste has been discarded in an area 500 m east of the **existing** Site. Therefore, the existing site as permitted by DWAF has not received any hazardous waste. The classification in respect of this size of the existing Tutuka site could therefore be based on the MRD. It is and therefore classified as a **G:S:B<sup>-</sup>** (based on MRD of 34.8 t/d; see Table 11 for average tons per day for 2008; please note that with either a 3.7% or 4.6% growth as have been calculated, the existing site will still receive less than 50 t/d at the time of closure).

### 2.2.1 Minimum Requirements site classification

The ultimate physical size of the Site is a function of the amount of waste it receives over its lifetime.

The size classification focuses on the size of the waste stream and as a result hereof the size of the operation.



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Disposal sites are classified using the “Maximum Rate of Deposition” or “MRD” in tonnes per day, during the expected life of the Site, which has been confirmed by Tutuka to be 50 years.

Site size classification is based on the formula indicated below:

- i  $MRD = (IRD)(1+d)^t$
- i IRD is the initial rate of deposition on site in T/day 18 t/d (as per 1991 SRK permit application after conversion by the previous DWAF)
- i  $d^1$  is the expected annual development rate, based on population growth Various scenarios
- i t is the years since deposition started at IRD 50 years (until closure)
- i MRD is the Maximum rate of deposition after t years

The landfill size classification for general sites as per the 1998 edition of the Minimum Requirements for Waste Disposal by Landfill (MR) is indicated below.

**Table 1: Landfill size classes**

Landfill Size Class	Maximum Rate of Deposition (MRD) (Tonnes per day) 1998
Communal	<25
Small	>25 <150
Medium	>150 <500
Large	>500

### 2.2.2 Data recovered from the 1991 Tutuka Permit Application (i.e. SRK Data in the absence of any data from Tutuka)

Tutuka Power Station was unable to provide Golder with waste generation data when preparing a waste classification report the first time.

For this reason Golder had to use an Initial Rate of Deposition (IRD based on the data that was available at the time of permitting the Site (i.e. 1991) and to use this IRD to calculate MRD after 50 years, but based on assumed growth rates.

The application forms submitted by SRK in 1991 recorded the IRD as 13 000 m<sup>3</sup> per day of which 5 500 m<sup>3</sup> is of domestic origin.

The soundness of this figure (i.e. 5 500 m<sup>3</sup> /d) has been assessed by using the demographical data in the SRK permit application of 1991. This permit application gives the waste generating population at Tutuka as 2 700 people. Translating this population into a *per capita* generation shows that the per capita waste generation amounts to approximately 2,81 kg per day which may be acceptable for affluent communities, but is significantly higher than the average (unless a high amount of ash from the generating area formed part of the waste stream).

When one uses the 13 000 m<sup>3</sup>/d of non-compacted waste (converted to 18 t/d by the previous DWAF) as recorded in 1991 (date on which permit application form was signed by Tutuka) as the IRD and extrapolate the IRD to the present, the following emerge:



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- The MRD for a 2% population growth with an estimated 50 years life of site is 68 ton/day. This is < 150 ton/day and therefore the Site classifies as Small.
- The MRD for a 3% population growth and an estimated 50 year life expectancy for the site is 130 ton/day. The classification remains Small (<150 ton/day); and
- If the population growth increase to 3.25%, the MRD will increase to 153 ton/day and the landfill classification will be Medium after 50 years (>150 ton/day but < 500 ton/day).

### 2.2.3 First set of Tutuka data (May 1993 to July 2009)

After the SRK data has been processed and the Tutuka Site classification results have been submitted, a first set of waste data has been received from Tutuka Power Station (see Table 6). This data covered monthly disposal figures for each month for the period of January to July 2009 and also the total amount of waste disposed for the period May 1993 up to July 2009. The units in which this data was provided varied and therefore had to be converted to mass by using the textbook densities of the different waste categories.

This data (in mass units) was used in two different scenarios to calculate the Maximum Rate of Deposition (MRD). The reason for this is to achieve an optimum level of confidence in the MRD calculations by using the different groupings of data that have been received from Tutuka while maintaining the scientific base of the site classification calculations.

The request from Tutuka Power Station was to develop a site for a further 50 years i.e. for 50 years from 2009 onwards. It would therefore not be appropriate to use the 1991 waste disposal data as an IRD for calculating MRD at the end of a 50 years of site life (however the 1991 SRK IRD has been used to determine growth rate over the period for which data are available). An IRD should therefore preferably be based on 2009 data for calculating a MRD at the end of 50 years commencing in 2009. The only avenue to calculate such an IRD for 2009 was by using the monthly average waste generated as calculated from the total waste generated during 2009 over the period from January to July 2009 (scenario 1 hereunder) (Tutuka did not have monthly waste figures). However despite the desirability of using an IRD based on waste figures that reflects the start of a 50 year period, the IRD was also determined by averaging the waste figures received from Tutuka Power Station over the period May 1993 up to July 2009 in order to determine its effect on Site classification (scenario 2 hereunder).

Therefore, in dealing with the challenge to classify the Tutuka Site with limited information also in respect of the IRD, two scenarios were used to calculate MRD i.e. in arriving at a Site Class in respect of Site size.

In **Scenario A** the calculations were based on the Tutuka data from January 2009 up to and including July 2009. The IRD was then calculated by averaging the data for this period. To calculate the MRD, the IRD was extrapolated over the lifespan of the waste disposal site that has been set at 50 years. Two annual development rates were used, namely 2% and 3% resulting in Site Classes Small and Medium respectively (see Table 2).

**Scenario B** calculations used figures in respect of waste received at Tutuka Disposal Site from May 1993 until July 2009. The IRD was calculated as the average in ton per day over this period. The lifespan of the waste disposal site remained 50 years in the calculation. Development rates of 2% and 3% were used, resulting in Site Classes Small in both instances.

**Table 2: First set of Tutuka data: Different scenarios to determine the MRD**

Scenario 1				
IRD (t/d)	d	t (years)	MRD	Classification
37.7	0.02	50	101.5	Small
37.7	0.03	50	165.3	Medium
Scenario 2				



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IRD (t/d)	d	t (years)	MRD	Classification
31.0	0.02	50	83.44	<b>Small</b>
31.0	0.03	50	135.9	<b>Small</b>

However rather than assuming reasonable growth rates (as we were compelled to do with the SRK data and explained in "2.2.2") it was argued that by using the first set of data received from Tutuka (January to July 2009) as well as the SRK IRD of 1991, growth rates could indeed be determined. This calculated growth rate can be used in calculating MRD after 50 years and hence Site class in respect of Site size. With this in mind growth rates has been determined.

The growth rate was calculated using the first set of data provided by Tutuka starting from May 1993 up to July 2009. The MRD of deposition for July 2009 was calculated as the average waste disposed between January 2009 and July 2009 which is 37.7 t/d. Based on a MRD of 37.7 t/d and an IRD of 18 t/d the growth rate were calculated as 4.64% (Table 3).

**Table 3: First set of Tutuka data: Calculation of growth rate**

Year	Waste Type (m <sup>3</sup> /year)				Total
	Domestic	Building	Garden	Commercial	ton/day
1993	5500	4000	-	3500	<b>18</b>
2009	13373	2382	7386	-	<b>37.7</b>

IRD (t/d)	d	t (years)	MRD (t/d)
18.00	<b>0.0464</b>	16.30	37.70

Based on growth rate and a Site life of 50 years the Site classifies a Medium as seen on Table 4.

**Table 4: First set of Tutuka data: Site size classification after 50 years**

IRD (t/d)	d	T (years)	MRD (t/d)	Classification
37.70	0.046	50.00	364.11	<b>Medium</b>

Based on the assumption that Tutuka Power Station may wish the Site to classify as Small, albeit at the cost of losing site life, the operational life of such a Small site has been calculated for two scenarios:

In Scenario C the IRD used was the average amount of waste disposed of, in 2009. The IRD was calculated as 37.7 t/d (see Table 2).

• The development rate i.e. the accumulative growth from 1993 until 2009, was then calculated as per Minimum Requirements (i.e. "d" in MRD formula). The growth rate over this period was then determined as 4.64% (see Table 3). A MRD of 150 t/d is used to calculate the lifetime of the disposal site. The operational lifetime was calculated as **30.4 years**; and

• In **Scenario D** an IRD of 40 t/d was used as provided by Peter Legg. The calculated growth rate of 4.64% is used with a MRD of 150 t/d is used to calculate the lifetime of the disposal site. The operational lifetime was calculated as **29 years**.

**Table 5: First set of Tutuka data: Different scenarios to determine Site operational life**

	IRD	d	MRD	t (Years)
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<b>Scenario 1</b>	37.7	0.0464	150	<b>30.4</b>
<b>Scenario 2</b>	40.0	0.0464	150	<b>29.1</b>

Table 6: First set of Tutuka data

<b>TUTUKA POWER STATION SOLID WASTE SITE</b>				
<b>WASTE RECEIVED DISPLAY SHEET:</b>				
<b>YEAR 2009</b>				
<b>SUBSTANCES</b>	<b>JULY</b>	<b>A</b>	<b>B</b>	<b>MEASUREMENT</b>
DOMESTIC WASTE	387	7801	134931	CUBIC METERS
GARDEN WASTE	72	4309	11915	CUBIC METERS
BUILDING WASTE	34	1390	54410	CUBIC METERS
WORKSHOP STEEL	0	0	2477	KILOGRAMS
ASH FROM STATION	0	0	15731	CUBIC METERS
COAL FROM STATION	0	0	12162	CUBIC METERS
<b>RECLAIM AT DUMPING SITE</b>	<b>JULY</b>	<b>A</b>	<b>B</b>	<b>MEASUREMENT</b>
STEEL	0	0	11123	TONS
DOMESTIC RUBBLE	0	0	9801.5	KILOGRAMS
<b>RECYCLING AT STATION</b>	<b>JULY</b>	<b>A</b>	<b>B</b>	<b>MEASUREMENT</b>
STEEL	0	0	60658.64	TONS
OIL	0	0	240711.42	LITERS
PAPER	0	0	49854.15	KILOGRAMS
KITCHEN FOOD	0	0	17652	KILOGRAMS
OTHERS ( BUILDING&GARDEN )	289	5853	10318	CUBIC METERS
SHEETS RECEIVED	22	366	4438	EACH
SHEETS SPOILED	0	4	127	EACH
WATER METER READING	0	0	255.61	KILO LITERS
OPERATING COST	29981.5	479281.82	2357222.82	RAND
<b>NOTE 1:</b>				
<b>A = TOTAL RECEIVED, YEAR TO DATE</b>				
<b>B = TOTAL RECEIVED UP TO DATE AS FROM MAY 1993</b>				



**2.2.4 Second set of Tutuka data (Jan 2004 – Dec 2009)**

Towards the end of 2009 a second set of data was received from Tutuka Power Station (see Table 11). These data contained monthly figures for the different categories of waste from January 2004 up to November 2009. The unit in which the waste was measured was not shown in the data that were received. However, in comparing this set of data with the first set of data it emerged that the waste was measured in tonnes per day.

**2.2.4.1 Assessment of second set of Tutuka data for the period January 2004 up to July 2009:**

- On visual inspection of the data an increase in total tonnages was observable from one year to the next, excepting for the monthly average of the total tonnages for 2009 which showed a sharp decrease (to a level even lower than 2005);
- On closer inspection of the 2009 figures it also emerged that the figures showed significant differences when compared to the first data set received from Tutuka for January to July 2009;
- The previous set of waste disposal data received from Tutuka for January to July 2009 showed an increase relative to the previous years. This increase appeared to be in line with the trend of an annual increase in waste disposal for each year since January 2004 up to December 2008 (as reflected in the second data set received from Tutuka Power Station); and
- It is therefore submitted that, unless Tutuka wish to motivate why the sharp decrease in waste disposal has occurred in 2009 and also present reasons why the decrease in waste disposal in 2009 will be sustainable, the 2009 data for the second data set ( i.e. January 2004 – November 2009) is not used. Rather than using the January 2004 - November 2009 data (from the second data set) it is submitted that the January 2004 until December 2008 figures from the second data set be used to determine the MRD.

**2.2.4.2 Second set of Tutuka data: Determining the growth rate**

The growth rate was calculated using the second set of data provided by Tutuka, except for the January 2009 up to November 2009 figures which were discarded for the reasons explained above. The data starting from January 2004 up to December 2008 was therefore used to calculate the MRD as the average waste disposed between January and December 2008. This calculation showed that the MRD was 34.8 t/d. Based on this MRD of 34.8 t/d and an IRD of 22.4 t/d as in January 2004 (second data set) the growth rate were calculated as **9,2 %** (see Table 7).

**Table 7: Second set of Tutuka data: Growth rate calculation for January 2004 up to December 2008**

IRD (t/d)	d	t (years)	MRD (t/d)
22.40	<b>0.092</b>	5	34.8

If the growth rate is determined for the MRD for December 2008 using the IRD as in the permit application i.e. 18 t/d the growth rate was 3,7% (see Table 8).

**Table 8: Second set of Tutuka data: Growth rate calculation for 1991 up to December 2008**

IRD (t/d)	d	t (years)	MRD (t/d)
18.00	<b>0.037</b>	18	34.8

Based on the calculations for growth rate as performed on the first and second sets of data that were received from Tutuka Power Station, the growth rates showed a **minimum of 3,7% and maximum of 9.2%**.



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It is submitted that the 3,7% growth rate be used to calculate Site class in respect of its size. The reasons for using this growth rate were as follows:

- It was based on the most complete set of data (Jan 2004 until December 2008);
- This set of data does not portray figures that provide reason not to accept its correctness; and
- It was based on an IRD i.e. 18 t/d which has been on record with the Regulator and at the same time provided growth rates that appeared the most reasonable of all (i.e. 3,7% compared to 4,64% and 9.2%).

### 2.2.4.3 Using the calculated growth rate to determine the Site size after 50 years

The calculated growth rate was used to calculate the size class of the disposal site after 50 years:

**Table 9: Second set of Tutuka data: Site size classification**

IRD	d	t	MRD	Classification
34.8	0.037	50	217.21	Medium

Based on the assumption that Tutuka Power Station may wish the Site to classify as Small, the operational lifetime of such a Small site has been calculated as 39.9 years and is shown in Table 10.

**Table 10: Second set of Tutuka data: Operational life for the Site in order to classify as Small**

IRD	d	t	MRD	Classification	Operational Lifetime
34.8	0.037	39.9	150	GSB	39.9 years

**Table 11: Second set of Tutuka data: (January 2008 - November 2009)**

<b>TUTUKA POWER STATION CLASS " G " WASTE SITE:</b>						
MONTH	DOMESTIC 04	DOMESTIC 05	DOMESTIC 06	DOMESTIC 07	DOMESTIC 08	DOMESTIC 09
JAN.	447	420	488	406	360	468
FEB.	271	339	502	414	508	550
MARCH	277	333	662	458	318	434
APRIL	382	354	461	370	575	406
MAY	419	510	533	556	445	387
JUNE	393	458	536	402	297	408
JULY	349	425	613	482	372	385
AUG.	297	457	519	589	361	403
SEPT.	453	466	352	419	393	387
OCT.	351	533	407	427	440	341
NOV.	428	647	520	359	375	
DEC.	318	590	414	396	319	
<b>TOTALS</b>	<b>4385</b>	<b>5532</b>	<b>6007</b>	<b>5278</b>	<b>4763</b>	<b>4169</b>
<b>Ave</b>	<b>365.42</b>	<b>461.00</b>	<b>500.58</b>	<b>439.83</b>	<b>396.92</b>	<b>416.90</b>

MONTH	Garden 04	Garden 05	Garden 06	Garden 07	Garden 08	Garden 09
JAN.	62	59	22	50	60	45
FEB.	85	85	119	111	900	118
MARCH	214	79	146	250	87	185



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<b>MONTH</b>	<b>Garden 04</b>	<b>Garden 05</b>	<b>Garden 06</b>	<b>Garden 07</b>	<b>Garden 08</b>	<b>Garden 09</b>
APRIL	138	47	145	352	174	336
MAY	173	69	211	358	249	343
JUNE	203	146	125	120	84	72
JULY	74	157	153	159	420	138
AUG.	96	354	66	139	171	133
SEPT.	14	174	39	84	234	130
OCT.	90	88	54	115	292	94
NOV.	98	33	56	63	326	
DEC.	8	71	22	78	75	
<b>TOTALS</b>	<b>1255</b>	<b>1362</b>	<b>1158</b>	<b>1879</b>	<b>3072</b>	<b>1594</b>
<b>Ave</b>	<b>104.58</b>	<b>113.50</b>	<b>96.50</b>	<b>156.58</b>	<b>256.00</b>	<b>159.40</b>

<b>MONTH</b>	<b>BUILDING 04</b>	<b>BUILDING 05</b>	<b>BUILDING 06</b>	<b>BUILDING 07</b>	<b>BUILDING 08</b>	<b>BUILDING 09</b>
JAN.	53	4	15	59	27	55
FEB.	14	6	2	43	250	93
MARCH	40	6	24	101	49	67
APRIL	0	1	4	9	420	24
MAY	0	37	34	132	135	3
JUNE	0	27	12	93	6	45
JULY	4	38	45	12	75	34
AUG.	21	20	6	60	150	93
SEPT.	19	31	6	60	3	30
OCT.	2	3	6	52	96	12
NOV.	8	53	11	150	0	
DEC.	12	17	32	30	12	
<b>TOTALS</b>	<b>173</b>	<b>243</b>	<b>197</b>	<b>801</b>	<b>1223</b>	<b>456</b>
<b>Ave</b>	<b>14.42</b>	<b>20.25</b>	<b>16.42</b>	<b>66.75</b>	<b>101.92</b>	<b>45.60</b>

<b>MONTH</b>	<b>Total 04</b>	<b>Total 05</b>	<b>Total 06</b>	<b>Total 07</b>	<b>Total 08</b>	<b>Total 09</b>
JAN.	562	483	525	515	447	568
FEB.	370	430	623	568	1658	761
MARCH	531	418	832	809	454	686
APRIL	520	402	610	731	1169	766
MAY	592	616	778	1046	829	733
JUNE	596	631	673	615	387	525
JULY	427	620	811	653	867	557
AUG.	414	831	591	788	682	629
SEPT.	486	671	397	563	630	547
OCT.	443	624	467	594	828	447
NOV.	534	733	587	572	701	546
DEC.	338	678	468	504	406	
<b>TOTALS</b>	<b>5813.0</b>	<b>7137.0</b>	<b>7362.0</b>	<b>7958.0</b>	<b>9058.0</b>	<b>6765.0</b>
<b>Ave</b>	<b>484.4</b>	<b>594.8</b>	<b>613.5</b>	<b>663.2</b>	<b>754.8</b>	<b>621.9</b>
<b>Ave/day</b>	<b>22.4</b>	<b>27.5</b>	<b>28.3</b>	<b>30.6</b>	<b>34.8</b>	<b>26.0</b>



### 2.3 Water balance for existing and new Tutuka disposal site

The following water balance calculations have been performed. The waste disposal site will be classified as B.

**Table 12: Water balance for Tutuka disposal site**

10 Wettest Years: Rainfall in mm (6 Wettest Months)						TOTAL
Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	
242	118	44	197	27	133	761
189	51	110	102	67	112	631
145	86	266	132	167	85	881
130	216	370	255	300	66	1337
84	218	93	285	173	74	927
74	214	103	101	100	106	698
158	74	91	90	233	62	708
99	85	223	241	54	49	751
157	39	151	54	101	160	662
179	151	148	146	43	86	753

Evaporation S-pan in mm (Same Months As Rainfall)						TOTAL
Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	
159	208	212	179	195	177	1130
200	160	194	222	167	194	1137
199	228	193	191	144	142	1097
221	185	198	218	156	162	1140
224	237	232	165	145	156	1159
210	203	209	189	173	122	1106
171	186	187	188	120	179	1031
168	196	203	193	167	194	1121
210	169	206	194	187	105	1071
185	185	186	217	178	157	1108

### 3.0 DISCUSSION

The Tutuka disposal site classification for the **new** site's size has been done using three sets of data and which warrants discussion.

The one set of data referred to as the **SRK data**, was extracted from the permit application submitted and signed by the Tutuka Power Station Manager on 22 January 1991. This data showed that in calculating the MRD (on which site size classification was based) the site classified as Small (development rate assumed as



## TUTUKA POWER STATION: CLASSIFICATION ON DISPOSAL SITES

2%) and remained Small when a development rate of 3% is used. However the Site in terms of its size became Medium if the development rate was taken as 3,25%.

After classification was done based on the SRK data and the report submitted to Tutuka Power Station, Golder received another set of data from Tutuka Power Station and which provided total volumes of waste for two timeframes namely May 1993 to July 2009 and from January 2009 to July 2009. This **first set of Tutuka Data** enabled Golder to determine the development rate instead of assuming the rate based on average population growth based on national demographic statistics. The IRD that was used to calculate the development rate was the SRK IRD which was in the permit application report submitted to DWAF in 1991. The accuracy of this IRD was also tested by calculating the per capita waste generation as in 1991. This calculation showed that the IRD is rather high which meant that the development rate in respect of the Tutuka Power Station of 4.64% tended to be on the low rather than on the high side.

Subsequent to the this and after having discussed the Site class calculations based on the first set of data with Tutuka a **second set of Tutuka Data** was received from the Power Station for the period of January 2004 until November 2009. These figures were assessed and excepting for the data covering January 2009 until November 2009 was found to be acceptable. The figures for January 2009 to November 2009 showed anomalies and was hence ignored in subsequent Site class calculations. The growth rate was then calculated as in 2008 using two different IRDs namely the 1991 IRD of 18 t/d and again the IRD as on January 2004 i.e. 22,4t/d. The growth rates calculated as 3,7% (IRD of 18 t/d) and 9.2% (using IRD of 22.4 t/d).

The three sets of data therefore provide different growth rates pending which IRD and MRD are used. It is Golder's view that the 3,7% growth rate should be used to calculate Site class in respect of its size. The reasons for using this growth rate were as follows:

- It was based on the most complete set of data (Jan 2004 until December 2008);
- This set of data did not portray figures that provide reason not to accept its correctness; and
- It was based on an IRD i.e. 18 t/d which is on record with the Regulator and at the same time provides growth rates that appear the most reasonable of all (i.e. 3,7% compared to 4,64% and 9,2%).

The **new** site classified as Medium when the calculated (rather than assumed) growth rate of 3,7% was used.

It is submitted that the calculated development rate of 3,7% rather than the assumed rates (2, 3 and 3,25%) be used for classifying the size of the **new** site. The reasons for this appear in the preceding paragraph and further include:

- The Site already classified as Medium in terms of an assumed development rate of 3,25%;
- The Site also classified as Medium when the calculated development rate of 3,7% was used;
- None of the calculated growth rates for a 50 year Site life, supported a Site classification in the Small category;
- At the calculated development rate of 9.2% the Site classified in the large size class which is > 500 t/d. (2 850 t/d at 9.2% over the next 50 years); and
- To use the assumed development rate of less than 3,25% in order to classify the new site as Small cannot be scientifically or otherwise defended.

For the new site to remain in the small size classification the MRD must be less than 150 t/d. Thus, if the lifetime of the site is less than 39,9 years at a growth rate of 3,7%, the site will stay in the Small size classification.



### 4.0 CONCLUSION

The new site will be:

- **General** in terms of the waste it receives;
- **Medium** in respect of the size of the waste stream in 50 years from now (using the lowest calculated growth rate i.e. 3,7%);
- **Small** in respect of the size of the waste stream if the operation life of the site was reduced to 39,9 years from now (using the lowest calculated growth rate i.e. 3,7%); and
- **B<sup>-</sup>** in terms of the Site water balance.

The **new** site therefore classified as a G:M:B<sup>-</sup> (for Site life of 50 years) and G:S: B<sup>-</sup> (for Site life of 39.9 years) based on the Second Edition of the DWAF Minimum Requirements and the various assumptions as discussed in this report.

The **existing** Site classifies as G:S: B<sup>-</sup>.

It is highly unlikely that the size classification of the **new** Site will change should more accurate waste generation data become available. If the water balance formula, as presented in the yet unpublished Third Edition Minimum Requirements of DWA is used for water balance calculations of the **new** site may possibly classify as a B<sup>+</sup> and require an engineered leachate management system.

The above provides for specific strategic implications for Tutuka Power Station in respect of the way forward towards obtaining the required authorisations.

#### GOLDER ASSOCIATES AFRICA (PTY) LTD.

L Bredenhann  
Divisional Leader: IWWMP

Elias Barnard  
Waste Consultant

LB/EB/js

Reg. No. 2002/007104/07

Directors: FR Sutherland, AM van Niekerk, SAP Brown, L Greyling, SM Manyaka

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# **APPENDIX A**

## **Document Limitations**





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Africa	+ 27 11 254 4300
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

[solutions@golder.com](mailto:solutions@golder.com)  
[www.golder.com](http://www.golder.com)



**Golder Associates Africa (Pty) Ltd**  
**PO Box 13776, Hatfield, 0028**  
**Ditsela Place**  
**1204 Park Street**  
**Hatfield, Pretoria**  
**Gauteng**  
**South Africa**  
**T: [+27] (12) 366 0100**

