

## ANNEXURE E

### ANALYSIS of FUTURE KOUGA ZONE DEMAND

This analysis was performed to determine the future demand to be expected from the towns within the Kouga Municipality which at present obtain water from the NMMM bulk supply system.

#### 1 Humansdorp: Water Sources & Bulk Infrastructure

The main sources of water supply to Humansdorp are several fountains in a vlei approximately 3 km north of the town. The supply of the fountains vary between a maximum of 4 000 kℓ/d to a minimum of 1 200 kℓ/d during severe drought periods. Water is collected into a dam and weir with combined capacity of 48000 m<sup>3</sup>. The system's estimated supply yield is 812 Mℓ/annum or 2200 kℓ/d (WSDP – KweziV3). Water gravitates from the fountains to the water treatment works via a 250 mm ø pipe. The WTW was constructed in 2001 and presently operates at about 60% of design capacity during peak season.

Borehole BH1 is situated in Boskloof near the Nelson House (previously named Motel Transvia) and has a yield of 400 kℓ/d. Additional production boreholes were developed in 1999 (Kruis –Elect.) and 2000 (Berg BH).

Since 1992, bulk water is supplemented from the Churchill pipeline which passes through the town. Water is pumped via a 250 mm ø x 3.5 km pumping main at a rate of 42 ℓ/s or 3 346 kℓ/d between the Churchill pipeline and the town reservoirs. The permitted abstraction amount for the year 1996/1997 (the last scheduled year of the agreement) was 250 m<sup>3</sup>/d and the annual limit of abstraction was 60 Mℓ/year. The actual volume abstracted from the pipeline for the year 2001/2002 was according to the Kouga Municipality (WSDP –KweziV3), approximately 352 Mℓ/year which equates to some 964 kℓ/d. Actual metered consumption by NMMM recorded 446.88 Mℓ/year (or 1224 kℓ/d)

The net effect of additional ground water resources as discussed above was a reduction in annual water abstraction rate from the NMMM system as illustrated in the table below.

Humansdorp Historical Water Use from all sources					
Source Name	Permitted Max abstraction		Actual abstraction Rate (Mℓ/year)		
	(Mℓ / year)	(Kℓ/day)	2000/01	2001/02	2002/03
Swartebosch Spring	812	2220	N/A	812	
Transvia Borehole	142	389	N/A	142	
Berg Borehole	21	58	0	21	
Kruisrivier Mech.	3	8	3	3	
Kruisrivier Elect.	68	167	0	68	
NMMM – Churchill Pipeline	60	250	504.3	446.9	398.3
Total Bulk Water Demand					

The Peak Week abstraction rate and peak week factor from the NMMM system has also reduced over the same period as follows:

Year	Peak Week Daily Demand	Peak Week Factor
2000/01	26 Jan '00 2 880 kl/d	2.08
2001/02	7 Nov '01 2 255 kl/d	1.84

The total reservoir storage capacity for Humansdorp amounts to 6.2 MI which equates to hours AADD storage. The following table summarises the existing reservoir infrastructure.

Humansdorp: Summary of Reservoirs								
General information	Res 1	Res 2	Res 3	Res 4	Res 5	Res 6	Res 7	Res 8
Component name	Water Tower	WTW	Kruis RSV's	Johnson's Ridge	Gill Marc	Gill Elev Tower	Kruis Prop Tower	Berg Tower
Date constructed	1997	1972	1972	1992	1999	1995	2002	2000
Reservoir capacity (M <sup>3</sup> )	0.5	3.77	0.56	0.3	0.8	0.03	0.21	0.035

The table below illustrates the anticipated future demand and peak week demand on the Churchill/Elandsjagt bulk supply system ("bold" figures are actual water use). Humansdorp showed little growth in water demand over the last four years.

HUMANSDORP							
Bulk Water Demand - Estimated growth rate				2.0 % per annum			
Peak Week Factor				1.7 x Ave Day Demand			
YEAR	Ave day demand (kl/day)			Peak Week Demand (kl/day)			
	Total	Own Sources	NMMM Supply	Total	Own Sources	NMMM Supply	PWF to NMMM
2001/02	<b>3324</b>	2100	<b>1224</b>	5651	2400	3251	2.7
2002/03	<b>3267</b>	<b>2173</b>	<b>1094</b>	5554	2400	3154	2.9
2003/04	<b>3131</b>	<b>1819</b>	<b>1312</b>	5323	2400	2923	2.2
2004/05	<b>3277</b>	<b>1632</b>	<b>1645</b>	5571	2400	3171	1.9
2005/06	3343	1800	1543	5682	2400	3282	2.1
2006/07	3409	1800	1609	5796	2400	3396	2.1
2007/08	3478	1800	1678	5912	2400	3512	2.1
2008/09	3547	1800	1747	6030	2400	3630	2.1
2009/10	3618	1800	1818	6151	2400	3751	2.1
2010/11	3690	1800	1890	6274	2400	3874	2.0
2011/12	3764	1800	1964	6399	2400	3999	2.0
2012/13	3840	1800	2040	6527	2400	4127	2.0
2013/14	3916	1800	2116	6658	2400	4258	2.0
2014/15	3995	1800	2195	6791	2400	4391	2.0
2015/16	4075	1800	2275	6927	2400	4527	2.0
2016/17	4156	1800	2356	7065	2400	4665	2.0
2017/18	4239	1800	2439	7207	2400	4807	2.0
2018/19	4324	1800	2524	7351	2400	4951	2.0
2019/20	4410	1800	<b>2610</b>	7498	2400	<b>5098</b>	2.0

## 2 Jeffreys Bay: Water Sources & Bulk Infrastructure

Jeffreys Bay is a coastal holiday town with a population of some 18 600 (2001/02) which during holiday peak season is “topped up” with some 31 900 tourists and holiday makers (WSDP – KweziV3).

Bulk water supply to Jeffreys Bay is sourced from two sources, namely groundwater and NMMM. and from the Churchill/Elandsjagt bulk supply pipeline which transfers treated water to the NMMM.

### (a) Groundwater

A borehole cluster northeast of town supplies groundwater to a WTW located at the borehole cluster. The WTW was constructed in 1972 with a design capacity of 3400 Kl/day. The annual volume treated in 2001/02 was 1130 MI (3096 Kl/day).

The safe yield of the cluster is unknown at present but has been operated at up to 60ℓ/s. This was reported during a geohydrological study of the borehole field carried out by Geocon Geohydrologists in 1999. Although individual boreholes capacities can deliver higher total flows as tabled below, the average flow rate for the cluster was found to be approximately 40ℓ/s (1260 MI/annum or 3456 Kl/day) and for the purpose of this report will be assumed as being the safe yield of the cluster.

The Water Services Development Plan compiled by KweziV3 indicated for 2001/02 and for future years that the abstraction rate (which appears to be the maximum “utilisation rate” due to stoppages for reservoirs being full and for maintenance) is 957 MI/annum (76% of yield).

<b>Jeffreys Bay – Groundwater sources &amp; individual capacities (Borehole cluster) – KweziV3</b>							
Component ID	<b>BH1</b>	<b>BH3</b>	<b>BH7</b>	<b>BH8</b>	<b>BH9</b>	<b>BH10</b>	<b>BH11</b>
Delivery capacity (Kl/day)	840	648	745	713	1200	881	972

### (b) NMMM

Treated water from the Churchill/Elandsjagt pipelines is abstracted at two points, one at the reservoir above Wavecrest and the other point towards Paradise Beach.

Water from the pipeline at the Wavecrest connection point gravitates to two reservoirs (joint capacity = 8,68 MI) just south of the connection point. Water from the second connection

point gravitates to a 4,0 MI collection reservoir from where the water is pumped to an adjacent water tower, which feeds Ashton Bay and Paradise Beach.

The permitted abstraction amount in terms of the outdated PEM Supply Agreement for year 1996/1997 (the last scheduled year of the agreement) was 3 600 m³/d and the annual limit of abstraction was 450 MI/year. The actual volume abstracted from the pipeline for the year 2001/2002 was according to the Kouga Municipality, approximately 1 211 MI/year (3317 KI/day), which is exceeding the limit by a substantial amount.

The total reservoir storage capacity for the Jeffreys Bay / Paradise Beach Zone amounts to 20.68 MI. The table below summarises the existing reservoir infrastructure.

	<b>Res 1</b>	<b>Res 2</b>	<b>Res 3</b>	<b>Res 4</b>	<b>Res 5</b>	<b>Res 6</b>
Component name	Churchill Res 1	Churchill Res 2	Borehole Res 1	Borehole Res 2	Paradise Beach	Paradise B W'tower
Reservoir capacity (MI)	8	0,68	2,5	3,0	4,0	2,5

The table below illustrates the anticipated future demand and peak week demand on the Churchill/ Elandsjagt bulk supply system (“bold” figures are actual water use).

**JEFFREYS BAY**

Bulk Water Demand - Estimated growth rate	8.0 % per annum
Peak Week Factor	2.1 x Ave Day Demand

YEAR	Ave day demand (KI/day)			Peak Week Demand (KI/day)			
	Total	Own Sources	NMMM Supply	Total	Own Sources	NMMM Supply	PWF to NMMM
1999/00	<b>5190</b>	<b>2500</b>	<b>2690</b>	10899	3398	7501	2.8
2000/01	<b>5212</b>	<b>2600</b>	<b>2612</b>	10945	3399	7546	2.9
2001/02	<b>5968</b>	<b>2600</b>	<b>3368</b>	12533	3400	9133	2.7
2002/03	<b>6456</b>	<b>2600</b>	<b>3856</b>	13558	3400	10158	2.6
2003/04	<b>6530</b>	<b>2400</b>	<b>4130</b>	13713	3400	10313	2.5
2004/05	<b>6350</b>	<b>2700</b>	<b>3650</b>	13335	3400	9935	2.7
2005/06	6700	2700	4000	14070	3400	10670	2.7
2006/07	7236	2700	4536	15196	3400	11796	2.6
2007/08	7815	2700	5115	16411	3400	13011	2.5
2008/09	8440	2700	5740	17724	3400	14324	2.5
2009/10	9115	2700	6415	19142	3400	15742	2.5
2010/11	9844	2700	7144	20673	3400	17273	2.4
2011/12	10632	2700	7932	22327	3400	18927	2.4
2012/13	11483	2700	8783	24114	3400	20714	2.4
2013/14	12401	2700	9701	26043	3400	22643	2.3
2014/15	13393	2700	10693	28126	3400	24726	2.3
2015/16	14465	2700	11765	30376	3400	26976	2.3
2016/17	15622	2700	12922	32806	3400	29406	2.3
2017/18	16872	2700	14172	35431	3400	32031	2.3
2018/19	18221	2700	15521	38265	3400	34865	2.2
2019/20	19679	2700	<b>16979</b>	41326	3400	<b>37926</b>	2.2

### 3 Loerie

Loerie receives potable water from the Loerie WTW adjacent to the Loerie Dam, which is approximately 2km away from the town. The Loerie WTW is being operated by the NMMM and supplies water to the Metro. Water from the treatment works are then pumped to 2 x 230kl reservoirs in Loerieheuwel north- east of town, as well as to a small elevated tank in the school yard in Loerieheuwel. The elevated tank provides emergency storage and pressure to the system should any failures in water supply occur. From these storage tanks water gravitates into the distribution network.

Present water demand for Loerie is about 36 MI/annum (98 KI/day). This volume is minute compared to the overall capacity of the NMMM infrastructure and will not be taken into further consideration for the purposes of this report.

### 4 Oyster Bay – Sources and Bulk Water Infrastructure

Oyster Bay receives bulk water from three sources, ie. two boreholes and one fountain. Water is pumped from these sources to the WTW north of the town with a 300 KI/day design capacity. Treated water is then stored in 2 x 0,25MI storage reservoirs for distribution in the network.

The WTW treated on average some 120 KI/day during 2002.

Source	Permitted abstraction / Yield		2002 Abstraction		Delivery Capacity ( KI/day)
	(MI/year)	(KI/day)	(MI/year)	(KI/day)	
BH 1	21	58	12.3	33.7	57
BH 2	7	19	3	8.2	19
Fountain	126	345	35	95.8	345

### 5 Patensie: Sources

Patensie receives bulk raw water from the Gamtoos Irrigation Board's canal, which runs from the Paul Sauer Dam. Raw water is then transported under gravity to the 2,0 MI/d WTW. From the WTW the purified water is then pumped to three communal supply reservoirs with capacities 1,3 MI, 0,5 MI and 0,5 MI respectively which feeds Upper Patensie, Citrus Village and Ramaphosa Village.

Present bulk water demand (2002) is in the order of 600 KI/day (treated water supplied = 495 KI/day).

## 6 Cape St Francis & St Francis Bay

St Francis Bay and Cape St Francis are both served through the same bulk water supply system. The scheme comprises of two sources, ie the Churchill/Elandsjagt pipelines (NMMM main supply) and 8 production boreholes.

Water from the boreholes is pumped to the 3.5 Ml/day design capacity WTW (constructed in 1997) in St Francis Bay for treatment. From the WTW it is pumped to 2 x 4,5 Ml reservoirs, which also stores water from the Churchill /Elandsjagt pipelines. From these reservoirs the water gravitates into the distribution system of St Francis Bay and the remainder gravitates to 2 x 0,5 Ml reservoirs in Cape St Francis, from where it is distributed in the system.

A booster pump station (capacity unknown) which boosts the water supplied from the NMMM supply point, was constructed in 1987.

The WTW treats at present (2002) some 677 Ml/annum (1850 Kl/day).

Borehole/ well name	Borehole I D	Permitted abstraction /Yield		2002 abstraction		Delivery Capacity (Kl/day)		
		(Ml/year)	(Kl/day)	(Ml/year)	(Kl/day)			
Palamos	BH-5	!		75	!	205		
Santa 2	BH-6	315	!	863	38	!	104	649
Santa 3	BH-7	441	!	1208	80	!	220	907
Fisherman Spring	BH-8	!			62	!	170	
Homestead	BH-9	!			!			248
Airfield 1	BH-1	315	!	863	151	!	414	646
Airfield 3	BH-2	208	!	570	8	!	22	427
Airfield 4	BH-3	315	!	863	-	!	-	646
Airfield 5	BH-4	!			261	!	715	691
				675	!	1850		

The following table summarises the existing reservoir infrastructure:

General information	RES 1	RES 2	RES 3	RES 4
Component name				Cape St Francis
Reservoir capacity (M <sup>3</sup> )	4	4	0,01	0.5

The table below illustrates the anticipated future demand and peak week demand on the Churchill/ Elandsjagt bulk supply system.

ST FRANCIS BAY						
Estimated water demand growth rate			2.0 % per annum			
Peak Week Factor			2.2 x Ave Day Demand			
YEAR	Ave day demand (KI/day)			Peak Week Estimated Demand (KI/day)		
	Total	Own Sources	NMMM Supply	Total	Own Sources	NMMM Supply
2001/02	2766	<b>1850</b>	<b>916</b>	6085	1950	4135
2002/03	2612	1800	<b>812</b>	5746	1950	3796
2003/04	2691	1800	<b>891</b>	5920	1950	3970
2004/05	2705	1800	<b>905</b>	5951	1950	4001
2005/06	2759	1800	959	6070	1950	4120
2006/07	2814	1800	1014	6191	1950	4241
2007/08	2871	1800	1071	6315	1950	4365
2008/09	2928	1800	1128	6442	1950	4492
2009/10	2987	1800	1187	6570	1950	4620
2010/11	3046	1800	1246	6702	1950	4752
2011/12	3107	1800	1307	6836	1950	4886
2012/13	3169	1800	1369	6973	1950	5023
2013/14	3233	1800	1433	7112	1950	5162
2014/15	3297	1800	1497	7254	1950	5304
2015/16	3363	1800	1563	7399	1950	5449
2016/17	3431	1800	1631	5832	1950	3882
2017/18	3499	1800	1699	5949	1950	3999
2018/19	3569	1800	1769	6068	1950	4118
2019/20	3641	1800	1841	6189	1950	<b>4239</b>

## 7 Thornhill: Water Sources

Thornhill receives purified water from the Summit-Chelsea water pipeline which runs adjacent to the Old Cape Road/Gamtoos Main Road south of town.

Thornhill previously received potable water directly from the pipeline into the distribution system without any storage facilities. The NMMM however requested the Municipality to supply extra storage capacity in the form of elevated storage tanks to avoid a 24 hour draw-off from one of the NMMM's main supply lines. Two elevated steel storage tanks ( 1 x 44 KI and 1 x 65 KI storage capacity) were constructed in 2002.

Water gravitates under pipeline head directly from the Summit-Chelsea pipeline to the elevated tanks, since the static pressure at the draw-off point is adequate to lift water into the tanks.

The table below summarises the historical water demand of Thornhill, Loerie, Thornhill Squatters and Dustpan.

NMMM - Bulk Metered Supplies from Loerie System (KI/annum)									
Town	1998/99	1999/00	2000/01	2001/02	2002/03	Ave Day 02/03 (KI/d)	Peak Week (KI/d)	Peak Week Date	Peak Week Factor
Loerie	42,025	42,458	48,148	57,936	65,427	179	182	24-Dec-01	1.0
Thornhill	15,727	10,500	7,394	7,404	15,412	42	48	26-Jan-00	1.1
Thornhill Squatters	9,137	32,028	14,153	16,658	14,940	41	61	10-Jan-01	1.5
Dustpan	10,520	9,087	10,749	11,470	13,568	37	55	10-Jan-01	1.5

## 8 Paradise Beach

Paradise beach is supplied from the Churchill Pipeline system as the only source.

The schedule below summarises historical and estimated future demand for this holiday town (bold figures = Actual).

PARADISE BEACH		
Estimated water demand growth rate		2.0%
Peak Week Factor		2.1
YEAR	Ave Day (KI/day)	Peak Week (KI/day)
	NMMM Supply	NMMM Supply
2001/02	<b>158</b>	332
2002/03	<b>266</b>	559
2003/04	<b>232</b>	487
2004/05	<b>639</b>	1342
2005/06	652	1369
2006/07	665	1396
2007/08	678	1424
2008/09	692	1453
2009/10	706	1482
2010/11	720	1511
2011/12	734	1541
2012/13	749	1572
2013/14	764	1604
2014/15	779	1636
2015/16	795	1668
2016/17	810	1702
2017/18	827	1736
2018/19	843	1771
2019/20	<b>860</b>	<b>1806</b>