
Annexure D

UPGRADING OF THE BULK WATER SUPPLY SYSTEM FOR COLCHESTER / CANNONVILLE

1. Introduction

Colchester /Cannonville is situated some 40km north of the Port Elizabeth city centre along the N2 National Road to East London. The two villages are presently slow in property development with only some 340 middle/high income type erven being developed out of some 790 registered erven (approximately 42%). All indications are that this situation will change drastically over the next 5 years.

A prestigious development (Ingleside Wildlife Estate) is being planned for some 342 erven and some 60 townhouses on the left bank of the Sundays River directly outside the Nelson Mandela Metropolitan Municipality (NMMM) municipal boundary. The Developer applied to NMMM for a bulk water service connection at its boundary with NMMM. This will start off a new interest into development at these two villages and will have a marked impact on demand for services.

This Zone Report is an investigation into the transfer and storage capacities of the present bulk supply and distribution water infrastructure and makes recommendations regarding the upgrading programme required to meet estimated future growth.

2. Bulk water supply system

Bulk water is supplied to Colchester / Cannonville from the NMMM Coega Kop reservoir (TWL 121m MSL) constructed in 2001/02 and a 1000/800/600/450mm diameter bulk distributor pipeline constructed in 1999. This pipeline was designed as the main feeder main into the Coega Industrial Zone, presently under development along the north-eastern boundary of the NMMM.

Coega Kop Reservoir is supplied from the Nooitgedagt Water Treatment Works on the right bank of the Sundays River. Water from the Gariep Dam is transferred over some 400km along a series of tunnels, canals and diversion weirs from the Orange River to the Great Fish River to the Littke Fish River and then into the Sundays River at Lake Mentz. Water is released by DWAF from Lake Mentz for the use of the Sundays River Irrigation Board (SRIB). The SRIB diverts water at Korhaansdrift Weir from the Sundays River into the SRIB canal system for distribution to irrigators. At the Scheepersvlakte Balancing Dam on the left bank of the Sundays River, water is abstracted by NMMM along a 9.1 kmx1,47m diameter gravity pipeline to its Nooitgedagt WTW.

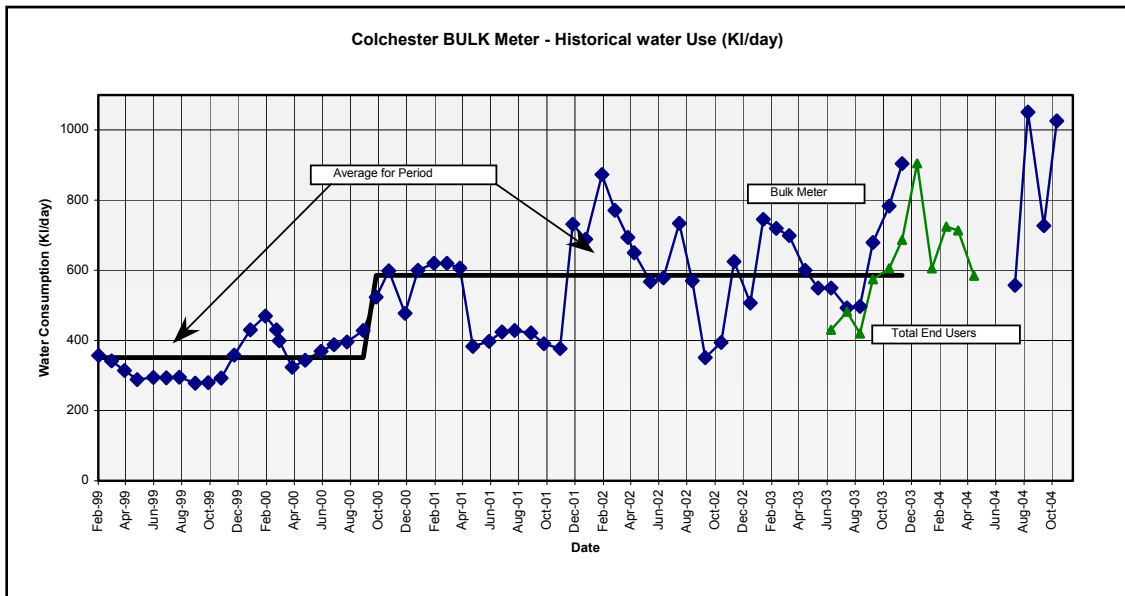
Water is pumped from the Nooitgedagt WTW along a 14,0 kmx1000mm diameter pipeline (maximum transfer capacity 105 Ml/day) to the 23 Ml storage capacity Grassridge Reservoir at TWL 235m MSL. From Grassridge Reservoir, water gravitates to the Coega Kop and Motherwell reservoirs along a 18,7 kmx1100mm diameter pipeline.

Water for Colchester/Cannonville gravitates from the lower end of the 450mm diameter section of the Coega Kop to Coega IDZ pipeline via a 200mm diameter FC pipeline over a distance of some 21.4km to the 1.5 MI storage reservoir (TWL 61.6m MSL) at Colchester. The 200mm feeder main to Colchester was constructed both as a supply and distribution pipeline for Colchester and Cannonville. This puts a limitation on the maximum static head within the supply main due to the maximum allowable design pressures of the reticulation system. In order to limit the maximum static pressures transferred from the main pipeline into the Cannonville and Colchester reticulation systems, a “pressure control station” was constructed at Chainage 11.7km from the NMMM off-take. This in turn reduced the maximum transfer capacity of the 200mm feeder main.

The Main Report gives an overview of the NMMM bulk water supply system from its Nooitgedagt Water Treatment Works to the Motherwell and Coega Kop reservoirs as well as the bulk supply pipelines between these main elements. It also shows the position of the existing 200mm diameter supply main to Colchester along the N2 route.

3. Present water demand and losses

The bulk water meter at the Colchester off-take on the 450mm diameter pipeline, has not been in operation at all times which left long periods in time without a proper flow record. Water sales records for Colchester only became available after the inclusion of this area into the new NMMM metropolitan boundaries.



The graphical information above is further amplified in the break down of the various bulk consumer demands and un-accounted for losses (15-24%) in the table below.

Table 1: Water Demands by Consumer categories

Water User Category	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	Jan-04
Domestic Users (Kl/day)	196.3	145.3	229.1	215.8	276.2	438.0	330.5
Small Bussiness (Kl/day)	6.4	5.8	7.4	8.5	7.9	13.8	27.9
Large Business -							
<i>Cerebos Ltd (Kl/day)</i>	198.3	185.7	216.7	257.0	250.4	283.3	120.0
<i>Marine Growers (Kl/day)</i>	10.5	11.6	11.2	11.3	11.2	15.2	8.4
<i>Myers Prop Trust (Kl/day)</i>	14.6	13.1	18.5	21.7	35.2	52.0	46.1
<i>Arizona Farm (Kl/day)</i>	56.2	51.3	51.6	50.9	63.1	89.0	40.0
<i>Newport Const. (Kl/day)</i>	0	6.9	40.0	40.0	43.3	13.6	32.5
Total Water Sales (Kl/day)	482.3	419.7	574.5	605.2	687.3	904.9	605.4
Bulk Meter (Kl/day)	493	497	679	783	904	N/A	N/A
UfW (Kl/day)	10.7	77.3	104.5	177.8	216.7		
UfW (%)	2.2%	15.6%	15.4%	22.7%	24.0%		

Note: Bulk Meter was removed in Dec 2003

Table 4 has been compiled to estimate future water demand in Colchester/Cannonville. The 2003 water demand (excluding system losses) by end-users in Colchester/Cannonville is calculated at 364 Kl/day. This amount equates to the average metered sales for the measuring period of **Table 1** above of only those consumers north-east of the Sundays River (i.e. within Colchester and Cannonville under the supply zone of the present 1.5Ml reservoir). Upstream users (Cerebos, Marine Growers and Newport Construction) have been excluded from **Table 4**.

4. Colchester / Cannonville Long Term Planning

(a) Reservoir storage

Until 2003 the development of private property has been slow in Colchester/Cannonville. The proposed Ingleside / Sundays River Estate Development will however change the historic demand pattern and escalate the demand for services and more specific for bulk water supply.

The long term (i.e. when fully occupied) effect of the proposed Ingleside Estate has been summarised in **Table 2** below:

Table 2: Average daily water demand for Ingleside:

Storage capacity of present reservoir	= 1500 Kl
Estimated 2005 average day water demand – Colchester /Cannonville (Refer Table 4 - 2005 AADD including 20% losses)	= 459 Kl/day
Ave day demand 342 erven @950l/day	= 325 Kl/day
Ave day demand 60 townhouses @ 800l/day	= 48 Kl/day
Ave day demand Admiral club, Lodge, etc.	= 50 Kl/day
Total Ave daily demand for Ingleside	= 423 Kl/day
Total Ave Day Demand	= 881 Kl/day

This equates to some (1500 / 881) 1.7 days (40.8 hours) storage. A norm of 36 hours storage is an acceptable risk of water supply norm in terms of the Department of Housing's "Guidelines for Human Settlement Planning and Design" (Revised August 2003) which states that "A storage capacity of 48 hours of annual average daily demand is suggested, although there may be situations where 24 hours will suffice".

The sale of property within the proposed Ingleside Wildlife Estate development is estimated to be sold out within 12 months of its completion. The actual development of houses and actual occupation rate is however estimated to be slower. **Table 4** reflects a most probable scenario of occupation (i.e. water usage) within Ingleside and its effects to the overall water demand.

From the Peak Week Demand and AADD columns it is estimated that the proposed construction of the second 1.5Ml reservoir in 2007/08 will be in time to ensure a 2 x AADD storage capacity for Colchester/Cannonville.

The registered /serviced erven for Colchester / Cannonville consists at present of –

Cannonville	180 middle/high income erven
Private land – left bank north of Cannonville	65 middle/high income erven
Colchester	540 middle income erven
Colchester	150 low income erven

Only some 342 middle and high income households were using water as developed erven in 2003 plus the 150 low income units.

Future land development will be limited due to the availability of land being restricted by the steep topography to the north, the Sundays River to the west and the south as well as the Larger Addo Elephant Park boundary.

Based on the limitations of available land, future low cost development could consist of some 300 units and middle/high income units of a further 550 units. The ultimate estimated water demand for the Colchester/Cannonville reservoir supply zone can therefore be summarised as scheduled in **Table 3** below:

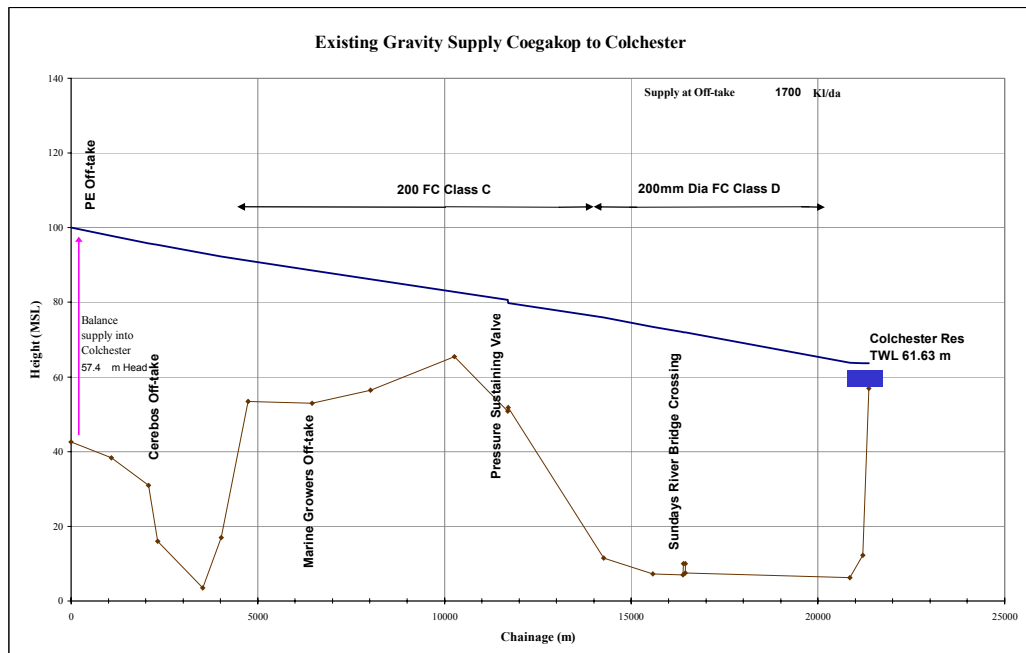
Table 3: Estimated Ultimate Water Demand for Colchester / Cannonville

Housing Area	Housing Type	Number Units (No)	Water Use/unit (L/day)	Water Demand (Kl/day)
Ingleside	High income	342	950	325
	Town Houses	60	800	48
Cannonville	Middle/High	380	680	258
Private Land	Middle/High	165	680	112
Colchester	Low	450	220	99
	Middle/High	790	680	537
Commercial /Others		Sum	Sum	130
Estimated Total Water Use (Excluding losses)				1509

(b) Bulk Supply Pipeline

Several consumers (such as Marine Growers and Cerebos) were supplied with water off-takes along the pipeline route and make use of the available pipeline capacity. These consumers are upstream of the pressure control valve, can therefore not be supplied from the Colchester reservoir and make use of the Coegakop Reservoir as their supply balancing reservoir. The peak water demand of these users however, impacts directly on the transfer capacity of the Colchester pipeline.

The average day water demand of Cerebos equals the present (2003) average day water demand of all households in Colchester and Cannonville. The impact of Cerebos is however minimised as the off-take is some 19.3km upstream of Colchester and the supply point therefore does not utilise storage or pipeline capacity over a long distance.



The graphical illustration on previous page, confirms that the maximum transfer capacity of the 200mm diameter pipeline is 1700 KI/day at the take-off point on the NMMM 450mm diameter pipeline with a balance of 1450 KI/day being transferred to Colchester reservoir.

The table below illustrates the impact of expected housing development in and around Colchester on the future water demand.

Table 4: Colchester / Cannonville: Estimated Future Water Demands												
Peak Week Factor (present) =			1.8 x AADD			Daily household demand - High /Middle			680 L/day			
Peak Week Factor (Future) =			2.0 x AADD			Daily household demand - Low Income			220 L/day			
Annual Growth in High/Middle Income =			3.0 % per Annum			Daily household demand - Estate			950 L/day			
Annual Growth in Low Income =			2.0 % per Annum			Daily household demand - COLCRA			220 L/day			
Percentage Losses in Reticulation =			20.0 % of AADD			Present Water Storage Capacity			1500 KI			
YEAR	Developed Erven (Households)			Demand per user type (KI/day)			Total Household Demand (KI/day)	Demand by Large Bussiness (KI/day)	Demand by Other Users (KI/day)	AADD All End-users (KI/day)	AADD Bulk Supply (Incl. Losses) (KI/day)	Peak Week (KI/day)
	High/Middle Income	Low Income	Sundays River Estate	High/Middle Income	Low Income	Sundays River Estate						
2002	332	150	0	226	33	0	259	87	11	357	428	771
2003	342	153	0	233	34	0	266	88	11	365	438	789
2004	352	156	0	240	34	0	274	88	12	374	449	807
2005	363	159	0	247	35	0	282	89	12	383	459	827
2006	374	199	80	254	44	76	374	90	12	476	571	1028
2007	385	203	170	262	45	161.5	468	90	13	571	685	1233
2008	396	207	220	270	46	209	524	91	13	628	754	1357
2009	408	211	270	278	46	256.5	581	92	14	687	824	1483
2010	421	215	300	286	47	285	618	93	15	726	872	1743
2011	433	220	330	295	48	313.5	656	94	16	766	920	1839
2012	446	224	350	303	49	332.5	685	95	17	797	957	1913
2013	460	229	370	313	50	351.5	714	96	18	828	994	1988
2014	473	233	375	322	51	356.25	729	97	19	845	1015	2029
2015	488	238	382	332	52	362.9	747	98	20	865	1038	2075
2016	502	243	382	341	53	362.9	758	99	21	878	1053	2107
2017	517	247	382	352	54	362.9	769	100	22	891	1069	2139
2018	533	252	382	362	56	362.9	781	100	23	904	1084	2169
2019	549	257	382	373	57	362.9	793	100	24	917	1100	2200
2020	565	263	382	384	58	362.9	805	100	25	930	1116	2232
2021	582	268	382	396	59	362.9	818	100	26	944	1132	2265
2022	600	273	382	408	60	362.9	831	100	27	958	1149	2299
2023	618	279	382	420	61	362.9	844	100	28	972	1167	2333
2024	636	284	382	433	63	362.9	858	100	29	987	1184	2369
2025	655	290	382	446	64	362.9	872	100	30	1002	1203	2405

Note: Large consumers upstream of exist. PRV (Newport, Marine Growers and Cerebos) not included in this model (these fall within Coega Kop Reservoir Zone)

The peak week transfer capacity of the present pipeline will be sufficient until about 2008. Upgrading of the bulk supply pipeline system must therefore be implemented in the 2007/08 financial year.

5. Infrastructure requirements

The following bulk water infrastructure upgrading as shown in Appendix A will be required to ensure continuity of water supply to consumers in the Colchester / Cannonville area:

1. Phase 1: 2005/06 – Construct a 250/200mm diameter distribution pipeline section from the existing 200mm diameter FC pipeline (Point A) to the NMMM boundary at the proposed Ingleside Wildlife Estate, complete with a supply meter at the boundary.

Nodes	Pipe Length (m)	Pipe Diameter (mm)	Unit Cost /m (R/m)	Total Cost (R)
A to C	1610	250	R 660	R 1 062 600
	500	250	R 660	R 330 000
C to B	1100	200	R 505	R 555 500
Total Cost - Incl design, supervision & construction (Excl VAT)				R 1 948 100 (Say) R 2.0 million

This cost of R2.0 million will be a shared cost between the developer of Ingleside Estate and NMMM. The pipeline will make provision for future reticulation demand within Colchester and will complete the planned ring main supply for the ultimate development of the area.

In order to estimate the split in the cost contribution between the Developer and NMMM, an evaluation of the NMMM long term infrastructure requirements (excluding Ingleside Estate) was made. The table below summarises the estimated cost contribution for NMMM based on a 200 / 160mm diameter pipeline section from Points A to C. For Ingleside, this section will be increased to a 250 /200 mm diameter pipeline.

Nodes	Pipe Length (m)	Pipe Diameter (mm)	Unit Cost /m (R/m)	Total Cost (R)
A to C	1610	200	R 505	R 813 050
	500	160	R 330	R 165 000
Total Cost - Incl design, supervision & construction (Excl VAT)				R 978 050

2. Phase 2: 2007/08 – Separate the present bulk water supply pipeline from the Colchester/Cannonville reticulation system. This will be achieved by the construction of a new 250 / 300mm dia. pipeline over a distance of some 4.7km from the Sundays River / N2 Road bridge to the existing 1.5 MI storage reservoir at Colchester.

This new pipeline section will eliminate the need for the upstream pressure reducing/control (PRV) valve and increase pipeline capacity by some 15% to 1670 Kl/day. Once the PRV has been removed from the system, then optimum use can be made of the higher top water level of Coega Kop reservoir of 121m MSL (present system was designed for Motherwell reservoir at TWL 109m MSL). This will increase the transfer capacity of the supply system to Colchester to 1850 Kl/day.

This Phase will also require the construction of a second 1500 Kl storage reservoir on the site of the existing reservoir where landscaping and leveling for this purpose was performed during construction of the first reservoir.

Cost – 250/300mm dia. x 4600 m bulk pipeline	R 3 900 000
Cost – 1.5 MI reservoir	<u>R 1 800 000</u>
	R 5 700 000

3. Medium Term – The proposed infrastructure required under this future phase will be implemented as dictated by circumstances as discussed below –
- a. Implement a 200mm dia ringmain which will improve distribution to existing serviced sites and open the rest of Colchester/Cannonville for future development onto vacant land. This ring main will be required once development proposals for the open land at Colchester has been received.
 - b. Table 4 confirms that by 2011 the Peak Week transfer capacity of the bulk system will reach the 1850 Kl/day of the upgraded system (Phase 2). Upgrading of the balance of the 200mm dia. bulk supply pipeline from the Coega River crossing to the Sundays River / N2 bridge to a 300mm dia. pipeline over a distance of some 9.9km may be required if the Coega Industrial Development Zone internal reticulation has not by then reached the north-eastern side of the Coega River.

The need for this section of pipeline will therefore be established at a future date based on the development rates of the Coega IDZ. Maximum transfer capacity of the bulk water supply system from 1800 Kl/day to some 2500 Kl/day is required.

Estimated cost (2005) of proposed future upgrading –

Cost - 200 mm dia. x 3800 m ring main	R 1 920 000
Cost - 300 or 250mm dia x 9900 m bulk pipeline	R 7 500 000