Tonkin & Taylor

Memo

To:	Joseph Thomas	**T&T job no:**	22032.005
From:	Sally Marx	**Date:**	6 June 2006
cc:	John Grimston		
Subject:	Waimea Water Augmentation - Storage Volumes and Drought Security – Future Regional Demands		

Joseph

Further to T&T's memo of 31 May 2006 re storage volumes and drought security, you requested that we also provide you with the expected storage volume requirements of the various scenarios including a further provision of 22,000m³/day to allow for potential future regional needs. For this analysis, we have assumed that the abstraction point is upstream of the aquifer recharge area (such that this take results in a direct river flow loss equal to 22,000m³/day).

We have calculated that a Future Regional Need of 22,000m³/day is the equivalent of between 1 and 2 million m³ over a drought season depending on the drought return period. The appendix attached to our memo of 31 May provides an explanation of estimating drought security for seasonal water demand.

The results are as follows:

Storage Drawdown Frequency Analysis – Lee Site 11

Drought Return Period*	Estimated Maximum Drawdown in million m³			
	1100 l/s Appleby Residual		600 l/s Appleby Residual	
(years)	Base case	Future Regional Need *	Base case	Future Regional Need *
10	4.4	5.8	2.6	3.7
20	6.3	7.9	3.9	5.2
35	8.0	9.8	5.1	6.6
50	9.2	11.1	6.1	7.6
100	11.8	13.9	8.1	9.6
simulated 82/83	7.4	9.3	5.2	6.2
simulated 00/01	11.3	13.0	7.7	9.2

Storage Drawdown Frequency Analysis – Wairoa Site 15

| Drought Return Period* | Estimated Maximum Drawdown in million m³ | | | |
| | 1100 l/s Appleby Residual | | 600 l/s Appleby Residual | |
(years)	Base Case	Future Regional Need *	Base Case	Future Regional Need*
10	4.3	5.6	2.6	3.6
20	6.2	7.8	3.8	5.2
35	7.9	9.7	5.1	6.5
50	9.2	11.0	6.0	7.5
100	11.8	13.7	8.0	9.6
simulated 82/83	7.3	8.9	5.1	6.2
simulated 00/01	11.2	13.0	7.6	9.2

The above estimated figures are sensitive to the same assumptions as in our memo of 31 May 2006.

Top water level (reservoir extent)

We present the top water level for the various storage scenarios in the tables below, using the same assumption as per memo of 31 June.

Lee – Site 11

| Drought Return Period (years) | Approx storage requirements (Mm3) Depending on residual flow (600-1100 l/s) | | Approx top water level (RLm) based on most conservative residual flow 1100 l/s * | |
	Base Case	Future Regional Need	Base Case	Future Regional Need
Original assumption	16	-	187	-
10	3.6 – 5.4	4.7 – 6.8	170.5	173.5
20	4.9-7.3	6.2 – 8.9	174.5	177
35	6.1 – 9.0	7.6 – 10.8	177.5	180
50	7.1- 10.2	8.6 – 12.1	179.5	182
100	9.1-12.8	10.6 – 14.9	183	185.5

Wairoa – Site 15

Drought Return Period (years)	Approx storage requirements (Mm3) Depending on residual flow (600-1100 l/s)		Approx top water level (RLm) based on most conservative residual flow 1100 l/s *	
	Base Case	Future Regional Need	Base Case	Future Regional Need
Original assumption	16	-	241.5	-
10	3.6 – 5.3	4.6 – 6.6	221	224.5
20	4.8- 7.2	6.2 – 8.8	226	229.5
35	6.1-8.9	7.5 – 10.7	229.5	233
50	7.0- 10.2	8.5 – 12.0	232	235.5
100	9.0- 12.8	10.6 – 14.7	236.5	239.5

* Note that these levels are normal top water levels (NTWL). Additional allowance is required, as per memo of 31 May 2006

Indicative percentage cost difference

Note: the calculations presented in the tables below are preliminary and indicative only and include/exclude the items as per 31 May memo.
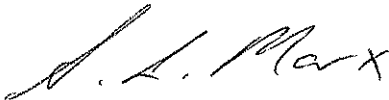
Lee – Site 11

Drought Return Period (years)	Change in top water level/dam height from original assumption (m)		Indicative percentage reduction in dam construction costs (%)	
	Base Case	Future Regional Need	Base Case	Future Regional Need
Original assumption (base case)	0	-	0	-
10	-16.5	-13.5	-19	-16
20	-12.5	-10	-15	-12
35	-9.5	-7	-11	-8
50	-7.5	-5	-9	-6
100	-4	-1.5	-5	-2

Wairoa – Site 15

Drought Return Period (years)	Change in top water level/dam height from original assumption (m)		Indicative percentage reduction in dam construction costs (%)	
	Base Case	Future Regional Need	Base Case	Future Regional Need
Original assumption (base case)	0	–	0	–
10	-20.5*	-17	-16	-13
20	-15.5	-12	-12	-9
35	-12	-8.5	-9	-6
50	-9.5	-6.0	-7	-5
100	-5	-2.0	-4	-2

* Note: Our memo of 31 May showed this value as 19.5. That should be revised to 20.5. The changed figure makes no difference to the other figures in the table (top water level and percentage cost reduction).

Sally Marx

J. L. Marx

Project Manager

Prepared by Sally Marx, David Leong, Alan Pickens
Reviewed by John Grimston

P:\22032\001\Storage reqmts future demands memo 060606.doc