

## 10.0 SOURCE, YIELD AND CAPACITY OPTIONS

This Section examines the following options and identifies the yield that will be obtained from each source. The Section also identifies the year in which the capacity of the respective sources will need to be upgraded.

The sourcing options considered are :

- € **Waterpark Creek** limited to a maximum diversion of **17ML/d**, the capacity of Kellys Offstream Storage increased and a **desalination plant** constructed in stages to satisfy future demands - refer Section 10.2.1;
- € **Waterpark Creek** limited to a maximum diversion of **17ML/d**, the capacity of Kellys Offstream Storage increased and a **pipeline constructed from the Fitzroy River Barrage** to satisfy future demands – refer Section 10.3.1;
- € **Waterpark Creek and Sandy Creek** limited to a maximum diversion of **35ML/d**, the capacity of Kellys Offstream Storage increased and a **desalination plant** constructed in stages to satisfy future demands - refer Section 10.4.1; and
- € **Waterpark Creek and Sandy Creek** limited to a maximum diversion of **35ML/d**, the capacity of Kellys Offstream Storage increased and a **pipeline constructed from the Fitzroy River Barrage** to satisfy future demands – refer Section 10.5.1;

In addition an option based on augmenting the Waterpark Creek and Sandy Creek combined supply with a pipeline from the Fitzroy River Barrage and then later with a desalination plant has been examined. This option is discussed in Section 10.6.

### 10.1 Planning Criteria

#### 10.1.1 The Planning and Construction Horizon

Historically it has been common to plan and construct water supply infrastructure on the basis of a capacity able to meet a demand 20 years hence (ie. Infrastructure is provided on the basis of a 20 year planning horizon).

In recognition of the fact that construction of infrastructure should not occur unnecessarily prematurely and to minimise overall costs a construction horizon of 10 years has been adopted. Overall, this means that infrastructure provided in the year 2006 has a capacity to meet the year 2016 water demands, providing that the staging of construction is feasible.

For instance, while it is possible to stage the construction of treatment or desalination plants at ten year intervals it is not possible to construct a pipeline over this period. Hence a pipeline must be sized and constructed to meet the demands of a much longer period, say 25 or even 50 years.

In some cases it is possible to reduce this planning horizon for particular infrastructure even further, say to 5 years, provided there is an economic benefit and the reduced timing does not jeopardise security of supply. Based on a consideration of the need for cost minimisation and security of supply this overall strategic investigation has adopted a period of 10 years.

### 10.1.2 Adopted Environmental Flows

The yield able to be derived from the existing water supply based on the Waterpark Creek source or the combined Waterpark and Sandy Creeks source is dependent on the environmental flow adopted and the capacity of Kellys Offstream storage.

Based on the earlier discussion in Section 7.0 an environmental flow of 50L/s and 100L/s has been adopted for Waterpark and Sandy Creeks respectively.

## 10.2 Waterpark Creek and Desalination

### 10.2.1 Maximum Diversion from Waterpark Creek of 17ML/d

The safe yields able to be obtained from Waterpark Creek based on a minimum environmental flow of 50L/s and Kellys storage constructed to Stage 1, Stage 2 and Stage 3 is given in Table 10.1 along with the MDMM supply. The existing diversion capacity of 17ML/d applies.

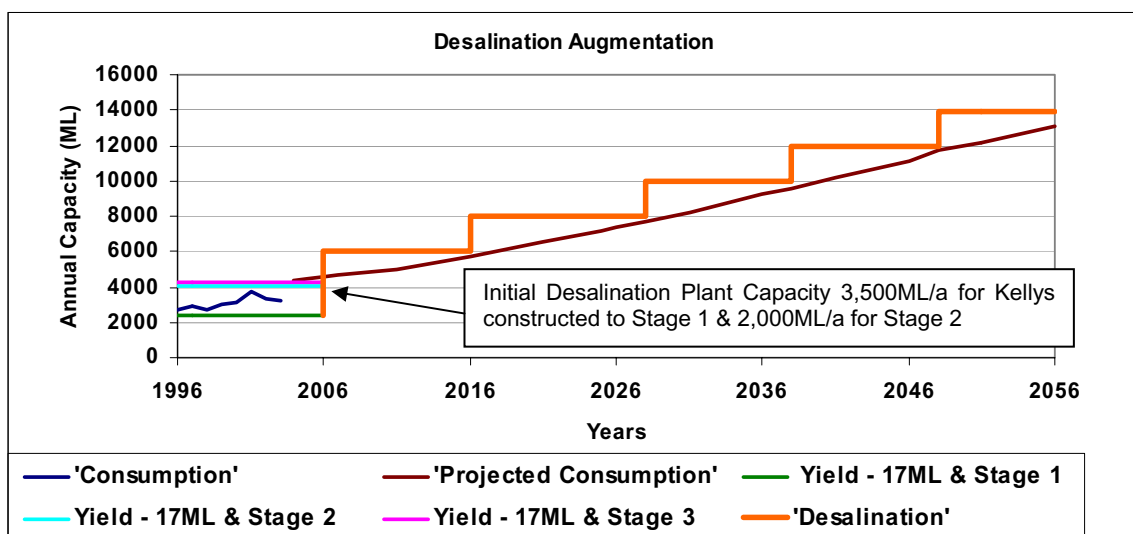
**Table 10.1**  
**Safe Yields – Waterpark Creek Supply**

Maximum Diversion (ML/d)	Kellys Storage		Safe Yield (ML/a)	MDMM Supply (ML/d)
	Stage	Max. Volume (ML)		
17	1	1,130	2,400	10
17	2	2,500	4,100*	17
17	3	6,000	4,300*	18
17	3	6,000	5,850**	24

\*denotes yields limited by max. diversion of 4,400ML/a

\*\* assumes allocation will be increased

Irrespective of the stage to which Kellys Offstream Storage is constructed the safe yields from Waterpark Creek indicate that it will be necessary to augment the existing supply by the year 2006 if the diversion rate remains at 17ML/d. Graph 10.1 shows that in order to meet future water supply requirements it will be necessary to augment the Waterpark Creek supply with a desalination plant having the following annual capacities given in Table 10.2 (based on maximum daily diversion of 17ML from Waterpark Creek).



**Graph 10.1**

**Table 10.2  
Desalination Plant Total Capacity Required**

Year Desalination Plant Stage Constructed	Desalination Plant Capacity (ML/a)		Approximate Total Capacity Waterpark Ck & Desalination (ML/a)	Year Total Capacity satisfies Projected Demand (Planning Horizon)
	Kelly Offstream Storage			
	Stage 1	Stages 2 and 3		
2006	3,500	2,000	6,000	2016
2016	5,500	4,000	8,000	2028
2028	7,500	6,000	10,000	2038
2038	9,500	8,000	12,000	2048
2048	11,500	10,000	14,000	> 2056

### 10.2.2 Desalination Plant Capacity and Demand Fluctuations

To accommodate the normal fluctuations in overall consumption and not increase the capacity of the desalination plant beyond that required to meet average day demands it will be necessary to increase the overall reservoir storage volume on the Capricorn Coast. Additional storage will be installed to compensate for the fact that the desalination plant will not be designed with a capacity able to satisfy the MDMM demand. This will allow the maximum capacity of the desalination plant to be limited to the required future average day augmented capacity.

Table 10.3 details the additional reservoir capacity required to ensure there is sufficient storage to accommodate for the provision of a desalination plant with a capacity equal to the average day water supply demand. Combined with the normal reservoir storage requirement this will mean that all demands can be satisfied.

**Table 10.3  
Additional Reservoir Requirements (ML)**

Year	Waterpark Creek Yield		
	2,400ML	4,100ML	4,300ML
2006	4.9	2.6	2.3
2011	4.9	2.6	2.3
2016	4.9	2.6	2.3
2021	7.7	5.3	5.1
2026	7.7	5.3	5.1
2031	10.4	8.1	7.8
2036	10.4	8.1	7.8
2046	13.2	10.8	10.5
2056	15.9	13.6	13.3

## 10.3 Waterpark Creek and Fitzroy River Barrage

### 10.3.1 Maximum Diversion from Waterpark Creek of 17ML/d

The capacity requirements of a pipeline from the Fitzroy River Barrage has been determined based on the safe yields for Waterpark Creek given in Table 10.1 and on the basis that the MDMM augmented supply will be provided over a 24 hour period. Table 10.4 details the capacity required based on a Waterpark Creek diversion of 17ML/d and yields of 2,100ML/a and 4,100ML/a.

The sizing and length of a pipeline from the Fitzroy River Barrage will depend on the route selected for the pipeline and the conurbations served. Table 10.4 details the maximum capacity required for each pipeline route, overall length and diameter.

The cases listed in Table 10.4 will be required to deliver a flow to the Capricorn Coast (Year 2056) of 44ML/d (510L/s) for Stage 1 of Kellys Offstream Storage and 37ML/d (430L/s) for Stages 2 and 3 of Kellys Offstream Storage.

**Table 10.4**

**Maximum Capacity of Pipeline – Waterpark Creek Diversion 17ML/d**

Pipeline Route	Capacity Required Year 2056							
	Kellys Offstream Storage Stage 1				Kellys Offstream Storage Stages 2 and 3			
	(ML/d)	(L/s)	Length (m)	Dia. (mm)	(ML/d)	(L/s)	Length (m)	Dia. (mm)
1A	48	554	27,200	750/600	41	473	27,200	750/600
2A	52	603	35,200*	750//600	45	522	35,200*	600
3A	52	603	57,300*	600	45	522	57,300*	600
4A	48	554	32,550	750	41	473	32,550	600
5A	52	603	42,000*	750	45	522	42,000*	600
2B	52	603	43,275*	750/600	45	522	43,275*	750/600
3B	52	603	65.580*	750/600	45	522	65.580*	750/600
5B	52	603	50,275*	750	45	522	50,275*	750/600

\* Includes a section of the existing pipeline to 'The Caves'

## 10.4 Waterpark Creek, Sandy Creek and Desalination

### 10.4.1 Maximum Diversion from Waterpark and Sandy Creeks of 35ML/d

The safe yields able to be obtained from Waterpark Creek and Sandy Creek based on a maximum diversion of 35ML/d and a minimum environmental flow of 50L/s and 100L/s respectively and with Kellys storage constructed to Stage 1, Stage 2 and Stage 3 are given in Table 10.5. Table 10.5 also lists the MDMM supply able to be drawn from Kellys Storage.

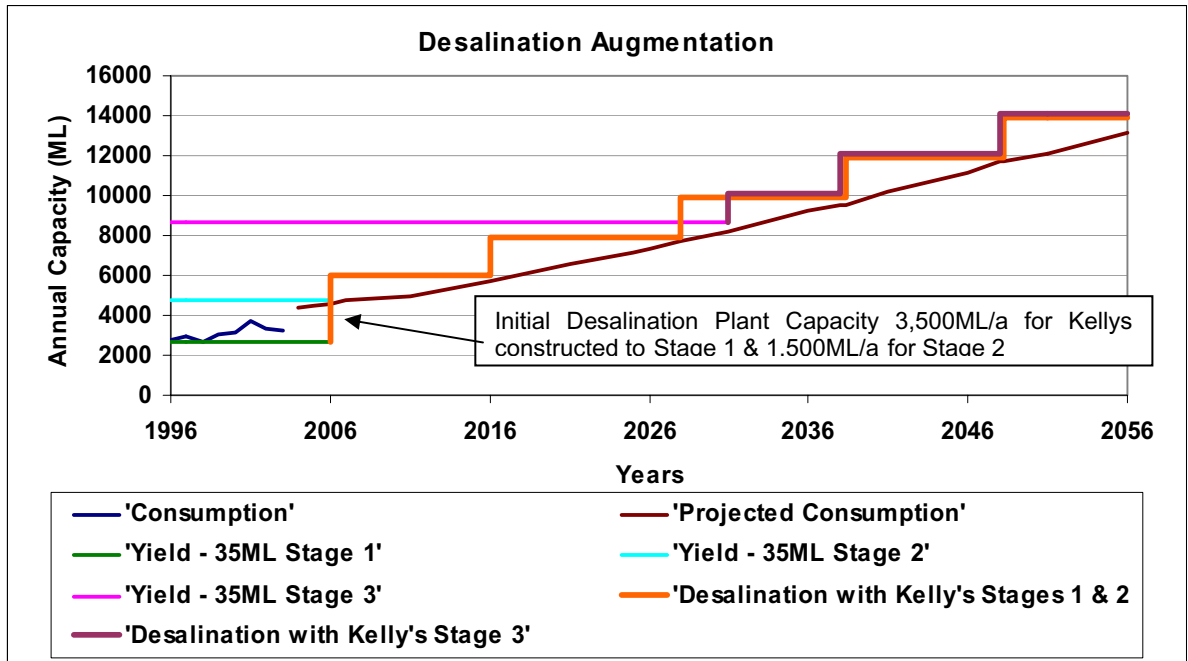
**Table 10.5**  
**Safe Yields – Waterpark Creek and Sandy Creek Supply**

Maximum Diversion (ML/d)		Kellys Storage		Safe Yield (ML/a)	MDMM Supply (ML/d)
Waterpark Ck	Sandy Ck	Stage	Max. Volume (ML)		
17	18	1	1,130	2,620	11
17	18	2	2,500	4,790	20
17	18	3	6,000	8,630*	36

\*denotes yields limited by max. diversion of 4,400ML/a

\*\* assumes allocation will be increased

If Kellys Offstream Storage is constructed only to Stage 1 or Stage 2 it will be necessary to augment the existing supply by the year 2006. Constructed to Stage 3 the augmentation can be delayed until the year 2031. Graph 10.2 shows that in order to meet future water supply requirements it will be necessary to augment the Waterpark Creek and Sandy Creek supply with a desalination plant having the following annual capacities given in Table 10.6



Graph 10.2

Table 10.6  
Desalination Plant Total Capacity Required

Year Desalination Plant Stage Constructed	Desalination Plant Capacity (ML/a)			Approximate Total Capacity Waterpark and Sandy Cks & Desalination (ML/a)	Year Total Capacity satisfies Projected Demand (Planning Horizon)
	Kelly Offstream Storage				
	Stage 1	Stages 2	Stages 3		
2006	3,500	1,500	-	6,000	2016
2016	5,500	3,500	-	8,000	2028
2028	7,500	5,500	-	8,000	2038
2031	7,500	5,500	1,500	10,000	2038
2038	9,500	7,500	3,500	12,000	2048
2048	11,500	9,500	5,500	14,000	> 2056

#### 10.4.2 Desalination Plant Capacity and Demand Fluctuations

To accommodate the normal fluctuations in overall consumption and allow the desalination plant to provide a uniform average day base flow it will be necessary to increase the overall reservoir storage volume on the Capricorn Coast.

Table 10.7 details the additional reservoir capacity required to ensure there is sufficient storage to accommodate for the provision of a desalination plant with a capacity equal to the average day water supply demand.

**Table 10.7  
Additional Reservoir Requirements (ML)**

Year	Waterpark Creek and Sandy Creek Yield		
	2,620ML	4,790ML	8,630ML
2006	4.6	1.7	0.0
2011	4.6	1.7	0.0
2016	4.6	1.7	0.0
2021	7.4	4.4	0.0
2026	7.4	4.4	0.0
2031	10.1	7.1	1.9
2036	10.1	7.1	1.9
2046	12.8	9.9	4.6
2056	15.6	12.6	7.4

## 10.5 WaterparkCreek, Sandy Creek and Fitzroy River Barrage

### 10.5.1 Maximum Diversion from Waterpark and Sandy Creeks of 35ML/d

The capacity requirements of a pipeline from the Fitzroy River Barrage have been determined on the basis of the safe yields for Waterpark Creek and Sandy Creek given in Table 10.5 and that the MDMM augmented supply will be provided over a 24 hour period. Table 10.8 details the pipeline capacity required based on a Waterpark Creek and Sandy Creek diversion of 35ML/d and yields of 2,620ML/a, 4,790ML/a and 8,630ML/a.

The sizing and length of a pipeline from the Fitzroy River Barrage will depend on the route selected for the pipeline and the conurbations served. Table 10.8 details the maximum capacity required for each pipeline route, overall length and diameter. Economic analyses have been undertaken to optimise the pipeline diameter.

Each of the cases listed in Table 10.8 will be required to deliver a flow to the Capricorn Coast (Year 2056) of 44ML/d (510L/s) for Stage 1 of Kellys Offstream Storage, 37ML/d (430L/s) for Stage 2 and 18ML/d (208L/s) for Stage 3 of Kellys Offstream Storage.

**Table 10.8  
Maximum Capacity of Pipeline – Waterpark and Sandy Creeks Diversion 35ML/d**

Pipeline Route	Length (m)	Capacity Required Year 2056								
		Kellys - Stage 1			Kellys - Stage 2			Kellys - Stage 3		
		(ML/d)	(L/s)	Dia. (mm)	(ML/d)	(L/s)	Dia. (mm)	(ML/d)	(L/s)	Dia. (mm)
1A	27,200	47	590	750/600	38	440	750/600	22	258	525
2A	35,000*	51	625	600/525	42	490	600	26	307	525
3A	57,307*	51	625	750/600	42	490	600	26	307	525
4A	32,550	47	590	750	38	440	750/600	22	258	600/525
5A	42,000*	51	625	750/600	42	490	600	26	307	600/525
2B	43,275*	51	590	750/600/525	42	490	750/600	26	307	600/525
3B	65,580*	51	590	750/600	42	490	750/600	26	307	660/525
5B	50,275*	51	590	750/600	42	485	750/600	30	347	600/525

\* Includes a section of the existing pipeline to 'The Caves'

## 10.6 Waterpark Ck, Sandy Ck, Pipeline from Fitzroy River Barrage and Desalination

A further option has been considered based on developing Sandy Creek, obtaining a maximum base flow of 2,000ML/a from the Fitzroy River Barrage and then installing a desalination plant. Details of the option are as follows.

1. Maximum daily diversion of 35ML/d from Waterpark Creek and Sandy Creek;
2. Kellys Storage Stage 2;
3. Pipeline from Fitzroy River combined with Waterpark & Sandy Creek Supply able to supply the Capricorn Coast's year 2024 demand of 7,000ML/a;
4. Desalination Plant to meet the Capricorn Coast's requirements from the year 2024 to the year 2056.

Clearly there are many combinations of sourcing options which could be considered. This option has been selected on the basis of providing an assured supplementary supply at an early date and minimising costs at least until the desalination plant is required. In addition the following rationale has been considered.

- € Augmenting of the existing Waterpark Creek system is a matter solely for Livingstone Shire Council and the State Government;
- € The viability of desalination as a source of supply is expected to become more attractive in the next 15 to 25 years; and
- € Limiting the water requirement to be drawn from the Fitzroy River may assist Livingstone Shire to reach agreement with Rockhampton City Council and the State Government in procuring 'high priority' water from the Fitzroy River Barrage.

Table 10.9 details the capacity requirements of the various components associated with this option.

**Table 10.9  
Capacity of Components**

Year	Capacity of Systems	Waterpark & Sandy Creeks System	Pipeline from Barrage	Desalination
2005	2,620ML/a	17ML/d to Kellys Storage	-	-
2006	4,790ML/a	35ML/d to Kellys Storage Stage 2	-	-
2006	6,790ML/a	35ML/d to Kellys Storage Stage 2	2,000ML/a Pipeline*	-
2048	13,800ML/a	35ML/d to Kellys Storage	2,000ML/a Pipeline*	7,000ML/a Desalination Plant

\* Pumping capacity to be upgraded in stages