Draft Discussion Paper

073

Baffle Creek Basin Water Resource Plan
Options on the Level of Water Resource Development

4 February 2008

Contents

O/Scope

Tables

O/Scope

Table 3 Baffle Creek Dam 2007 Yield Studies

O/Scope

Appendix 4 Baffle Creek Dam – Background and Yield Studies

O/Scope

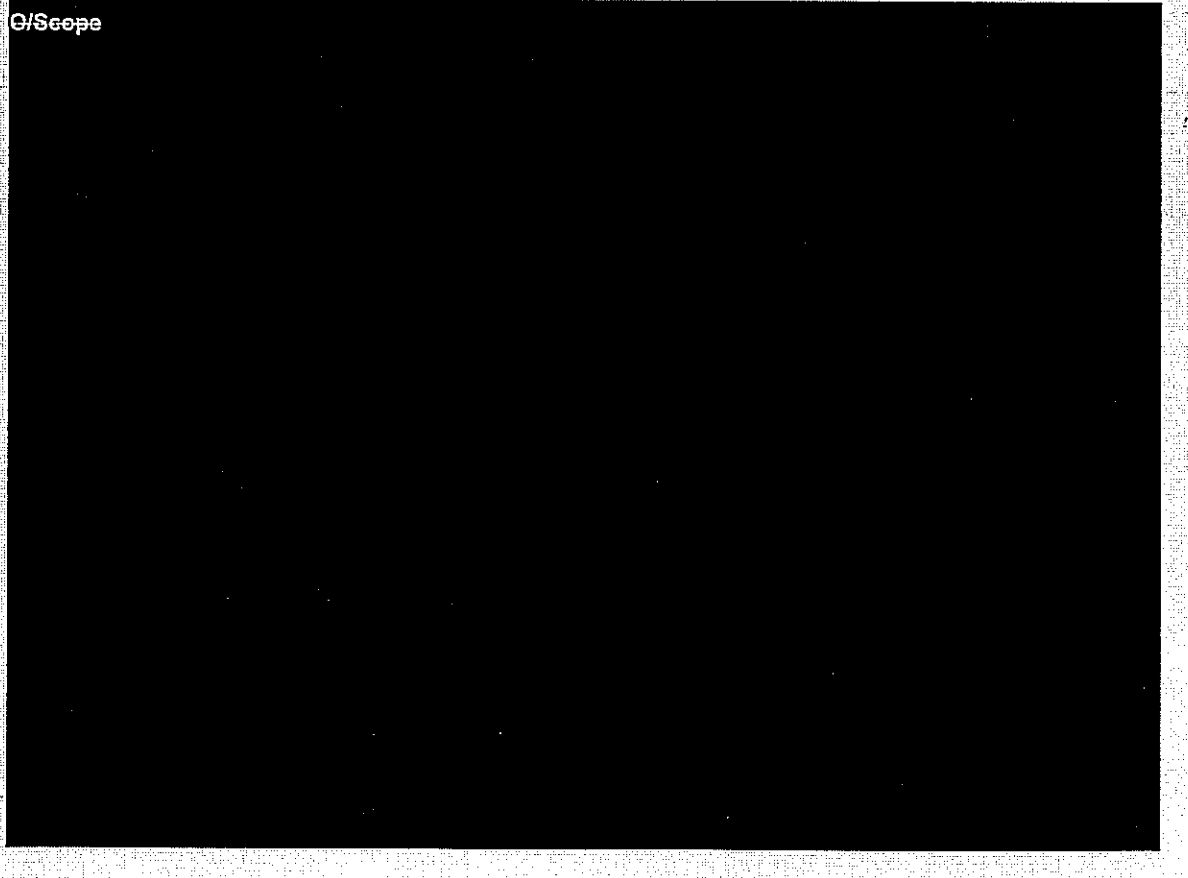
O/Scope

APPLICATION NO. 3169

Potential Supply from a Dam on Baffle Creek

Preliminary modelling undertaken for this investigation, including preliminary environmental flow provisions, indicates that a dam on Baffle Creek is hydrologically very efficient and potentially could provide a significant increase in supply to the region, i.e. 30,000 ML/a for a dam at FSL 23 m (76,000 ML capacity). End of system mean annual flows for such a dam would be greater than 90% of pre-development flows.

Modelling to assess the impact of possible climate change showed that the yield of a Baffle Creek dam would only be reduced marginally. The yield estimates derived in the 2007 analyses are considered to be sufficiently reliable for the purposes of considering the regional water supply issues discussed in this paper.



7.0 Baffle Creek Dam – Pre-Feasibility and Impacts

7.1 Potential Supply

The water supply potentially available from a dam on Baffle Creek at the 55.7 km site has been assessed previously (see Appendix 4). The site is a short distance upstream of the Mimdale gauging station and a considerable distance upstream of the Baffle

Creek estuary section. Further modelling has been undertaken for the purposes of this investigation using the hydrologic model developed for the Baffle Creek Basin WRP

The Baffle Creek Basin WRP has not yet been completed, and environmental flow objectives and water allocation security objectives for the basin have not yet been adopted. Nevertheless, some preliminary modelling was undertaken in 2007 to provide an estimate of the supply which might be available from a dam on Baffle Creek.

Preliminary analyses for dams with FSL's 20, 23 and 25 m were undertaken to assess potential yields and possible impacts on end of system flows (see Table 1). It was assumed that existing entitlements are fully utilised. Preliminary environmental flow rules were nominated by NRW water resource planning staff to maintain:

- Low flows at Mimdale to provide protection for the brackish environment downstream.
- Medium/high flows of more than 2 days duration to protect the over bank lagoon environment.

Further detail on the environmental flow rules adopted is provided in Appendix 4.

To gain some understanding of the possible impacts of climate change on the supply potentially available from a dam on Baffle Creek, further cases were run assuming a 20 % reduction in stream flows throughout the catchment.

The following table summarises the relevant simulation run results.

Table 3: Baffle Creek Dam 2007 Yield Studies

Dam FSL (m) (assumed storage capacity ML)	HNFY with preliminary environmental flow rules		HNFY with preliminary environmental flow rules and climate change*	
	HNFY (ML/a)	EOS MAF (% of PD)	HNFY (ML/a)	EOS MAF (% of PD)
20.0 (40,000)	16,000	96.0	15,500	76.0
23.0 (76,000)	30,000	92.9	29,000	73.0
25.0 (110,000)	42,000	90.2	37,000	71.0

HNFY is Historic No Failure Yield
EOS MAF is End of System Mean Annual Flow
PD is Pre Development
* Climate change impact results in EOS MAF of 80% of PD flow.

The climate change impact alone (i.e. without a dam) is to reduce the EOS MAF values to 80% and for a FSL 23.0 m dam to reduce EOS MAF to 73% of pre development flows.

This analysis indicated that the impact of climate change on the yield of a FSL 23.0 m dam would not be significant, a reduction from 30,000 ML/a to 29,000 ML/a, and the impact on EOS flows similarly would not be significant compared with the assumed 20% reduction in flows.

The potential yields from a dam on Baffle Creek are significantly lower than the estimates obtained in previous studies (see Appendix 4). This is likely due to the recent dry years now included in the period of record and the higher standard of environmental flow rules now proposed.

Nevertheless, the results indicate that a dam on Baffle Creek has the potential to supply Gladstone with substantial quantities of water, i.e. 30,000 ML/a for a dam at FSL 23 m. The impact of the climate change scenario assumed in the above analysis on the supply available from a dam on Baffle Creek would be relatively minor, except for the FSL 25 m dam. Further stochastic analyses may reduce the supply likely to be available from a Baffle Creek dam.

7.2 Potential Benefits

A Baffle Creek dam is the lowest dollar cost option able to provide a significant increase in the reliable water supply available for use in the Gladstone region including possible use within the Baffle Creek basin. The dam could potentially provide a 28% increase on the *unrestricted allocation* available from Awoonga Dam together with the proposed 30,000 ML/a pipeline from the Lower Fitzroy River. A Baffle Creek dam would be even more significant if it is found necessary to derate the Awoonga Dam supply as discussed in section 6.3 above. In this case, a Baffle Creek dam would provide a 38% increase in the supply available from Awoonga Dam together with the Fitzroy River pipeline assuming the yield from a Baffle Creek dam is not de-rated at the same rate as other storages.

Assuming growth in water demands as predicted by GAWB in its SWPP, a Baffle Creek dam would meet 16 years growth before a higher cost supply option such as a desalination plant would need to be implemented.

Since more than 80% of water use in the Gladstone region is by high value industrial users, a Baffle Creek dam could potentially support a more than 22% increase in industrial production (and in employment) in the region with the balance of the supply providing for the urban growth likely to be associated with such an expansion.

Construction of the dam and delivery pipeline system would also provide employment opportunities for 200-300 workers during a construction period of 3-4 years.

Importantly, a Fitzroy River pipeline together with a Baffle Creek dam and delivery pipeline would increase Gladstone's sources of supply from the current sole source to three sources of supply creating a regional water grid providing a substantial reduction in the supply and infrastructure risks associated with a single source of supply.

O/Scope

Analysis of the environmental flow objectives for the dam cases FSL 23m and 25m revealed that they marginally did not meet the initial targets set for flows to inundate offstream lagoons (Table 4 Appendix 3).

As suggested by Halliday *et al.* 2007, it is during the times of low flow (droughts) that aquatic ecosystems are likely to be at greater risk from fishing pressure, water abstraction and other anthropogenic impacts. The most critical period to ensure freshwater flows to estuaries occur is probably during and just after extended dry periods, it is this period that is affected the most by operating water infrastructure with the sole purpose of maximising yield rather then limiting impact on environment.

The inundation of Baffle Creek would provide ideal habitat for exotic floating aquatic weeds (such as Salvinia (*Salvinia molesta*) and hyacinth (*Eichornia crassipes* already found in the Baffle basin) which would potentially have serious impacts on available water quality within the storage and available for releases. There is a significant risk that such an invasion could cause further detrimental downstream impacts such as fish kills and seeding of exotic plants to the downstream native aquatic plant communities as documented in field surveys of the Mary River for the proposed Traveston Crossing Dam (GHD, 2007)[4].

Degradation and loss of aquatic ecosystems is now being recognized to have serious economic and social consequences, and these trade-offs need to be considered in the management of water resources, particularly in countries where there is physical water scarcity[5]

O/Scope

[4] GHD, 2007. Environmental Impact Statement: Traveston Crossing Dam.

[5] Turpie, Jane (Lead Author); Cutler J. Cleveland (Topic Editor). 2007. "Tug of water: an economic perspective on water and the environment." In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [Published in the Encyclopedia of Earth July 27, 2007; Retrieved November 13, 2007].
<http://www.eoearth.org/article/Tug_of_water:_an_economic_perspective_on_water_and_the_environment>

Table 1: Estimated Costs of Water Supply Options

Option	Potential Supply Capacity (ML/a)	Indicative Costs including Operating Cost ($ million)	Indicative Cost per ML of Supply ($)	Comments
Baffle Creek Dam and pipeline. (FSL 23 metres)	30,000	160-180	5,333-6,000	• Could be a useful component of a State Water Grid • The lowest cost option able to provide a significant increase in supply to Gladstone.

O/Scope

Appendix 4 Baffle Creek Dam – Background and Yield Studies

Background

The dam site on Baffle Creek has been considered on various occasions as a possible source of supply to meet needs in the Gladstone area or to meet needs in the Miriam Vale Shire area including urban demands in Miriam Vale, Agnes Waters and the Town of 1770.

The site is a short distance upstream of the Mimdale Gauging Station AMTD 55.7 km where flows for the period 1889-2005 have been reported as follows;

- Maximum annual discharge 1,114,748 ML
- Mean annual discharge 243,435 ML
- Minimum annual discharge 923 ML

These flows are based on stream gauge records collected since establishment of a gauging station at Roadview at AMTD 55.7 km in 1968 and then the Mimdale station in 1972 and on records prior to that, synthesised from rainfall records.

The catchment area upstream of the Gauging Station is about 55% of the Baffle Creek sub catchment for which the mean annual discharge is estimated to be 533,000 ML/a. The mean annual discharge from the whole of the basin including other streams is estimated to be 750,000 ML/a.

Dam Proposals

The maximum height of dam at the site is considered to be limited by the alignment of the main north coast railway. Previous studies focussed on 2 options as follows.

Table 1: Baffle Creek Dam Options

Full Supply Level (m AHD)	Storage Capacity (ML)
25.0	113,000
20.0	38,000

Geotechnical studies suggest that the site is suitable for a straight-forward concrete gravity or roller compacted concrete dam.

Previous Yield Studies

1996 Studies

As part of a Gladstone region water supply study, yields were assessed on a HNFY basis with an environmental flow allowance of the 20th percentile flow. Yields were assessed as follows.

Table 2: Baffle Creek Dam 1996 Yield Studies

Full Supply Level (m AHD)	Storage Capacity (ML)	Supply Yield (ML/a)
25.0	113,000	52,350
20.0	38,000	21,300

2004 Studies

These studies were undertaken by SunWater on behalf of GAWB as part of their SWPP. This work included development of an IQQM model initially using historic 1891-1997 data "*with environmental flow objectives similar to those adopted for the adjacent Boyne River WRP and ROP*" with a later recalibration of the model taking into account the 1996-2003 dry period. (The daily trigger flows and the low flow requirements assumed for the Baffle Creek site are given on pages 9-10 of the SunWater report.)

The estimates of yield from these studies were as follows.

Table 3: Baffle Creek Dam 2004 Yield Studies

Full Supply Level (m AHD)	Storage Capacity (ML)	Supply Yield (ML/a)
25.0	113,000	55,000
20.0	38,000	22,000

2007 Yield Studies

In preparation for development of the Baffle Creek WRP, NRW has extended the period of record for the IQQM model for the Baffle Creek basin to June 2006 and developed possible scenarios to assess ecological, social and economic impacts for a range of possible future developments. Target Environmental Flow Objectives (EFOs) are also being developed which are expected to be closer to near-natural conditions rather than those adopted for the Mary River WRP and those adopted for the Boyne River WRP and used by SunWater in the 2004 studies referred to above.

The EFO's and Water Allocation Security Objectives (WASOs) finally adopted for Baffle Creek will be an outcome of the WRP process which is not expected to be completed for some months. However, to provide some understanding of the supply which might be available from a Baffle Creek dam under a WRP, preliminary analyses using the IQQM model have been undertaken for dams with Full Supply Levels 20,23 and 25 metres to assess possible flow and ecological impacts. Preliminary environmental flows should be maintained as follows.

- Low flows- up to 150 ML/day maintained at Mindale for a target 95% of pre dam flow days to protect the brackish environment downstream.
- Medium/high flows- maintain 21 day flow events of > 5,000 ML/day up to a maximum of 13,000 ML/day for a target 90% of pre dam flow days to protect the over bank lagoon environment.

These analyses assume that existing entitlements are fully utilised.

The following table summarises the relevant simulation run results. Results for Cases 9, 10 &11 (with the environmental flow targets) show the number of days with flow at Mimdale (below the dam) greater than 5,000 ML/d & 13,000 ML/d as a percentage of the number of days without a dam. For example: days of flow > 5,000 ML at Mimdale pre dam = 1,336 and for Case 9 days with flow > 5,000 ML with a dam to EL 20 m = 1,249 or 93.5% of pre dam days, again assuming full utilisation of existing entitlements.

Table 4: Baffle Creek Dam 2007 WRP Yield Studies

Case	Dam FSL (assumed capacity ML)	Continuous uninterrupted supply (ML/a)	EOS MAF (% of PD)	Frequency of days with flow (% of pre dam days FU)		
				≥ 5,000 ML/d	≥ 13,000 ML/d	< 150 ML/d
1	EL 20m (40,000)	-	> 75%	Not reported	n/r	n/r
2		-	> 80%			
3		-	> 85%			
4		**20,000**	**95.4%**			
5	EL 25m (110,000)	-	> 75%	n/r	n/r	n/r
6		-	> 80%			
7		**48,000**	**89.4%**			
8		**44,000**	**90.0%**			
9	EL20 (40,000)	**16,000**	**96.0%**	93.5%	97.8%	All flows maintained downstream of dam
10	EL 23.0 (76,000)	**30,000**	**92.9%**	88.0%	94.0%	
11	EL25 (110,000)	**42,000**	**90.2%**	85.1%	90.2%	

Scenario number as assigned by Water Assessment
EOS = End of System
MAF = Mean Annual Flow
PD = Pre-development
FU = Full utilisation of existing entitlements

To gain some understanding of sensitivity to climate change of the supply potentially available from a Baffle Creek dam, further cases were run assuming a 20% reduction in stream flows throughout the catchment. The following table indicates the possible impacts on End of System Flows and on the above EFO's of both the dam as well as sensitivity to climate change.

Table 5: Baffle Creek Dam 2007 WRP Yield Studies Sensitivity to Climate Change

Case	Dam FSL (assumed capacity ML)	Continuous uninterrupted supply (ML/a)	EOS MAF (% of PD)	Frequency of days with flow (% of pre dam days FU)		
				≥ 5,000 ML/d	≥ 13,000 ML/d	< 150 ML/d
9	EL20 (40,000)	**15,500**	**76.0%**	75.9%	81.3%	Significant reduction in flows downstream of dam
10	EL 23.0 (76,000)	**29,000**	**73.0%**	71.3%	74.7%	
10	EL25 (110,000)	**37,000**	**71.0%**	69.0%	62.2%	

The table indicates that the impact of climate change on the supply available from a Baffle Creek dam would be relatively minor excepting for the EL 25.0 m dam but that the impact on pre climate change EOS flows and EFO's would be significant.

It also should be noted that the climate change impact alone is to reduce EOS MAF to 80% of PD flows.

Comment on Reliability of Yield Estimates

As above, the yield estimates detailed above were derived using the daily timestep IQQM model being developed for the Baffle Creek basin water resource plan which has a period of record 1891-June 2006. The majority of the recent dry years have been taken into account.

For the preliminary environmental flow rules nominated by Water Planning, the analyses to date show that the yield of a Baffle Creek dam is primarily a function of the dam's storage capacity since in simple terms, mean annual flow is several times the capacity of the dams under consideration. The climate change impact modelling which assumed a 20% reduction in flows throughout the catchment reinforces this conclusion.

Although the Mimdale gauging station is the only station in the Baffle Creek catchment it is close to the proposed dam site and therefore, the yield estimates derived in the 2007 analyses are considered to be sufficiently reliable for the purposes of considering the regional water supply issues discussed in this paper.

for the FSL 25 m dam. Further stochastic analyses may reduce the supply likely to be available from a Baffle Creek dam.

Deleted: would provide a more certain assessment of

7.2 Potential Benefits

A Baffle Creek dam is the lowest dollar cost option able to provide a significant increase in the reliable water supply available for use in the Gladstone region including possible use within the Baffle Creek basin. The dam could potentially provide a 28% increase on the *Unrestricted allocation* available from Awoonga Dam together with the proposed 30,000 ML/a pipeline from the Lower Fitzroy River. A Baffle Creek dam would be even more significant if it is found necessary to derate the Awoonga Dam supply as discussed in section 6.3 above. In this case, a Baffle Creek dam would provide a 38% increase in the supply available from Awoonga Dam together with the Fitzroy River pipeline assuming the yield from a Baffle Creek dam is not de-rated at the same rate as other storages.

Deleted: would

Deleted: also

Deleted: .

Deleted: would

Deleted: in effect

Deleted: 7.3 .

Formatted: Bullets and Numbering

Assuming growth in water demands as predicted by GAWB in its SWPP, a Baffle Creek dam would meet 16 years growth before a higher cost supply option such as a desalination plant would need to be implemented.

Since more than 80% of water use in the Gladstone region is by high value industrial users, a Baffle Creek dam could potentially support a more than 22% increase in industrial production (and in employment) in the region with the balance of the supply providing for the urban growth likely to be associated with such an expansion.

Deleted: A

Formatted: Font: Not Bold

Formatted: Font: Not Bold

Deleted: additional

Formatted: Font: Not Bold

Deleted: . ¶
¶

Formatted: Font: Not Bold

Deleted: Although

Deleted: A

Deleted: a

Deleted: however

Deleted: is the lowest cost of the water supply options for Gladstone, it

Deleted:

Deleted: ,

Construction of the dam and delivery pipeline system would also provide employment opportunities for 200-300 workers during a construction period of 3-4 years.

Importantly, a Fitzroy River pipeline together with a Baffle Creek dam and delivery pipeline would increase Gladstone's sources of supply from the current sole source to three sources of supply creating a regional water grid providing a substantial reduction in the supply and infrastructure risks associated with a single source of supply.

The creation of a fresh water storage on Baffle Creek would also be of significant social benefit in that it would increase the diversity of recreational opportunities available to residents and visitors to the region.

7.3 Potential Impacts

Deleted: extensive and irreversible environmental impacts

While all of the future water supply options considered in this paper would involve environmental impacts, a dam on Baffle Creek will have potentially significant impacts on the near pristine aquatic ecosystems of Baffle Creek, its estuary and the coastal zone. A dam on Baffle Creek will also have local economic impacts in terms of recreational fishing and tourism.

Deleted: nvironment in Baffle Creek

Deleted: which are in a near pristine condition

Deleted: and is likely to be met with strong opposition from the local community and conservation groups.

7.3.1 Environmental Impacts

Construction of a storage on Baffle Creek will have potentially significant impacts on the aquatic environment in Baffle Creek.

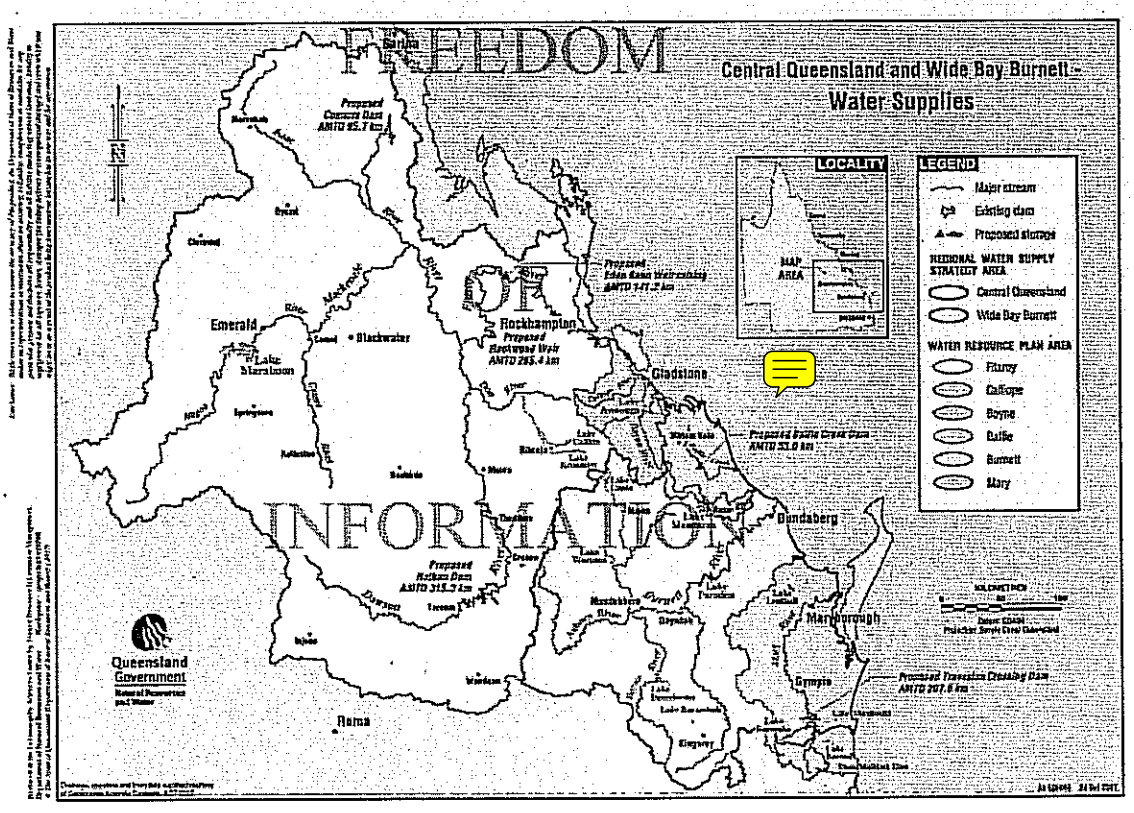
Deleted: *Future water demand in Baffle Creek_Ver11.doc*

Deleted: *Future Water Demand in Baffle Creek_ver11).doc* . 19

Development of the Wide Bay Burnett Regional Water Supply Strategy (WBBRWSS) commenced in June 2007. The strategy area includes the Baffle Creek Basin and the Burnett Basin, and extends from Miriam Vale Shire in the north to Cooloola Shire in the south.

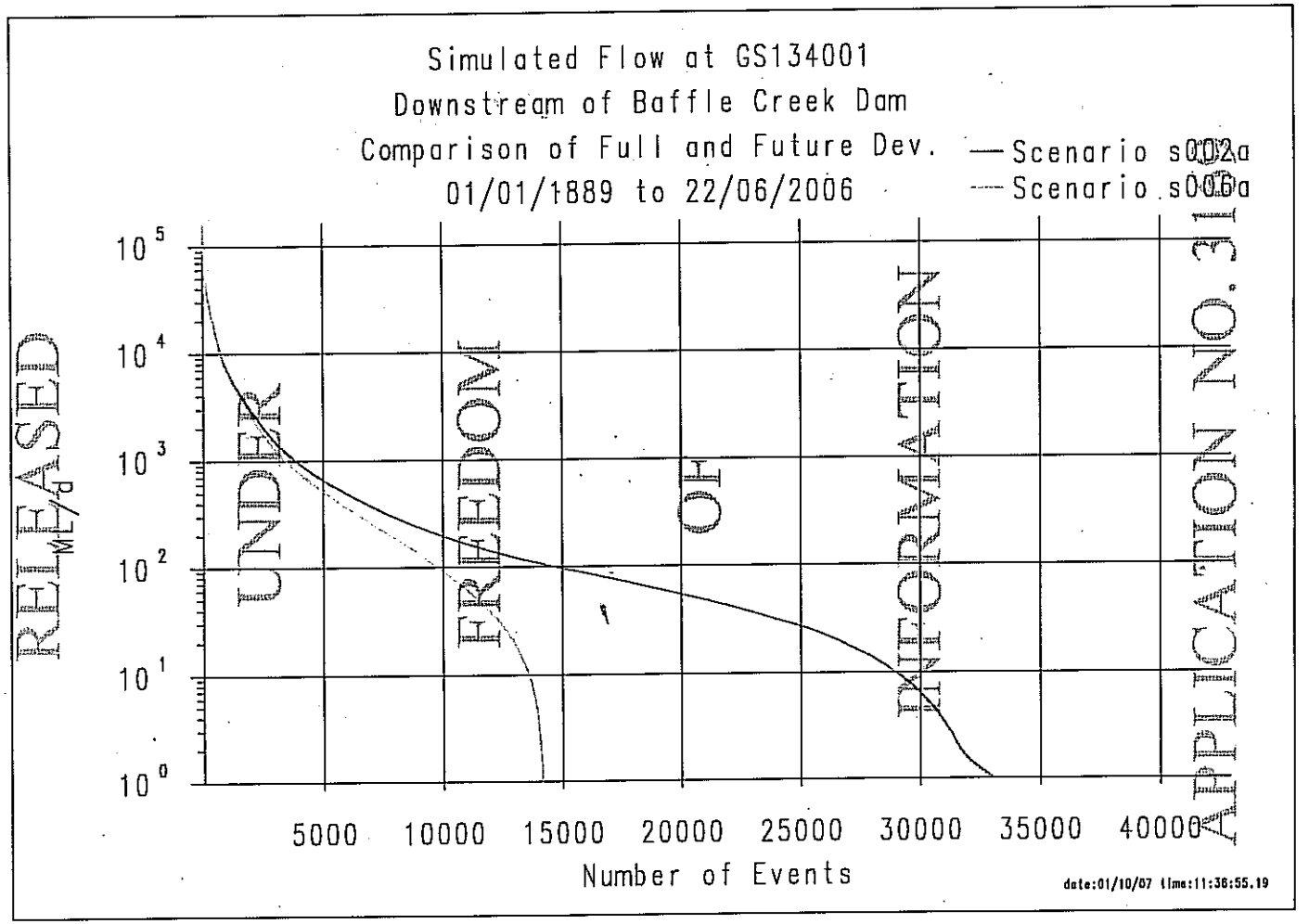
The objective of the WBBRWSS is to develop a whole of government approach to meeting the water supply requirements of the region's urban, industrial, mining and agricultural activities over the next 50 years. The strategy will consider a range of supply options including desalination, new surface water storages, increased use of wastewater, use of underground water and optimal use of existing dams and weirs, including Paradise Dam. The strategy will also consider demand management and water use efficiency options.

Work is currently in progress to estimate potential demands for water over the next 50 years. This work is expected to be completed early 2008, with a draft strategy expected to be completed by September 2008.

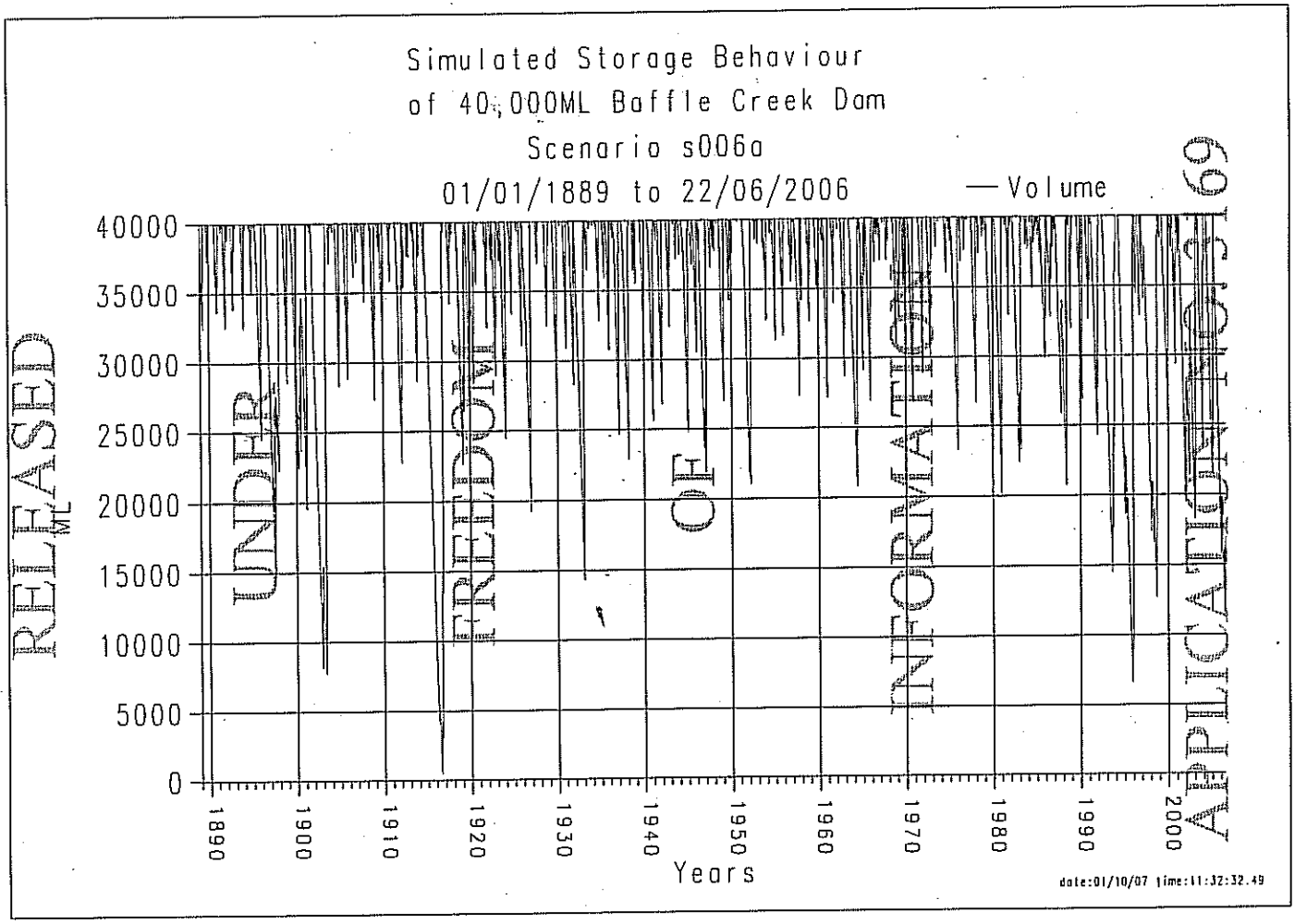


6.0 Regional Water Balances

6.1 Fitzroy River Basin



Simulated Flow Duration Curve (Entire Flow Range) Downstream of EL 20m Baffle Creek Dam (WT Case 4).



Simulated Storage Behaviour for EL 20m Baffle Creek Dam (WT Case 4)

Department of Natural Resources and Water
Location: South Wing - CSIRO, 120 Meiers Rd, Indooroopilly
Postal: 80 Meiers Rd, Indooroopilly, Qld 4068

From: Gilbert & Associates [mailto:gaconslt@bigpond.net.au]
Sent: Friday, 28 September 2007 2:24 PM
To: Casey Amanda; Mahmutovic Alma
Subject: Baffle Ck Dam Scenarios

Dear Alma,

Further to Wai-Tong's request following Monday's meeting, we have undertaken a series of modelling runs to assess the potential yield from a dam on Baffle Creek for varying dam capacity and environmental flow assumptions.

Initial cases tested (and reported) previously on the basis of maintaining a specified level of MAF at End of System indicated the following results:

- **Baffle Creek Scenario s006a:** EL20m Baffle Dam (40,000 ML capacity) with approx 20,000 ML/a continuous supply lead to an EOS MAF of 95.4% of pre-development levels. 20,000 ML/a was the maximum demand able to be continuously supplied under these assumptions (ie. HNFY).
- **Baffle Creek Scenario s006b:** EL25m Baffle Dam (110,000 ML capacity) with approx 44,000 ML/a continuous supply lead to an EOS MAF of 90.0% of pre-development levels.
- **Baffle Creek Scenario s006c:** EL25m Baffle Dam (110,000 ML capacity) with approx 48,000 ML/a continuous supply lead to an EOS MAF of 89.4% of pre-development levels. 48,000 ML/a was the maximum demand able to be continuously supplied under these dam assumptions (ie HNFY).

Further cases were then undertaken to preserve further environmental flow criteria as provided by the Regional office, specifically:

1. Low flow: Maintain all flows at Mimdale below 150 ML/d (brackish environment protection) - target = 95% of pre-development flow days
2. Medium/high flow: Maintain 2+ day flow events of > 5,000 ML/d up to a maximum of 13,000 ML/d (overbank lagoon environment protection) - target = 90% of full utilisation flow events

For low flow maintenance, modelling was undertaken such that all inflows to the simulated Baffle Ck Dam up to 150 ML/d were released. For medium/high flow maintenance, releases from Baffle Creek Dam was simulated to mirror inflow events of greater than 5,000 ML/d occurring for 2 (or more) consecutive days.

- **Baffle Creek Scenario s007a:** EL20m Baffle Dam (40,000 ML capacity) with approx 16,000 ML/a continuous supply lead to an EOS MAF of 96.0% of pre-development levels. 16,000 ML/a was the maximum demand able to be continuously supplied under these assumptions (ie. HNFY).

- **Baffle Creek Scenario s007b:** EL25m Baffle Dam (110,000 ML capacity) with approx 42,000 ML/a continuous supply lead to an EOS MAF of 90.2% of pre-development levels. 42,000 ML/a was the maximum demand able to be continuously supplied under these assumptions (ie. HNFY).

The following table summarises the relevant simulation run results. Results for Cases 9 & 10 (with additional environmental flow targets) show the number of days with flow at Mimdale (below the dam) greater than 5,000 ML/d & 13,000 ML/d as a percentage of the number of days without a dam (ie the FU case). For example: days of flow > 5,000 ML at Mimdale for FU case = 1,336 and for Scenario s007a (case 9) days with flow > 5,000 ML = 1,249 or

93.5% of FU days.

Case	Scenario	Dam EL	Continuous (ML/a)	EOS MAF (% of PD)	Frequency of days with flow (% of FU)		
					≥ 5,000 ML/d	≥ 13,000 ML/d	< 150 ML/d
1	-	EL 20m (40,000 ML)	-	>75%	Not reported	n/r	n/r
2	-		-	> 80%			
3	-		-	> 85%			
4	**s006a**		**20,000**	**95.4%**			
5	-	EL 25m (110,000 ML)	-	> 75%	n/r	n/r	n/r
6	-		-	> 80%			
7	**s006c**		**48,000**	**89.4%**			
8	**s006b**		**44,000**	**90.0%**			
9	**S007a**	EL20	**16,000**	**96.0%**	93.5%	97.8%	All flows maintained downstream of dam
10	**S007b**	EL25	**42,000**	**90.2%**	85.1%	90.2%	

Note: Case number as per Wai-Tong email dated Monday, 24 September 2007 6:07 PM

Scenario number as assigned by Water Assessment
EOS = End of System
MAF = Mean Annual Flow
PD = Pre-development
FU = Full utilisation of existing entitlements

If you have any queries regarding any of the above, or wish to discuss anything further, please do not hesitate to call.

Regards,

Owen

Alma

Alma Mahmutovic
Principal Project Officer, Water Assessment
Telephone: 07 3896 9119 (Qnet 39119) **Facsimile:** 07 3896 9149
E-mail: alma.mahmutovic@nrw.qld.gov.au
www.nrw.qld.gov.au

Natural Resource Sciences
Department of Natural Resources and Water
Location: South Wing - CSIRO, 120 Meiers Rd, Indooroopilly
Postal: 80 Meiers Rd, Indooroopilly, Qld 4068

From: Casey Amanda
Sent: Wednesday, 3 October 2007 4:26 PM
To: Mahmutovic Alma
Cc: Droop Owen
Subject: Baffle Creek Dam Scenarios

Alma,

Further to Wai-Tong's request in Monday's meeting, we have undertaken a series of modelling runs to assess the potential yield from a EL23m dam on Baffle Creek and assessing the impact of a 20% reduction in inflows for 3 storage sizes.

Scenarios s006a-c were undertaken to maintain a specified level of MAF at End of System.

Scenarios s007a-c were then undertaken to preserve further environmental flow criteria as provided by the Regional office, specifically:

1. Low flow: Maintain all flows at Mimdale up to 150 ML/d (brackish environment protection) - target = 95% of pre-development flow days
2. Medium/high flow: Maintain 2+ day flow events of > 5,000 ML/d up to a maximum of 13,000 ML/d (overbank-lagoon environment protection) - target = 90% of full utilisation flow events

For low flow maintenance, modelling was undertaken such that all inflows to the simulated Baffle Ck Dam up to 150 ML/d were released. For medium/high flow maintenance, releases from Baffle Creek Dam was simulated to mirror inflow events of greater than 5,000 ML/d occurring for 2 (or more) consecutive days.

Scenarios s008a-c weredeveloped in order to provide inflow senstivity assessment as a first-pass estimate of potential climate change impacts on catchment inflows. A base assumption of a 20% reduction in catchment inflows was adopted.

The following table summarises the relevant simulation run results. Results for Cases 1 to 14 (some with additional environmental flow targets) show the number of days with flow at Mimdale (below the dam) greater than 5,000 ML/d & 13,000 ML/d as a percentage of the number of days without a dam (i.e. the FU case). For example: days of flow > 5,000 ML at Mimdale for FU case = 1,336 and for Scenario s007a (case 9) days with flow > 5,000 ML = 1,249 or 93.5% of FU days.

Case	Scenario	Modelling Assumptions		Continuous, uninterrupted supply (ML/a)	EOS MAF (% of PD)	Frequency of days ≥ 5,000 ML/d	Frequer days 13,000 I
		Dam EL	Inflow %				
1	-	EL 20m (40,000 ML)	100%	-	> 75%	Not reported	n/r
2	-			-	> 80%		
3	-			-	> 85%		
4	s006a			20,000	95.4%		
5	-	EL 25m (110,000 ML)	100%		> 75%	n/r	n/r
6	-			-	> 80%		
7	s006b			48,000	89.4%		
8	s006c			44,000	90.0%		
9	S007a	EL20	100%	16,000	96.0%	93.5%	97.8
10	S007b	EL25		42,000	90.2%	85.1%	90.2
11	S007c	EL23		30,000	92.9%	88.0%	94.0
12	S008a	EL20	80%	15,500	76.0%	75.9%	81.3
13	S008b	EL25		37,000	71.0%	69.0%	62.2
14	S008c	EL23		29,000	73.0%	71.3%	74.7

Note: Case number as per Wai-Tong email dated Monday, 24 September 2007 6:07 PM

Scenario number as assigned by Water Assessment
EOS = End of System
MAF = Mean Annual Flow
PD = Pre-development
FU = Full utilisation of existing entitlement

I have also attached relevant plots of storage behaviour and the flow frequency curves at the gauging station.

If you have any queries regarding any of the above, or wish to discuss anything further, please do not hesitate to call.

Amanda

Amanda Casey
Hydrologist, Water Assessment
Telephone: 07 3896 9153 **Facsimile:** 07 3896 9149 **Mobile:** 0412 636 046
Email: amanda.casey@nrw.qld.gov.au
www.nrw.qld.gov.au

Department of Natural Resources and Water
Work Address: 120 Meiers Road, Indooroopilly Qld 4068
Postal Address: 80 Meiers Road, Indooroopilly Qld 4068

Alma

Alma Mahmutovic
Principal Project Officer, Water Assessment
Telephone: 07 3896 9119 (Qnet 39119) **Facsimile:** 07 3896 9149
E-mail: alma.mahmutovic@nrw.qld.gov.au
www.nrw.qld.gov.au

Natural Resource Sciences
Department of Natural Resources and Water
Location: South Wing - CSIRO, 120 Meiers Rd, Indooroopilly
Postal: 80 Meiers Rd, Indooroopilly, Qld 4068

From: Casey Amanda
Sent: Wednesday, 3 October 2007 4:26 PM
To: Mahmutovic Alma
Cc: Droop Owen
Subject: Baffle Creek Dam Scenarios

Alma,

Further to Wai-Tong's request in Monday's meeting, we have undertaken a series of modelling runs to assess the potential yield from a EL23m dam on Baffle Creek and assessing the impact of a 20% reduction in inflows for 3 storage sizes.

Scenarios s006a-c were undertaken to maintain a specified level of MAF at End of System.

Scenarios s007a-c were then undertaken to preserve further environmental flow criteria as provided by the Regional office, specifically:

1. Low flow: Maintain all flows at Mimdale up to 150 ML/d (brackish environment protection) - target = 95% of pre-development flow days
2. Medium/high flow: Maintain 2+ day flow events of > 5,000 ML/d up to a maximum of 13,000 ML/d (overbank lagoon environment protection) - target = 90% of full utilisation flow events

For low flow maintenance, modelling was undertaken such that all inflows to the simulated Baffle Ck Dam up to 150 ML/d were released. For medium/high flow maintenance, releases from Baffle Creek Dam was simulated to mirror inflow events

of greater than 5,000 ML/d occurring for 2 (or more) consecutive days.

Scenarios s008a-c weredeveloped in order to provide inflow senstivity assessment as a first-pass estimate of potential climate change impacts on catchment inflows. A base assumption of a 20% reduction in catchment inflows was adopted.

The following table summarises the relevant simulation run results. Results for Cases 1 to 14 (some with additional environmental flow targets) show the number of days with flow at Mimdale (below the dam) greater than 5,000 ML/d & 13,000 ML/d as a percentage of the number of days without a dam (i.e. the FU case). For example: days of flow > 5,000 ML at Mimdale for FU case = 1,336 and for Scenario s007a (case 9) days with flow > 5,000 ML = 1,249 or 93.5% of FU days.

Case	Scenario	Modelling Assumptions		Continuous, uninterrupted supply (ML/a)	EOS MAF (% of PD)	Frequency of days ≥ 5,000 ML/d	Frequ 13
		Dam EL	Inflow %				
1	-	EL 20m (40,000 ML)	100%	-	> 75%	Not reported	
2	-			-	> 80%		
3	-			-	> 85%		
4	**s006a**			**20,000**	**95.4%**		
5	-	EL 25m (110,000 ML)	100%	-	> 75%	n/r	
6	-			-	> 80%		
7	**s006b**			**48,000**	**89.4%**		
8	**s006c**			**44,000**	**90.0%**		
9	**S007a**	EL20	100%	**16,000**	**96.0%**	93.5%	
10	**S007b**	EL25		**42,000**	**90.2%**	85.1%	
11	**S007c**	EL23		**30,000**	**92.9%**	88.0%	
12	**S008a**	EL20	80%	**15,500**	**76.0%**	75.9%	
13	**S008b**	EL25		**37,000**	**71.0%**	69.0%	
14	**S008c**	EL23		**29,000**	**73.0%**	71.3%	

Note: Case number as per Wai-Tong email dated Monday, 24 September 2007 6:07 PM
Scenario number as assigned by Water Assessment
EOS = End of System

MAF = Mean Annual Flow
PD = Pre-development
FU = Full utilisation of existing entitlement

I have also attached relevant plots of storage behaviour and the flow frequency curves at the gauging station.

If you have any queries regarding any of the above, or wish to discuss anything further, please do not hesitate to call.

Amanda

Amanda Casey
Hydrologist, Water Assessment
Telephone: 07 3896 9153 **Facsimile:** 07 3896 9149 **Mobile:** 0412 636 046
Email: amanda.casey@nrw.qld.gov.au
www.nrw.qld.gov.au

Department of Natural Resources and Water
Work Address: 120 Meiers Road, Indooroopilly Qld 4068
Postal Address: 80 Meiers Road, Indooroopilly Qld 4068

141

Subject: Modelling EFO stats for Baffle storage for brackish habitat and inundation of waterholes
Importance: High
Sensitivity: Confidential

Mark

Ad discussed my environmental flows required to meet demands of the downstream environment recognised as valuable by the TAP include:

To be modelled at Mimdale node:

1. Brackish habitat conservation flow statistic (flows <150ML/d occurring 95% of period of the full utilisation model flow, i.e. 30%tile flow for the full utilization should not drop below 28.5%tile). Should be modelled as an inflow outflow rule where flows <150ML/d released thru storage as equivalent volume (i.e. 30 ml/d inflow, release 30 ML/d). If inflow greater than 150 ML/d then release only 150 ML/d.
2. Waterhole inundation flow events (flows greater than 5 000 ML, where flow of this volume is recorded for >=2 days should occur 90% of the events of the full utilization model flow (flows between 5000 and 13000 Ml/d will be released). Should be modelled where inflow is greater than 5 000 ML/d for a period of =>2 days, inflow is released at equivalent volume up to a maximum of 13000 ML/d including spills. That is if the 25 m storage is empty and inflow reached 25000 ML/d for 2 days, then 13 000 ML should be released for 2 days. Extra day on event to slowly bring back to 150 ML/d to continue releases as long as there is inflow.

Justification:

- The TAP and EPA have recognised the importance of offstream waterholes that act as refugia during the dry periods. The inundation flow for two of the key waterholes downstream was calculated using a digital elevation model and determining the height at which connectivity was reached for these two waterholes relevant to the nearby stream level. Cross-sections were also assessed at these sites using the same technique to determine if similar to the cross-section for Mimdale. As river geomorphology is similar at these sites relative to Mimdale, the crossection at Mimdale was used to determine suitable discharges to inundate applicable stream depths - these correlate to approximately 5000 Ml/d for the waterhole at AMTD 45, and approximately 13 000 ML/d for the waterhole in proximity to AMTD 41. These waterholes act as nursery areas for catadromous (fish that migrate between freshwater and estuary to breed) species such as barramundi, sea mullet and tarpon (all species listed by the TAP and EPA as ecological assets in their own right). Only releasing flow that is extended over a period greater than 2 days allows fish to move in and out of the system.
- The 150 Ml/d will be sufficient to provide connectivity between waterholes below the storage, to maintain brackish conditions in these waterholes and for a short distance downstream to the declared downstream limit (DDL). Coupled with the waterhole release events, this release strategy will ensure that there is sufficient brackish habitat suitable for fish species such as the freshwater mullet (*Myxus petardi*) and important aquatic macrophyte species. 150 ML/d is approximately at the apex of many hydrographs where the surface water runoff diminishes and the baseflow continues as the water seeps through the riparian vegetation.

If Ok with text please forward on to Wai Tong, Owen and rest of team.

Andrew

Andrew Mc Dougall
Project Leader (Aquatic Ecology)
Telephone: 07 41315 749 **Facsimile:** 07 41315 766
Email: andrew.mcdougall@nrw.qld.gov.au
www.nrw.qld.gov.au

28/02/2008

153

Cc: Wong Wai Tong; Wood Diana; Rogers Lee; Dayaratne, Sunil
Subject: RE: IQQM - Baffle Creek

Thanks Peter.

We shall start preparing a brief proposal and await the further detail from Wai Tong / Diana so that we can slot it in.

FYI, I have discussed with Jim Grayson - all ok there.

Cheers,

Tom Vanderbyl
Manager, Corporate Strategy, SunWater
Level 9, 120 Edward Street, Brisbane Qld 4000
PO Box 15536, City East Qld 4002
Ph. (07) 3120 0105 Fax (07) 3120 0333
Mobile: 0411 066 793 Int'nal: +61411066793
www.sunwater.com.au

From: Gilbey Peter [mailto:Peter.Gilbey@nrw.qld.gov.au]
Sent: Thursday, 20 September 2007 9:12 AM
To: Vanderbyl, Tom
Cc: Wong Wai Tong; Wood Diana; Rogers Lee
Subject: FW: IQQM - Baffle Creek

Tom
Further to our discussions I would like to confirm that NRW would like to engage Sunwater's Services to confirm the yield of the Baffle Creek 55.6 km dam option for a range of EOS flow and other pertinent flow objectives using the IQQM model developed for the July, 2004 report reg G-80600-07-06 and provided to us by Jim Grayson.
I understand Wai tong and Di will confirm shortly the range of efo's to be considered.
As soon as you can could you please provide me with the SunWater proposal as this work is required urgently.

Peter Gilbey
Director - RPEQ 2551
Regional Water Supplies
Natural Resources & Water
Ground Floor, 144 EdwardSt. Brisbane Qld 4000
GPO Box 2454 Brisbane Qld 4001
Ph (07) 3224 8417 Fax (07) 32393911
Mobile: 0418 710 697
peter.gilbey@nrw.qld.gov.au

From: Wong Wai Tong
Sent: Wednesday, 19 September 2007 5:42 PM
To: Wood Diana
Cc: Gilbey Peter
Subject: IQQM - Baffle Creek

Hi Di

The DG has requested for some preliminary simulations for the Baffle Creek Weir site – within the

839

Orellana Jose

From: Wong Wai Tong
Sent: Monday, 24 September 2007 6:07 PM
To: Quinlan Rupert; Droop Owen; Mahmutovic Alma; McDougall Andrew; Pearson Mark; Wood Diana; Rogers Lee
Cc: Gilbey Peter
Subject: Baffle Creek Scenario
Attachments: Baffle Creek Data.xls

Hi all

Further to our meeting today, please find attach the storage curve for the proposed Baffle Creek Dam option.

1. The IQQM simulations required are:

Case	Storage	EOS Mean Annual Flow	Comments
1	EL 20 (40,000 ML)	75%	
2	EL 20 (40,000 ML)	80%	
3	EL 20 (40,000 ML)	85%	
4	EL 20 (40,000 ML)	90%	
5	EL 25 (110,000 ML)	75%	
6	EL 25 (110,000 ML)	80%	
7	EL 25 (110,000 ML)	85%	
8	EL 25 (110,000 ML)	90%	
9	EL 20 (40,000 ML)	85%	With other EFOs from Andrew
10	EL 25 (110,000 ML)	85%	With other EFOs from Andrew
11	To be determined, if necessary		Based on results
12	To be determined, if necessary		Based on results

Kindly provide the maximum demand that could be continuously supplied at storage within the EOS MAF (and other EFOs) stipulated in the table above.

2. All runs are to use the Full Utilisation of Existing Entitlements case. The model 1889-June 2006 would suffice for the purpose of this work.

3. Andrew McDougall, Bundaberg will provide some key flow objectives within the next 2 days based on the ecological assets in that area. The water holes and protection of the estuarine environment have been proposed.

4. Given the urgency, Water Assessment has indicated that these runs can proceed tomorrow and the results for Cases 1 – 8 could be available within the next two/ three days. This works in well with the information from Andrew for Cases 9 onwards. I have included the options for future runs if necessary, but this is dependent upon the results and subsequent discussions.

5. The group agreed to meet at 3pm Monday 1 October Ground floor 144 Edward Street to discuss the results and further run requirements. A separate invitation will be issued.

Alma/Owen: I have also received a CD of some files from the work by GAWB along with the report provided to you at the meeting today. I will provide you with the files but note that they are marked Commercial in