CHAPTER 6

OPTIONS SHORTLIST

Nullinga Dam and Other Options Preliminary Business Case

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CHAPTER SUMMARY AND CONCLUSIONS

Option 1: Do minimum (base case)

- As the service need is an opportunity (and not a problem), there is a threshold question of whether there is government appetite to address the opportunity.
- The majority of irrigators in the MDWSS have adopted on-farm efficiency measures and will continue to do so where it creates efficiencies for their businesses operations. The MDWSS is moving towards an efficient market of water, with temporary and permanent trading of water promoting 'highest and best usage'.
- Option 1 is therefore a viable option in its own right in the event that the service need is not considered to be a priority by government at this time.

Option 2: Improve MDWSS rules and operations

- The aim of Option 2 is to review the MDWSS operating rules to increase operational performance of the scheme and reduce current constraints. Key potential opportunities for improvement include consideration of changing the water year, carryover provisions, water ordering, education and potential trading of peak flow entitlements (ML per day) and revising Transmission and Operation Allowances (TOA).
- The success of Option 2 will depend upon a range of factors, including modelling of the rule changes showing an increase in water availability, appetite of government for reform, a change in behaviour by irrigators in response to any improvements made and LMA considerations.

Option 3: Modernise MDWSS and convert losses

- The aim of Option 3 is to conduct a targeted modernisation of the MDWSS distribution infrastructure to increase the amount of water allocations available in the MDWSS. This option is estimated to result in conversion of up to 15,000 ML current distribution loss allocations to new tradeable medium priority water allocations for sale.
- The success of Option 3 will be dependent upon a number of factors, including the costs of works, the ability to convert a suitable yield of loss allocations, irrigators taking up the new allocations and increasing agricultural production, limiting negative impacts on the existing scheme and the level of agricultural production from owners of existing allocations and LMA considerations.

Option 4: Nullinga Dam for agricultural use

- The aim of Option 4 is to develop a new bulk water source for the major expansion of irrigated agriculture in the region. The scope of this option 4 is to design and build a primarily medium priority Nullinga Dam, initially for delivery of water to Walsh River irrigators within and potentially downstream of the MDWSS area, but with the flexibility for commercial (private) distribution solutions to evolve. A "river delivery, bulk only" Nullinga Dam simplifies design, costing, water pricing, stakeholder engagement, water planning and scheme operation.
- No distribution infrastructure for delivery to the MDWSS is included in Option 4. Future connection into the MDWSS would be subject to the result of a process that identifies clear cost effective opportunities for new or augmented distribution infrastructure.

- The success of Option 4 will be dependent on the realisation of a credible demand and economic profile for new agricultural production along the Walsh River, affordability of the option for government and irrigators, the ability to secure approvals to progress the option to construction (including amendments to the Barron Water Plan), deliverability of the option, the take up of new water allocations and increasing agricultural production.

6.1 Purpose

The purpose of this chapter is to describe the shortlisted options. The descriptions underpin the subsequent analysis in the PBC.

6.2 Stakeholder Consultation on Shortlisted Options

Following the options filtering process and determination of a proposed shortlist of options, key regional stakeholders were consulted to further refine the description of the shortlisted options including:

- SunWater officers in Mareeba
- Large irrigators within the MDWSS
- DNRM officers in Mareeba
- DAF officers in Townsville.

6.3 Option 1: Do Minimum (Base Case)

The options filtering process determined a short list of three options for further analysis in the PBC. However, as the service need is an opportunity (and not a problem), there is a threshold question of whether there is government appetite to address the opportunity.

In the MDWSS, there are a high number of SunWater's customers with small holdings. Over 60 per cent of SunWater's customers have less than 50 ML of water entitlements with 41 per cent holding less than 10 ML.

The analysis of the service need and options filtering process included the following conclusions:

- The majority of irrigators in the MDWSS have adopted on-farm efficiency measures to maintain or improve crop yield per ML of water applied, and will continue to do so where it creates efficiencies for their business operations. For example, for the 2015 harvest season, for farms contracted to the Mossman Mill, over 65 per cent of irrigators have converted their irrigation from flood or furrow to overhead low pressure and only 23 per cent of irrigators are using surface furrow irrigation. Improvements in water efficiency can 'free up' water allocations to support additional production.
- The current operation of the MDWSS is moving towards an efficient market of water, with temporary and permanent trading of water promoting 'highest and best usage' – consistent with government water policy. Permanent trades of water entitlements that are currently not used facilitate industry growth and can activate sleepers (a water entitlement holder who uses none of its allocation over the course of the water year) and dozers (a water entitlement holder that uses very little of its announced allocation over the course of the water year).
- The recent dry conditions have increased water trading activity to address scarcity.

This indicates the do minimum option is a viable option to be pursued as it provides for incremental expansion of agricultural production on the Atherton Tableland via existing mechanisms. If this decision is

made, the analysis of the shortlisted options in the following chapters of the PBC will not be material to any decision in the consideration of the PBC.

However, other options if progressed would provide for additional water availability and have a greater capacity to meet the identified service need. Increased water trading does not increase the existing level of water supply. Instead, it allows greater utilisation of the existing water supply and a number of stakeholders have expressed concern that this could erode the reliability of all water allocation holders, particularly in dry periods. It therefore would not be able to provide long term additional water security for the region.

The ability to improve water efficiency is also principally limited to sugarcane producers because higher value crops are already using spray or trickle systems as the principal irrigation system. Consultation undertaken by MJA indicated that of the 23 per cent of sugarcane producers on surface furrow, a significant proportion would not change to overhead low pressure systems because their soil types were not suitable. Irrigators also commented that changing to subsurface drip can deliver additional water use efficiency savings and improve yield, but at very high costs. There can also be other problems that emerge with subsurface drip, for instance blockages can be hard to locate and fix, and vermin can eat into the pipes. Blockages are understood to present a key challenge with sugarcane because of its fascicule root system, composed of thin roots, which grow and penetrate into the drip systems. Additionally, the change from surface furrow irrigation to pressured irrigation systems does not simply involve the installation of a new system. The new system needs to be carefully designed and specified so that the application rate aligns with soil types (particularly the soil moisture capacity) and new irrigation schedules need to be developed. Also, they are expensive to purchase and install and the expense is typically borne by the producer. There therefore appears limited opportunity to free up water allocations through on-farm water efficiency investment.

A do minimum option does not address expectations in the region in relation to the proposed Nullinga Dam.

6.4 Option 2: Improve MDWSS Rules and Operation

State Infrastructure Plan category: Reform

Option 2 seeks to improve the water supply scheme operating rules (e.g. Resource Operations Plan (ROP) and Resource Operations Licence (ROL)) and operation to increase performance of scheme and reduce current non-physical constraints.

The key aspect of Option 2 is to review the rules and operation of the MDWSS against the changed cropping and water use practices of the modern scheme. Potential opportunities to improve the MDWSS rules and operation include:

1. *Reviewing the water year* to match the current demand patterns within the existing crop mix in the region to better reflect higher announced allocations at the start of the water year. There is currently a real resistance of water users within the MDWSS not to use above 70 to 80 per cent of their individual allocations to ensure water is available for the following water year. With the current water year commencing on 1 July, the scheme starts most years below 100 per cent for medium priority water allocations but sees that lift to 100 per cent over the course of the water year.
2. *Carryover entitlements* exist within MDWSS, but only when Tinaroo Falls Dam is at 75 to 100 per cent capacity. The ability to draw carryover water also only endures for the first six months of the new water year. Not every customer accesses their carryover entitlement. With a change in use of water to more permanent crop types (avocado, banana, etc.) individual water users are reducing water use to make more water available into the future, only to see the water they saved being spread across all water users in the scheme at the commencement of the new water year.

3. *Water ordering* is currently an area of underperformance for the MDWSS. It is estimated that only 40 per cent of customers by number order water in the MDWSS, and only approximately 50 per cent of water by volume is ordered in the MDWSS. This means that 60 per cent of customers do not order water and half the volume of water is not ordered. This results in operational inefficiencies and exacerbates distribution losses.
4. *Peak flow entitlement* exists in the MDWSS and is referred to as Design Flow Rate Entitlement (DFRE). Not all DFREs (i.e. an individual property's peak flow entitlements) have been documented by SunWater and not all irrigators are aware of their specific entitlement in ML per day. As the scheme has developed to maximum use, the need for the DFRE to be better understood by customers has intensified. It is important to ensure the DFRE's are defined across the scheme to allow for continued changes in use. SunWater has commenced this process and it is recommended that it continue.
5. *Seasonal trading* of a portion of the distribution losses allocation would allow unused water to go to productive use. This is to allow the market to determine the highest productive use of this unused water rather then it staying within Tinaroo Falls Dam and being part of the next water year's allocation.
6. *Transmission and Operation Allowance (TOA)* is a volume of water set aside in Tinaroo Falls Dam as part of the Announced Allocation formula for the river transmission losses. This volume is a large percentage of volume of the water allocation to be delivered within the river and could be reviewed to confirm the actual requirement.

It is considered that improvements in water ordering, peak flow trading and carryover use and operations rules would increase water use within the MDWSS without undermining the current supply or reliability of supply.

The success of Option 2 is considered to depend upon a number of factors, including:

- modelling showing the implementation or rule and operational changes will make a difference to water availability
- ability of government/SunWater to implement improvements/reforms to scheme rules and operation
- change in water use practices by irrigators in response to the improvements, and associated increase in agricultural production
- local management considerations – a change in management may affect the management of the scheme operation.

6.5 Option 3: Modernise MDWSS and Convert Losses

State Infrastructure Plan category: Better use/improve existing

The aim of Option 3 is to increase the amount of medium priority water allocations available in the MDWSS for irrigators to increase yields and expand agricultural production. It aims to achieve this at a cost per ML that is cost effective when compared to other options, including major capex options such as Nullinga Dam.

SunWater currently has about 45,000 ML in water allocations for managing transmission losses in the delivery system, comprising 8,000 ML of high priority and 37,000 ML of medium priority entitlements.

There are four main ways that water can be 'lost' in a water delivery system:

- evaporation (water lost to the atmosphere)
- seepage (the movement of water through the beds of irrigation channels)

- leakage (e.g. water lost through channel banks, structures and end of system flows)
- operational losses (e.g. theft, outfalls, unmetered diversions and inaccurate metering).

It is estimated that currently the MDWSS is operating at around 70 to 80 per cent water conveyance efficiency. Elsewhere in Australia where delivery system upgrades have been implemented, it has been possible to lift water conveyance efficiency up to 90 per cent.[1]

The key elements of Option 3 are:

1. Undertake engineering and feasibility studies in relation to modernisation of parts of the MDWSS distribution system via a range of infrastructure improvements. This would include obtaining support from DNRM for the proposed loss conversions.

   On the basis of preliminary assessments, SunWater has identified 11 potential sub-projects of modernisation works, as follows:

   a. Arriga Main Channel and A02: Construction of 6.5 kilometres pressurised pipeline system to replace open, earth channel and open pipeline.

   b. Mareeba Main Channel: 10 kilometres pressurised pipeline system to replace open, earth channel.

   c. 'M9': Construction of 10 kilometres pressurised pipeline system to replace open, earth channel.

   d. 'EB4': Construction of 4.5 kilometres pressurised pipeline system to replace open, earth channel.

   e. Southedge: Stand-alone earthworks construction of 200 ML balance storage and installation of 25 automated control gates within main delivery channels.

   f. South Walsh: In-channel and stand-alone earthworks construction of additional 100 ML balancing storage and installation of 40 automated control gates within main channels.

   g. Atherton Creek: Installation of 20 automated control gates within main delivery channels.

   h. East Barron: In-channel earthworks construction of additional 20 ML of balancing storage and construction of 13 kilometres of pressurised pipe.

   i. Biboohra Main Channel downstream of storage: Installation of 5 automated control gates.

   j. Biboohra Main Channel upstream of storage: Conversion of 4.5km of open, earth channel and open pipeline to pressurised pipe.

   k. North Walsh: In-channel earthworks construction of additional 5 ML of balancing storage.

   There is also a potential for returning water to customers from the end of pipes/channels and potential use of variable speed drives, if appropriate, where water is pumped.

   SunWater has estimated the amount of loss allocations able to be saved could be 8,000 to 15,000 ML, depending on the works conducted.

2. Implement infrastructure improvements and apply to DNRM to convert current distribution loss allocations to new tradeable medium priority water allocations created by the loss savings from

[1] Advice from MJA.

infrastructure improvements. The volume would be determined as part of any further detailed investigation and could be done in stages.

3. Sell the new medium priority water allocations on the market.

In its irrigation pricing report the QCA (2012) found that MDWSS may not have excessive distribution loss allocations based on an analysis of historical water delivered. Nevertheless, further investigation of Option 3 could consider whether SunWater can – without implementing new infrastructure – satisfy itself and DNRM that a portion of its distribution loss allocations are not needed. This could allow creation of new water allocation with potentially very limited capex. There is also an opportunity to provide flexibility to seasonally trade distribution losses, where possible dependent on rainfall, storage and yield considerations.

Optimisation of Option 3 from a commercial perspective will be relevant to ensure the option delivers savings at least costs for acceptable risk.

The success of Option 3 is considered to be dependent upon a number of factors, including:

- deliverability and cost of the infrastructure improvements
- ability for SunWater to convert a suitable yield of loss allocations to new allocations for sale
- purchase of new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production
- limited negative impacts on the existing scheme and owners of existing allocations from the implementation of the option
- LMA considerations.

6.5.1 Interaction with Queensland Government Application to NWIDF Capital Component

In March 2017, the Queensland Government and SunWater submitted an Expression of Interest application to the NWIDF seeking a capital contribution towards several of the sub-projects in Option 3 to modernise the existing MDWSS distribution system.

6.6 Option 4: Nullinga Dam for Agricultural Use

The aim of Option 4 is to develop a new bulk water source for the expansion of irrigated agriculture in the region. The scope of inclusions and exclusions for Option 4 are:

1. Design and build a Nullinga Dam primarily for medium priority water allocations open to all customers and in particular for agricultural users, initially for delivery of water to Walsh River customers within and potentially downstream of the MDWSS area, but with the flexibility for commercial distribution systems to evolve. A 'river delivery, bulk only' Nullinga Dam simplifies design, costing, water pricing, stakeholder engagement, water planning and scheme operation.
2. No distribution infrastructure for delivery to the MDWSS or elsewhere is included. Future connection to the MDWSS would be subject to the result of a process that identifies clear cost effective opportunities for new or augmented distribution infrastructure.

DNRM and DAF have reported areas of suitable soils and provided details on the type of crops that may succeed in this region. Up to 9,900 hectares of suitable land for irrigated agriculture has been identified from the proposed Nullinga Dam wall to the end of the Dimbulah area.

There is also potential demand from up to 8,000 hectares of greenfield land near Chillagoe. However, significant bulk transmission losses in the Walsh River would result during the transfer of water and for environmental and commercial reasons delivering to this area may not be preferred.

Irrigation application rates (of water) are likely to range between 8 ML per hectare and 12 ML per hectare annually dependent on a range of variables. At 10 ML per hectare it is theoretically possible for up to 99,000 ML (based on 9,900 hectares) to be used within the MDWSS existing scheme boundaries. In addition, the Arriga area and others are likely to express interest in water allocations as the MSF Sugar mill and extensive farms (including proposed expansion areas) are within a reasonable service area for this option.

The success of Option 4 is considered to be dependent on a number of factors, including:

- realisation of an economic profile for a new irrigation scheme and agricultural production along the Walsh River
- realisation of credible water demand for the dam yield
- affordability of Nullinga Dam for irrigators and government
- ability to secure approvals to progress Nullinga Dam (including amendments to the Barron Water Plan and environmental assessments)
- deliverability of Nullinga Dam within a suitable cost and risk profile
- purchase of new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production.

6.6.1 Potential Yield of Nullinga Dam

Previous assessments of Nullinga Dam have provided for small, medium and large sizes. These sizes have been the subject of hydrological assessment before and during the PBC. The yield estimates are reported in Table 1.

All hydrological assessments have been undertaken to match existing performance of Tinaroo Falls Dam (e.g. holders of Nullinga Dam medium priority allocations would receive the full volume of their allocation with at least the same reliability as a medium priority allocation holder from Tinaroo Falls Dam).

Table 1 Hydrological Assessments of Proposed Nullinga Dam Yield

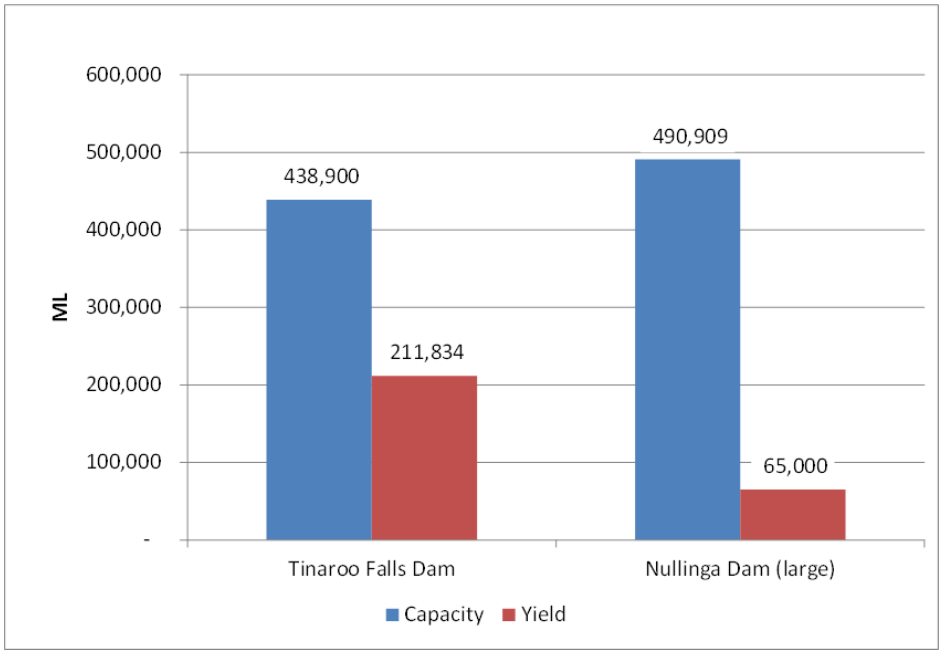
DAM CAPACITY	1. QLD HYDROLOGY		2. QLD HYDROLOGY		3. OD HYDROLOGY	4. QLD HYDROLOGY	5. QLD HYDROLOGY	
	Potential yield —MP	Potential yield —HP	Potential yield —MP	Potential yield —HP	Potential yield —MP	Potential yield —MP	Potential yield—MP with climate change modelling and environmental releases	
ML	ML	ML	ML	ML	ML	ML	ML	Notes
168,000 (SMALL)	55,398	35	36,000	12,500	50,000	56,000	A – 43,000 B – 45,000 C – 49,000	A – Release median daily flow for each month B – Release quarter of inflows to maximum of 3,000 ML a day between January and March C – Release up to 50ML/day
364,000 (MEDIUM)	78,398	35	59,000	12,500	59,000	Not modelled	Not modelled	
491,000 (LARGE)	88,898	35	69,500	12,500	65,000	84,000	A – 70,000 B – 68,000 C – 76,000	A, B and C as above

Source: Queensland Hydrology Unit, OD Hydrology.

Notes: Qld Hydrology results based on historical sequence modelling. OD Hydrology results based on stochastic modelling. (1) Nullinga Dam yield accounting for Nullinga Dam to supply the current Tinaroo Falls Dam supply to Zone E. (2) Nullinga Dam yield based on current Tinaroo Falls Dam supply of 19,398 MP/a medium priority (MP) and 35 ML/a high priority (HP) to Zone E being converted to 12,500 ML/s HP for release from Tinaroo Falls Dam down the Barron River for CRC use (extraction from Lake Placid). (3) Nullinga Dam MP yield with no conversion. (4) Nullinga Dam MP yield with no conversion. (5) Nullinga Dam MP yield with no conversion, accounting for climate change modelling and environmental releases.

It should also be noted that Nullinga Dam is less effective than Tinaroo Falls Dam due to yield and hydrology efficiency. The figure below highlights that for a comparable size dam (i.e. a Nullinga Dam the size of Tinaroo Falls Dam), the medium priority yield from Nullinga Dam is much less than Tinaroo Falls Dam. The Nullinga Dam site also suffers from inefficiency issues for irrigation purposes as it can only deliver water to a limited number of existing farms via current delivery infrastructure. This inefficiency is expected as the original decision was to build Tinaroo Falls Dam was based on its more favourable features.

Figure 1 Tinaroo Falls Dam and the Proposed Nullinga Dam



Source: Marsden Jacob Associates

Option 4 has assessed the Nullinga Dam on the basis of the 'small size' in previous assessments to allow for analysis against the other shortlisted options. This yield may change with further hydrological assessments.

Regardless, if Nullinga Dam proceeds, it is recommended the size of the dam be determined by further demand assessment and matched the volume of credible demand, rather than an arbitrary 'pre-determined' yield.