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3 September 2010

Mr Rick Stankiewicz
Queensland Competition Authority
GPO Box 2257
BRISBANE QLD 4001

By email: rick.stankiewicz@qca.org.au

Dear Rick

HEADWORKS UTILISATION FACTORS – TECHNICAL REPORT

Please find attached a copy of a report prepared by SunWater entitled "Headworks Utilisation Factors – Technical Paper" dated 3rd September 2010.

SunWater engaged Dr Sharmil Markar of WRM Water and Environment to undertake an independent peer review of SunWater's approach as well as the data, assumptions and calculations as summarised in the Technical report. A copy of a letter dated 3 September 2010 containing Dr Markar's conclusions from this peer review is also therefore attached for your reference.

We would of course be more than happy to discuss this issue further with the QCA or its consultants.

Yours sincerely

[redacted]

Peter Boettcher
CHIEF EXECUTIVE

0715-01-E
3 September 2010

wrm
water + environment

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Tom Vanderbyl
Manager, Strategic & Stakeholder Relations
SunWater Limited
PO Box 15536
City East Brisbane
QLD 4002

Dear Tom,

SUBJECT: PEER REVIEW OF HEADWORKS UTILISATION FACTORS TECHNICAL PAPER

The overall approach adopted to determine Headworks Utilisation Factors as outlined in the technical paper is sound and appears to be rigorous and robust. The data sources used to prepare the technical paper and for the running of models (IQQM's) are appropriate. The key assumptions used in the technical paper regarding the operation of the headworks storages (including the allocation of water for different types of entitlements) appear to be reasonable.

I certify that SunWater's final draft of the Headworks Utilisation Factors Technical Paper dated 3 September 2010 is in accordance with my recommendations made on 6 August 2010 and that SunWater has determined the headworks utilisation factors in accordance with the assumptions, approach and data sources used or referenced in the technical paper.

For and on behalf of
WRM Water & Environment Pty Ltd

[redacted]

Dr Sharmil Markar
Director / Principal Engineer

HEADWORKS UTILISATION FACTORS

Technical Paper

3 September 2010

Prepared by SunWater Limited

ACN 131 034 985

Headworks Utilisation Factors

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HEADWORKS UTILISATION FACTORS

Introduction

SunWater has developed and applied a robust methodology for determining "Headworks Utilisation Factors" (HUFs) that apportion each water supply scheme's (WSS's) storage headworks volumetric capacity[1] utilised by each water entitlement[2] priority group in the scheme. This is a key consideration in the allocation of the relevant capital costs (i.e. asset value and renewal costs) associated with SunWater's bulk water assets. The paper is set out in four parts:-

Part A – Rationale

Part A sets out background information relating to the nature of water access entitlements in Queensland supplemented water supply schemes (particularly with respect to how priority groups work in conjunction with statutory water sharing rules and other operational requirements to define a water entitlement's access to water supplies).

Part A then outlines the rationale for using Headworks Utilisation Factors to apportion bulk water asset costs between priority groups of water access entitlements within a scheme. It also highlights the differences between HUF's, Resource Operations Plan (ROP) conversion factors and the water pricing conversion factors that were used in the previous pricing round to allocate lower bound costs to customer sectors within scheme segments. The reasons why the latter two factors are unsuitable for the apportionment of bulk water asset costs are also explained.

In general, the HUF allocates a greater proportion of capital costs per megalitre of high priority due to a more detailed assessment of the storage required to service high priority entitlements.

Part B – Methodology

Part B sets out an overview of the technical methodology for deriving Headworks Utilisation Factors within a water supply scheme having regard to:

- The volumes and priority groups of water entitlements within the scheme (including the potential for conversion between priority groups where applicable);
- The water sharing and water accounting rules (including taking into account announced allocation and continuous sharing arrangements);
- The critical water supply arrangements (CWSAs) including storage cut-off rules;
- Other Resource Operations Plan (ROP) requirements relating to instream storage infrastructure operations (including discharge release rules, environmental flow requirements as well as inter-storage management arrangements); and
- An analysis of hydrologic performance of headworks storages (in terms of the probability of storages actually holding various volumes of water during critical periods).

Part C – Results

Part C presents a summary of the values of the Headworks Utilisation Factors that have been calculated for each water entitlement priority group in each water supply scheme.

Part D – Appendices

Part D is comprised of a suite of Appendices that set out a detailed step-by-step guide to the methodology for calculating the HUFs and the values of key input data and the details of other scheme specific information relevant to the calculation of the HUFs for each water supply scheme.

[1] Headworks volumetric capacity in this context includes the useable storage of all dams and weirs within a scheme.
[2] The term "water entitlement" is used throughout this report and has the same meaning as "water access entitlement" as defined under the National Water Initiative and "water allocation" as defined under the Queensland Water Act 2000.

Part A – Rationale

Background to Water Entitlements and Priority Groups

Each water user that draws water from a supplemented water supply scheme is able to do so because either:

- they own or lease a water entitlement that authorises the holder to take water subject to certain conditions, or
- they have secured access within a water year by way of a seasonal water assignment from the owner of a water access entitlement.

Each water entitlement in a scheme belongs to a "priority group" which is defined under the Water Act 2000 to mean water allocations that have the same water allocation security objective[3].

A water entitlement's priority group is important both in:

- determining the volume of water that may be made available to the water entitlement under the scheme's water sharing rules, and
- identifying the conditions under which supply to that water may be allowed or restricted.

These rules and other operational requirements are defined in statutory catchment-based Resource Operations Plans (ROPs) which are prepared by the Department of Environment and Natural Resources (DERM) and approved by the Governor-in-Council in accordance with Water Resource Plan provisions under the Water Act 2000.

The performance, numbers, types and names of priority groups differ between each of the water supply schemes reflecting the unique arrangements that have been defined within the applicable ROP. Most schemes have just two water entitlement priority groups, namely High Priority, and Medium Priority[4] although some schemes have just one priority group (Julius Dam WSS) and others may have as many as five (Upper Condamine WSS).

Generally, the water sharing rules within the ROP provide a holder of a high priority water entitlement with superior access to the nominal volume[5] specified on their water entitlement. That is, a holder of a high priority water allocation will usually be able to access a quantity of water equal to their nominal volume more frequently and with less restriction on their water availability than the holder of a water entitlement within a medium or other lesser priority group[6].

This superior performance is achieved through a number of mechanisms including;

- sharing rules that give high priority water entitlements first access to available water,
- reserve volumes that specify volumes of stored water to be set aside for future use by high priority water entitlements, and
- storage cut-off rules that restrict access to water supplies by medium priority water entitlements once water storage levels fall below defined levels.

[3] A water allocation security objective (WASO) is based on the probability of being able to obtain water. Target values of WASO (usually in terms of minimum mandatory values and/or target ranges) are specified in a Water Resource Plan for each priority group of water entitlements within a catchment.

[4] Although the names of priority groups generally give an indication of their relative access to water supplies within a scheme, this is not always the case, particularly in supplemented groundwater schemes where both groundwater and surface water allocations exist.

[5] The term "nominal volume" is defined in the Act to mean "the number used to calculate the allocation's share of the water available to be taken by holders of water allocations in the same priority group".

[6] Exceptions to this may occur in some supplemented groundwater schemes where medium priority allocations accessing groundwater and surface water supplies may be able to access water supplies more often than high priority water allocations that are entirely reliant on surface water supplies.

In addition, in most schemes there are Critical Water Supply Arrangements (CWSAs[7]) that, once triggered, effectively replace the "normal" water sharing rules and other operational requirements during extended drought periods. The CWSAs therefore give further priority to reserving or allocating dwindling supplies to high priority entitlements. In such situations, environmental flow provisions are also typically suspended by the CWSAs. These arrangements mean that medium priority entitlement holders may be cut off from accessing stored water supplies for extended periods of time during extended droughts, while high priority entitlement holders continue to access the water stored by the headworks.

In very severe water shortage situations, the Minister may exercise powers under the Water Act to disallow all water entitlements from accessing water, and restrict water use to "essential" purposes only (such as domestic/drinking, power generation etc.). To date, this power has not been exercised in SunWater's water supply schemes.

When to use Headworks Utilisation Factors?

The Headworks Utilisation Factors are used to apportion the bulk water capital costs in accordance with the benefit or "level of service" attributable to each water entitlement priority group.

The discussion in the previous section regarding water sharing arrangements illustrates how high priority water entitlement holders clearly derive more benefit from bulk water infrastructure than other lesser priority water entitlement holders. Indeed the proportion of the overall benefit derived from storage headworks by high priority water entitlements is typically greater than their proportion of the total nominal volume of entitlements in a scheme. In other words, the benefits derived from bulk water assets are not shared uniformly between all water entitlements.

It follows that high priority water entitlements should therefore be apportioned a share of the storage assets that is proportionate to this increased utilisation.

Headworks Utilisation Factors are defined as "the percentages of a scheme's storage headworks volumetric capacity able to be utilised by each priority group of water entitlements in that scheme, taking into consideration:

- ***the application of operational requirements, water sharing rules and Critical Water Supply Arrangements associated with the relevant Resource Operations Plan (ROP) or interim resource operations plan (IROL); and***
- ***the probability of utilisation of the scheme storages under conditions of relative supply shortage".***

A Headworks Utilisation Factor does not represent a priority group's proportional share of a scheme's overall "hydrologic yield" nor reflect any proportional demand for – or usage of – operational services. In general, the HUF allocates a greater proportion of capital costs to high priority due to a more detailed assessment of the storage required to service high priority entitlements.

For supplemented water supply schemes, the benefit derived from bulk water assets essentially relates to the ability of the storage headworks to store flows during wet periods and then subsequently make releases during dry periods and combine with (i.e. supplement) natural flows within a scheme thereby ultimately meeting the water demands of water entitlement holders.

Headworks Utilisation Factors specifically exclude water entitlement groups that are not included in the scheme's water sharing rules thereby deriving little or no benefit from the scheme's bulk water infrastructure (e.g. "risk-A priority" in the Upper Condamine Water Supply Scheme).

[7] CWSAs are approved by DERM in accordance with processes and requirements established within ROPs.

How do Headworks Utilisation Factors differ from Conversion Factors?

Water Pricing Conversion Factors

Headworks Utilisation Factors are considered to be more appropriate for apportioning bulk water asset costs between water entitlement priority groups than the "water pricing conversion factors" that were used in the previous 2005-2010 water pricing round.

This is because the water pricing conversion factors used in the previous pricing round sought to establish a simple relationship between medium priority and high priority water entitlements as a means to allocating total lower bound costs between different customer sectors within scheme segments.

The water pricing conversion factors[8] were based purely on long-term hydrologic modelling of water entitlement performance (generally averaged over periods of more than 90 years). The conversion factors failed to take account of how the water sharing rules, critical water supply arrangements, storage cut-off rules/triggers and other rules gave preferential access to high priority entitlements during periods of prolonged or recurring critical water supply shortages like those experienced in recent years.

Unlike Headworks Utilisation Factors, the water pricing conversion factors were not designed – or appropriate – for apportioning bulk water asset costs between the various water entitlement priority groups that benefit from the bulk water service.

ROP Conversion Factors

It should also be noted that a few Resource Operations Plans contain "ROP Conversion Factors" that are not the same as the old water pricing conversion factors. ROP conversion factors represent the rate at which medium priority water entitlements may be converted to high priority water entitlements and vice versa. However, where ROPs specify conversion factors, they also place limits on the maximum volumes of each priority group of water entitlements that may exist at any one time. These limits are usually very restrictive.

ROP conversion factors and their associated restrictive limits are designed to allow for limited conversion from one priority group to another without causing unintended third party impacts on either the performance of other water entitlements or on riverine environmental flow regimes[9]. The ROP conversion factors are not designed for apportioning bulk water asset costs between different priority groups of water entitlements within a scheme.

When not to use Headworks Utilisation Factors?

It is appropriate at this point to advise caution against the broad-scale adoption of HUF's as the basis of the allocation of other non-headworks and non-asset related headworks costs.

Bulk water operational costs are not related to extent to which storage headworks volumetric capacity is able to be utilised by a priority group of water entitlements. Such costs are driven by operational elements such as scheduling and delivering water, meter reading and maintenance, environmental management obligations, data management, compliance reporting, customer support and billing.

[8] Water pricing conversion factors used in the previous pricing round essentially equalled the ratio of the volume of all water entitlements in a scheme modelled at medium priority reliabilities divided by the volume of all water entitlements in the scheme modelled at high priority reliabilities. The calculation was based on the ratio of two modelled numbers that were neither based in reality nor compliant with Water Resource Plan Environmental Flow Objectives or Water Allocation Security Objectives.

[9] The criteria and mandatory performance standards for assessing such impacts are specified in terms of Water Allocation Security Objectives and Environmental Flow Objectives within Water Resource Plans.

Such functions relate to the entire bulk water scheme (including those only accessing a share of natural flows) and not just the headworks. Furthermore, these costs will not change if the amounts of high or medium priority entitlements in a scheme change.

The determination of the appropriate drivers for the apportionment of these other costs is the subject of a separate discussion paper.

Part B – Methodology

Overview

Appendix 1 provides a detailed step-by-step guide to the approach for deriving Headworks Utilisation Factors. This approach may be summarised as involving the following main steps[10]:

1. ***Identify the water entitlement groupings*** – for each water supply scheme, establish which water entitlement priority groups are to be considered in the "high priority" versus "medium priority" groupings for the purposes of this analysis.

   In most schemes where there are high and medium water entitlement priority groups this step is straightforward. However, in some schemes there are more than two types of priority groups with a variety of names, some of which may (for the purposes of this analysis) utilise scheme headworks to a similar extent and therefore may be assembled together under either the high or medium priority group.

   The conditions attached to some other water entitlement priority groups may be such that they utilise storage headworks to either little or no extent (such as those entitlements with access that is wholly conditional on the existence of run of river flows) and therefore excluded from the analysis (and assigned a HUF of zero).

2. ***Determine the volumes of the identified water entitlement groupings*** – for each water entitlement grouping that has been identified in a water supply scheme, establish the total volume of water entitlements included in each grouping.

   Again, for most schemes this step is straightforward with the volume simply being equivalent to the total nominal volume of the relevant water entitlement priority group (or groups where more than one has been assembled together under one grouping).

   However, some ROPs provide for the conversion of limited volumes of water entitlements from medium priority to high priority using a conversion factor. Where this is the case, the analysis takes account of this by setting the high priority nominal volume to the maximum allowable under the ROP rules and calculating the reduced medium priority nominal volume by applying the ROP conversion factor.

   This step ensures that the headworks utilisation factors take account of the effect of converting medium priority water entitlements to high priority water entitlements.

3. ***Determine the extent to which water sharing rules, critical water sharing rules and other operational requirements give the different water entitlement priority groups exclusive or shared access to components of storage capacity*** – the ROP rules and requirements are analysed to establish the (bottom) volume of storage that is effectively reserved for supplying high priority water entitlements, the (next) volume of storage (above that effectively reserved for high priority) that is available for use by medium priority water entitlements, and the (top)

[10] For water supply schemes where continuous sharing has been implemented through a ROP (viz. St George and Macintyre Brook Water Supply Schemes, steps 1 through 4 do not apply because the volumes of headworks storage attributable to each water entitlement priority group can be directly inferred from the Continuous Share Volumes stated in the relevant ROP. See Appendices 14 and 21 for more details.

volume of storage shared between priority groups. Figure 1 in Appendix 1 includes a conceptual diagram of this.

Examples of rules and requirements that influence these volumes include the water sharing (i.e. announced allocation) rules, split/joint sub-scheme provisions, critical water supply arrangements (including storage cut-off and trigger rules), and other ROP requirements relating to instream storage infrastructure operations including discharge release rules, low-flow environmental release requirements, hydro release rules as well as inter-storage water level management requirements.

4. ***Assess the hydrologic performance of each component of headworks storage*** – ROP-based hydrologic models (based on Integrated Quantity Quality Models or IQQM) are used to assess the probabilities of each component of headworks storage being accessible to the relevant water entitlement priority group during periods of relative supply shortage. These probabilities are used to determine the volumes of components of headworks storage effectively utilised by different water entitlement priority groups.

   This is an important step because the probability of the lower layers of the headworks storage storing water is likely to be greater than the probability of upper layers of headworks storage storing water. This in turn means that high priority water entitlements effectively have access to – and therefore are able to utilise – headworks storage capacity more often and with less restriction than medium priority water entitlements.

   Probabilities were derived by extracting the modeled headworks storage levels for the driest contiguous fifteen year critical period (the "standard period"). Recent storage levels actually observed were also checked for the driest fifteen year period. A fifteen year period was considered an appropriate duration for the purposes of this analysis and is consistent with short and medium term planning periods used in contemporary climate scenario modeling in Australia[11]. A fifteen year period is also representative of the typical horizon over which irrigation enterprises plan for and base their business investment decisions.

5. ***Determine the Headworks Utilisation Factors*** – using the parameters established and derived in steps 1 to 4 above, calculate the Headworks Utilisation Factors for each of the medium and high priority water entitlement groups.

   In some instances, water sharing rules are common to two water supply schemes (such as the Lower Fitzroy and Fitzroy Barrage Water Supply Schemes) or to water entitlement priority groups arising from specific headworks infrastructure within a scheme (such as pre-existing and new groups of water entitlements in the Bundaberg Water Supply Scheme). In such cases, Headworks Utilisation Factors are disaggregated and apportioned to the relevant headworks storage capacity.

   In those schemes where different priority groups of water entitlements were (for the purposes of analysis) assembled together under either the "high" or "medium" priority group, the Headworks Utilisation Factors are disaggregated in proportion to the nominal volumes of the priority groups that were assembled together

   A summary of the Headworks Utilisation Factor values is presented in Part C Table 1 of this report.

   A sensitivity analysis was undertaken to assess the effect of changing the duration of the standard period by performing HUF calculations using both ten year and twenty year critical periods. The summary results of the sensitivity analysis are presented in Appendix 26.

[11] See Chiew FHS, Cai W and Smith IN, 2009. Advice on defining climate scenarios for use in Murray-Darling Basin Authority Basin Plan modelling, CSIRO report for the Murray-Darling Basin Authority.

For the calculations using a ten year critical period, the HUFmp in 15 schemes (out of a total 23 schemes) varied by 2% or less from the HUFmp calculated using the standard 15 year critical period. Twenty two schemes varied by less than 10% from the standard period results and only one scheme varied by greater than 10% (16%).

For the calculations using a twenty year critical period, the HUFmp in 17 schemes varied by 2% or less from the HUFmp calculated using the standard 15 year critical period. Twenty two schemes varied by less than 10% from the standard period results and only one scheme varied by greater than 10% (12%).

Part C – Results

The Headworks Utilisation Factors for each Water Supply Scheme are presented in Table 1.

Table 1 – Headworks Utilisation Factors for each Water Allocation Group within each Water Supply Scheme

Water Supply Scheme	Headworks Utilisation Factors (%) and volume of water allocations relating to each priority group (ML) for each Water Allocation Priority Group in each Water Supply Scheme			
Barker Barambah WSS	Medium Priority (32079 ML) 75%	High Priority (2236 ML) 25%		
Bowen Broken Rivers WSS	Medium Priority (5676 ML) 0%	High A1 Priority (11649 ML) 35%	High A2 Priority (21605 ML) 65%	
Boyne River and Tarong WSS (Note 1)	Medium Priority (10934 ML) 9%	High Priority (33340 ML) 91%		
Bundaberg WSS (SunWater Headworks)	Medium Priority (207457 ML) 82%	High Priority (24372 ML) 18%		
Bundaberg WSS (Burnett Water Headworks)	Medium Priority (124000 ML) 77%	High Priority (20000 ML) 23%		
Burdekin Haughton WSS	Medium Priority (979594 ML) 79%	High Priority (99998 ML) 21%		
Chinchilla Weir WSS	Medium Priority (2884 ML) 12%	High Priority (1165 ML) 88%		
Callide Valley WSS	Medium Priority (Groundwater) (19527 ML) 9.8%	Risk Priority (Surface Water) (443 ML) 0.2%	High Priority (Surface Water) (4311 ML) 90%	
Cunnamulla WSS	Medium Priority (2612 ML) 100%			
Dawson Valley WSS	Medium Priority (36944 ML) 46%	Medium A Priority (19309 ML) 24%	High Priority (5579 ML) 30%	
Eton WSS	High B Priority (58970 ML) 80%	High A Priority (3089 ML) 20%	Risk Priority (504 ML) 0%	
Julius Dam WSS	High Priority (48850 ML) 100%			
Lower Fitzroy WSS (SunWater Headworks) (Note 2)	Medium Priority (2562 ML) 7%	High Priority (25800 ML) 93%		
Macintyre Brook WSS	Medium Priority (24509 ML) 87%	High Priority (488 ML) 13%		
Mareeba Dimbulah WSS (Note 3)	Medium Priority (176034 ML) 46%	High Priority (33900 ML) 54%		
Maranoa River WSS	Medium Priority (805 ML) 100%			
Lower Mary River WSS	Medium Priority (32688 ML) 42%	High Priority (1809 ML) 58%		
Nogoa Mackenzie WSS (Note 4)	Medium Priority (156729 ML) 40%	High Priority (56000 ML) 60%		
Pioneer River WSS	High B Priority (47357 ML) 44%	High A Priority (30753 ML) 56%		
Proserpine River WSS	Medium Priority (38075 ML) 27%	High Priority (22000 ML) 73%		

(continued over page)

Table 1 (continued) – Headworks Utilisation Factors for each Water Allocation Group within each Water Supply Scheme

Water Supply Scheme	Headworks Utilisation Factors (%) and volume of water allocations relating to each priority group (ML) for each Water Allocation Priority Group in each Water Supply Scheme				
St George WSS	Medium Priority (81554 ML) 94%	High Priority (3000 ML) 6%			
Three Moon Creek WSS	Medium Priority (Surface Water) (1940 ML) 8%	Medium Priority (Groundwater) (12621 ML) 52%	High Priority (Groundwater) (580 ML) 40%		
Upper Burnett WSS (SunWater Headworks) *(excluding John Goleby Weir)*	Medium Priority (27230 ML) 18%	High Priority (1530 ML) 82%			
Upper Burnett WSS (Burnett Water Headworks) *(excluding John Goleby Weir)*	Medium Priority (18230 ML) 100%	High Priority (0 ML) 0%			
Upper Burnett (John Goleby Weir only)	Medium Priority (1560 ML) 100%				
Upper Condamine WSS	Medium Priority (22165 ML) 11%	Risk A Priority (7320 ML) 0%	Risk B Priority (925 ML) 0%	High A Priority (3262 ML) 86%	High B Priority (125 ML) 3%

Notes:

1. Water allocation volumes based on 875 ML of existing Medium Priority Water Allocation being converted to 350 ML of High Priority Water Allocation as provided for in the Burnett Basin Resource Operations Plan.
2. Lower Fitzroy WSS Water allocation volumes based on 502 ML of existing Medium Priority Water Allocation being converted to 335 ML of High Priority Water Allocation as provided for in the Fitzroy Basin Resource Operations Plan.
3. Water allocation volumes based on 28391 ML of existing Medium Priority Water Allocation being converted to 19874 ML of High Priority Water Allocation as provided for in the Barron Basin Resource Operations Plan.
4. Water allocation volumes based on 33891 ML of existing Medium Priority Water Allocation being converted to 11297 ML of High Priority Water Allocation as provided for in the Fitzroy Basin Resource Operations Plan.

Part D – Appendices

Appendix 1 – Step-by-step guide to deriving Headworks Utilisation Factors

STEP 1 – Identify the water entitlement groupings

a) Establish the existing volumes of the highest (typically described as high) priority group of water entitlements

- Referenced from the Department of Environment and Resource Management (DERM) water entitlement register
- Usually equivalent to the nominal volume of high priority water entitlements (with exceptions noted in Appendices to this report)
- = "HPA"

b) Establish the existing volume of the second highest (typically described as medium) priority group of water entitlements

- Usually equivalent to the nominal volume of medium priority water entitlements (with exceptions noted in Appendices to this report)
- Where more than two priority groups of water entitlements exist in a scheme, the purpose, water sharing rules and other characteristics differentiating the groups are taken into account in determining whether to include them in the HPA, MPA or neither group
- = "MPA"

STEP 2 – Determine the volumes of the identified water entitlement groupings

a) Establish the medium priority to high priority ROP conversion factor (if applicable)

- Only applicable where a ROP includes a ROP medium priority to high priority water entitlement conversion factor
- = "ROPCF"
- Note that ROPCF is normally specified in terms of a number greater than one, where 1 ML high priority is worth (1* ROPCF) ML medium priority. In some ROPs the ROPCF is specified as less than one (e.g. Section 106 of the Burdekin Basin ROP where ROPCF= 0.565), in which case 1 ML high priority is worth (1/ ROPCF) ML medium priority
- Also note that some ROPs allow conversion in both directions i.e. medium to high and vice versa. However, the current water market trend is for conversion from medium to high and hence this approach has been adopted for the purposes of this HUF analysis.

b) Determine the maximum volume of high priority water entitlement that can exist (if applicable)

- Only different from HPA where a ROP specifies the maximum allowable volume of high priority entitlements that may be converted from medium priority water entitlements in a scheme
- = "HPA max"

c) Determine the volume of medium priority water entitlements corresponding to the maximum volume of high priority water entitlements determined above (if applicable).

- (If applicable) based on reducing the volume of medium priority water entitlements by the volume of the increase in high priority water entitlements multiplied by the ROP conversion factor
- = "MPA min" = MPA – (HPA max – HPA) x ROPCF *(or* x *1/ROPCF for those ROPs that specify the ROPCF as a number less than 1)*

STEP 3 – Determine the extent to which water sharing rules, critical water sharing rules and other operational requirements give the different water entitlement priority groups exclusive or shared access to components of storage capacity

a) Determine the volume of scheme storage below which the water sharing rules effectively make water unavailable to medium priority water entitlements by reserving for high priority entitlements

- Calculated as the minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year
- Calculation based on applying water sharing rules to HPA max ML of high priority water entitlements and MPA min ML of medium priority water entitlements, with previous year's carryover and projected inflows both assumed to be zero
- = "MP0 AA"

b) Check existence of any critical water supply arrangements, storage cut-off rules or other operational requirements likely to increase the volume effectively reserved for high priority entitlements (and therefore unavailable to medium priority water entitlements)

- Despite the "normal" water sharing rules, the critical water supply arrangements or other operational rules may increase the storage volume below which access to medium priority water entitlements is effectively cut-off[12];
- Where future (non pass-through) low-flow environmental release provisions, hydro releases or other reserve volumes outlined in a ROP are not explicitly or fully included as a term in the water sharing rules, the total volume of the required release is added to the volume effectively reserved for high priority entitlements and therefore unavailable to medium priority water entitlements;
- = "MP0"

c) Determine the minimum volume of scheme storage required before water sharing rules effectively give medium priority water entitlements maximum water availability

- Calculated as the minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (usually 100%) at the commencement of the water year
- Calculation again based on applying water sharing rules to HPA max ML of high priority water entitlements and MPA min ML of medium priority water entitlements, with previous year's carryover and projected inflows both assumed to be zero
- = "MP100 AA" (cannot exceed scheme full supply volume)

d) Check existence of any operational requirements likely to increase the minimum volume of scheme storage required before water sharing rules effectively give medium priority water entitlements maximum water availability

- Despite the "normal" water sharing rules, the critical water supply arrangements or other operational rules may increase the storage volume at which medium priority water entitlements can access their full water availability;
- = "MP100" (cannot exceed scheme full supply volume)

[12] In the case of the Pioneer Valley Water Supply Scheme, the water sharing rules provide some access to high-B priority water entitlements below the level at which high-A priority announced allocations equal 100%. See Appendix19 for details.

e) Establish full supply volume of the major headworks storages in the scheme

- Generally equivalent to the cumulative full supply volume of the major headworks storage/s (dam/s and weir/s) in the scheme. Note that the storage volumes of downstream weirs are included in the HUF analysis only when these are specifically included in the relevant ROP (or IROL) water sharing rules
- Where there is no major dam in a scheme, the sum of the full supply volumes of the weirs is used (such exceptions are noted in Appendices to this report)
- = "FSV hwks"

f) Establish dead storage volume of the major headworks storage in the scheme

- Generally equivalent to the cumulative dead storage volume of the major headworks storage/s (dam/s and weir/s) in the scheme
- Where there is no major dam in a scheme, the sum of the dead storage volumes of the weirs is used (such exceptions are noted in Appendices to this report)
- = "DSV hwks"

g) Calculate the capacity volume of the bottom horizontal layer of the headworks storage effectively reserved for high priority

- Figure 1 shows conceptual breakdown and apportionment of headworks storage capacity
- = "HP1" = MP0 – DSV hwks

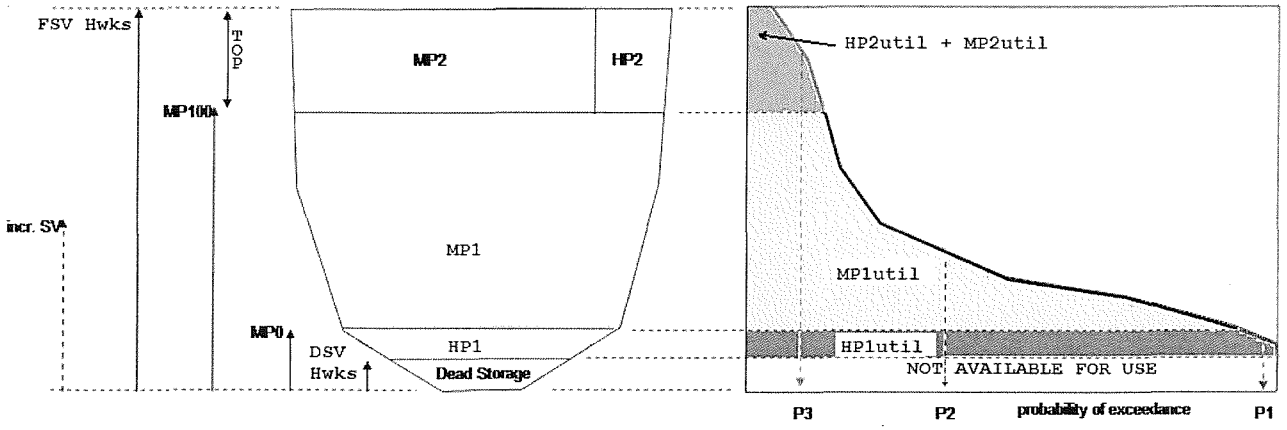


Figure 1 – Relationship between parameters used in the calculation of Headworks Utilisation Factors

h) Calculate the capacity volume of the next horizontal layer of the headworks storage effectively available for medium priority

- See Figure 1
- = "MP1" = minimum of { (MP100 – MP0) and (FSV hwks – MP0) }

i) Calculate the capacity volume of the top horizontal layer of the headworks storage effectively available for sharing between medium and high priority

- = "TOP" = maximum of { (FSV hwks-MP100) , 0 }
- The top layer is apportioned between medium and high priority in the same proportions as the respective volumes in bottom part of the storage

j) Calculate the proportion of the capacity volume of the top horizontal layer of the headworks storage effectively available for high priority

- See Figure 1
- = "HP2" = HP1/(MP1+HP1) x TOP

k) Calculate the proportion of the volume of the top horizontal layer of the headworks storage effectively available for medium priority

- See Figure 1
- = "MP2" = MP1/(MP1+HP1) x TOP

STEP 4 – Assess the hydrologic performance of each component of headworks storage

a) For each water supply scheme, extract multiple 15 year sequences of combined daily storage volume data (for those dams and weirs referred to in the scheme's water sharing rules) starting each of the 15 year sequences on the first day of the water year (defined in the corresponding ROP or IROL) from:

- The Department of Environment and Resource Management's long-term IQQM simulation of the scheme under the current ROP or IROL conditions (see Appendix 27); and
- The recent recorded daily storage data (if available) which mostly corresponds to the last 30-40 years.

Then for each of these fifteen year sequences, calculate (b) through (j) below.

b) Assess the probability of the headworks storage being in the bottom (high priority) horizontal layer of the headworks storage volume

- = "P1"

c) Assess the probability of the headworks storage being in the next (medium priority) horizontal layer of the headworks storage volume

- = "P2"

d) Assess the probability of the headworks storage being in the top (shared medium and high priority) horizontal layer of the headworks storage volume

- = "P3"

e) Determine the utilised volume of the bottom horizontal layer of the headworks storage by applying the high priority probability for that bottom layer

- = "HP1util" = HP1 x P1

f) Determine the utilised volume of the next horizontal layer of the headworks storage by applying the medium priority probability in that next layer

- = "MP1util" = MP1 x P2

g) Determine the utilised proportion of the volume of the top horizontal layer of the headworks storage effectively available for high priority, by applying the high priority probability in that top horizontal layer

- = "HP2util" = HP2 x P3

h) Determine the utilised proportion of the volume of the top horizontal layer of the headworks storage effectively available for medium priority, by applying the medium priority probability in that top horizontal layer

- = "MP2util" = MP2 x P3

STEP 5 – Determine the Headworks Utilisation Factors

a) For each of the fifteen year sequences analysed in Step 4, calculate the medium priority and high priority Headworks Utilisation Factors

- = "HUFmp" = (MP1util + MP2util) / (MP1util + MP2util + HP1util + HP2util) %

b) Set the HUFmp to equal the minimum of these HUFmp values. Note that the adopted 15 year critical period may not always correspond to the driest rainfall period due other factors such as ROP rules, headworks water storage levels at the start of the water year, etc. The adopted period exceedance curves for the headworks storages in each scheme are presented in the Appendices to this report.

c) Calculate the high priority Headworks Utilisation Factor

= "HUFhp" = 1 – HUFmp

d) (If applicable) Disaggregate the Headworks Utilisation Factors to apportion subsets of water priority water entitlements to the relevant headworks storage capacity (such exceptions are noted in Appendices to this report)

- The overall HUF results for **Bundaberg WSS** are disaggregated into two separate sets of results:
  - water allocations associated with the original scheme (pre Paradise Dam); and
  - water allocations associated with Burnett Water Pty Ltd (based on Paradise Dam)
- For Bundaberg WSS, the process of disaggregation is simply based on an apportioning of the overall scheme HUF factors each into two components on the basis of the water allocation volumes in the relevant grouping (SunWater vs. Burnett Water). A similar approach is used for the Upper Burnett WSS since it also has infrastructure owned by Burnett Water Pty Ltd.
- The operational rules outlined in the Fitzroy Basin ROP necessitated the calculation of overall HUF results for the combined Lower Fitzroy and Fitzroy Barrage schemes. The overall HUF results were then disaggregated so that only the results for the water allocations in the **Lower Fitzroy WSS** (operated by SunWater) are provided. Results for Fitzroy Barrage WSS (operated by Fitzroy River Water) are not provided.
- For the Fitzroy, the process of disaggregation is simply based on an apportioning of the combined Lower Fitzroy WSS and Fitzroy Barrage WSS HUF factors each into two components on the basis of the water allocation volumes in the relevant water supply scheme.

Appendix 2 – Barker Barambah Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	32079 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 32079 ML
High Priority	2236 ML	= HPA		HPAmax = 2236 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 11245 ML	
Adjustments	• The Burnett ROP (August 2009) details the Critical Water Supply Arrangements in Att 4.3E, s1.4.1. This CWSA specifies in the Stage 1 trigger, the storage volume as 12000 ML below which MP are cut off. It should be noted that a subsequent ROP amendment (April 2010) has introduced other CWSA, which effectively work more as "normal" water sharing rules on an interim basis. In this HUF analysis, SunWater has retained the 12000ML cutoff volume as being more representative of future water sharing arrangements in the Barker Barambah WSS.`	
MP0	= max {MP0 AA , CWSA Adjustment}	12000 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 73169 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	73169 ML

FSV Hwks	= to the full supply volume of the major headworks storage/s in the scheme	136190 ML
DSV Hwks	= to the dead storage volume of the major headworks storage/s in the scheme	1122 ML

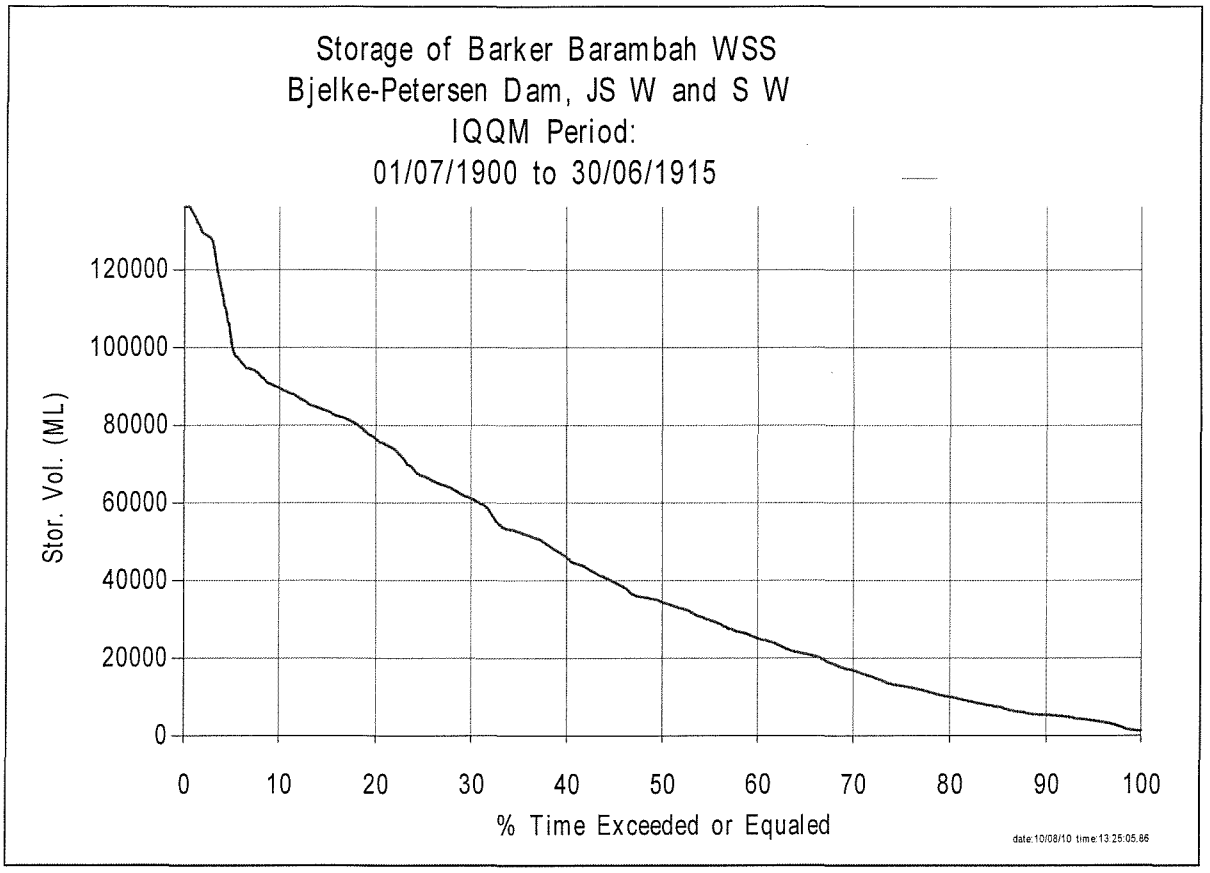
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 53506 ML	HP2 = 9515 ML	P3 = 7%	MP2util = 3963 ML	HP2util = 705 ML
MP1 = 61169 ML		P 2 = 45%	MP1util = 27510 ML	
HP1 = 10878 ML		P1 = 88%	HP1util = 9562 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	75%	Medium Priority	75%
HPA	25%	High Priority	25%

EXCEEDANCE CURVE USED FOR BARKER BARAMBAH WSS



Appendix 3 – Bowen Broken Rivers Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	5676 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 5676
High A1 Priority (*)	11649 ML	= HPA		HPAmax = 33254
High A2 Priority (*)	21605 ML			

Note * With reference to water sharing rules for BBWSS (Burdekin ROP, s131 and s132), High A1 Priority and High A2 Priority are considered to be comparable products for the purposes of this HUF analysis

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 53189 ML	
Adjustments	• Burdekin ROP (Chap 2, s32) specifies Reserve Volume for future allocation to SunWater of 8744 ML that is not included as a term in the current water sharing rules	
MP0	= Sum of MP0AA and Reserve Volume provision =	61933 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 65867 ML	
Adjustments	• Burdekin ROP (Chap 2, s32) specifies Reserve Volume for future allocation to SunWater of 8744 ML that is not included as a term in the current water sharing rules	
MP100	= min (MP100 AA, Adjustment Volume)	74611 ML

FSV Hwks	= to the full supply volume of the major headworks storage/s in the scheme	118573 ML
DSV Hwks	= to the dead storage volume of the major headworks storage/s in the scheme	1241 ML

C. PROBABILITY OF UTILISATION

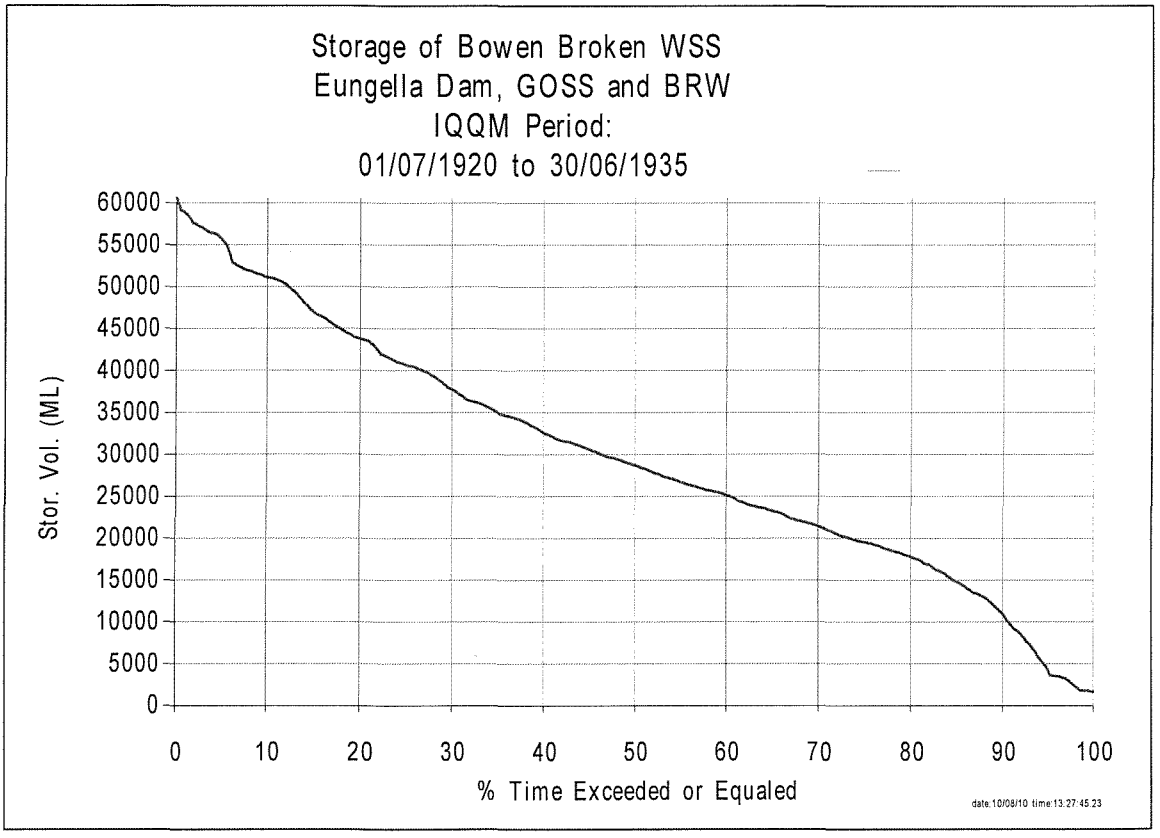
Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 7596 ML	HP2 = 36366 ML	P3 = 0%	MP2util = 0 ML	HP2util = 0 ML
MP1 = 12678 ML		P 2 = 0%	MP1util = 0 ML	
HP1 = 60692 ML		P1 = 47%	HP1util = 28610 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	0%	Medium Priority	0%
HPA	100%	High A1 Priority	35%
		High A2 Priority	65%

*** HUF RESULTS DISAGGREGATED IN PROPORTION TO THE VOLUME OF WATER ENTITLEMENTS IN THE RESPECTIVE GROUPING**

EXCEEDANCE CURVE USED FOR BOWEN BROKEN RIVERS WSS



Appendix 4 – Boyne River and Tarong Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	11809 ML	= MPA	Burnett ROP Conversion Factor (Att 4.4H) = 2.5	MPAmin = 10934 ML
High Priority	32990 ML	= HPA		HPAmax = 33340 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	= Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 119856 ML	
Adjustments	• Burnett ROP Att4.4F, s1.2 specifies a storage cutoff volume to protect HP as 70000 ML	
MP0	= max (MP0 AA, Cutoff Adjustment)	119856 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 137742 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	137742 ML

FSV Hwks	= to the full supply volume of the major headworks storage/s in the scheme	204200 ML
DSV Hwks	= to the dead storage volume of the major headworks storage/s in the scheme	8360 ML

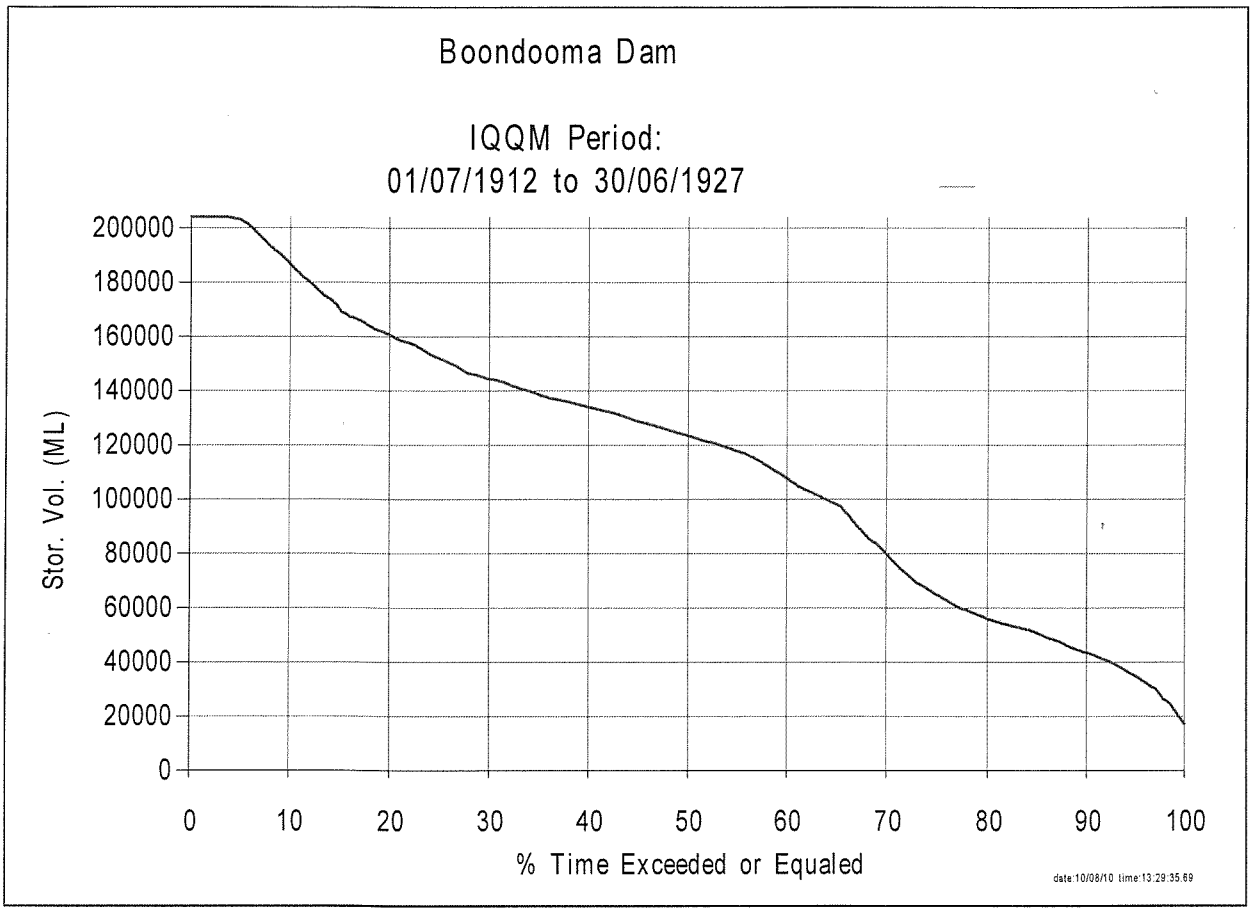
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 =9187 ML	HP2 = 57271 ML	P3 = 17%	MP2util =1553 ML	HP2util =9679 ML
MP1 = 17886 ML		P 2 = 45%	MP1util = 8050 ML	
HP1 = 111496 ML		P1 = 79%	HP1util = 87759 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	9 %	Medium Priority	9 %
HPA	91 %	High Priority	91 %

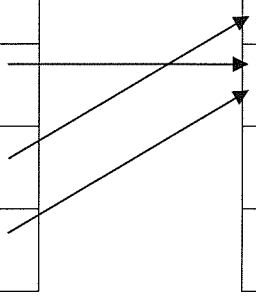
EXCEEDANCE CURVE USED FOR BOYNE RIVER & TARONG WSS



Appendix 5 – Bundaberg Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group * (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority (SunWater)	*207457 ML*	MPA =331457 ML	ROP Conversion Factor = N/A	MPAmin = 331457 ML
High Priority (SunWater)	*24372 ML*	HPA = 44372 ML		HPAmax = 44372 ML
Medium Priority (Burnett Water)	*124000 ML*			
High Priority (Burnett Water)	*20000 ML*			



* Water entitlements in Bundaberg WSS consist of SunWater allocations and Burnett Water allocations.

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA (**KOLAN SUBSCHEME** DURING SPLIT SCHEME)	Announced allocation water sharing rules give minimum storage volume in the sub-scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 19538 ML	
Adjustments	• Bucca Weir release rule as per Burnett ROP, Att 4.1E, Table 6 {(380 x 31) + (380 x 28) + (380 x 31) + (380 x 30)} = 45600 ML	
MP0_kolan	= (MP0 AA + Bucca Adjustment)	65138 ML

MP0 AA (BURNETT SUBSCHEME DURING SPLIT SCHEME)	Announced allocation water sharing rules give minimum storage volume in the sub-scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 69165 ML	
Adjustments	• None	
MP0_burnett	= MP0 AA	69165 ML

MP0	= MP0_kolan + MP0_burnett	**134303 ML**

MP100 AA (JOINED SCHEME)	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 637363 ML	
Adjustments	• Bucca Weir release rule as per Burnett ROP, Att 4.1E, Table 6 {(380 x 31) + (380 x 28) + (380 x 31) + (380 x 30)} = 45600 ML	
MP100	= MP100 AA + Bucca Adjustment Volume	**682963 ML**

FSV Hwks	full supply volume of the major headworks storage/s in the scheme	**937420 ML**
DSV Hwks	dead storage volume of the major headworks storage/s in the scheme	**29590 ML**

C. PROBABILITY OF UTILISATION

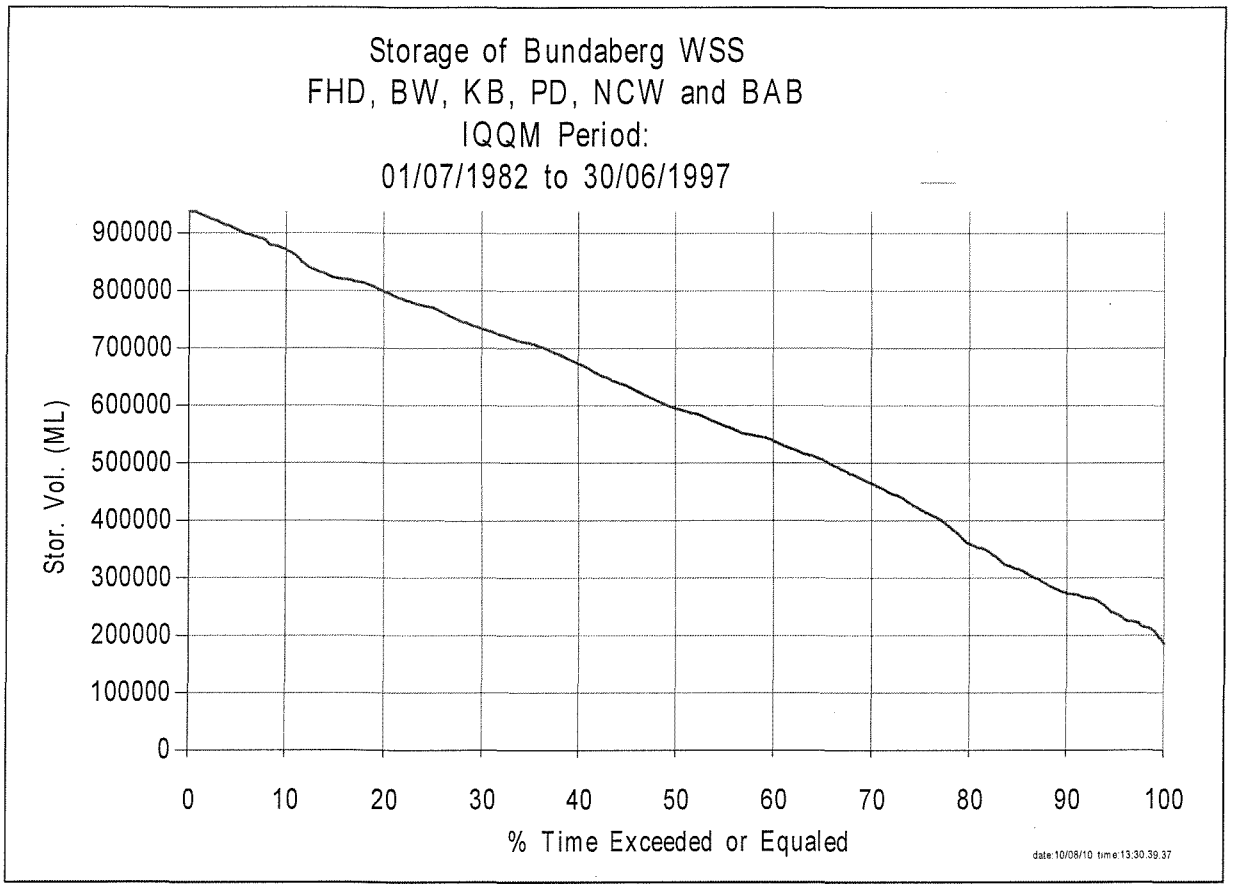
Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 213676 ML	HP2 = 40781 ML	P3 = 19 %	MP2util = 40004 ML	HP2util = 7635 ML
MP1 = 548660 ML		P 2 = 74 %	MP1util = 406534 ML	
HP1 = 104713 ML		P1 = 100 %	HP1util = 104737 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	DISAGGREGATING* FOR SUNWATER & BURNETT WATER INFRASTRUCTURE	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	80 %	→	*Medium Priority (SunWater)*	82 %
HPA	20 %	→	*High Priority (SunWater)*	18 %
		→	*Medium Priority (Burnett Water)*	77%
		→	*High Priority (Burnett Water)*	23%

*** HUF RESULTS DISAGGREGATED IN PROPORTION TO THE VOLUME OF WATER ENTITLEMENTS IN THE RESPECTIVE GROUPING AND THEN EXPRESSED AS A PERCENTAGE TOTALLING 100% FOR EACH HEADWORKS**

EXCEEDANCE CURVE USED FOR BUNDABERG WSS



Note: In the IQQM model Paradise Dam is named 'Burnett River Dam'

Appendix 6 – Burdekin Haughton Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:		Water entitlement grouping (in HUF calc.) :		
Medium Priority	979,594 ML	→	= MPA	Burdekin ROP s106 Conversion Factor = (1/ 0.565)	MPAmin = 979,594 ML
High Priority	99,998 ML	→	= HPA		HPAmax * = 99,998 ML

* CONSIDERED TO BE AT THE HIGH PRIORITY CONVERSION LIMIT FOR PRACTICAL PURPOSES

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	= Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 271913 ML	
Adjustments	• None	
MP0	= max (MP0 AA and CWSA Adjustment)	271,913 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a max. (100%) at the commencement of the water year = 1767325 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	1,767,325 ML

FSV Hwks	= to the full supply volume of the major headworks storage/s in the scheme	1,875,900 ML
DSV Hwks	= to the dead storage volume of the major headworks storage/s in the scheme	7,870 ML

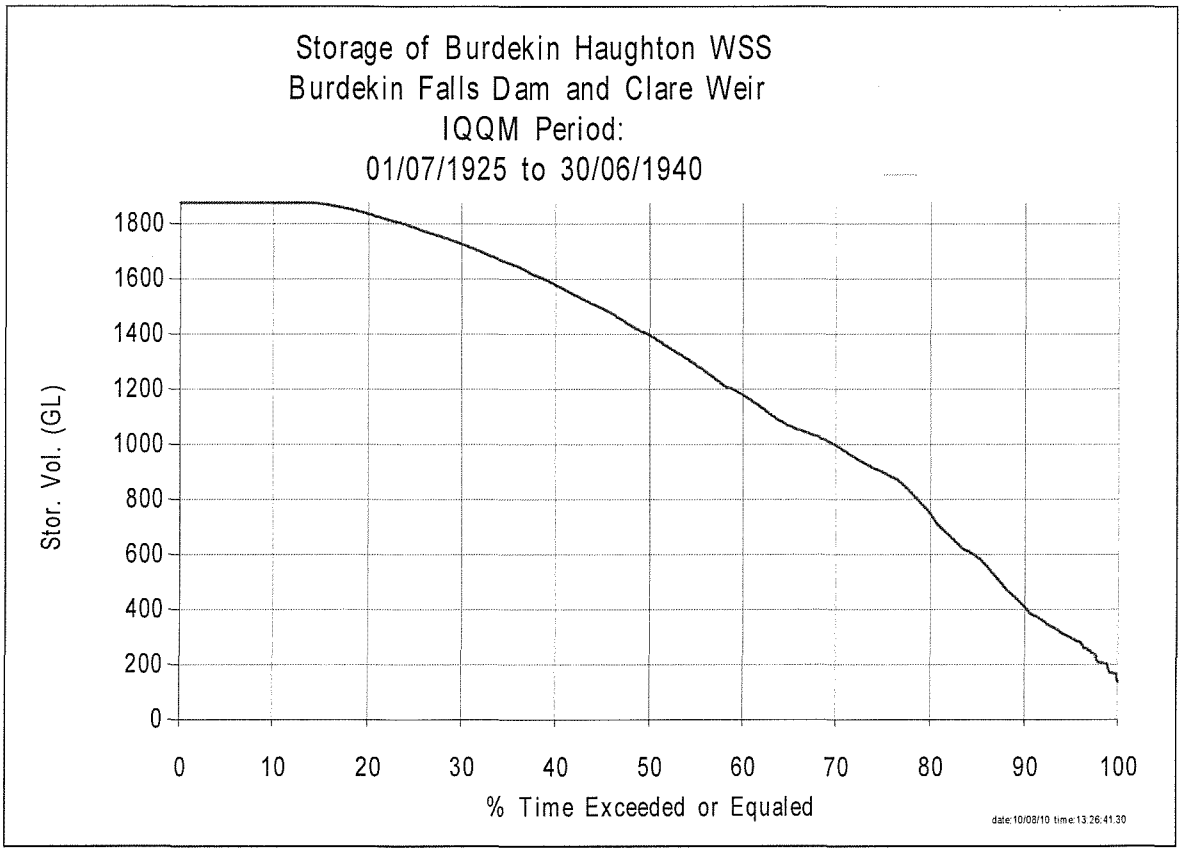
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 92281 ML	HP2 = 16294 ML	→ P3 = 19 % →	MP2util =17688 ML	HP2util = 3123 ML
MP1 = 1495411 ML		→ P 2 = 65 % →	MP1util = 976166 ML	
HP1 = 264043 ML		→ P1 = 99% →	HP1util = 261223 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping		Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	79 %	→	Medium Priority	79 %
HPA	21 %	→	High Priority	21 %

EXCEEDANCE CURVE USED FOR BURDEKIN HAUGHTON WSS



Appendix 7 – Chinchilla Weir Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	2884 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 2884 ML
High Priority	1165 ML	= HPA		HPAmax = 1165 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	= Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = NOT APPLICABLE	
Adjustments	• 6757 ML = storage volume below which HP AA<100% on 1 July according to the water sharing rules (Condamine & Balonne ROP, Chap 9, s197)	
MP0	= max (MP0 AA and CWSA Adjustment) = ML	6757 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = NOT APPLICABLE	
Adjustments	• Full Supply Volume of Chinchilla Weir =9780 ML	
MP100	= min {MP100 AA, Adjustment Volume (FSV) }	9780 ML

FSV Hwks	= to the full supply volume of the major headworks storage/s in the scheme	9780 ML
DSV Hwks	= to the dead storage volume of the major headworks storage/s in the scheme	120 ML

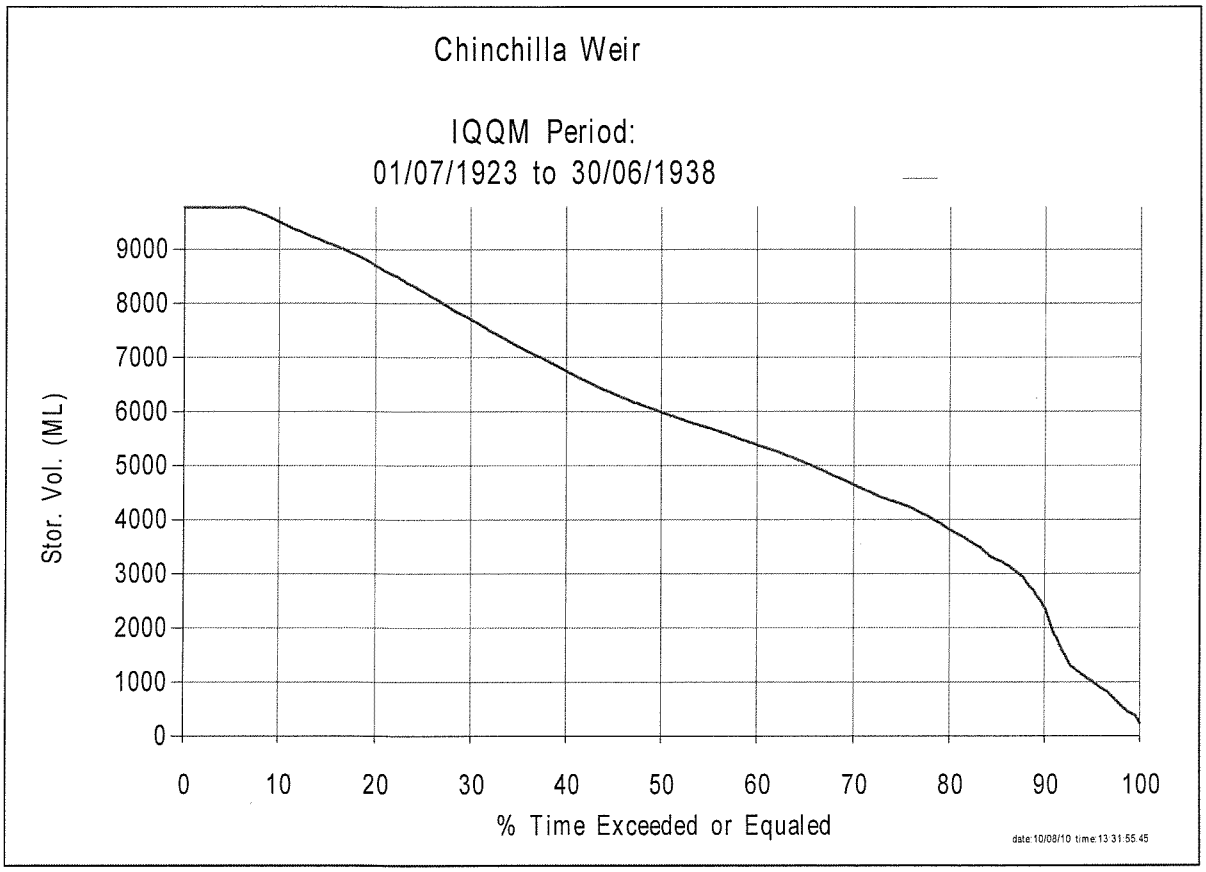
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 0 ML	HP2 = 0 ML	P3 = 0 %	MP2util = 0 ML	HP2util = 0 ML
MP1 = 3023 ML		P 2 = 24 %	MP1util = 724 ML	
HP1 = 6637 ML		P1 = 78 %	HP1util = 5147 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	12 %	Medium Priority	12 %
HPA	88 %	High Priority	88 %

EXCEEDANCE CURVE USED FOR CHINCHILLA WEIR WSS



Appendix 8 – Callide Valley Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority (GW)	19527 ML	{ 19970 ML = MPA	ROP Conversion Factor = N/A	MPAmin = 19970 ML
Risk Priority (Surf. W) *	443 ML			
High Priority	4311 ML	= HPA		HPAmax = 4311 ML

Note * As described in s2.3 of the Callide Valley IROL, Risk Priority (Surface Water) is generally available as a result of releases from Callide Dam and is therefore considered to be a comparable product to Medium Priority (Groundwater) for the purpose of HUF analysis.

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	= Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = NOT APPLICABLE	
Adjustments	• 26500 ML = storage volume for HP reserve (Callide Valley IROL, s2.3, Item 8)	
MP0	= max (MP0 AA, Reserve Adjustment)	26500 ML

MP100 AA	Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = NOT APPLICABLE	
Adjustments	• Maximum fill volume for Callide Dam in recent years (May 2003) LESS volume typically stored from the Awoonga scheme = 48700 ML	
MP100	= min (MP100 AA, Adjustment Volume)	48700 ML

FSV Hwks	= to the full supply volume of the major headworks storage/s in the scheme	136370 ML
DSV Hwks	= to the dead storage volume of the major headworks storage/s in the scheme	2880 ML

C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 42477 ML	HP2 = 45193 ML	P3 = 0 %	MP2util =8 ML	HP2util = 8 ML
MP1 = 22200 ML		P 2 = 7 %	MP1util = 1635 ML	
HP1 = 23620 ML		P1 = 66 %	HP1util = 15678 ML	

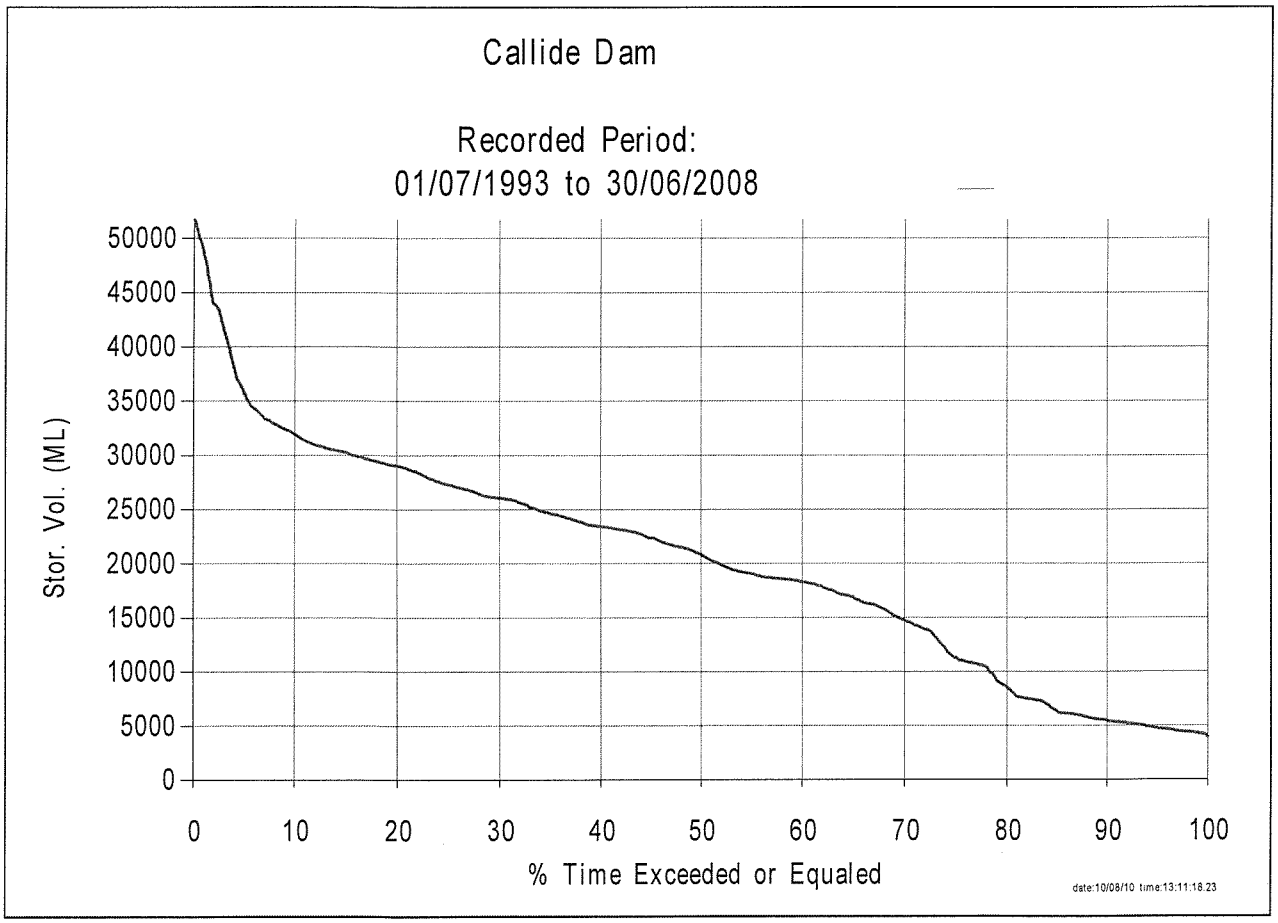
D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping
MPA	10 %
HPA	90 %

Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group*
Medium Priority (GW)	9.8 %
Risk Priority (Surf. W)	0.2 %
High Priority	90.0 %

*** NOTE THAT HUF RESULTS FOR THE WATER ENTITLEMENT GROUPINGS ARE ROUNDED AND THEN DISAGGREGATED IN PROPORTION TO THE VOLUME OF WATER ENTITLEMENTS IN THE RESPECTIVE GROUPING**

EXCEEDANCE CURVE USED FOR CALLIDE VALLEY WSS



NOTE THAT THIS EXCEEDANCE CURVE IS CALCULATED USING RECENT RECORDED STORAGE DATA

Appendix 9 – Cunnamulla Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	2612 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 2612 ML
High Priority	None	N/A		

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	100 %	Medium Priority	100%

NOTE: EXCEEDANCE CURVE NOT REQUIRED FOR CUNNAMULLA WSS

Appendix 10 – Dawson Valley Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	36944 ML	MPA = 56253 ML	ROP Conversion Factor = N/A	MPAmin = 56253 ML
Medium-A Priority *	19309 ML			
High Priority	5579 ML	= HPA		HPAmax = 5579 ML

Note * With reference to water sharing rules for DVWSS (Fitzroy ROP, Att. 4.1F), Medium-A Priority and Medium Priority are considered to be comparable products for the purposes of this HUF analysis

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 17475 ML (This volume is a combination of results from the Upper and Lower Dawson subschemes.)	
Adjustments	• None	
MP0	= max (MP0 AA, Adjustment)	17475 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = NOT APPLICABLE	
Adjustments	• The sum of the weir full suppply volumes in both Upper and Lower Dawson subschemes = 60780 ML (excluding Orange Creek Weir which is not included in the water sharing rules as per ROP,Att 4.1F, s5)	
MP100	= min (MP100 AA, Adjustment Volume)	60780 ML

FSV Hwks	the full supply volume of the major headworks storage/s (weirs) in the scheme, excluding Orange Creek Weir	60780 ML
DSV Dam	the dead storage volume of the major headworks storage/s (weirs) in the scheme, excluding Orange Creek Weir	6160 ML

C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 0 ML	HP2 = 0 ML	P3 = 0 %	MP2util = 0 ML	HP2util = 0 ML
MP1 = 43305 ML		P 2 = 58 %	MP1util = 25192 ML	
HP1 = 11315 ML		P1 = 95 %	HP1util = 10705 ML	

Results on next page

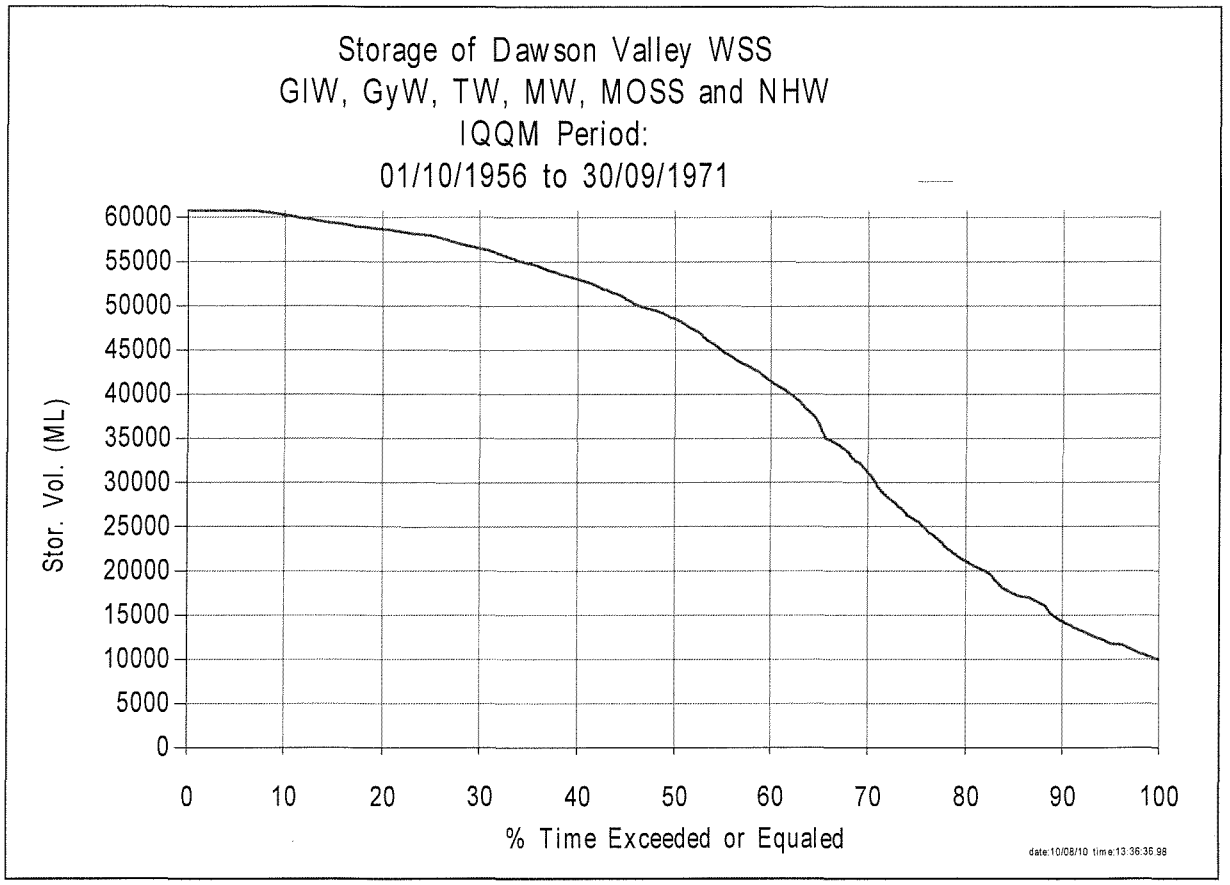
D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping
MPA	70 %
HPA	30 %

Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
Medium Priority	46 %
Medium-A Priority	24 %
High Priority	30 %

*** HUF RESULTS DISAGGREGATED IN PROPORTION TO THE VOLUME OF WATER ENTITLEMENTS IN THE RESPECTIVE GROUPING**

EXCEEDANCE CURVE USED FOR DAWSON VALLEY WSS



Appendix 11 – Eton Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
High B Priority	58970 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 58970 ML
High A Priority	3089 ML	= HPA		HPAmax = 3089 ML
Risk (*)	504 ML	Not included		

Note * For the purpose of this HUF analysis, the Risk water allocations along Mirani Diversion Channel are considered to be based on opportunistic access and are not based on storage capacity. Section 91 of the Pioneer ROP stipulates that these water allocations may only be distributed subject to the proviso that the security of other Eton WSS allocations is not affected.

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 8423 ML	
Adjustments	• none	
MP0	= max (MP0 AA , Adjustment) = ML	8423 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = NOT APPLICABLE	
Adjustments	• Full supply volume = 62800 ML	
MP100	= min (MP100 AA, Adjustment Volume)	62800 ML

FSV Hwks	the full supply volume of the major headworks storage/s in the scheme	62800 ML
DSV Hwks	the dead storage volume of the major headworks storage/s in the scheme	600 ML

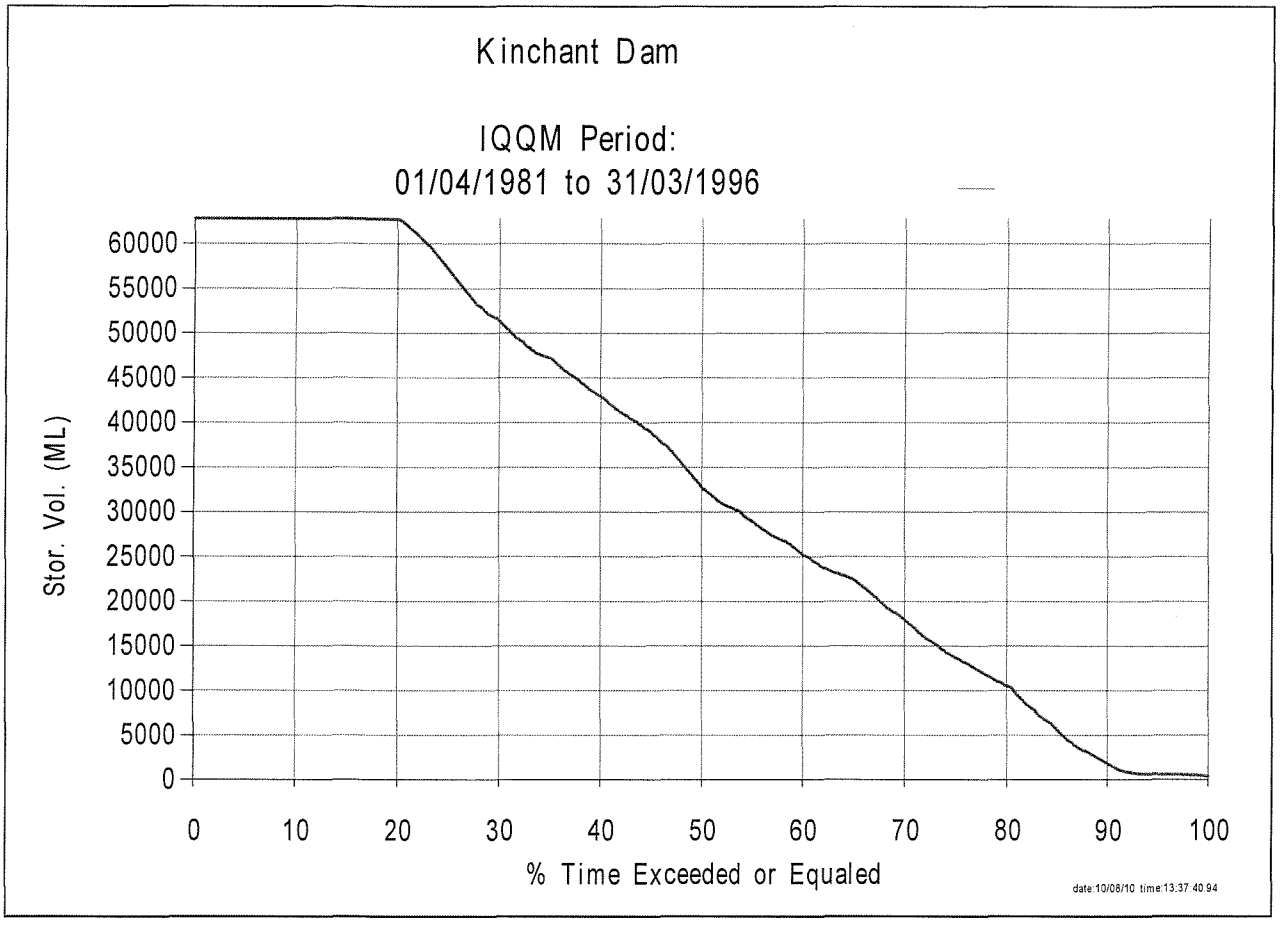
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 0 ML	HP2 = 0 ML	P3 = 0 %	MP2util = 0 ML	HP2util = 0 ML
MP1 = 54377 ML		P 2 = 49 %	MP1util = 26577 ML	
HP1 = 7823 ML		P1 = 87 %	HP1util = 6769 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping		Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	80 %	→	High B Priority	80 %
HPA	20 %	→	High A Priority	20 %
None		→	Risk	0 %

EXCEEDANCE CURVE USED FOR ETON WSS



Appendix 12 – Julius Dam Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:
Medium Priority	None
High Priority	48850 ML

Water entitlement grouping (in HUF calc.) :		
N/A		
= HPA	ROP Conversion Factor = N/A	HPAmax = 48850 ML

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping
HPA	100%

Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
High Priority	100%

NOTE: EXCEEDANCE CURVE NOT REQUIRED FOR JULIUS DAM WSS

Appendix 13 – Lower Fitzroy Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority (Lower Fitzroy WSS)	3101 ML	14711 ML = MPA	Fitzroy ROP Conversion Factor (att 4.3H, s1.2) = 1.5	MPAmin = 13216 ML *consisting of LFWSS= 2562 ML FBWSS = 10580 ML*
*Medium Priority (Fitzroy Barrage WSS)**	*11610 ML*			
High Priority (Lower Fitzroy WSS)	25520 ML	76003 ML = HPA		HPAmax = 77000 ML *consisting of LFWSS= 25800 ML FBWSS = 51200 ML*
*High Priority (Fitzroy Barrage WSS)**	*50483 ML*			

Note* As described in Appendix 1, Step 5 of this report, the operational rules outlined in the Fitzroy Basin ROP (Att 4.3F and Att 4.4F) necessitated the calculation of initial HUF results for the combined Lower Fitzroy and Fitzroy Barrage schemes. The initial HUF results are then disaggregated so that only the results for the water allocations in the Lower Fitzroy WSS (operated by SunWater) are provided. Results for Fitzroy Barrage WSS (operated by Fitzroy River Water) are not provided.

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = NOT APPLICABLE	
Adjustments	• Fitzroy ROP Att 4.3F, s2.1.1 stipulates an MP cut off volume of 40,500 ML	
MP0	= max (MP0 AA , Cutoff Adjustment)	40500 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = NOT APPLICABLE	
Adjustments	• Fitzroy ROP Att 4.3F, s2.1.1 stipulates the resumption of MP supply occurs at 41,600 ML	
MP100	= min (MP100 AA, Adjustment Volume)	41600 ML

FSV Hwks	full supply volume of the major headworks storage/s in the scheme	117200 ML
DSV Hwks	dead storage volume of the major headworks storage/s in the scheme	31550 ML

C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised Storage component volumes	
MP2 = 8275 ML	HP2 = 67325 ML	P3 = 88 %	MP2util = 7311 ML	HP2util = 59487 ML
MP1 = 1100 ML		P 2 = 100 %	MP1util = 1096 ML	
HP1 = 8950 ML		P1 = 100 %	HP1util = 8943 ML	

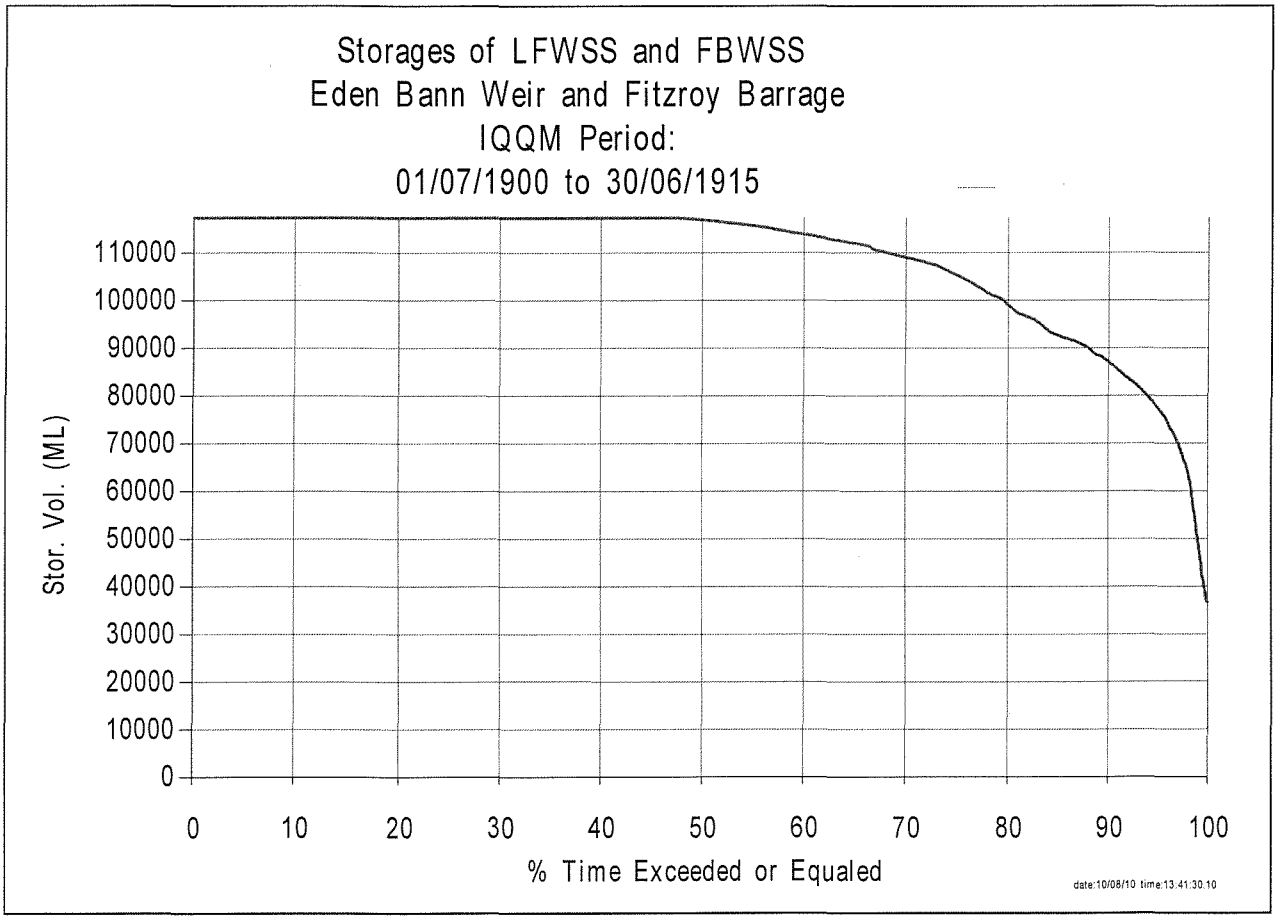
D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	DISAGGREGATING* RESULTS SO THAT SCHEMES ARE SEPARATED	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	11 %	→	Medium Priority (Lower Fitzroy WSS)	7 %
HPA	89 %	→	High Priority (Lower Fitzroy WSS)	93 %
		→	*Medium Priority (Fitzroy Barrage WSS)#*	Not reported
		→	*Medium Priority (Fitzroy Barrage WSS)#*	Not reported

Note # Results for Fitzroy Barrage WSS (operated by Fitzroy River Water) are not provided.

Note * **HUF RESULTS DISAGGREGATED IN PROPORTION TO THE VOLUME OF WATER ENTITLEMENTS IN THE RESPECTIVE GROUPING AND THEN EXPRESSED AS A PERCENTAGE TOTALLING 100% FOR EACH HEADWORKS**

EXCEEDANCE CURVE USED FOR LOWER FITZROY WSS



Appendix 14 – Macintyre Brook Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:		Water entitlement grouping (in HUF calc.) :		
Medium Priority	24509 ML	→	= MPA	ROP Conversion Factor = N/A	MPA min = 24509 ML
High Priority	488 ML	→	= HPA		HPA max = 488 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

This scheme is operated under Continuous Sharing water sharing rules.

C. PROBABILITY OF UTILISATION

MPutil	= MP1util + MP2util Refer to Border Rivers ROP, Table 3 for details of continuous sharing parameters	60137 ML
HPutil	= HP1util + HP2util Refer to Border Rivers ROP, Table 3 for details of continuous sharing parameters	9300 ML

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping		Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	87 %	→	Medium Priority	87 %
HPA	13 %	→	High Priority	13 %

NOTE: EXCEEDANCE CURVE NOT REQUIRED FOR MACINTYRE BROOK WSS

Appendix 15 – Mareeba Dimbulah Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	204425 ML	= MPA	Barron ROP Conversion Factor (s89) = 1 /0.7	MPAmin = 176034 ML
High Priority	14026 ML	= HPA		HPAmax = 33900 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	= Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 102561 ML	
Adjustments	• Volume of Tinaroo falls Dam required to supply hydro releases in first month of Water Year (Barron ROP s78 (2)) = 24700 ML	
MP0	= MP0 AA volume and hydro release volume adjustment	127261 ML

MP100 AA	Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 329461 ML	
Adjustments	• Volume of Tinaroo falls Dam required to supply hydro releases in first month of Water Year (Barron ROP s78 (2)) = 24700 ML	
MP100	= MP100 AA volume and hydro release volume adjustment	354161 ML

FSV Hwks	the full supply volume of the major headworks storage/s in the scheme	438920 ML
DSV Hwks	the dead storage volume of the major headworks storage/s in the scheme	1300 ML

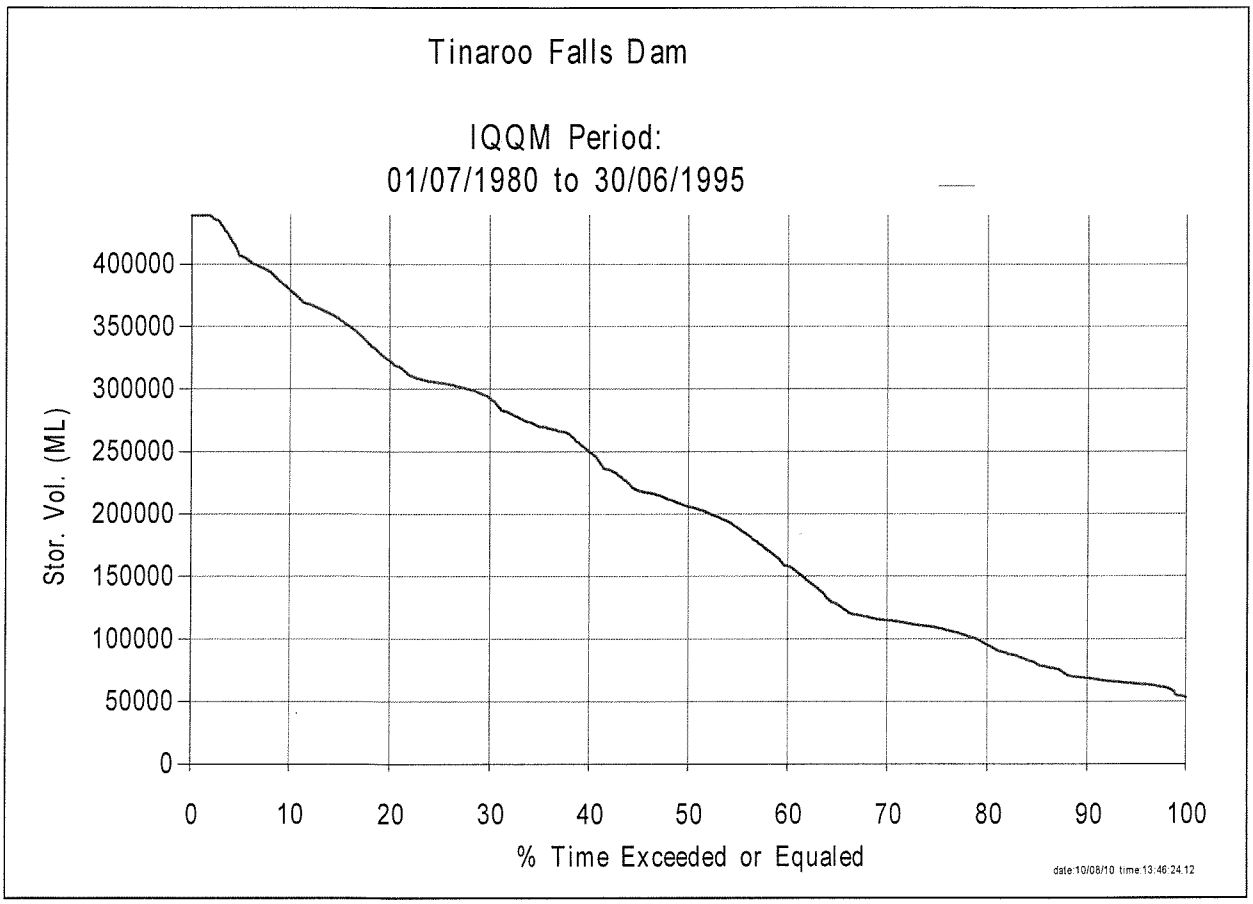
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 54503 ML	HP2 = 30256 ML	P3 = 8 %	MP2util = 4121 ML	HP2util = 2287 ML
MP1 = 226900 ML		P2 = 41 %	MP1util = 93171 ML	
HP1 = 125961 ML		P1 = 89 %	HP1util = 112544 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	46 %	Medium Priority	46 %
HPA	54 %	High Priority	54 %

EXCEEDANCE CURVE USED FOR MAREEBA DIMBULAH WSS



Appendix 16– Maranoa River Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	805 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 805 ML
High Priority	None	N/A		

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	100 %	Medium Priority	100%

NOTE: EXCEEDANCE CURVE NOT REQUIRED FOR MARANOA WSS

Appendix 17 – Lower Mary Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	32688 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 32688 ML
High Priority	1809 ML	= HPA		HPAmax = 1809 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 12193 ML	
Adjustments	• None	
MP0	= max (MP0 AA, Volume Adjustment)	12193 ML

MP100 AA	Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 16700 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	16700 ML

FSV Hwks	the full supply volume of the major headworks storage/s (barrages) in the scheme	16700 ML
DSV Hwks	the dead storage volume of the major headworks storage/s (barrages) in the scheme	7065 ML

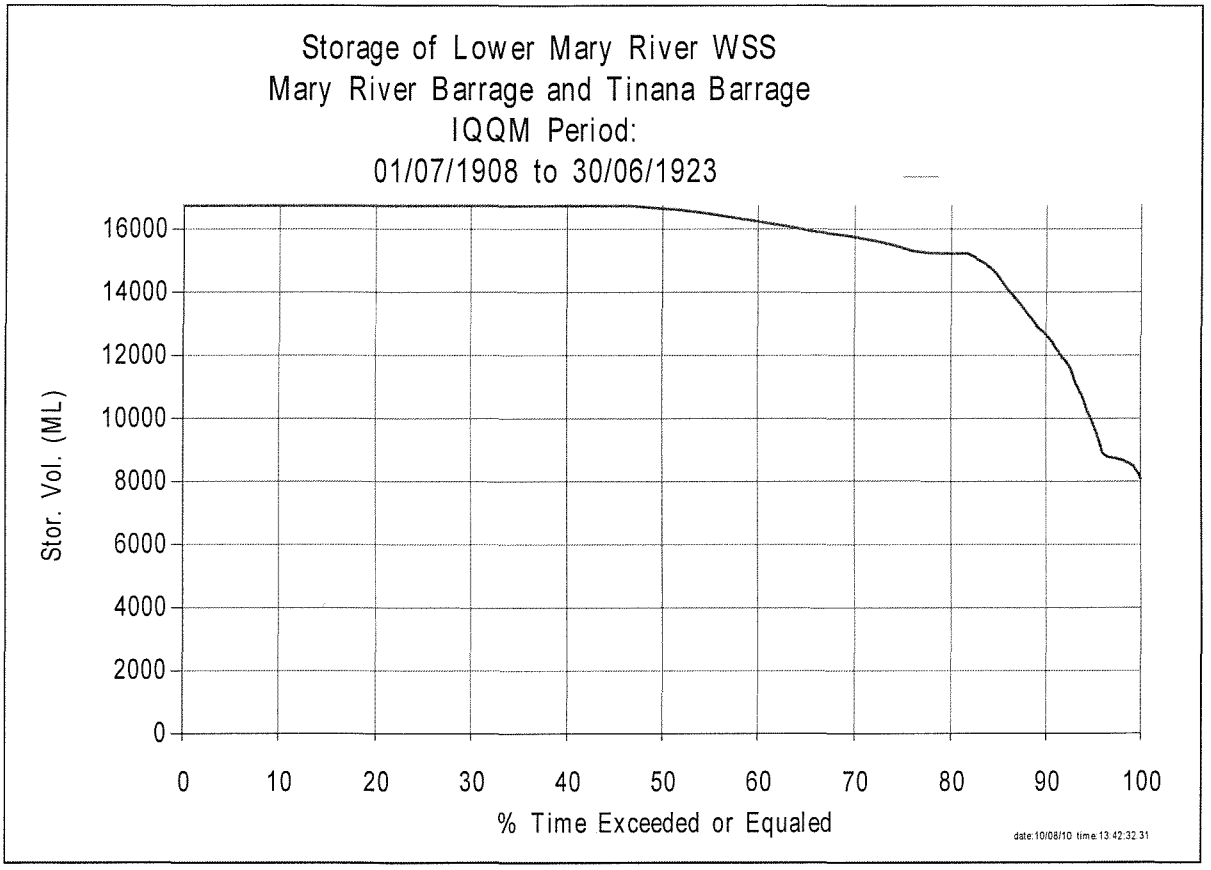
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 0 ML	HP2 = 0 ML	P3 = 0 %	MP2util = 0 ML	HP2util = 0 ML
MP1 = 4507 ML		P 2 = 80 %	MP1util = 3596 ML	
HP1 = 5128 ML		P1 = 96 %	HP1util = 4916 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	42 %	Medium Priority	42 %
HPA	58 %	High Priority	58 %

EXCEEDANCE CURVE USED FOR LOWER MARY WSS



Appendix 18 – Nogoa Mackenzie Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	190620 ML	= MPA	Fitzroy ROP Conversion Factor (Att 4.2H, s1.4) = 3.0	MPAmin = 156729 ML
High Priority	44703 ML	= HPA		HPAmax = 56000 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	= Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 233238 ML	
Adjustments	• None	
MP0	= max (MP0 AA, Adjustment)	233238 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 445930 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	445930 ML

FSV Hwks	full supply volume of the major headworks storage/s in the scheme	1,343,960 ML
DSV Hwks	dead storage volume of the major headworks storage/s in the scheme	19,520 ML

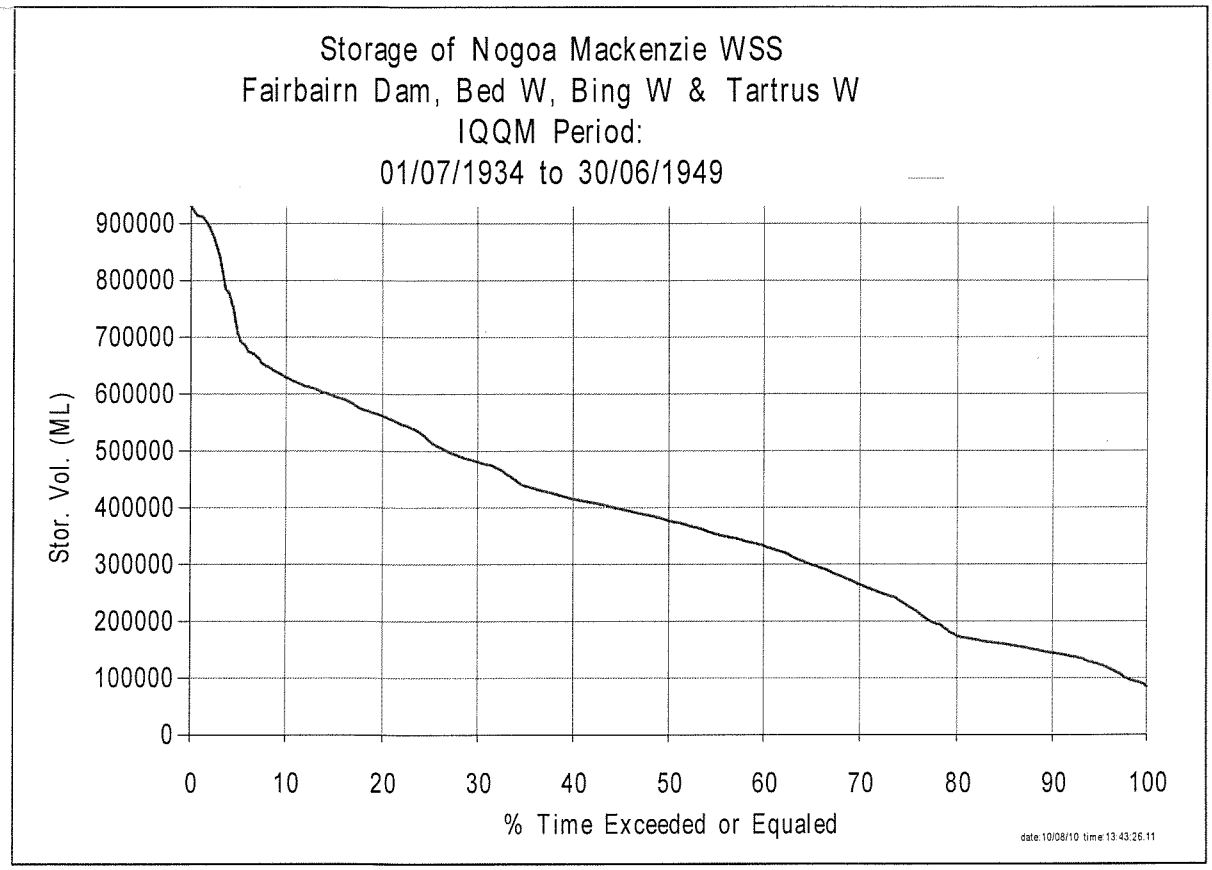
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 447934 ML	HP2 = 450096 ML	P3 = 6 %	MP2util = 26921 ML	HP2util = 27051 ML
MP1 = 212691 ML		P 2 = 57 %	MP1util = 120090 ML	
HP1 = 213718 ML		P1 = 91 %	HP1util = 193313 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	40 %	Medium Priority	40 %
HPA	60 %	High Priority	60 %

EXCEEDANCE CURVE USED FOR NOGOA MACKENZIE WSS



Appendix 19 – Pioneer River Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
High B Priority	47357 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 47357 ML
High A Priority	30753 ML	= HPA		HPAmax = 30753 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 44035 ML. The corresponding high priority announced allocation at this volume at the commencement of the water year is 80%.	
Adjustments	• Under water sharing rules in s100 and 101 of the Pioneer Valley ROP, the storage volume at which high priority announced allocation is 100% is 56478 ML which is 12443 ML greater than MP0 AA. The corresponding medium priority announced allocation at this volume at the commencement of the water year is 10%. • Adjustment = 7030 ML = 12443 x ((100% - 80%) x 30753) / (10% x 47357 + (100% - 80%) x 30753)	
MP0	= MP0 AA + Adjustment	51065 ML

MP100 AA	Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 102292 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	102292 ML

FSV Hwks	the full supply volume of the major headworks storage/s in the scheme	164980 ML
DSV Hwks	the dead storage volume of the major headworks storage/s in the scheme	8950 ML

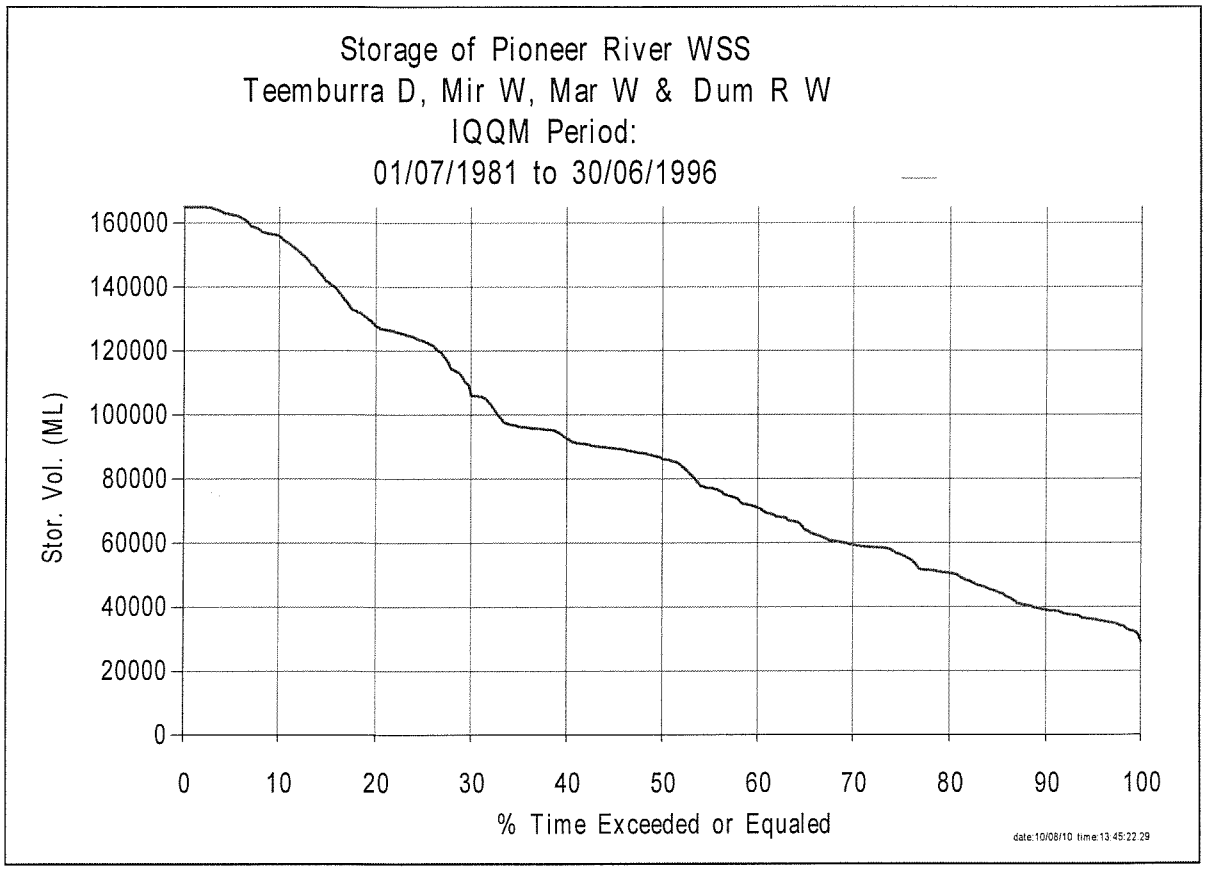
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 34404 ML	HP2 = 28284 ML	P3 = 19 %	MP2util = 6494 ML	HP2util = 5339 ML
MP1 = 51227 ML		P 2 = 55 %	MP1util = 28375 ML	
HP1 = 42115 ML		P1 = 95 %	HP1util = 39944 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping		Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	44 %	→	High B Priority	44 %
HPA	56 %	→	High A Priority	56 %

EXCEEDANCE CURVE USED FOR PIONEER RIVER WSS



Appendix 20 – Proserpine River Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	38075 ML	= MPA	ROP Conversion Factor = N/A	MPAmin =38075 ML
High Priority	22000 ML	= HPA		HPAmax =22000 ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 69965 ML	
Adjustments	• None	
MP0	= max (MP0 AA, Adjustment) = ML	69965 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 127055 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	127055 ML

FSV Hwks	full supply volume of the major headworks storage/s in the scheme	491400 ML
DSV Hwks	dead storage volume of the major headworks storage/s in the scheme	970 ML

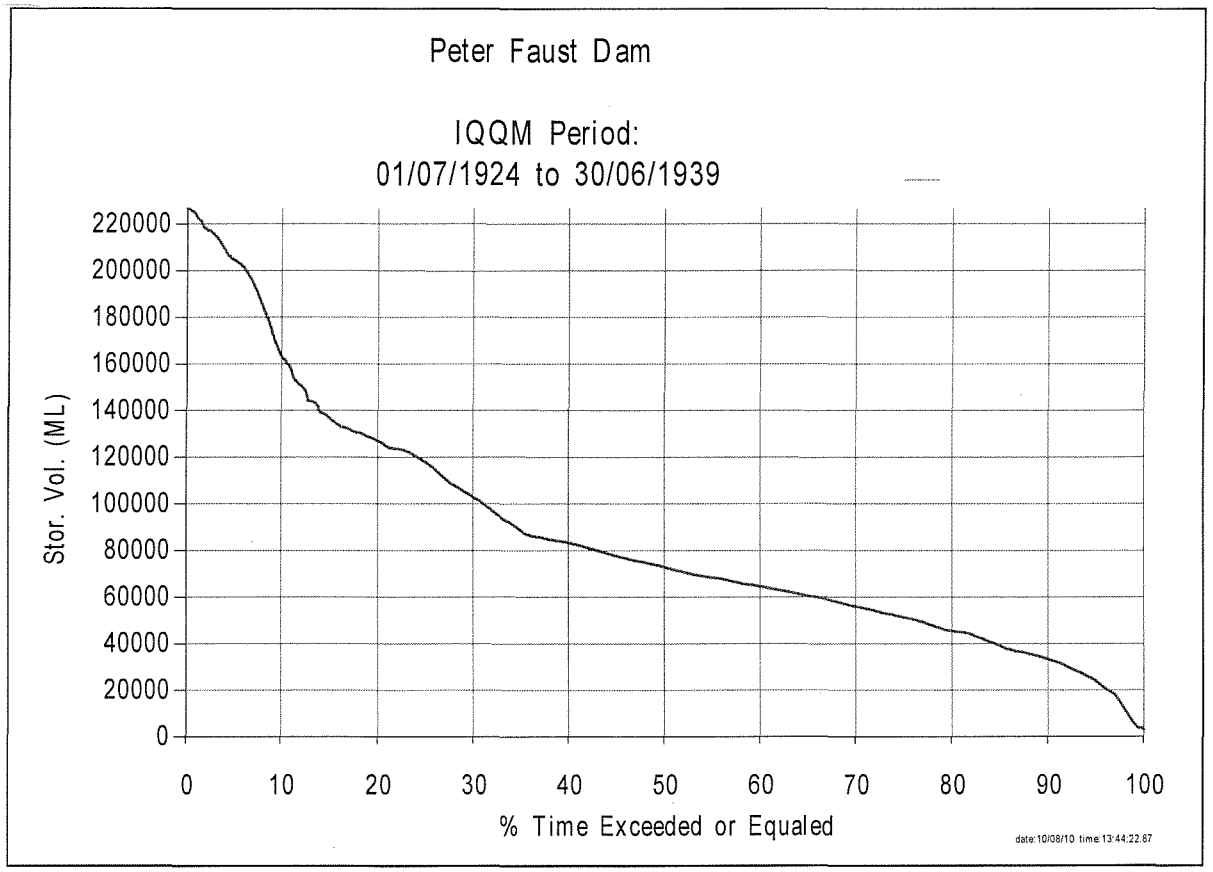
C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 164972 ML	HP2 = 199372 ML	P3 = 2 %	MP2util = 3965 ML	HP2util = 4792 ML
MP1 = 57090 ML		P 2 = 33 %	MP1util = 18963 ML	
HP1 = 68995 ML		P1 = 84 %	HP1util = 58080 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	27 %	Medium Priority	27 %
HPA	73 %	High Priority	73 %

EXCEEDANCE CURVE USED FOR PROSERPINE RIVER WSS



Appendix 21 – St George Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	81554 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 81554 ML
High Priority	3000 ML	= HPA		HPAmax = 3000ML

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

This scheme is operated under Continuous Sharing water sharing rules.

C. PROBABILITY OF UTILISATION

MPutil	= MP1util + MP2util Refer to Border Rivers ROP, Table 15.2 for details of continuous sharing parameters	88170 ML
HPutil	= HP1util + HP2util Refer to Border Rivers ROP, Table 15.2 for details of continuous sharing parameters	5490 ML

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	94 %	Medium Priority	94 %
HPA	6 %	High Priority	6 %

NOTE: EXCEEDANCE CURVE NOT REQUIRED FOR ST GEORGE WSS

Appendix 22 – Three Moon Creek Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority * (Surface Water)	1940 ML	MPA = 14561 ML	ROP Conversion Factor = N/A	MPAmin = 14561 ML
Medium Priority * (Groundwater)	12621 ML			
High Priority (Groundwater)	580 ML	= HPA		HPAmax = 580 ML

Note * As described in s2.1 of the Three Moon Creek IROL, Medium Priority (Surface Water) and Medium Priority (Groundwater) are both classified as Medium Priority

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = NOT APPLICABLE	
Adjustments	• 6650 ML = Effective reserve volume (Three Moon Ck IROL, s2.3 and s1.1 (2) (c))	
MP0	= max (MP0 AA, Reserve Adjustment)	6650 ML

MP100 AA	Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = NOT APPLICABLE	
Adjustments	• 26715 ML = Volume equivalent to storage level of 319.18 mAHD (Three Moon Ck IROL, s2.3)	
MP100	= min (MP100 AA, Adjustment Volume)	26715 ML

FSV Hwks	= to the full supply volume of the major headworks storage/s in the scheme	88500 ML
DSV Hwks	= to the dead storage volume of the major headworks storage/s in the scheme	650 ML

C. PROBABILITY OF UTILISATION

Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 47562 ML	HP2 = 14223 ML	P3 = 1 %	MP2util = 655 ML	HP2util = 196 ML
MP1 = 20065 ML		P 2 = 37 %	MP1util = 7365 ML	
HP1 = 6000 ML		P1 = 88 %	HP1util = 5268 ML	

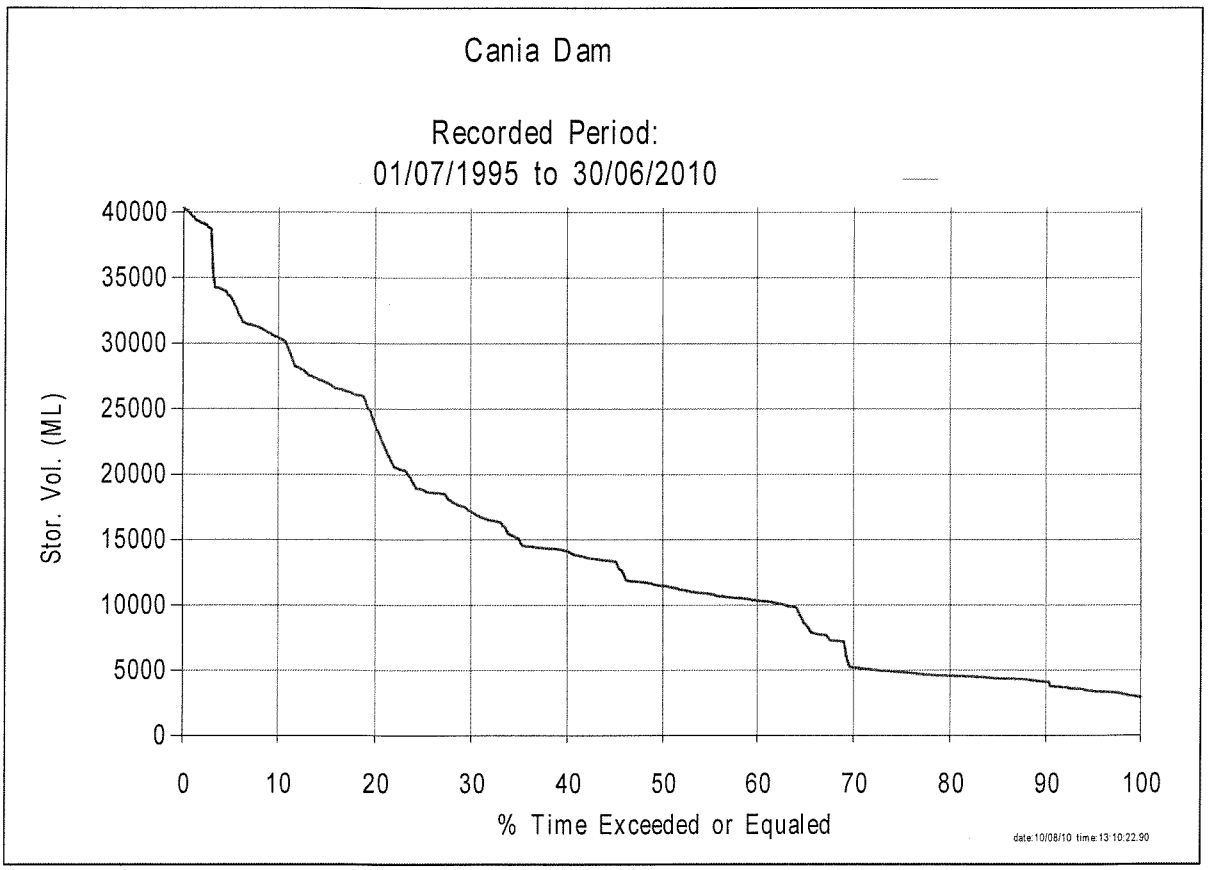
D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping
MPA	60 %
HPA	40 %

Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
Medium Priority (Surface Water)	8 %
Medium Priority (Groundwater)	52 %
High Priority (GW)	40 %

*** HUF RESULTS DISAGGREGATED IN PROPORTION TO THE VOLUME OF WATER ENTITLEMENTS IN THE RESPECTIVE GROUPING**

EXCEEDANCE CURVE USED FOR THREE MOON CREEK WSS



NOTE THAT THIS EXCEEDANCE CURVE IS CALCULATED USING RECENT RECORDED STORAGE DATA

Appendix 23 – Upper Burnett Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement * Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority (SunWater)	*27230 ML*	MPA = 45460 ML	ROP Conversion Factor = N/A	MPAmin = 45460 ML
High Priority (SunWater)	*1530 ML*	HPA = 1530 ML		HPAmax = 1530 ML
Medium Priority (Burnett Water)	*18230 ML*			
High Priority (Burnett Water)	*0 ML*			

* Water entitlements in Upper Burnett WSS consist of SunWater allocations and Burnett Water allocations.

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = NOT APPLICABLE	
Adjustments	• Storage volume above which MP AA >= 24% on 1 July. Refer to Critical Water Supply Arrangements for Upper Burnett (DERM website http://www.derm.qld.gov.au/wrp/burnett.html) = 24524 ML • Maxiumum storage volume in the scheme at which CWSA triggers MP cutoff = 15254	
MP0	= max (MP0 AA , 24% AA adjustment volume, MP Cutoff Volume)	24525 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 92403 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	92403 ML

FSV Hwks	full supply volume of the major headworks storage/s in the scheme	191460 ML
DSV Hwks	dead storage volume of the major headworks storage/s in the scheme	2581 ML

C. PROBABILITY OF UTILISATION

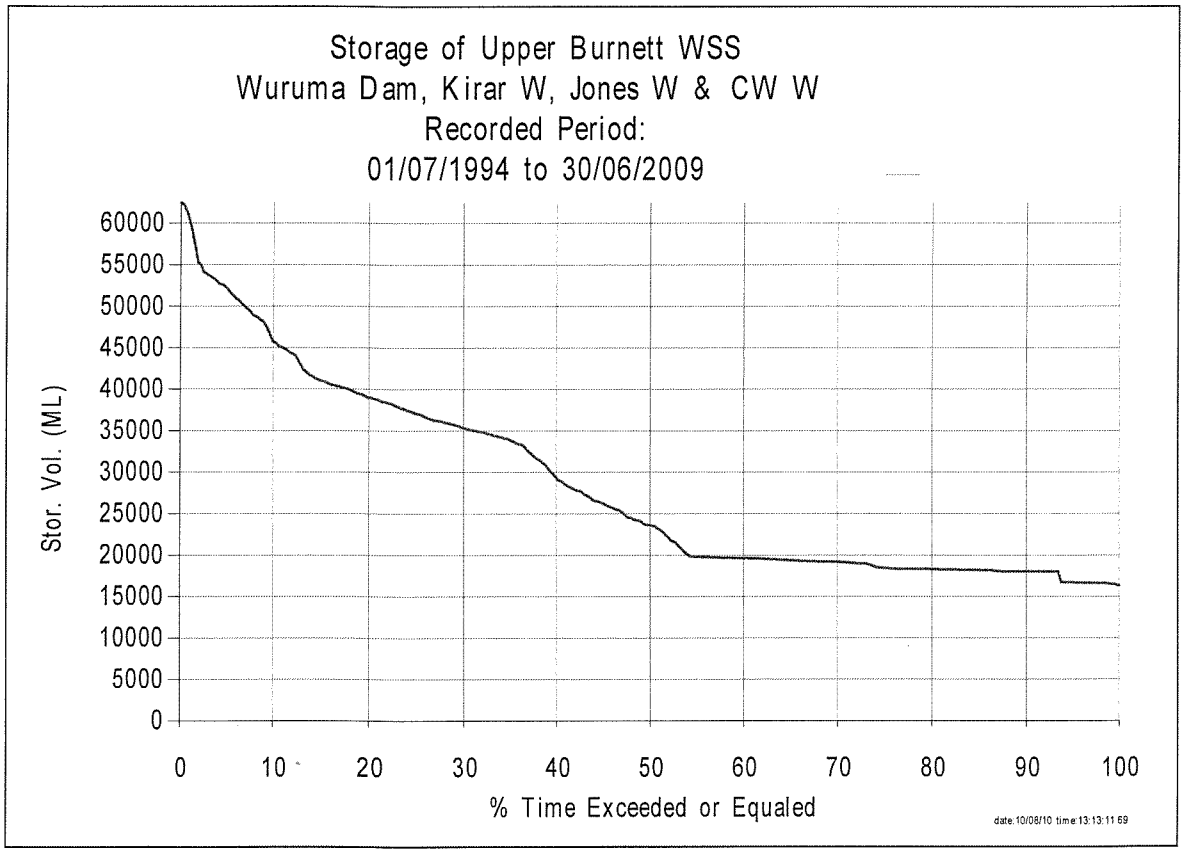
Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 74857 ML	HP2 = 24200 ML	P3 = 0 %	MP2util = 0 ML	HP2util = 0 ML
MP1 =67878 ML		P 2 = 10 %	MP1util = 6853 ML	
HP1 = 21944 ML		P1 = 87 %	HP1util = 19068 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	DISAGGREGATING FOR SUNWATER & BURNETT WATER INFRASTRUCTURE	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	26 %	→	*Medium Priority (SunWater)*	18 %
HPA	74 %	→	*High Priority (SunWater)*	82 %
		→	*Medium Priority (Burnett Water)*	100 %
		→	*High Priority (Burnett Water)*	0 %

*** HUF RESULTS DISAGGREGATED IN PROPORTION TO THE VOLUME OF WATER ENTITLEMENTS IN THE RESPECTIVE GROUPING AND THEN EXPRESSED AS A PERCENTAGE TOTALLING 100% FOR EACH HEADWORKS**

EXCEEDANCE CURVE USED FOR UPPER BURNETT WSS



NOTE THAT THIS EXCEEDANCE CURVE IS CALCULATED USING RECENT RECORDED STORAGE DATA

Appendix 24 – John Goleby Subscheme

(not included in the above analysis of Upper Burnett Water Supply Scheme due to separate water sharing rules in the Burnett ROP, Att. 4.2F, s1.3 and s1.5)

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	1560 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 1560 ML
High Priority	None	N/A		

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	100 %	Medium Priority	100%

NOTE: EXCEEDANCE CURVE NOT REQUIRED FOR JOHN GOLEBY SUBSCHEME

Appendix 25 – Upper Condamine Water Supply Scheme

A. INPUT DATA FROM WATER ALLOCATION REGISTER (DERM)

Water Entitlement Priority Group (in ROP or IROL):	Nominal Volume:	Water entitlement grouping (in HUF calc.) :		
Medium Priority	22165 ML	= MPA	ROP Conversion Factor = N/A	MPAmin = 22165 ML
High-A Priority (*)	3262 ML	HPA = 3387 ML		HPAmax =3387 ML
High-B Priority (*)	125 ML			
Risk A (#)	7320 ML	Not included		
Risk B (#)	925 ML	Not included		

Note * With reference to water sharing rules for UCWSS (Condamine & Balonne ROP, Chapter 8, s167 and s168), High Class A Priority and High Class B Priority are considered to be comparable products for the purposes of this HUF analysis. These are both intended to be urban supplies.

Note # With reference to water access rules for UCWSS (Condamine & Balonne ROP, Chapter 8, s172 and s171), Risk Class A Priority and Risk Class B Priority are considered to be comparable products for the purposes of this HUF analysis. Risk Class A is a streamflow product (available on an opportunistic, run--of-the-river basis and is not related to storage capacity). Risk Class B is a low value water product which is not expected to result in significant access to water over the period of analysis.

B. WATER SHARING RULES & OPERATIONAL REQUIREMENTS (ROP)

MP0 AA	Announced allocation water sharing rules give minimum storage volume in the scheme above which medium priority announced allocation is greater than 0% at the commencement of the water year = 21357 ML	
Adjustments	• None	
MP0	= max (MP0 AA , Adjustment Volume)	21357 ML

MP100 AA	= Water sharing rules give minimum storage volume in the scheme at which medium priority announced allocation is at a maximum (100%) at the commencement of the water year = 59253 ML	
Adjustments	• None	
MP100	= min (MP100 AA, Adjustment Volume)	59253 ML

FSV Hwks	full supply volume of the major headworks storage/s in the scheme	106200 ML
DSV Hwks	dead storage volume of the major headworks storage/s in the scheme	2130 ML

C. PROBABILITY OF UTILISATION

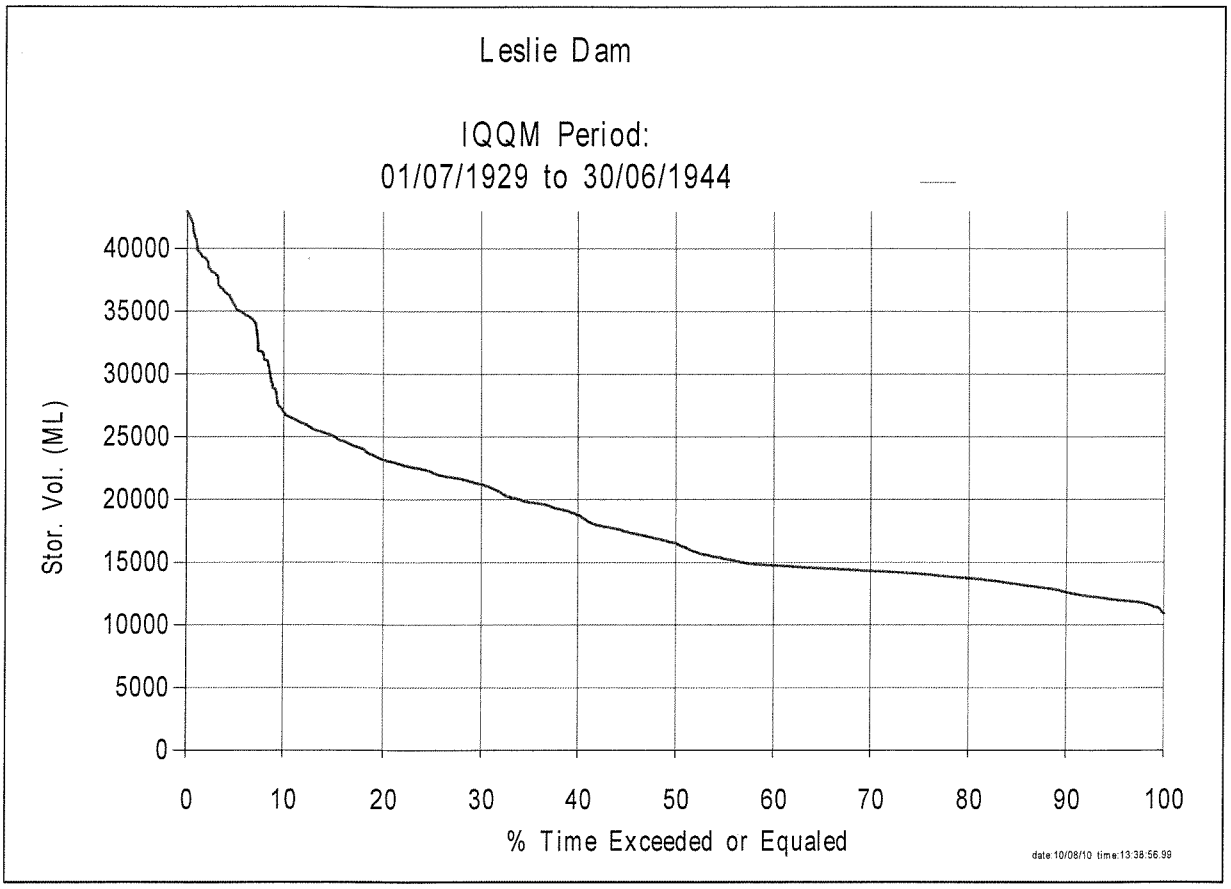
Storage component capacity volumes:		Probability of Utilisation	Utilised storage component volumes	
MP2 = 31146 ML	HP2 = 15802 ML	P3 = 0 %	MP2util = 0 ML	HP2util = 0 ML
MP1 = 37896 ML		P 2 = 5 %	MP1util = 1842 ML	
HP1 = 19227 ML		P1 = 78 %	HP1util = 14941 ML	

D. HUF RESULTS

Water entitlement grouping (in HUF calc.) :	Headworks Utilisation Factor for Grouping	Water Entitlement Priority Group (in ROP or IROL):	Headworks Utilisation Factor for priority group
MPA	11%	Medium Priority	11 %
HPA	89%	High-A Priority*	86 %
		High-B Priority*	3 %
None		Risk A	0 %
None		Risk B	0 %

*** HUF RESULTS DISAGGREGATED IN PROPORTION TO THE VOLUME OF WATER ENTITLEMENTS IN THE RESPECTIVE GROUPING**

EXCEEDANCE CURVE USED FOR UPPER CONDAMINE WSS



Appendix 26 – Summary of Sensitivity Analysis Results

The HUF results have been calculated using a fifteen (15) year critical period, termed the standard period below.

In addition, a set of HUF results were also obtained using a 10 year critical period and a 20 year critical period. The medium priority HUF (HUFmp) results were categorised according as to how much they deviate from the results obtained in the 15 year analysis e.g. if the HUFmp for a certain scheme using the 15 year critical period was 50% and the HUFmp for the 20 year critical period was 52%, this would be categorised as a deviation of 2%.

The results are summarised in Table 27 below

Table 27: Results of Senstivity Analysis using Other Year Critical Periods (10 yr. & 20 yr.)

	Number of Schemes (Total of 23 schemes)	
Medium Priority HUF (HUFmp) Range of percentage values by which other critical periods deviate from the standard 15 year critical period	**10 year critical period**	**20 year critical period**
Less than 2%	15 schemes	17 schemes
From 2% to 5%	3 schemes	3 schemes
From 5% to 10%	4 schemes	2 schemes
Greater than 10%	1 scheme	1 scheme

Scheme	IQQM Case	IQQM Simulation Period	Model Version	IQQM Model Date	15 year Critical Period Used in Final Results(*)	Data used for 15yr Critical Period (measured or IQQM)	Announced Allocation Spreadsheet Model	Announced Allocation Spreadsheet Model version
Mareeba Dimbulah	D02h_i1.sys	1913-1995	6.36.1	Jun 2008	1980-1995	IQQM	AA-MDWSS-current.xls	5
Lower Mary River	PO45CW	1890-1999	6.73.4	May 2007	1908-1923	IQQM	AA-LMR-current.xls	5
Nogoa Mackenzie	06NR49C.sys	1898-1995	6.73.4	Jan 2007	1934-1949	IQQM	AA-NMWSS-current.xls	8
Pioneer River	PionRE37.sys (SWEO)	1900-1996	6.36.1	Dec 2004	1981-1996	IQQM	AA-PiRWSS-current.xls	6
Proserpine River	WH_392w.sys	1890-2004	6.73.4	Jun 2007	1924-1939	IQQM	AA-PrR-current.xls	6
Three Moon Creek	071c.syt	1890-2000	6.4	Jan 2007	1995-2010	Measured	N/A	
St George	Model not used in HUF analysis (continuous sharing)					N/A	N/A	
Upper Burnett	186F.syu	1890-1997	6.3	Mar 2008	1994-2009	Measured	AA-UBWSS-AAM2-current.xls	7
Upper Condamine	UC0909B.sys	1895-2006	6.73.4	Sep 2009	1929-1944	IQQM	AA-UC-current.xls	1

Note *: As per ROPs, standard water year of 1 July -30 June used in all schemes except Dawson Valley WSS (1 October -30 September) and Eton WSS (1 April -31 March)

LOCATION OF HUF CALCULATION TOOL AND RESULTS

HUF calculation tool (approx 40Mb size): Hummingbird #964425, version 1.

HUF Results Spreadsheet: Hummingbird #926060, version 14.

Appendix 27 – Model List (RECORD OF MODELS USED IN THE HUF ANALYSIS)

Scheme	IQQM Case	IQQM Simulation Period	Model Version	IQQM Model Date	15 year Critical Period Used in Final Results(*)	Data used for 15yr Critical Period (measured or IQQM)	Announced Allocation Spreadsheet Model	Announced Allocation Spreadsheet Model version
Barker Barambah	BE22.sys	1890-1997	6.26.7	Feb 2004	1900-1915	IQQM	AA-BaBaWSS8-draft.xls	8
Bowen Broken Rivers	BH020R.sys	1890-2004	6.36.1	Sep 2009	1920-1935	IQQM	100125_Draft_AA-BoBrWSS-current1.xls	1
Boyne River and Tarong	07bc.syB	1890-1997	6.26.7	Apr 2005	1912-1927	IQQM	AA-BRTWSS-current.xls	4
Bundaberg	T206A.sys & T206B.sys	1890-1997	6.75.2	Oct 2005	1982-1997	IQQM	AA-BunWSS-VA-AllWA-current.xls	7
Burdekin Haughton	BH020R.sys	1890-2004	6.36.1	Sep 2009	1925-1940	IQQM	100209_AA-BH-current1.xls	1
Callide Valley	CALrop2.SYS	1900-1995	5.7	Dec 2001	1993- 2008	Measured	N/A	
Chinchilla Weir	MC0909B.sys	1895-2006	6.73.4	Sep 2009	1923 - 1938	IQQM	AA-CHIN-HP-current.xls & AA-CHIN-current.xls	1
Dawson Valley	daw31B.s36	1900-1995	6.36.1	Sep 2004	1956-1971	IQQM	AA-DVWSS-upper-current.xls & AA-DVWSS-lower-current.xls	5 (U) & 6 (L)
Eton	PionRE37.sys (SWEO)	1900-1996	6.36.1	Dec 2004	1981-1996	IQQM	AA-EtonWSS-current.xls	5
Lower Fitzroy	fitz01A.sys (EO_SW01A)	1900-1995	6.73.4	Oct 2008	1900-1915	IQQM	N/A	
Macintyre Brook	Model not used in HUF analysis (continuous sharing					N/A	N/A	