



THE BASIN PLAN IMPLEMENTATION

Namoi Water Resource Plan – Namoi Baseline Diversion Limit Scenario Report – Namoi Regulated River

Appendix A to Schedule F

Published by NSW Department of Planning, Industry and Environment

dpie.nsw.gov.au

Title: Namoi Water Resource Plan – Namoi Baseline Diversion Limit Scenario Report – Namoi Regulated River

Subtitle: Appendix A to Schedule F

First published: May 2019

Department reference number: INT17/214169

NOTE: On 1 July 2019, NSW Department of Industry and NSW Department of Planning and Environment were consolidated to form NSW Department of Planning, Industry and Environment. Any references to Department of Industry or Department of Planning and Environment in this document, except where made in a historical context, can be taken to refer to Department of Planning, Industry and Environment. Environmental water responsibilities of the former Office of Environment and Heritage (OEH) are now with the Biodiversity and Conservation branch within Department of Planning, Industry and Environment.

More information

Michael Sugiyanto, Department of Planning, Industry and Environment—Water, Parramatta

© State of New South Wales through Department of Planning, Industry and Environment 2019. You may copy, distribute, display, download and otherwise freely deal with this publication for any purpose, provided that you attribute the Department of Planning, Industry and Environment as the owner. However, you must obtain permission if you wish to charge others for access to the publication (other than at cost); include the publication in advertising or a product for sale; modify the publication; or republish the publication on a website. You may freely link to the publication on a departmental website.

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (August 2019) and may not be accurate, current or complete. The State of New South Wales (including the NSW Department of Planning, Industry and Environment), the author and the publisher take no responsibility, and will accept no liability, for the accuracy, currency, reliability or correctness of any information included in the document (including material provided by third parties). Readers should make their own inquiries and rely on their own advice when making decisions related to material contained in this publication.

Glossary

Term	Definition
BDL	Baseline Diversion Limit under the Basin Plan
Cap	The Murray Darling Basin Ministerial Council Cap on Diversions
DPI Water	NSW Department of Primary Industries, Water Division (now Department of Planning, Industry and Environment—Water)
EFRG	Environmental Flows Reference Group
EWA	Environmental Water Allowance
HEW	Held Environmental Water
IQQM	Integrated Quantity and Quality Model
LTADEL	Long term Average Annual Extraction Limit
MDB	Murray Darling Basin
MDBA	Murray Darling Basin Authority
MDBC	Murray Darling Basin Commission
MDBSY Project	Murray Darling Basin Sustainable Yields Project
OFS	On farm storage
PBP	Pre-Basin Plan
SDL	Sustainable Diversion Limit
WA 2007	Commonwealth Water Act (2007)
WMA 2000	NSW Water Management Act (2000)
WRP	Water Resource Plan
WSP	Water Sharing Plan

Contents

1	Introduction	1
1.1	Basin Plan requirements.....	1
1.2	BDL Scenario.....	1
1.3	Purpose of report	2
2	2 Model Development	3
2.1	WSP to 2009.....	3
2.2	MDBA BDL Model.....	3
2.3	Revisions for NSW BDL estimates	3
2.3.1	Climate Data	4
2.3.2	Flow re-calibration	4
2.3.3	Other changes	5
3	Results	6
4	PBP model parameters	7
5	References.....	9

Tables

Table 3-1.	Comparison of results from original MDBA BDL and updated BDL scenarios.....	6
Table 4-1.	Infrastructure and Development Parameters	7

1 Introduction

Statutory water sharing arrangements in NSW are generally developed with consideration of the analysis of results from computer models of a river system. These models estimate a range of water balance components such as streamflow and diversions based on climatically derived water availability, levels of water resource development, and water sharing policies. Different combinations of development and policies are tested in the models, and presented to stakeholders to gain an understanding of how policies may affect water users and the environment in a wide range of circumstances. A model scenario may also be selected as the basis for a statutory arrangement.

This process was followed by NSW to develop statutory WSPs under the WMA 2000 legislation using models developed with the IQQM software. WSP provisions were developed through modelling in IQQM. These provide an agreed set of sharing rules to achieve productivity and environmental outcomes, based on modelled annual diversions averaged over a long period of historically varying climate. A similar process will be used to develop the WRPs under the 2012 Basin Plan established under the Commonwealth Water Act 2007 (WA 2007).

A significant element of the WRP is that the long term average annual diversions have been set, known as the SDL. This SDL estimate depends on the estimate of the Baseline Diversion Limit (BDL). An estimate of the BDL was made at the time the Basin Plan was formulated. This estimate has been revised by Department of Planning, Industry and Environment—Water based on improved modelling.

This report describes the development of the revised BDL scenario for the Namoi River. This description includes development information for the initial BDL scenario run in 2010, revisions for the improved BDL scenario run, and reporting of the output difference.

A separate report will be prepared to describe a more contemporary scenario that will be the baseline for WRP scenarios, and will be used to represent the SDL scenario.

1.1 Basin Plan requirements

The Basin Plan has a range of requirements, including a key requirement that for a WRP to be accredited, annual diversions averaged over the 114 year historical reference climate period cannot be greater than the SDL. The SDL is defined as the BDL minus a fixed recovery value. The BDL scenario is a reference point that will be used to measure all changes made by the Basin Plan including by WRPs, the achievement of SDLs and any impacts that may occur.

The BDL is included in the Basin Plan as a definition in Column 2, paragraph (a)(i) of Schedule 3 for NSW regulated rivers the “... *the water that would have been taken... ..under State water management law as of 01/07/2010...*”. A note to this component provides an estimate based on reported MDBA modelling as of 2010. The BDL is based on a particular model scenario, based on the WSP rules for that water source. This scenario is the level of irrigation development and management arrangements at 1999/2000. The Basin Plan allows for this estimate to be revised whenever it can be demonstrated that a better estimate is available.

1.2 BDL Scenario

NSW interprets the BDL definition as being the Long Term Average Annual Extraction Limit (LTAAEL) provided for in the WSP in place as at 1 July 2010. The LTAAEL is based on water use development levels at a specific point in time, e.g., 1999/2000, (crop areas, on-farm storage capacity, pump capacity, headwater storage, etc.), associated crop planting decision making, storage operation, and other management practices, and the rules set out in the WSP. The model scenario that has all these settings is the Plan Limit model, and is equivalent to the BDL.

A note was included in the WSP of the LTAAEL estimate at the time the WSP was formulated. This estimate has been revised as a consequence of continual improvement of the underlying model calibration, as well as improved representation of processes. The Plan Limit model was passed onto MDBA in 2006 to allow them to undertake Basin Plan modelling.

Further improvements have since been made, as well as a close audit to make certain the Plan Limit model conforms closely to WSP rules. These are more fully described in Chapter 2.

1.3 Purpose of report

This report is intended primarily for SAPs and the MDBA as a record of changes to the BDL estimate. The purpose of the report is to describe how the BDL Scenario was formed, and fully document what this scenario includes. The technical content of this report is kept to only that necessary to meet the intent.

2 Model Development

The Namoi IQQM has been used as the principal tool to inform water planning and diversion compliance since the mid-1990s, and has been subjected to continual improvement. The Namoi IQQM was used to inform WSP development in the early 2000s, and has been reviewed as fit for purpose MDBMC Cap Auditing, and for use in formulating the Basin Plan. The model described herein is an improvement on its usage for these purposes, and can be considered suitable for the WRP process.

2.1 WSP to 2009

The initial Namoi IQQM was developed in the mid-1990s using an early version of the IQQM software for the purpose of MDBMC Cap compliance and for developing the 2004 WSP. A key element of the WSP was that the LTAAEL was lower than the long term average Cap diversion. The reported figures of Cap diversion and Plan Limit in the published WSP are 238 GL/y and 256 GL/y respectively, averaged over the 1892-2000 climate period.

Subsequent to the WSP, the capability of the Namoi IQQM to estimate annual and long term average diversions was established by an independent review under MDBC Cap governance arrangements. The review assesses the following aspects:

- accuracy of the model to predict annual diversions and end of system flows
- the method used to establish levels of development, and their representation in the models
- the method used to adjust water use for climatic variation
- capability of the model to simulate long-term average diversions
- robustness of the model to simulate outside the calibration period.

The model report describing conceptualisation, data, calibration and scenario configuration (Ribbons et al, 2005) and the model itself were submitted for review in 2005.

The reviewer concluded the model to be sufficiently robust and unbiased, and recommended it could be used to estimate annual and long-term average diversions (Bewsher, 2005). The model was Cap approved by the Commission in June 2005 as fit for purpose.

The approved model reported LTAAEL of 254 GL/y and corresponding long term average annual Cap diversion of 256 GL/y, an increase of the original estimates reported in the WSP estimated over 1892 to 2000.

2.2 MDBA BDL Model

NSW provided the 2006 version of Namoi IQQM configured with the WSP to MDBA for use in their Basin Plan development. The key modifications to the 2006 Namoi IQQM by MDBA are listed below:

- Water year changed from October-September to 'July-June'.
- Peel inflow was updated from the updated Peel IQQM.
- On farm storage volumes reverted back from 2003 to the records collected in 2000.
- Minor configuration alteration for more equitable distribution of supplementary diversion.

The above was the current MDBA BDL. The BDL estimated diversion over the period 01/07/1895-30/06/2009 was 245 GL/y. A further review of the model was undertaken as part of the MDBSY Project, and to establish its fitness-for-purpose for use for MDBA modelling for the Basin Plan (Podger et al., 2010).

2.3 Revisions for NSW BDL estimates

The current Namoi BDL was updated by Department of Planning, Industry and Environment subsequent to its supply. The key updates are:

- more consistent climate data source
- higher resolution of flow path configuration
- improved ungauged flow and loss estimates due to longer calibration period
- better reflection of Split Rock to Keepit transfer behaviour.

2.3.1 Climate Data

The climate input data of Namoi IQQM comprise of daily rainfall and evaporation. The inputs were reviewed as part of this upgrade (Ribbons and Chowdhury, 2014). No change of rainfall was necessary. However, a comparison of pan evaporation records to interpolated data on the SILO database indicated inconsistencies. This was resolved by replacing post 1997 data with SILO data. Changes in the eastern part of the Namoi valley were small with the exception of Manilla PO for Split Rock Dam which decreased by 10%. West of Narrabri the evaporation estimates increased by 6–9%.

2.3.2 Flow re-calibration

The Namoi IQQM used for WSP and MDBA BDL was calibrated against 1983-1997 data. The availability of more data, including flow and diversions during the Millennium Drought, provided a strong case to recalibrate the flow in the model. Lower Namoi flow calibration was updated by considering 1958-2011 data (Chowdhury and Jayawickrama, 2013). Hence there are changes in the flow path configuration, ungauged inflow estimates, routing parameters and loss relationship. We took this opportunity to improve the resolution and flow paths of the model at key areas. The improved resolution and flow paths included the following changes:

- increased resolution of Mooki River losses and ungauged inflows
- Narrabri high flow break-out to anabranch added
- high flow break-out bypass and flood breakout around Weeta Weir
- separation of large irrigation areas in Pian Creek upstream of Rossmore
- greater detail around Pian Creek lateral inflows and losses.

These changes were factored into a flow re-calibration which included re-estimating residual inflows for the following reaches:

- Keepit Dam to Gunnedah, with two separate residual inflows were estimated for different subregions of the reach
- Gunnedah to Boggabri, improved representation of inflow estimate and loss function
- Narrabri to Mollee, with two separate residual inflows were estimated for different subregions of the reach
- Weeta to Bugilbone, re-estimation of ungauged inflows using additional data
- Bugilbone to Goangra, with two separate residual inflows were estimated for different subregions of the reach.

The changes to resolution and placement of loss nodes allowed for more realistic estimates of ungauged runoff contribution when expressed as mm over the catchment. Whereas prior estimates were up to 2-3 times that depth of runoff from the nearest gauged catchment, the new estimates were close to the same.

Losses were recalibrated for all reaches in the flow network as a consequence of new flow paths, improved ungauged catchment inflows, and new data more generally.

Capacity-outflow tables were also re-calibrated with additional data for the following:

- Mollee Weir
- Gunidgera Offtake
- Pian Regulator.

2.3.3 Other changes

Miscellaneous other changes were also made, such as:

- improved representation of Split Rock to Keepit transfer operational behaviour by maintaining Keepit Dam at or above 38 GL
- removing and/or refining nodes that control supplementary diversions in each reach to better represent diversions
- Correction of carry-over tables for Split Rock Dam and Keepit Dam.

3 Results

The average annual usage for different components of the models is shown in Table 3-1. Please note that both the Floodplain Harvesting and On Farm Harvesting estimates will be revised under the Namoi Healthy Floodplain Policy¹ rollout.

Table 3-1. Comparison of results from original MDBA BDL and updated BDL scenarios

Category	Scenario	
	MDBA BDL	New BDL
Entitlements	(long term average usage (GL/y) (1895-2009))	
General Security	197.7	191.4
Supplementary Access	32.3	44.3
Flood Plain Harvesting ²	13.1	18.6
Utilities, Domestic & Stock	1.6	1.4
On Farm Harvesting ²	79.5	80.9
TOTAL	324.2	336.6

¹ http://www.water.nsw.gov.au/__data/assets/pdf_file/0012/548499/floodplain_harvesting_policy.pdf

² This is Pre-Healthy Floodplain project estimate and will be revised

4 PBP model parameters

Table 4-1 contains all relevant configuration information for the PBP Scenario.

Table 4-1. Infrastructure and Development Parameters

Items	Description
General	
System File Name	NamoB514.SQQ
IQQM Version developed in	7.91.6
Available Simulation Period	01/09/1892 - 30/06/2016
Water Year	July to June
Valley Development Levels	
Maximum Crop area	1997 to 2002
Crop Mix	1999
Licence Volume	1999
Crop Planting Decision	1999
Catchment Information	
<i>Headwater storages modelled</i>	
Split Rock	
Inactive storage (GL)	3.2
Full supply volume (GL)	397.4
Keepit	
Inactive storage (GL)	6.6
Full supply volume (GL)	425.5
Entitlements	
<i>General Security Entitlements (ML)</i>	
d/s Split Rock Dam	9,642
d/s Keepit Dam	244,860
TOTAL	254,502
<i>High Security Entitlements (ML)</i>	
d/s Split Rock Dam	80
d/s Keepit Dam	6,218
TOTAL	6,298
Town Water Supply Entitlements (ML)	2,421
Stock and domestic Entitlements (ML)	2,636
Supplementary Access Cap (ML/y)	119,926
Irrigation development	
Maximum farm size (ha)	70,939
Maximum summer area (ha)	51,584
Maximum winter area (ha)	19,356
On-farm storage capacity (ML)	183,130
Installed pump capacity (ML/d)	9,234
<i>On-farm storage operation</i>	
Rainfall runoff harvesting	Yes

Items	Description
Airspace allowed	Yes
Accounting System Lower Namoi	
Type	Continuous
Debiting type	Water order
Maximum balance	200%
Maximum use of entitlement	125% subjected to a max of 300% in 3 consecutive years
Accounting System Upper Namoi (not modelled explicitly)	
Type	Annual, first priority
Debiting type	Water use
Uncontrolled flow	Use without debit when AWD < 60 %
Storage Operation	
Split Rock to Keepit transfers	Water can be transferred from Split Rock to Keepit when volume stored in Keepit Dam is insufficient to meet projected downstream demands and when volume stored in Keepit Dam drawn out to 38 GL. Releases made to a pattern.
In-stream requirements	
<i>Average annual usages and maximum replenishment flow requirements (ML/y)</i>	
Pian Creek	2,000 (14,000)
<i>Minimum flow requirements at various locations (ML/d)</i>	
Manilla R d/s Split Rock	5 (Apr – Sep) and 6 (Oct – Mar)
Namoi R d/s Keepit	10
Namoi R @ Walgett	21 (Jun), 24 (Jul) and 17 (Aug)
Environmental Water	
<i>Planned Environmental Water</i>	
Surplus flow sharing	90:10 July to October (Environment: Irrigation) 50:50 November to June
Surplus flow threshold	Various, as of WSP c49(9) to (12), function (allocation, month)

5 References

- Bewsher Consulting Pty Ltd (2005), Namoi Valley Independent Audit of Cap Model. February 2005, pp 65
- Chowdhury, S. and Jayawickrama, H. (2013). Namoi 2013 Flow recalibration – Technical Note. DPI Water (unpublished).
- Podger, G.M., Barma, D., Neal, B., Austin, K. and Murrphy, E. (2010). River System Modelling for the Basin Plan Assessment of fitness for purpose. CSIRO: Water for a Healthy Country National Research Flagship, Canberra, ISSN 1865-095X, December 2010..
- Ribbons, C., Brown, A., and Chowdhury, S. (2005). Namoi River Valley; IQQM Cap Implementation Summary Report. CNR, DLWC, 2005
- Ribbons, C. and Chowdhury, S. (2003). Climate Data Used in Namoi IQQM: Appendix A, August 2014 Data Extension – Technical Note, (unpublished).