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# Floodplain harvesting entitlements for the Namoi Valley river system

Model Scenarios

November 2022





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# Executive Summary

In 2008 the NSW Government announced that water users harvesting water from floodplains would need a licence and approval to use the water harvesting works that they had installed. To facilitate this, the Department of Planning, Industry and Environment introduced the *NSW Floodplain Harvesting Policy* (the policy) in 2013. The policy sets out the floodplain harvesting licensing eligibility criteria and the licensing process where licences define the volume of water (overbank and rainfall runoff) that users can legally harvest from floodplains. The policy is now being implemented across the northern NSW Murray-Darling Basin.

Floodplain harvesting limits are set out in NSW water sharing plans. These limits were estimated at the time of policy introduction and are now being updated using improved information and modelling developed under the NSW Floodplain Harvesting Program.

This report describes how the new Namoi Valley river system Source model<sup>1</sup> (the Namoi Valley model) has been used to recalculate the long-term diversion limit (the 'plan limit') set in the *Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016* (the Namoi WSP), estimate individual floodplain harvesting entitlements, and demonstrate that the new floodplain harvesting water access licences will bring total diversions within the plan limit. Model scenarios have been developed that represent different combinations of levels of development, entitlements and account management rules designed to ensure equitable distribution of the individual floodplain harvesting entitlements.

Each scenario has been run through the Namoi Valley model, over the period 1 July 1895 to 30 June 2009<sup>2</sup>, to calculate an estimate of long-term average annual total diversion. Issues such as compliance with the plan limit, equitable distribution of entitlements and risk of growth in use have been considered when evaluating the results to determine the revised plan limit and the volume of access licences and associated management rules.

The new modelling confirms that long-term average diversions under the Namoi WSP Scenario are lower than under the 1993/94 Cap Scenario, and this represents the Plan Limit for the Namoi Valley.

The results show that there has been significant growth in supplementary access and floodplain harvesting, and no significant increase in general security water use. Supplementary access has increased by 7.7 GL/year (22%) and, with the tailwater exemption in place, floodplain harvesting has increased by 4.8 GL/year (10%) above that for the Plan Limit Scenario. The overall growth in water use above the Plan Limit for the regulated river system is 12.7 GL/year (5.6%).

Introducing the combination of entitlements and account management rules will reduce floodplain harvesting, particularly after a series of wet years. The modelling shows that the licensing of

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<sup>1</sup> The companion Model Build Report (DPIE Water 2021a)

<sup>2</sup> 1895–2009 period is based on the 2012 Murray-Darling Basin Plan assessment period and refers to water years rather than calendar years

floodplain harvesting, together with a reduction in the maximum supplementary available water determinations of 45%, will bring the long-term average annual diversions for the valley within the plan limit. The impact on individual properties has been tested using an individual impact scenario which shows that impacts are equitably distributed with a reduction in non-exempt floodplain harvesting component of 14% for all properties.<sup>3</sup>

The scenario modelling reported here has been used to update the plan limit estimate for the Namoi unregulated river water source and to determine floodplain harvesting entitlements. Evaluation of results shows that the proposed entitlements and account management rules manage floodplain harvesting equitably and could be managed within the plan limit should future growth in water use be required.

While all care has been taken in this modelling and the work undertaken has substantially improved the estimation of floodplain harvesting, uncertainty can be further reduced with better information through ongoing monitoring of harvesting volumes and management practices, and better representation of return flows from floodplains to river channels.

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<sup>3</sup> Individual impacts on all floodplain harvesting (i.e. including exemption) are variable with reductions of up to 23%.

# 1 Introduction

In 2008 the NSW Government announced that water users harvesting water from floodplains would need a licence and an approval to use the works. To facilitate this, the Department of Planning, Industry and Environment (now the Department of Planning and Environment; the department) developed the *NSW Floodplain Harvesting Policy* (the policy). The policy was introduced in 2013 and is now being implemented across the northern NSW Murray-Darling Basin. The policy sets out the floodplain harvesting licensing eligibility criteria and the licensing process.

Floodplain harvesting licences define the volume of water that users can legally harvest from floodplains. Bringing floodplain harvesting into the water licensing system will ensure the volume of total diversions stays within the limits established in NSW water sharing plans (WSPs) for each valley.

NSW WSPs set out how much, and how, water is shared between users within the state. They define how limits on diversions, including for floodplain harvesting, are to be calculated in each valley, and include estimates for these limits. The floodplain harvesting estimate is now being updated using improved data and methods developed under the NSW Floodplain Harvesting Program.

The updated data and modelling for the Namoi Valley river system have been described in detail in the companion Model Build report (DPE Water 2022a).

The model has been used to recalculate the diversion limit set in the *Water Sharing Plan for the Upper and Lower Namoi Regulated River Water Sources 2016*, referred to as the Namoi WSP, and calculate floodplain harvesting entitlements to ensure that total diversions are within that limit.

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## 1.1 Namoi Valley river system model

The existing model of the Namoi Valley river system model (Namoi Valley model) was built to support policy and planning in this water system, including its contribution to the Murray Darling Basin Plan 2012 (Basin Plan).

The new Namoi Valley model has been developed to better represent floodplain harvesting and to determine volumetric floodplain harvesting entitlements as required by the policy.

The new model makes use of multiple lines of evidence and best available industry data to ensure that the assessment of floodplain harvesting capability at each irrigation property is realistic.

Assessment criteria<sup>4</sup> measured how well the model reproduced system behaviour, that is inflows, diversions and flow distribution, necessary to meet the modelling objectives, and whether model performance was better or worse than an alternate model. The Model Build report (DPIE Water 2021a) provides evidence and assessments to demonstrate that the model makes best use of

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<sup>4</sup> Ref Table 30 in DPE Water (2022a)

available data and methods to produce the estimates of limits to diversions required for implementation of the policy. In addition, the quality of the model build process (as described in the Model Build report) will be assessed through independent external review.

### 1.1.1 Model scenarios

Meeting policy purposes required configuring and running a set of defined model scenarios. Scenarios reflect a particular level of development and management rules in the river system, usually at a point in time. The scenarios to be discussed in this report have been qualitatively defined by the Namoi WSP and, separately, by the policy.

Scenarios are developed as modifications to the inputs to the base river system model, and are checked against observed data. When run over long-term climate sequences, the modified model can then simulate **long-term average annual diversions** under the level of development and management rules described in each scenario.

The modifications to create these scenarios are described in this report.

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## 1.2 Report purpose and structure

This report describes how the Namoi Valley model was used to recalculate the diversion limit in the Namoi WSP and estimate individual floodplain harvesting entitlements. This includes discussion of the relevant policy instruments, how models are used to implement these, and how development levels and water management rules (the two key components of the scenarios) were determined.

Section 2 introduces the key elements of the Namoi WSP and the policy, particularly the definitions for the Cap Scenario, and the framework for establishing floodplain harvesting entitlements.

Section 3 describes the scenarios and their data requirements in more detail and how they have been combined to estimate floodplain harvesting entitlements.

Section 4 presents the modelled results, summarised at whole of river system scale as required by the Basin Plan and the policy. Results are categorised by (1) determining the Namoi WSP's diversion limit, (2) growth in use assessment, (3) plan limit compliance, and (4) entitlement distribution. Summary information on individual entitlements is reported, including estimated changes in diversions as a consequence of implementing these entitlements.

Section 5 concludes with an assessment of how the requirements of the policy have been addressed, along with identification of future work.

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## 1.3 Companion reports

How the model has been used to update the Namoi WSP limit and calculate floodplain harvesting entitlements to bring total diversions back within that limit is described in this report.

The updating of the river system model which provides the data for assessing entitlements is described in companion report *Building the river system model for the Namoi regulated river system* (DPE Water 2022a).



The use of the model results for predicting potential environmental outcomes is described in companion report *Environmental outcomes of implementing the Floodplain Harvesting Policy in the Namoi Valley* (DPE Water 2022b).

The three reports together serve to describe how the modelling meets the objectives of the *Floodplain Harvesting Policy*.

# 2 Floodplain Harvesting Policy background

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## 2.1 Purpose

Allowable limits for water diversions in NSW’s regulated rivers, including the Namoi, are determined in WSPs established under the 2000 *NSW Water Management Act*. Following accreditation of NSW Murray-Darling Basin Water Resource Plans by the Commonwealth Water Minister on advice from the Murray-Darling Basin Authority, WSPs will be amended to ensure these limits will also reflect the Sustainable Diversion Limit set out in the Basin Plan. These limits allow for flows in the river and on associated floodplains that provide for environmental outcomes and a level of reliability to downstream water users.

Unconstrained harvesting of water from floodplains has resulted in growth in diversions above those limits in some valleys, resulting in reduced downstream and lateral flow with consequent impacts on reliability of water supply to downstream water users including the environments of the river and its floodplains and wetlands.

The purpose of the policy is to protect the environment and the reliability of downstream water supply by managing the diversion of water for consumptive use through floodplain harvesting. These diversions will be managed to be within authorised long-term average annual extraction limits (LTAAELs). **This LTAAEL is referred to as the ‘plan limit’.**

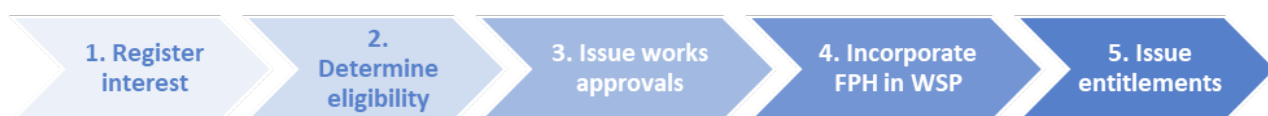
The policy ensures compliance with the 2000 *NSW Water Management Act*, which requires all diversions to be taken under an appropriate water access licence, a basic landholder right or a licence exemption. The policy also meets the objectives of the National Water Initiative by bringing these floodplain harvesting diversions into the water access entitlement framework.

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## 2.2 Implementation

The policy provides a framework for licensing floodplain harvesting diversions (comprising overbank flow harvesting and rainfall runoff harvesting), setting out five stages (Figure 1) of the administrative process for eligibility for a floodplain harvesting entitlement, from registration of interest through to the issue of entitlements. The *Implementation Guideline* (DPIE 2020) provides further detail on this process.

Figure 1. Stages in floodplain harvesting implementation



The department's river system models for each valley are being extended to determine all regulated river floodplain harvesting entitlements, through:

- updating estimates of the plan limit defined in each valley's WSP
- assessing floodplain harvesting capability of eligible works
- using the eligible works capability assessment to equitably estimate entitlements such that total diversions can be managed within the plan limit.

The role of the models in stages 4 and 5 is described in the following sections. They rely on information collected in stages 1, 2 and 3.

The entitlements process described here is restricted to the regulated river system. Entitlements in the unregulated river system are determined using a separate process as outlined in the *Implementation Guideline* (DPIE 2020).

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## 2.3 Definition and estimates of diversion limits

The policy requires that total diversions do not exceed the plan limit. This also means that total diversions cannot exceed that allowed for under the Cap<sup>5</sup>.

The plan limit for the Namoi regulated river system is established in clause 29(1) of the Namoi WSP as the lesser of the long-term average annual extraction for this water source that would occur:

- '(a) ... with the water storages, water use development that existed in 1999/2000, the share components in this water source that existed on 1 July 2004 and the water management rules that were defined in this Plan on 1 July 2004, or**
- (b) ... under Cap baseline conditions.'**

The Namoi Valley model has been designed to determine which set of development conditions and management rules ((a) or (b)) results in the lower long-term average annual diversion. The sets are configured as model scenarios and run through the model, using a long period of climate data, to estimate the long-term average annual total diversion under each scenario.

- Clause 29(1)(a) is configured as the Water Sharing Plan Scenario (the WSP Scenario)
- Clause 29(1)(b) is configured as the Cap Scenario.

The Plan Limit Scenario is defined as that which produces the lower result. The scenarios are described in Section 3.2.1.

The categories of diversions included in the plan limit definition are specified in the Namoi WSP. The limit estimated using the Namoi WSP is based on the department's river system model that was in use at that time. This included an estimate of floodplain harvesting, however this was not a reliable estimate as that part of the model was not sufficiently developed for that purpose.

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<sup>5</sup> The Cap is as defined in Schedule E of the *Murray Darling Basin Agreement* and as agreed under the *Murray Darling Basin Ministerial Cap on Diversions*.

A revised estimate of the plan limit is being made as part of implementation of the policy. The same estimate will be used for the Baseline Diversion Limit (BDL) under the Basin Plan – consequently, the BDL estimate used by the Murray-Darling Basin Authority will also be updated, and by inference, the Sustainable Diversion Limit (SDL).

As results are averaged (i.e. the long-term average annual extraction), the time period is important. To comply with the Basin Plan, the period 01/07/1895 to 30/06/2009 is used for calculating long-term averages for the implementation of the policy.

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## 2.4 Eligible works capability assessment and determination of entitlements

The policy states that the determination of individual entitlements will not be based on history of use. Instead, determination is informed by a capability assessment that considers the works (physical infrastructure) used for floodplain harvesting and the opportunity to access floodplain flows based on location and climatic variability. Note that the assessment includes only those works deemed eligible for consideration<sup>6</sup>.

This capability has been included in the updated Namoi Valley model.

Growth in total diversions **above** the plan limit is addressed through two steps:

- Firstly, growth resulting from ineligible works is addressed by not including those works in the capability assessment or in the design of the entitlements
- Secondly, to bring total diversions back within the plan limit, entitlements are designed so that, in conjunction with the account management rules, each irrigation property has a uniform reduction in the long-term average non-exempt portion of floodplain harvesting.

If total diversions are **below** the plan limit, then the entitlements will be designed so that there is no impact. The assessment of impact in both cases is based on eligible works only.

To implement the above, 4 model scenarios are required to assess:

- the plan limit (called the Plan Limit Scenario)
- current infrastructure (called the Current Conditions Scenario)
- eligible works (called the Eligible Development Scenario)
- implementation of the policy (called the Plan Limit Compliance Scenario).

These scenarios are described in Section 3.

Determination of entitlement volumes depends on the accounting rules used. The proposed accounting rules are discussed in the following section. The method to calculate entitlements is further described in Section 3.2.4 on the implementation of the policy.

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<sup>6</sup> The process of assessing eligible works is described in *Guideline for the implementation of the NSW Floodplain Harvesting Policy* (DPIE 2020)

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## 2.5 Proposed accounting rules

Accounting rules affect the sizing of entitlements; for example, if there is no carryover, larger entitlements are required to achieve the objectives of the policy. The amount of floodplain harvesting over the long term is affected by climate variability. These need to be taken into account when designing entitlement volumes and account management rules. We undertook extensive analysis of combinations of entitlements and account management rules.

Issues such as equitable reductions and risk of growth in use were considered when evaluating the combinations of entitlement volumes and accounting rules. This process was overseen by a NSW interagency working group including the Department of Primary Industries (Fisheries), Department of Primary Industries (Agriculture) and the department's Energy Environment and Science division. A summary of the analysis and recommendations were provided for stakeholder consultation to seek feedback (DI 2018a) and outcomes of the consultation were published (DI 2018b).

The proposed accounting rules for each entitlement are:

- 100% of an entitlement to be credited annually to the account up to a maximum value of 500% of the entitlement.
- Annual floodplain harvesting is limited to the balance left in the account.
- The account is debited annually for all floodplain harvesting in that year, allowing for exclusions such as rainfall runoff harvesting during exempt periods.
- Any unused balance can be carried over into the next water year subject to the 500% account limit.

These proposed rules, along with some additional initialisation rules, will be further described during water sharing plan consultation. Appendix A illustrates how these accounting rules work.

NSW has introduced a partial rainfall runoff harvesting exemption to the policy, which means that there will be times when rainfall runoff harvested from the farm is not required to be accounted for against the licence. This provision is taken into account by removing exempted harvesting from results when determining the entitlement. The exemption is also reflected in the modelling of accounting rules. For modelling purposes:

- exempt rainfall runoff harvesting is defined as that which occurs from fallow or cropped areas on days when no water is being harvested from outside the irrigation property<sup>7</sup>.
- non-exempt rainfall runoff harvesting is considered part of floodplain harvesting and as such will be included in the floodplain harvesting results in this report.

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<sup>7</sup> cl.17C in Part 1 of Schedule 4 in the *Water Management (General) Regulation 2018*. Rainfall run-off from undeveloped land on a farm is not exempt and is modelled separately to run-off from developed land on the farm.

# 3 Scenarios: use and data

## 3.1 Overview

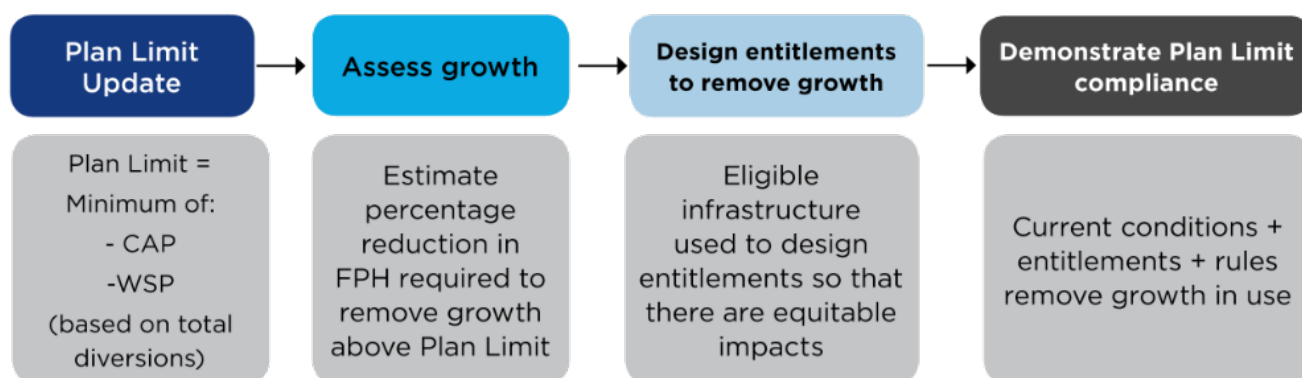
The intent of the policy is to bring floodplain harvesting into the water licensing framework, including managing any growth above statutory limit through a combination of entitlement volumes and account management rules as noted in Section 2.5. These two factors combined are hereafter referred to as the ‘floodplain harvesting licensing framework’.

Four scenarios have been developed to implement this framework in the Namoi Valley (Table 1). The relationship between the scenarios is shown in Figure 2.

Table 1. Scenarios developed to implement the floodplain harvesting licensing framework in the Namoi Valley

	Scenario name	Description, including title used in Figure 2
(a)	Plan Limit Scenario	Plan limit update There are two clauses in the plan limit definition in the Namoi WSP: the Water Sharing Plan limit and the Murray Darling Basin Ministerial Council Cap on diversions. The Plan Limit Scenario is whichever has the lesser long-term average total diversions
(b)	Current Conditions Scenario	Assess growth The latest available levels of development and management rules used to estimate the current level of diversions without the licensing framework in place and determine the reduction, if any, required to comply with the plan limit
(c)	Eligible Development Scenario	Design entitlements In accordance with the policy, this Scenario is based on the levels of farm infrastructure development that were present or otherwise eligible as at 3 July 2008. It is used to determine individual shares of the total volume of floodplain harvesting entitlements
(d)	Plan Limit Compliance Scenario	Demonstrate plan limit compliance An evolution of the Current Conditions Scenario with the floodplain harvesting licensing framework applied to bring diversion back to statutory limits, with shares of the total floodplain harvesting entitlements based on distribution of floodplain harvesting volumes from (c)

Figure 2. Process for using the model scenarios to determine floodplain harvesting entitlements. The four steps, moving from left to right, reflect the relationship between the four model scenarios



It is worth noting that some of the steps shown in Figure 2 are not required if there is no overall growth in water use, and the design of floodplain harvesting entitlements would be designed to avoid impacts to eligible floodplain harvesting properties.

These scenarios are described in more detail in Section 3.2, including how the modelled implementation of the licensing framework equitably distributes impacts.

## 3.2 Descriptions of scenarios

This section gives a general description of each model scenario. All scenarios have been adapted from the 2008/09 Scenario described in the Model Build report (DPE Water 2022a). The Model Build report should be read in conjunction with this report for further detail on how the 2008/09 Scenario was developed and model performance assessed. Changes from that scenario are described in Section 2.3.

### 3.2.1 Plan Limit Scenario

The plan limit is assessed through two separate scenarios, defined in the Namoi WSP and described in Section 2.3. Depending on results, one of these scenarios becomes the Plan Limit Scenario. This is reported in Section 4.1.

Table 2. The two scenarios used to assess the plan limit

Scenario name	Description
Water Sharing Plan (WSP) Scenario	Reflects the level of development at 1999/00 and management arrangements set out in the Namoi WSP
Cap Scenario	Reflects agreements made under the Murray Darling Basin Ministerial Council Cap on diversions. For the Namoi valley, as for most valleys in the basin, this refers to the development levels and management arrangements in place at 1993/94

### 3.2.2 Current Conditions Scenario

This scenario uses the best available information on the most recent known levels of irrigation infrastructure and entitlements in the Namoi river system, and existing management arrangements as defined under the Namoi WSP. The information is described in Section 2.3.

Apart from infrastructure, entitlements (noting all Held Environmental Water is modelled as irrigation use) and some system operation rules introduced post-2008, the Current Conditions Scenario is the same as the 2008/09 Scenario.

This scenario is used to estimate diversions **prior** to implementing the floodplain harvesting licensing framework so as to assess whether there has been growth in total diversions compared to the plan limit. It will require ongoing monitoring by DPE to ensure that development levels are kept up to date and to assess whether there have been behaviour changes, for example changed cropping practices and efficiency of irrigation.

### 3.2.3 Eligible Development Scenario

This scenario is used to estimate the floodplain harvesting that would have occurred **with only eligible infrastructure**. This is used to determine the distribution of floodplain harvesting entitlements, as was described in Section 2.4.

All information on eligible works is provided by the NSW Natural Resources Access Regulator (NRAR) who conducted the eligible works assessment against the eligibility criteria in the policy on behalf of the department.

It is the same as the 2008/09 Scenario, with the inclusion of any eligible infrastructure that was approved, but not yet constructed, in 2008/09. For the Namoi Valley, there were some works that were approved in 2008 but not yet constructed.

### 3.2.4 Plan Limit Compliance Scenarios

Plan limit compliance is assessed using two model scenarios to assess compliance at two scales – individual and valley.

#### Individual entitlements (Individual Impact Scenario)

Entitlements were calculated by analysing the results from the Eligible Development Scenario using a utility program to simulate the effect of the proposed accounting rules on floodplain harvesting<sup>8</sup>. The utility estimates the entitlement which would be required, in conjunction with the accounting rules, to achieve any required impact on long-term floodplain harvesting diversions.

The utility assumes that the same impact should apply to each individual entitlement. To test this, the entitlements and proposed accounting rules have been added into the Eligible Development Scenario to create a new scenario, the Individual Impact Scenario.

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<sup>8</sup> The utility program was developed outside of the Namoi Valley model for efficiency (run-time) reasons.



This process of designing the entitlement and assessing the impact of the rules takes into account the partial rainfall runoff harvesting exemption. The exemption is described in Section 2.5.

### Valley scale (Valley Compliance Scenario)

This scenario uses the Current Conditions Scenario and proposed accounting rules and individual floodplain harvesting entitlements in accordance with the policy to demonstrate modelled diversions comply with the plan limit, which is set for the valley.

This scenario is not used to report on individual impacts as there may be other issues, such as entitlement changes, that cause changes in results compared to the Eligible Development Scenario.

## 3.3 Data for scenarios

The sources and characteristics of data for each model component are detailed in the companion Model Build report. Most of the data discussed relates to model calibration (data such as climate, inflows, water diversions, transmission losses) and are therefore the same for each scenario. The model components that may vary between scenarios are:

- distribution of entitlements
- the level of irrigation infrastructure development in place
- crop planting decision assumptions
- management rules at the relevant point in time.

The data required for each of these components is summarised below.

### 3.3.1 Entitlements

The distribution of entitlements information comes from departmental databases. All scenarios use the distribution of shares associated with the development conditions associated with that scenario. The Cap and the Water Sharing Plan scenarios use the distribution of shares as at 1993/94 and 2000 respectively. The Eligible Development Scenario and the 2008/09 Scenario uses the distribution of shares as at 1 July 2009. The Current Conditions Scenario uses the distribution of shares as at 30 June 2018. The total volumes are very similar (Table 4).

The small volumes of use associated with domestic and stock licences are represented implicitly in the river transmission losses within the model.

Table 3. Total Valley scale entitlements for scenarios (Shares)

Entitlement type	Cap Scenario	WSP Scenario	2008/09 Scenario	Current Conditions Scenario
Local Water Utilities	2,786	2,786	2,786	2,786
Domestic and stock	2,151	2,151	2,151	2,151
High security	4,084	4,084	4,084	4,084
General security	257,395	257,816	258,402	257,747
Supplementary	-	113,880	115,480	114,227
Groundwater	73,918	73,918	73,918	73,918

Approximately 13.7 GL of entitlement has been purchased by the Commonwealth government for environmental water use<sup>9</sup> in the Namoi Valley. This entitlement has been represented as a consumptive water use with an irrigation pattern in the Current Conditions Scenario as not enough is known about how this Held Environmental Water (HEW) will be used for environmental watering. This issue has been addressed in other reporting for Basin Plan compliance. We plan to explicitly represent how HEW is used in future versions of the model.

## Development levels for scenarios

The farm development levels refer to the physical attributes of an irrigation property that provide ongoing capability to use water, specifically

- the area of the property that can be irrigated
- the additional area from which rainfall runoff can be harvested
- volumetric capacity of on-farm storages
- the rate at which water can be pumped both from the river as well as separately for floodplain harvesting.

Table 4 summarises the data types and sources of information used in each scenario.

Table 4. On-farm development data types and sources of information used for each scenario

Farm development attribute	(Plan Limit) Cap	(Plan Limit) WSP	Eligible Development and Individual Impacts	Current Conditions and Plan Limit Compliance	Data sources
On-farm storage capacity (GL)	30 June 1994	30 June 2000	3 July 2008 <sup>1</sup>	2020	LIDAR / storage survey
On-farm storage pump capacity (ML/d)	30 June 1994 <sup>4</sup>	30 June 2000	3 July 2008 <sup>1</sup>	2020	NRAR works data <sup>2</sup>
Floodplain harvesting intake rate (ML/d)	30 June 1994 <sup>4</sup>	30 June 2000	3 July 2008 <sup>1</sup>	2020	NRAR works data <sup>2</sup>
Installed river pump capacity (ML/d)	30 June 1994	30 June 2000	3 July 2008	2014	Farm survey <sup>3</sup> / WaterNSW records
Maximum irrigable area (ha)	30 June 1994	30 June 2000	3 July 2008	2014-2020	Farm survey <sup>3</sup> and remote sensing
Undeveloped farm area (ha)	30 June 1994	30 June 2000	3 July 2008	2014-2020	Farm survey <sup>3</sup> and remote sensing

<sup>1</sup>Eligible works as defined by NRAR, which may include some storages developed after 2008

<sup>2</sup> NRAR works data are data collected under the policy, primarily from site inspections

<sup>3</sup> The Farm Survey dataset covers water years from 1993/94 to 2012/13 but does not include all years in between and does not specify exact dates. It did include 1993/94 and 99/00 so we have used that data for the Cap and Water Sharing Plan scenarios.

<sup>4</sup> Eligible works associated with storages existing in 1994.

<sup>9</sup> There is 30,359 ML of licence shares are held by the NSW and Commonwealth governments for environmental water use as at 30 June 2020. The combined total represents approximately 15% of the total shares in the Namoi regulated river system.

The valley totals for each attribute used for each scenario are summarised in Table 5. They represent all regulated water user nodes in the Namoi regulated river.

Table 5. On farm development levels for scenarios

Farm development description	(Plan Limit) CAP	(Plan Limit) WSP	Eligible Development	Current Conditions
On-farm storage capacity (ML)	139,579	173,178	208,824	218,245
On-farm storage pump capacity (ML/d)	21,692	25,333	31,980	30,709
Installed river pump capacity (ML/d)	9,932	11,188	12,271	12,691
Maximum irrigable area (ha)	68,174	69,477	93,449	97,258

## On farm storage capacity

Early on, we identified that floodplain harvesting results are very sensitive to on farm storage capacities. Significant effort has been put into improving the accuracy of this information using LIDAR or photogrammetry data with verification against a sample of surveyed storages (Morrison and Chu, 2018). Where survey data were available, it was reviewed as part of a submissions process and adopted where suitable. This process, including the function of the Healthy Floodplains Review Committee, is further described in the *Implementation Guideline* (DPIE, 2020).

NRAR determined which of the storages were eligible under the policy and these were used in the Eligible Development Scenario.

We determined which storages existed at earlier dates by using Landsat satellite imagery.

## Pump capacity

Installed river pump capacity was based on farm survey data for all floodplain harvesting properties, and on earlier survey data for other relatively small water users.

On-farm storage pump capacity was estimated using NRAR works data. These data are based on site inspections that recorded the size, type of work and any upgrades. For a given pump type and size, a standard set of rates was adopted to determine the total on-farm storage pump capacity<sup>10</sup>.

NRAR determined which pumps should be included in the Eligible Development Scenario. The on-farm storage capacities for earlier dates were based on an analysis of storages that existed at those dates. Where there was no evidence that a storage existed at a date, the capacity of the lift pumps associated with the storage was not included in the Plan Limit Scenario. Farm survey data were also reviewed for information on pump upgrades.

The rate of intake of floodplain harvesting water into the property is generally set to the on-farm storage pump rate. A lower rate is applied where the intake is restricted by pipe capacities, and a higher rate to represent gravity filling of significant buffer storages<sup>11</sup>.

A worked example, with diagram, to describe how the storage capacity, pump capacity and floodplain harvesting capacity were determined for different scenarios, is provided in Appendix B.

<sup>10</sup> Rates are described in Appendix G of the companion Model Build Report (DPIE Water, 2021a).

<sup>11</sup> These rate exceptions are further described, with examples, in Appendix G of the companion Model Build Report (DPIE Water, 2021a).

## Developed and undeveloped areas

The developed area refers to the area developed for irrigated cropping. Both developed and undeveloped areas were based on farm survey data for all floodplain harvesting properties.

The rainfall runoff from each type of area is configured separately in the model as described in the companion Model Build report (DPE Water 2022a)

Remote sensing has been used to check developed and irrigated areas for selected properties and, where appropriate, to review submissions to the Healthy Floodplains Review Committee as part of the farm-scale validation process. This process is described in the *Implementation Guideline* (DPIE, 2020). For other relatively small water users, we adopted the values used in the existing IQQM Water Sharing Plan model, which were based on earlier survey data.

### 3.3.2 Crop model and planting decisions

Irrigation water use is estimated using a crop model component which estimates (i) how much area is planted in a water year based on water availability, and (ii) irrigation water demand based on daily climate data. The crop area planting component was derived by combining published data, farm surveys and remote sensing as described in the companion Model Build report.

The crop model and planting decisions parameters and settings are based on those in the 2008/09 Scenario described in the companion Model Build report, with adjustments as appropriate to improve the model's reproduction of observed behaviour.

### 3.3.3 Management rules

All scenarios, except the Cap Scenario, include the 2012 Namoi WSP rules as described in the companion Model Build report.

The Cap Scenario includes a range of water management rules that pre-date the Namoi WSP, including water access conditions, licences, and account management rules.

The proposed floodplain harvesting accounting rules are included in the two scenarios that test the impact of these rules – i.e. the Plan Limit Compliance Scenario and the Individual Impact Scenario.

## 4 Results

The key results from running the scenarios through the Namoi Valley model relate to long term average annual diversions prior to and with the estimated entitlements. These are reported in summary tabular and graphical format at valley scale in this section.

Diversions are reported for each entitlement category for the 1895 to 2009 Basin Plan comparison period and include annual time series graphs for total diversions. From this reporting, we are able to provide some commentary on key differences between scenarios.

The versions of the model used to run the scenarios are listed in Appendix C.

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## 4.1 Plan Limit Scenario results

The Water Sharing Plan Scenario has a smaller long-term average annual total diversion than the Cap Scenario (Table 6). This means that the Water Sharing Plan Scenario defines the plan limit and is referred to hereafter as the Plan Limit Scenario.

Table 6. Long-term average annual total diversion under the Plan Limit Cap scenario

Diversion component	Cap Scenario (GL/year)	WSP Scenario (GL/year)
Local water utility, domestic and stock, and high security	2.6	2.6
General security	135.5	142.0
Supplementary access	68.5	34.4
Floodplain harvesting	33.9	46.5
Overbank flow harvesting	16.9	25.2
Non-exempt rainfall runoff harvesting	17.0	21.3
Exempt rainfall runoff harvesting	12.6	16.2
<b>Total (less exempt RR)</b>	<b>240.3</b>	<b>225.6</b>
<b>Total</b>	<b>252.9</b>	<b>241.7</b>

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## 4.2 Growth in use assessment

The Plan Limit Scenario and Current Conditions Scenario were both configured in the Namoi Valley model and run for the period of climate record (1891 to 2020). Results for the benchmark climate period defined in the Basin Plan (1 July 1895 to 30 June 2009) for categories of diversions were calculated and are summarised in Table 7.

Table 7. Modelled long-term (1895 to 2009) average annual diversions (GL/year) under the Plan Limit and Current Conditions scenarios to determine growth in use

Diversion component	Plan Limit Scenario (GL/year)	Current Conditions Scenario (GL/year)
Local water utility, domestic and stock, and high security	2.6	2.6
General security	142.0	142.2
Supplementary access	34.4	42.1
Floodplain harvesting	46.5	51.3
Overbank flow harvesting	25.2	30.6
Non-exempt rainfall runoff harvesting	21.3	20.7
Exempt rainfall runoff harvesting	16.2	21.0
<b>Total (less exempt RR)</b>	<b>225.6</b>	<b>238.3</b>
<b>Total</b>	<b>241.7</b>	<b>259.3</b>

Note: diversion component results have been rounded, and totals may not exactly match.

These results show that there has been significant growth in supplementary access and floodplain harvesting, and general security water use has not increased significantly. Supplementary access has increased by 7.7 GL/year (22%). With the tailwater exemption in place, floodplain harvesting has increased by 4.8 GL/year (10%) above that for the Plan Limit Scenario, and the overall growth in water use for the regulated river system has been 12.7 GL/year (5.6%).

Without the tailwater exemption in place, these results show that floodplain harvesting has increased by 9.6 GL/year above the level in the Plan Limit Scenario, and overall water use has increased by 17.6 GL/year.

## 4.3 Plan Limit compliance results

The implementation of the Plan Limit Compliance Scenario (Section 3.2.4) brought the floodplain harvesting component of the Namoi regulated river system to Plan Limit levels as reported in Table 8. As other diversion components still exceed Plan limit levels and are higher than the growth-in-use thresholds set out in clause 31(2) of the *Namoi WSP*, a growth in use adjustment was also required for diversions pumped directly from the river. In this scenario we have assumed that this was implemented by reducing the annual available water determinations for supplementary water access licences from 100% to 55%. The growth in use action may change in response to the public submission process.

Table 8. Modelled long-term (1895 to 2009) average annual diversions (GL/year) under the Plan Limit Compliance Scenario compared to the Plan limit

Diversion category	Plan limit (GL/year)	Plan Limit Compliance Scenario (GL/year)
Local water utility, domestic and stock, and high security	2.6	2.6
General security	142.0	144.0
Supplementary access	34.4	32.3
Floodplain harvesting	46.5	46.0
Overbank flow harvesting	25.2	24.9
Non-exempt rainfall runoff harvesting	21.3	21.1
Exempt rainfall runoff harvesting	16.2	23.4
<b>Total (less exempt RR)</b>	<b>225.6</b>	<b>225.2</b>
<b>Total</b>	<b>241.7</b>	<b>248.7</b>

The entitlements and account management rules will not have impacts on floodplain harvesting diversions in every year. In some years there will be no impact. The impacts will typically be during extended wet periods when water accounts reach zero.

The variable impacts in total annual diversions over the benchmark climate period (1895 to 2009) are shown in Figure 3. The columns show the year-to-year variation with little apparent variation for most years. This shows that the greatest impact is apparent during wet periods when the accounting rules restrict diversions after the first wet year. Examples of this are apparent during mid-1900s, early parts of the 1950s, 1970s and late 1990s.

Figure 3. Modelled annual floodplain harvesting under the Current Conditions and Plan Limit Compliance scenarios over the period 1895 to 1950

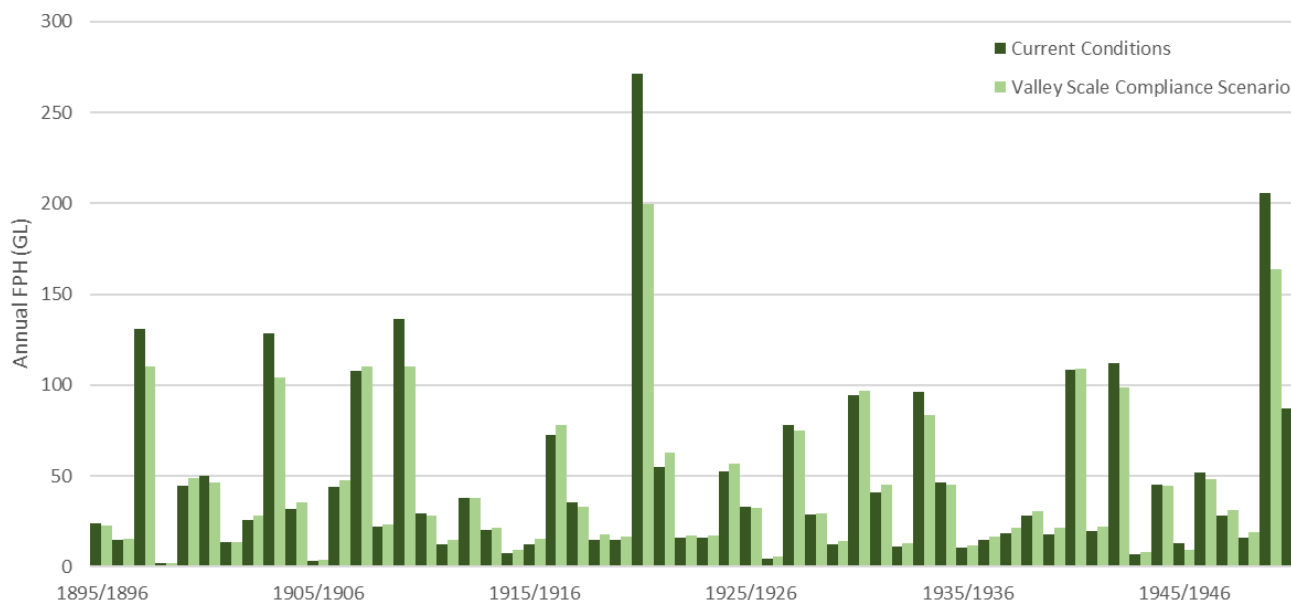
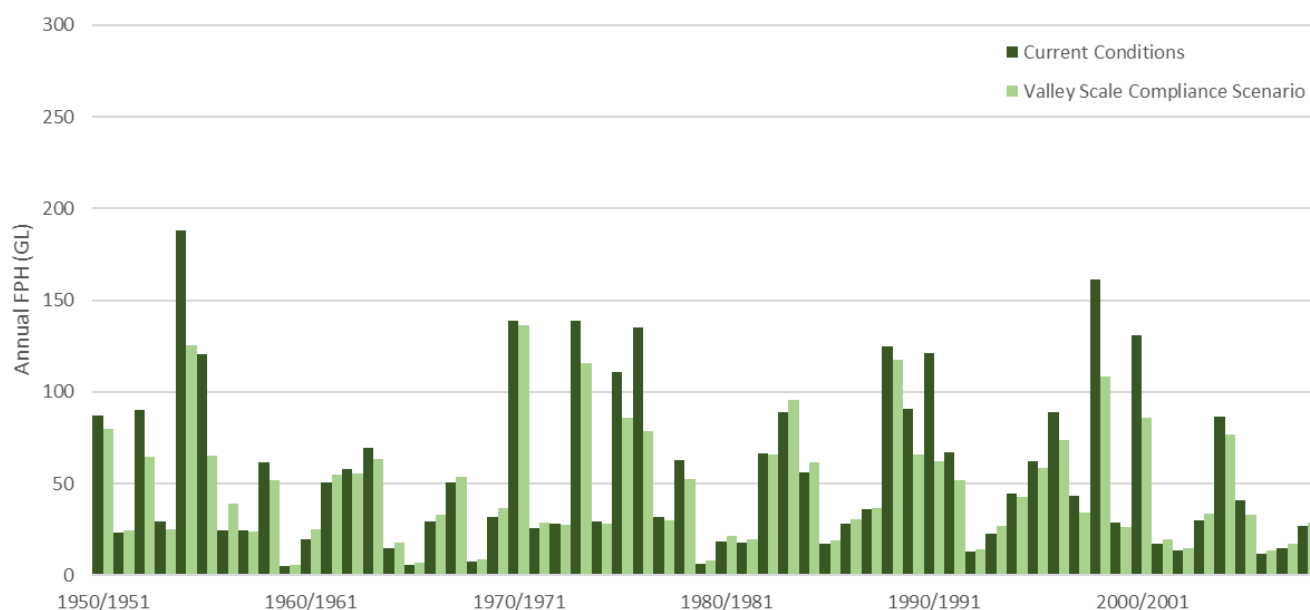


Figure 4. Modelled annual floodplain harvesting under the Current Conditions and Plan Limit Compliance scenarios over the period 1950 to 2009



## 4.4 Entitlement distribution

The entitlements have been designed so that the impacts required to remove growth in diversions above the plan limit are shared equitably. Impacts on individuals were tested using the Plan Limit Individual Impacts Scenario<sup>12</sup>. This test allowed us to isolate all other changes which may have occurred in recent years (e.g. changes in other entitlement products). The results confirm that the relative impacts on individual properties are very similar over the long-term period.

Under implementation of this scenario, individual properties have a reduction in the non-exempt floodplain harvesting diversion component over the 1895 to 2009 reporting period of up to 14% to ensure floodplain harvesting diversions are returned within their plan limit level. Figure 4 shows the change in percentage of non-exempt floodplain harvesting diversions pre and post the licensing framework (in both cases using the Eligible Development Scenario) across the 114 properties or groups of properties<sup>13</sup>. The model indicates that some properties have impacts which vary from the overall 14% reduction. We are reviewing the modelling to ensure that impacts are distributed equitably.

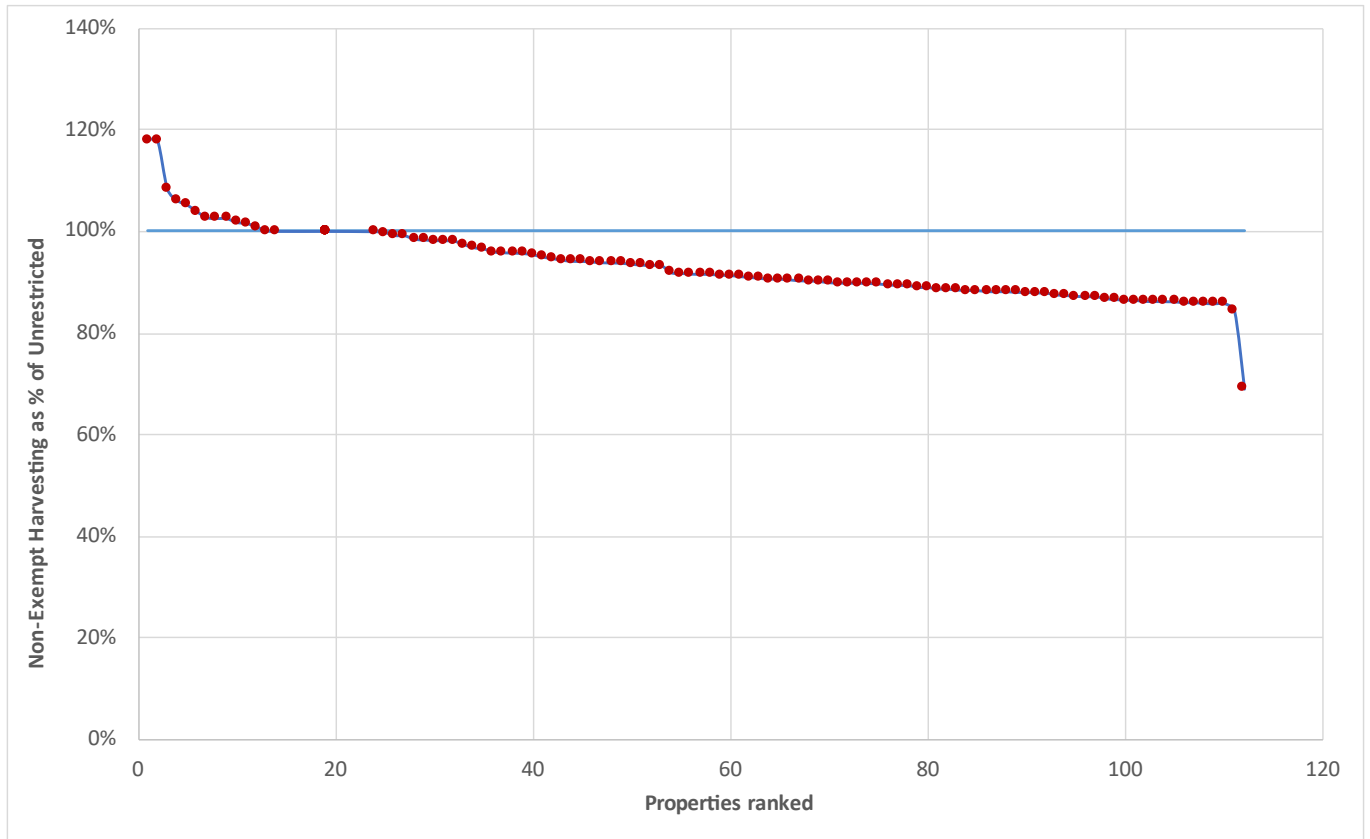
<sup>12</sup> As described in Section 3.2.4, the Individual Impacts Scenario was created by adding the entitlements and accounting rules to the Eligible Development Scenario.

<sup>13</sup> Those Irrigation farms that were assessed as eligible for floodplain harvesting entitlements are represented in the model individually or as a group. The remaining, generally smaller, farms and other water users have been aggregated in the model within the reach they are located. As a result, 114 individual eligible floodplain harvesting farms within Namoi WSP area were represented using Irrigator nodes. (Sourced from Section 6.2.2 DPE Water 2022a)



We have found that some properties have impacts which are smaller than the overall reduction targeted. This is because when we model the rules, the reduction in upstream diversions increases the water availability for downstream properties.

Figure 5. Distribution of change in floodplain harvesting diversions for individual properties under the Individual Impacts Scenario.



Note: the x-axis is the number of individual eligible properties represented in the Namoi Valley model (each data point represents individual property as modelled)

# 5 Conclusions and future work

Water sharing plans made under the *Water Management Act 2000* define how the limits to extractions are to be calculated within NSW water sources. The WSPs include an estimate of these limits which are also used as estimates of the Baseline Diversion Limit (BDL) and included in the Basin Plan. The Basin Plan allows for BDL estimates to be revised whenever a demonstrably better estimate is available.

The river system models used for the original WSPs and BDL estimates represent river diversions and flows to the best available standard of accuracy at that time and were independently reviewed as fit for that purpose; however, the floodplain harvesting diversions were not well represented.

As part of the *NSW Floodplain Harvesting Policy*, there has been significant investment in data and modelling to quantify floodplain harvesting more accurately. This has been incorporated into the new Namoi Valley Source model. The development of the model has been described in the companion Model Build report (DPE Water, 2022a).

The model has been used to create an updated estimate of the Long-Term Average Annual Extraction Limit (LTAAEL), or plan limit, as defined by the Namoi WSP. This model will also be used to determine regulated river floodplain harvesting entitlements in the Namoi regulated river system. Through the analyses in this report, we have demonstrated that the proposed entitlements and accounting rules can equitably manage floodplain harvesting such that total diversions are managed within the required limits.

The work undertaken as part of implementing the policy has substantially reduced uncertainty in our estimates for floodplain harvesting. Despite this improvement, uncertainty can be further reduced with better information. The companion Model Build report (DPE Water, 2022a) lists several areas of future work. Four key areas of improvement are:

- Review of floodplain harvesting measurement data following implementation of the policy to determine whether any further model improvements are required
- water use data from the current upgrading of water use meters across the Namoi Valley
- Ongoing updates of the Current Conditions Scenario, including consideration of irrigation behaviour changes and management of held environmental water
- Better representation of return flows from floodplains to river channels. This will require further research to develop a methodology for addressing this limitation in the models.

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## Legislation, policies and plans

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(NSW) *Water Management Act 2000* No 92. Last updated 2020.

<https://legislation.nsw.gov.au/~view/act/2000/92/>

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*NSW Floodplain Harvesting Policy*. First published May 2013, updated September 2018.

[https://www.industry.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0017/143441/NSW-Floodplain-harvesting-policy.pdf](https://www.industry.nsw.gov.au/__data/assets/pdf_file/0017/143441/NSW-Floodplain-harvesting-policy.pdf). Referred to in this report as the policy

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[https://www.industry.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0003/146307/Draft-floodplain-management-plan-lower-namoi-background.pdf](https://www.industry.nsw.gov.au/__data/assets/pdf_file/0003/146307/Draft-floodplain-management-plan-lower-namoi-background.pdf)

*Guideline for the implementation of the NSW Floodplain Harvesting Policy*. June 2020. NSW Department of Planning, Industry and Environment.

[https://www.industry.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0007/272338/guideline-for-implementation.pdf](https://www.industry.nsw.gov.au/__data/assets/pdf_file/0007/272338/guideline-for-implementation.pdf)

## Reports and journal articles

DI (2018a) *Implementing the NSW Floodplain Harvesting Policy – Consultation paper*, NSW Department of Industry- Lands & Water, March 2018.

[https://www.industry.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0009/318879/floodplain-harvesting-policy-consultation-paper.pdf](https://www.industry.nsw.gov.au/__data/assets/pdf_file/0009/318879/floodplain-harvesting-policy-consultation-paper.pdf)

DI (2018b) *Outcomes paper from the NSW Floodplain Harvesting Consultation*. June 2018. NSW Department of Industry – Lands & Water.

(DI, 2018c) *Water Reform Technical Report: Derivation of LTDLE factors in NSW* May 2018 NSW Department of Industry – Lands & Water.

[https://www.industry.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0019/162181/technical-paper-derivation-technical-factors-nsw.pdf](https://www.industry.nsw.gov.au/__data/assets/pdf_file/0019/162181/technical-paper-derivation-technical-factors-nsw.pdf)

DPIE (2020) *Guideline for the implementation of the NSW Floodplain Harvesting Policy*. June 2020. NSW Department of Planning, Industry and Environment.

[https://www.industry.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0007/272338/guideline-for-implementation.pdf](https://www.industry.nsw.gov.au/__data/assets/pdf_file/0007/272338/guideline-for-implementation.pdf)

DPE Water (2022a). *Building the Namoi Valley river system model: Conceptualising, constructing and calibrating the DPIE Water river system model for the Namoi Valley*. NSW Department of Planning, Industry and Environment – Water.

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[https://www.industry.nsw.gov.au/\\_data/assets/pdf\\_file/0010/271936/Storage-bathymetry-model-update-and-application-gwydir.pdf](https://www.industry.nsw.gov.au/_data/assets/pdf_file/0010/271936/Storage-bathymetry-model-update-and-application-gwydir.pdf)

# Appendix A Illustration of accounting rules

Table 9 illustrates how the proposed 5-yearly accounting rules would work over a short term (17 years), noting that the actual design of entitlements uses long-term results. The example does not include some of the account initialisation rules.

The example is for an entitlement of 3,850 ML. Table 9 shows, for every year:

- unrestricted usage is the volume (ML/year) that could be harvested given eligible works, if no rules were in place (column A)
- opening and closing accounts keep track of the accounting rules; the account limit of 500% of entitlement is applied (columns B and D)
- restricted usage is how much could have been harvested with eligible works after the accounting rules are in place (column C)

Table 9. Example of annual floodplain harvesting (ML/year) under 5 year accounting rules

Year	Unrestricted usage (based on eligible works) (A)	Opening account (B)	Restricted usage (C)	Closing account (D)
1	2,658	19,250	2,658	16,592
2	586	19,250	586	18,664
3	90	19,250	90	19,160
4	0	19,250	0	19,250
5	13,592	19,250	13,592	5,658
6	0	9,508	0	9,508
7	11,979	13,358	11,979	1,379
8	0	5,229	0	5,229
9	10,615	9,079	9,079	0
10	8,344	3,850	3,850	0
11	407	3,850	407	3,443
12	0	7,293	0	7,293
13	4,723	11,143	4,723	6,421
14	138	10,271	138	10,133
15	0	13,983	0	13,983
16	6,838	17,833	6,838	10,994
17	226	14,844	226	14,618
<b>Total</b>	<b>60,197</b>		<b>54,166</b>	

Column (B) is calculated by adding 100% of the entitlement to the closing account balance from the previous water year, with the maximum balance limited to 500% (5 times 3,850 = 19,250 ML).

Column (C) is calculated by taking the lesser of the unrestricted usage at column (A) or the opening account balance for that year at column (B).

Column (D) is calculated by subtracting the restricted usage at Column (C) from the opening account balance for that year at column (B).

This entitlement, in conjunction with the rules, resulted in total floodplain harvesting over the period being reduced by 10%. This is a hypothetical example, for illustrative purposes. In reality, the entitlement volumes and the rules have been determined so that the reduction in floodplain harvesting is sufficient to return total valley diversions back within the plan limit in valleys where that is required.

You can see that in most years the accounting rules have no impact on harvesting; it is only in a cluster of wetter years that there are impacts.

# Appendix B Worked example for development levels (scenarios)

The following describes an example property where there are multiple storages and floodplain harvesting intake points. Figure 5 is a schematic of the property. Data in this example are hypothetical, for the purposes of illustrating the modelling method.

The property has multiple works:

- Two eligible storages with a total estimated pump capacity of 720 ML/day based on the works installed. Both storages were present at June 1994.
- One ineligible storage built after 2008. The lift pumps associated with this storage have an estimated combined capacity of 360 ML/day.
- There are multiple pipes which bring water in from the channels into the developed part of the farm and allow delivery to the storages. The total capacity of these pipes was estimated at 768 ML/day assuming a 0.2m head.

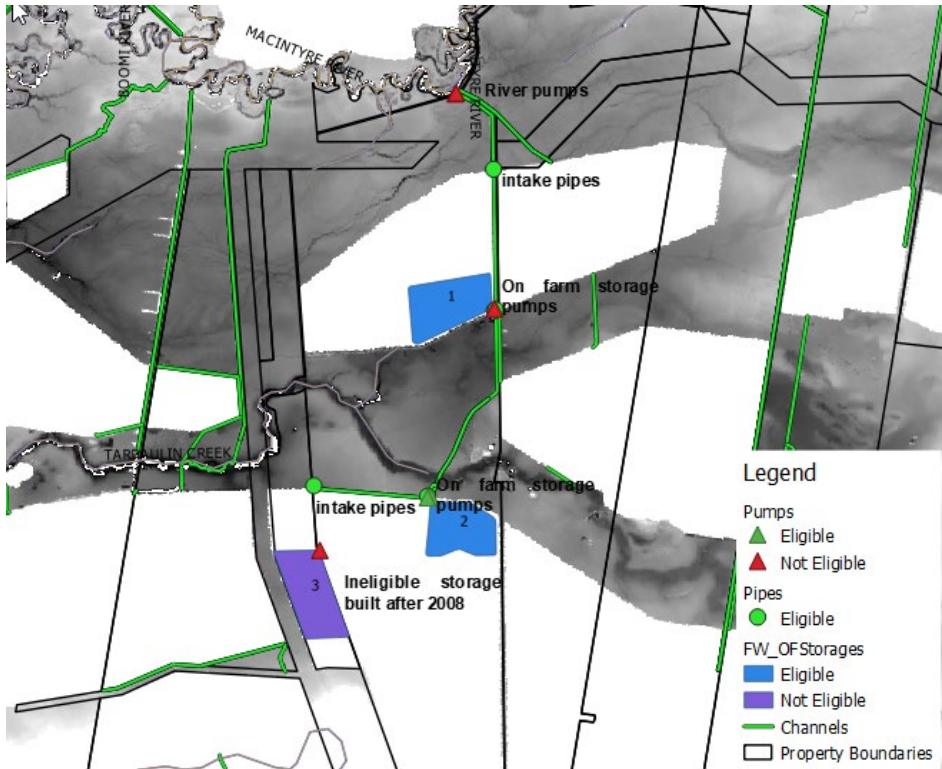
For the Eligible Development Scenario, the on-farm storage pumps were considered the limiting factor. For the Current Conditions Scenario, the intake pipes are smaller in capacity and hence are adopted for the intake rate (Table 10).

Table 10. Hypothetical property works and their capacities under the various model scenarios

Parameter	Plan Limit – Cap and WSP Scenarios	Eligible Development Scenario	Current Conditions Scenario
On farm storage capacity (ML)	6,520	6,520	10,822
On farm storage pumps (ML/d)	720	720	1,080
Floodplain harvesting intake rate (ML/d)	720	720	768

The capacity of pumps and pipes are all determined using farm inspection works data provided by NRAR and standard rates for each type and size of work. This is described further in Appendix G4 of the companion Model Build report (DPE Water, 2022a). In some cases, there was additional information about upgrades to pumps on storages. This information was sometimes contained in the farm survey or NRAR notes; these were reviewed and adopted where relevant for historical scenarios.

Figure 6. Example property with multiple storages and intakes





# Appendix C Model Version

All Scenarios have been developed with the following version of the model:

File Name - NAMO\_CAL\_264\_5.17.0\_report\_results.nightlybuild.rsproj

Source Version - 5.16.0.12332 with continuous accounting fixes LT run

Each Scenario is implemented by selecting a different Scenario input set contained within this file. These are as follows.

Scenario	Filename
Plan limit (Cap Scenario)	LongTerm_Scenarios> CAP_93_94>GW_TSR_Flux> Upper_Namoi_Fixes> AutoCal_RiskFuncs> PD_Risk_Cali> Change_Eff_CAP> Infra_Data_Update_20221010_v11> Dam_Initial_Conditions> CAP_PD_Summer_Func> Factored_OFS
WSP Scenario (BDL)	LongTerm_Scenarios> BDL_99_00>GW_TSR_Flux> Upper_Namoi_Fixes> AutoCal_RiskFuncs> PD_Risk_Cali> Change_Eff_BDL> Infra_Data_Update_20221010_v11> Dam_Initial_Conditions> BDL_PD_Summer_Func
Eligible Development	LongTerm_Scenarios> BDL_99_00>GW_TSR_Flux> Upper_Namoi_Fixes> AutoCal_RiskFuncs> Infra_Data_Update_20221010_v11>FPH_Rules
Current Conditions Scenario	LongTerm_Scenarios>CurrentConditions_15_16> W_TSR_Flux> Upper_Namoi_Fixes> AutoCal_RiskFuncs> PD_Risk_Cali> Change_Eff> Dam_Initial_Conditions>HEW_IRRI>FPH_Rules
Plan Compliance Scenario	LongTerm_Scenarios>CurrentConditions_15_16> W_TSR_Flux> Upper_Namoi_Fixes> AutoCal_RiskFuncs> PD_Risk_Cali> Change_Eff> Dam_Initial_Conditions>HEW_IRRI>FPH_Rules>Minus_14>Supp_AWD_Reduction>Supp_AWD_Minus_45
Current infrastructure with floodplain harvesting rules	LongTerm_Scenarios>EligibleWorks_08_09_built_GW_TSR_Flux>Upper_Namoi_Fixes>AutoCal_RiskFuncs >Minus_14>Supp_AWD_Reduction>Supp_AWD_Minus_45

# Appendix D Glossary and abbreviations

Table 11. Abbreviations and acronyms

Acronym	Expansion
BDL	Baseline diversion limit
LTADEL	Long-term average annual extraction limit
LTDLE	Long-term diversion limit equivalent (factors)
NRAR	NSW Natural Resources Access Regulator
SDL	Sustainable diversion limit
WSP	Water Sharing Plan

Table 12. Terms

Term	Description
2008/09 Scenario	Model baseline scenario representing floodplain harvesting works in place in 2008/09. The derivation of this baseline scenario is described in companion Model Build report
2020/21 water year	A water year runs from 1 July to 30 June, in this example from 1 July 2020 to 30 June 2021. A slash is used to identify this and to be consistent with Basin legislation. (2020-2021 would refer to the range of years, 2020 and 2021)
Cap Scenario	Model scenario that reflects agreements made under the Murray Darling Basin Ministerial Council Cap on diversions. Candidate for the Plan Limit Scenario (details in Table 2)
Current Conditions Scenario	Model scenario that uses the best available information on most recent known levels of irrigation infrastructure and entitlements (details in Section 3.2.2)
Eligible Development Scenario	Model scenario used to estimate the floodplain harvesting that would have occurred with only eligible infrastructure (details in Section 3.2.3)
Long-term average annual extraction limit (LTADEL)	The upper limit on the average of annual extractions from the water source over the period for which an assessment is carried out. (Source: <a href="https://www.waternsw.com.au/customer-service/service-and-help/tips/glossary#l">https://www.waternsw.com.au/customer-service/service-and-help/tips/glossary#l</a> )
Long-term diversion limit equivalent (LTDLE) factors	Factors used to describe the proportion of the Plan Limit that a licence represents. (DI 2018c)
Plan Limit	The authorised long-term average annual extraction limit as defined in the Water Sharing Plan
Plan limit compliance	Compliance with the plan limit, which is assessed using long-term modelling.

Term	Description
Plan Limit Scenario	Model scenario that results in the lower long-term average diversions from either the conditions set out in the Water Sharing Plan or agreements made under the Murray Darling Basin Ministerial Council on diversions (derivation for each valley described in Section 3). Selected from the Cap Scenario and the WSP Scenario
The policy	Shortened term for the <i>NSW Floodplain Harvesting Policy</i>
Water Sharing Plan (WSP) Scenario	Model scenario that reflects the level of development specified in the Water Sharing Plan. For the Namoi regulated river system, this is the level of development at June 2000 and management arrangements set out in the Namoi WSP. Candidate for the Plan Limit Scenario (details in Table 2)