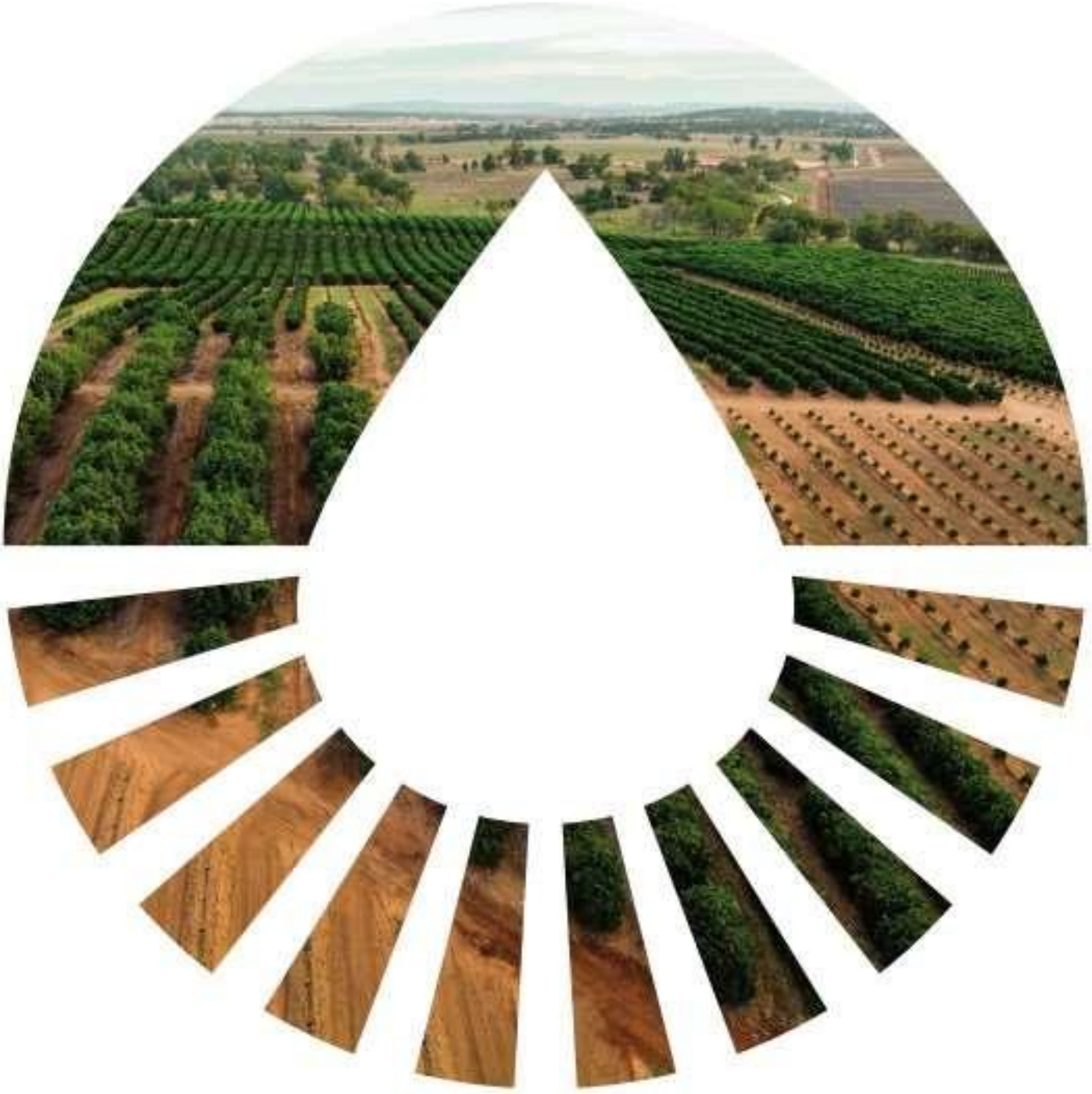
2023

Barren Box Project

Annual Environmental Management Report



Murrumbidgee Irrigation

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Document authorisation

Authorisation	Name	Position	Date
Endorsed by:	Alan Shea Mark Dance Lindsay Golsby-Smith	General Manager – Asset Performance & Delivery General Manager – Maintenance & Logistics General Manager – Customer Services	October 2023
Approved by:	Brett Jones	Managing Director & Chief Executive Officer	October 2023

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Abbreviations

ACR	Annual Compliance Report
Act	*Environmental Planning and Assessment Act 1979* (NSW)
AEMR	Annual Environmental Management Report
ANZECC	Australian and New Zealand Environment and Conservation Council
Applicant/ Consent owner	Murrumbidgee Irrigation Limited
BBS	Barren Box Storage
BBSW	Barren Box Storage and Wetland
Brays Dam	Current name for En-route Storage (term used in EIS)
CSC	Carrathool Shire Council
CSIRO	Commonwealth Scientific Investigation and Research Organisation
Department	NSW Department of Infrastructure, Planning and Natural Resources (for original consent); subsequently: Department of Planning, Department of Planning and Environment (current)
DEC – now EHG	NSW Department of Environment and Conservation (incorporating the EPA and former National Parks and Wildlife Service); now called Environment and Heritage Group (part of Department of Environment and Planning).
development	the development as described in DA-101-4-2004-i, and all additional information submitted in support of that application. This includes the works associated with Barren Box Swamp, the Wah Wah main and the En-route Storage Facility
Director-General/ D-G	Director-General of the NSW Department of Infrastructure, Planning and Natural Resources, or delegate (now Department of Planning and Environment)
DPE	NSW Department of Planning and Environment
DPE BCD	Biodiversity, Conservation and Science (part of the EHG)
dust	any solid material that may become suspended in air
EC	Electrical Conductivity
EHG	Department of Environment and Planning - Environment and Heritage Group.
En route storage	EIS terminology – now known as Brays Dam
EPA	NSW Environment Protection Authority (formerly part of the Department of Environment and Conservation)
EIS	Amended Environmental Impact Statement: Barren Box Swamp Project, NSW, Volumes One, Two and Three prepared by URS Australia Pty Ltd and dated December 2004
EPL	Environment Protection Licence issued under the *Protection of the Environment Operations Act 1997* (NSW)
ER	Environmental Representative

ETo	Evapotranspiration (crop reference)
EWO	Environmental Water Officers (DPE EHG)
GCC	Griffith City Council
GIS	Geographic Information System
GPWSD	Gunbar Private Water Supply District
ha	hectare(s)
HSC	Hay Shire Council
LMCF	Lower Mirrool Creek Floodway
LCR	Licence Compliance Report
LWMP	Land and Water Management Plan
Minister	NSW Minister for Infrastructure and Planning (now DPE), or delegate
MDBP	Murray Darling Basin Plan
MDBPA	Murray Darling Basin Plan Authority
MI	Murrumbidgee Irrigation Limited
MIA	Murrumbidgee Irrigation Area
ML	Megalitre
NRAR	Natural Resources Access Regulator
OEMP	Operational Environmental Management Plan
operation	any activity that results in the use of the Barren Box Swamp Project as described in DA-101-4-2004-i, including the use of the Intermediate and Active Storage Areas of Barren Box Swamp, the enlarged Wah Wah Main and En-route storage facility for the purposes of capturing, storing or diverting water
Principal Certifying Authority	the Minister or an accredited certifier, appointed under section 109E of the Act to issue a Part 4A Certificate as provided under section 109C of the Act
Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
site	the land to which this consent applies
t	tonnes
µS/cm	micro siemens per centimetre
µg/L	micrograms per litre
WAL	Water Access Licence
water licence	Licence issued under the *Water Act 1912* (NSW)
WONs	Weed of national significance as identified under NSW's Weedwise and supporting legislation.
WWID	Wah Wah Irrigation District
WWM	Wah Wah Main – a channel system downstream of BBSW
WWSD	Wah Wah Stock & Domestic

1 Project details

Project Name:	Barren Box Swamp Project
Project Application Number:	DA-101-4-2004-i
Description of Project:	The construction and operation of the Barren Box Swamp Project "the development" as part of the operation of an integrated irrigation scheme within the Murrumbidgee Irrigation Area, and including: ▪ the splitting of the Barren Box Swamp into three distinct cells; ▪ an active storage cell covering 1,230 hectares with a storage volume of 24,000ML at full supply level (30% of the current Swamp storage volume); ▪ an intermediate storage cell covering 320 hectares with an effective storage volume of 4,000ML (10% of the current storage volume); ▪ the restoration of a more natural flooding regime to the remaining 1,500 hectare area of the cell for the purposes of rehabilitating this area as an ephemeral wetland; ▪ widening of the Wah Wah main channel; ▪ construction and use of a 2,500 ML En-route storage facility on Mirrool Creek, which is located upstream of Barren Box Swamp.
Project Address:	Shaw Road, Tabbita, NSW
Proponent:	Murrumbidgee Irrigation Limited

2 Requirements

The Barren Box Project Annual Environmental Management Report **(AEMR)** for the financial year 2022/23 has been prepared to meet the reporting requirements of MI's development approval. The report comprises and is in the format outlined in:

- Conditions 7.4 a-m of the development approval DA 101-4-2004-I – see **Appendix A**;
- Include any matters identified by the Director-General under Condition 7.6; and
- Be submitted to the Director-General, Council (i.e., Griffith City) and the DEC (now EHG) annually under Condition 7.5.

MI formerly completed an AEMR that encompassed the operational period of 2006 to 30 June 2022 that was submitted in June 2023. This report has been prepared for the financial period 2022/23 that is due 30 October yearly to align with Condition 7.5 which is in line with MI's Annual Compliance Report for Environmental Protection Licence (**EPL4651**) and Combined Approval (40CA403245) Monitoring and Reporting plan. At the time of creation of this report MI were awaiting a formal response regarding the submission of the 2006-2022 AEMR from the Department. Any future comments received from the Department will be incorporated into future BBS Project AEMR's.

2.1 Clause 7.4 Annual performance reporting requirements

This report is structured to address the requirements of an Annual Environmental Management Report as required under Condition 7.4 and is summarised in **Table 1**.

Table 1: Annual Environmental Management Report requirements

Condition	Report section
7.4 The Applicant must, throughout the life of the development, prepare and submit for the approval of the Director-General, an AEMR. The AEMR shall review the performance of the development against the Operation Environmental Management Plan (condition 6.4), the conditions of this consent and other licences and approvals relating to the development.	This report
The AEMR shall include, but not necessarily be limited to; a) details of compliance with the conditions of this consent;	This report Section 3 Appendix A
b) a copy of the Complaints Register (refer to condition 5.3 of this consent) for the preceding twelve month period (exclusive of personal details), and details of how these complaints were addressed and resolved. This must include details of any environmental surplus flow related complaints;	Section 4 Appendix B
c) a comparison of the environmental impacts and performance of the development against the environmental impacts and performance predicted in the EIS and the additional information listed condition 1.1;	Section 7
d) results of all environmental monitoring required under this consent and other approvals, including interpretations and discussions by a suitably qualified person;	Sections 7, 8, 9, Appendix C, Appendix D, Appendix E, Appendix F, Appendix J, **Error! Reference source not found.** Appendix K
e) a list of all occasions in the preceding twelve-month period when environmental performance goals for the development have not been achieved, indicating the reason for failure to meet the goals and the action taken to prevent recurrence of that type of incident;	Section 10
f) demonstration and documentary evidence that a minimum average of 20,000 Megalitres of water savings have been made for the twelve month period, including evidence that the water savings have been returned to Water for Rivers. Should a minimum average of 20,000 Megalitres of water savings not be achieved for the reporting period, the Applicant shall provide detailed justification as to why the level of savings was not made;	Section 7.1.3, Appendix A
g) details of the total volume of water savings that have been made for the reporting period	Section 7.1.3
h) details of the health of the Lower Mirrool Creek Floodway Wetland System. This is to include details of the condition of vegetation, duration and extent of inundation and quality of the water discharged through the system;	Section 7.1.2, Section 9, Appendix D Appendix K
i) details of any deliberate releases: refer to condition 6.5d) xv);	Section 7.1.2, Section 9.2
j) outline the number of occasions and estimate of water volume that was made available as off-allocation / environmental surplus to licence holders in Barren Box, Mirrool Creek and the Wah Wah District in the 12 month period;	Section 7.1.5
k) identification of trends in monitoring data over the life of the development to date;	Sections 7, 8, 9

Condition	Report section
l) a list of variations obtained to approvals applicable to the development and to the site during the preceding twelve-month period; and	Section 11
m) environmental management targets and strategies for the following twelve-month period, taking into account identified trends in monitoring results.	Section 12
7.5 The Applicant must submit a copy of the AEMR to the Director-General, Council and the DEC (now EHG) every year, with the first AEMR to be submitted no later than twelve months after the commencement of operation of the development. The second and subsequent AEMRs are to be submitted every 12 months from the first AEMP or concurrently with the EPA's annual reporting period established for the site under its EPL for the site. [Note: EPL4651 annual report due 30 October]	Noted. Report will be issued to: DPE – Planning & EHG (via Major Projects portal), and Griffith City Council
7.6 The Director-General may require the Applicant to address certain matters in relation to the environmental performance of the development, in response to review of the Annual Environmental Report and any comments received from the EPA and Council. Any action required to be undertaken shall be completed within such period as the Director-General may agree.	Noted

3 Compliance status summary (7.4a)

A compliance table, including references to relevant sections of this report is included in **Appendix A**.

Table 16 in **Appendix A** outlines the exceptions and/or nonconformances against the conditions of consent applicable to the operational phase of the development and progress or response undertaken to date by MI. A summary of compliance is outlined below in **Table 2.**

Table 2: Operational conditions – compliance summary

Compliance status	Conditions	Summary	Proposed actions
Compliant	1.3, 1.8, 1.9; 2.1, 2.3; 3.1, 3.6, 3.11, 3.12, 3.13, 3.14, 3.39, 3.40, 3.52; 4.1, 4.2; 5.1, 5.4; 6.1a-d; 6.4b-k; 6.5a, 6.5b, 6.5c, 6.5di-dii, 6.5div-vi, 6.5dviii-xiii, 6.5xv; 6.5ei 6.5eiii-vi; 7.1, 7.3a-d, 7.4a-g, 7.4i-m, 7.6		
Partially compliant	4.3	No evidence construction independent audit submitted to EPA or Council.	Nil. Significant time has elapsed.
	6.4, 6.4a	6.4a – OEMP requires updating with all statutory and other obligations.	OEMP to be reviewed in 2023. Proposed to be lodged in Q4 2023.
	6.5d, 6.5di-xiv	Wetland Rehabilitation and Management Plan:	
		diii – Financial commitment	See Section 8.2
		dvii – Salt and nutrient accretion	Section 8.3.3
		dxiv – Ongoing monitoring of LMCF	Section 9. Work collaboratively with DPE EHG EWO.
	6.5e, 6.5ei-vi	6.5 Flood management plan:	
		6.5e – Consultation with Council and DNR	Section 7.1.7.2. Continue working with relevant Councils and DPE South West Region Floodplain Management staff via Floodplain Management Committees and where required, Local Area Emergency Management Committees and the SES.
		6.5eii - Program for assessment of water requirements for LMCF	Section 9. Work collaboratively with DPE EHG EWO.
	7.4h	7.4h Health of LMCF, etc	Section 9. Update provided see other LMCF actions.
Non-compliant	6.1, 6.1e	Project Environmental Representative. ER not nominated since 2016 for D-G approval.	ER to be nominated for D-G approval.
	6.6	OEMP – 3 yearly review and notification to D-G, EPA and Council	Section 6 2023 OEMP update planned and will be notified.

4 Complaints (7.4b)

MI's Customer Services team responds to customer and community enquiries, requests, and complaints. Where required, environmental staff and/or other subject matter experts within MI will be consulted to investigate and/or respond.

Table 3 summarises the complaints received for the financial year 2022/23 with further details included in **Appendix B** as required under Condition 7.4b.

Table 3: Summary of complaint numbers for 2022-2023 financial year.

Year	Number
2022-2023	2

5 Meteorology

The weather conditions between the completion of construction of the BBS project (August 2006) and 2023 have varied significantly. This included the end of the Millennium drought and floods in 2012, 2016/17, and 2022 (**Figure 1**, **Appendix C**).

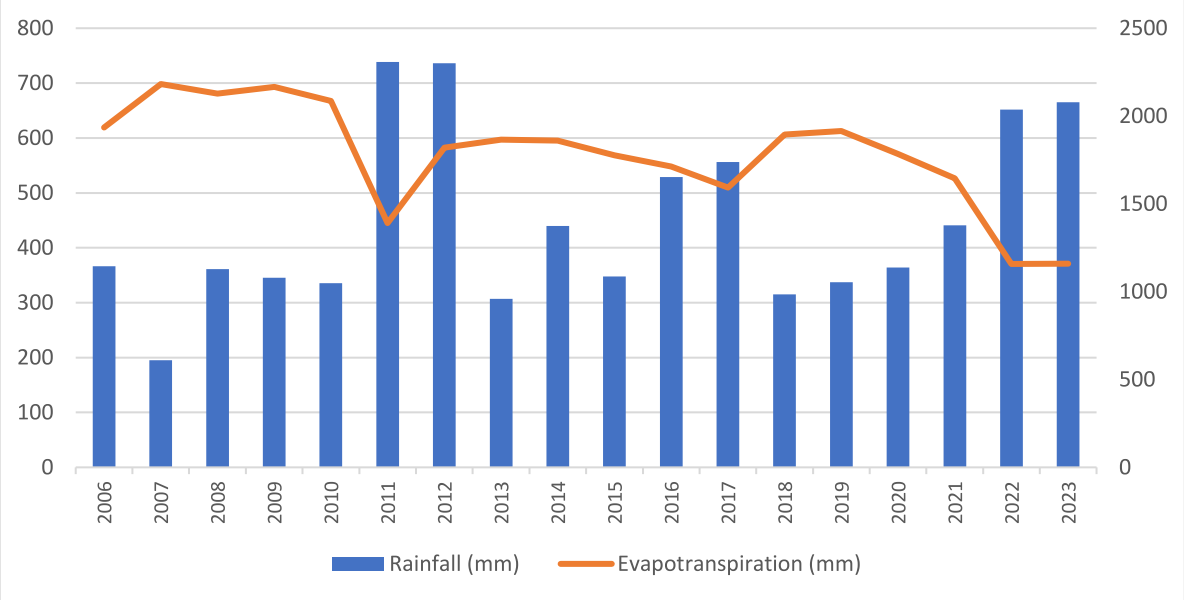


Figure 1: Rainfall and evapotranspiration for financial years 2006-2023

Rainfall has continued to increase throughout the last five years with above average rainfall recorded for 2022/23. There was a 12mm increase compared to last year 2021/22 and 223mm compared to 2020/21. The evapotranspiration remains consistent with the prior year 2021/22.

5.1 2022 Weather conditions

The 2022 significant weather and resulting flood event was summarised in a Special Climate Statement from the Bureau of Meteorology. In the MIA it resulted in flooding requiring discharge to both the BBS wetland cell and the LMCF:

SPECIAL CLIMATE STATEMENT 77 Persistent heavy rain and flooding in eastern Australia during spring 2022 Issued 21 September 2023 Climate Information Services Bureau of Meteorology.

Spring 2022 saw the highest rainfall on record for the Murray–Darling Basin (MDB), New South Wales and Victoria, in the Bureau's rainfall analyses starting in 1900. Although there were few extreme daily rainfall totals, the spring 2022 total was more than double the 1961–1990 average for

most of the MDB. The rain fell on catchments that had received above average rainfall in the two years prior to spring 2022. Soils were already saturated, many water storages in the MDB and south-eastern Australia were at or near capacity, and streamflow at many locations was higher than average. The antecedent conditions combined with the record rainfall resulted in extensive major flooding across the MDB, eventually flowing into South Australia. Victoria and Tasmania also experienced major flooding, particularly in October 2022. Comparison using a consistent set of flood observations showed that the spring 2022 floods in the southern MDB had a greater extent, severity and duration than the 2010–11 floods. However, at the national level 2010–11 remains the most significant flooding in recent decades.

6 Operational environmental management plan (6.4-6.6)

An Operational Environmental Management Plan (**OEMP**) for the project was developed and approved by the Department of Planning in 2008, following MI addressing Departmental comments after the initial submission in July 2006.

The OEMP is currently under review and will be updated by the end of 2023 to include any information and/or proposed actions from this and/or prior AEMR's, Department or Council feedback and/or ongoing Modification request considerations. Following this review, notification will be provided as required under Condition 6.6.

7 Environmental performance (7.4c)

The following sections detail the environmental impacts and performance predicted in the EIS and compares them with the performance of the project as required under condition 7.4c of the development consent.

Figure 2 and **Figure 3** are the maps for locality and BBS structural changes as provided in the EIS.

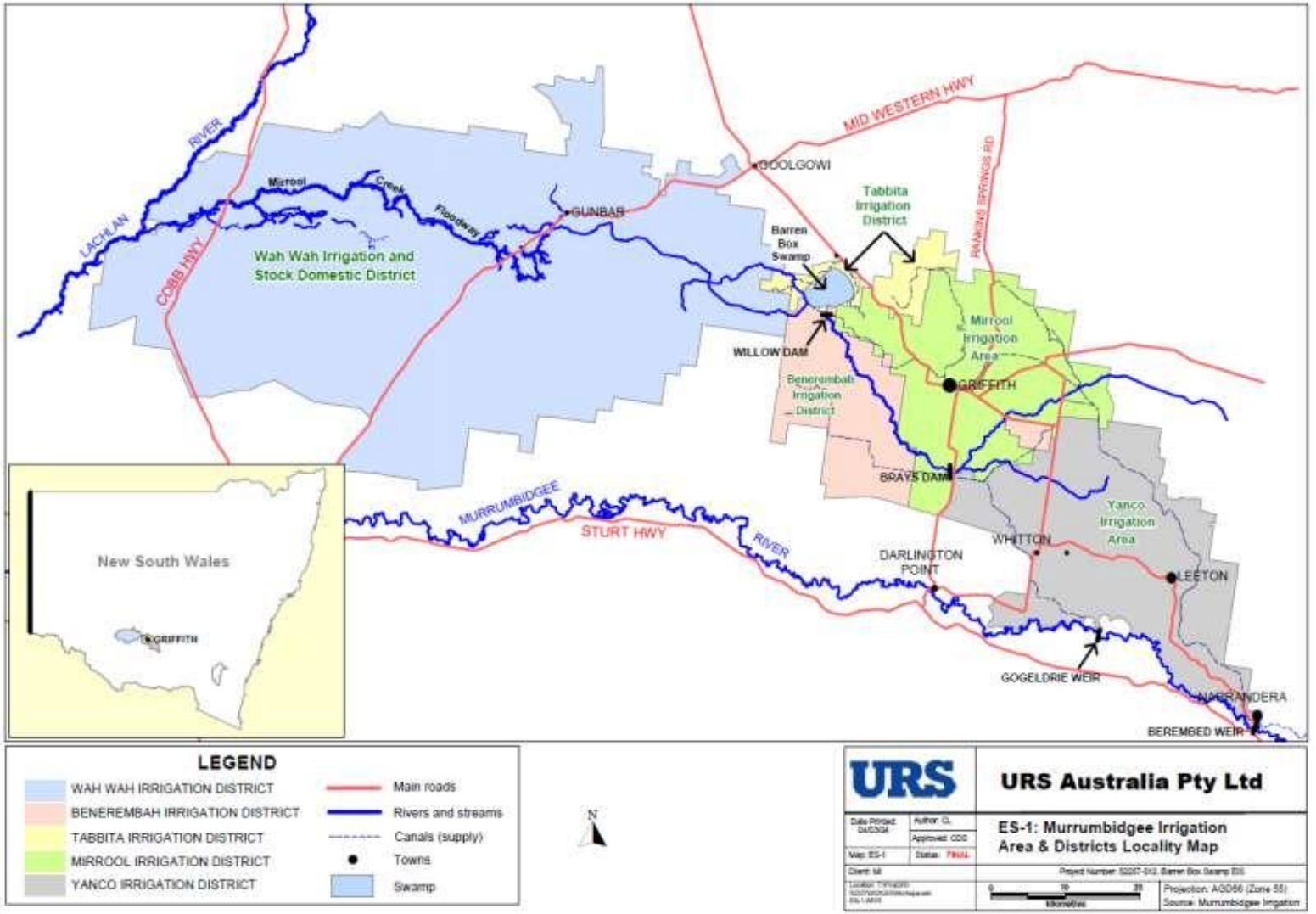
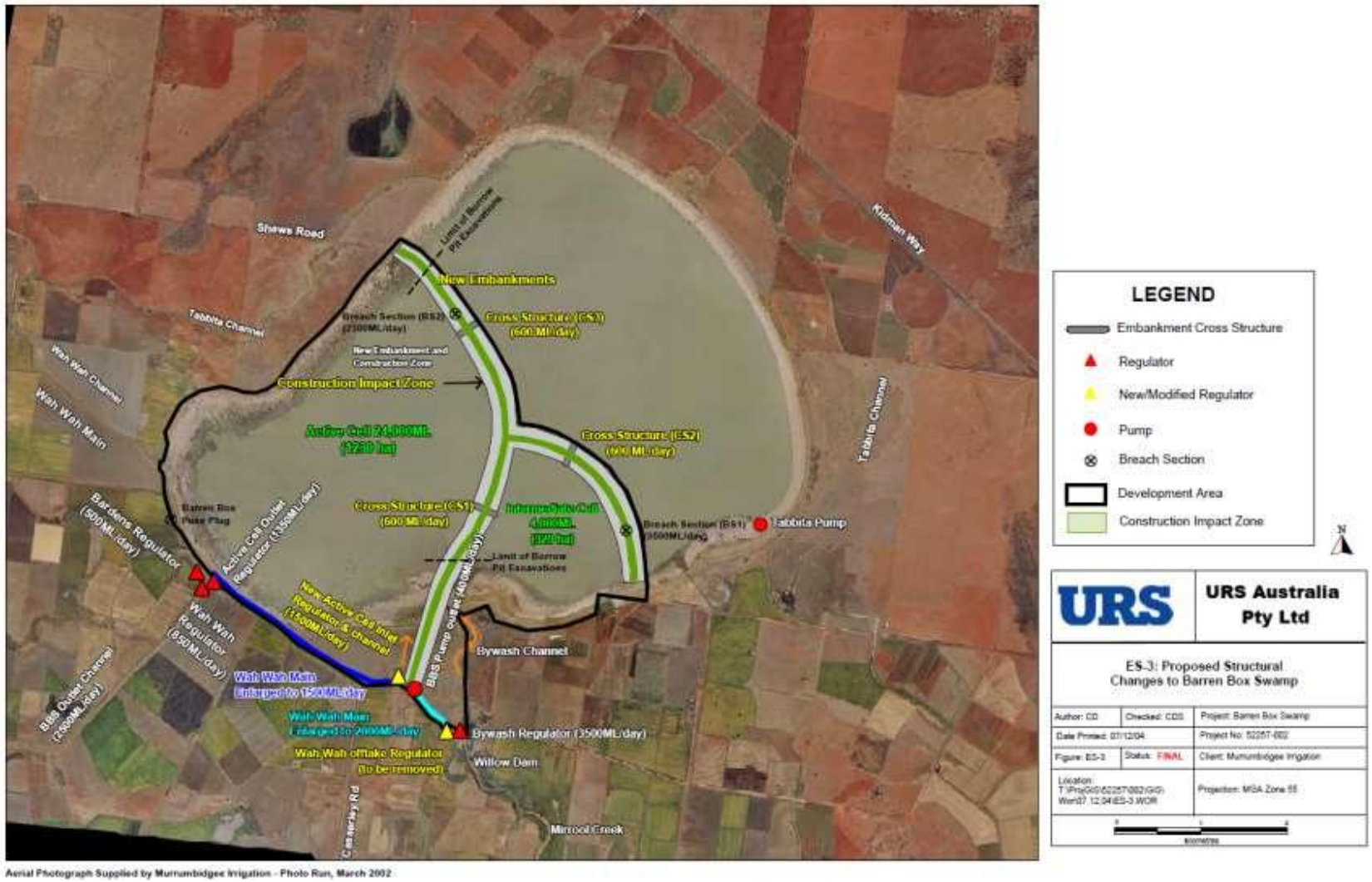


Figure 2: Murrumbidgee Irrigation Area and Districts 2004 Locality Map (EIS ES-1)



Aerial Photograph Supplied by Murrumbidgee Irrigation - Photo Run, March 2002

Figure 3: Structural changes to BBS (EIS ES-3)

7.1 Surface hydrology and flooding (EIS Chp 11)

The BBS EIS covered surface hydrology and flooding under Chapter 11, supported by EIS Appendix C: Resources Modelling and Flooding.

The EIS identified several potential impacts associated with the proposed changes to the water regimes in the MIA as a result of the BBS Project. They were:

- reduction in MIA water entitlement;
- reliability of supply to the WWID;
- impact on water access licences;
- water regime for ephemeral wetland and Mirrool Creek Floodway; and
- affect on flood mitigation capacity and flood levels.

The potential impacts associated with each of the above are discussed below, with supporting data provided in **Appendix D.**

7.1.1 Water balance model and hydrological changes

7.1.1.1 EIS impacts or predictions

The EIS determined the average annual water savings expected from the project, by modelling the existing and proposed system, with the reduction in the calculated river diversion volumes deemed as water savings.

The model showed predicted water savings principally resulted from:

- Reduced evaporation from Barren Box Swamp through the creation of smaller, more responsive storage, and
- the ability to capture and reuse excess water from Mirrool Creek upstream of BBS, that may be discharged as forced releases to the Lower Mirrool Creek Floodway.

The consequence of these water savings would be a reduction in river diversions to the Sturt Canal and a slight increase in diversions to the Main Canal.

The EIS schematic model is shown in **Figure 4** (EIS Figure 11-3), the summary of modelled average annual water savings (Submissions Report Figure 4-1) is shown in **Figure 5** and the summary of Hydrological Changes in the MIA (EIS Table 12.3, Submission Report revision Table 4.4) is shown in Error! Reference source not found..

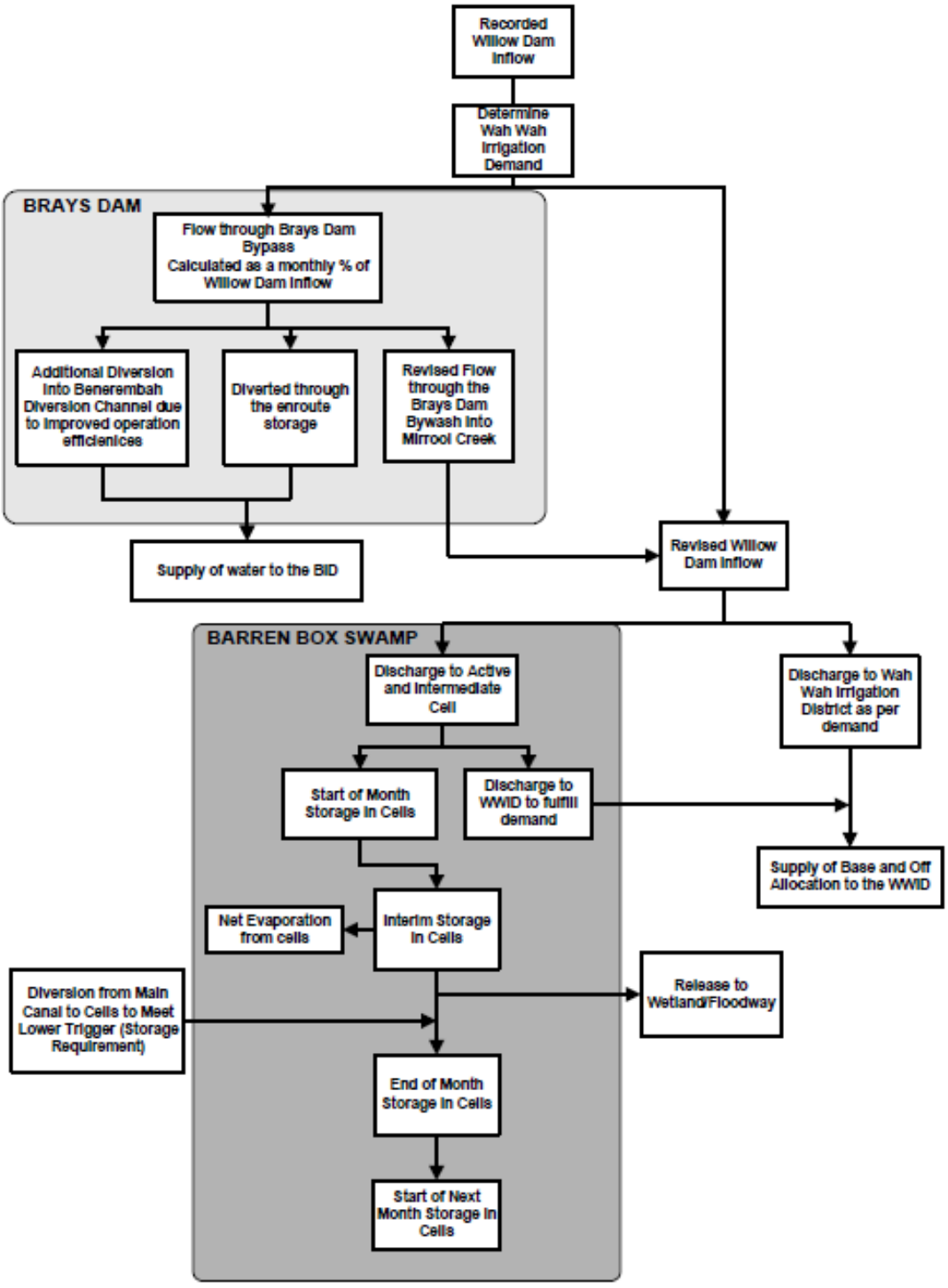


Figure 11-3 Schematic Model for Proposed Conditions

Figure 4: EIS Model for predicted/ proposed conditions

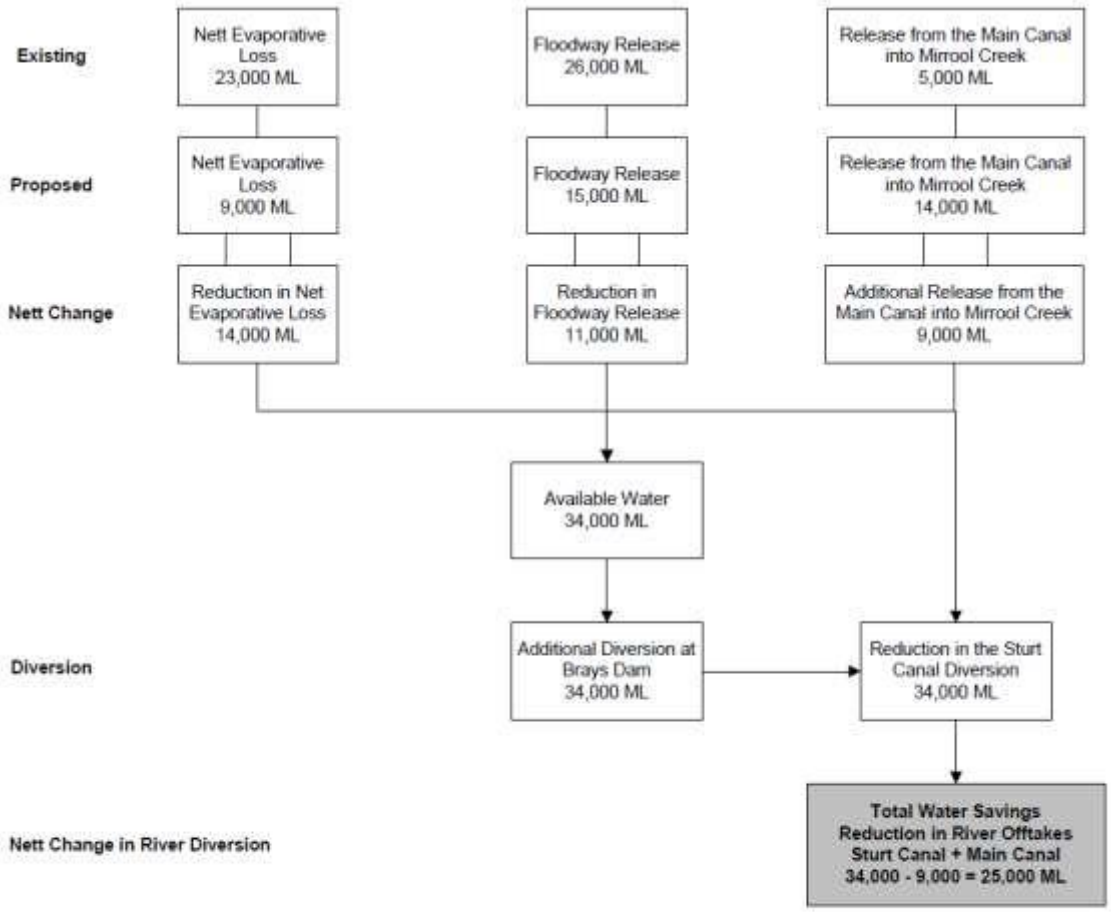


Figure 4-1 Revised Figure 5.6 and C17

Figure 5: Summary of modelled average annual water savings (Submissions Report Figure 4-1)

Table 4 below (based on EIS Table 11-3, revised in the Submissions Report as Table 4-4) outlines the proposed hydrological changes in the MIA due to the BBS project.

Table 4: Summary of hydrological changes in the MIA

ID	Description	Annual average flows (ML)		
		Existing conditions	Proposed conditions	Difference
MAIN	Main Canal at East Mirrool regulator	165,000	174,000	+9,000
EMR	Diversion from the Main Canal into Mirrool Creek	5,000	14,000	+9,000
BRAYS	Flow into Brays Dam	90,000	99,000	+9,000
BDC	Total flow diverted to BID (?)	25,000	58,500	+33,500
	Via diversion channel	*25,000*	*35,500*	*+10,500*
	Via en-route storage (Brays Dam)	*0*	*23,000*	*+23,000*
MIR	Flow through Brays Dam bywash	65,000	40,500	-24,500

ID	Description	Annual average flows (ML)		
		Existing conditions	Proposed conditions	Difference
STURT	Diversion from Murrumbidgee River in Sturt Canal (into Gogeldrie Weir	160,000	126,500	-33,500
WILL	Flow into Willow Dam	192,000	167,500	-24,500
WWID	Water delivered into the WWID	144,000	144,000	0
EVAP	Net evaporative losses from BBS	23,000	9,000	-14,000
FLOOD	Release to Lower Mirrool Creek Floodway	26,000	15,000	-11,000

7.1.1.2 Current performance

The key hydrological changes from the Water Balance Model provided in the EIS are:

- Releases to the LMCF: see Section 7.1.2
- Water savings from the project: see Section 7.1.3.
- Water delivered to the WWID: see Section 7.1.4 and
- Net evaporative losses from BBS.

Net evaporative losses from BBS was estimated as 14,000ML annual average saved from the project. This was predicted based on the reduction in surface area of stored water due to the construction of storage cells and the improved flexibility to move water within the storage system to respond to both customer demand and seasonal volumes.

In 2008 MI commissioned Water Technology to develop a hydrological model of the Barren Box Storage and Wetland. The primary purpose of the model was to provide MI with an appropriate tool to investigate appropriate water management strategies for the wetland cell and support rehabilitation planning.

In addition, the model would provide MI with the capability to explore the implications of different control rules to govern water movement between the three Barren Box cells as well as inflows from Willow Dam and outflows to the WWID.

The model runs determined evaporative losses for the constructed BBSW achieved a mean annual water saving of a little over 17GL/annum. The project found the evaporative saving was consistent with the EIS prediction of 14GL/annum and suggested the EIS modelling was conservative. The model results and report also indicated the magnitude of the savings varied significantly from year to year and month to month (Water Technologies 2008).

7.1.2 Discharges to BBS and Lower Mirrool Creek Floodway

7.1.2.1 EIS impacts or predictions

7.1.2.1.1 BBS and Lower Mirrool Creek Floodway discharges

The results of the EIS water balance model indicated the average annual discharge of excess drainage waters to the LMCF would be reduced from an average of 26,000 ML per year, to 15,000 ML per year. The predicted 40% reduction occurs because of the proposed improvements in the efficiency of the water supply and drainage system. Under the EIS proposed conditions, a portion or all this water could be released into the section of BBS dedicated for flood mitigation as a continuation of the existing use.

With the implementation of the MIA and Districts Community Land and Water Management Plan (MI, 1998), MI committed to reducing the occurrence of releases to the floodway to minimise the impact on landholders in the area. Therefore, the predicted reduction in the number and volume of forced discharges to the floodway would contribute to this undertaking.

7.1.2.2 Current performance

7.1.2.2.1 BBS wetland cell

Discharges to the BBS wetland cell have been mainly driven by flood events.

A monthly summary of water discharged to the BBS wetland cell for 2022/23 is presented in **Table 5.** A total volume of 42,157ML was released during 2022/23.

Table 5: Monthly releases to the BBS wetland cell for 2022/23

Month	Total (ML)
Jul-22	0
Aug-22	0
Sep-22	386
Oct-22	0
Nov-22	36037
Dec-22	0
Jan-23	0
Feb-23	0
Mar-23	0
Apr-23	5504
May-23	0
Jun-23	230
Total	**42,157**

7.1.2.2.2 Lower Mirrool Creek Floodway

Since the commissioning of the BBS project discharges to the LMCF have been mainly driven by flood events and following directions from Flood Management Authorities. Some smaller releases have occurred due to operational needs, which can include operational constraints and/maintenance, infrastructure malfunction and/or damage, and management of flows in excess of downstream demand.

A monthly summary of water discharged to the LMCF for 2022/23 is presented in **Table 6.** A total volume of 112,117ML was released during 2022/23.

Table 6: Monthly released to the Lower Mirrool Creek Floodway for 2022/23

Month	Total (ML)
Jul-22	0
Aug-22	7,459.6
Sep-22	13,053.1
Oct-22	34,712.0
Nov-22	44,340.0
Dec-22	10,744.0
Jan-23	2.8
Feb-23	0.1

Mar-23	652.5
Apr-23	1,152.5
May-23	0
Jun-23	0
Total	**112,116.6**

7.1.3 Reduction in MIA water entitlement and water savings

7.1.3.1 EIS impacts or predictions

EIS Section 11.3 outlined and Section 11.4.2 summarised the predicted water savings principally result from:

- A reduction in evaporation from BBS through the creation of a smaller, more responsive storage; and
- The ability to capture and reuse excess water from Mirrool Creek upstream of BBS, that may be discharged as forced releases to the LMCF.

The water savings from the project were proposed to contribute to the return of environmental flows to the Snowy River System and was set at a minimum average of 20,000 ML per year.

Therefore, river diversions to the MIA and ultimately MI's entitlement would need to be reduced to allow for these environmental flows to occur.

7.1.3.2 Current performance (Conditions 1.7, 1.8, 1.9, AEMR 7.4f, 7.4g)

On 6 October 2006, MI provided to the Department a certificate of title for a permanent transfer of 20,000 ML of water from MI's Continuing Annual Conveyance in satisfaction of Condition 1.9 of the development consent. Further details are provided in **Appendix A** as these conditions have been fully met and are not reported annually.

7.1.4 Reliability of the supply to Wah Wah Irrigation District (WWID)

7.1.4.1 EIS impacts or predictions

EIS modelling of the proposed changes to BBS (and the En-route Storage) provided for an annual average flow of 162,500 ML through Willow Dam (i.e., water to supply the WWID), which is 132% of the base allocation of the WWID. This amount was used as the 95 % confidence limit to determine the optimum storage requirement in BBS. The modelling is therefore conservative in ensuring that the storage and supply system can satisfy the demand in the WWID when water is available.

The results of the EIS modelling showed the reduction in available water storage capacity at BBS, because of the splitting of the swamp and the increase in diversions at Brays Dam as a result of the proposed En-route Storage, would not have a significant impact on the delivery of the stated water volume objectives to the WWID.

7.1.4.2 Current performance

7.1.4.2.1 Original concept for BBSW operation

The original concept for the operation of BBS outlined in the EIS included the expectation of high drainage flows arriving at Willow Dam. The original guidelines included upper and lower trigger volumes for the combined volume of the Active and Intermediate Cells. Whilst no longer relevant, the lower monthly trigger volumes were developed for supply to WWID and included an assumed diversion pattern from Brays Dam.

These operating volumes were based on an annual demand for WWID of 165,000 ML and assumed a guaranteed inflow arriving at Willow Dam during the peak months. This inflow was to be from farm drainage, rainfall and escape flows to meet the required water to be diverted from the river throughout the season to meet the monthly trigger levels proposed.

The upper trigger volumes were developed to support the determination of internal surplus events for WWID customers. These upper triggers remain as the BBS surplus trigger volumes and are included in MI's Surplus Water Rules available on MI's website: Surplus Water Rules.pdf.aspx (mirrigation.com.au).

7.1.4.2.2 Current operating guidelines

Significant changes to MI's integrated water delivery system and changes to customer usage needs mean the original concepts for BBS operation are no longer suitable. Significant changes from the original concept include:

- Annual metered usage to WWID customers has not exceeded 95,000ML - **Table 7** (FYE 2010-2023).
- MI's modernisation and automation works, including on farm works and channel modernisation, has significantly reduced the drainage and inadvertent flows to Willow Dam.
- Original trigger levels do not account for:
  - water allocation %
  - annual and seasonal change in land use and associated practices
  - annual and long-term climate forecasts
- Permanent plantings have increased on the WWM channel system, which introduces more reliance on BBS Intermediate Cell pumps.
- Changes in land use and expansion of irrigated areas means the capacity of the Main and Sturt channel systems is required to meet demand in the upper supply system, therefore, deliberate diversions to BBS during peak demand periods is managed to reduce stress on these systems.

The operation of BBS now accounts for individual season variabilities including water allocation, land use changes and annual climate forecasts to accurately determine fill times and volumes (whilst maintaining water delivery efficiencies) to secure water delivery to WWID.

Table 7: Water delivered to WWID customers during 2009-2023 irrigation seasons

Season	Wah Wah metered usage (ML)	Season	Wah Wah metered usage (ML)
2009-10	30,224	2016-17	59,870
2010-11	40,989	2017-18	66,467
2011-12	82,842	2018-19	42,080
2012-13	93,999	2019-20	27,910
2013-14	65,008	2020-21	60,908
2014-15	66,542	2021-22	63,212
2015-16	51,642	2022-23	43,292

The metered usage shown in Error! Reference source not found. does not include water supplied up t o and including October 2019 for Wah Wah Stock and Domestic (WWSD) users, or WWID conveyance which was accounted for in the EIS water balance. In December 2019, the Gunbar Water Pipeline was gazetted and subsequently MI handed over control of this area of supply to the Gunbar Private Water Supply District (**GPWSD**). Consequently, MI's Area of Operations decreased by

192,202 hectares as displayed in **Figure 6** below. The GPWSD covers the stock and domestic requirements via pipeline directly from the Murrumbidgee River and not via the MIA network.

As part of the negotiations for this project, including the Review of Environmental Factors (GHD 2017) a total of 9GL (9,000ML) of MI's water entitlement was handed back to the Commonwealth Environmental Water Holder.

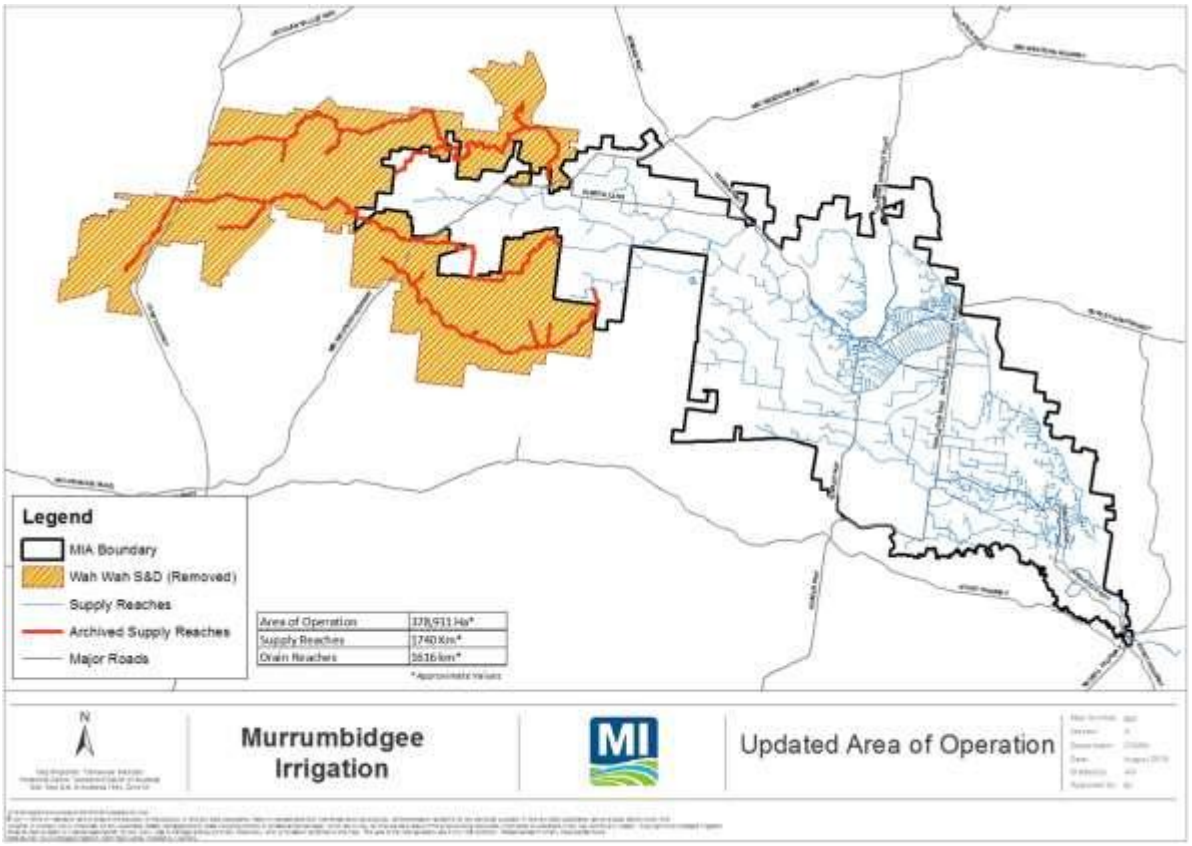


Figure 6: MI Area of Operation change in 2019

7.1.5 Off allocation/ environmental surplus provided (7.4j)

The Department of Planning advised in their letter dated 31 January 2008 that condition 7.4j is no longer relevant due to the deproclamation of Mirrool Creek. Further details are provided in **Appendix A** as the condition has been fully met and is not reported annually.

7.1.6 Water Access Licenses

7.1.6.1 EIS impacts or predictions

The EIS documents identified the deproclamation of the Crown land and implementation of the *Water Management Act 2000* (NSW) and the Plan was occurring independently of the proposed BBS Project, however the splitting of Barren Box Swamp would have an impact if transfer of water access licences to MI had not been completed.

By the nature of the development, the proposed alteration n of the water regime would mean that flows may not be available for water access licences.

7.1.6.2 Current performance

Twenty one (21) licences were identified in the Project's Submission Report. MI negotiated new agreements with those licensees, with the terms now captured in MI's Surplus Water Rules.

7.1.7 Flood handling capacity

7.1.7.1 EIS impacts or predictions

7.1.7.1.1 BBS

The EIS determined the proposed BBS development would improve the ability of the swamp to pass and store flood waters. A summary of the proposed changes and their implications for the control of flood water was presented in EIS Table 11-4.

Under the proposed operation of BBS, a total of 5,000 ML per day could be passed as controlled channel flow through Willow Dam, of which 1,500 ML per day would bypass the swamp via the Wah WWM, 3,500ML per day could enter the swamp via the BBS Bywash Channel. If the Active Cell has storage space, a further 1,500 ML per day would enter the swamp via the new Active Cell inlet structure. Overtopping of the bywash and inlet regulators under the proposed conditions was therefore unlikely to occur below 5,000 ML per day (EIS Figures 5-2 and 5-3 showed the location of the structures).

The existing capacity of the BBS to release floodwaters was 1,350 ML per day (through the outlet regulator) and the outfall channel capacity (2,250 ML per day) remained unchanged.

7.1.7.1.2 En-route Storage

The size of the proposed En-route Storage limits its use as a significant flood mitigation structure however, it would have some benefit in reducing flood peaks for moderate flood flows. This would add to the overall flood management improvements at BBS as described above.

7.1.7.2 Current performance

7.1.7.2.1 BBS

The development of the Flood Management Plan under the 2006 OEMP (approved 2008) included consultation with Griffith City Council and the Department of Natural Resource Murray Murrumbidgee Office.

The 2006 OEMP included the 1998 Flood Release guidelines, which detailed both the BBS water level (volume) and the release rate to the Mirrool Creek Floodway.

In 2008, MI commissioned Water Technology to develop a hydrological model of the Barren Box Storage and Wetland. The primary purpose of the model was to provide MI with an appropriate tool to investigate appropriate water management strategies for the wetland cell.

The 2008 analysis considered data from 1979 to 2004, which included the large flood event of 1989.

MI was consulted and provided information to assist GCC's consultants BMT WBM during their flood studies undertaken in 2014 and 2015 and are noted as a stakeholder within the reports. These reports are available on GCC's website.

Following flood events impacting BBSW (March 2012 and September 2016) and changes in winter operations of BBSW to better service downstream customers, MI also engaged BMT WBM to provide advice on the overall flood risk management of BBSW.

The 2017 study was used to further develop operational guidelines for BBSW as well as taking into consideration that MI is not a flood authority under the *State Emergency and Rescue Management Act 1989* (NSW). The relevant State Emergency Agencies and local Council/s are responsible for flood response for the areas MI operates within. This position has recently been restated to MI through the NSW Office of Local Government.

MI provides support, operational knowledge and responds to directions made under an emergency direction. This may include opening of regulators and breaching channels, and diversion of flows based on risk assessments and directions from the relevant authority [6.5ev].

A schematic showing the BBSW Operational Guideline process for flood risk management as at 30 June 2023 is shown in **Figure 7** which is based on the outcomes of the BMT WBM study in 2017.

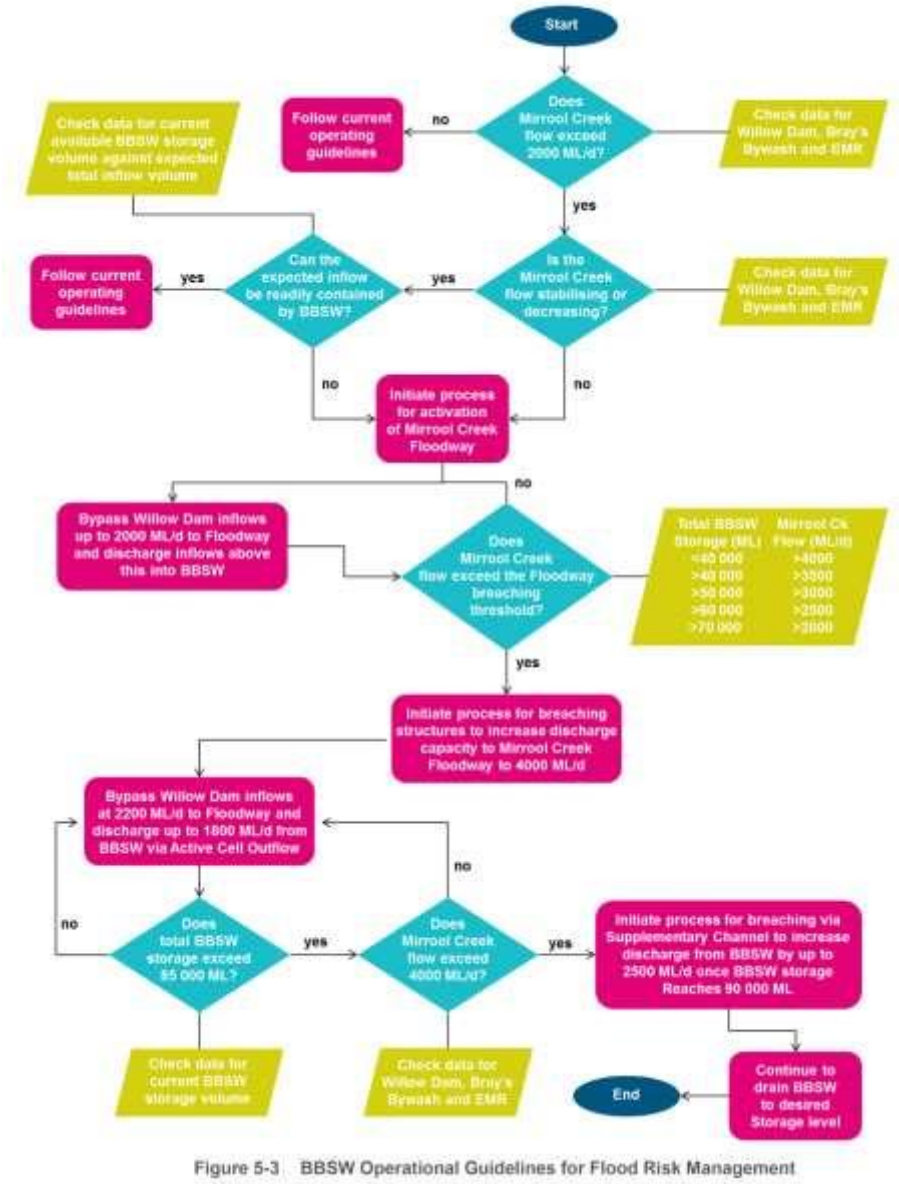


Figure 5-3 BBSW Operational Guidelines for Flood Risk Management

Figure 7: BBSW Operational Guidelines for Flood Risk Management

MI is involved as a stakeholder on GCC's Floodplain Management Committee as well as being involved in any Local Emergency Management Committee meetings when serious flooding is expected or occurring with the GCC area.

Minutes from the Floodplain Management Committee are available on GCC's website: **Floodplain Management Committee | Griffith City Council (nsw.gov.au)**. They are currently available from 2016 and document attendance by MI staff, together with DPE South West Region floodplain management staff, local community representatives and Council representatives. During these meetings, flood

preparedness and flood response and/or review are discussed, noting that emergency management actions are discussed and documented separately.

Since the development of the original OEMP Flood Management Plan, in addition to the GCC's forums above, MI has sought to engage and consult (both in-writing and in-person) with both CSC and Hay Shire Council as downstream stakeholders in the LMCF and the bodies responsible for flood mitigation within their respective local government areas. In contrast to positive interactions with other Flood Management Authorities in the MIA (namely GCC, Leeton and Narrandera shire councils), MI has been unable to successfully engage or consult with either CSC or HSC. During the flooding in late 2022, CSC refused to meet with MI and HSC provided a combative response to the situation. As a result, MI escalated to the Minister for Local Government (letter dated 16 November 2022) to seek assistance with resolution.

In the 2022 flooding events engagement and consultation with CSC and HSC was primarily performed via the Griffith Local Emergency Management Committee. During the 2022 event, MI provided local Mirrool Creek flood information updates directly to MI customers in the Mirrool Creek floodplain and also (via the Griffith LEMC) to CSC and HSC in order for them to distribute as applicable to their respective communities.

MI is committed to working collaboratively with all flood authorities to share information on our system and past flood experience and to allow the best approach for managing future floods to be adopted for both the MIA and downstream communities and environmental values.

7.1.7.2.2 En-route Storage

The EIS summarised that the incremental increase in flooding associated with the construction of the En-route Storage on the floodplain would be negligible.

The BBS Operational Guidelines and studies include consideration of the 2,500ML capacity of Brays Dam and its use during smaller flood events. During larger flood events, e.g. 2012 and 2016 Brays Dam had negligible effect on flood levels arriving at BBSW.

7.2 Water quality (EIS Chp 12)

7.2.1 EIS impacts or predictions

7.2.1.1 Barren Box Swamp

The EIS Section 12 identified the controlling factor in determining the quality of the water in BBS at a point in time and therefore the quality of the outflow, is the quality of the water entering the swamp and the volume and quality of water in the storage prior to that. The quality of inflow water would be the same for the proposed conditions, as the quality of inflows is not affected by this project.

The EIS concluded the operation of the modified BBS, using a smaller Active Cell, would be expected to improve on average the quality of water discharged from the swamp, with respect to salinity concentrations. This is primarily due to the reduced evaporation from the swamp. Other water quality indicators were unlikely to be significantly affected by the developments at BBS. The operation of the En-route storage (Brays Dam) was unlikely to affect the quality of water passing through the proposed storage cell.

The EIS stated it was expected that MI would continue with its water quality monitoring program as part of its environmental protection licence and would assess the need to include the monitoring of water quality in the ephemeral wetland as part of the overall program.

The EIS recognised the splitting of the BBS and its operation under the new arrangement would result in significantly lower evaporation rates (from 23,000 ML to 9,000 ML per year), due to a reduced surface area in the Active Cell, and a higher turnover of water in the Active Cell. These two

factors were identified as reducing the concentrating effect of salts in the water that has entered the storage. Therefore, it was expected that on average water discharged from the proposed Active Cell in BBS would have lower salinity than under the current condition, provided the quality of inflows does not change. It was noted, that the proposed conditions would not affect the total salt load passing through the overall MIA system.

Table 8: Median (and range) of electrical conductivity (EC) for 2002-2003

Monitoring site (and sample size)	EC median (µS/cm)	EC range (µS/cm)
ANZECC 2000 POAE guideline value	*125-2200*	
MIRMCN (12:48 for EC) - upstream from BBS	251	177-783
BBST (6:24 for EC) - BBS water	455	344-729
BBOW (10: 20 for EC) - BBS outflow water	321	175-453
BB0 (0: 50 for EC) - BBS outfall channel	429	187-998

Source: MI's Environmental Performance Report 2002-2003 & extract from EIS Table 12-1

7.2.1.2 En-route storage

The EIS determined that given the size and residence time of water in the En-route storage (Brays Dam), the use of the storage to temporarily hold water (for up to two weeks at a time) is unlikely to significantly affect the water quality downstream of the site.

7.2.2 Current performance

MI regularly monitor water quality in key areas around the MIA, including any discharges out of the MIA as required by our EPL.

7.2.2.1 BBS salinity results

Salinity was the main parameter of concern identified in the EIS. MI monitors salinity, using EC via a hand-held water quality multiprobe meter throughout key locations within the MIA system, including during discharges out of the MIA, when safe to access the monitoring site.

The available results since BBS became operational at key locations surrounding and downstream of the BBS are provided in **Appendix E**. Historical water quality data back to 2006 has been collated from a variety of monitoring records with some results missing due to methods of recording data and MI's water quality meters since 2006 have changed.

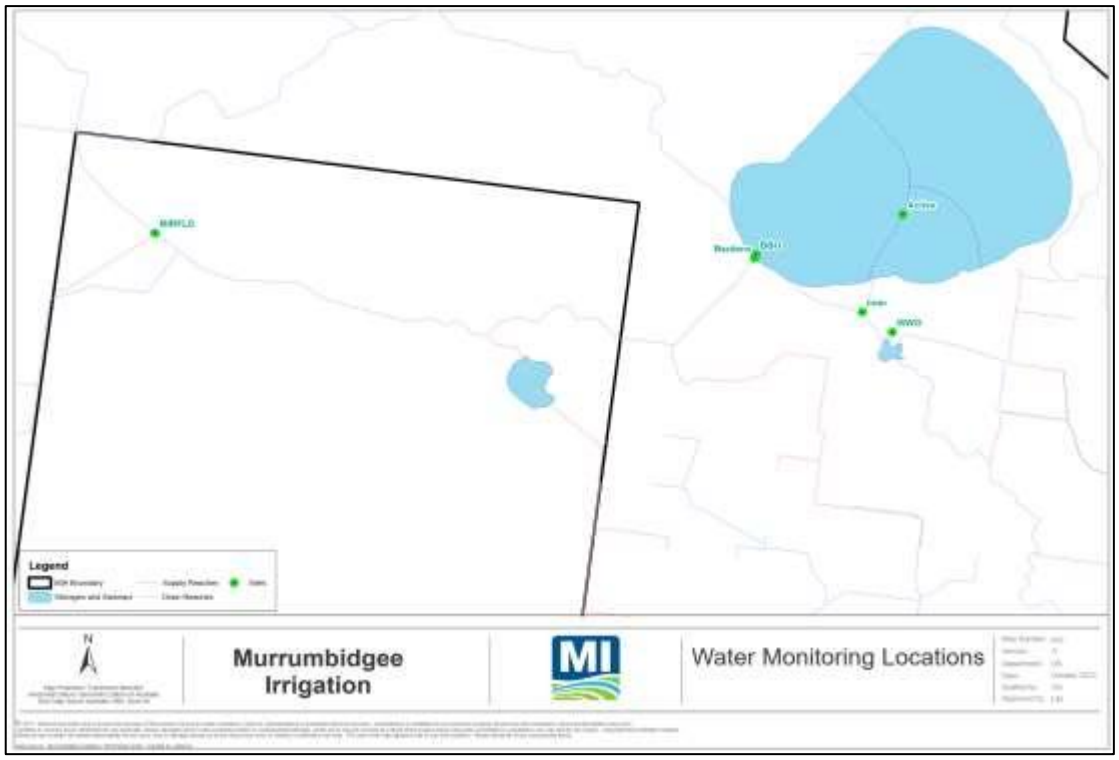


Figure 8: Water monitoring locations around Barren Box Storage

The locations where water is monitored and/or sampled under MI's Water Monitoring Plan are presented in **Figure 8**. The locations are described below, and graphs of the EC are provided from **Figure 9** to **Figure 13**.

- WWO – Willow Dam Regulator – flows can be directed BBS cells and to downstream supply channels via WWM.
- Inter – BBS Intermediate cell.
- Active – BBS Active cell. Note: No water volumes were stored in this cell post-construction until FY2011 (July 2010- June2011) due to low water allocation/ drought conditions.
- Bardens – Bardens Regulator – flows can be directed to Barren Box outfall channel (which also can lead to Mirrool Creek Floodway), continue down WWM to western supply channels and can also allow management of flows into or out of BBS Active cell. Site monitored from 2008.
- MIRFLD – Mirrool Creek Floodway: also, a discharge point under MI's EPL4651.

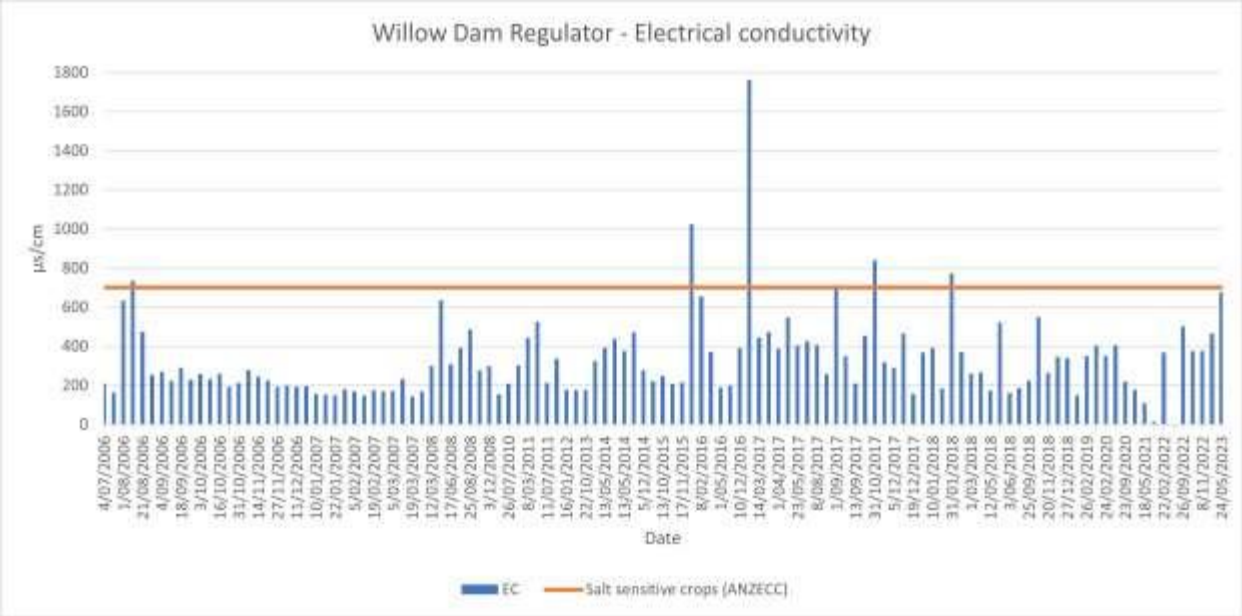


Figure 9: Electrical conductivity at Willow Dam Regulator – 2006 to 2023

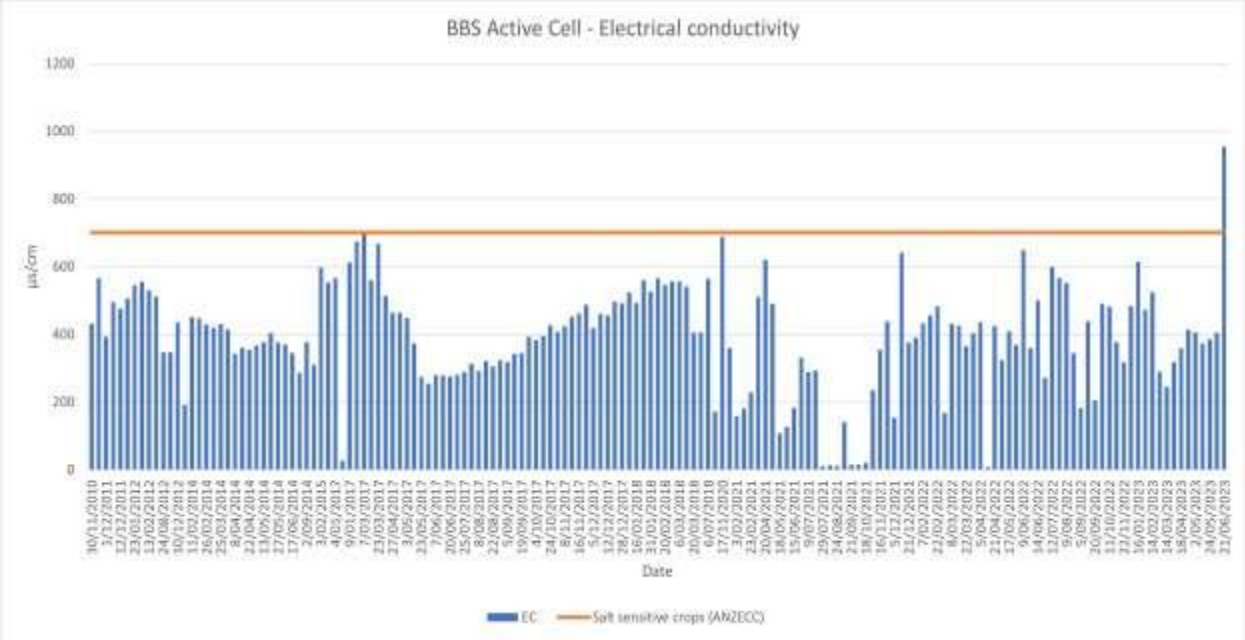


Figure 10: Electrical conductivity in BBS Active Cell – 2010 to 2023

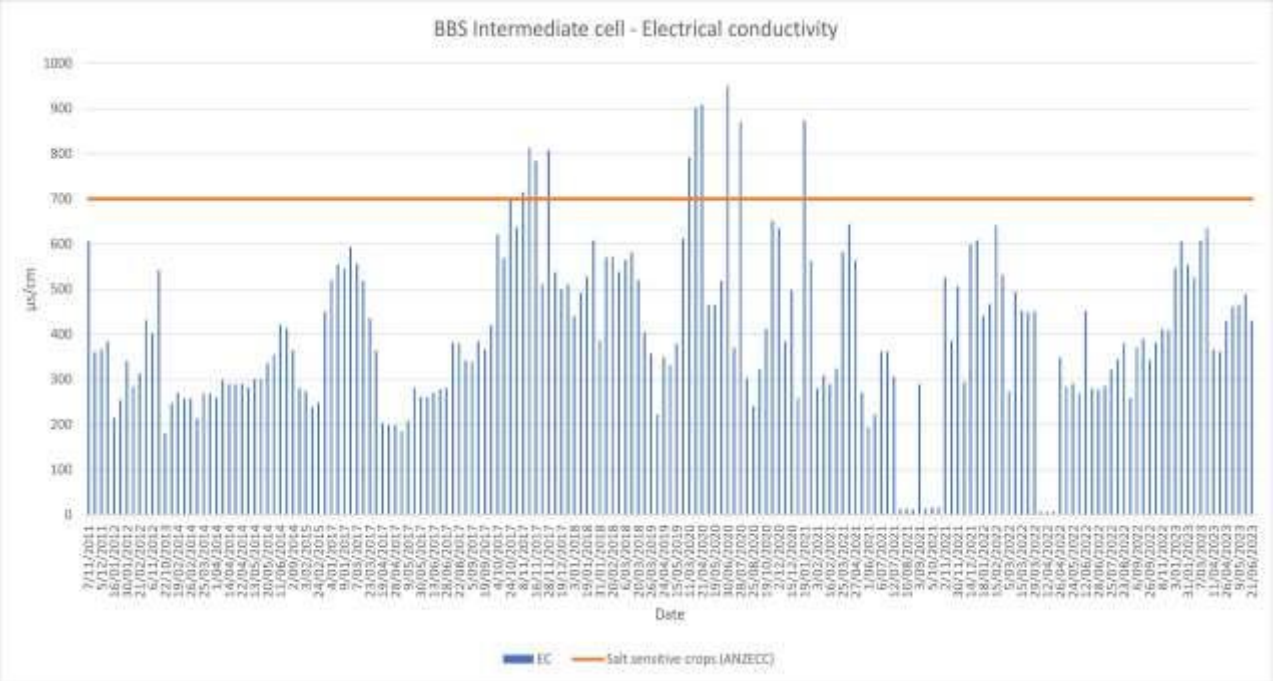


Figure 11: Electrical conductivity in BBS Intermediate Cell – 2011 to 2023

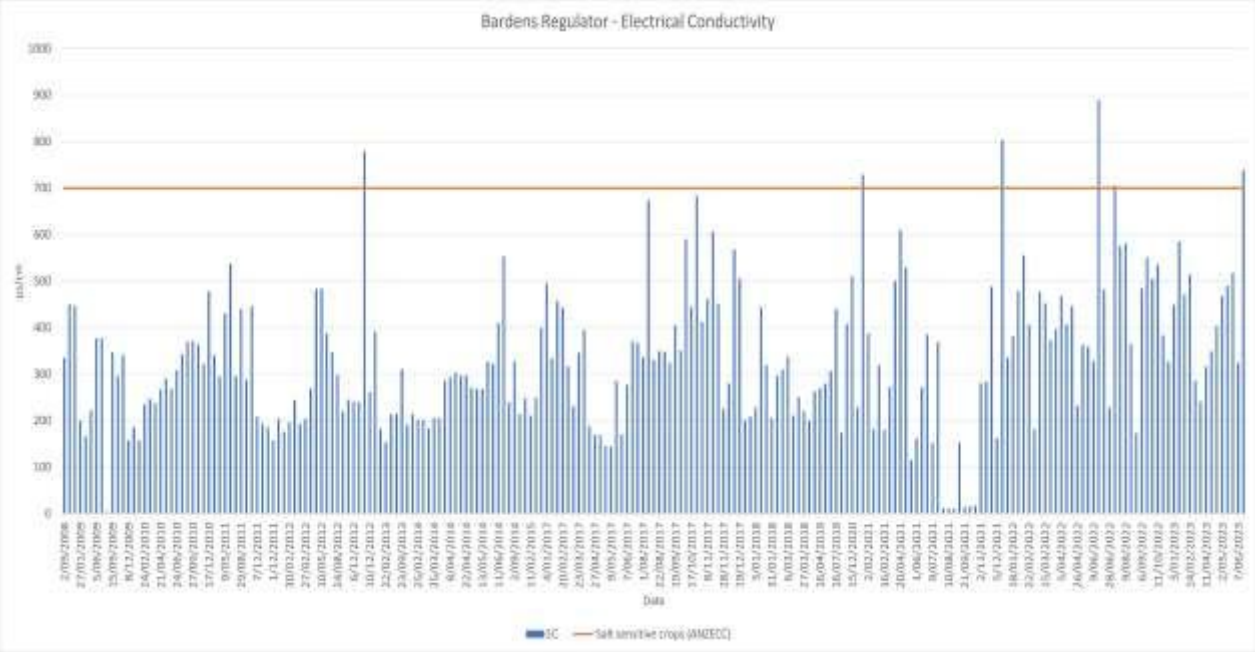


Figure 12: Electrical conductivity at Bardens Regulator (on WWM) – 2008 to 2023

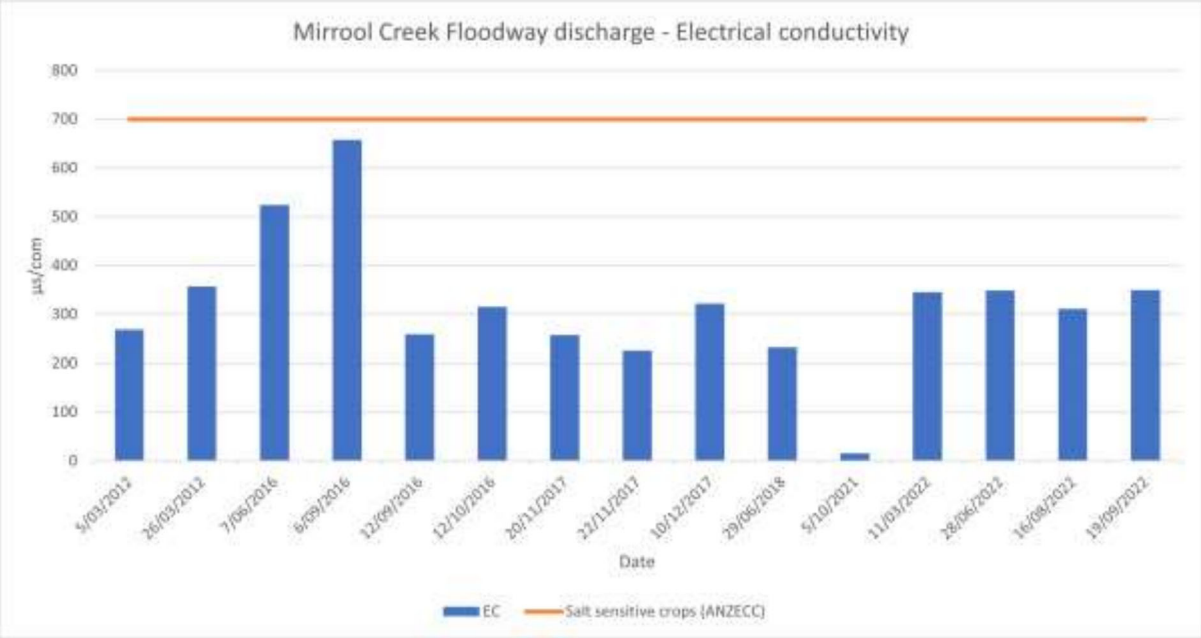


Figure 13: Electrical conductivity at Mirrool Creek Floodway for release events– 2012 to 2023

While the EIS provided some EC data, it was only for one year (2002-2003) and therefore would not reflect the many operating conditions experienced by the MIA, e.g. drought, supply volume variations, weather and floods.

The EIS Table 12-1 (see Error! Reference source not found.) and MI's Licence Compliance Reports (LCRs) provided the following information relevant to the graphs above.

- BBST – water within BBS – EIS: EC range 344-729 µs/cm.
- BBOW – BBS outflow water – EIS: EC Range 175-453; LCR: 2005-2006: 151-1296; 2006-07: 162-293; 2007/08: 150-471; FY 2009 - 2015 <700, 2015/16: 11 days in Feb/ Mar 17 exceeding 700 with max 732.
- BBO – Barren Box Outfall channel – EC Range 187-998

A key performance indicator for salinity in an irrigation setting, is based on the ANZECC guidelines (2000) for salt tolerant crops of 650 µs/cm adjusted based on the LWMP benchmark of 700 µs/cm used for BBOW sampling results to monitor water salinity supplied to Wah Wah customers.

MI's annual reporting and the graphs provided above shows salinity in and downstream of BBS has EC levels below this benchmark for the majority of the time. Exceedances reflect the variability of the generally closed irrigation system within the MIA, which is influenced by drainage water reuse throughout the system, water allocation and flood or severe wet weather events.

7.2.2.1.1 Results above benchmark

The Intermediate Cell, Willow Dam, and releases via the MIRFLD did not record any EC results above the benchmark over the period of 2022/23. Results above the benchmark are summarised in **Table 9** and more detailed data in **Appendix E**.

In general, results above the benchmark were short term and, in most cases, compliant results were achieved within one to two months if not sooner, depending on the regularity of monitoring. It is also likely that flood events and/or MI operations to manage flows up to, during and post flood recovery and draining of flood waters in the upper catchments, including by customers, have influenced results.

Table 9: Summary of samples above 700 µS/cm EC relating to BBS

Monitoring location	Financial year	Number
Willow Dam (BBS and WWM inflows)	2015	1
	2017	2
	2018	1
BBS Active cell	2023	1
BBS Intermediate cell	2017	5
	2020	5
	2021	1
Barden's Regulator (flows to BBS outfall and LMCF if releasing and WWM)	2012	1
	2021	2
	2022	2
	2023	1

Detailed results above the benchmark recorded since the BBS operations commenced are provided in **Appendix E**.

Further water quality information is provided under Section 8.3.4 for the BBS wetland cell and Section 9.2.2 for the water discharged to the LMCF.

7.3 Flora and fauna (EIS Chp 13)

7.3.1 BBS

The EIS determined the reduction and alteration of the flow regime at BBS would result in increased diversity of wetland plants including a range of submerged, emergent and woody perennial native taxa endemic to the region. Habitat diversity at BBS would also be increased for native fauna.

Positive impacts for waterbirds, for instance, would include:

- increased feeding grounds for wading species provided in the gilgai regions due to rainfall and incident runoff, and in the ephemeral shallows on the southern shore of the active cell;
- deep water feeding environment for birds such as ducks and cormorants in the active cell;
- increased diversity in nesting habitat with dead trees, live woody vegetation, lignum shrubs and reed bed systems; and
- increased food sources due to the predicted increased productivity of intermittent systems compared with those that have a permanent water regime.

The proposed restoration of a more natural flow regime to a significant portion of the BBS was likely to enhance habitat for native fish. The Active Cell would provide a permanent water source, while the ephemeral wetland area would encourage extensive habitat for small fish reliant on aquatic vegetation for food, refuges and breeding. It was expected that the wetland area would provide increased diversity of native emergent macrophytes and follow-on effects of increased macroinvertebrate and small fish populations, providing higher value food resources and habitat for a variety of fish. The deep water, permanent environment of the active cell and wetland area would provide habitat for obligate aquatic species such as turtles and crustaceans. The intermittent zone of the wetland area would be inundated every one in three to one in ten years and provide habitat for terrestrial species of mammal and reptiles and the gilgai area would possibly provide habitat for frogs.

7.3.2 Lower Mirrool Creek Floodway

During the EIS process, it was noted there was insufficient information to determine what the environmental water requirements of the LMCF should be. The EIS stated it had been suggested that it currently (i.e. 2004-5) received too much water and that flows into this ephemeral system should be reduced (Kinhill, 1994). This nationally significant wetland is the subject of a number of investigations and contains remnant vegetation, although the extent, condition and floristics have not been surveyed.

The EIS acknowledged that in the absence of this knowledge, MI would continue its current practice of releasing flows into the LMCF, at a reduced rate, in the short term (as was consistent with the MIA and Districts Community LWMP). An adaptive management approach would be adopted and linked with the outcomes of the current investigations which would be reviewed when available and the insight integrated into future water release practices.

7.3.3 Brays Dam

The EIS determined the hydrology of Mirrool Creek and Bray's Dam would not significantly alter with the addition of the En route Storage, with water levels remaining similar to those of current operations. There would therefore not be any significant changes to flora or fauna at the site. Revegetation post construction was identified as a mitigation measure due to vegetation clearance requirements for construction of the storage.

7.3.4 Current performance

The current performance is outlined below and/or referenced to another part of this report.

7.3.4.1 BBSW

Details on the BBS Wetland cell rehabilitation is detailed in Section 8.

7.3.4.2 LMCF

Details on the LMCF is detailed in Section 9.1.

7.3.4.3 Brays Dam

As part of compliance with condition 3.39 during 2006-7 planning and ground preparation of 6.5 hectares around Brays Dam was completed with planting of indigenous species taking place in July 2007.

A total of 2300 native species were planted, to form a future corridor with other proposed plantings along the entire length of Mirrool Creek which will improve the ecological functioning of the creek and surrounding landscape with future linkages to the rehabilitated Barren Box Wetland. Further Mirrool Creek works were undertaken over the following years as part of the Mirrool Creek project as part of the LWMP.

Direct seeding undertaken around Brays Dam in 2021 is outlined in Section 7.5.

7.4 Groundwater (EIS Chp 14)

7.4.1 EIS predictions

7.4.1.1 Barren Box Swamp

The EIS Chapter 14 determined the modifications to the BBS could result in an overall reduction in the rate of water seepage. The seepage flux for the widened WWM could increase along the length

of the channel alignment. However, while this may have resulted in an increase in seepage, the volume was considered insignificant when compared to seepage water savings resulting from the nearby modifications to BBS. Therefore, in combination, the EIS concluded works could be expected to produce an overall beneficial impact on the local groundwater regime.

7.4.1.2 En-route storage

The EIS concluded the combined steady state seepage from the proposed pumped En-route Storage was likely to occur above the rate that occurs under the existing site conditions which could further contribute to what appeared to be an existing high groundwater levels in the area.

The EIS noted, if seepage were to occur, waterlogging of land between the northern side of the proposed En-route Storage and Mirrool Creek would be the likely area where a partially enclosed groundwater basin could be created. These potential impact areas would be on MI land and no other adjoining properties are likely to be affected. The need for the installation of a groundwater cut-off drain in this area would be investigated following the installation of a more rigorous groundwater monitoring network. Engineering methods to reduce seepage were also considered in EIS Section 15 Geology, Soils and Geotechnical.

7.4.2 Current performance

During the detailed design, construction and development of the operational environmental management plan (OEMP), the (then) Department of Natural Resources Murray Murrumbidgee Office was consulted on the monitoring and management approach.

The OEMP included information covering the (then) current groundwater conditions and the EM31 results and compaction test results for the WWM. At the request of the Department of Natural Resources an additional three piezometers were installed adjacent to the WWM channel to allow the ability to monitor for seepage from the channel.

MI uses a combination of field observations, loss calculations and customer notifications for any seepage risks and investigations.

7.4.2.1 Monitoring and management – BBS and WWM

The WWM channel had investigations and remedial works that occurred following an Electromagnetic (EM) survey in 2004. Further details on the investigation and actions were included in the OEMP.

Groundwater monitoring using existing piezometers (where still in place) has continued since commissioning, in line with MI's Combined Approval 40CA403245.

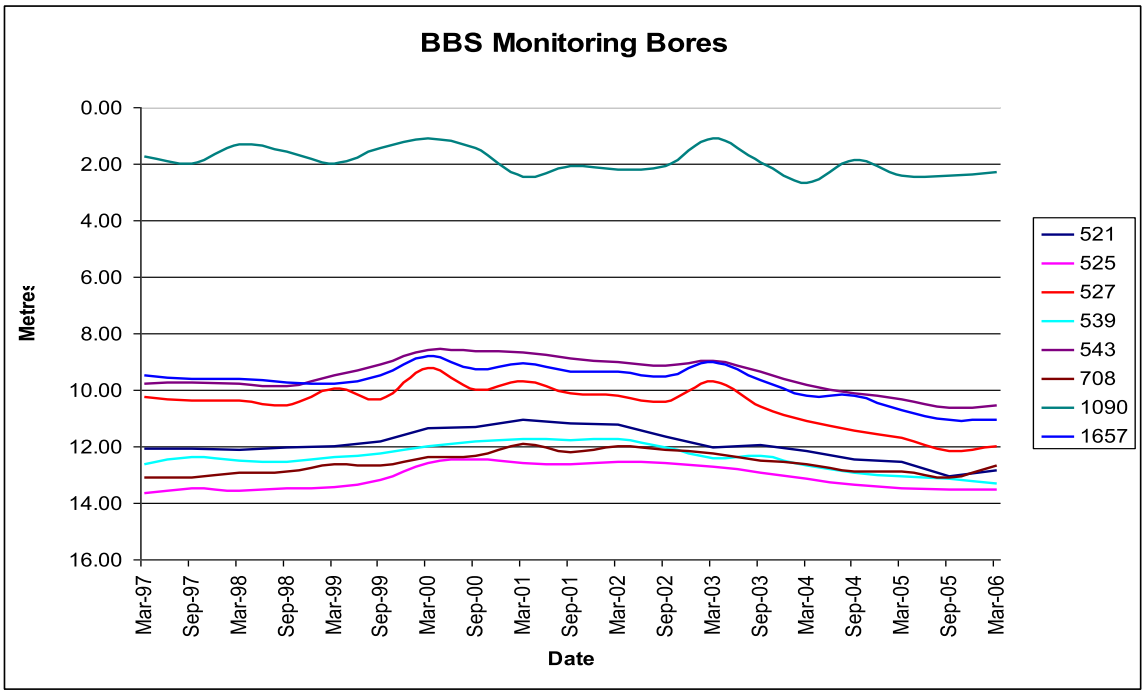


Figure 14: Standing water levels of BBS piezometers (pre-commissioning)

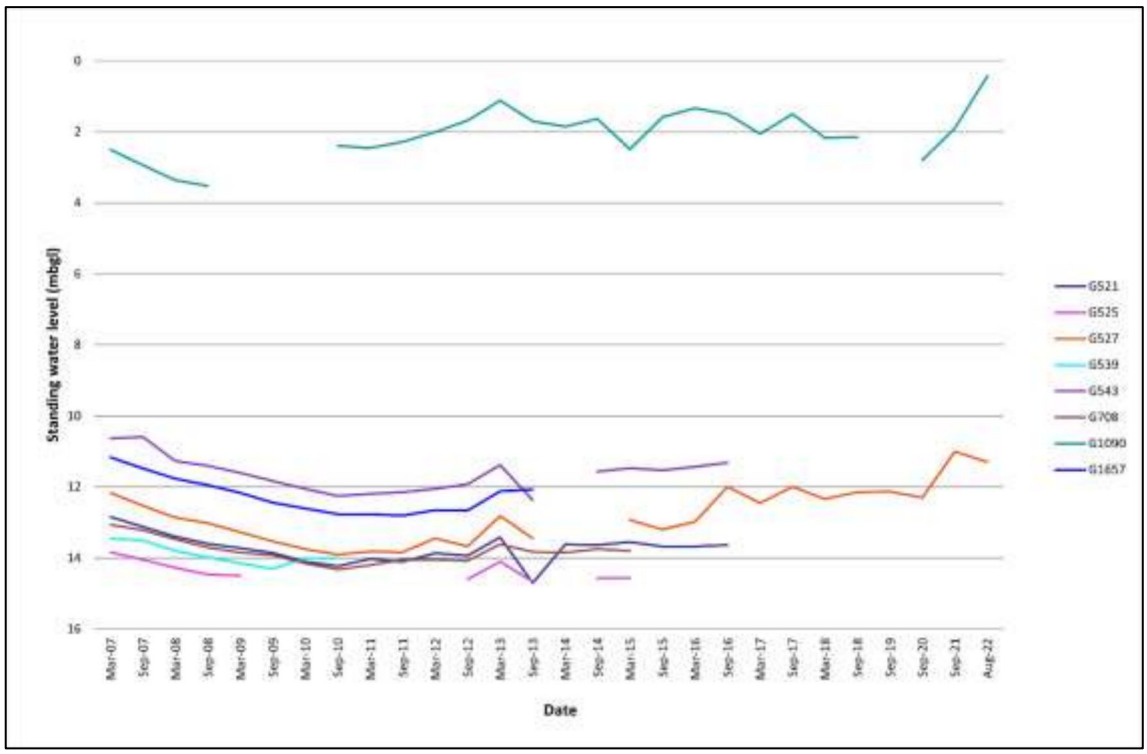


Figure 15: Standing water levels of BBS piezometers (post-commissioning)

The graphs above indicate that groundwater levels around BBS are generally in line with baseline levels, and in some cases are lower. Recent small increases in levels are likely to reflect higher above average rainfall and water allocations since 2020 following a longer period of drought.

No seepage evidence and/or complaints have occurred adjacent to the WWM since the project was commissioned.

7.4.2.1.1 Seepage estimation BBS

MI can estimate if there is a seepage risk, by monitoring levels during a 'lock-up test'. This is where inflow and outflow are stopped or not occurring for a particular storage or length of channel. The preferred minimum period for a lock up test is 72 hours.

Recent estimation results are not highly reliable for MI storages for 2022/23 season, due to the lack of suitable lock up periods from both higher water allocation, flood events and high rainfall.

The following estimate outlined below is from the 2021/22 season using a Huber regression method for the recorded levels at the BBS Active cell. No suitable lock up period was available for the BBS Intermediate cell due to high operational demand during 2021/22.

- Daily loss = 2.7mm/day ± 1.8mm/day
- Yearly loss = 11673.5ML ± 7951ML

The high error in the loss estimates is due to high variance in the lock-up test data as shown in the figure below:

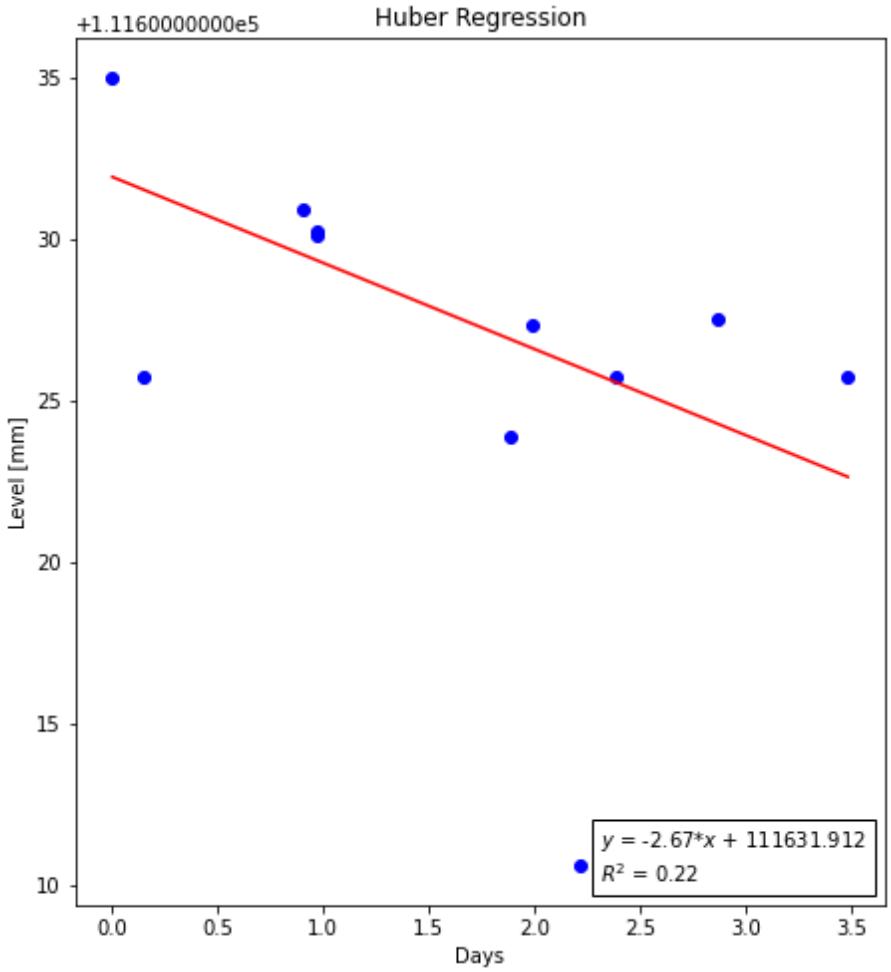


Figure 16: Huber regression for BBS Active Cell lock up data 2021

The loss calculation includes both evaporative losses and any influence on water levels due to wind action during the lock up period, so would be expected to be higher than actual seepage losses.

As part of MI's Asset Management Strategy development for water storages and our Automation project, seepage calculations will be refined to allow better assessment of seepage risks across MI's storages and include agreed lock up periods when irrigation demands aren't high.

In general, MI uses 5mm/day as an average expected seepage loss through channel banks and beds, indicating that seepage losses from the BBS Active cell are well within expected tolerances.

7.4.2.2 Monitoring and management – En-route storage (Brays Dam)

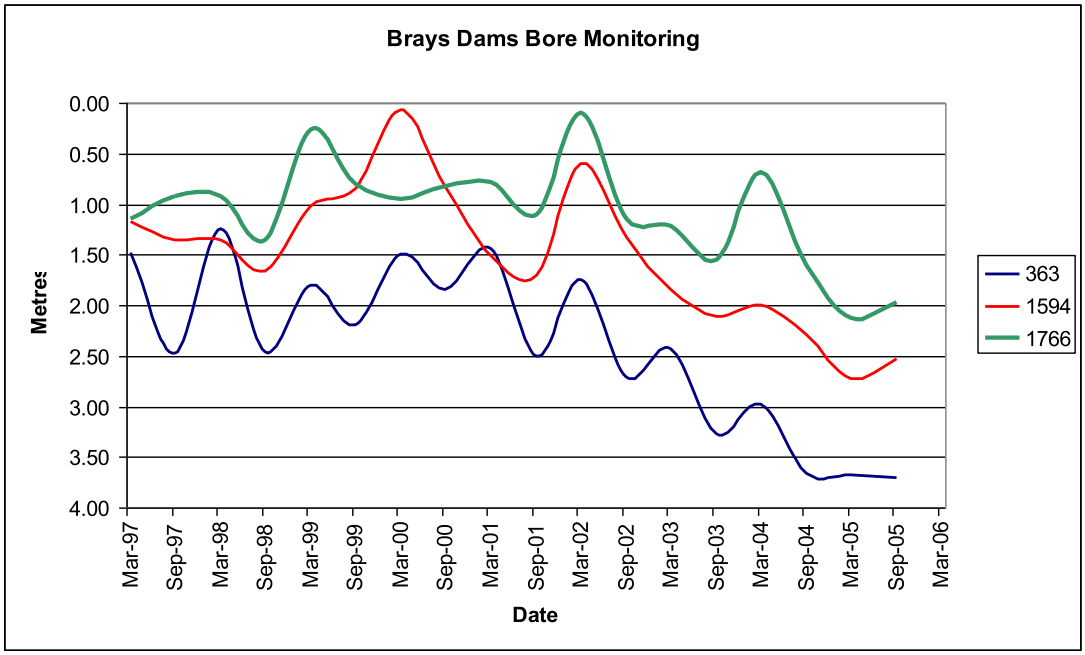


Figure 17: Standing water levels of Brays Dam piezometers (pre-commissioning)

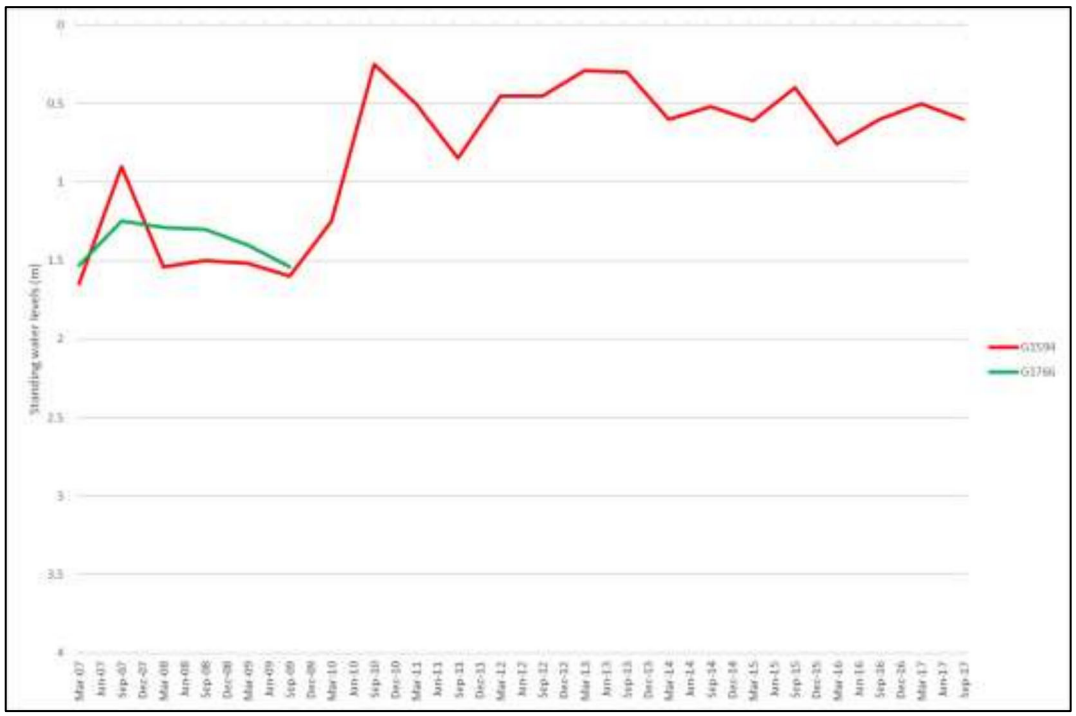


Figure 18: Standing water levels of Brays Dam piezometers (post-commissioning)

Piezometer G363 was decommissioned during construction as it was within the construction footprint. Piezometer G1766 was available until 2009 when it was destroyed, however results to that time show no rise in standing water levels above the pre-commissioning levels.

G1594 was available until 2017 when it was also destroyed. Standing water levels are within the extents of the baseline levels. As this was a shallow piezometer, the increase in levels past 2010 are

likely reflective of its location adjacent to a supply channel and in a low lying area in between both Brays Dam and the channel. This area was noted in the EIS as prone to water logging.

Destruction of piezometers over time occurs due to land development activities, as most piezometers are either not on MI lands or are in location where they are not readily seen. MI does have three piezometers installed post-construction along the northern bank of Brays Dam for use should seepage risks be identified.

7.4.2.2.2 Seepage estimation Brays Dam

The loss estimate at Brays Dam for the 2022/23 season is shown below in **Figure 19.** The Huber regression method was used for the estimates presented in **Table 10**. The daily loss value of 6.9mm/day for 2022/23 is very close to the estimate from the prior year 2021/22 of 6.8mm/day which shows that there hasn't been any significant change in water loss rates.

Table 10: Brays Dam lockup results

Season	Daily Loss	Yearly Loss
2022/23	6.9mm/day ± 0.3mm/day	1028ML ± 80ML
2021/22	6.8mm/day ± 0.6mm/day	2177.1ML ± 201ML

Figure 19 below shows the rate of change in level during the lock up period during July 2022, it shows a reasonably good fit to the data (r^2=0.75):

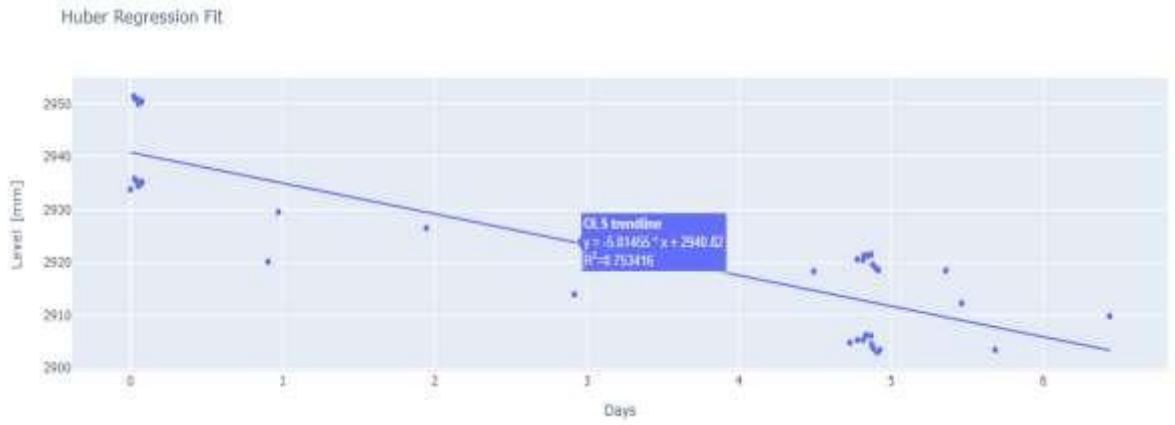


Figure 19: Huber regression for Brays Dam lock up data 2022

The loss calculation includes both evaporative losses and any influence on water levels due to wind action during the lock up period, so would be expected to be higher than actual seepage losses. Data from BOM show that the annual evaporation rate (Class A evaporation pan) from 1975-2005 data is 1800mm.

As part of MI's Asset Management Strategy development for water storages and our Automation project, seepage calculations will be refined to allow better assessment of seepage risks across MI's storages and include agreed lock up periods when irrigation demands aren't high.

In general, MI uses 5mm/day as an average expected seepage loss through channel banks and beds, indicating that seepage losses from the Brays Dam are within expected tolerances, when consideration of the expected evaporation is considered in the loss calculations.

There have been no seepage reports and/or complaints around Brays Dam since its construction.

7.5 Landscape and visual (EIS Chp 15, 3.39)

In December 2020, MI approached Griffith City Council to determine if they were satisfied with landscaping provided around Brays Dam in response to Condition 3.39:

The Applicant shall ensure that landscape works surrounding the En-route storage facility is undertaken to the satisfaction of Griffith City Council.

The Submissions Response Report (URS 2005 – Section 4.13.2) for the project outlined that landscaping around Brays Dam would meet Table 14-4 of the EIS which stated:

Replace trees removed from the surrounding home site for both ecological and aesthetic purposes.

Council advised in early 2021 that the original landscaping expectation was not met by the landscaping which had established on site and that additional planting work was required. While this appeared to be beyond what was determined during the EIS, MI agreed to undertake direct seeding to the remaining perimeter areas of the dam where it was feasible. This approach and the proposed species were accepted by Council.

Direct seeding was undertaken on 9 April 2021 by specialist contractor Riverina Revegetation, following delays due to rain. In March 2022, good establishment was noted from the seeded zones as shown in **Photo 1** and **Photo 2**.

MI's correspondence with Council on this matter is included in **Appendix G**.

Photo 1: Direct seeding performed on 9 April 2021 by Riverina Revegetation Pty Ltd

Photo 2: September 2022 establishment following direct seeding during April 2021

7.6 Archaeology and heritage (EIS Chp 16)

The EIS concluded that BBS is a place of Aboriginal cultural significance and was once a meeting place for large groups of indigenous people. The proposed BBS Project had the potential to impact on a number of features of cultural heritage value. Artefacts would be collected and managed in accordance with the NPW Act and in consultation with the local Aboriginal community under the AHIP obtained for the project.

A construction phase Cultural Heritage Management Plan (CHMP) was prepared to ensure that any disturbance of archaeological artefacts was minimised and that contingency measures, as agreed to by the Aboriginal Community, were put in place should any artefacts be uncovered during construction works.

The cultural objectives and values of BBS were found to be complimentary to the proposal and present an excellent opportunity for both research and education within the wider community. MI would continue to work with the local Aboriginal community to ensure the archaeology of BBS, as identified by this project, is protected and further investigated. The protection and enhancement of the cultural heritage values of BBS is also a key principle for the management of the remaining area.

In addition, a CHMP was to be developed for the BBS wetland rehabilitation strategy and this requirement was included in the OEMP approved in 2008.

7.6.1 Current performance

MI have several processes and procedures for protecting cultural heritage in place within BBS, these include:

- Restricted access to BBS via fencing, locked gates, security cameras.
- OEMP requiring induction prior to entry to BBS.
- BBS induction outlining the cultural heritage significance and past artefact finds.
- MI Maps (MI's spatial mapping) highlights the whole of BBS as a cultural heritage risk site, triggering assessment prior to any earth disturbance and/or access off existing access tracks.
- MI's Cultural Heritage Management Procedure detailing the requirement to check prior to works and/or stop work and report should any potential artefact be found.

8 Barren Box Storage and Wetland rehabilitation (6.5d)

MI reported annually up to 2013 on the BBS project during its environmental approval process, planning and construction and then post commissioning via the LCR and later ACR which has been published on MI's website over the years.

Funding for rehabilitation and other environmental initiatives was mainly managed via the Envirowise funding, which supported the requirements of the MIA & Districts LWMP. Reporting on both financial and milestone reporting also occurred to relevant committees and government bodies on an agreed basis.

A summary of reported information is included in **Appendix H**.

The sections below summarise the progress highlighted in these reports, plus recent progress.

8.1 Barren Box Wetland rehabilitation plan

The Barren Box Wetland rehabilitation plan 2009-2014 as required under Condition 6.5d was developed by the Barren Box Storage and Wetland Rehabilitation Technical Panel which was made up of MI staff, technical experts and stakeholders, including cultural heritage staff and adjacent landholders. The plan was developed with reference to the Wetland Concept Plan provided in the EIS and *Deflation basins and BBS* (Jane Roberts June 2007).

The draft plan was publicly displayed and provided to Government departments for comment towards the end of 2008. Implementation commenced in 2009 with preliminary works and some trials and revegetation having commenced in 2007 and 2008. Direct seeding occurred in May 2011, tube stock planting in July 2017 and tree planting in 2018 all in the Education Area.

8.1.1 Timeline of activities

A timeline of activities has been summarised from LCRs and ACRs developed by MI over time and is included in **Appendix H**.

Information from these reports, together with historical records of seed purchases, contractor engagement, etc was collated and provided to NGH and is summarised in Section 8.1.2.

In 2014 the LWMP came to an end as government funding ceased in 2013, resulting in no further reporting under the then ACRs and/or as a requirement of MI's EPL 4651. As noted in Section 2, MI inadvertently ceased reporting externally on the project and rehabilitation plan.

Activities following the 2012 floods are outlined in the following sections and included post-flood monitoring, weed and pest fauna control and revegetation on terrestrial sites around the Intermediate Cell.

Internal MI information provided the following summary of rehabilitation plan activities:

Table 11: Summary of BBSW Rehabilitation Plan activities

Activity	Completed
Site specific revegetation plans completed in accordance with BBWRP and legislative requirements	December 2009
Site preparation (weed control, groundworks, etc) using Indigenous and community members complete.	March 2010
Native seed collected and prepared for revegetation works using Indigenous community members.	June 2010

Activity	Completed
Revegetation completed in accordance with BBSWRP	March 2010 to June 2012
Indigenous partnership created to prepare the cultural and heritage management plan	December 2009
Nesting boxes constructed and placed in existing stags within Barren Box	June 2010
Feral animal control plan developed and implemented	Ongoing
Development and construction of educational facilities including Indigenous interpretive sites using members of the Indigenous community.	June 2012
MER plan implemented	Commenced June 2010

8.1.2 Implementation of revegetation program

The following summary was included as Table A1 in NGH's report: *Site Inspection Barren Box Storage and Wetland Modification October 2021*, which was provided with MI's Modification Application as detailed in Section 11. The report is included in **Appendix I**.

Table 12 outlines the revegetation efforts completed under the plan, with minor updates as additional information was identified after the report was issued.

Figure 20 below reproduces Figure 25 of the plan showing the planting zones proposed for revegetation activities.

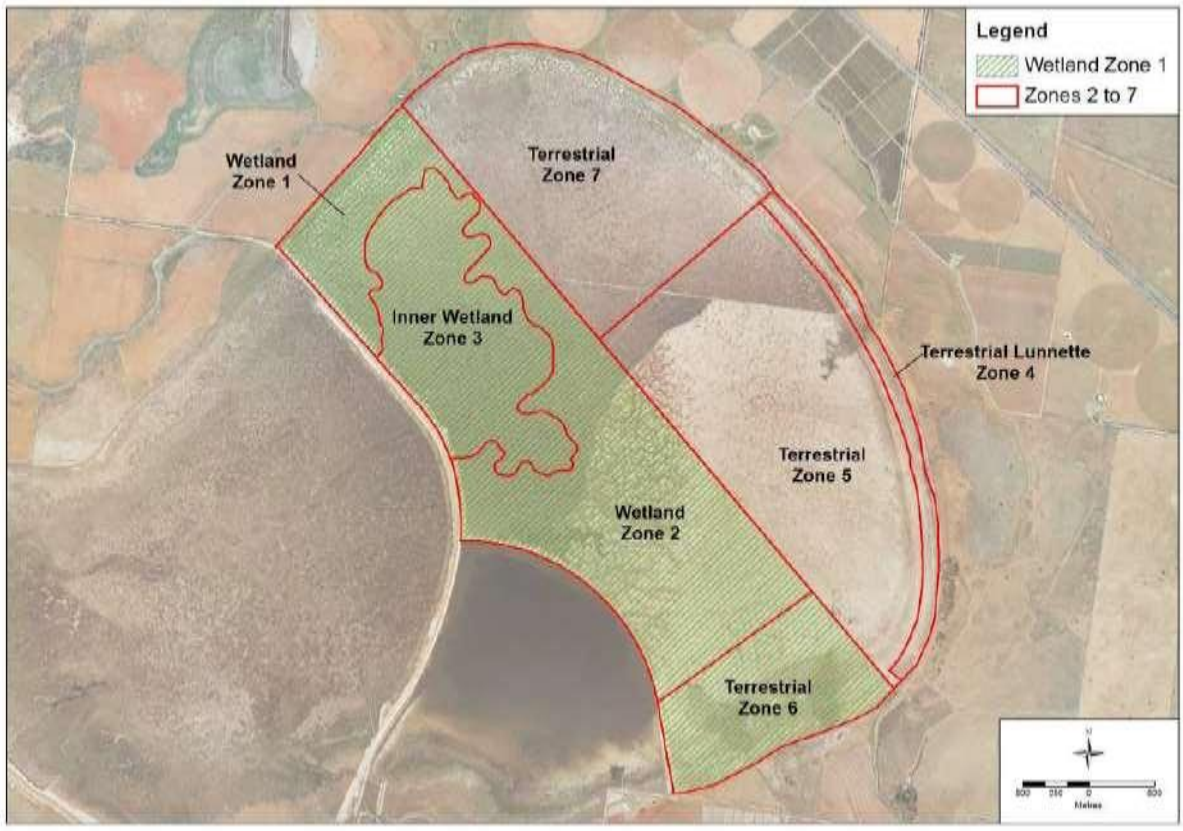


Figure 20: BBS Wetland cell planting zones for revegetation activities.

Table 12: Implementation review of BBWRP - Revegetation Program

BBWRP Action	Location	Timing proposed under plan	MI Implementation
Aerial sowing of 30kgs of local provenance Black Box (*Eucalyptus largiflorens*) seed	Wetland Zone 1	August 2008	2007 seed collection undertaken. Aerial seeding Zone 2c July / August 2008 – 30 kg over 690 ha Zones 1, 2, 3 & 4 (drier conditions with some residual soil moisture, 50% burnt 50% unburnt) November 2010 - 30kg applied over 500 ha of zone 1, 2 & 3 (optimum conditions due to semi-inundation from environmental water flow allocation application to wetland)
Aerial sowing of 20kgs of local provenance Black Box (*Eucalyptus largiflorens*) seed	Wetland Zone 2	Spring following average winter rains and soil moisture is near field capacity Or Early Spring 2009 following forced autumn/Winter releases into Wetland Zone	
Tubestock of local provenance Lignum *(Muelenbeckia florulenta)*	Inner Wetland Zone 3	Spring following average winter rains and soil moisture is near field capacity Or Early Spring 2009 following forced autumn/Winter releases into Wetland Zone	No record of tubestock planting in zone 3. Aerial sown in 2008 and 2010
Tubestock Planting **Community 2** Refer to Appendix 3 (Rehab Plan) for full species list	Terrestrial Lunette Zone 4	Autumn 2010 Dependant on favourable conditions	Undertaken in Autumn 2011, 2012.
Direct Seeding of local provenance chenopod shrubland species	Terrestrial Zone 5 Terrestrial Zone 6 Terrestrial Zone 7	Zone 5 Spring 2009 Zone 6 Autumn 2010 Zone 7 Autumn 2011 Dependant on favourable conditions	Terrestrial zone – direct seeding 300ha June 2009 – Boree & chenopod shrubland species. Terrestrial Zone 5 – Direct Seeding 390 ha undertaken in May 2010, May 2011 and 2018. Air blown native grass seed 2010 Terrestrial Zone 6 – Direct seeding undertaken in May 2011. Terrestrial Zone 7 – Direct Seeding Undertaken July and Aug 2009 300ha.

BBWRP Action	Location	Timing proposed under plan	MI Implementation
Additional works (not RP actions)			
Tubestock planting of native vegetation	Education Area (Intermediate cell)	N/A	Direct Seeding in May 2011 Post 2016 floods: Tubestock (48,000 seedlings) planting August 2017 Tree planting (18,000 seedlings) May 2018
Direct seeding and tubestock planting	Active Cell (new 2a) Perimeter BBS	n/a	Direct seeding August 2007 March 2008, July 2009 June 2009 native tree species perimeter BBS

8.2 Financial information (6.5diii)

MIA EnviroWise (otherwise known as the MIA and Districts' Community Land and Water Management Plan 1998) LWMP, was endorsed by DNR in 2001.

The MIA EnviroWise program was funded from the National Action Plan for Salinity and Water Quality (NAP). The cost of implementing MIA EnviroWise was shared between the NSW and Australian governments and the MIA and Districts community.

The expenditure of MIA EnviroWise funds was administered in accordance with the cost share principles negotiated prior to the approval of the LWMP 1998 and subsequent principles developed by the MIA EnviroWise Advisory Panel in 2001. Government funding for the LWMPs ceased in 2013.

While financial information wasn't included in the rehabilitation plan (Condition 6.5 d iii), the commitment was included in the EnviroWise funding process under the LWMP. MI was required to report quarterly under the EnviroWise funding process to the NSW Government's Murrumbidgee Catchment Management Authority (MCMA). Full copies of these reports have not been retained due to the retention policies relating to those financial records.

Financial expenditure under the LWMP was summarised annually by MI via the LCR/ACRs.

Financial information is summarised below, using estimates from graphs provided in the LCR/ACRs and other supporting information found in historical records:

- 2007/2008 – budget request for $203,000 (from Biodiversity project expenditure of $900,000, exact expenditure not found).
- 2008/09 - $191,590 (budget $450,000)
- 2009/10 - $184,000 (budget $254,000)
- 2010/11 - $263,151 (budget $215,000)

From the 2012 report, no further financial breakdown was provided, however funds were expended in 2011/12, with tubestock planting occurring in Autumn for both 2011 and 2012. With very wet conditions during late 2011 and the 2012 floods, expenditure for these periods were likely to be less than 2010/11.

Following the floods, additional plantings were undertaken under the Million trees funding and with regular weed treatment, water quality sampling, pest fauna control and fire trail and fence maintenance covered under MI operational expenses. MI operational expense records:

- 2021/22 - $160,000 (budget $175,000)
- 2022/23 - $137,000 (budget $100,000)

Overall, it is estimated that to date over $1.15m has been spent on the rehabilitation plan implementation. This includes the operational expenditure from 2021 onwards and is inclusive of recent investigations, research and reporting as part of the modification application. It does not include any costs related to the LMCF works and investigations.

8.3 Monitoring and measurement

Barren Box Wetland Rehabilitation Plan 2009-2014 – Section 7 detailed the essential components of monitoring, evaluation and review on the status and condition of the ecosystem (Condition 6.5 d xi).

Monitoring for the rehabilitation of the Wetland Cell at Barren Box Storage and Wetland was to be undertaken in two parts:

- Short term monitoring of revegetation success to inform ongoing management; and
- Long term monitoring against ecological targets.

The plan indicated a comparison of these against targets allowed evaluation of project progress and success.

The plan had a life of 5 years (2009-2014). At the end of this period, a formal review was proposed to assess the achievements and progress towards ecological targets and review the vision and objectives to assess their further relevance and feasibility. The review was to include an assessment of monitoring data by an expert technical panel to determine whether additional actions are required to meet long-term ecological targets.

In 2016, MI undertook an internal review of the plan and prepared a draft action plan for the 2016-2021 period, based on the work done by Paul Blumer (2015) and others. Unfortunately, due to the 2016/17 flooding, this plan could not be enacted around the wetland cell, so revegetation efforts focused on the land area around the Intermediate cell and Education shelter and to weed and pest fauna control as well as improving fencing and access control.

8.3.1 Waterbird monitoring

To support understanding of the ecological outcomes of the wetland rehabilitation a detailed waterbird monitoring program of the intermediate cell was initiated by MI in April 2007. Surveys began in March 2008. Initially proposed with fortnightly surveys over a period of 24 months, these surveys were planned to establish baseline data on waterbird species and abundance in the MIA.

Following completion of the 2008-2010 waterbird study MI agreed to extend the study period for a further two years with surveys conducted monthly to enable comparisons of abundance and species richness over a longer timeframe.

The findings of the monitoring program are summarised in **Appendix H** based on annual reporting from MI's Licence Compliance Reports. All reports were issued to the (then) Department of Natural Resources as part of the reporting against the MIA & District LWMP.

8.3.1.1 Bird field survey data

MI has facilitated and/or funded bird field surveys over many decades. The data has been collected via local community interest groups (i.e. bird watching groups, local community groups) as well as formal ecological surveys. Bird data is also supplemented by information from e-bird (a global birding database) and Birdlife Australia's Birdata as well as MI staff observations.

In general, bird surveys are undertaken annually, however in 2020 and 2021 due to a combination of alligator weed outbreaks and covid-19 restrictions surveys were not undertaken. The 2020 data was obtained from e-bird data taken from Shaw Road Tabbita indicating observations were taken from outside the BBS gates but focused on the adjacent BBS areas visible from the survey location.

The collated data has been graphed below in **Figure 21** and Error! Reference source not found.. While not all records are directly comparable, they do indicate BBS and its surrounds provide waterbird habitat and/or refugia over the longer term with species numbers increasing in recent years, including for bird species protected under legislation as shown in Error! Reference source not found.. Negative values shown in Error! Reference source not found. indicate the species was recorded based on measures other than visual sightings, e.g. bird call, nest or specific habitat noted.

During 2022/23 the Department of Regional NSW completed an aerial survey by drone at BBS to obtain waterfowl species data to assist in their annual waterfowl quota report. The waterfowl species observed at BBS included:

- Australasian Darter - Anhinga novaehollandiae
- Australian Pelican - Pelecanus conspicillatus
- Black Swan - Cygnus atratus
- Eurasian Coot - Fulica atra

- Great Cormorant - Phalacrocorax carbo
- Great Egret - Ardea alba
- Grey Teal - Anas gracilis
- Little Pied Cormorant - Microcarbo melanoleucos
- Pacific Black Duck - Anas superciliosa
- Pied Cormorant - Phalacrocorax varius

This data will be reviewed as part of the broader assessment of the Wetland Rehabilitation in 2023/24.

MI will continue to facilitate bird counts at BBS by community groups, while maintaining strict access and weed hygiene protocols due to the General Biosecurity Direction in place due to the presence of Alligator weed.

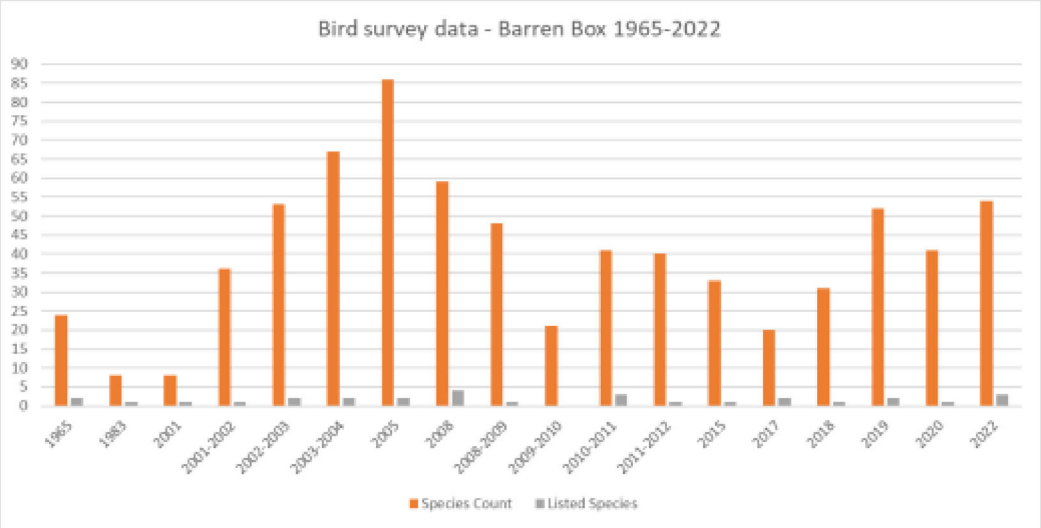


Figure 21: Bird species numbers recorded at Barren Box Swamp/ Storage 1965-2022

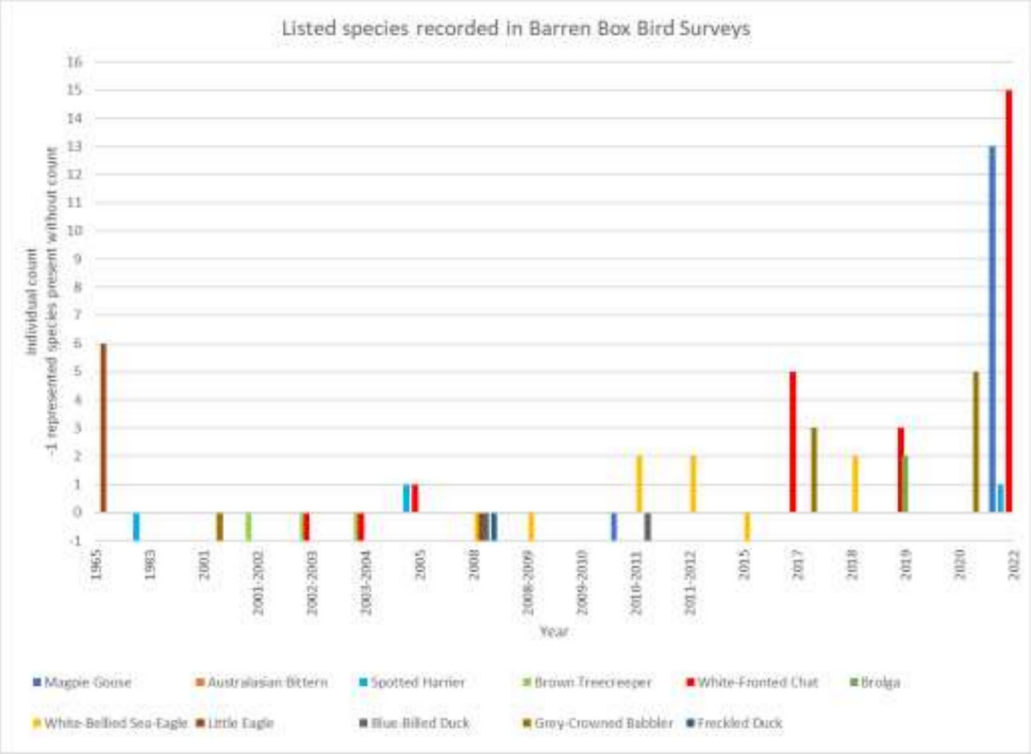


Figure 22: Listed bird species counts recorded at Barren Box Swamp/ Storage 1965-2022

8.3.2 Ecological surveys

The vegetation survey efforts relevant to the rehabilitation of the Wetland Cell that have been undertaken consist of:

- URS Flora and Fauna Assessment 2004
- Baseline Vegetation Survey 2007
- 2013 post-2012 flood monitoring
- Review of Vegetation 2015
- NGH Barren Box Storage Modification Site Inspection 2021 (**Appendix I**)
- NGH Barren Box Storage Modification Site Inspection 2022

For further information regarding the vegetation survey efforts outlined above please refer to Murrumbidgee Irrigation Barren Box Project AEMR 2006-2022.

Given the time from the initial EIS survey and more recent surveys and the changes in ecological assessment methodologies over this period, MI engaged NGH Environmental to develop a survey methodology and seek feedback from DPE Biodiversity Conservation and Science officers. Once feedback is received, and access is available, surveys will be undertaken and allow ongoing survey efforts to be more easily compared to determine rehabilitation outcomes and any additional actions to be undertaken, e.g. weed control or similar.

Information from past surveys will still be considered where applicable and build on the knowledge of the wetland cell and its ecology. Flooding, inundation periods and environmental water regimes will also be incorporated into ongoing assessments.

Due to flooding experienced in the Griffith and surrounding areas in late 2022, ecological field surveys were delayed due to flood waters. MI submitted NGH's survey methodology to DPE-BCD in September 2022 and received feedback in July 2023. The feedback is currently under review and an update on the progress will be provided in the next reporting period of 2023/24.

8.3.3 Salt and nutrient accretion

A condition of the approval (6.5dvii) was for the rehabilitation plan to include:

vii) procedures for the management of salt and nutrient accretion

The plan's development by the Technical Panel, which included experts in wetland ecology and rehabilitation consider this requirement and determined (see Section 4.4.2 of the plan) that the likely consequence of eutrophication and algal blooms are likely to be minor, given:

As a terminal system that receives irrigation drainage water, it is highly likely that the system will become nutrient enriched. However, this will be mitigated by extended dry periods. Consequence: Given that inundation of the Wetland Cell will occur on average once every 4 years for 2 – 8 months and that the water will not be extracted for human use, the consequences of eutrophication and algal blooms are likely to be minor.

Therefore, no specific measures for nutrient accretion were included in the plan.

Salinity management had been a focus area under the LWMP, driven by the overarching MDBA's salinity plan and targets. MI undertook significant works and educational programs to aid in minimising salinity levels across the MIA.

As noted in Section 7.2.2.1 the salinity levels (using EC) of the waters flowing into and out of the BBS system are generally below the benchmark level of 700 µS/cm and therefore have salinity levels close to or lower than accepted Australian drinking water levels for EC.

Since the BBS project was commissioned, no evidence of salt accretion has been noted in or around the wetland. In addition, no corrosion of concrete or steel infrastructure has been noted to indicate high salt levels in the ground or water.

Given there has been two major floods in the past as well as one occurring in late 2022, the original expectation that major floods occur 10-15 yearly in the region has not been realised. These floods aid in further dilution and/or flushing of both surface and groundwater EC levels.

Further details are included in Section 8.3.4 regarding salinity assessment.

8.3.4 Water quality

As noted previously MI undertakes water quality monitoring for both discharges from licenced discharge points as well as key locations within the MIA network.

Sampling of BBS storages occurs tri-annually when the cells are holding sufficient water to safely sample.

Since commissioning of the BBS project, the storage water quality has been used as an indicator of the water discharged to the wetland cell. Releases to the wetland cell that occurred during 2022/23 are included in section 7.1.2.2.

During 2022/23, water quality samples were taken directly from the storage cell discharge points to better define the water quality entering the wetland cell.

Water quality results for 2022/23 are included in **Appendix J**.

The results indicate that water quality is a good quality, with EC, dissolved oxygen and pH all within a suitable range. The turbidity is slightly elevated, which is expected due to managing Mirrool Creek minor flood flows which also is indicated in elevated iron and aluminium results, likely to due to local soils contributing to these levels.

Trace indicators of some agricultural pesticides are present, with no chemical levels above the EPL4651 notification and action levels triggered for the 2022/23 season.

MI's Water Monitoring Plan was updated to include water quality sampling following release events where the wetland cell is inundated, nominally more than 10,000ML, in line with the tri-annual benchmarking samples. Sampling also indicates field observations of inundation levels, and when evidence exists of ecological change, e.g. change in pest flora or fauna, evidence of salt accretion, significant flora or fauna presence or physical damage from floods or unauthorised or illegal activities.

Figure 23: Drone photo taken 11 November 2022 of BBSW during the flood
Active cell top left, intermediate cell bottom left and wetland cell top right

8.4 Biosecurity management

8.4.1 Weeds

MI manages biosecurity risks from weeds and nuisance plants under a Weed Management Strategy which outlines weed identification, inspection schedules, preferred treatment and any specific permits available for targeted treatment. The Weed Management Strategy also outlines treatments including biocontrol and non-chemical treatments and any trials to be researched and/or undertaken.

Supporting the Weed Management Strategy is MI's Weeds of National Significance (WONS) Strategy. This procedure focuses on WONS found in the MIA, and outlines the requirements for annual planning, inspections, treatment and external notification/ reporting based on the plant type, recommended treatments, including applicable APVMA permits, and life cycle.

The above procedures support the BBS OEMP.

Weed inspections and treatment efforts remained steady during 2022/23, wet conditions and the flood, restricted access to areas such as the wetland cell and surrounding ground level access and fire trails. It is expected that where the wetland cell remains inundated, woody weeds will be drowned out and/or inhibited.

Future surveys, once access is available, will aid in determining further weed treatment requirements and opportunities.

8.4.1.1 Alligator weed

The key biosecurity risk in the BBSW area is Alligator Weed (*Alternanthera philoxeroides*). MI undertakes scheduled inspections of areas where past or current outbreaks occurred, as well as areas further downstream should conditions such as flood or high water supply/ allocation indicate a potential for spread.

During 2022/23 Alligator Weed inspections increased due to the flood event that occurred in late 2022. MI saw an exponential rise in plant growth during the summer months and undertook measures to prevent the spread by utilising floating booms along key supply channels, to impede the movement of floating mats of weed and allow easier inspection and retrieval / treatment as required. MI also undertook a blanket spray of the edges of the Active and Intermediate Cells to reduce weed growth with the aim to increase identification efforts of Alligator Weed.

The General Biosecurity Direction issued in December 2021 by Griffith City Council (GCC), as the local weed authority remains in place to exclude unauthorised entry to the public from BBS land and associated riparian zones. The direction was due to the increasing presence of alligator weed identified by both MI and Council due to above average rainfall and higher storage water levels creating ideal weed growth conditions.

While entry to BBS lands is restricted by locked entry gates controlled by MI and other approved entities (e.g. Council and approved Utilities), some illegal entry had been noted through other areas of the site. MI works collaboratively with GCC on managing these risks.

Since the issue of the direction, MI has increased security at gates and surrounding the site, a permit system for any approved contractors or visitors to the site is in place, along with the BBS site induction to ensure all MI staff, contractors and visitors are aware of the direction, weed hygiene requirements and the unique environmental and safety risks applicable to the site.

Table 13 outlines inspections and treatment undertaken in the BBSW and surrounding areas for Alligator Weed during 2022/23 compared to prior years.

Table 13: BBS Alligator weed inspection and treatments

Financial year	Inspections	Inspection area	Findings and treatment
2005-2006	2	BBSW – 31 plants, downstream channels 9 plants floodway - 12	All chemically treated when located and GPS points taken
2006-2007	2 2 1	BBSW – 6 plants Downstream channels – 3 plants Floodway – 3 plants	All chemically treated when located and GPS points taken
2007-2008	2 2 1	BBSW – 19 plants Downstream channels – 8 plants Floodway – 1 plant	All chemically treated when located and GPS points taken
2008-2009	2 2 1	BBSW – 6 plants Downstream channels – 7 plants Floodway – 4 plants	All chemically treated when located and GPS points taken
2009-2010	1 1 1	BBSW – 11 plants Downstream channels – 1 plant Floodway – 1 plant	All chemically treated when located and GPS points taken
2010-2011	2 1 1	BBSW – 6 plants Downstream channels – 2 plants Floodway – no plant found	All chemically treated when located and GPS points taken. Two larger plants removed by hand and buried on site at BBSW.
2011-2012	2 2 0	BBSW – 6 plants Downstream channels – 2 plants Floodway – no inspection due to flooding	All chemically treated when located and GPS points taken
2012-2013	3 3 1	BBSW – 14 plants Downstream channels – 23 plants Floodway – Wyvern only. 1 plant	All chemically treated when located and GPS points taken
2013-2014	2 2 2	BBSW – 11 plants Downstream channels – 4 plants Floodway. 0 plant	All chemically treated when located and GPS points taken
2014-2015	2 2	BBSW – 6 plants Downstream channels – 1 plant	All chemically treated when located and GPS points taken
2016-2022	At least 2 per annum	The MI spray record system, in place since 2016, shows the following treatments in the BBS zone: 2016 – 3 treatments 2017 – 4 treatments 2018 – 3 treatments 2019 – 3 treatments 2020-22 – numerous treatments, detailed inspections, physical removal and residual herbicide treatments.	All chemically treated when located and GPS points taken. Where the weed is found in an area not in close proximity of previously mapped plants, this information is reported to the relevant local weed authority (Council).
2022-23	56	BBSW – 225 plants Downstream channels – 146 plants	All chemically treated when located and GPS points taken. All sites were mapped with a 30m buffer zone implemented.

MI works closely with GCC and CSC and the State Priority Weed team on WONS management for alligator weed. MI also supports, attends, and where required facilitates the State or Council site inspections, the last of which was held in May 2023. It involved inspections of BBS lands, surrounding farms and downstream channels. MI staff, when available also attend Riverina Murray Alligator Weed meetings and Regional Weed Committee meetings.

MI supports and works collaboratively with the Irrigation Research and Extension Committee (IREC) on their many weed related initiatives and forums.

MI keeps detailed mapping and weed treatment records on all WONS locations. Where a WONS is mapped and not in close proximity to previously identified locations, notifies the applicable Weed Authority (i.e., local Council - GCC (for BBS and nearby zones) and Carrathool Shire Council for supply channels downstream of BBS past Bringagee Road, Tabbita). The Council weed officers then provide the information to the State Priority Weed Team.

8.4.2 Pest fauna

A few pest fauna are known to historically occur at BBS. The higher risk species include feral pigs, foxes and European carp.

MI staff and contractors are encouraged to report any signs of pest species, so that they can be assessed for potential control or other mitigation. In addition, MI takes reports from customers and surrounding community members or Councils relating to our land.

Pest fauna management undertaken since the BBS project was commissioned:

- 2006 Aerial shooting
- 2007 Fox baiting
- 2007 Pig trapping and shooting
- 2008-10 Pig trapping
- 2015 Fox baiting
- 2017-2018 European Carp removal
- 2021 Aerial shooting of pigs – LLS project included BBS lands
- 2021 Sheep removal (escaped into BBS from surrounding properties)
- 2021 Fox baiting and den fumigation (October)
- 2022 Fox baiting (March)
- 2022 Fox baiting and cat trapping (October)
- 2023 Fox baiting (April)

MI engages fully qualified and licenced contractors for pest control activities.

8.5 Planned activities to be undertaken in the next reporting period

Activities planned to be progressed for BBS including the wetland rehabilitation monitoring are detailed under Section 12.

9 Lower Mirrool Creek Floodway (6.5 d-x,xiv,xv, 6.5eii,iii & 7.4 h-i)

During the EIS process for the BBS project, it was acknowledged by both the Department of Planning and MI that a long-term study to determine ecological water requirements of the Lower Mirrool Creek was proposed/ required. At the time MI considered this study was best undertaken as part of the EIS for the WWSD Water Use Study, via the Water for Rivers program.

Water for Rivers was the joint government enterprise established to develop water efficiency projects and other measures, including licence purchases, to recover the water for the three Increased Flows programs.

The Water for Rivers enterprise completed its task of securing enough water entitlements from the western rivers to achieve the target Increased Flows volumes in July 2012.

While the initial Water Use Study was undertaken for the WWSD in 2006, the project was not funded under the Water for Rivers scheme and planning and construction of the project did not occur until 2016-2019. At that time it was determined that an EIS was not required, and the project proceeded under a Review of Environmental Factors process.

9.1 Assessment of the health of the LMCF (7.4h)

Figure 24 shows the location of LMCF, with the listed wetlands marked from left – Belaley Swamp, Berangerine Swamp, Little Berangerine Swamp, Highway Swamp and Five Oaks Swamp. This map was provided to Department of Planning during negotiations on the EIS to highlight the wetlands to be considered during any environmental water investigations.

Narrabri Swamp is located approximately 7km upstream of Five Oaks Swamp, however in some cases was not considered to fall within the floodway wetland system (URS 2006).

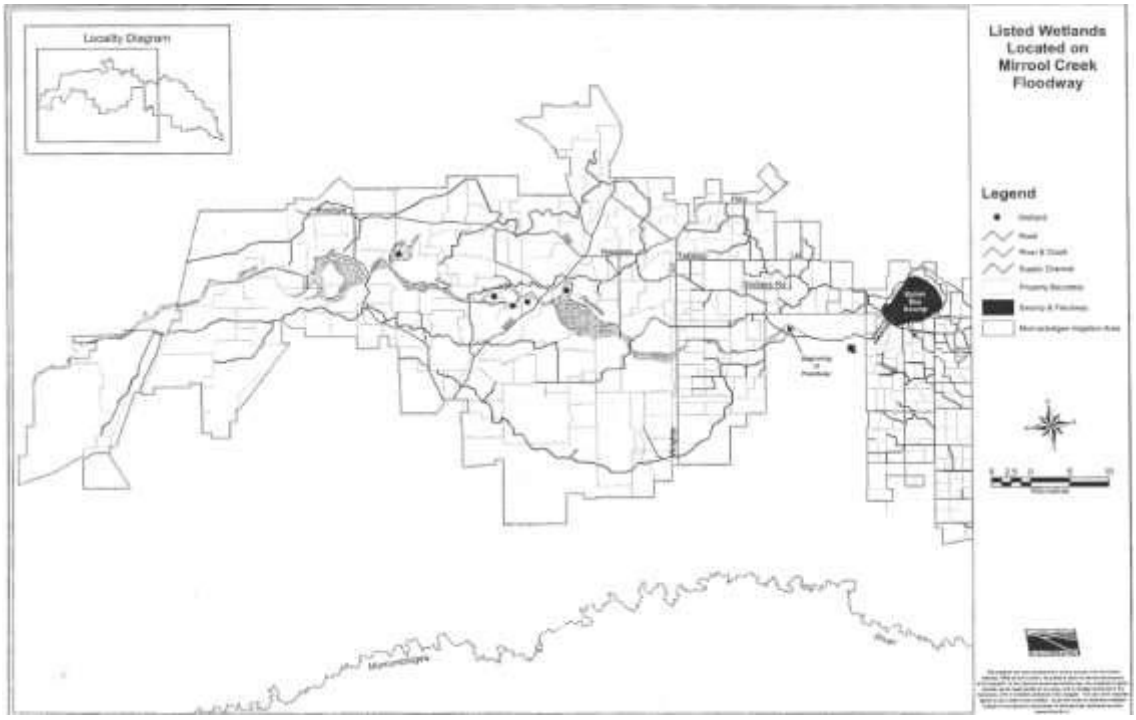


Figure 24: Lower Mirrool Creek Floodway location (MIA extent in 2004)

Figure 25: Lower Mirrool Creek Floodway location (MIA extent from 2019)

Aerial imagery from SixMaps utilised in MI Maps (MI's GIS mapping system)

9.1.1 Condition of vegetation

Several studies and assessments have been undertaken since the early 1990s of the vegetation along the LMCF, focusing on the wetlands outlined above, these studies and assessments consist of:

- Wetland vegetation of the floodway monitoring program 1992-2002
- Monitoring the floodway 2003
- Condition and biodiversity of vegetation remnants in the MIA area 2002
- Condition and biodiversity vegetation remnants of the MIA Stage 2 2003
- Condition and biodiversity of vegetation remnants in the MIA 2001-2004
- Condition and biodiversity of vegetation remnants in the MIA: Stage IV: Assessing change between 2001 and 2011
- Gunbar pipeline and channel decommissioning (WWSD) Reviews of environmental factors
- NGH site inspection 2021

For further information regarding the studies and assessments outlined above please refer to Murrumbidgee Irrigation Barren Box Project AEMR 2006-2022.

9.1.1.1 Planned ecological assessment

NGH Environmental has reviewed available information regarding the BBS Wetland Cell and LMCF, a proposed survey methodology was provided to DPE BCD officers. MI received a response from DPE BCD in May 2023 and ongoing correspondence is occurring. Surveys will be scheduled and undertaken, which will allow ongoing survey efforts to be more easily compared. This information will then be made available to DPE EHG EWO for use in the project to determine environmental water requirements (Section 9.2.3).

Due to flooding experienced in the Griffith and downstream catchments in late 2022, ecological field surveys have been delayed until flood waters recede/drain and are tentatively scheduled in spring/summer 2023/24.

9.2 Releases to the floodway

During the construction of the BBS project and renewal of the offtake structure to the floodway during the 2006 season, approximately 1,950 ML of water was diverted into the floodway. The upgrade of the offtake structure allowed improved control over floodway releases and the BBS project provided additional control over water management. Environmental gains from the release were achieved by supplying water to trees and other vegetation in the vicinity, which had tolerated four years of drought.

As detailed under Section 7.1.2 since the commissioning of the BBS project discharges to the LMCF have been mainly driven by flood events and following directions from Flood Management Authorities, with smaller releases due to operational reasons.

Section 7.1.2 details the monthly volumes released during 2022/23. **Table 14** below includes the annual released since commissioning.

Table 14: Summary of releases to the Lower Mirrool Creek Floodway

Financial year end	Total (ML)
2012	**116,891**
2016	**281**
2017	**121,363**
2018	3,405
2019	150
2022	6,886.3
2023	**112,116.6**
Total	*363,044*
Average (2007-2022)	*15,561*

Note: figures in **bold** denote releases during major flood events.
BBS project opened August 2006

MI releases water to the floodway in a controlled manner via the approved discharge location MIRFLD, and during flood events in consultation with the local and or state flood management authorities (such as GCC and CSC, and SES). During significant floods, water can find its way, via a variety of flow paths, towards the Lower Mirrool Creek - including both over-land and through/out MI's infrastructure. Where time permits, early notification of downstream landholders is undertaken by both MI for our area of operations and Councils for their LGAs. Section 7.1.7 outlines BBSW Operational Guidelines, including the management approach during flood events.

No deliberate releases have been made based on vegetation conditions since the commissioning of the BBS Project. While historical data indicated flood events of every 10-15 years, the 2012, 2016 and 2022 flood events indicate a more regular wetting of the floodway due to natural events with major floods occurring every 4-6 years since the BBS project was commissioned.

Discussions with State and Federal EWOs commenced in mid-2022 regarding environmental water releases to the floodway. See Section 9.2.3 for further information.

9.2.1 Inundation - duration and extent

MI does not have detailed records of inundation levels along the length of the LMCF during flood and/or release events since the BBS project was commissioned. Prior to privatisation, other State government departments supplied satellite imagery interpretation showing inundation during floods to MI, which was then Government-owned. MI now uses anecdotal records, site inspections and feedback from local flood/ Council authorities, customers and landholders to aid in determining this information. MI also accesses publicly available satellite imagery taken during flooding, where available.

It is noted the DPE EHG EWO feasibility project will undertake mapping of inundation extent based on satellite and aerial mapping. MI will provide available flow and/or discharge data, including staff knowledge from prior flood events, to support this mapping and allow understanding of inundation extents against released volumes.

The 2022 flooding occurred due to saturated catchments, prolonged rainfall with above average rainfall in the two years prior and many storages were at or near capacity. MI started to release

water via the Lower Mirrool Creek Floodway (MIRFLD) in August 2022. The water reached Narrabri swamp (**Error! Reference source not found.**) on 26 August 2022 and past the Mid Western Hwy d uring early September 2022 indicating that Five Oaks swamps were also being inundated.

Figure 26: Griffith Flooding 26 August 2022 – area around Narrabri Swamp

Figure 27: Griffith flooding 17 March 2012 – area around Narrabri Swamp

During the 2022 flooding MI utilised flow-gauging stations located at key points throughout the MIA and outside the MIA to better manage inflows and outflows. Drones were used at key locations within MI's Area of Operations to capture the extent of flooding and assist with responses. MI worked over a prolonged period to engage and coordinate with local governments in the Lower Mirrool Creek catchment, to build on the coordination and cooperation already experienced with GCC, Leeton and Narrandera shire councils on flood planning, management and emergency matters.

During October 2022 the MIA experienced 200mm of rainfall, the flooding consisted of the localicalised catchment including the Mirrool Creek and Murrumbidgee River. The MIRFLD releases were continual from August through to December 2022. Roads located in the Hay Shire such as Wongalea Rd and Belaley Rd were closed from mid November through to mid December 2022 due to flooding. This indicates that the water travelling via Lower Mirrool Creek potential reached Highway Swamp, Little Berangerine swamp and possibly Berangerine swamp as well.

The 2022 flood event was very similar to 2012 and 2016 flood events as most of the wetlands located in the lower Mirrool Creek Floodplain experienced watering during the events (**Figure 27**). A total of 112,116 ML was released via MIRLFD during 2022 only 9,247 ML less than in 2016 and 4,775 ML less than 2012.

9.2.2 Quality of water discharged via MIRFLD

As part of MI's EPL4651, MI monitors discharges at Point No 15 MIRFLD, which releases to the LMCF. When access to this location is a safety risk due to severe weather and/or flooding, MI samples either at Channel 13 or a nearby safe location which is assessed as containing water representative of the outflow.

When time permits, MI samples prior the release and notifies EPA of the potential of a release. This is to inform the EPA in case of enquiries from downstream landholders to the EPA, however it is noted that this is not a EPL condition.

Water quality data is provided in **Appendix K** for release or due diligence events via the MIRFLD location. In general, the data shows water released is suitable for primary production based on ANZECC 2000 guidelines, with only occasional results outside of the guidelines, which should be expected during flood release events when turbidity is raised with the resulting elevated levels of soil-associated metals and chemicals.

For chemicals tested as part of EPL4651 compliance, no exceedances were recorded during 2022/23. Historical exceedances are included in **Table 15** with all exceedances reported to EPA upon receipt, published on MI's website and summarised in the relevant LCR/ACR. In addition, MI has a Chemical Contingency Plan which outlines the investigations and contingency measures MI follows should an exceedance be received.

Table 15: Water quality released via MIRFLD – summary of EPL4651 chemical exceedances

Parameter	Notification level	Action level	Comments
Chlorpyrifos	4 (Nov/Dec 17)	-	-
Diuron	1 (Nov 17)	-	-
Metalochlor	4 (Sept/Oct 2016, Nov 17)	6 (2012, 2016, 2017, 2018)	All pre-2018 exceedances were under the current EPL levels which are based on the 2020 technical brief for guideline values.
Thiobencarb	-	1 (Nov 17)	-

9.2.3 Environmental water allocations

MI works cooperatively with State and Commonwealth EWOs to deliver environmental water allocations when ordered. In addition, MI has worked with Councils and other stakeholders to deliver water for other environmental needs.

The LWMP identified that the LMCF releases, which at that time were regular and annual events, led to environmental impacts and/or changes to the floodway vegetation and wetlands. Since the 1990's MI and other government stakeholders have investigated management measures for this lower part of the Mirrool Creek system which is approximately 100km long and up to 4 km wide in places.

Throughout these investigations it was acknowledged that a variety of stakeholders needed to be involved, including private landholders along the floodway. In addition, releases from BBS were unlikely to reach the end of the floodway, i.e. its confluence with the Lachlan River due to the vast volumes of water required to fully wet the floodway. The last recorded flood that reached the Lachlan River was in 1989 and MI records show a floodway release volume of 218,385ML in 1988/89 plus any additional floodway catchment and escape flows realised prior to and during the flood event.

Following discussions on MI's Modification application for the BBS Project approval conditions with government stakeholders, DPE EHG EWOs approached MI in early July 2022 to discuss their planned Environmental Water Feasibility study for LMCF and BBS Wetland cell. MI has since shared information for the 2022/23 reporting period to assist DPE and their consultants in delivery of the project and its outcomes.

9.3 LMCF wetland system - monitoring program (6.5dxiv)

The monitoring program for the LMCF wetland system has changed over time due to the changing focus from the LWMP when it was considered that too much water was being discharged to the floodway, then the BBS project when the change in watering regimes was identified as having the potential to impact on the floodway ecology.

While the proposed Water Use Study did not investigate the LMCF as originally intended, as outlined above, ecological information was collected in 2011, 5 years after commissioning of the BBS project and compared with data from 2001-2003 which was prior to the project. The findings of the report did not indicate any significance ecological decline at the monitoring sites along the LMCF, indicating the change (i.e. reduction) in water being discharged into the floodway had not impacted the vegetation communities downstream.

NGH Environmental has reviewed available information regarding the BBS Wetland Cell and LMCF, a proposed survey methodology was provided to DPE BCD officers. MI received a response from DPE BCD in May 2023 and ongoing correspondence is occurring.

Surveys will be scheduled and undertaken, which will allow ongoing survey efforts to be more easily compared. This information will then be made available to DPE EHG EWO for use in the project to determine environmental water requirements.

Due to flooding experienced in the Griffith and downstream catchments in late 2022, ecological field surveys were delayed until flood waters recede/ drain and are tentatively scheduled in spring/summer 2023/24.

9.4 Planned activities to be undertaken in the next reporting period

Activities planned to be progressed for LMCF monitoring are detailed under Section 12.

10 Environmental performance goals not met (7.4e)

As outlined in Section 3 and **Appendix A**, a number of conditions were not met, and by association, the performance goals relating to those conditions were only partially or not met.

The performance goals that were not met during 2022/23 consist of:

- BBS Weed treatment, including investigating biocontrol release for African Boxthorn in the wetland cell (to be trialled within MIA initially in another location).
- BBS fencing project.

Due to the 2022 flooding that inundated the BBS wetland cell access has been restricted (**Figure 28**). However, MI were able to complete the due diligence investigations for ecological and cultural heritage risks for the BBS fencing project and the African Boxthorn biocontrol was released and trailed within the MIA at another location.

Figure 28: BBS Wetland cell inundation 11 January 2023

MI is progressing compliance with the items included in Section 3 and **Appendix A** in a number of ways:

- Operational compliance audit undertaken by NGH 2018-2020
- Modification request (Section 11)
- Ongoing consultation with government agencies to respond to requests for information.
- Further improvements in MI's environmental management system, including the BBSW OEMP and compliance software to ensure ongoing compliance is assured.
- Actions outlined in Section 12.
- Ongoing collaboration with DPE EHG – EWOs on environmental water feasibility study for LMCF and BBS Wetland cell.

11 Variations to approvals (7.4l)

During 2022/23 no variations to the BBS Project approval have been obtained. The following approval request was lodged in 2021 and is currently under consideration:

- A Modification request for DA101-4-2004i was submitted on 10 November 2021 seeking amendment and/or removal of a number of conditions. This request is in the post approval review stage based on Department responses.

While the following is not related to the BBS project, the following Direction is in place over BBS land:

- General Biosecurity Direction Griffith City Council (GCC), as the local weed authority, issued a General Biosecurity Direction in December 2021 to exclude unauthorised entry to the public from BBS land and associated riparian zones. This direction is in place for 5 years.

12 Environmental management targets and strategies (7.4m)

12.1 Activities planned for next reporting period (FY2022-23)

The following activities are planned to be progressed during the next reporting period (2023-24 financial year), subject to weather conditions, field access and availability of suitably qualified consultants and contractors:

Activity	Timeframe
Next reporting period	
Continuation of water sampling and analysis of wetland cell, including mapping of inundation levels as flood waters recede over time. Field observations will include any evidence of salt accretion, damage, recovery or other noteworthy occurrence.	FY2024
BBS Fox baiting, fox den fumigation and feral cat trapping	FY2024
BBS Alligator weed inspections, including planned inspection by Councils, LLS, State Priority Weed team.	FY2024
Finalise due diligence investigations for ecological and cultural heritage risks for the BBS fencing project.	FY2024
Consultation with GLALC regarding proposed BBS fencing, proposed rehabilitation investigations, and fire management.	FY2024
Finalise fencing project of BBS lands as part of General Biosecurity Direction for alligator weed	FY2024
MI to liaise on ecological methodology with DPE-BCD and DPE EWO	FY2024
Ecological field assessment of BBS wetland cell and reporting	FY2024
Ecological field assessment of LMCF and reporting	FY2024
Assess the Wetland Rehabilitation Plan Monitoring data	FY2024
Continue to work with DPE – EWO on LMCF environmental water assessments.	FY2024
Update OEMP based on ecological assessment outcomes and AEMR findings. Notify D-G, GCC and DPE EHG of review.	FY2024
Finalise seepage assessment procedures for storages as part of the MI Storage Asset Management Strategy and cross-reference to OEMP.	FY2024
Fire management activities in consultation with Griffith RFS.	FY2024

Activity	Timeframe
Next reporting period	
Environmental Representative to be nominated for D-G approval.	FY2024
Progress Modification application report through RFI response with DPE Planning.	FY2024

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