Rigorous science helps develop the Barwon-Darling Valley Floodplain Management Plan to maintain flood connectivity to important wetlands and riverine ecosystems

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Barwon-Darling Valley Floodplain Management Plan 2017

- Developed under NSW Healthy Floodplains Project – funded by Australian Government’s Sustainable Rural Water Use & Infrastructure Program as part of the implementation of the MDB Plan in NSW

- Detailed legal instrument and spatial map developed under the Water Management Act 2000

- Commenced 30 June 2017 – due for extension or replacement on 30 June 2027
Recognition & respect of the Traditional Owners of the Barwon-Darling Valley Floodplain

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Sydney, Australia | 14 - 18 October 2018

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Image courtesy of Planet Labs, Inc. 2018
Floodplain management plans developed according to the environmental protection provisions of the Water Management Act 2000

Advancements in technology:
- Landsat Satellite Imagery
- ADS40 Sensor Head (Leica Geosystems)
- Stereoscopic Displays (Planar)
- Landsat 8 satellite (https://landsat.usgs.gov)
- LIDAR Digital Elevation Models
Negative impacts of uncoordinated flood work development on ecological assets

If built in the wrong location flood works can impact flood connectivity:

- Disconnect wetlands from overland flooding by obstructing flow paths
- Redistribute flood flows
- Increase flooding duration of ecological assets exceeding their requirements
- Restrict native fish passage and opportunities for migration
Strategy for coordinated flood work development to maintain flood connectivity to ecological assets

- Five management zones with rules & assessment criteria - strategically coordinate future flood work development
- Critical connections supporting floodplain wetlands & dependant biota identified ensuring they are not impacted by new flood works
Identification of flood dependent ecological assets of the Barwon-Darling floodplain

**Wetlands**
- Semi-permanent wetland
- Floodplain wetland (Flood-dependent shrubland wetlands)

**Other floodplain ecosystems**
- Flood-dependent Forest/woodland (wetlands)
- Flood-dependent woodland
Identification of flood dependent ecological assets of the Barwon-Darling floodplain

**Wetlands**
- Semi-permanent wetland
- Floodplain wetland (Flood-dependent shrubland wetlands)
- Wetland sites*


**Other floodplain ecosystems**
- Flood-dependent Forest/woodland (wetlands)
- Flood-dependent woodland
Identification of flood dependent ecological assets of the Bourke – Louth floodplain

Study Region 2,950 sq km

Toorale Vegetation (University of Ballarat 2012)

Barwon-Darling & Condamine-Balonne Vegetation (Eco Logical Australia 2015)

PCT = NSW Plant Community Type

Floristic Survey Plot (Shultz et al. 2014)

Image courtesy of Planet Labs, Inc. 2018

Anthropogenic herbland/cropland
Belah/Black Oak - Western Rosewood - Leopardwood low open woodland (PCT 59)
Black Bluebush low open shrubland of alluvial plains and sandplains (PCT 153)
Black Box woodland wetland (PCT 37)
Canegrow grass swamp tall grassland wetland of drainage depressions, lakes & pans (PCT 24)
Chenopod low open shrubland - ephemeral partly derived fornlad saline wetland (PCT 212)
Coolabah - River Coolabah - Lignum woodland wetland (PCT 39)
Coolabah open woodland wetland (PCT 40)
Derived mixed shrubland (PCT 229)
Ephemeral water bodies
Gidgee Chenopod shrubland (PCT 118)
Ironwood woodland of the semi-arid plains (PCT 134)
Leopardwood low woodland (PCT 144)
Lignum shrubland wetland on floodplains and depressions (PCT 25)
Man-made irrigation & storages
Mitchell Grass grassland - Chenopod low open shrubland (PCT 43)
Mulga shrubland (PCT 120)
Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland (PCT 143)
Nitre Goosfrost shrubland wetland (PCT 160)
Permanent & semi-permanent freshwater lakes wetland (PCT 238)
Poplar Box - Coolabah floodplain woodland (PCT 87)
Poplar Box - Mulga - Ironwood woodland (PCT 109)
Poplar Box grassy woodland (PCT 105)
River Red Gum tall to very tall open forest / woodland wetland (PCT 36)
Sandplain Mulga tall shrubland - open shrubland (PCT 119)
Whitebox low open woodland (PCT 146)
Identification of flood dependent ecological assets of the Barwon-Darling floodplain

River Red Gum, *Eucalyptus camaldulensis*

Simon J Hunter/OEH
NSW Office of Environment & Heritage worked together with Geoscience Australia to collect LiDAR across the Barwon-Darling floodplain.

- Major aerial survey – data capture
- Increased understanding of riverine-wetland connectivity and flood behaviour at the river valley scale
Hydraulic modelling to map floodway’s & inundation extents of the Barwon-Darling floodplain

- MIKE 21 FM models created for each of the four reaches
- 2-dimensional hydrodynamic model using MIKE 21 and Flexible Mesh (FM) bathymetry
- DVP of ≥ 0.3m²/s large design flood (February 1976)
- Flood extents of the small (December 2011) and large design flood (February 1976)
Satellite imagery to validate floodway network & flood connectivity to wetlands

- Landsat 5 TM satellite imagery (August to October 1998 flooding)
- Validate floodway network derived from hydraulic modelling to ensure accuracy
- Examine flow paths and historical patterns of flood connectivity to wetlands of the Barwon-Darling
Historical inundation count to validate floodway network & wetland connectivity

- Inundation count developed using all Landsat 5 TM and Landsat 7 ETM+ images from 1 January 1988 to 31 December 2012
- Validate floodway network derived from hydraulic modelling to ensure accuracy
- Examine flow paths and historical patterns of flood connectivity to wetlands of the Barwon-Darling

Fisher and Danaher (2016)
Ecological criteria to ensure flood connectivity is maintained to flood-dependent ecological assets

Fish passage

- Silver Perch: *Bidyanus bidyanus*
- Olive Perchlet: *Ambassis agassizii*
- Purple Spotted Gudgeon: *Mogurnda adspersa*

Semi-permanent wetlands*

- Shallow freshwater wetland sedgeland (PCT 53)
- Water Couch marsh grassland wetland (PCT 204)
- Permanent and semi-permanent freshwater lakes (PCT 238)
- Ephemeral herbaceous vegetation (PCT 238a)

Floodplain wetlands

- River Cooba swamp wetland (PCT 241)
- Lignum shrubland wetlands (PCT’s 25 and 247)

Forest/woodland wetlands

- River Red Gum tall/very tall open forest/woodland wetland (PCT 36)

Entire mapped spatial extent incorporated within Management Zone A and Zone D

*Includes billabongs and lagoons of the Barwon-Darling fed by floodwater

Mapped spatial extent hydraulically connected to Management Zone A and Zone D

Increasing requirement for flooding

NSW DPI (2016)
Integration of ecological criteria to protect Barwon-Darling floodplain & wetland connectivity

**Semi-permanent wetlands**
- Shallow freshwater wetland sedgeland (PCT 53)
- Permanent & semi-permanent freshwater lakes (PCT 238)
- Ephemeral herbaceous vegetation (PCT 238a)

**Shrubland wetlands**
- Lignum shrubland wetland (PCT 247)
- Lignum open shrubland wetland (PCT 247a)

PCT = NSW Plant Community Type
Integration of ecological criteria to protect Barwon-Darling floodplain & wetland connectivity

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Elevation (m)
- 102
- 132

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**Water depth – velocity (Feb 1976)**
- Increasing water depth - velocity
- Decreasing water depth - velocity
- Water velocity vector

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**Floodway network**
- Floodway
- Inundation extent of the small (2011) and large (1976) modelled floods

PCT = NSW Plant Community Type

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Integration of ecological criteria to protect Barwon-Darling floodplain & wetland connectivity

Application of ecological criteria

Enhanced riverine-floodplain hydrological connectivity

Protection in statutory Floodplain Management Plan for the Barwon-Darling Valley Floodplain 2017

Barwon-Darling Management Zone

- Management Zone A
- Management Zone B
- Management Zone C
Integration of ecological criteria to protect Barwon-Darling floodplain & wetland connectivity

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**Inundation Count (1988 -2012)**
- Increasing inundation frequency
- Decreasing inundation frequency

Fisher and Danaher (2016)
PCT = NSW Plant Community Type

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Special protection zone for areas of ecological and/or cultural significance of the Barwon-Darling

- Special protection zone covering 58 wetland sites - 5,500 hectares
- Range of different wetland systems, types and sizes (3 – 816 ha)

Future flood works limited to:
- Aboriginal value enhancement
- Ecological value enhancement
- Heritage enhancement
Special protection zone for areas of cultural significance of the Barwon-Darling floodplain

Management Zone
- Major Discharge (Zone A)
- Flood storage (Zone B)
- Flood fringe (Zone C)
- Urban areas (Zone CU)
- Special ecological & cultural protection (Zone D)

Photograph: Powerhouse Museum Sydney (dating from 1880 – 1923)
Special protection zone for areas of cultural significance of the Barwon-Darling floodplain

Brewarrina Aboriginal Fish Traps Baiame’s Ngunnhu. Julie Bishop/OEH
Special protection zone for areas of ecological significance of the Barwon-Darling floodplain

The Big Billabong, Bourke, NSW

Simon J Hunter/OEH

Management Zone
- Major Discharge (Zone A)
- Flood storage (Zone B)
- Flood fringe (Zone C)
- Urban areas (Zone CU)
- Special ecological & cultural protection (Zone D)
Management zones to protect flood connectivity to ecological assets of the Barwon-Darling floodplain

- Management Zone A - 337,700 ha (31% of the floodplain)

Assessment criteria for flood works

- Ecological & cultural impacts
- Flood connectivity to ecological assets
- Flood connectivity to facilitate fish passage
- Flood connectivity to aboriginal values
- Flood connectivity to heritage sites
- Heritage site impacts
Management zones to protect flood connectivity to ecological assets of the Barwon-Darling floodplain

**Flood storage**
Assessment criteria for flood works
Ecological & cultural impacts

- Flood connectivity to ecological assets
- Flood connectivity to facilitate fish passage
- Flood connectivity to aboriginal values
- Flood connectivity to heritage sites
- Heritage site impacts

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Management zones to protect flood connectivity to ecological assets of the Barwon-Darling floodplain

**Flood fringe**

Assessment criteria for flood works

Ecological & cultural impacts

- Flood connectivity to ecological assets
- Flood connectivity to facilitate fish passage
- Flood connectivity to aboriginal values
- Flood connectivity to heritage sites

**Heritage site impacts**
Management zones to protect flood connectivity to ecological assets of the Barwon-Darling floodplain

Urban areas
Assessment criteria for flood works
Ecological & cultural impacts

- Flood connectivity to ecological assets
- Flood connectivity to facilitate fish passage
- Flood connectivity to aboriginal values
- Flood connectivity to heritage sites
- Heritage site impacts
Benefits and broader impacts

- Integration of wetlands and flow paths into statutory valley floodplain management planning
- Protection of flood connectivity to ecological and cultural features of the Barwon-Darling river system under a statutory plan (2017 – 2027)
- Rules for assessing future flood work applications - focus on protecting flood connectivity to floodplain wetlands and facilitating fish passage
- Coordinated approach to future flood work development pivotal to healthy floodplain management
- Inform Long Term Water Plan for the Barwon-Darling - part of the NSW Government’s commitment to implementing the Murray-Darling Basin Plan
Project Team:

Michelle Cavallaro, Simon Morton, Mal Ridges, Peter Sobinoff, Jason Wilson (NSW Office of Environment and Heritage), Rebecca Ballard (NSW Department of Industry - Water)

Specialist Advice:

Nick Shultz, Stacey Gowans, Martin Westbrooke (Centre for Environmental Management, Federation University Australia), Owen Maguire - Aerial Photograph Interpretation - Vegetation Mapping, Karen Danaher (NSW Department of Primary Industries - Fisheries), Adrian Fisher (NSW Office of Environment and Heritage & Joint Remote Sensing Research Program, University of Queensland) and Tony Gill (NSW Office of Environment and Heritage) - NSW Inundation Count dataset
Floodplain Management Plans:


Floodplain Management Plan for the Barwon-Darling Valley Floodplain 2017:


Barwon-Darling Valley Floodplain Designation: