



## Aboriginal heritage as ecological proxy in south-eastern Australia: A Barapa wetland case study

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Dan Hutton, Deniliquin, NSW

### ABSTRACT

Aboriginal archaeology has a central role to play among the myriad government agencies and professional disciplines involved in land and water management of the Murray River Basin. This is Australia's food bowl that today produces one third of our food supply while using four fifths of the water supply. Conservation and environmental restoration efforts along the Murray River have concentrated on water delivery to six icon sites (MDBA 2016a, b).

Using a case study from one of these, Koondrook State Forest, we set out a case for the modification of environmental water delivery from large area forest flooding for the benefit of trees to smaller water bodies that form ecological hot spots throughout the forest. Such sites form one of the micro-environments of the riverine forest that were, and might be again, centres for mass migratory bird and small fish breeding as well as the associated wetland plants and invertebrates.

The basis for identification of these ecological hot spots that may not otherwise be apparent is the archaeological signature of large human populations resident for several months of each year.

We describe the relation between seasonal water flow and residential patterning at the Pulitj, a small alveolar swamp in Koondrook State Forest. A total of 154 earth mounds are distributed in an area 4x3km, including the 1.6km diameter swamp. Mounds are the by-product of housing and cooking. The village life of this archaeological record is a distillation of 3,000 years of traditional knowledge and land management practices.

Seasonal residential patterns and economic activities have been reconstructed using environmental, archaeological, ethnographic and hydrological information. The result is a picture of traditional Aboriginal land use in this particular ecosystem that can be used to link and inform future heritage, land and water management.

### INTRODUCTION

Environmental changes consequent to European settlement of the Murray River in the 1840s changed the land. Changes since the 1980s have proven even more severe; accelerating removal of water for irrigation coupled with broad-acre laser-planing has left barely 1/5 of the water available for a restricted river floodplain. In the section of river that

crosses the Eastern Riverine Plain, most of this water is unearned, having fallen as rain and snow in the Dividing Range catchment.

Aboriginal cultural heritage is protected by legislation, requiring assessments as part of any development that includes earthworks. While attempting to protect heritage, it is usually seen as a problem, an impediment to development. Avoidance and mitigation strategies are typically implemented in the construction phase, with no further Aboriginal involvement in operations.

In this paper we describe research that arose out of the largest earthworks project on the Murray Floodplain in the last 100 years; the Koondrook Perricoota State Forests Flood Enhancement Project. This ambitious engineering approach to conservation entailed the construction of a 5m tall 45km levee around the downstream end of the floodplain forest. The intent was to provide environmental flow [eWater] to the Redgum and Black Box forest.

The distribution of earth mounds around a small floodplain swamp, Pollack Swamp or the Pulitj, is patterned by floodwater flow through the forest. The number and density are an indication of the productivity of some of these swamps. Earth mounds are the product of long-term residence at particular locations. They grew as the by-product of charcoal, ash and baked clay used in ground ovens, as well as the detritus of daily life. They were placed to take advantage of water flows, with the use of weirs for catching fish. Ponds in the small creeks or 'runners' resulted from digging clay for the heat retainers. These became useful as water and fish storage facilities. The mounds themselves date from around 3,000 bp.

This archaeological record is a distillation of 3,000 years of traditional knowledge about where people would be best placed to harvest fish and plants as well as hunting birds and other animals in the immediate area. Two mounds on either side of a small creek, with an adjacent pond, indicate fine-tuning of land and resource use. This is the family level of spatial organisation.

At a population level, the whole of the Pulitj appears to be a village, with residence for perhaps five months each year, following the more or less annual spring meltwater floods. We have recorded 154 mounds distributed in clusters around the swamp. The mounds vary in size from 7 to 57m long and 6 to 28m wide, with areas between 15 and 806m<sup>2</sup>. Average area is 159m<sup>2</sup>. For comparison, house blocks in Australian urban centres are currently being released at sizes of between 200 and 500m<sup>2</sup>.

Each household might be considered to consist of a family of parents and children, with perhaps grandparents, uncles and aunts and other relatives resident in a few houses arranged on the mounds. If only a third of mounds were occupied at any given time, then a total population at the Pulitj could number 250 to 500 individuals. Since humans are omnivorous apex predators, it becomes clear that such population numbers concentrated in a small area would require substantial food and water resources.

As a result of our investigations, we were able to secure an environmental flow allocation for Pollack Swamp in 2015. An amount of 500ML was estimated from the flow model created by the Murray Darling Basin Authority (MDBA 2011, Tuteja and Shaikh 2009). It became clear that this was insufficient. A further 1,000ML was used over the next few weeks, but never filled the swamp to the level suggested by lidar topography and the placement of the mounds. While dry ground would have contributed to the discrepancy, it is almost certainly the case that the modelled flow is biased. The flow model is used for today's situation, including weirs, dams and regulators, but as a model of the pre-regulation system, has been unable to take account of those early changes in land, particularly the

soil compaction from sheep that took place in the first decade of European settlement [1840s in this area; Beveridge 1889], and the clearance of the reed beds.

The overbanking event of September 2016, while not completely natural, covered the floodplain and showed the system in operation. At this point, the filling of the ponds, a previously un-noticed feature of the mounds, indicated the obvious placement of weirs. It also clarified the position of many of the mounds.

As we canoed through the floodwaters, along main channels and into smaller side 'runners', bordered by earth mounds, across ponds, eventually leading to lagoons and swamps, we recorded a sequence of water plants, water invertebrates, frogs, fish, turtles and birds. The dense wall of mosquitoes collapsed about 15 days following the height of the flood, as water invertebrates including shrimp followed by fish, started to breed and consume the mosquito larvae. These small fish are or were locally abundant, but many are endangered or locally extirpated [abundant: Bony Bream, Australian Smelt, Spangled Perch, M-D Rainbowfish; extirpated: Olive Perchlet, Murray Hardyhead, Southern Purple Spotted Gudgeon; threatened: River Blackfish, Southern Pygmy Perch]. They are an important component in plans to reduce European Carp numbers, as they will be relied on to reduce the Carp fry. They were an important resource for Barapa Aboriginal people, who would have caught large numbers in the Swamp. While large fish were important in the traditional diet, these are usually caught in the main channels. Whitebait would have been a significant component of the local diet during the early to mid summer. Further studies of mound contents at different locations will provide quantitative estimates of species and number.

Local waterfowl began egg laying [eg Chestnut Teal, Wood Duck, Cormorants], but the arrival of colonial waterbirds triggered most emotion among local residents [Eastern Great and Intermediate Egrets, Nankeen Night Heron, White Necked Heron, Australian White Ibis]. Most of these species had not been seen since 1996 (Hutton 2015, 2017).

In 1840, immigrant Europeans named the nearby town of Deniliquin after a senior Barapa man, Denilikoon. His totem was recorded the Yabil Yabila, the Nankeen Night Heron. Mr Norman Moore, a Barapa Aboriginal man descendant of Denilikoon, saw these birds returning for the first time in a generation.

## DISCUSSION

A clear relationship between mound clusters and rookeries is emerging. Our work with the Aboriginal monitoring team at the Forest Flood Enhancement works, and in further studies, demonstrated that, while there are many swamps and lagoons in the forest, not all are were selected as village sites that we see today from the evidence of earth mounds, scarred trees and burials and other features of occupation. Others, like the Pultij, have dense concentrations around them, indicating hamlet or village settlements.

We are of the view that a focus on Aboriginal village sites throughout the forest offers the best evidence of species diversity and density. Aboriginal management of the flooding events through the construction of ponds that retain water throughout the year has contributed to the late Holocene distribution, number and density of many species tethered to standing water, with ranges within the forest corridor. Our discussions with a range of ecologists and water managers has stimulated interest in a multi-disciplinary team approach where Barapa people can play a central role in the management of their land and water through the documentation of their ancestral heritage.

We have moved from a position of passive consultation primarily about effects of water management on cultural heritage (MDBA 2016c), to a position where Barapa people can offer a distillation of their traditional knowledge, encapsulated in the 3,000 year record of

residence at ecological hot spots throughout the forest. Our plan is to document 10 to 15 of these localities. It would be feasible to provide on the order of 1.5Gl to these, possibly with extra cost in infra-structure. By comparison, the Pollack [220 ha] required 1.5Gl for a successful breeding event. The GKP Icon Site [50,000 ha] requires 360 GL for natural flow equivalent (MDBA 2016a and b). The 2015-16 environmental water allocation was 25 GL for 3,000 ha of forest.

Water allocation targeted on traditional Barapa villages would provide specific benefits to colonial waterbirds and small fish, as well as the greater diversity of plants and invertebrates found at these spots. It is our view that the archaeological record is the best ecological proxy for targeting water delivery for best ecological result.



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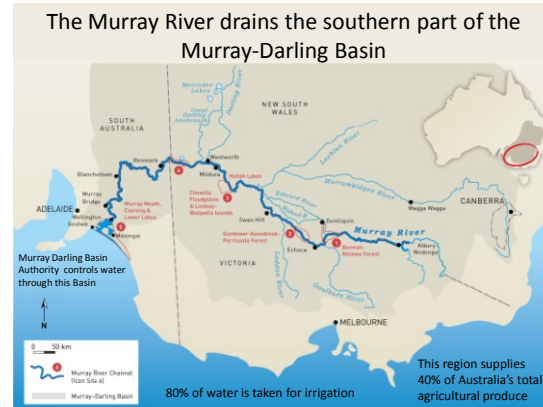
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### Aboriginal heritage as ecological proxy in south-eastern Australia: A Barapa wetland case study

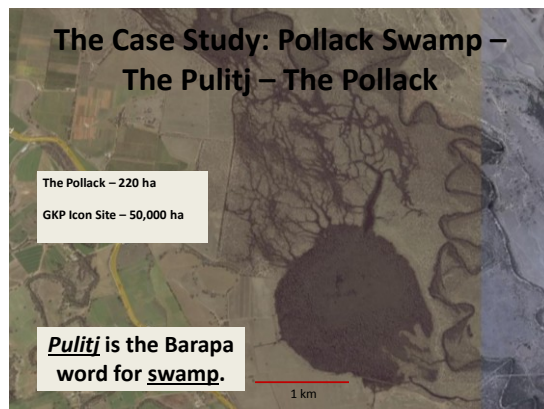


Colin Pardoe, Archaeology  
Dan Hutton, Ecology

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### The Case Study: Pollack Swamp – The Pulitj – The Pollack



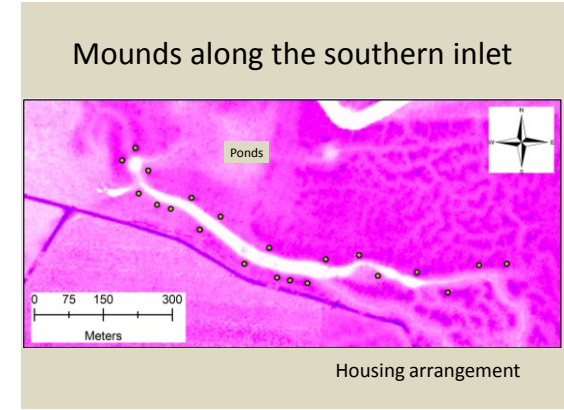
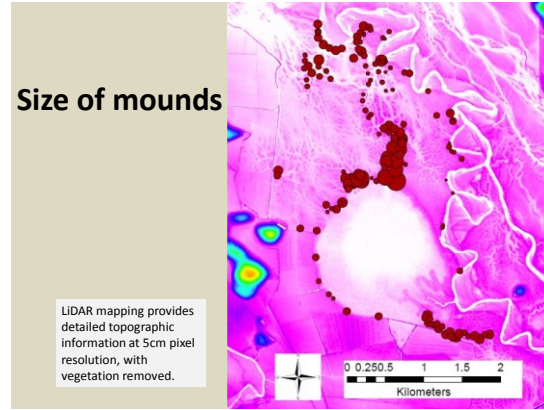
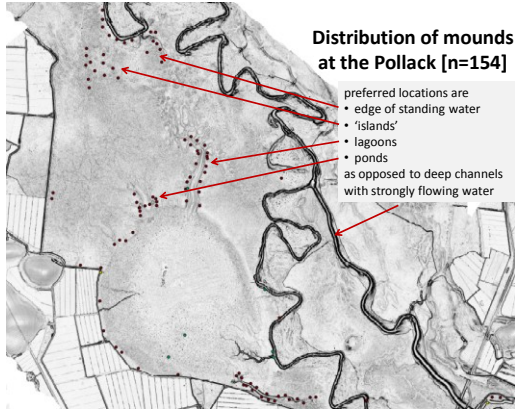
The Pollack – 220 ha  
GKP Icon Site – 50,000 ha

***Pulitj* is the Barapa word for swamp.**

1 km







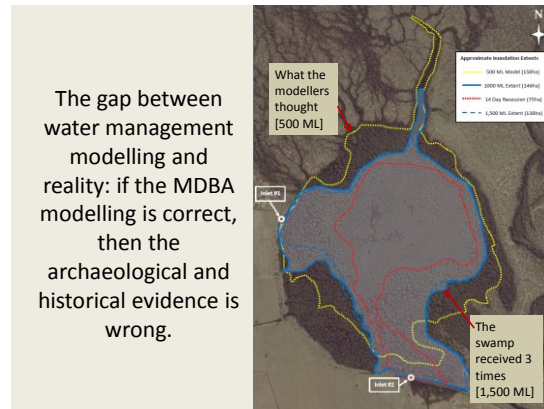
### The MDBA Flooding Program 2015

The plan was to flood the swamp with 500ML (0.5 GL) of Environmental Water.

The specific aims of the watering event were:

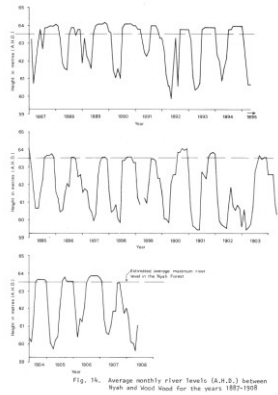
- to provide water to stressed River Red Gums
- to encourage the recruitment of terrestrial and aquatic flora
- to provide drought refuge for water birds including Egrets and Ibis
- to support a bird breeding event if triggered
- to assist in the rehabilitation of wetlands within the Mid Murray floodplain.

1 ML [megalitre] = 1 million litres  
 1 GL [gigalitre] = 1 billion litres  
 1 OSP [Olympic Swimming Pool] = 2.5 ML  
 1 SH [Sydney Harbour] = 500 GL



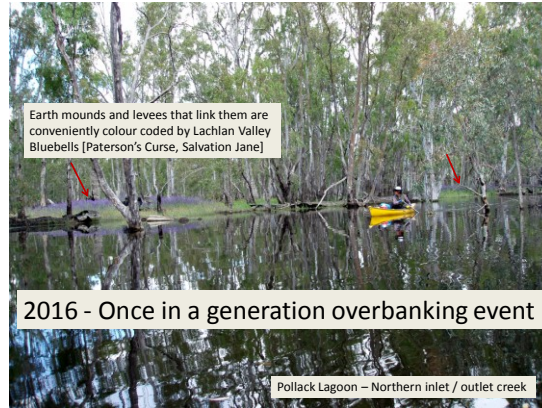
### Since 1842 [175 years] the Aboriginal landscape has been transformed by:

- an end to Aboriginal land management – principally firestick farming
- compaction of soils by stock, leading to increased runoff of water
- destruction of native vegetation by stock
- introduction of exotic plant and animal species
- land clearance and transformation of reed beds into agricultural land
- felling of the forests for timber and steamboat fuel
- local drainage and construction of large holding dams upstream
- major irrigation works from the 1920s onwards



Unregulated Murray River flows 1887 – 1907, long after stock impact on soils, but before regulation [weirs and storages]

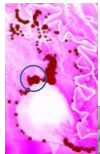
Coutts et al. 1980



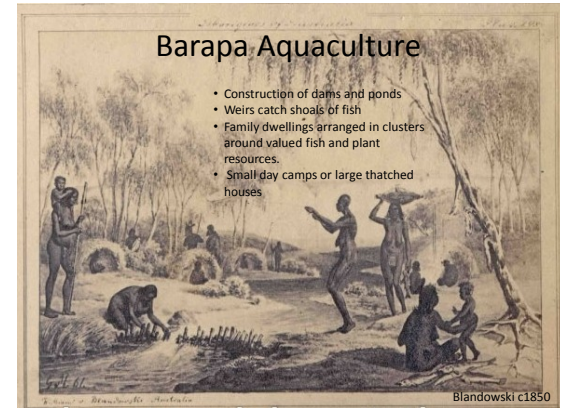
Largest mounds at the best real estate  
Absolute water frontage at the Neck



*Beveridge observed people "living on islands on the floodplain up to 5 months of the year". [1840s]*



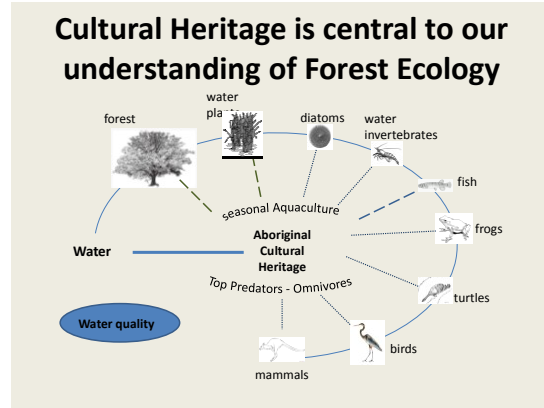
2 Ponds and 11 mounds at the NW suburb







Placement of weirs becomes obvious



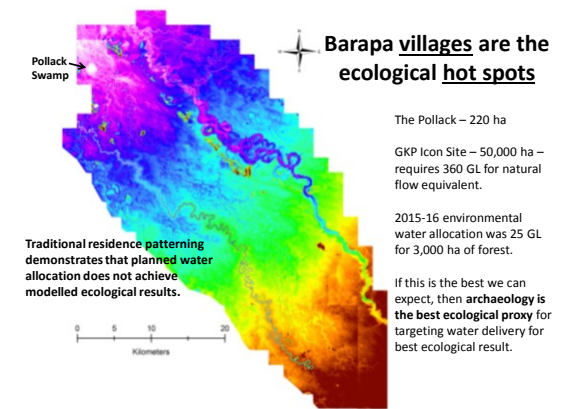
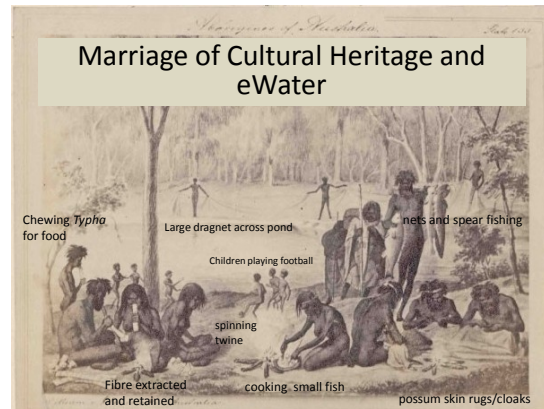
Bird Breeding commences

A pair of Nankeen Night Herons in breeding plumage [17 November 2016]

Great Egret in breeding plumage [24 November 2016]



Norman Moore with Murray Cod



### The Plan

Ground survey to identify 10-15 village sites throughout the central Murray River floodplain. These are the ecological hotspots. Provide eWater to ensure breeding events every year [2-3 gL each site].

### The Team

- Barapa Traditional Owners
- Archaeologists
- Ecologists
- Water Managers

### Our Resolution

We will continue to document archaeological evidence relevant to conservation efforts in the floodplain of the Murray River. Aboriginal participation is essential for effective environmental management. In this project Barapa traditional knowledge incorporates the distillation of traditional residential patterns over the last 3,000 years to identify important conservation sites.

### Acknowledgements

Barapa Barapa Aboriginal Corporation and the Joint Indigenous Group  
 Moama Local Aboriginal Land Council  
 Murray Darling Basin Authority  
 Forestry Corporation NSW  
 Local land holders  
 Graham Heffer, owner of Pollack neighbouring property, 'The Ark'  
 North Central Catchment Management Authority, Victoria  
 Andrew Keogh (MDBA) for hydrological modelling  
 NSW Office of Environment and Heritage  
 The Australian National University  
 Penny Taylor for ethno-historical and language research

Painting by Reverend Robyn Davis

### Monitoring at KP

Aboriginal ponds: suitable for monitoring birds, small vertebrates, wetland water plants and invertebrates, small fish

Vegetation monitoring point: beside track, crossing runner

1:4,614

0 67 133 200 266 m

### MDBA Indigenous Engagement Principles 2012

These Principles include the following:

- ◆ Consistent and grounded involvement of Aboriginal people in natural resource management decision making;
- ◆ Work towards improving the capacity of Indigenous/Aboriginal people in relation to effective involvement in natural resource management.
- ◆ Recognise that natural resource management programs have a role in delivering cultural, social, economic and environmental outcomes that are equitable and appropriate to Aboriginal people.

### Opportunities for Aboriginal People and Government Land and Water Management Agencies

- 1. Aboriginal cultural heritage is central to effective eWater delivery and ecological monitoring.**
  - ◆ Trained and experienced local workforce
  - ◆ Trained in data collection and monitoring
  - ◆ Provide field support to visiting ecological monitoring contractors
  - ◆ Provide local knowledge of forest, roads, conditions
  - ◆ Trained WHS for local conditions in the forest
  - ◆ Knowledge of cultural heritage as key background for ecological monitoring
- 2. Aboriginal People are keen to participate.**
  - ◆ Trained and experienced local workforce
  - ◆ Trained in data collection and monitoring
  - ◆ Provide field support to visiting ecological monitoring contractors
  - ◆ Provide local knowledge of forest, roads, conditions
  - ◆ Trained WHS for local conditions in the forest
  - ◆ Knowledge of cultural heritage as key background for ecological monitoring

### Traditional Barapa Kitchen Implements

grinding plate: thin indurated sandstone

Axes traded from neighbours for local manufactured goods [nets, spears]

Elbow grease of the ancestors

Small broken mortar

Residue analysis

Economic value

Did seed-grinding contribute to a population explosion in the last 2,000 years?  
 Or did a population explosion demand new food resources?

Population Density

Year (BC/AD)

2000 1500 1000 500 0 500 1000 1500 1800

Timeline labels: Chinese, Roman, Islamic, European, Industrial, Modern, 20th century, 21st century



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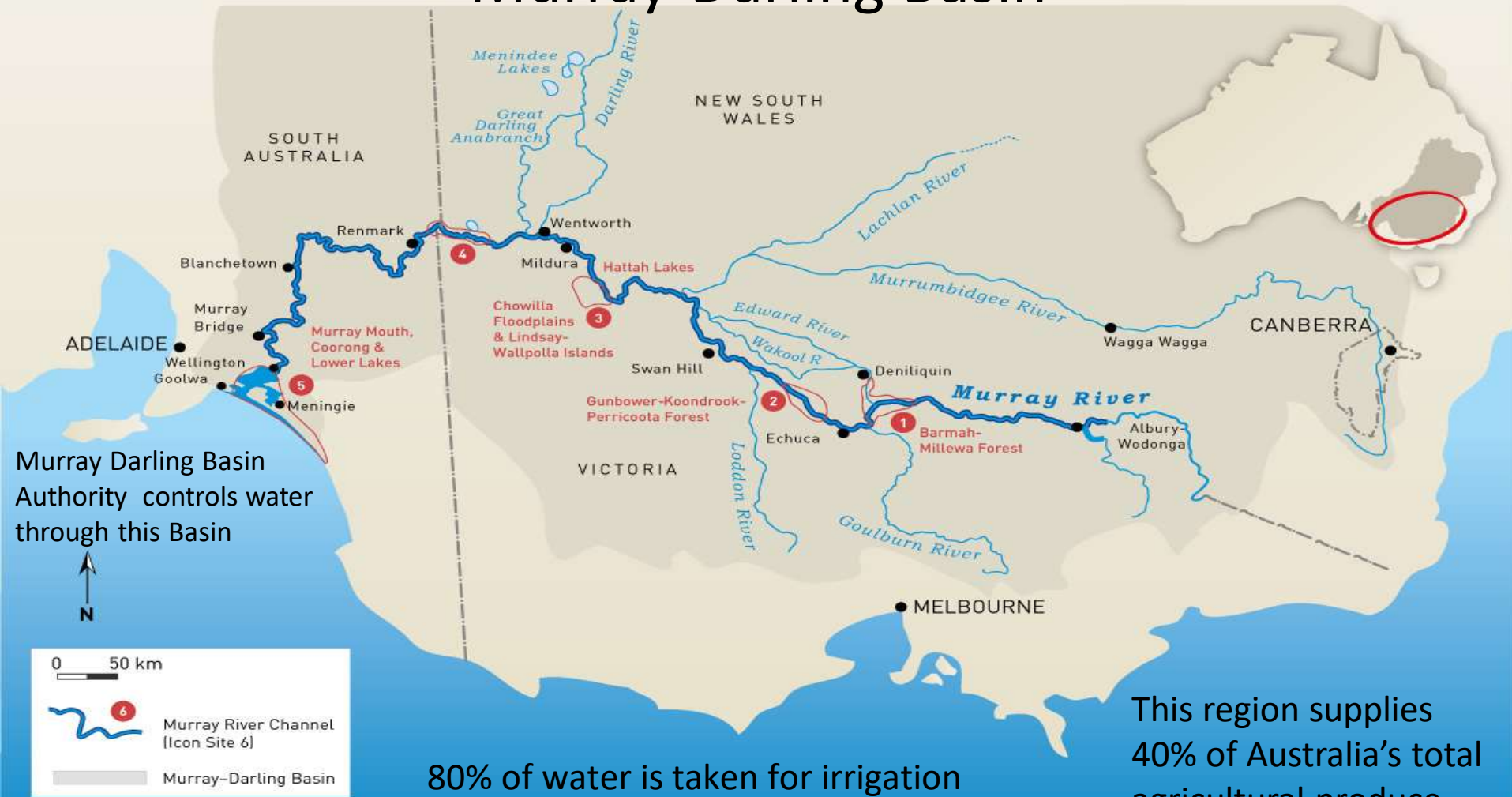
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and The Australian National University

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# The Murray River drains the southern part of the Murray-Darling Basin





# Cultural Heritage at K-P

Stage 1 - Construction



## Heritage as Problem



# The Case Study: Pollack Swamp – The Pulitj – The Pollack

The Pollack – 220 ha

GKP Icon Site – 50,000 ha

Pulitj is the Barapa  
word for swamp.

1 km



# Documentation of mounds at the Pollack

154 earth mounds in the vicinity of a 1.6 km diameter floodplain swamp







Small runner  
between mounds

Notoriously difficult to photograph

Mounds are 200-500 m<sup>2</sup> area – equivalent to urban house blocks.  
They are the remains of housing and cooking in ground ovens.



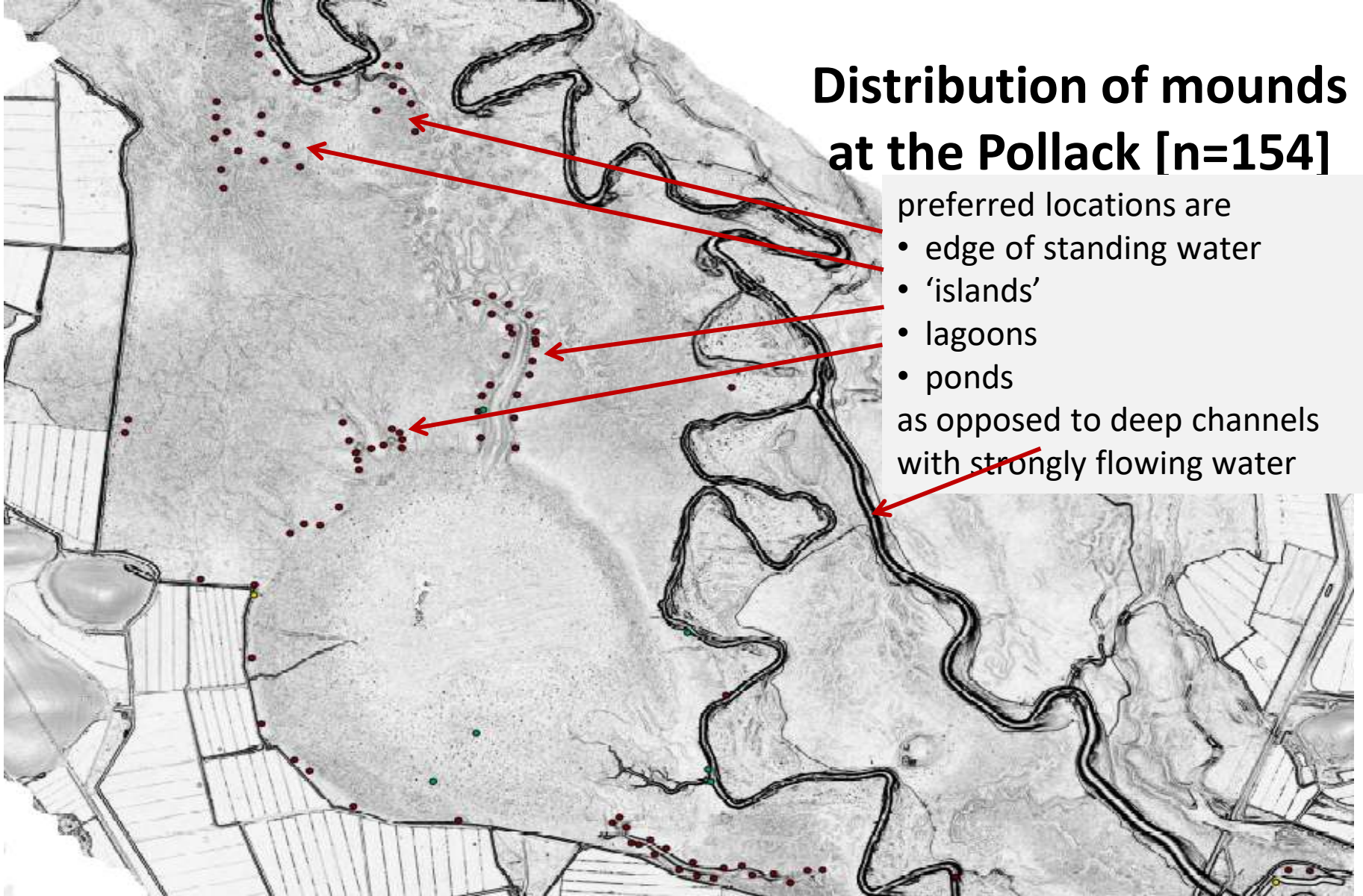


## Distribution of mounds at the Pollack [n=154]

preferred locations are

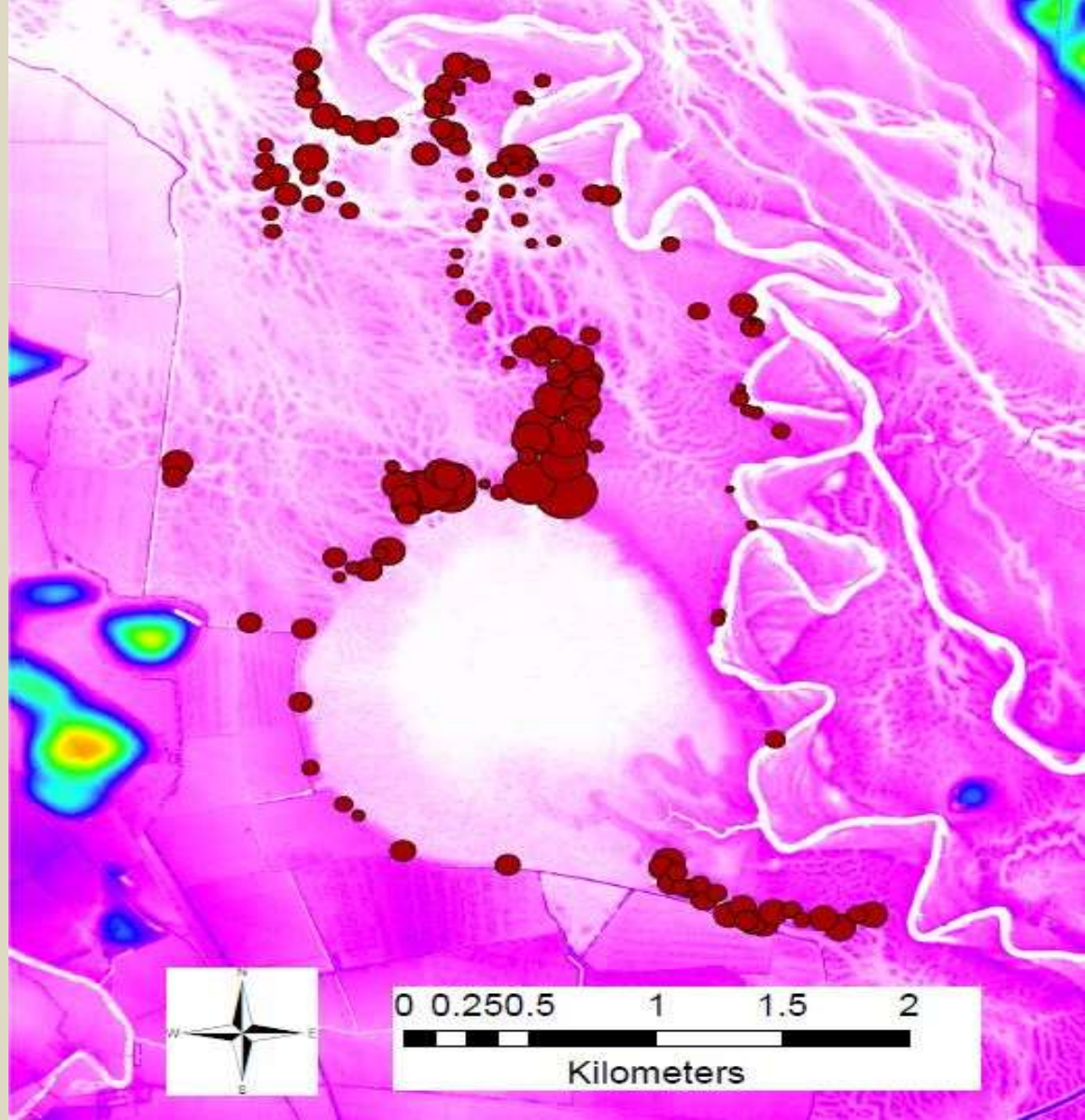
- edge of standing water
- 'islands'
- lagoons
- ponds

as opposed to deep channels  
with ~~strongly~~ flowing water



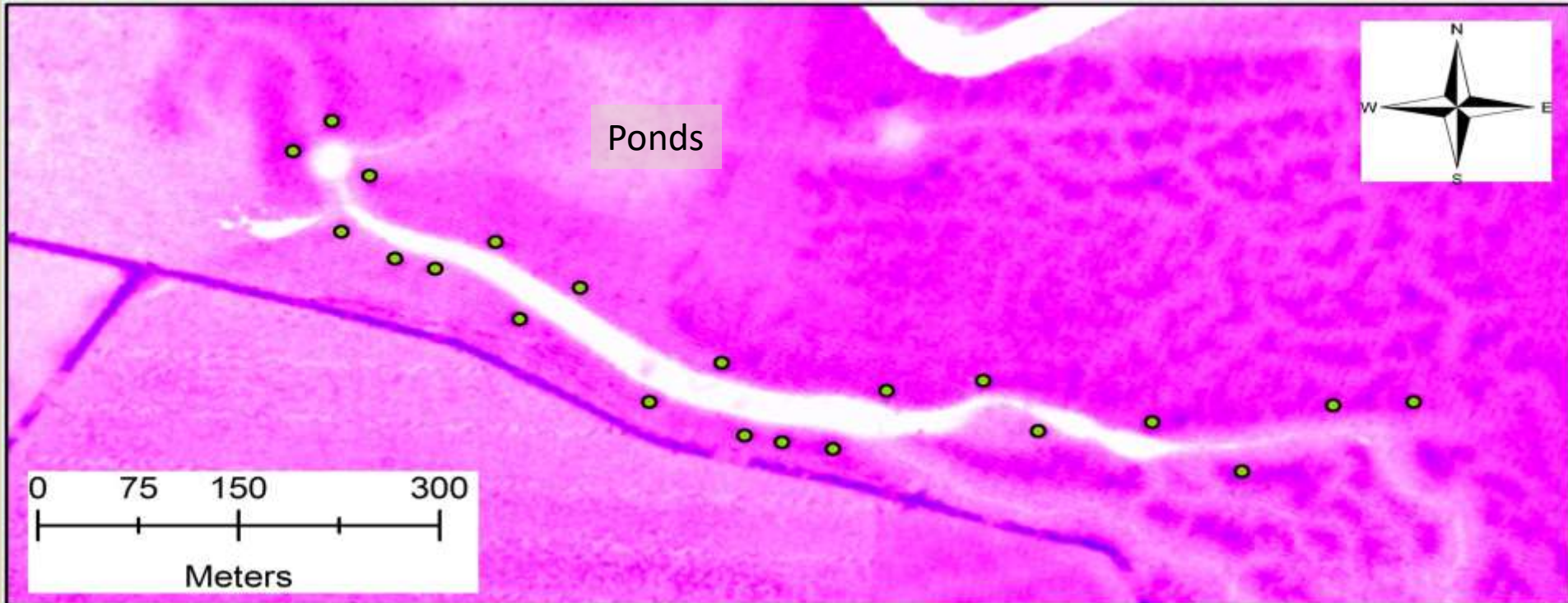
# Size of mounds

LiDAR mapping provides detailed topographic information at 5cm pixel resolution, with vegetation removed.





# Mounds along the southern inlet




Housing arrangement

# The MDBA Flooding Program 2015

The plan was to flood the swamp with 500ML (0.5 GL) of Environmental Water.  
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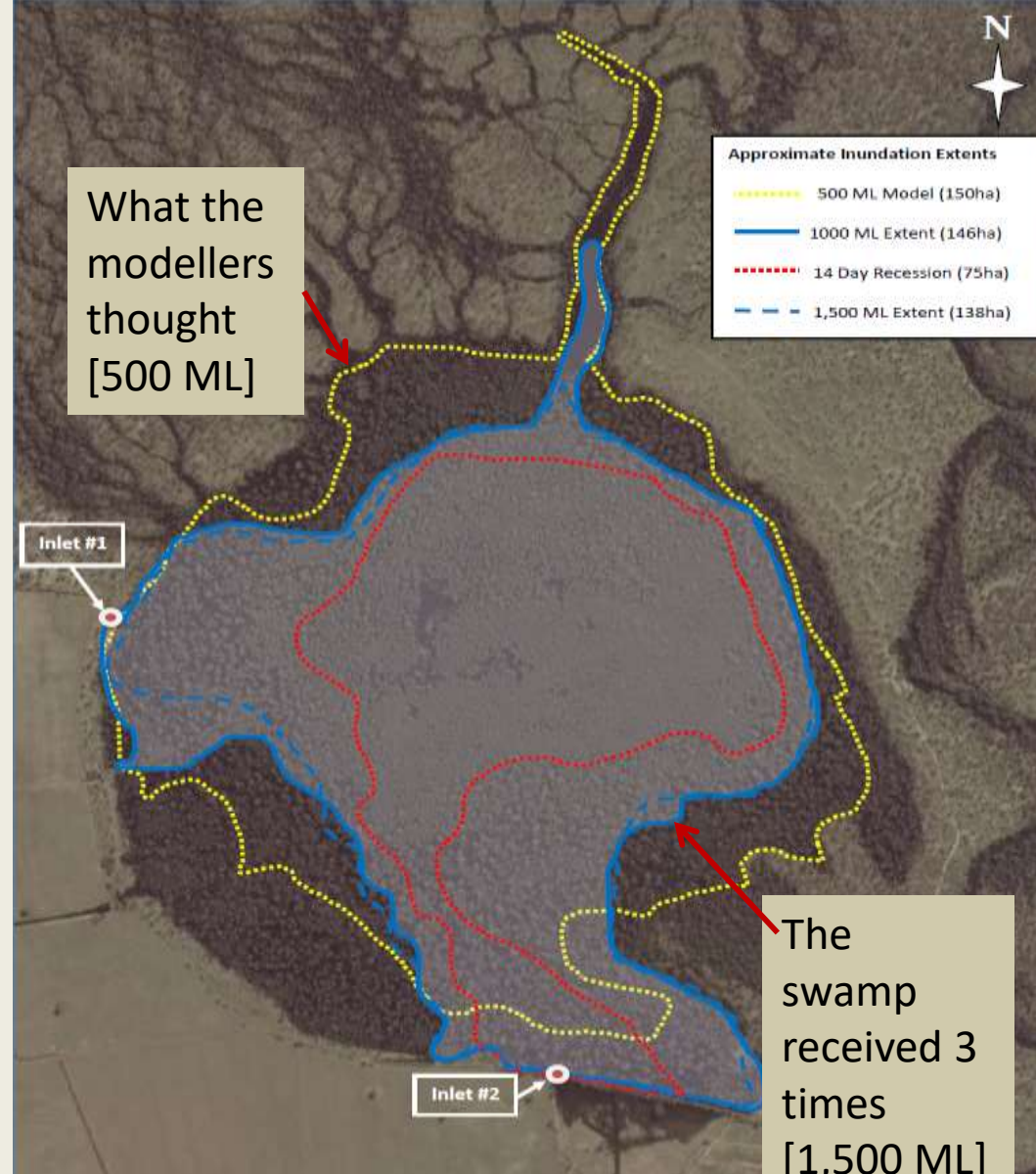
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The gap between water management modelling and reality: if the MDBA modelling is correct, then the archaeological and historical evidence is wrong.



# Since 1842 [175 years] the Aboriginal landscape has been transformed by:

- an end to Aboriginal land management – principally firestick farming
- compaction of soils by stock, leading to increased runoff of water
- destruction of native vegetation by stock
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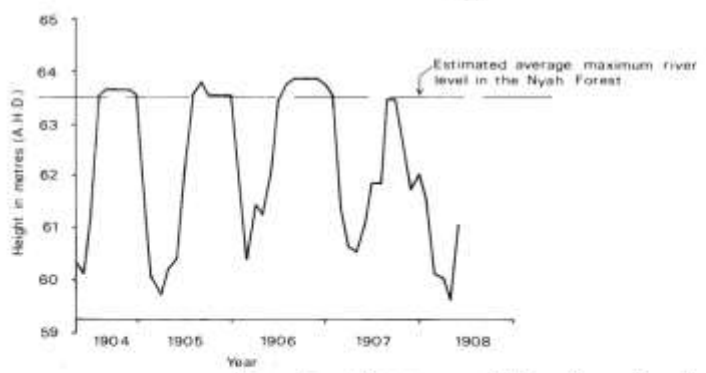
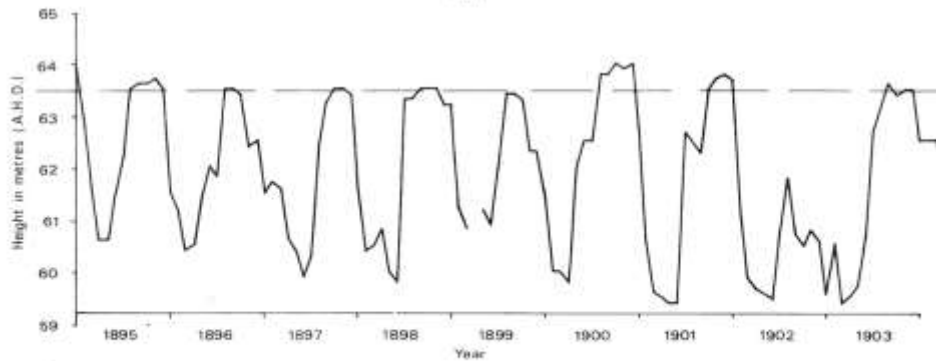
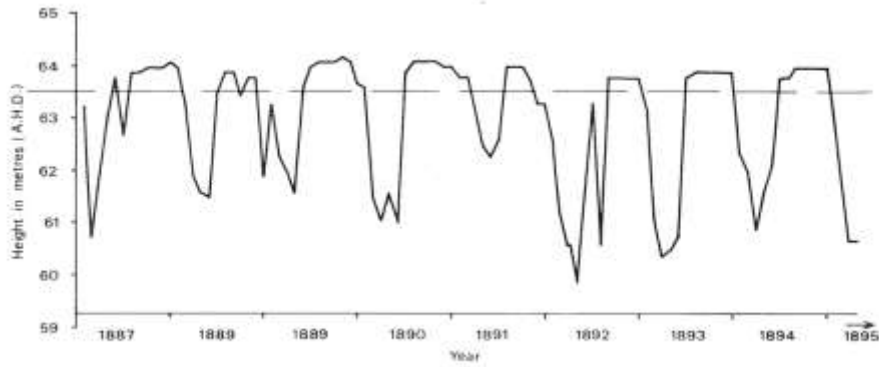



Fig. 14. Average monthly river levels (A.H.D.) between Nyah and Wood Wood for the years 1887-1908

Unregulated Murray River flows 1887 – 1907, long after stock impact on soils, but before regulation [weirs and storages]

Coutts et al. 1980





Earth mounds and levees that link them are conveniently colour coded by Lachlan Valley Bluebells [Paterson's Curse, Salvation Jane]

2016 - Once in a generation overbanking event

Pollack Lagoon – Northern inlet / outlet creek



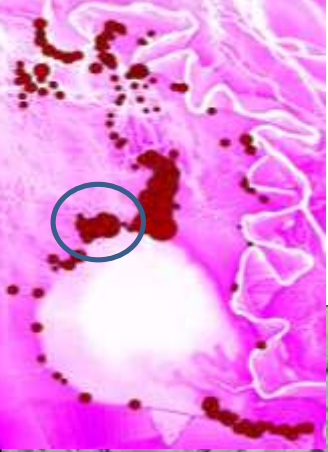
# Largest mounds at the best real estate Absolute water frontage at the Neck



***Beveridge observed people “living on islands on the floodplain up to 5 months of the year”. [1840s]***



# 2 Ponds and 11 mounds at the NW suburb





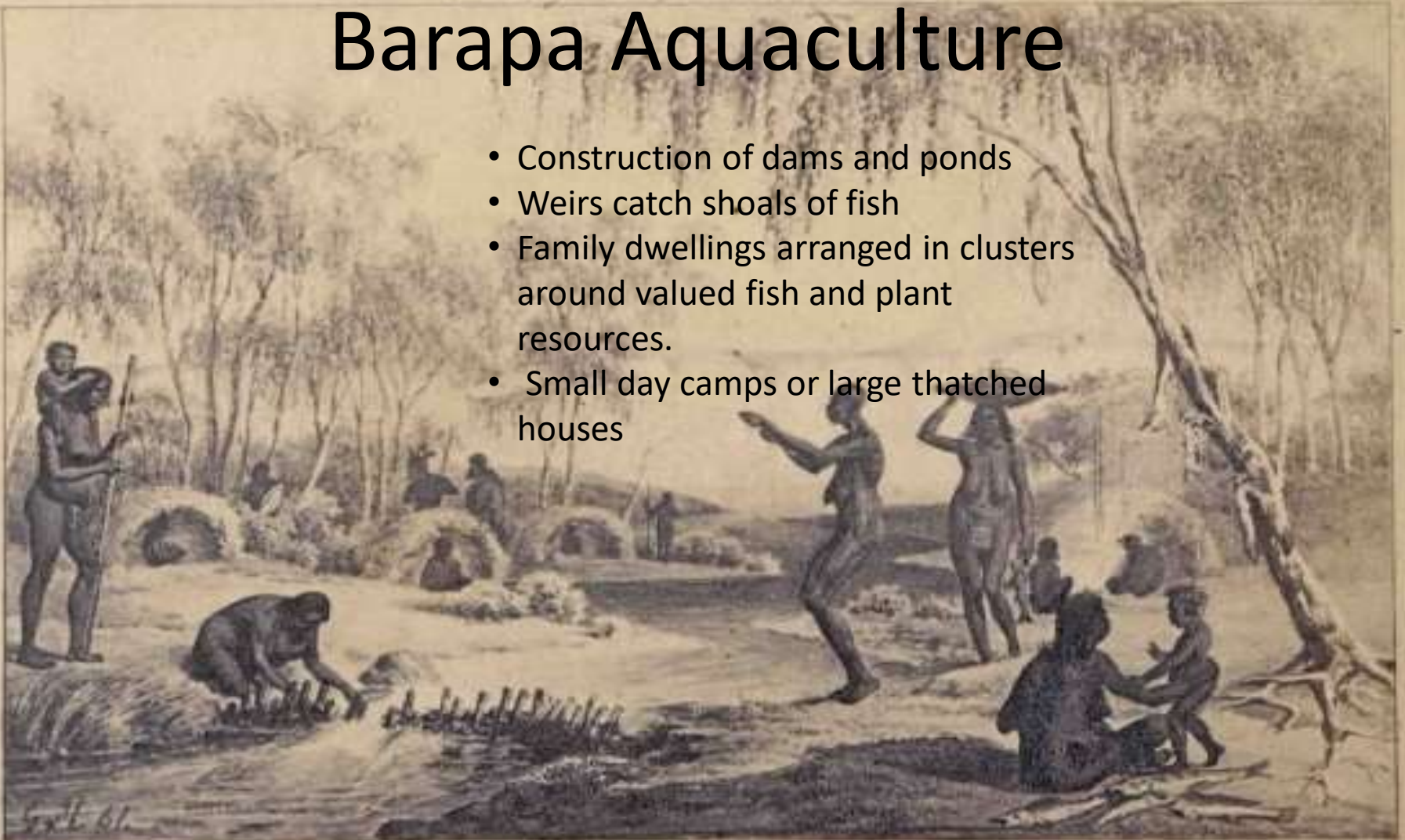
# Pond after flood peak





# Barapa Aquaculture

- Construction of dams and ponds
- Weirs catch shoals of fish
- Family dwellings arranged in clusters around valued fish and plant resources.
- Small day camps or large thatched houses

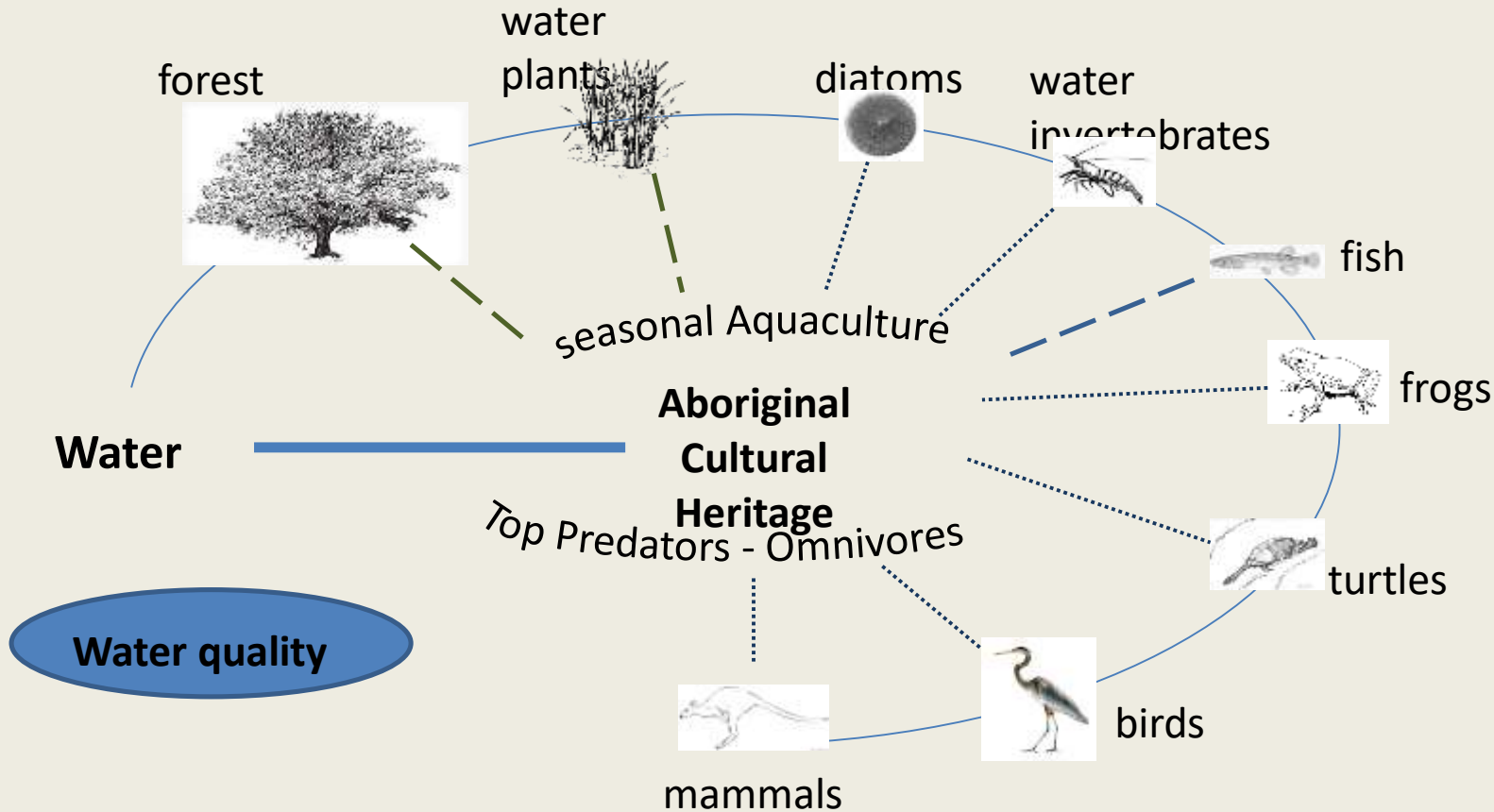






Placement of weirs becomes obvious

# Cultural Heritage is central to our understanding of Forest Ecology





# Bird Breeding commences



**A pair of Nankeen Night Herons in breeding plumage** [17 November 2016]



**Great Egret in breeding plumage**  
[24 November 2016]



Norman Moore  
with Murray Cod



# Marriage of Cultural Heritage and eWater

Chewing *Typha* for food

Large dragnet across pond

nets and spear fishing

Children playing football

spinning twine

Fibre extracted and retained

cooking small fish

possum skin rugs/cloaks



Pollack  
Swamp →



# Barapa villages are the ecological hot spots

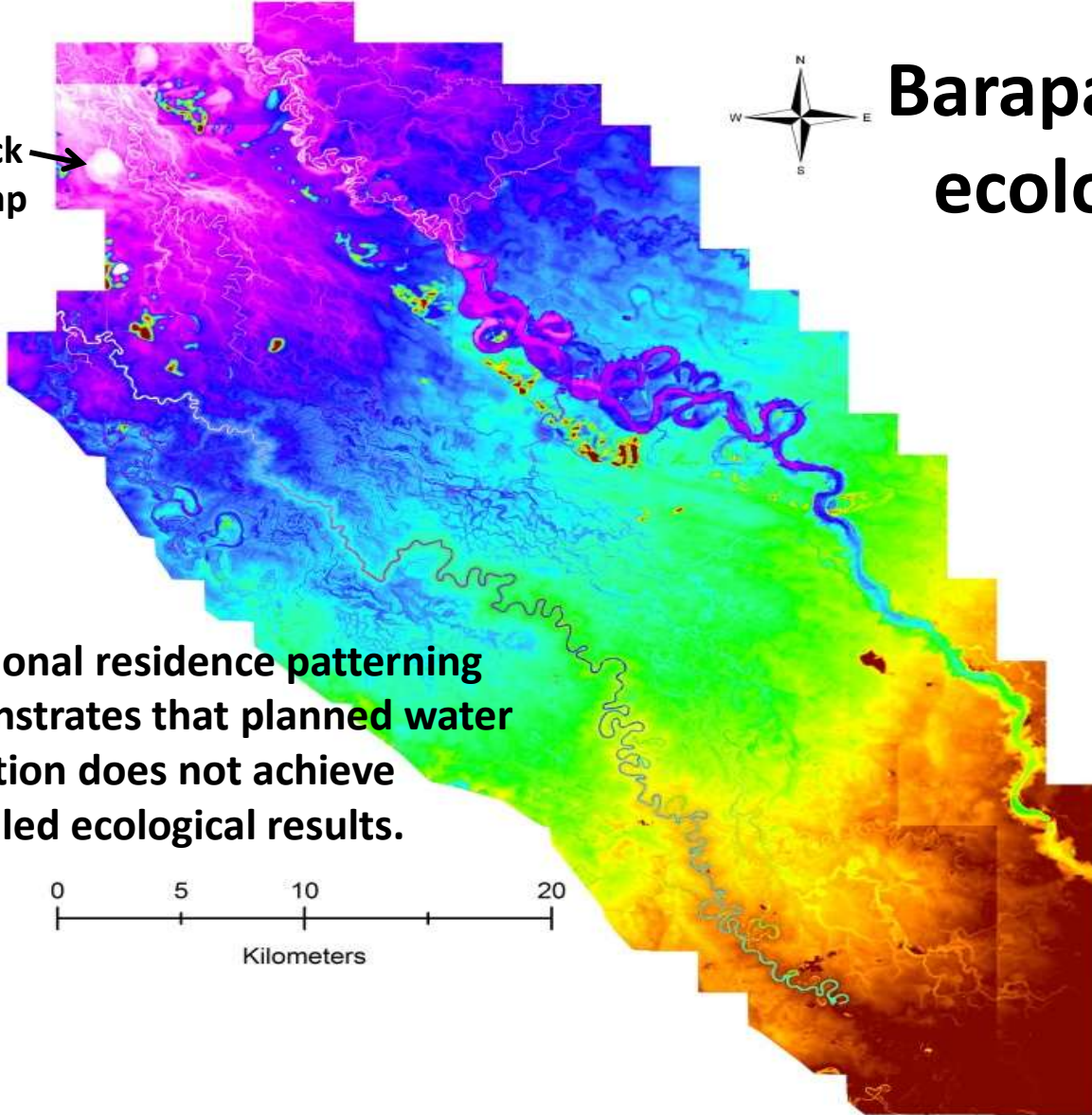
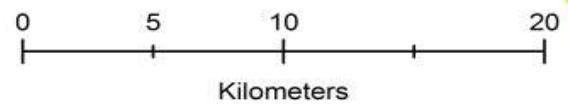
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If this is the best we can  
expect, then **archaeology is  
the best ecological proxy** for  
targeting water delivery for  
best ecological result.

**Traditional residence patterning  
demonstrates that planned water  
allocation does not achieve  
modelled ecological results.**





# The Plan

Ground survey to identify 10-15 village sites throughout the central Murray River floodplain. These are the ecological hotspots. Provide eWater to ensure breeding events every year [2-3 gL each site].

# The Team

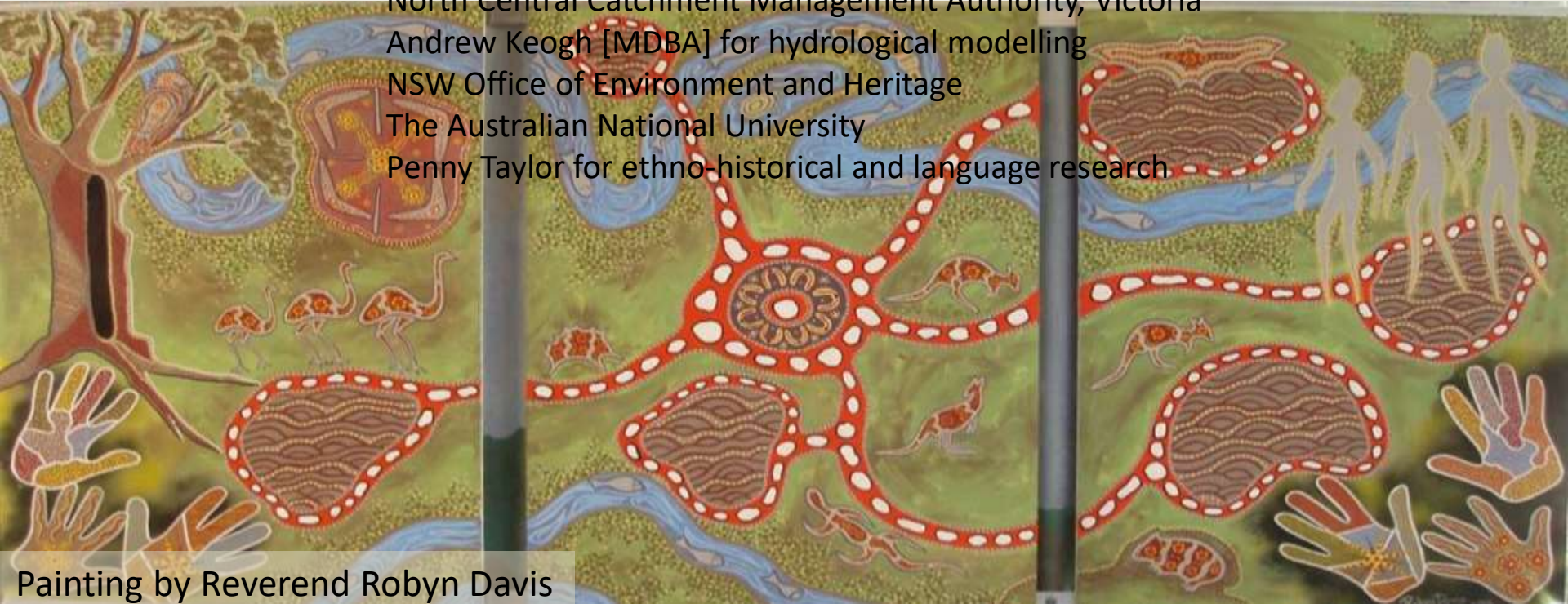
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We will continue to document archaeological evidence relevant to conservation efforts in the floodplain of the Murray River. Aboriginal participation is essential for effective environmental management. In this project Barapa traditional knowledge incorporates the distillation of traditional residential patterns over the last 3,000 years to identify important conservation sites.

# Acknowledgements

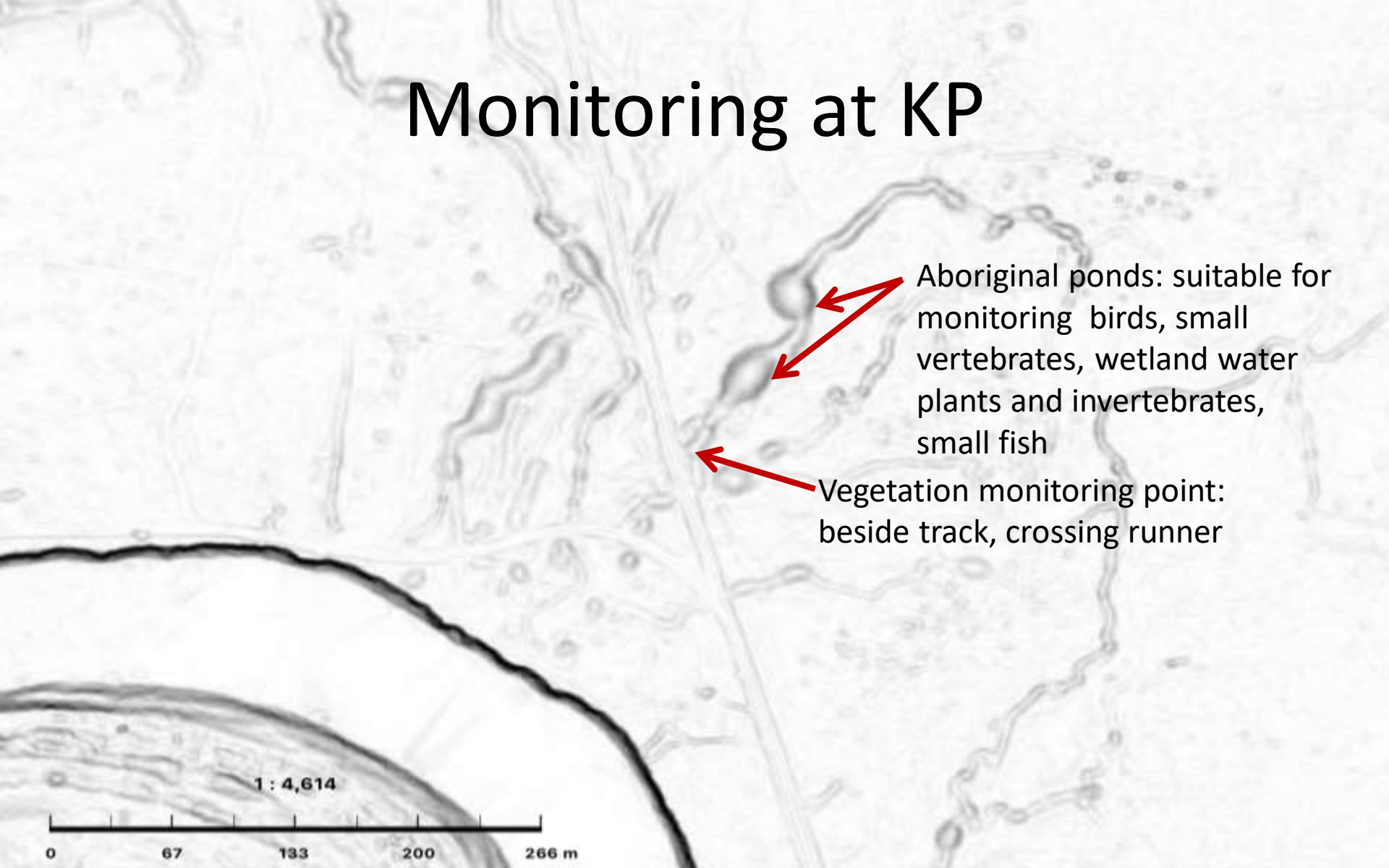
Barapa Barapa Aboriginal Corporation and the Joint Indigenous Group  
Moama Local Aboriginal Land Council  
Murray Darling Basin Authority  
Forestry Corporation NSW  
Local land holders  
Graham Heffer, owner of Pollack neighbouring property, 'The Ark'  
North Central Catchment Management Authority, Victoria  
Andrew Keogh [MDBA] for hydrological modelling  
NSW Office of Environment and Heritage  
The Australian National University  
Penny Taylor for ethno-historical and language research



Painting by Reverend Robyn Davis



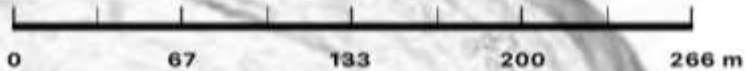
# Monitoring at KP



Aboriginal ponds: suitable for monitoring birds, small vertebrates, wetland water plants and invertebrates, small fish

Vegetation monitoring point: beside track, crossing runner

1 : 4,614



# MDBA Indigenous Engagement Principles 2012

These Principles include the following:

- ◆ Consistent and grounded involvement of Aboriginal people in natural resource management decision making;
- ◆ Work towards improving the capacity of Indigenous/Aboriginal people in relation to effective involvement in natural resource management.
- ◆ Recognise that natural resource management programs have a role in delivering cultural, social, economic and environmental outcomes that are equitable and appropriate to Aboriginal people.



# Opportunities for Aboriginal People and Government Land and Water Management Agencies

**1. Aboriginal cultural heritage is central to effective eWater delivery and ecological monitoring.**

**2. Aboriginal People are keen to participate.**

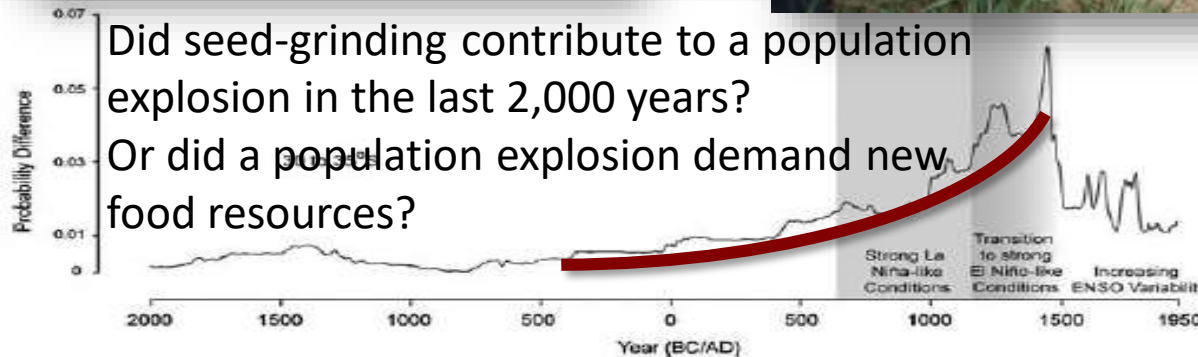
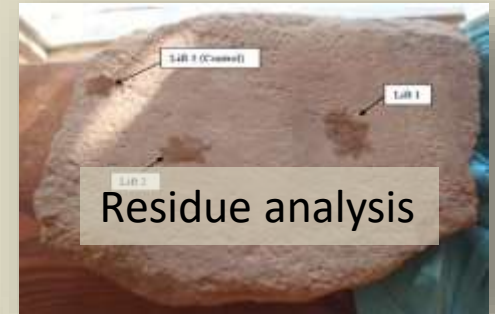
- ◆ Trained and experienced local workforce
- ◆ Trained in data collection and monitoring
- ◆ Provide field support to visiting ecological monitoring contractors
- ◆ Provide local knowledge of forest, roads, conditions
- ◆ Trained WHS for local conditions in the forest
- ◆ Knowledge of cultural heritage as key background for ecological monitoring

# Traditional Barapa Kitchen Implements



Axes traded from neighbours for local manufactured goods [nets, spears]

## Elbow grease of the ancestors



## Economic value





# Timing of resources

A photograph of a flooded forest. In the center, a person wearing a dark hat and a light-colored shirt is wading through the water. The water is dark and reflects the surrounding trees. In the foreground on the right, there are vibrant purple flowers. The background is filled with tall, thin trees with light-colored bark, likely eucalyptus, standing in the water. The overall scene is lush and green, suggesting a wetland or floodplain environment.

Water Ribbon is an early source of starch





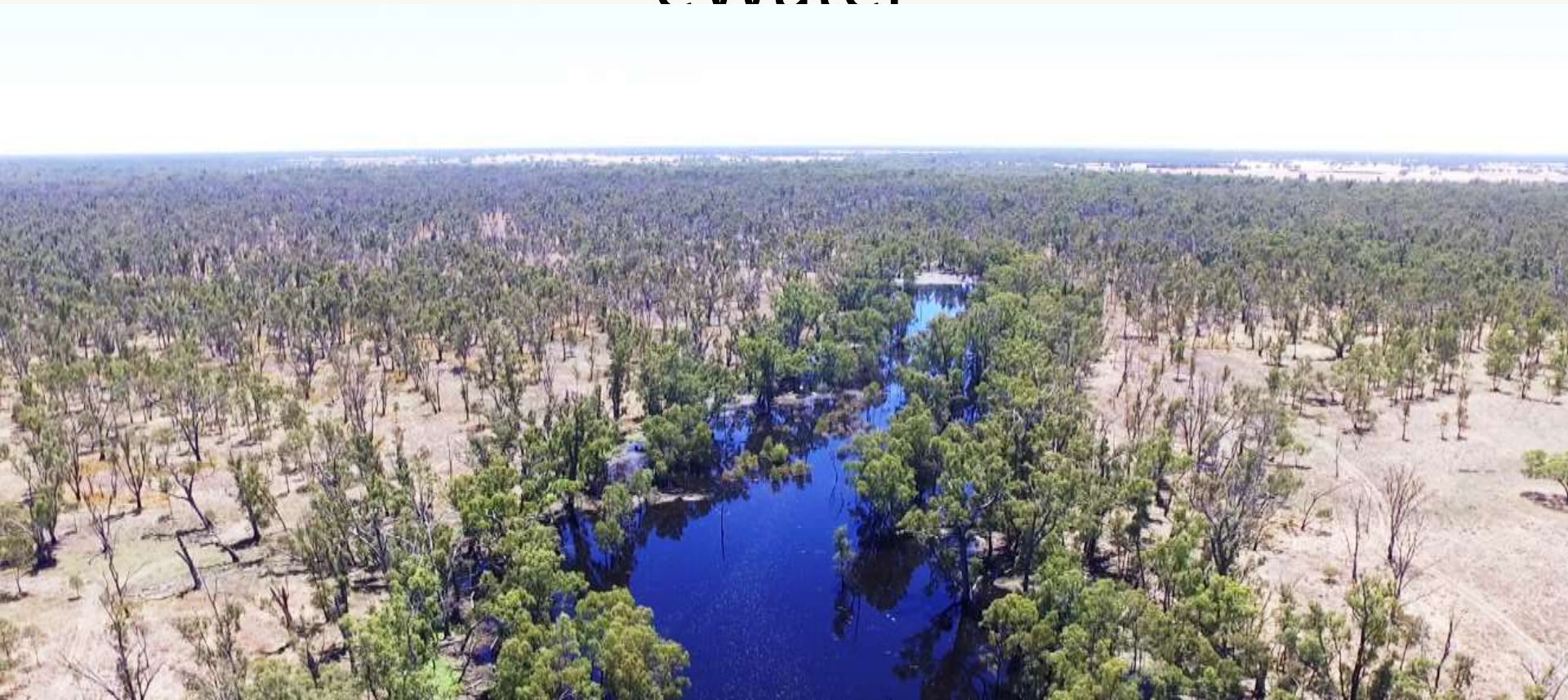
Zack McCullough  
with Water  
Ribbon tubers  
and some clay  
balls for a ground  
oven





January 2017

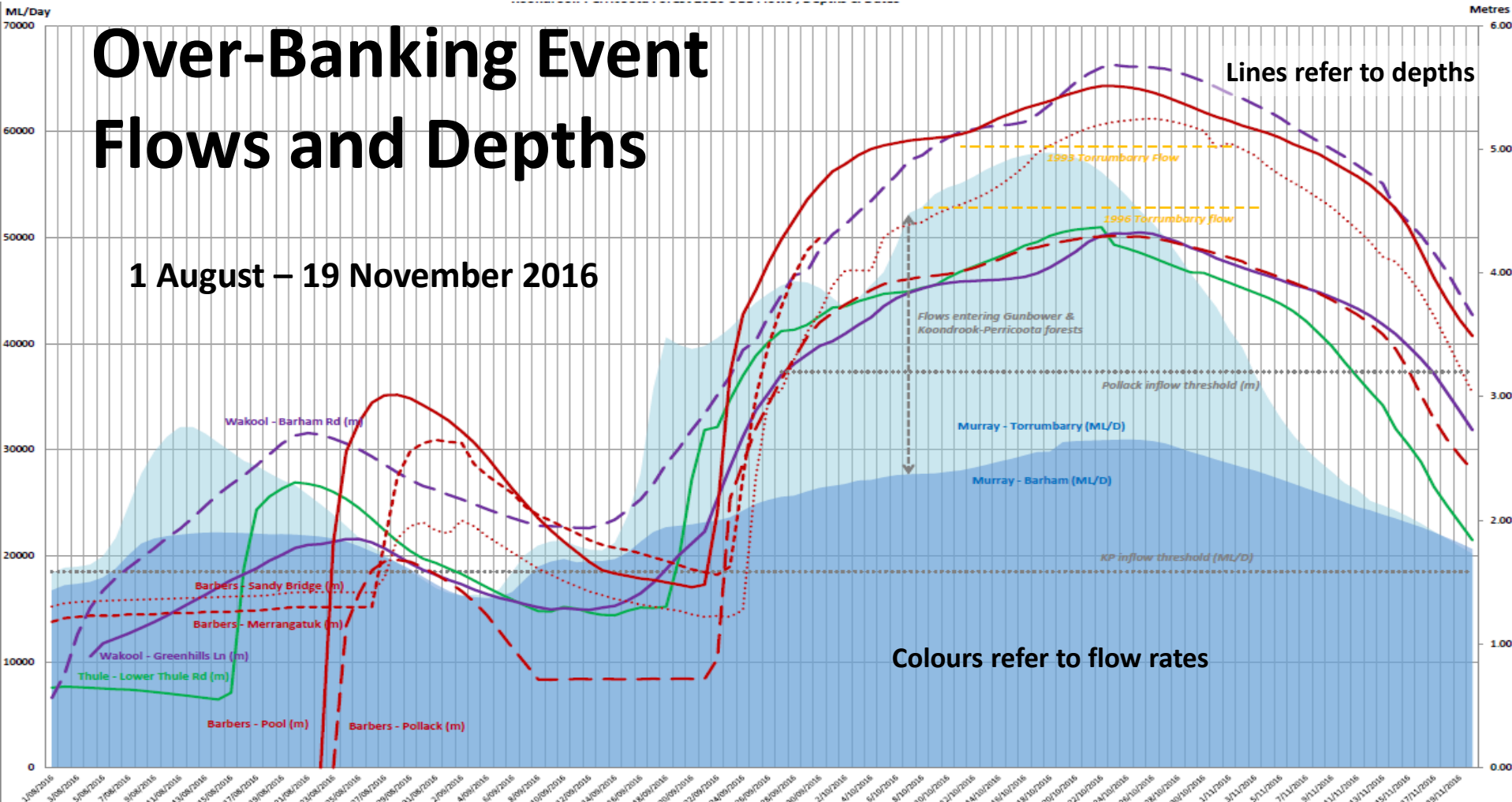
Overbanking event topped up with 1GL  
eWater



# Koondrook-Perricoota Forest 2016

## Over-Banking Event Flows and Depths

1 August – 19 November 2016







**A pair of Nankeen  
Night Herons nesting**  
[17 November 2016]



**White-necked  
Heron nesting**  
[24 November 2016 ]









Channel Levees used as roads







The channels [runners] overbank, flooding the surrounding floodplain forest



# Pulutj – The Pollack







# Ponds at the NW suburb





# Overhead of NW Pond 1

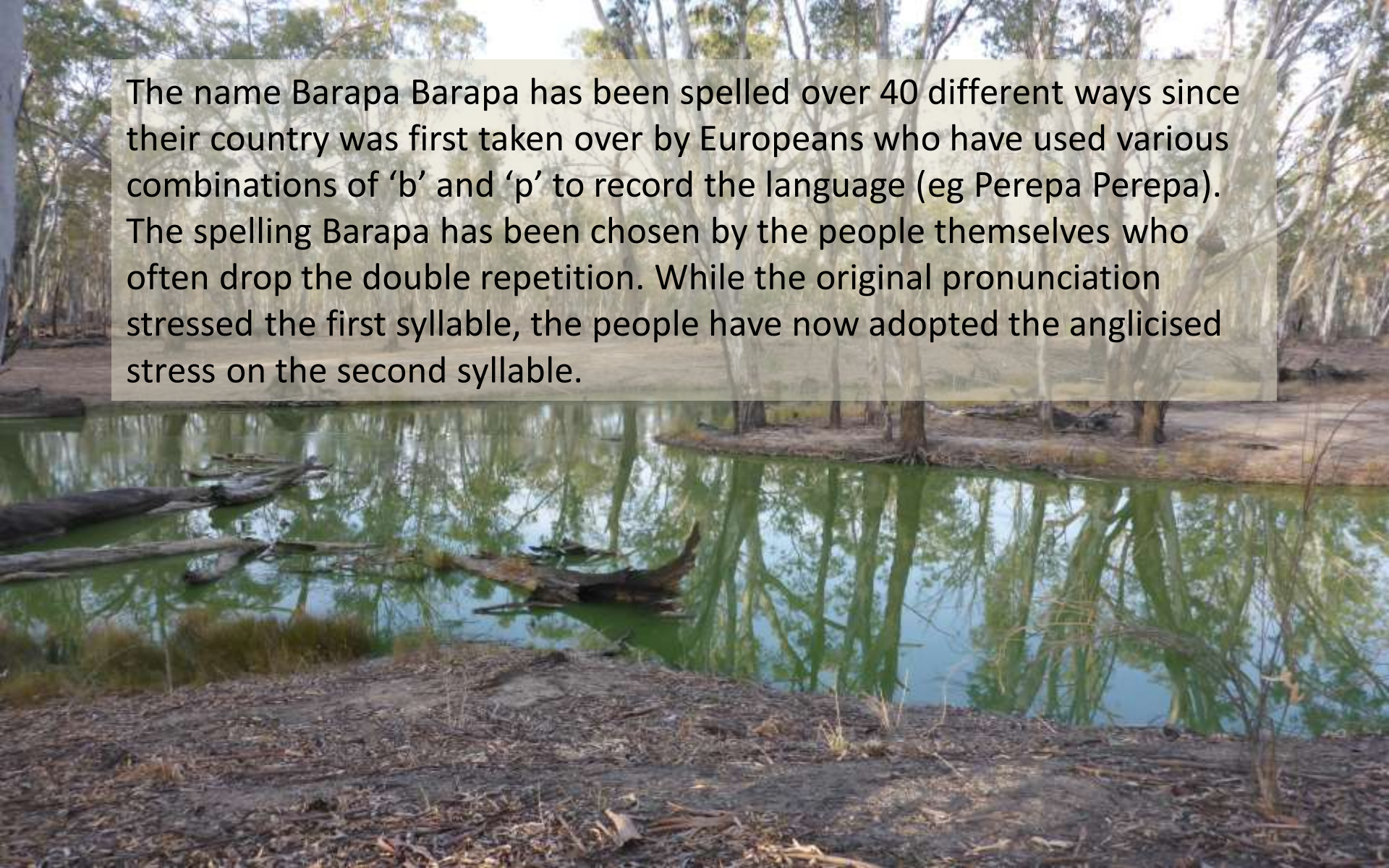




# NE Ponds

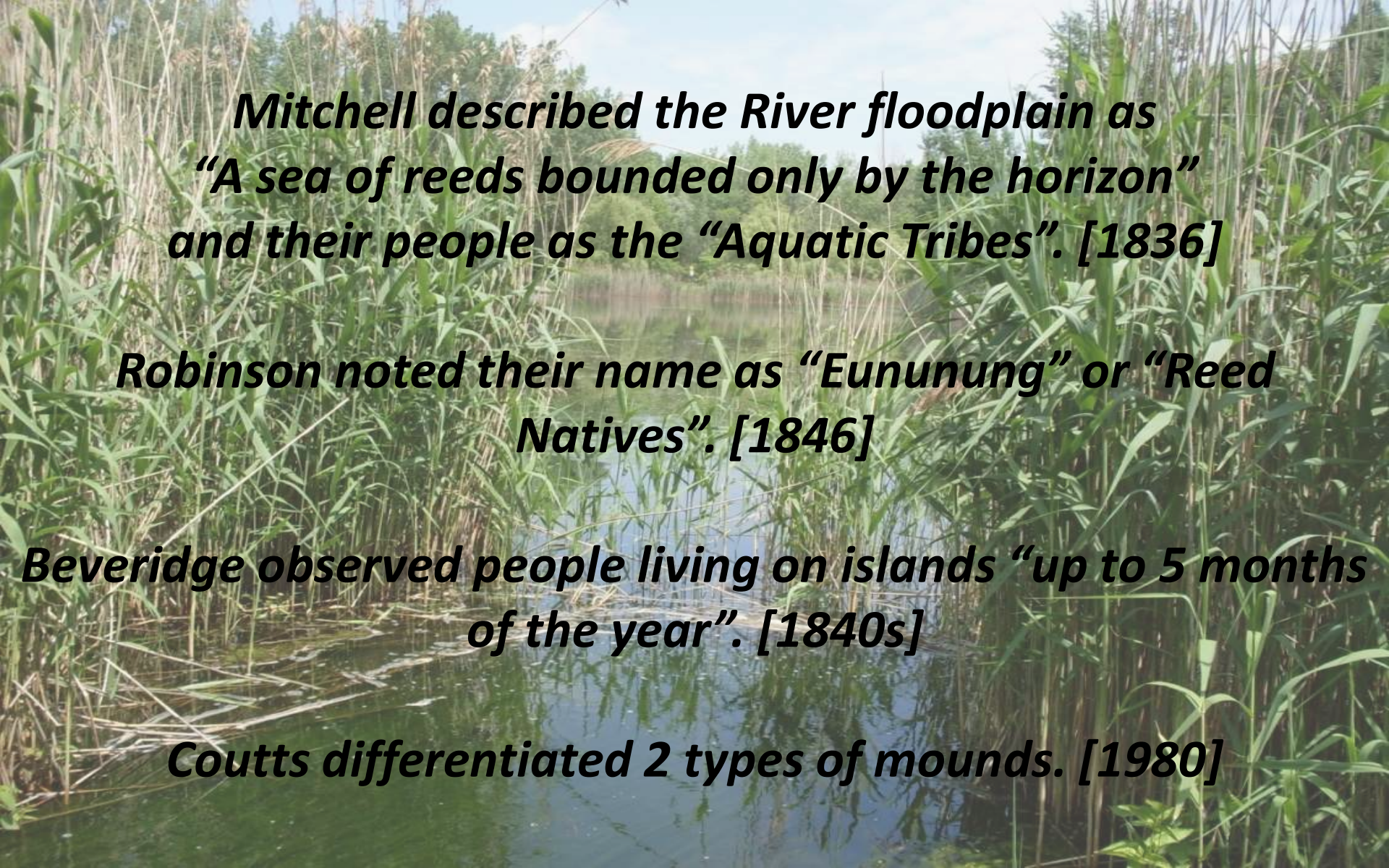




A scenic view of a riverbank. The foreground shows a dark, muddy bank with some dry leaves and twigs. The middle ground is a calm body of water reflecting the surrounding trees and sky. The background is a dense forest of tall, thin trees with green foliage. A semi-transparent text box is overlaid on the upper part of the image.

The name Barapa Barapa has been spelled over 40 different ways since their country was first taken over by Europeans who have used various combinations of 'b' and 'p' to record the language (eg Perepa Perepa). The spelling Barapa has been chosen by the people themselves who often drop the double repetition. While the original pronunciation stressed the first syllable, the people have now adopted the anglicised stress on the second syllable.



A photograph of a river floodplain with tall reeds and water. The reeds are green and brown, and the water is dark and reflective. The background shows a line of trees under a blue sky with some clouds.

***Mitchell described the River floodplain as  
“A sea of reeds bounded only by the horizon”  
and their people as the “Aquatic Tribes”. [1836]***

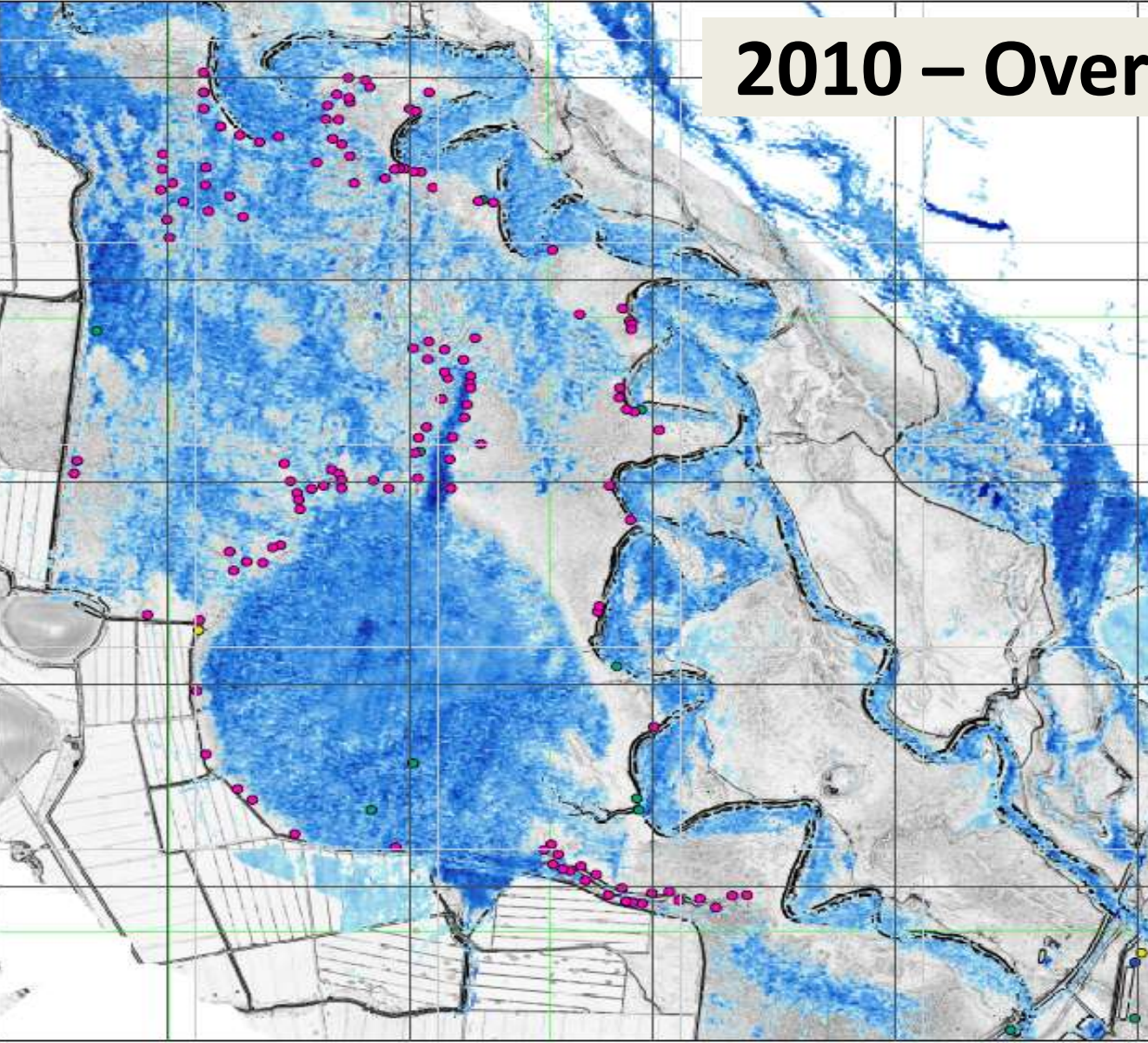
***Robinson noted their name as “Eununung” or “Reed  
Natives”. [1846]***

***Beveridge observed people living on islands “up to 5 months  
of the year”. [1840s]***

***Coutts differentiated 2 types of mounds. [1980]***



# 2010 – Overbanking Event



Large population living on island mounds for 5 months

All movement by canoe

Residential pattern follows seasonal flows:

- Deep flowing channels
- Overbanking and flooding the plains
- Still, shallow, warm water
- Lagoons, ponds remain after recession



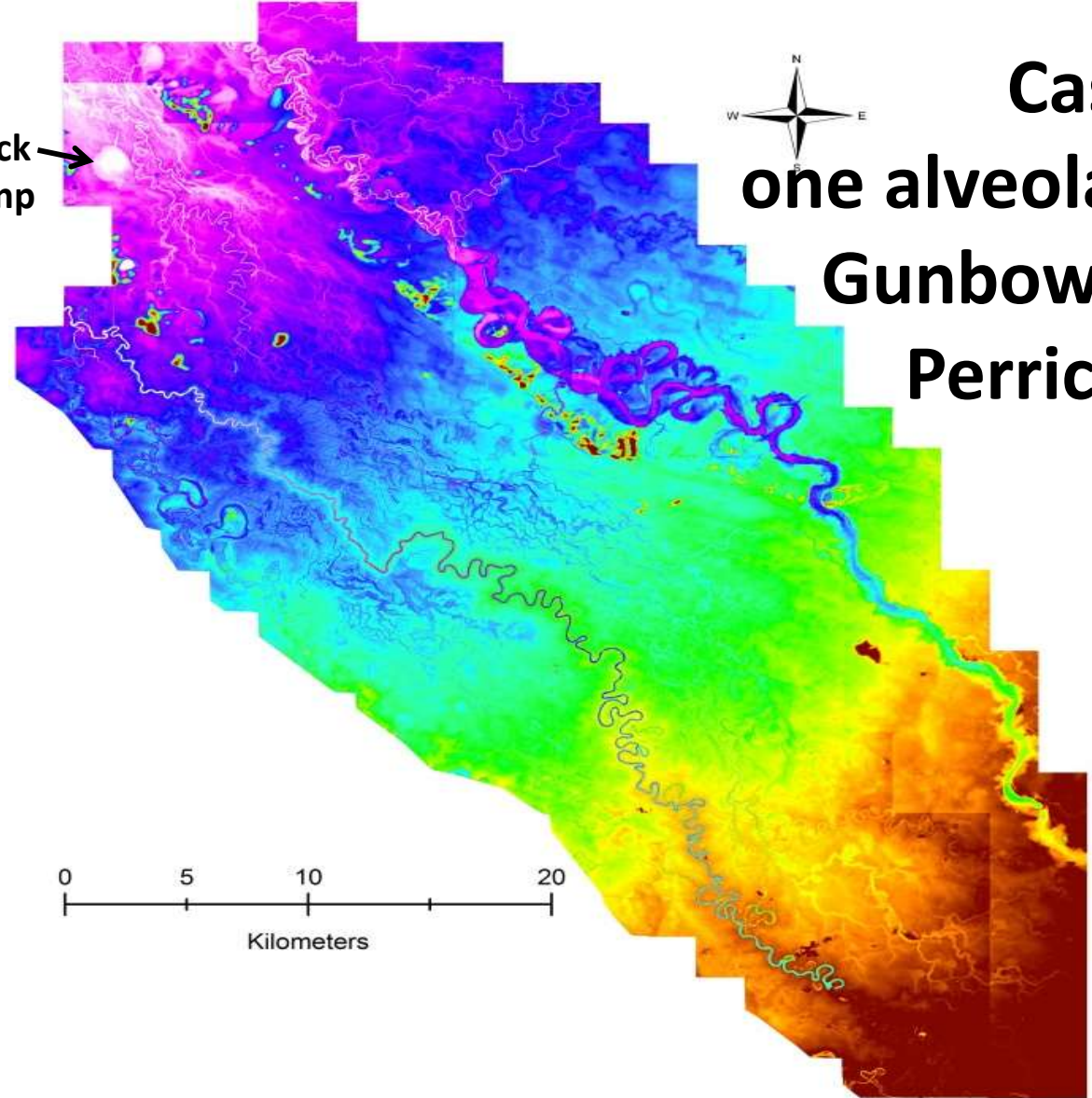
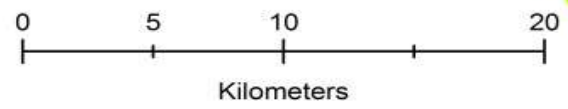
Pollack  
Swamp



# Case Study one alveolar swamp within Gunbower Koondrook Perricoota Forest

GKP Icon Site – 50,000 ha

The Pollack – 220 ha  
[0.44%]



# The Murray River Red Gum Forests are RAMSAR wetlands



80% reduction in colony nesting  
of migratory waterbirds since  
intensive irrigation

53 species of amphibians  
at risk or endangered





























