

Attachment 1 to Item 229

Presentation from Infrastructure NSW/Water NSW - Warragamba Dam Environmental Impact Statement

Date of meeting: 23 November 2021 Location: By audio-visual link Time: 6:30 p.m.

Proposed Warragamba Dam Raising for Flood Mitigation

Environmental Impact Statement Briefing to Hawkesbury City Council 21 October 2021



Acknowledgement of Country



Representatives here tonight

We are New South Wales

The Flood Strategy

Maree Abood Head, Hawkesbury-Nepean Flood Risk Management Directorate

Alison White Senior Community Engagement Specialist Hawkesbury-Nepean Flood Risk Management Directorate



David Harper, Project Director

Emma Hately

Project Manager, Planning and Environmental Approvals





EIS Preparation

Member of the Surbana Jurong Group

Bob Tilbury, EIS Director

Chris Masters, EIS Lead Author

Online consultation



www.waternsw.com.au/wdr

Planning & assessment process and submissions



The Flood Strategy



INSW – The Flood Strategy

Infrastructure

New South Wales

Alison White

6 Warragamba Dam Raising Briefing 2021

Hawkesbury Nepean Valley

- High flood risk:
 - highest flood risk in NSW, if not Australia
 - flood risk is not mitigated
- Unique geography:
 - the 'bathtub effect'
 - 5 major tributaries contribute floodwaters
 - downstream gorges hold back floodwater
- Floods can be very deep and rapid:
 - deeper than most Australian floodplains
- Large existing population at risk



A long history of flooding

Largest flood since European settlement:

- June 1867 record flood
- approximately 1 in 500 chance per year
- 13 people lost their lives
- Largest flood in living memory:
 - November 1961
 - 1 in 30 to 50 chance per year
- Last major flood:
 - March 2021
 - 1 in 10 to 20 chance per year
- Before European settlement:
 - Nepean Gorge sediments reveal at least one flood reached or exceeded 1 in 1,000 chance per year



1867 flood level

Warragamba Dam Raising Briefing 2021

Flood and drought dominated cycles



9

Flood and drought dominated cycles



Deeper floods in the Hawkesbury-Nepean



The floodplain communities

- A dynamic community:
 - ~140,000 people live or work on the floodplain
 - 30% not living in valley five years earlier
 - many thousands moved in since last flood cycle
 - more than one generation grown up
- Diverse and changing
 - most have limited experience of major floods
 - large and growing CALD populations
 - vulnerable groups & individuals at high flood risk
- Insurance affordability



140,000 people currently live or work on the floodplain

1 in 100 chance per year flood



~ 55,000 people need to evacuate

7,600+ homes impacted



• 1 in 500 chance per year flood (similar to1867 flood of record):



 Lifetime social costs to people impacted by major floods are likely to equal damages to homes and infrastructure

All options investigated and reassessed

- Flood Strategy for the Hawkesbury-Nepean released in 2017
 - Taskforce Options Assessment Report 4 years of investigations
- **Reduce risk to life and flood damages** to homes and infrastructure, including:
 - X River dredging
 - Currency Creek Diversion Channel
 - Local levees
 - Buy back of properties
 - Warragamba Dam options:
 - imes Lower full supply level (5 metres)
 - X Lower full supply level (12 metres)
 - X Lower full supply level & raise wall
 - X Raise wall by 20 metres
 - ✓ Raise wall by 14 metres.

- **Reduce risk to life**, including:
 - Regional road upgrades (10 different options)
 - ✓ Priority local road upgrades
 - ✓ Non-infrastructure measures
 - ✓ Regional coordination
 - Integrated land use, roads and emergency planning
 - An aware, prepared and responsive community
 - ✓ Better weather and flood predictions
 - ✓ Best-practice response and recovery
 - Ongoing monitoring, evaluation, reporting and improvement

Land use planning in the floodplain

- Very substantial existing flood risk
- Dam raising key in reducing risk now and for the future
- Regional Land Use Planning
 Framework essential to manage future growth
- Existing flood planning levels would not be reduced



Homes inundated in Windsor - March 2021 flood

Upgrading regional evacuation roads

- Evacuation roads
 - vital during a flood emergency
- New and major upgrades to regional evacuation roads
 - no benefit in reducing damages to existing properties and assets
- Program to increase resilience of existing local evacuation roads
 - fixing existing constraints minimise risk routes cut by local catchment flooding
- Guidelines for building flood resilience into new and upgraded regional roads

Flood Strategy - Local road resilience upgrade program



Why Warragamba Dam?



(approximate chance per year at Windsor)

Mitigation options at Warragamba Dam

- Warragamba historically contributed up to 70% of inflows to floods
- Deep 'V' shaped valley behind the dam
- Warragamba around 80% of Greater Sydney's water supply
- Water supply at its sustainable limit
 - any reduction in permanent storage would need to be replaced



Relative costs of options

- No low-cost options:
 - water supply lowering options major cost is replacing lost supply
 - dam raising major costs relate to construction and biodiversity offsets
 - major road upgrades high cost and do nothing to reduce damages
 - buy back dwellings whole suburbs, thousands of homes, massive cost and social dislocation
 - no new dwellings doesn't address large existing risk.

- Current estimates of proposed dam raising and alternatives
 - outlined in Chapter 4 of EIS
- Final cost of dam raising:
 - completed detailed design
 - conditions of planning approval
 - competitively priced proposals
 - market conditions at the time.

Project Construction and Operation



David Harper

Project Proponent



20 Warragamba Dam Raising Briefing 2021

Design and constructability



Play video at: https://caportal.com.au/wnsw/wd/virtual?hview=modalDesignConstructibility

Environmental flows infrastructure



Construction program

Indicative construction timeline

Task					
Site establishment					
Construction of concrete elements for thickening and widening the dam abutments, central spillway and modifications to the auxiliary spillway					
Roads, bridges and ancillary facilities					
Environmental flows infrastructure					
Site demobilisation and rehabilitation					

Years				
Y1	Y2	Y3	Y4	Y5
_				

Biodiversity



EIS Preparation



Chris Masters

Warragamba Dam Raising Briefing 2021 24

Study areas



Downstream study area

- Where is the downstream study area?
- Information sources:
 - previous studies
 - reports
 - documentation
 - relevant databases
 - vegetation mapping
 - threatened flora surveys
- Vegetation mapping and threatened flora surveys
- Assessment followed the Guidelines for Threatened Species Assessment
- No quantifiable impacts to biodiversity
 - downstream area is highly modified
 - wetlands rely on local flows and groundwater (not spills from the dam)



Play upstream biodiversity video at:

https://caportal.com.au/wnsw/wd/virtual?hview=modalBiodiversity

Upstream study area

- Survey effort:
 - 40 weeks between 2017 and 2019
 - About 3,000 hectares assessed
- Summary of impacts:
 - increased extent and duration of temporary inundation

/arragamba Dan

Targeted field

over 40 weeks

work carried out

- affects individual species differently
- depends on size of event, level of lake, location of vegetation, etc.

Potential impacts to:

- 3 threatened ecological communities
- up to 76 threatened flora species
- up to 16 threatened fauna species

2019-2020 bushfires

- For the study area:
 - 55% of the upstream study area was mapped as 'Low' or 'Unburnt'
 - less than 10% mapped as 'High' or 'Extreme'
- For the Greater Blue Mountains World Heritage Area within the study area:
 - 70% of the area was mapped as 'Low' or 'Unburnt' and about 12% mapped as 'High' or 'Extreme'
- Field surveys occurred well before the fires
- EIS assessments are based on pre-fire conditions

Extent of 2019/2020 bushfires



Species-specific questions

Camden White Gum:

- WaterNSW commissioned a controlled CSIRO study
- trees were inundated for up to 6 weeks
- monitored over 2 years
- small but statistically significant increase in growth over the 2-year study period
- no evidence of negative impact on the growth or survival of the trees
- Regent Honeyeater:
 - was recorded in the study area
 - suitable foraging and breeding habitat is not limited to the impact area
 - unlikely to have a significant impact on the local population of this species
 - not considered a key breeding area*

* National Recovery Plan for the Regent Honeyeater



Protected and Sensitive Lands



EIS Preparation



Chris Masters

31 Warragamba Dam Raising Briefing 2021

Greater Blue Mountains World Heritage Area

- Area extends for more than 250 km from edge of Hunter Valley, to the Southern Highlands near Mittagong
- Made up of 8 national parks and reserves
- Project overlaps with parts of 3 national parks
- At some locations, the boundary of the World Heritage Area matches the full supply level of Lake Burragorang, the waterbody formed by the damming of the Warragamba River



Source: L. Tasker, NPWS

Play World Heritage video at:

https://caportal.com.au/wnsw/wd/virtual?hview=modalWorldHeritage

Wild rivers and national parks

Kowmung River

- approx. 40 km from the dam wall
- declared wild river section is approx. 3km upstream of the junction with the Coxs River
- about 1,250 metres of the declared wild river section is within the <u>study</u> area, but outside the <u>impact</u> area
- no change to the level or extent of inundation

National Parks and Conservation Areas:

- some temporary inundation to areas of surrounding parks and conservation areas
- some of these overlap with the World Heritage Area
- in the order of 0.2% to about 2% of the areas
- accounted for in the Offset Strategy



Aboriginal Cultural Heritage



Approach to Aboriginal Cultural Heritage Assessment

- Aboriginal Cultural Heritage Assessment includes:
 - Archaeological Report: focus on sites & objects
 - Cultural Values Assessment: focus on culture & stories
- Consultation with Registered Aboriginal Parties:
 - 22 Registered Aboriginal Parties identified
 - commented on draft methodology and reports
 - participated in field work
 - provided information to improve the assessments
 - reviewed the mitigation measures and management options



Archaeological survey extent and process

Field works:

- 2 archaeologists
- 1-3 of the Registered Aboriginal Parties
- archaeological sites recorded
- 76 days of upstream field surveys
- Survey included:
 - areas that have potential for Aboriginal objects
 - previously recorded sites that are of high and very high significance
 - areas selected by Registered Aboriginal Parties for cultural significance
- Covered an area of 2,655 hectares
 - larger than impact area (1,400 hectares)
- Produced a predictive model





What we found

- Types of sites identified:
 - Open camp sites
 - Ceremony and dreaming sites
 - Resource and gathering sites
 - Engraving sites
 - Axe grinding and groove sites
 - Scarred trees
 - Rock shelter sites
 - Stone arrangement sites
 - Water hole sites
 - Combinations of the above



Archaeological survey

- Findings:
 - no sites in the construction area
 - 334 sites identified (incl. 303 new sites) upstream
 - 127 outside the study area
 - 119 already affected by temporary inundation
 - 43 within the impact area
 - Predictive model \rightarrow 174 sites within impact area
 - assessment assumes all predicted sites within the impact area to be lost regardless of susceptibility to temporary inundation



Left: Hands on the Rock, an art site below the waters of Lake Burragorang.

Below: Sketches of carved trees from the Burragorang Valley; example of the tangible heritage lost in the valley (Etheridge 1893).



Cultural Values Assessment

- Six strands of distinct but interrelated cultural values:
 - Gurrangatch-Mirrigan Dreaming Track
 - Buru (Kangaroo) Dreaming Story Places
 - Living Places (history of occupation and use)
 - Cultural Places (ritual life)
 - Archaeological Sites
 - Waterways (Wollondilly, Nattai, Warragamba & Coxs Rivers and their tributaries)
- 32 cultural value places identified in the study area:
 - 18 are already fully impacted
 - 11 are already partially impacted and would be further impacted
 - 3 are above the Project impact area
- Through the consultation process the Registered Aboriginal Parties identify the area as highly significant



Recommendations

- 17 Combined recommendations
 - Input from the Registered Aboriginal Parties
- Themes related to:

41

- Continued consultation with Registered Aboriginal Parties
- Implement Aboriginal Cultural Heritage Management
 Plan (ACHMP)
- Improved access to Country
- Further surveying and site recording
- Audit of cultural values records and visits in NSW/ACT
- Interpretive and educational materials, talks & tours
- Registered Aboriginal Parties' views on the Project
 - Varying levels of concern
 - Seen as a continuance of the loss of cultural heritage associated with the original development of the Warragamba Dam in the 1950s
 - Reluctance to share cultural knowledge





Social Impact Assessment



EIS Preparation



Warragamba Dam Raising Briefing 2021 42

Social impact methodology



- SEIA Scoping
 - review of existing information
 - identification of stakeholders and communities

(local, downstream, upstream)

 review of land use planning, demographics from census data, etc





Social impact methodology



Play Social Impact video at:

https://caportal.com.au/wnsw/wd/virtual?hview=modalSocioEconomicImpact

Social impacts and benefits

Avoiding loss of life is the single most significant social change provided by the Project

- Each study area experiences different impacts and benefits
 - Local communities construction impacts to local amenity and economy
 - Upstream communities operational impacts to Aboriginal cultural heritage and natural heritage
 - Downstream communities significant positive social benefits include reduced risks to people's health & safety, homes, and livelihoods





George St Windsor during the 1961 flood event

South Windsor during the 1961 flood event

Case Study: March 2021 Flood



INSW – The Flood Strategy

Infrastructure

New South Wales

Alison White

47 Warragamba Dam Raising Briefing 2021

March 2021 flood – in context

At Penrith:

- moderate flood mostly within bank
- ~1 in 10 to 20 chance per year
- slightly higher than 1961 flood

At Windsor:

- first major flood since 1990
- inundated low lying areas significant damage and dislocation
- 1 in 10 to 20 chance per year
- around 2 metres lower than 1961 flood
- around 7 metres lower than record flood



Nepean River, Bellevue Road Regentville - near flood peak March 2021



Streets under water, McGraths Hill - near flood peak March 2021

Case Study: March 2021 Flood March 2021 flood – reduction in flood peak levels



Note: Review of the March 2021 flood is ongoing.

Figures presented are based on analysis of flood hydrology at Oct 2021.

March 2021 flood – dam pre-releases?

- Flood mitigation not an approved purpose
- Pre-releases ahead of a forecast flood could:
 - bring forward downstream flood peak
 - cut off evacuation routes earlier
- Pre-releases over a longer term:
 - require precision in forecasting not currently possible
 - could risk Greater Sydney's water security
- To avoid dam spilling in March 2021:
 - storage would have to be lowered to around 30%
 - more than 2.5 years supply for Greater Sydney
 - below levels in 2017-19 drought and millennium drought
 - not been achievable in forecast time available for this event



Yarramundi Bridge – March 2021 flood

March 2021 and February 2020 – Richmond/Windsor



Had the dam been
raised, the March 2021
flood would have
been similar in extent
and depth to the
February 2020 event.

Flooding without and with a raised dam



March 2021

February 2020

March 2021 – with raised dam

Some key benefits:

- 80% reduction in houses impacted from around 600 to around 100
- 60%+ reduction in manufactured homes impacted
- Reduced evacuation and isolation
- Reduced closure of bridges:
 - new Windsor Bridge delayed more than 13 hours and shortened by more than 4 days
- Major reduction in damages to roads and other regional infrastructure









In larger floods - supporting evacuation and saving lives



In larger floods - supporting evacuation and saving lives



Proposed dam raising - benefits in larger floods

• 1 in 100 chance per year flood



1 in 500 chance per year flood (similar to1867 flood of record)



Re-assessment of options to inform EIS

- Reassessment of dam raising and alternatives
- Confirmed dam raising offers most benefits in reducing downstream flood risk
- Ongoing implementation of integrated Flood
 Strategy measures
- EIS providing information to consider impacts and benefits







Visit the web portal at:

<u>www.waternsw.com.au/wdr</u>