

No Consideration of an Ocean Outfall Option as a real alternative to Raising the Dam Wall.

There is an urgent short term priority to better manage water levels of Warragamba Dam. Longer term increased flooding issues arising from Climate Change are relevant to future management of water levels in Warragamba Dam.

The NSW Government, has declared raising Warragamba Dam wall by 14 metres Critical State Significant Infrastructure (CSSI), effectively quarantining the project from external community, political, legal and planning scrutiny under NSW Planning Legislation.

The ability to comment on the raising the dam wall is welcome and my comments are below.

I Object to Raising the Dam Wall by 14 metres as proposed in the Draft EIS.

Executive Summary

It is obvious, dropping the Full Supply Level (FSL) of the Dam by 12 metres is “a short term no brainer”, including use of increased desalination and re-cycled water use. It lowers the risk profile of major floods in the Hawkesbury- Nepean Valley. Current FSL is 116.7 Metres RL.

Warragamba contributes around 45% of Hawkesbury/ Nepean water flows, but it is how the Dam is managed during periods of flooding is central to changed water control practices and investment in infrastructure to reduce flood risk and impact. **The has been no investigation of options to divert some flood waters from Warragamba Dam away from entering the Hawkesbury/ Nepean River system, such as an underground Ocean Outfall Option, towards the South Coast north of Wollongong. This is a major failure of the Draft EIS.**

Flood management is also about controlling and limiting urban development in flood prone areas as well as preserving/ minimising adverse impacts on the natural environment, such as the adjacent Blue Mountains World Heritage Area. The current Draft EIS fails on all fronts !! Raising the dam wall is likely to prolong the duration and potentially intensity of flooding in the Hawkesbury Nepean Valley.

The EIS Dam Wall Raising Proposal, if approved under the CSSI Declaration, is the worst outcome **both** for people in the Hawkesbury/ Nepean as well as adjacent world renowned Blue Mountains World Heritage natural areas.

Short term options to reduce the FSL by 12 metres needs to be accompanied by revised strategic investigations into alternatives to raising the dam wall, given the very high levels of EIS Objections to the current proposal. To date the alternatives in the Draft EIS do not satisfy real alternative engineering options to raising the dam wall other than building other dams !!!

The NSW Government is attempting to “steamroll” approval of the Raising the Dam Wall under a CSSI Declaration. It will have a difficult approval process including obtaining approval under Federal Environmental Protection and Biodiversity Conservation Act, 1999, (EPBC Act). It is likely,

due to adverse impacts of the proposal on the Blue Mountains World Heritage Area. it will also attract international environmental scrutiny.

This paper strategically outlines a potential **Ocean Outfall Option** to remove excess dam flooding, even with short term reduced FSL, should it be needed.

An Ocean Outfall Option would involve underground water tunnel/ s from the Dam to the Illawarra Coast most likely between Wollongong and Thirroul. Yes there are many challenges strategically outlined below. But it appears to be feasible.

An **Ocean Outfall Option, with 11 metre diameter tunnel could almost double the outflow** when water is 1 metre over the FSL at the existing drum/ radial gates. Tunnel size and design would need to be investigated.

An Ocean Outfall Option was not considered in the Draft EIS. This is major failure of the Draft EIS.

I submit the Ocean Outfall Option, requires detailed feasibility investigations, prior to any CSSI approval and/ or contractual construction commitments to raising the dam wall.

Subject to detailed investigations, an Ocean Outfall Option could be quicker to build, have fewer local and wider environmental impacts than raising the dam wall as well as provide more benefits to the people of the Hawkesbury through reduced, not delayed/ prolonged flood flows, whilst NOT destroying parts of a World Heritage Area. Raising the Dam Wall merely delays/ prolongs flooding in the Hawkesbury and will not reduce/ divert waters as an ocean outfall could achieve.

Subject to detailed investigation, an Ocean Outfall Option would operate independently to riverine flows downstream from Warragamba Dam. It would reduce volumes, intensity and duration of downstream flood impacts without adversely affecting the Blue Mountains World Heritage Area.

An Ocean Outfall Option would be a win/ win for "**people and plants**" contrary to the views of Premier Perrottet and his key Ministers.

Background

As expected, in the Raising the Dam Wall EIS, the proponents are averse to any water level reduction and any other activities likely to improve flood mitigation, other than raising the dam wall. As expected water management authorities say lowering the FSL by 12 metres will raise water cost, availability and decreased drought tolerance are key issues.

This is a very blinkered view and ignores and/ or underplays potential other ways to reduce flooding impacts in the Hawkesbury, with minimal impact on the adjacent World Heritage Area and/ or Sydney's water supply.

Premier Dominic Perrottet on many occasions has said "*the issues are complex in raising the dam wall*" ... or words to that effect. He has also said in relation to recent NSW floods "*things need to be done differently*" with respect to management of natural disasters.

Yes the issues are complex but after my reading parts of the EIS, I am astounded at the lack any real serious engineering alternatives to minimise flooding on the Hawkesbury ... some of the "alternatives" are really associated works - not alternatives, as promoted in the EIS. Some of these works in the Hawkesbury Valley / elsewhere will be required, even in the unlikely event the dam wall is raised ...

See Attachment 1 below, from the first Version of the EIS.

I thought it appropriate to share with you, from NSW Planning and Infrastructure, the publicly available Response to Submissions (just in case you have not seen this) see link below

<https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSI-8441%2120220221T233241.043%20GMT>

In total, some 2586 Submissions were received of which 2475 (or 96%) Objected to the Proposal to raise the dam wall !!!!!!!

Only 60 Submissions in Support of the project were received.

It is unclear how many of the Hawkesbury community are aware that 96% of all Submissions were opposed to raising the dam wall !!!!!!! I suspect not many.

Given the overwhelming Objections to raising the dam wall, many on environmental grounds related to impact on the Blue Mountains World Heritage Area, one can understand why the the Premier says " the issues are complex" !!!!

Yes the issues are also politically complex ... but the essence of the problem is lack of clear Objectives for flood mitigation in the Hawkesbury, other than raising the dam wall.!!!!!!

It is also critically important to strongly advocate changes to Legislation governing water management of the dam along with infrastructure changes in the Hawkesbury are required now. This is totally consistent with the Precautionary Principle of Planning.

In addition, legislation will be required to better manage, often prohibit certain types of development in flood prone areas in perpetuity, throughout NSW.

In the Short Term

If the Government proceeds to seek planning approval, under the CSSI Declaration for the raising the dam wall project, it is likely to be contested via Federal EPBC Act Legislation and will face strong community opposition. Given the estimated construction time around 10 years the Hawkesbury appears to be unprotected from intense floods for perhaps 15 years whilst Court/ other issues are resolved etc.

Lowering the FSL by 12 metres is a good short term viable solution, BUT it must be accompanied by detailed investigation of dam flood mitigation alternatives, other than raising the wall, that do not involve temporary raising of the water level above the current FSL in times of major flood.

These Legislative and Governance changes are a must be delivered as an urgent priority to allow gradual lowering of the dam FSL towards 12 metres below current FSL within weeks or months. This will help reduce immediate flood risk in the Hawkesbury.

More efficient water recycling and increased use of the desalination plant could go along way to resolving these “complex issues” in times of drought to guarantee Sydney’s water supply in the medium term. It also needs to be recognised that water security will be important to Sydney’s growing population and could be politically challenging in the years ahead.

What are the longer term Objectives/ Options ?

With Climate Change it is likely the Warragamba Dam, along with the Upper Nepean Dams will overflow more often with greater intensity causing significant flooding in the Hawkesbury at future times.

It is appropriate other potential longer term serious engineering alternatives, to raising the dam wall, be assessed. It is important to better understand ability of options to minimise flood flows into the Hawkesbury prior to any permanent decisions on the dam wall ... to date no public information is available or if any serious studies been done into engineering alternatives to raising the dam wall and/ or more dams. ????

Yes, I understand previous studies mostly on new dam location may have been undertaken. However a comprehensive assessment of Ocean Outfall Options and using lowered short term FSL of 12 metres as a baseline, needs to be undertaken.

The Objectives of any long term engineering studies should include, as much as practicable, investigation of:

- Options to reduce, slow and store dam water, utilising the lower FSL as a base and sensitivity testing of various levels;
- Timing, duration and intensity of flood releases, as much as possible, to ensure releases are independent of the Hawkesbury-Nepean flood flows;
- Diversion options of some high flood waters from Warragamba Dam and potentially other Upper Nepean Dams to Ocean Outfalls via underground tunnel/s;
- Reduction of overall levels/ intensity of flood water flowing through the Hawkesbury-Nepean floodplain;

- Major works to ensure any Hawkesbury flood mitigation impacts is totally outside the Blue Mountains World Heritage Area;
- Improving real time rainfall and river monitoring along the entire Hawkesbury-Nepean system; and
- Revised urban planning to ensure minimal managed/ ongoing use of flood plains for all residential and most commercial/ industrial uses.

An independent public inquiry/ assessment would be required.

An Ocean Outfall Option - not considered to date ?

I am not aware of any previous consideration of an Ocean Outfall Option. ???

A detailed engineering, hydrological and environmental investigation should be undertaken into the Feasibility of a Gravity Ocean Outfall tunnel/ s from Warragamba Dam to the ocean.

This would include about 55 to 66 kilometres of tunnels. Depending on route/ s taken it could also capture some peak flooding from the Upper Nepean dams.

By way of example, the current gravity fed surface water supply pipeline between Warragamba and Prospect Reservoir is about 28 kilometres long over undulating surface terrain, with some uphill sections. It appears that this pipeline would cease to operate as a gravity feed when water levels are lower than 33M below current FSL or 83.7Metres RL **See Attachment 2 below, from the EIS.**

The highest drainage points for the proposed tunnel/ s could be around RL 104.5 m, that is, the bottom level of the radial gates which is about 12 metres below current FSL of 116.7M RL. If an 11 metre diameter tunnel is used the bottom of the tunnel at 93.7 Metres RL is still about 10 metres higher than the existing Prospect off take to ensure continuation for gravity feed for the Prospect water supply pipeline.

It is important independent outflows to the ocean be assessed rather than totally relying on traditional outflows via the current Hawkesbury-Nepean. This would easily enable pre releases of Dam water once a major flood event is predicted without prejudicing levels in the Hawkesbury-Nepean. Updated measuring equipment can more accurately measure scale of the floods whilst an Ocean Outfall Option, would be independent of and minimise any impact on downstream river levels by reduced Dam releases to the Hawkesbury-Nepean.

Water movement through the tunnels would be controlled by slush valves/ gates under the dam water and only opened under future Legislated/ prescribed flood circumstances to divert the worst of flood water from the dam away from the Hawkesbury Nepean Rivers.

Options for these tunnels could either start from near the Dam Wall (about 66Kms) **or near** Burragorang Lookout/ Nattai area (about 55Kms) and proceed underground towards the coast.

Both locations have road access, but there may be other sites. These locations would be on the eastern side of the dam and therefore have no impact on the World Heritage Area. All options

would need to be assessed and large flood debris captured before entering the tunnel/s. Dam overflow water in any event currently runs into the ocean via the Hawkesbury/ Nepean River, the Ocean Outfall Option is a diversion of some overflow water.

The Burragorang option, due to higher surface terrain, would be further underground than the Dam Wall option, thereby minimising risk of “tunnel daylighting”. The Dam Wall option is likely to have a longer tunnel due to need to avoid “tunnel daylighting” and travel south before transversing towards the coast.

It is likely, but would need to be assessed, that the gradient of the proposed tunnel/ s would be about the same average gradient of current gravity surface water supply pipeline to Prospect and most likely a consistent gradient to outfall, as it would not follow surface topography (as Prospect pipeline does) , ensuring good flows. Until investigations are done, I have assumed a sea level outfall, but outfall may be below sea level.

The critical % gradients at base of radial gates RL 104.7M RL are:

- Dam wall to Prospect (existing) - 0.0016%
- Dam wall to Coast - 0.0016%
- Burragorang to Coast - 0.0019%

Yes the gradients are slight, but with hydraulic head and good consistent downhill gradients if Prospect works, so should an Ocean Outfall Option work. Burragorang to Coast appears to be slightly steeper than the existing Prospect pipeline gradient.

See Attachment 3 Excel spreadsheet, below, that outlines possible gradients including from FSL, subject to detailed review.

It is likely an Ocean Outfall Option would take less time to build and have fewer environmental impacts than raising the dam wall and provide more benefits to the people of the Hawkesbury.

Obviously, any Ocean Outfall Option, the following , but not limited to issues, will need to be carefully assessed:

- **avoiding existing underground coal mines at Burragorang, Appin and along the Coast;**
- **minimising/ avoiding surface environmental impacts on sensitive ecological areas along the route, including National Parks;**
- **geological and engineering stability, including at ocean outfall site/s;**
- **marine environmental impacts near the ocean outfall point/s;**
- **community social - economic impacts, constructability impacts at Ocean Outfall site/s;**
- **risk assessment, safety and construction time/ costs;**
- **reduced impacts/ benefits on the Blue Mountains World Heritage Area, compared to the Draft EIS; as well as**
- **economic/social/ environmental benefits for the Hawkesbury/ elsewhere of reduced river flows in high flood scenarios.**

if an ocean outfall option was in place any spillway overflow to the Hawkesbury would be greatly reduced. Moreover, additional water could be diverted directly to the Ocean based on predicted

inflows therefore maintaining water levels for Sydney consumption, whilst ensuring reduced flooding for people in the Hawkesbury.

It's Not Pie in the Sky

Currently Snowy 2.0 is using 3 Tunnel Boring Machines (TBM) - each of 11 metres diameter.

In total, the tunnels being bored in the Snowy 2.0 for water transfer scheme, are around 40 kilometres in length. Excavation rate is around 30 metres per day !!!

See link:

https://www.snowyhydro.com.au/wp-content/uploads/2020/09/Snowy-2.0_Tunnel-Boring-Machines_Fact-sheet-2_MAY-21.pdf

Given that the M31 road Hume Motorway, is about half way between the Dam and the Ocean where the M31 crosses the Upper Nepean River. This could be a potential location, given road access for materials and spoil removal to "launch" 2 TBM's - one to head towards the dam and second towards the Ocean, thereby halving tunnelling time. !!!! Plenty of technical/ environmental assessment to be done.

An 11 Metre diameter tunnel is approximately 95 square metres in area - about the same square metres as the current Dam Radial and Drum Gates, if there was a 1 metre spill.

Therefore spill capacity could be effectively doubled, less flow constraints in the tunnel. Obviously the tunnel size, route and flow rates would need to be fully assessed.

Conclusion

The Ocean Outfall Option is longer term lateral thinking that needs to be seriously assessed by independent thinkers with strong water management, planning and engineering credentials.

In the Short Term there appears to be little option but to reduce the FSL by 12 metres to minimise the risk of recurring serious flooding in the Hawkesbury. However, I recognise this may not be technically feasible or politically tolerable if a drought returns, even with desalination etc

Development of an Ocean Outfall Option will provide flexibility on quick reductions of water level below FSL, during floods. The timing, extent and duration of flood water releases would be independent to downstream river flows, without adversely impacting on the Hawkesbury/ Nepean levels.

Above all Ocean Outfall Option will give water managers confidence to release water early without prejudicing either Sydney's Water supply and/ or add to downstream flows likely to increase flooding in the Hawkesbury.

Water management at Warragamba Dam seems to be an endless debating point - going nowhere, over the past 60 plus years, at the expense of the Hawkesbury.

An Ocean Outfall Option is likely to deliver real progress, to break this ongoing vicious circle. it deserves serious attention of either the current State Government or the next State Government after the March 2023 Election.

In addition, the current Federal Government will need to ensure any plans for Warragamba Dam do not adversely impact on the Blue Mountains World Heritage Area, because the current State Government appear to "don't give a damn about plants." or the wider natural environment. !!!!!

Time to look at real engineering options !!!!!

I am happy to discuss.

Regards

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Personal Background:

- Lived in the Hawkesbury for 7 decades and at this address (in 2 time periods) for over 60 years.
- Retired, nearly 6 years, previously long term strategic planning in the NSW rail industry/ Transport for NSW for around 40 years.
- Projects included a leading role in concept development of North West Rail Link (now Metro) rail corridor, including tunnel and station locations, (2008 to 2012) , when handed over to builders, amongst other major rail corridor/ tunnel investigations as well as many other major rail projects.
- Tertiary Qualifications in Economics and Town Planning (emphasis of Transport Planning).

ATTACHMENT 1

Warragamba Dam Raising

Environmental Impact Statement – Chapter 4: Project development and alternatives

4.3 Taskforce - alternatives considered

The assessed alternatives and non-infrastructure measures are detailed in the Taskforce Options Assessment Report (INSW 2019) and include:

- operational alternatives using the existing Warragamba Dam – these primarily modify how the dam is operated but may require some modification to existing infrastructure; these include:
 - – opening Warragamba Dam gates more slowly to temporarily hold back inflows ('surcharge' method)
 - – pre-releases from Warragamba Dam water supply to create a temporary FMZ in advance of a forecast flood
 - – lowering Warragamba Dam's water supply storage to create a dedicated FMZ
 - – combined operational alternatives
- new flood mitigation dams – alternatives include new dams built and operated only for flood mitigation:
 - – new dams upstream of Warragamba Dam
 - – new dam on Nepean River
 - – new dams downstream of Warragamba Dam
- raising Warragamba Dam wall to temporarily store flood waters in a dedicated FMZ – this alternative included detailed consideration of two different heights:
 - – raising by 14 metres
 - – raising by 20 metres
- infrastructure upgrades to enhance drainage or protect downstream communities, including:
 - construction of diversion channels to improve the drainage of floodwaters

ENVIRONMENTAL IMPACT STATEMENT – CHAPTER 4: PROJECT DEVELOPMENT SMEC Internal Ref. 30012078 AND ALTERNATIVES 10 September 2021 Warragamba Dam Raising

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Project development and alternatives

Project development and alternatives

- – dredging of Hawkesbury River to improve drainage of floodwaters
- – levees to provide localised flood protection to flood prone communities
- evacuation road upgrades – involving upgrade packages to improve evacuation road network capacity.

Two

categories of road upgrades were considered:

- – nine evacuation road upgrade packages for major regional evacuation routes
- – local evacuation road upgrades
- non-infrastructure measures – a wide range of non-infrastructure measures was considered including changes to land use planning controls, improved flood forecasting and response, building community resilience, and better coordination between agencies. Generally, these measures do not result in any reduction in flooding extent or frequency, and so cannot be considered substitutes to flood mitigation infrastructure that would reduce significant existing risk exposure. Nonetheless, these non-infrastructure measures are critical for an integrated and sustainable approach to managing current and future flood risk in the valley.

This approach is consistent with best practice frameworks for disaster risk management across the prevent, prepare, respond and recover spectrum.

ATTACHMENT 2 - from S 4.4.1.6

Warragamba pipelines and Deep Water Pumping Station

Warragamba Dam typically supplies around 80 percent of greater Sydney's water needs. Two gravity-feed pipelines from the dam are the primary method supplying water to filtration plants at Orchard Hills and Prospect. Lowering the FSL of Warragamba Dam by 12 metres would reduce the capacity of Warragamba pipelines by 15 percent. Pipeline capacity continues to reduce as the storage depletes due to the reduction in hydraulic head. When the level in the dam falls to 33 metres below FSL, the flow to the pipelines cannot be delivered by gravity and the offline Deep Water Pumping Station would need to be brought into service. The operation of this facility turns a gravity system into a pumped system and is a major undertaking with considerable cost. Lowering the FSL by 12 metres would increase by over 20 times the likelihood of reaching the level at which the Deep Water Pumping Station would be required.

ATTACHMENT 3.

Indicative Fall Rates for Prospect Pipeline and

Options		Approximate Distance Km		FSL (M) - RL		Base of Radial Gates (M) - RL		Estimated at Outfall
Prospect pipeline (existing)		28		116.7		104.5		60
Dam wall to Coast		66		116.7		104.5		0
Burratorang to Coast		55		116.7		104.5		0

				Minimum RL for gravioty feed to Prospect			
Prospect pipeline (existing) - minimum Water RL for gravity feed to Prospect		28		83.7		NA	60