Submission on State Significant Infrastructure Proposal, Application Number SSI-8441, EPBC ID 2017/7940 Warragamba Dam Raising

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Executive Summary

Recommendations:

1. **It is recommended that this proposal not proceed.** This project is not in the National Security interest of Australia as Sydney's water supply currently is dependent on maintaining as full a dam as possible, when there are other strategies that can be adopted which are independent of rainfall and do not present a singular target for foreign Governments and Terrorist organisation.
2. **It is recommended that a Royal Commission, ICAC or Federal ICAC (once established) is established to look at the system protocols and investment mechanisms that were part of DPIE's processes.** This includes meetings, emails and discussion of Departmental and Agency officers with NSW and Federal Ministers, Industry stakeholders and lobbyists. It is also important that how and why contracts for expert opinion where awarded and what discussion, meetings and emails were exchanged prior to those decisions and what pressures were then brought to bear on companies awarded the contracts or individuals to water down their findings. Most of this is hidden from public view, even though this project will cost multibillions of dollars. The potential losses from any inappropriate decision making are 3 orders of magnitude greater.
3. I**t is recommended that proper scientific studies of Dam failure are undertaken using 3D SPH or similar modelling techniques to understand where failure can occur.** As outlined in this submission there are a number of threats that can cause the collapse of the dam. While the author has no knowledge of what studies have been undertaken because they have not been published (another tactic to hide the truth from the public and underplay the consequences), simple 3D SPH simulation of failures of the dam wall can be shown to be outside the assumptions used in the flood modelling. Because of short inundation times from collapse, the true death toll is likely to be in excess of 30000 people.
4. **It is recommended that the use of alternative technologies be investigated to produce a water supply that is independent of rainfall in any catchment.** Ocean based Reverse Osmosis has the potential to deliver the quantities of water required to replace dependence on Warragamba Dam. This has the advantage that multiplying the number of units required reduces the sole dependence on one source of water. By using the Hydraulic potential in the deep ocean the energy cost can be substantially reduced and the problem of Brine disposal from the RO unit can be tailored to ensure no ecological damage occurs.
5. **It is recommended that all future plans for water security in NSW (and Australia) take account of the full Drought-Bushfire-Flood cycle.** The cycle is evident in the climatic record and currently leads to continual cycles of loss during drought, bushfire and floods. By assessing how to manage water security over the whole cycle rather than this proposal, which only looks at flood, will in the longer term produce a more resilient population and communities.
6. **It is recommended that any proposal like this, properly engages with the population groups that are going to be affected by the proposal.** In this project no proper consultation was undertaken with the indigenous communities, the flood affected communities and environmentally concerned groups that will be affected in developing this proposal. As a result, there has been an outcry from each of these groups against the proposal. These groups need to be part of the stakeholders in any similar projects rather than just business and commercial entities and their lobbyists.

Summary

The State Government of NSW has developed a proposal to raise Warragamba Dam wall by 14m as a means of mitigation of floods downstream of the dam with consequential impacts on the Blue Mountains World Heritage areas and parks, destruction of significant indigenous sites and flora and fauna associate with the wild rivers that feed lake Burragorang behind the dam wall. At the same time modifications are being made to the height of the spillway and replacement of radial and drum gates to what is a heritage concrete dam. These changes will enable enclosure of the dam wall in a further 15 years to support an increased reservoir capacity to meet demand for an increasing population. The proposal is nothing more than adaption by stealth that impacts World Heritage status of the Blue Mountains through extinction of habitat and species, with irreversible psychological and physical impacts on Indigenous culture and individuals.

My objections to this proposal are briefly summarised here but are outlined below in full.

1) This proposal is not in the National Interest. Warragamba dam currently supplies 80% of fresh water for Sydney. It is therefore a top priority of foreign Governments and Terrorist organisation that have a grievance against Australia to ensure that the dam is attacked and if successful would leave Sydney short of water for at least 7 years and significantly affect all businesses and the population of Sydney. The cost of such damage will be 3 fold that of the cost this proposal. Such risks should have been discussed to properly inform the public of these catastrophic risk.
2) This proposal is nothing more than an attempt to satisfy stakeholder interest who want a return for other planning investment. The business papers, EIS and related reports on flood mitigation are based on false assumptions that demonstrates that the EIS is nothing more than propaganda instead of a real attempt to inform the public of the real risks in this project. As it stands, the project will not mitigate any of the serious flooding risks that lead to outcomes larger than the floods that occurred in 2020- 2022.

   Instead, there is concrete evidence that pressure has been applied to downplay the seriousness of the consequences causing some experts in their field to resign because they would not water down their finding. In doing this Government and Government agencies are playing legal niceties to prevent being sued in the courts. Legally there is a great deal of difference between “should” and “could” or “will” and “may” in a sentence in interpretation by courts who will not have expertise across all areas of conflicts in the EIS. These watered down words make a difference to judgements

   Similarly the terms of references for each subcontractor and the limitations on what they can or cannot do, have not been published. The SEARS directions for the project are too vague to be properly interpreted. Another sign that this is a faux project. The outcome of this is that many of the risks associated with this project are misrepresented or ignored.

3) This proposal has not discussed collapse of the dam even though it is a 15 year requirement for Schedule 1 Concrete Dams. Such a loss is Catastrophic and will cost NSW in excess of $5 trillion based on current monetary values when compared with similar international natural disasters. This would set back the economy of Sydney and NSW for a decade and seriously impact manufacturing and processing industries.
4) The risk assessments that were undertaken and published in support documents to this proposal do not address the foreseeable risks that will occur over the next 50 years. These support documents have ignored collapse of the dam as a risk to the population and the functioning of Sydney. These can occur because of changes in our understanding of Natural Phenomena and changes to Human technology that place such risks outside of the control of both the NSW and

Federal Governments. There is no attempt to assess alternative technologies that could replace the need for raising the dam. The risk mitigation suggested in this proposal does not stop floods greater than 0.05% AEP and consequently more people will be affected than in the floods of 2021 and 2022. Clearly this proposal does not mitigate the risks it purports to do.

5) The proposal Is designed to support urbanisation on a flood plain that will be affected by future floods and not development for NSW more generally. This is opposite to the stated aims of this proposal. In particular, the benefit to society and industry from alternative approaches has been ignored. The structure of the DPIE is conducive to corrupt behaviour either from undue influence of stakeholders for favourable investment terms or corrupt behaviour of individuals within Government.
6) The proposal did not consider the true costs associated with changing drought-bushfire-flood cycles on the population of NSW and how opportunities in new technology can enhance the lives and wellbeing of the population. The proposal has not properly assessed alternative technologies and strategies that will add to the benefit of NSW and which are independent of rainfall.
7) The project has not considered the benefit of indigenous heritage to the Blue Mountains National Parks and world heritage areas. This again can be concluded as evidence of corrupt behaviours on the part of the NSW Government.

Detail of Objections to Raising Warragamba Dam Wall:

I Strongly Object to this proposal for the reasons outlined below:

1. This proposal is not in National Interest. Warragamba dam currently supplies 80% of fresh water for Sydney. It is therefore a top priority of foreign Governments and Terrorist organisations that have a grievance against Australia to ensure that the dam is attacked and if successful would leave Sydney short of water for at least 7 years and significantly affect all businesses and the population of Sydney.

   The international landscape has significantly changed since February this year and the recent events in Ukraine are a reminder that from a National Security perspective that Warragamba is a one of the primary NSW targets in Foreign War Plans. Figure 1 shows a Russian cruise missile just before it hit a shopping mall in Kremenchuk. These types of weapons are extremely difficult to hit prior to it reaching its target even if though they can be successfully tracked.

Figure 1 Russian Cruise Missile about to hit a shopping mall in Kremenchuk, Ukraine, killing 18 people and injuring many more.[1]

While a missile like this can probably be intercepted if it started from offshore, there are other modes of attack as well as natural events that can cause catastrophic failure of the dam. None of these mechanisms have been addressed in the planning, EIS or risk assessment documents associated with this proposal. This indicates that much of the information presented to the public is nothing more than propaganda. Increasing the dam wall height even if temporarily**,** increases the risk of failure and increases inundation water heights downstream of the dam by between 0.5 and 0.75 the height of the increase. This would be a further 7 to 10m additional height increasing the number in the population who would perish.

There are both natural and human behavioural causes of catastrophic loss arising from operation of the dam. These are summarised in Figure 2. The natural causes (in blue) are due to the uncertainties that have increased due to better knowledge of the natural world and because

current risk assessment practices for the dam rely on estimates of likelihood of the hazard rather than establishing hazardous criteria where there is no or little control on the impact.

For example, while the Government takes the view that sea level rise will be in the order of 1.3 to 2m by 2100, it ignores the 1% chance that it will be 7m espoused by Scientist involved in ice melt mechanisms.[2] That degree of sea level rise will affect the Nepean River all the way to the Penrith Weir. Not only will this impact the natural flood levels but also alter the water tables in the Hawkesbury-Nepean system. Much larger floods can be expected as a result and current building criteria in the Hawkesbury-Nepean valley will be inadequate. Another effect of climate change is the positioning of an east coast low that is blocked from moving to the east causing heavy rain to fall for five or seven days. Currently 3 days of 100mm-150mm from east coast lows is not uncommon and has been the cause of successive floods estimated at between 0.02 and 0.005%AEP in 2021[3] and 2022. The impact heavily depends on which parts of the Hawkesbury-Nepean catchments it falls within.

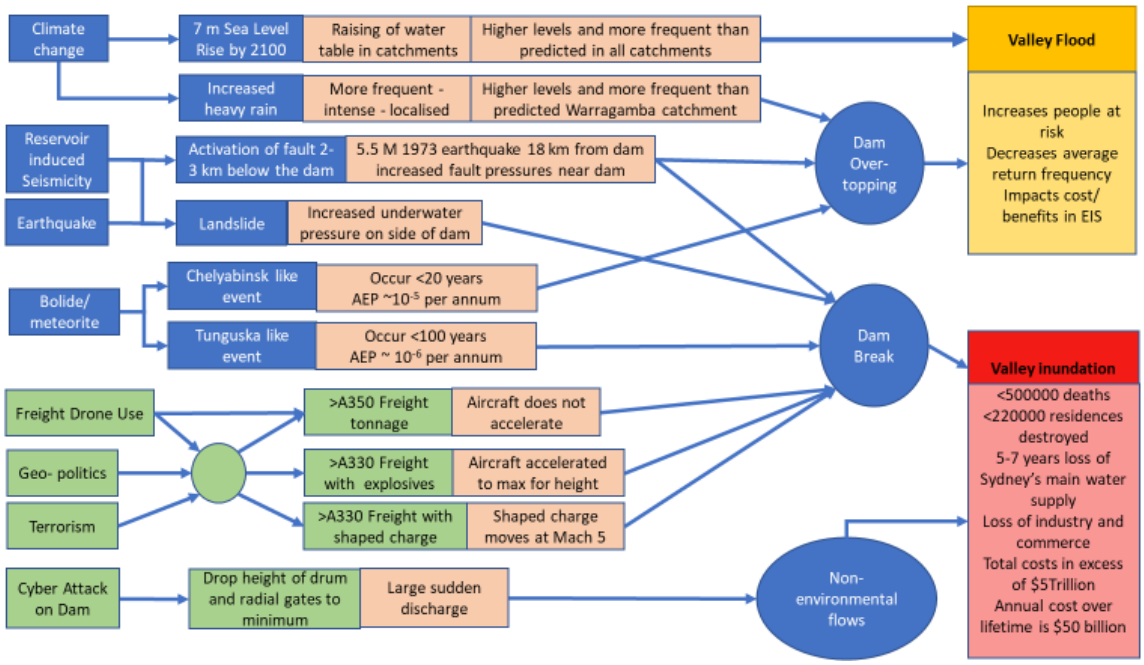

Figure 2 Mechanism for catastrophic loss at Warragamba Dam.

Warragamba dam has a history of earthquake along a slip fault that goes under the dam.[4] While Warragamba dam has been fitted with seismic sensors to monitor movement of the dam, they are not good predictors of movement from an earthquake particularly if the slip fault 2km below the dam becomes activated. The 1973, 5.5 magnitude earthquake 18 kilometres to the west and aftershocks not only caused problems with anchoring the dam to the western wall (tension bolts included as part of the construction of the spillway in 2006 to anchor the dam) but would have increased the pressure in the slip fault that is about 2km below the dam. Failure of this part of the slip fault would cause collapse of the dam. Any landslide from an earthquake into Lake Burragorang may produce an impulse pressure and movement at the base of the dam wall large enough to cause failure.

While the impact of meteorites and bolides are relatively rare events, recent data on Near Earth Orbit impacts suggest that estimates of the risk have been at least an order of magnitude too low. Because of the impact on cities and infrastructure such as Warragamba Dam is very high, the risks

moves into an intolerable category of social risk even though the likelihood is very low. In 2013 the 20m diameter Chelyabinsk meteor caused 1500 injuries requiring medical treatment mainly due to flying glass and damage to 7200 buildings in six cities from the pressure shockwave.[5] An event similar in size to the 1908 Tunguska River meteorite (which levelled about 2000 square kilometres of forest in Siberia), was thought to be responsible for the destruction of 15 cities in the Jorden valley including Sodom, Gomorrah and Jericho in 1569 BC increasing salinity and sterilising the area for at least 600 years.[6] While this risk is intolerable, an impact of this size would be much greater than just collapse of the dam.

Behaviour risks that threaten the dam are mainly due to the construction of Western Sydney Airport (WSA) and the flight paths which invariably can be used to hide destructive intent. Currently IATA are trialling remotely piloted air services (RPAS) for freight in the US.[7] This type of aircraft use substantially changes the risks from current flying. The operating mode, 05, approach flight path into the airport (from the southwest) would be at about 570m above the terrain (the low height is due to the airport being 300m below the escarpment over which the aircraft are flying) at a speed of approximately 330km/hr at the merge point of 10 nautical miles. This is some 12 km from the dam wall and several flightpaths from the north to land from the southwest come much closer. Previous studies in the 1997 EIS for WSA looked at controlled flight into terrain with the previous generation of aircraft at a two strike angles of 20^{o} and 60^{o} on Warragamba dam. This was published in relation to the 1995 EIS for the proposed Second Sydney Airport which did not succeed at that time. These studies are now irrelevant given that current dedicated freight aircraft can carry 100 tonnes of freight with a maximum range of 9200km and engines that can generate 500kN of thrust each. Near the end of its range, a fully loaded cargo plane would weigh about 250 tonnes. Consequently the plane can generate enough thrust to accelerate from a nominal land speed to its maximum speed close to the ground. Impact on the dam can be above the threshold for collapse. Warragamba dam is therefore vulnerable to terrorism or pilot suicide.

This scenario is considerably different from a CFIT (controlled flight into terrain) accident due to the ability to fly the aircraft at full speed into the dam wall at low level. This speed is well above the normal commercial speeds which aim to conserve fuel efficiency. This increases both the energy and the momentum at impact that can result in breaching the top 30m of the dam. Once the dam is breached in this way, the hydraulic pressure behind the dam, assuming it occurs when the dam is near full or in flood, will cause further collapse of the dam.

The cargo fleet makeup now is different to 20 Years ago. Currently the main cargo plane used for major longhaul cargo is the B777. This is not the largest cargo plane by volume and larger payloads are possible. The engines on this type of aircraft have much more thrust than those on commercial aircraft of 20 years ago which can provide a high impulse on the dam wall on impact.

The cargo capacity of a B777 has a payload carrying capacity of 100 tonnes with a maximum payload and aircraft weight after a 9000km journey of 250 tonnes. A full cargo of high explosive that is initiated at impact will ensure the dam wall is breeched if the initial impact of the aircraft is not wholly successful. Modification of the internal fuselage to produce a shaped charge in front of the explosive would increase the impulse loading on the dam compared even to the 100 tonne explosives scenario.

Clearly all these hazardous scenarios can cause overtopping of the dam wall, collapse of the dam or sudden large environmental releases. Leading to valley floods or valley inundations.

While a flood risk study considers that a 0.005% AEP (1 in 200 year) flood would affect a population of approximately 350,000 residents in the Penrith, Richmond, Windsor and the Hills districts of NSW, the releases do not consider the effect of dam break on the ability to respond to the inundation waters. The population is expected to double by 2050 to 700,000 in the same area.[8] To put this in perspective a catastrophic dam break leads to releases that can be 50 times as large as the July floods on the Hawkesbury Nepean rivers system. They occur over a 2 hour time period as opposed to 2 or more days for a flood.

According to published documents, the NSW dam safety committee have a duty to assesses Schedule 1 dams against this societal risk every 15 years through an EIS for any changes. [9] The EIS associated with the proposal to raise the dam wall does not contain any evidence that it has considered the loss of life and effect on the economy of Sydney, NSW or Australia. Due to changes and foreseeable changes in technology, the societal impact of collapse of the dam has moved into an intolerable category because of the shear number of people who will be killed by collapse of the dam. While many of the risks are outside the control of NSW Water, raising of the dam wall exacerbates this societal risk and demonstrates a failure of duty by the NSW Government to protect the people of NSW.

2. Under the legislation for schedule 1 concrete dams, the owner or operator of the facility has to review the safety of the dam every 15 years. One of the reasons is that all manmade structures can suffer catastrophic collapse. Analysis of dam failure statistics indicates that the ratio between earth dam and concrete dam failure is about 60%:40%.**[10]** The current published business case, EIS and associated modelling studies for this proposal to heighten the dam wall has no mention of dam failure or collapse, even though it leads to high levels of death and infrastructure damage downstream of the dam in Wallacia, Penrith, Castlereagh, Richmond and Windsor.

   The Government has a duty to not mislead the public and the failure to mention dam collapse even if studies have been done is criminal. There are only two real reasons why the Government has failed in this duty, notwithstanding the National Security Target this dam poses. The first is the undue influence by stakeholders to ensure that the dam can be raised to support more housing development in Wollondilly Shire and Penrith councils and other Western Sydney areas. The second is that there would be substantial criticism of any modelling attempts stating that the dam can safely withstand any type of impact. The uncertainty and increase in threat from both natural and human threats to the dam have increased such that the risk assessment based on the methodology espoused by the dam safety committee would move the risk into the intolerable zone meaning that there should be a decision not to proceed as many of the vectors of threat are outside the control of both the NSW and Federal Government.

   Figure 3 shows the discharge from collapse of the dam as a function of the area of collapse. The collapse is assumed to occur at 48 hours from the start of inflow to Lake Burragorang. Two series involved a 60m and 90m high dam collapse. The shaded areas represent the volumes of discharge between a full dam and a PMF flood for a given discharge. The results show that once the area of collapse is greater than 3000m^2, the amount of water being discharged exceeds the peak discharge during a PMF flood and no collapse.

   There is significant difference between a flood and a sudden inundation due to the timescale over which it occurs. With a flood there is usually a forecast of heavy rain and potential for flooding occurring over several days. This allows time for NSW SES to put evacuation orders into place. An inundation occurs more quickly, over a few hours at most, and is likely to cause a wave that is above the possible maximum flood at Penrith, discussed in the EIS. There will be little or no

forewarning and if it occurs at night most residences will be occupied and the ability to evacuate limited. An upper estimate is about 300,000 killed in this type of scenario based on the current population and this will be double by 2050.

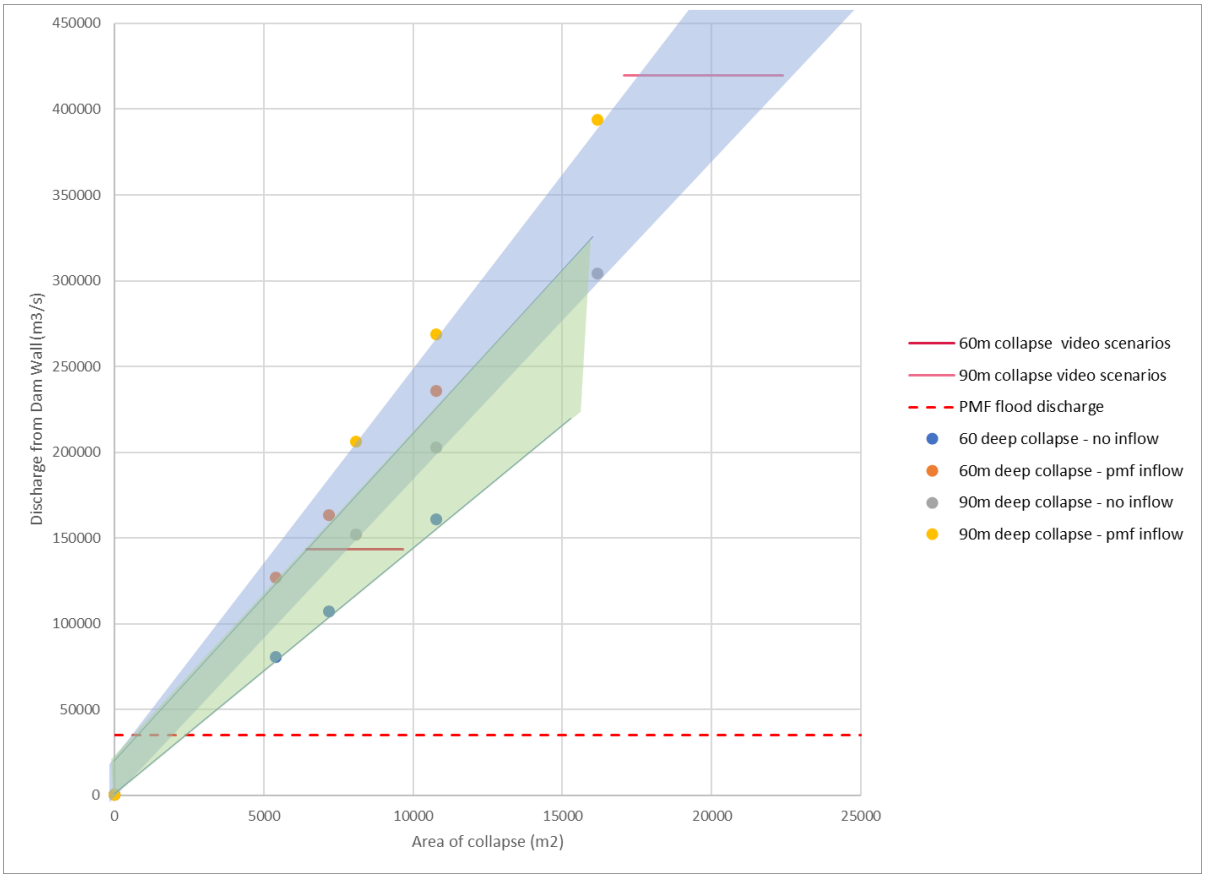

Figure 3 Discharge from collapse of the dam. The blue shaded area represents a 90m deep collapse and the green shaded area represents a 60m collapse.

Two preliminary 3D simulations of the discharge from the collapsed dam were undertaken to ascertain how quickly the flow would arrive at Penrith and how deep it would be. One involved a 60m collapse that was 110m wide, the other was 90m deep by 195m wide.

Figure 4 is taken from the two 3D simulations for the Penrith Area. The time is 60-70 minutes after dam collapse. The larger release has flooded the majority of the computational domain flow outside the boundary of the simulation. The markers on the figure are well known locations in the area to get a sense of scale. The maximum levels in the larger release of 90m deep by 195m wide at the Lennox centre, Emu Plains Station and Penrith station has an average peak flood level about RL 53m. This is some 20m above the possible maximum flood (pmf) stated in published studies to date. The maximum level from the 60m deep by 110m wide collapse are about RL 32 similar to the pmf but occurring about one hour after collapse rather than four days.

The timescale over which it occurs would not allow significant evacuation mainly because residential housing in the area typically have 3 vehicles per household.[11] There will be a difference in evacuation if the dam break occurs overnight or during the day. In one case, the problem is likely to be getting the information to a largely asleep population, in the other evacuation will be impeded by vehicular traffic and traffic control lights in the escape routes.

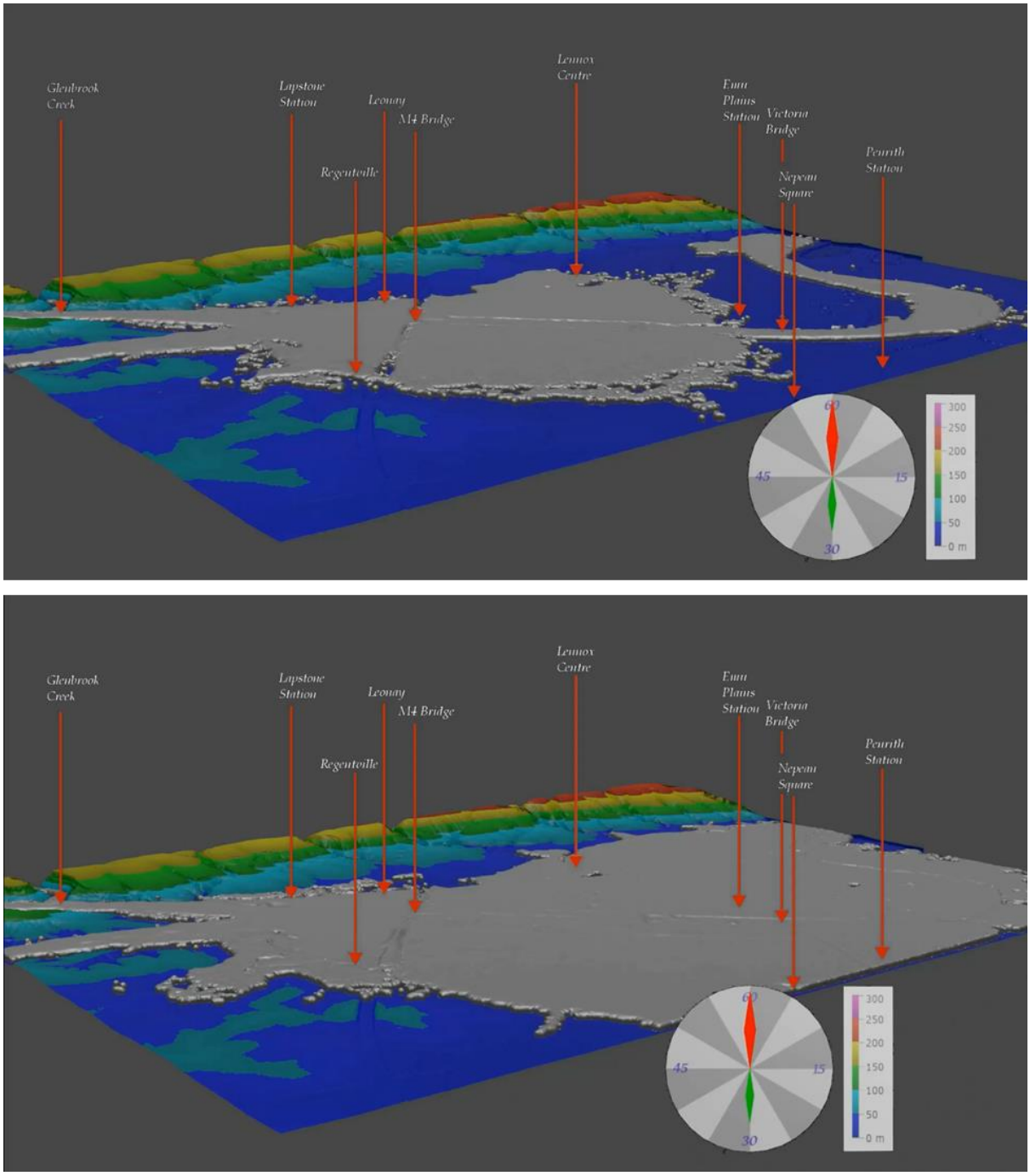

Figure 4 Inundation over Penrith. Top: dam collapse 60m deep x 110m wide. Bottom: 90m deep x 193m wide. The arrows indicate the position of well-known landmarks on the model. The simulation are based on an SPH fluid dynamic model within the animation program, Blender. The video for the 60m collapse is at https://www.youtube.com/watch?v=rCQfUpaQnpo. The video for the 90m collapse is at https://www.youtube.com/watch?v=GRf6opHhZr0. Note that the labelling on the video is incorrect and should be 60m deep x 90m wide and 90m deep x 190m wide respectively.

Figure 5 shows the inundation expected when the Relative level (RL) are used in mapping software for assessing flooding. The increased area due to the larger collapse is clearly visible and unlike the lesser collapse ware would reach the Penrith hospital precinct further complicating evacuation. Furthermore, the main Police station would be under water.

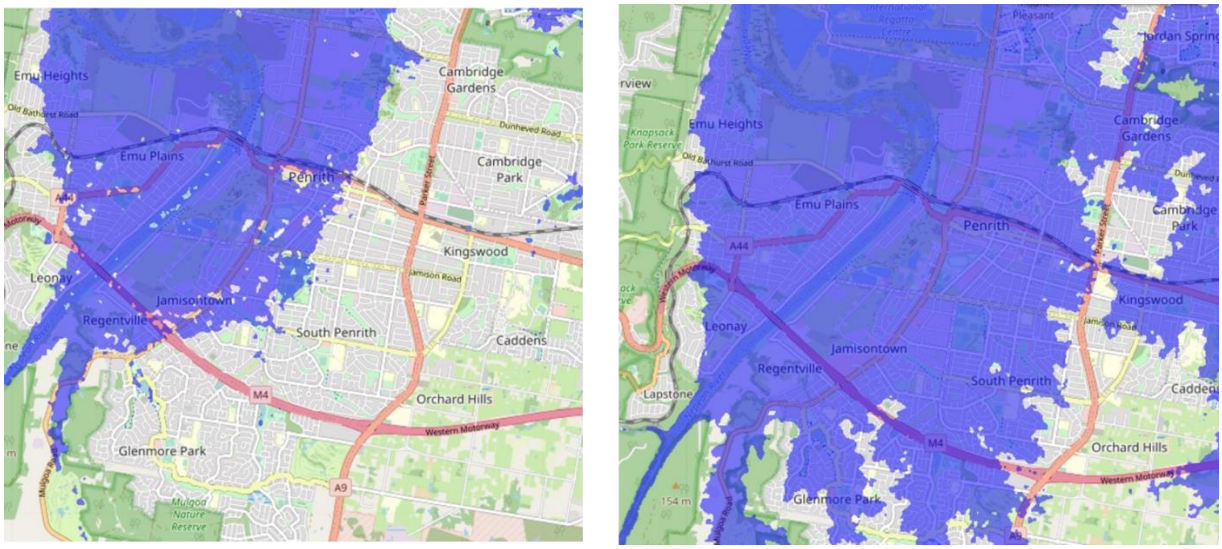

Figure 5 Inundations due to collapse of the dam. LHS: 60m deep x 110m wide. RHS 90m deep by 193m wide.

Church Tower is 13m.
RL 14 above the road

Inundation level from collapsed dam

Figure 6 St Stephen's Church, Penrith. The inundation level from a 90m by 193m wide dam collapse shown in red.

A well-known landmark in Penrith is St Stephens Anglican Church at the top of the High Street. While it is not affected by a pmf level flood, the water level from the larger collapse of dam reaches 75% of the height of the church tower (Figure 6).

Table 1 shows the level of inundation at other well-known landmarks. A collapse or 60m deep by 110m wide is similar to a pmf flood and many of the landmarks towards the Northern road are not under water. On the other hand, in the larger collapse water will cross the northern road because this is an inundation and water velocities are much higher than floods. The hospital precinct will be impacted.

Similarly other major evacuation routes such as the M4, will be cut by the inundation and this makes a nonsense of the SES evacuation plans for the area. Impacts on life and property will occur because:

- Warning times are too short with inundations starting after 40m in Penrith
- Police communications at Penrith with be impacted within an hour.
- Major evacuation routes will be cut by the inundation within an hour.
- 89940 people live in Penrith LGA west of the Northern Road. All are at risk of death due to the above.

Table 1 How well-known locations in the Penrith are impacted by dam collapse inundation. A negative number in either of the last two columns indicates that the flood inundation did not occur at this point.

Location	RL (m)	60 m deep by 110m Dam Collapse above surface RL (m)	90 m deep by 193m Dam Collapse above surface RL (m)
Lennox Centre carpark	30	2.8	23
M4 - Leonay bridge Lapstone Hill	36	-3	17
railway track over Nepean River	29	4	24
Mulgoa Road under M4 overpass	33	0	20
Penrith Station rail track	31	2	22
NDIS and Tax Office 121 Henry St.	32	1	21
Nepean Square	29	4	24
ST Stephens Anglican Church High Street	42	-9	11
Penrith Police Station High Street	42	-9	11
Intersection GWH and Northern Road	53	-20	0

3. The risk assessments that were undertaken and published in support documents to this proposal do not address the foreseeable risks that will occur over the next 15-50 years. These support documents have ignored collapse of the dam as a risk to the population with consequences to the functioning of Sydney but which can occur because of changes in Natural Phenomena and Human technology that place such risks outside of the control of both the NSW and Federal Governments. There is no attempt to assess alternative technologies that could replace the need for raising the dam. The risk mitigation suggested in this proposal do not stop floods greater than 0.05% AEP and consequently more people will be affected than in the floods of 2021 and 2022.

   Assessment of risk is often based on empirical historical data of a threat or hazard occurring (Figure 7 top). There usually is plenty of data on common risks but as risks become rarer there is decreasing data and much larger uncertainties in its interpretation. At some point there are

examples around the world of events but no local data. At this point assessment of risk must rely on foreseeable *credible* mechanisms for the threat or hazard to occur that are assessed by modelling the system. Beyond this thought experiments and imagination can lead to incredible mechanisms of failure, often in the realm of science fiction. A problem is that with the passage of time there are changes that occur in technology, society, the natural world and community, that bring future scenarios of threat from fantasy to being credible.

Another complication is that at some point control of the system is lost due to external vectors out of the control of the designers or operators of the system. It can also occur because of the complexity of the system itself, (Figure 7 bottom).

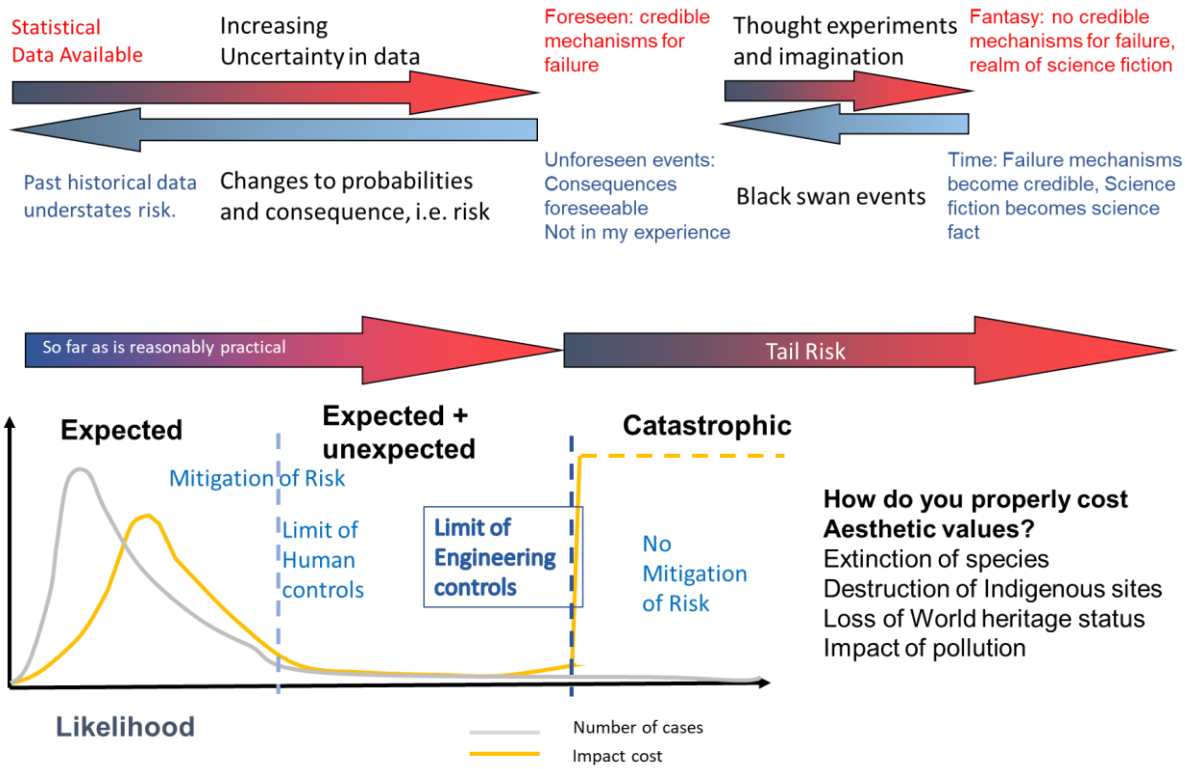

Figure 7 Current Risk Paradigms. Top: Risk assessment and Uncertainty; Bottom: risk profiles with likelihood.

One of the reasons for this failure is that control of the system is considered in isolation from the damage that can occur. This proposal is a good example of this. There the NSW Government is proposing a solution for the future water security of Sydney not by mitigating all floods but only some floods. Unfortunately, this approach has not included the full natural cycle that occurs in South Eastern Australia and which is likely to be distorted by climate change. This cycle is one of drought which impacts on food production and water security, followed by bushfire that removes topsoil, degrades the land and impacts housing followed by rain that produces silting of river systems and dam lakes as well as flooding impacting on riverine systems including farmland and societal buildings as well as water quality available for treatment.

Furthermore, the analysis of rainfall in the catchments is based only on historical data. A better analysis would be to analyse the data based on increasing extremes as has been done for regions of Victoria.[12] They found that most extreme precipitation events increased in intensity by more than more moderate extremes, with larger increases during the warm season. The proportion of

precipitation that could be attributed to extreme precipitation events during the warm season has increased in recent decades while annual precipitation totals have been declining. They also found that there is a markedly difference in return periods for data based between 1987 to 2014 compared with 1958 to 1995. Consequently, the projected rainfalls on which the flooding are based are underestimated and invalidates many of the assumptions and analysis which has been put into the flood studies.

4. The proposal Is designed to support urbanisation on a flood plain that will be affected by future floods and not development for NSW more generally. It ignores the benefit from considering the effect of the drought-bushfire-flood cycle as a whole. In particular the benefit to society and industry from alternative approaches has been ignored. This primarily comes about because of the structure within DPIE as shown in Figure 8. The DPIE require external funding to support any infrastructure development. As a result industrial and commercial groups have a strong influence over the type of development and investment irrespective of legal constraints such as that of the NSW dam safety committee.

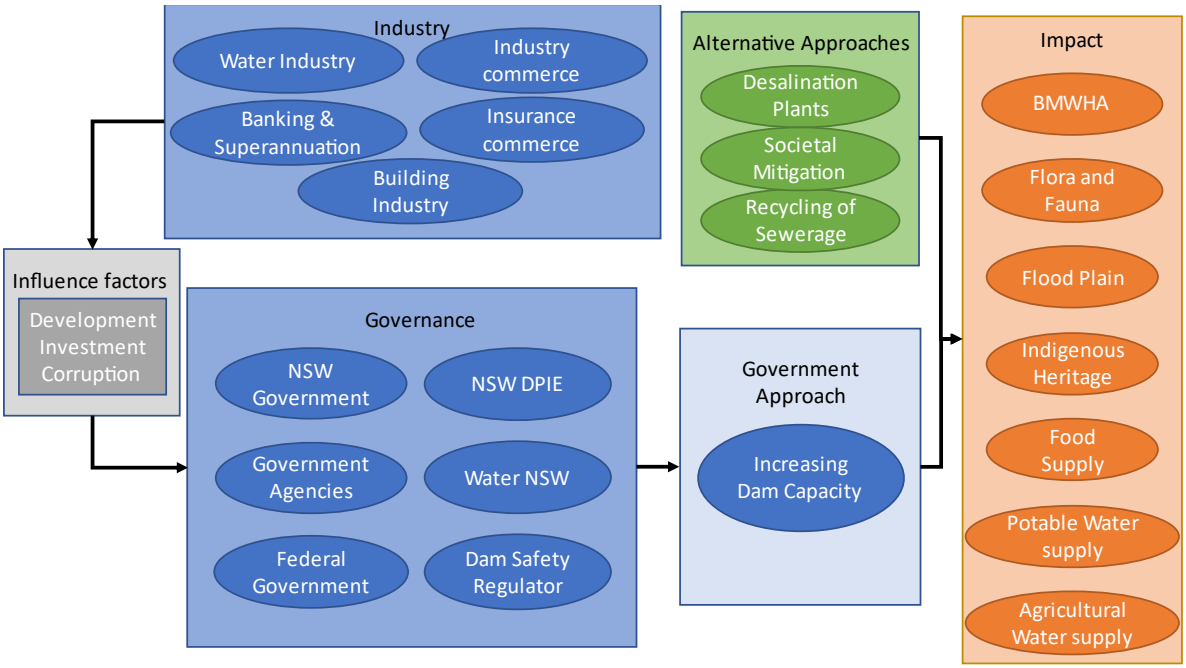

Figure 8 The structure for decisions on infrastructure within the DPIE

The development of infrastructure requires that the outcome for the investment produces both societal and individual resilience for the future. Different solutions to this complex problem can lead to benefit or loss as shown in Figure 9 where loss and benefit are compared with the natural cycle of Drought, Bushfire and Flood. The best solution might not be the immediate or obvious one as it does not produce an optimal solution over the complete cycle. Detrimental behaviours can influence governments and individuals to investing in suboptimal technologies for the future resilience of society to these threats.

Unfortunately, the influence of these private partners leads to inefficient use of government resources due to undue influence by industry and commercial partners that are not really in the public interest, and which lead to public loss, i.e. the taxpayers have to pay for poor decisions rather than those who influence or make these decisions.

Corruption cannot be ruled out in this proposal because the EIS does not present a truthful picture of the hazards associated with this dam. The failure to discuss collapse of the dam as a risk to the general population when it is actually a requirement of the dam safety committee every 15 years strongly indicates that the Government does not want any truthful discussion on the need for this proposal. Furthermore, the lack of consultation with the public during the drafting of the proposal also suggests corruption is a factor in this proposal because of the secrecy this causes. Furthermore, the lack of any real amelioration of risk outlined in this proposal indicates that this is an afterthought brought about by the recent floods on the Nepean-Hawkesbury system. A Propaganda exercise to hoodwink the public into thinking there is a public benefit from this proposal. The use of a 0.01%AEP flood as the criteria for building on the flood plain when this level is changing due to extreme rainfall events is another indication of a corrupt process.

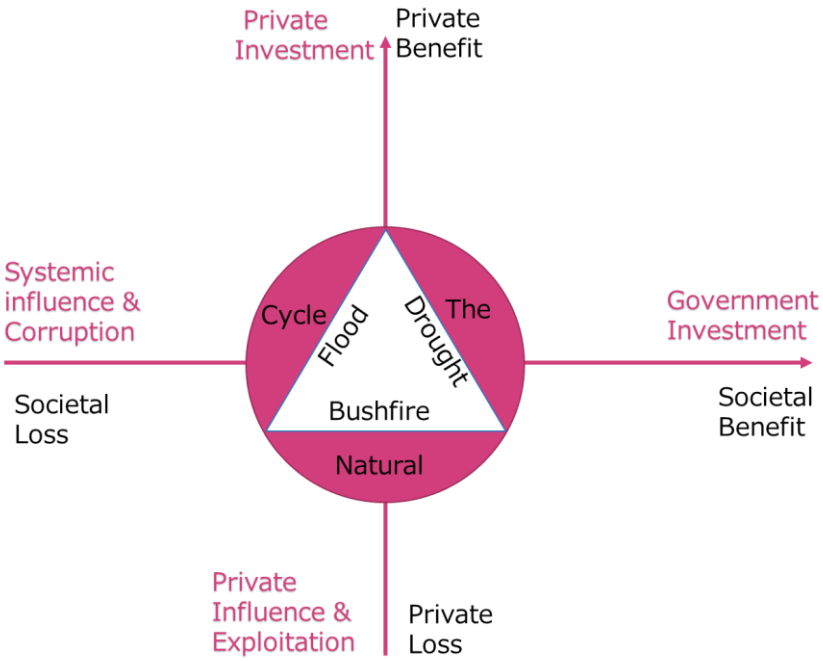

Figure 9 Public and private benefit and loss from the need to find investment support for infrastructure building

5. The proposal did not consider the true costs of impacts associated with changing drought-bushfire-flood cycles on the population of NSW and how opportunities in new technology can enhance both the resilience of NSW and commercial opportunities in new technology. The proposal has not attempted to assess alternative technologies for water management that will add benefit to NSW.

   It is well known that Australia is a dry continent and hence different areas will have water shortages due to drought. It is not just drought but also increasing water scarcity because of an increasing population and population migration, industrialization with changing consumption patterns as well as Climate Change. [13,14] These mechanisms of causation for water scarcity go beyond limited access to clean water from drought but include an economic dimensions through inadequate supply of portable water due to poor management of water resources, lack of infrastructure and diversion of water for industrial and agricultural growth. An extreme example of this occurred within the Murray-Darling Catchment at Menindee, NSW, in 2019 when a million

fish were found dead along a 40 kilometre stretch of the Darling River, leaving the town with putrid drinking water.[15] The killing of significant populations of Murry Cod which is responsible for the health of the riverine systems in the catchment is another type of Catastrophic loss to that caused by loss of Warragamba dam and similar dams.

It is clear that to avoid or minimise catastrophic loss and build resilience in Society and individually, the complete natural cycle of water needs to be analysed for opportunities that decrease loss across the complete cycle. This is the cycle of drought, bushfire and flood that has historically been over one or two decades but in recent years has seen changes to the cycle lengths and intensity because of climate change.

The main effects of drought in Australia are:

- Townships having to tanker in water. If prolonged, then the township can collapse and not recover once the drought is broken.
- Livestock farmers having to destock and transport in feed leading to a long recovery when the drought breaks
- Farmers not being able to plant or harvest crops leading to a societal shortage of food and inevitable associated price rises on the community.
- Farmers giving up on working on the land
- Loss of support jobs for the agricultural sector
- Water restrictions in the major cities. In extreme cases this can affect manufacture production with loss of jobs and manufacture being placed overseas rather than locally
- The need to replace low water supplies from other areas of the country not in drought incurring transport costs.

The main effects of bushfires are:

- Loss of housing and lives. If extreme bushfires occur at the end of an extensive drought, there are no water resources to protect property leading to increased losses, control strategies are impacted by lack of water.
- Loss of livestock and crops
- Loss of topsoil and forests. The effect of this is usually apparent when following rain occurs with water taking fire debris into water catchments and sedimentation clogging local rivers.

The main effects of flood are:

- Loss of life and property to flooding and inundation.
- Loss of infrastructure
- Costs associated with moving, either temporarily or permanently form the area
- Costs associated with rebuilding society
- Supply of clean water and food to communities
- Contamination of drinking water supplies
- Loss of farm produce and livestock.
- Farmers not being able to plant or harvest crops leading to a societal shortage of food and inevitable associated price rises on the community.
- Farmers giving up on working on the land.

Clearly having enough water but not too much is essential for a sustainable future. Dams tend to lead to high societal impacts during heavy periods of rain, but lack societal water during droughts. Alternative technologies need to ensure that they can supply water throughout the natural cycle,

independent of rainfall in an area, will be amenable to climate change and assists in growing society at the same time. They also need to ensure that there is a reduction in catastrophic risk.

While there are many remedial technologies that could ameliorate shortage of water, most do not have the potential to supply water throughout the natural cycle to ensure it is not dependent on rain in any area. The one technology that may provide this potential independence is Desalination technology.

Sydney and many of the cities and towns in Australia are situated near the coast. It lends itself to sea based desalination technology as a low cost alternative. Currently there are 7 plants around Australia with a capacity of greater than 100ML/day (36.5GL/yr).[16] All use reverse osmosis (RO) as the basis for delivering potable water. These RO plant require a stable electricity supply. Many supplies come from wind farms but some who rely on the general grid are using offset requirements to supply energy.

Because of the current flooding and full dams on the east Coast of Australia, the desalination plants are not supplying to capacity. The exception is the Magnetite mine in the Pilbara which uses the total capacity for ore processing.

There are basically two approaches to desalinating seawater, thermal distillation or membrane filtration. In the former the seawater is evaporated in a multistage process usually using a concentrated solar radiation to heat the water or electricity. In the latter the process uses either forward (FO), osmosis reverse (RO) or a combination of the two. Currently the former process account for about 30% of world desalination and about 65% for RO.[17] Currently the availability and cost of energy is a strong determinant of economic feasibility due to it being is 30% of the operational costs. Furthermore, electricity is shared across domains and because of restraints on price of electricity due to rising populations there is a need to look for innovative solutions for desalinating water where energy demands on the grid are less and which can produce portable water at low cost.

Sydney's desalination plant is not the answer because of the ecological harm than it is doing from discharge of the brine that remains after desalination. Discharge usually occurs into local water bodies or directly into the sea. Because of the high concentration of brine, which can be as much as 40% of the intake, the alkalinity, salinity and average temperature are all changed compared to the intake. This has serious impacts on the environment and a real threat to the ecosystem. Recent papers have shown how these ecological systems are impacted.[18] Another problem is the potential fouling of the membrane.

Many of these problems can be overcome by using the natural resource in deep sea oceans. A concept diagram is shown in Figure 10. Normal pressures used in reverse osmosis technology require about 60 Bar overpressure and is the reason why desalination requires so much energy. AN ocean depth of at least 800m depth is above this pressure. As a consequence the hydraulic pressure can be used to generate electricity to run on board equipment and pump to shore. the maintenance of this pressure for reverse osmosis. Seawater taken at this depth requires prefiltering to protect RO membranes. The RO unit produces a concentrated brine on one side and desalinated water on the other. This desalinated water does contain minerals but these are within World Health guidelines. The brine waste water has to be mixed with water containing less salt and then discarded at a level within the ocean with a compatible level of salt. This ensures that there is minimum disruption to the surrounding ecosystems.

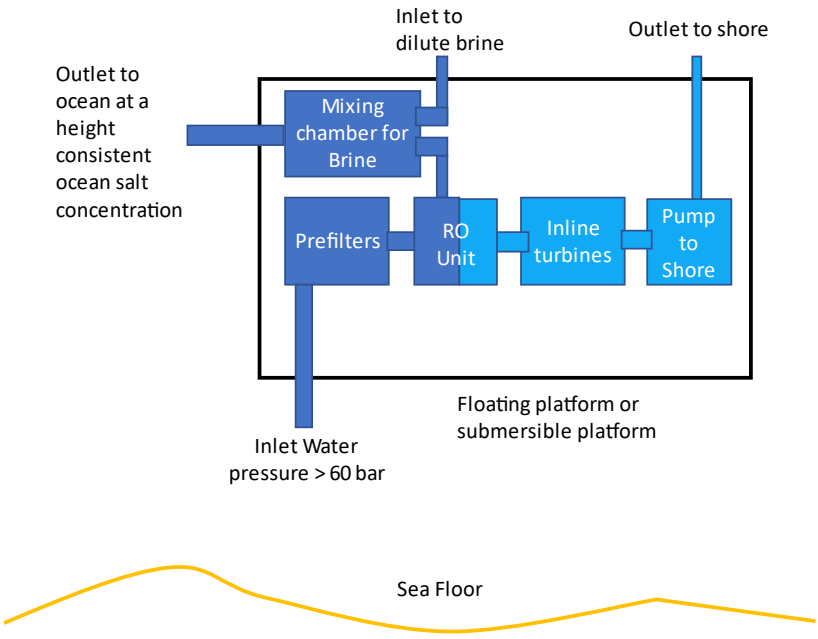

Figure 10 Schematic of deep oceans desalination plant

This does require pressure balancing and temperature balancing over the whole process to ensure a stable mixing of waters as well as desalinated output.

Turbines on the desalinated side of the process can take the pressure from about 60Bar to 10bar for pumping ashore while producing electricity for the processes. Current technology would allow this type of system to be built now, and ongoing research into membrane technology with make this more efficient in the future.

6. The proposal does not adequately address the impacts of indigenous heritage or the Blue Mountains National Parks and World Heritage areas in a way that reflects current assessment on the health and wellbeing of the general public.

   A report commissioned by the NSW Government after the original report was slammed by indigenous groups who state that should this proposal proceed, it would have consequences on the Indigenous peoples of the Blue Mountains that could not be mitigated.[19]. *"The further flooding of the Burragorang valley will contribute to irreversible harm to the cultural and spiritual connection that Aboriginal people hold to this part of the country, their heritage and the cultural landscape and will obscure the tangible aspects of the creation stories associated with the Burragorang such as the Gurrangatch and Mirrigan story."*

   Similarly an independent report found that the EIS had been changed to make the project's consequences for the World Heritage environmental area appear "less definite".[20] The findings of that investigation reveal Water NSW "directed" Musgrave's consultancy firm to change the EIS "on the basis that the upstream impacts of the project on biodiversity would be 'indirect' rather than 'direct'". The implication is that both habitats and species loss are underestimated. Furthermore, the report indicated the NSW Water had not conformed to best practice.

   There are two problems associated with these behaviours. The first is that it is clear that the NSW Government are not interested in the health and wellbeing of indigenous groups or the people of Western Sydney. Permanent loss of culture has a profound effect on society. To put this in a

different context, a government would not think of trashing world heritage environmental areas such as Brodgar in Scotland or Stonehenge in England. There is plenty of research on how access to the open environment affects mental health as there is with the loss of culture. The NSW Government seems immune to such concerns.

Secondly the adjustment of reports to water dawn their impact is a corrupt practice that needs to be put into the open as to why and whom is causing this interference.

Statement of Political Donations or Conflicts of Interest

I do not have any Political party affiliations and have never been a member of any political party. I have not donated monies to any political party.

I do not have a conflict of interest in developing this submission.

Dr AR Green

12th December 2022

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