Submission No 106

INQUIRY INTO WATER AUGMENTATION

Name: Mr Alec Lucke

Date received: 22 March 2017

Alec Lucke

22 March 2017

Senate Inquiry into the augmentation of water supply for rural and regional NSW.

Attention contact person Claire Armstrong

Dear Claire,

I have recently spoken with Inquiry Chairman Hon. Robert Brown and been encouraged to lodge a belated submission and ask that it be accepted by the above Senate Inquiry. I am available and would welcome the opportunity to appear in person before the Inquiry at either Tamworth or Moree.

Thanking You,

Yours sincerely,

Alec Lucke

Submission to NSW Senate Inquiry into the augmentation of water supply for rural and regional NSW.

The principal focus of this submission is on cold water pollution (CWP) for which the State has responsibility.

This submission is made under item 1, 1 (f) and 1 (g).

(1) With regard to: the performance and effectiveness of the NSW government agencies that are responsible for the augmentation of water supply for rural and regional NSW.

This year will make ten years since my wife and I moved from the industrial centre of Gladstone in Central Queensland to Bingara in Gwydir Shire NSW. In 2007, drought was widespread and water restrictions were everywhere. Bingara was not so affected and this in combination with the scenic Gwydir River influenced us to settle in Bingara. We bought an urban property but before we moved in, received written advice from Council not to drink the water as it was contaminated with arsenic. My enquiries met with differing advice. The Department of Environment maintained the arsenic came from naturally occurring sludge in Copeton Dam while Council alleged the source was from an old gold and silver mine that the EPA had attempted but failed to properly remediate.

I was further advised that Inverell's water is supplied from Copeton Dam, but unlike Bingara, a filtration system kept the arsenic below threshold levels.

Just prior to the commissioning of Bingara's new water treatment plant in April 2011 a council representative was asked at a public meeting whether the facility would bring arsenic below the threshold levels.

"Yes," he said, "and it will also bring the other heavy metals under the threshold levels as well."

Previous to this disclosure there had been no mention of "other heavy metals." It is obvious that supply and illegal sale of a dangerously contaminated product for public consumption and use persisted for quite some years without rectification.

As an individual with a background of exposure to chemicals and atmospheric pollution I was relieved to see the filtration system installed. I do not know who bears ultimate responsibility for what occurred but I have observed that the populated regional centres like Tamworth, Armidale (and others) frequently have water restrictions. I am personally at a loss to understand how planning can be so poor as to promote and allow development without providing the essential infrastructure for a reliable and adequate water supply. In my judgement, the performance and effectiveness of the NSW Government and its agencies is found wanting

All quotes in this submission are from the NSW Cold Water Pollution Strategy adopted by the NSW Government in 2004 - Report on stage one by NSW Office of Water covers the five year period to 2009. The report, released in July 2012 can be downloaded from www.water.nsw.gov.au

This particular report provides an excellent summary of the CWP problem and its associated impacts upon native fish and river biota. It deals with the achievements of the first five years and itemises those intentions not carried out but deferred to Stage 2 – the next five year period. It identifies funding as inadequate to meet research needs and to keep the program on track. A cost benefit analysis shows remediation of CWP would be cost effective and hugely beneficial to river health, communities and resurgence of species dependent upon a natural temperature ranges. The report prioritises those dams most in need of urgent CWP remediation. The document, although somewhat dated, is sufficiently comprehensive to substantiate that the NSW Government and its agencies are conversant with CWP, its implications and cost effective benefits that would flow from remediation. It cannot therefore be argued in 2017 - that the glacial pace of reform is a consequence of anything other than lack of political will to deal with an institutionalised environmental disaster. There is such an unrelenting focus on Sydney, with its house prices, traffic congestion, infrastructure projects and population increases that the rest of the State languishes for want of funds and neglect of their welfare.

Quote:

Executive Summary of NSW Cold Water Pollution Strategy- report on the implementation of stage one

The Cold Water Pollution Strategy was adopted by the New South Wales Government in July 2004. The strategy aims to reduce the significant effect that major dams have on the ecology of many of the large rivers across New South Wales and is designed to progress in five year stages of planning, implementation and evaluation of outcomes. This report describes progress on the strategy, evaluates its economic benefits and sets objectives for subsequent work to reduce or mitigate the impacts of cold water pollution.

Outcomes achieved in the first five years of the strategy include major infrastructure works at Jindabyne and Tallowa Dams, investigations at both Keepit and Burrendong dams, integration of cold water pollution conditions in State Water works approvals and the identification of high priority dams for possible action in stage 2 of the strategy.

Outcomes not achieved include the completion of works at Keepit and Burrendong dams; investigations on the other identified high priority dams (Blowering, Copeton and Wyangala); the installation of temperature monitoring equipment to aid in the development of improved operating protocols, and the implementation of the revised protocols.

The key causes of delays in meeting these outcomes were the need to coordinate cold water mitigation investigations and works with State Water's Dam Safety Upgrade Program and the lack of funding for cold water pollution modelling and temperature monitoring equipment. The development of improved operating protocols has also proved more complex than anticipated.

It is proposed that the outcomes not achieved in stage 1 be carried over to stage 2 of the strategy. Several additional initiatives are also recommended for Stage 2.

Quote continued:

1 Background

1.1 Benefits of addressing cold water pollution

Good water quality is one of the fundamental requirements of aquatic ecosystem diversity, productivity and health. Suitable water temperature regimes, in particular, are critical for aquatic ecosystem health. In recent years, governments have made large investments in returning water to the environment, restoring aquatic habitat and reducing barriers to fish passage. The full ecological benefits of these efforts will not be realised if the water released from dams continues to be too cold for native fish and other aquatic organisms to survive and breed.

Cold water pollution (temperature depression), is an artificial decrease in the temperature of water in a natural river. Cold water pollution commonly occurs downstream of large dams due to thermal stratification within the dam, coupled with the release of the lower cold water layer through outlets located towards the base of the wall. The water released from the dam is commonly 10^{o}C colder than natural, and can be up to 17°C colder. Cold water releases from NSW dams have always been an ecological issue, with known effects on ecological processes downstream of dams evident as soon as the dams are filled. Cold water pollution becomes more pronounced when dams contain more than 10 metres of water and is most significant when they are full. The highly developed irrigation industry of the Murray-Darling Basin means that releases from dams is related to irrigation demand. Demand can rapidly change, based on rainfall events, interstate water trading or crop mix water requirements. Large releases may occur independent of dam levels, but cold water pollution is likely to be less of a problem when dam levels are low and releases small.

In New South Wales, cold water pollution is thought to affect around 2000 km of rivers. Longitudinal profiles of river temperatures indicate that water temperature, for example, in the Murrumbidgee, may not recover for the length of the river (Lugg *pers.comm).* No detailed analysis of the total distance of NSW rivers affected by cold water pollution has ever been conducted, but cursory analysis based on available data indicate that 2000 km is a realistic figure. Cold water pollution is not limited to New South Wales. It is a global problem, anywhere large dams have been constructed and water is released from valves at the base of the dam wall. There is a well recognised problem in Victoria, with Hume Dam having well documented cold water effects downstream in the Murray River (Sherman *et al.* 2007).

South-eastern Australian rivers are particularly likely to be affected for three main reasons:

- Dams in the Murray-Darling Basin and south-east Australia are large and deep and are managed to store sufficient water to be useful in the driest conditions
- Murray-Darling Basin dams are generally on the main river and release stored water to the river channel. Dams elsewhere divert water away from the river channel rather than release it to the river channel
- River fisheries in North America and Europe are typically based on Salmonids, such as trout and salmon, cold water species which spawn in winter. Australian native fish tend to spawn in spring and summer in warmer temperatures.

Cold water pollution occurs during the warmer months (spring through to autumn) and is most pronounced in mid-summer when the stratification is most pronounced and large volumes of water are being released for downstream use. The cold water pollution effect can be detected for hundreds of kilometres downstream of many dams.

The impacts of cold water pollution range over a wide spectrum of organisms including fish and macroinvertebrates and are well known (Astles *et al.* 2003, Sherman 2000). The effect on native fish spawning and recruitment is of particular concern and is the best documented impact. The life-cycles of fish are finely tuned to natural daily and seasonal variations in temperature. Large volumes of cold water, lowering the overall temperature of water downstream from a dam, disturb these ecological adaptations. Fast-start performance of golden perch have been found to be affected by cold water, such as that released from dams. This affects competitive behaviour for resources and ability for native warm water fish to escape from predators (Lyon *et al.* 2007). Many species of native fish have been almost eliminated from significant sections of rivers, impacting heavily on both river health and recreational and commercial fishing.

Fish have reasonably well-defined temperature thresholds for the initiation of breeding events. If water temperature fails to reach the relevant threshold fish will not breed despite the fact that other parameters (e.g. day, length, and river flow) may be suitable. Laboratory experiments replicating the effects of Burrendong Dam showed that juvenile silver perch and Murray cod were both profoundly affected by colder water with much lower survival and growth rates over only a 30-day period.

Freshwater catfish are now extremely rare in western rivers where they used to be abundant in the 1960s. Their absence from the Murray River between Hume Dam and Yarrawonga weir and from the Murrumbidgee River between Burrinjuck Dam and Wagga Wagga, when they are otherwise abundant further downstream, is almost certainly due to cold water releases from both dams.

Other research has indicated that cold water pollution eliminates native fish species from the affected rivers. For example, the construction and operation of Dartmouth Dam on the Mitta Mitta River completely eliminated Murray cod, trout cod and Macquarie perch within a few years.

On the basis of available scientific evidence, it is reasonable to conclude that cold water pollution is one of the more serious degrading processes operating in the main rivers of the Murray-Darling Basin as well as some coastal rivers and is probably one of the key factors behind the reduction in abundance and range of native freshwater fish species. Available evidence suggests that cold water pollution reduces the growth and survival of native fish, reduces spawning opportunities, delays egg hatching and promotes invasion by alien species.

The Sustainable Rivers Audit initiated by the Murray-Darling Basin Commission includes an ‘expectedness’ measure, which compares the number of native fish species expected at a site (taking into account fish habitat preferences, altitude, habitat type etc) with the numbers actually caught. The data indicate that the reaches of the main western rivers downstream of large impoundments are generally missing 50 per cent or more of the expected number of native species (generally between 10 to 15 species missing).

Of course this decline in diversity is not wholly attributable to cold water pollution. Other contributing factors include alien species, fish passage barriers (weirs, road crossings), decline in riparian health, desnagging, fishing, sedimentation and disease as well as hydrologic changes and decline in habitat quality. It is interesting to note, that current drought conditions appear to be benefitting many fish populations. Reasons for this are various, including low breeding of floodplain spawning carp, but more importantly, cold water pollution may be less of an issue as dams and discharge rates are at low levels. Nevertheless, research indicates that a substantial increase in the number of native species is certainly possible if one or more of the limiting factors can be eliminated or significantly reduced and cold water pollution is viewed as being one of the most important factors and one that can be more easily addressed.

It is reasonable to assume that addressing cold water pollution will result in the return of native fish to reaches of rivers where they are currently absent. Indeed it is likely that five to seven species could return in many cases. Although some are small-bodied species with little economic value, they often occur in large numbers and play a critical role in aquatic food webs.

Raising water temperatures offers a high probability of inducing significant beneficial response within aquatic ecosystems: higher productivity at all trophic levels; a greater number of native fish breeding events; more successful breeding events; and greater diversity of aquatic invertebrates, fish and other cold-blooded animals such as turtles and frogs. Stocking with hatchery raised fish may be needed to initiate the recovery of local fish populations if fish from adjoining populations are unable to migrate into the affected area or if numbers are so low that natural recruitment cannot be relied upon. These improvements are not likely to be immediate. Some benefits may become apparent within the first 12 months. For example, it is likely that a highly migratory and highly fecund species such as golden perch would migrate upstream and breed in the first spring/summer period following the commissioning of a new multi-level offtake. Increased numbers of ‘young at year’ would be apparent the following year.

However, many fish species (e.g. Macquarie perch, river blackfish, purple-spotted gudgeon) are at such low levels that even if the few remaining individuals responded immediately, it would take several years at least for populations to re-establish and re-populate throughout the river channel. The full benefits may not be apparent for ten years or more.

Recovery could be speeded up in some instances by stocking hatchery reared fish. However, stocking is not a substitute for addressing cold water pollution for several reasons. Indeed stocking fingerlings into rivers affected by cold water pollution is pointless as the habitat is unsuitable and the fingerlings die. This option is only possible for a small number of species with recreational angling value. The majority of species are not stocked at present and indeed, the scientific and technical expertise to breed most species in captivity does not yet exist. Cold water pollution is an ecosystem wide problem. Stocking rivers with fish where cold water pollution has not allowed algal or invertebrate food sources to grow, would be pointless.

Increasing the productivity and abundance of important native fish species such as Murray cod, trout cod, silver perch and golden perch is likely to have significant longer term benefits to the recreational fishing industry by increasing angler satisfaction. Cold water pollution also has an adverse impact upon the suitability of inland rivers for recreational use, most notably swimming, as the water is frequently uncomfortably cold. Addressing cold water pollution will help improve the recreational and tourism value of inland rivers, with substantial social and economic benefits to the communities living along those rivers.

Cold water pollution, while being a common feature of dams everywhere, is not well addressed everywhere. While it is obvious that the ecological effects of cold water pollution are highly degrading and that there are numerous options for addressing the problem (Sherman 2000), active management is not common.

It is important that options to mitigate cold water pollution are tested or modelled before construction; many of the options are relatively expensive and cheaper options may be available. Due to the individual nature of cold water pollution in the large dams in NSW, good feasibility studies prior to construction are required to ensure that the option for mitigation is successful under all conditions for each dam. Each dam needs individual investigation as costs and benefits of mitigation vary.

Sherman (2000) outlined the major options for addressing cold water pollution by NSW dams, with multi-level offtakes and suspended curtains showing the most promise. Surface mounted impellors and compressed air bubblers are less attractive as long term solutions due to ongoing energy consumption and accompanying greenhouse gas implications.

End of quote

1 (f) examine social, economic and environmental aspects of water management practices in NSW and international jurisdictions …

The Murray Darling Basin Authority conducted some socio-economic assessments of the Northern Basin arising from the buyback and reallocation of irrigation entitlements for environmental flows. It found economic impacts were severe in those researched communities.

The Gwydir River is Bingara's most important asset and the river is to Bingara what the harbour is to Sydney. Cunningham traversed the Gwydir in its natural state and his journals recorded the river and its tributaries, "were abundant with fish." Yet ever since Copeton Dam was built and came into operation in about 1973, the river has been used as a ditch to channel irrigation water. The design does not incorporate a fish ladder and cold, dead water and sediment discharges near the bottom of the deep dam. The cold water (10-12 degrees C) and sediment loading, sterilises and silts up the river. Copeton is the second worst CWP dam under control of State Water and the temperature for recreational fish like Murray Cod, Yellowbelly and Catfish (that require temperatures above 20 degrees C) to spawn and for fingerlings to thrive is never met and populations of the once abundant small fish upon which they feed have likewise collapsed. Other aquatic species like, platypus, water rats, turtles along with shrimp, lobsters etc are also much less prevalent and constantly challenged. (I frequent the river but I am yet to sight a platypus.)

Carp that have much greater adaptability are ever present in the river.

In recognition of the dam's adverse impacts, a voluntarily operated fish hatchery was established at Bingara thirty five years ago to hatch and release fingerlings to help offset the effects of CWP. However, the Strategy Study confirms that fingerlings are sluggish in cold water and highly susceptible to predators while the biota food sources are inadequate. The report concludes restocking is futile and in contrast to unaffected rivers where virtually all stay alive only about 25% of fingerlings survive.

In early 2015, local community organisation 20-20 Vision asked State Water NSW to make a presentation on the management of Copeton Dam. State Water declined and it took the intervention of local member Hon Adam Marshall to arrange a public meeting / presentation on 5 February 2015 at the Imperial hotel.

At this meeting locals bemoaned the decline in fish populations and how the river that once used to run strong and clean and have deep holes where Catfish and other species were visible at six metres is now dirty, often smelly and the deep holes have silted up. In 2010-11, major prolonged dam discharges (reputedly approaching 10,000 ML /Day) eroded and shifted the banks.

Mention was made of a world first, innovative thermal curtain installed at Burrendong Dam in 2014 at a cost of around four million dollars. An adjustable curtain surrounds the tower and warm surface water flows over the rim of the curtain for controlled release.

The installation of the curtain reputedly improved temperatures downstream of Burrendong Dam by about 3.5 degrees C. However, a lightning strike, full dam recharge and engineering defects rendered the thermal curtain inoperable. Since ministerial letters state the thermal curtain, if successfully trialled, would have wider applications, then it needs to be established whether there is any sense of urgency to repair and make the curtain operative again.

Representations:

I have been writing to respective Minister Hon Niall Blair and local member Hon. Adam Marshall about CWP since before the last State election. I have taken out an electronic petition, and along with colleagues attended a number of meetings with State public servants, and Murray Darling Basin Authority at Moree, participated in a deputation to Hon Barnaby Joyce, written letters to the press and lodged various submissions.

Twenty three dams are affected by CWP in NSW. Fourteen are moderate while nine are severe. CWP affects hundreds of kilometres of downstream flow and around the State totals some thousands of kilometres of waterways.

Under its Terms of Reference the MDBA is restrained from allocating money to remediate the effects caused by CWP. However, during consultations in consideration of the Northern Basin the MDBA appeared to accept that CWP may:

- impede the potential benefits of measures already undertaken by the MDBA.
- have severe adverse effects upon river health
- rectification of CWP could greatly benefit river health.
- such an initiative would welcomed by irrigators and communities alike and could do a lot more to improve overall river health than further mandatory reallocation of entitlements.

Presently there appears to be political inertia at a State level to deal with CWP as decisions are awaited from within the MDBA on future policy directions and whether a bucket of money may become available for wider purposes. It is also suggested that influential parties may be engaged in horse trading as they jockey for the most advantageous position.

On the basis of a public seminar entitled Fish and Flows organised and addressed by Environment NSW, DPI Fisheries, DPI Water at the Bingara Living Classrooms on July 2016, the various agencies appeared dysfunctional and lacking in freedom to openly declare support for community driven initiatives and aspirations.

1 ***(g) the efficiency and sustainability of environmental water being managed by different State and Federal Government departments and agencies.***

- Copeton Dam was built principally to service irrigated cotton. ***Once operational, the dam very quickly removed much of the eco from tourism.***
- The prime time for environmental flow releases coincides with spawning by desirable native fish in spring and early summer.
- However, the Bingara community and creatures that inhabit the river derive no benefits what-so-ever from "environmental flows" due to CWP's sterilising effects upon the river.
- Various studies confirm that temperature rises do not occur until the river exits the Bingara community.
- Even when the temperature rises, the environmental flow still remains highly compromised by the sterility of the upper reaches and its inability to contribute food sources to advantage aquatic life and wetland bird colonies.

Presently Federal Government planning is underway to try and control Carp through the release of a virus. It is obvious that some advance procedures need to be put in place to take full advantage of the lethal potential of the Carp virus. It is recommended that:

1. All dams in NSW releasing CWP be remediated before the introduction of the Carp virus.
2. Failing that, remediate at least those nine severely affected dams.
3. That Murray Cod and Yellowbelly fingerlings be subsequently released below such dams so that Carp survivors are subjected to competition.
4. Ensure strategic timing for release of the Carp virus.

Socio-economic impacts attributable to CWP upon the Bingara community has existed for more than forty years. Since Bingara is heavily tourist orientated and rated in a 2015 survey conducted by Caravan and Motor Home Magazine as the best inland riverside camping spot in Australia it becomes even more imperative to try and restore – as best we can- those eco–tourism features that existed before the dam was built.

The NSW Office of Water July 2012 Report includes a cost benefit analysis, portion of which is quoted below:

Results of Stage 1 Economic analysis over 30 years

The assessment of economic benefits and costs is summarised in the following table. Under the conservative assumptions applied in the analysis, the net present benefits are positive and the benefit-cost ratios are greater that one. This indicates that under the assumptions applied in this analysis the Cold Water Pollution Strategy stage 1 is economically viable. The net present value over 30 years was $15 million and the benefit-cost ratio was 1.74. Applying the upper bound benefits showed a net present value of $33 million and a benefit-cost ratio of 2.64.

Table 24 Summary of economic benefits and costs of stage 1 Cold Water Pollution Strategy over 30 years

	lower bound $	**upper bound $**
Total benefits	49,218,000	70,543,900
Total costs	33,626,750	33,626,750
Net benefits	**15,591,250**	**36,917,150**
Present value benefits	35,485,600	53,793,600
Present value costs	20,393,600	20,393,600
Net present value	**15,092,000**	**33,400,000**
Benefit cost ratio	1.74	2.64

Note: data rounded

Sensitivity analysis

Sensitivity analysis addresses the uncertainty surrounding the data and scenarios being evaluated. The values of key variables in the analysis are changed to assess the significance of assumptions on the final outcomes of this study.

The key variables in this study are outlined in the following table, together with the impact on the lower bound net present value and the benefit-cost ratio of the identified changes. Halving the dollar value of willingness to pay had the greatest impact, reducing the benefit-cost ratio to 0.89 from 1.74. Changing the discount rate to four per cent reduced the benefit-cost ratio by 0.11, and changing the discount rate to ten percent increased the benefit-cost ratio by 0.08.

Table 25 Summary of sensitivity analysis of key variables

Variable	Change in variable	Net present value ($)	BCR	change from BCR= 1.74
Monitoring costs	where estimated at $40,000 were halved to $20,000	$ 15,516,000	1.78	0.04
Discount rate 4%		$ 15,416,500	1.63	-0.11
Discount rate 7%		**$ 15,092,000**	**1.74**	0.00
Discount rate 10%		$ 14,524,000	1.82	0.08
Capital replacement costs	changed from 25% to 15**%	$ 15,587,000	1.78	0.04
Capital replacement costs	changed from 25% to 35%***	$ 14,597,000	1.70	-0.04
Residual value of capital *	$0 value after 30 years	$ 14,192,000	1.70	-0.04
Willingness to pay benefits	half of the average value of benefits calculated	$ (2,201,000)	0.89	-0.85

Life of capital was estimated as 50 years.
Note capital expenditure already incurred so sensitivity analysis was not conducted on changes in capital expenditure, only on capital replacement costs.

** Note that Tallowa replacement capital was calculated at 30% Source Sydney Catchment Authority

Threshold analysis

Threshold analysis can be used to indicate the minimum level of benefits such that the net present value of benefits would equal the net present value of costs and the benefit-cost ratio would equal one. The threshold analysis indicated key variables that could change the lower bound benefit-cost ratio to equal one, for example:

- an increase of only five species of native fish
- a decrease in the average value held by the public from $5.02 per household to $2.85 per household
- a decline in household values in the southern coastal catchment areas from $7.93 to $2.45 per increase of one species of native fish.

Discussion

The economic analysis was based on a conservative estimate of benefits. The economic analysis indicated that the stage 1 of the Cold Water Pollution Strategy was economically viable with a robust benefit-cost ratio and significant positive net present value.

The estimated benefits focussed on household willingness to pay for a possible increase in native fish species in the rivers associated with the project.

The study did not evaluate total economic benefits. A number of other benefits could have been included, such as willingness to pay for changes in water quality, aesthetic riverine habitat improvements or recreation values. Inclusion of these benefits would be expected to increase the benefits of the Cold Water Pollution Strategy and increase both the net present value and benefit-cost ratio. These results indicate that continuation of the strategy can be expected to result in further significant benefits to communities across NSW.

The strategy has other unquantified benefits, such as supporting the capital works of fish passage and river management works. Therefore the current analysis is indicative of a high return on capital invested in the strategy. The benefits as estimated indicated that the public values improvements in water quality as measured by increases in the numbers of species of native fish.

End of quote and submission

Signed,

Alec Lucke

Reference:

Publisher:

NSW Department of Primary Industries, a division of NSW Department of Trade and Investment, Regional Infrastructure and Services.

NSW Cold Water Pollution Strategy - report on the implementation of stage one

This report can be cited as: NSW Cold Water Pollution Interagency Group (2012): Cold Water Pollution Strategy in NSW - report on the implementation of stage one, NSW Department of Primary Industries, a division of NSW Department of Trade and Investment, Regional Infrastructure and Services

First published: July 2012

ISBN 978 1 74256 310 7

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