Wilton Action Group

WAG

Better Community Outcomes

Independent Expert Panel for Mining in the Catchment

Submission by Wilton Action Group

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Independent Expert Panel for Mining in the Catchment - submission by Wilton Action Group

Preamble - Limited investigation concerns

After our own analysis, we find that are in agreement with the Lock the Gate Alliance who state on p.1 of their 3 October submission to the Independent Expert Panel that :

'*the panel is tasked with looking into the effects of current coal mining in the Greater Sydney Water Catchment Special Areas, including effects on the quantity of water available, the environmental consequences for swamps and the issue of cumulative impacts*

We note that an inquiry restricted to the Special Areas misses investigating a great deal of the impact that coal mining has on the quantity and quality of water in Sydney's drinking water catchment. The Special Areas are important, but only cover approximately 25% of the catchment.

In the Warragamba and Nepean catchments there are considerable areas of catchment beyond the Special Areas

In the headwaters of Warragamba's catchment there are mines operating that discharge polluted mine water into creeks that feed the Coxs River in the north and in the south, the defunct Berrima Colliery is already a pollution source and the new Hume Coal mine stands to cause considerable groundwater drawdown if it proceeds.

Wilton Action Group is therefore concerned that the Independent Expert Panel's findings not be interpreted as applying to the entire catchment in NSW.

Wilton Action Group (WAG)

The Wilton Action Group formed in February 2018 after discussions at the NSW Department of Planning (DPE) community engagement sessions for the Wilton North Planned Precinct. Since forming our group, we have over 400 registered Facebook supporters. Our group is not anti-development but is concerned about proper planning processes and ecologically sustainable development. To this end, we see gross failures with the planning processes that have applied to the proposed developments at Wilton known as Wilton New Town, including a failure to factor in the future impact of mining on the water supply for Wilton New Town now called Wilton 2040 by the DPE.

The Wilton development - water and mining impacts.

Wilton is a small peri-urban town in the Wollondilly Shire. The town is dissected by the Canberra to Sydney Hume Motorway and the notoriously dangerous Picton Road, which travels east to Wollongong, and west to Picton. The Wilton New Town area is proposed for large-scale development (15,000 + homes for a projected population of over 60,000 people – a city the size of Port Macquarie – now called Wilton 2040 by the Department of Planning and Environment) Our analysis of the planning studies exhibited by DPE is that the land area is highly constrained and costly to develop. The area has significant natural resources, including coal and is part of the Nepean River Catchment which is an important part of the Sydney Water Catchment. It is highly bushfire prone, and features many threatened species (including important populations of Koalas)

Sadly, the "Kruck Report", which is an important 2015 NSW government investigation into the coexistence of mining and housing development in the Wilton area and the Nepean/ Sydney Catchment, has not been publicly released due to its current Cabinet in Confidence status. Does this report suggest perhaps a precautionary principle in planning for the then Wilton Junction development which does not seem to have been applied in the planning for the Wilton 2040 draft plan? See: https://www.planning.nsw.gov.au/News/2018/Plan-for-Vibrant-Wilton-Growth-Area

As currently intended, the Wilton New Town/2040 developments will nearly double the population of the Wollondilly Shire itself which will make the provision of a stable, clean water supply of the highest priority for such a development.

Relevance to the Independent Expert Panel for Mining in the Catchment investigation

WAG therefore agrees with experts like Dr Ian Wright that there should be no mining in the catchment areas in NSW due to the dangers it presents to current and future water quality for the rapidly expanding urban areas of Sydney.

And WAG fully supports Water NSW's total opposition to mining in the catchment where it will damage water quality and infrastructure. http://waternsw.com.au/water-quality/catchment/mining. It is worth quoting Water NSW's submission to the Independent Expert Panel that 'from the Water NSW viewpoint, the single most important consequence ... is that subsidence induced by the Dendrobium mine longwalls is likely to be resulting in significant diversion of surface water which would otherwise contribute to greater Sydney's water supply," www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/.../2-WaterNSW-submission.PDF pp11-12

This statement is also in alignment with the submission to the Independent Expert Panel from the National Parks Association in relation to Dendrobium Area 3B - p.79

Mining has caused considerable drawdown extending across and beyond Area 3B and this is impacting the watercourses, suggesting a change in character from being gaining to being losing streams.

The large drawdowns tabulated in the December 2016 NPA report (Table 2 below)will have continued and point to a more than negligible decline in groundwater supply to at least the southern side of Cordeaux Reservoir.

It would seem likely that the mine's approval conditions have been breached.

As the groundwater decline continues, at some point a tipping pint will be reached and passed, with the reservoir losing more water to the groundwater system than it gains. Association regarding the Cordeaux reservoir) and loss of groundwater.

We also agree with Wollondilly Council on its submission to the Independent Expert Panel regarding the cumulative impacts of mining in the catchment and the need for a whole of catchment approach for monitoring and assessment of water quality – p. 8

Managing cumulative impacts associated with mining operations

The assessment of cumulative impacts on water supplies within the Drinking Catchment is acknowledged as being highly important given the number of mining operations under different ownership. The absence of reference to cumulative water quality impacts in the ToR item is however noted with concern given the strong interrelationship between water quality and quantity identified by a range of research studies. The *"Cumulative Impacts of Activities which Impact Groundwaters and Surface waters within the Sydney Water Catchment Area" Report* produced by the NSW Office of the Chief Scientist and Engineer is noted to include the following recommendations of relevance to this matter:

- *That the Government develop a whole-of-Catchment environmental monitoring system.*
- *That the Government commission computational models which can be used to assess the impacts on quantity and quality of surface and groundwater.*

The above recommendations of the Chief Scientist in association with research studies known to Staff are viewed as highlighting the importance for the identification and management of the cumulative risks of mining operations to both water quantity and water quality. **The Panel is consequently requested to provide advice and recommendations for the avoidance and minimisation of these risks in its final report to the DPE.**

In relation to the above WAG makes this submission to the Independent Panel following our recent representations on issues of mining impact and water supply, quality and treatment for the proposed Wilton New Town development. At the recent Special Community Forum as part of the Wollondilly Shire Council Extraordinary meeting held on 30 April at Wilton, WAG called for:

Commissioning of a full hydrological analysis to determine the future adequacy of the water supply for Wilton New Town's projected population of 50-60,000 people - allowing for impacts of factors like climate change and future mine closures on that critical, limited water supply from the local dams.

WAG repeated this call for a full hydrological assessment for the Wilton development at the 8 October Community Forum at Wollondilly Council.

In its submission to the Independent Expert Panel, Water NSW gives some assurance on that with its preliminary work in assembling the stakeholders on a broad hydrological and hydrogeological study being started across the catchment. They recognise that it is a very complex and challenging task for the predictive modelling required but one that is vitally needed with the mining impacts now in overdrive across the Sydney catchment

But WAG feels that the investigation by the Independent Expert Panel may not been not permitted to fulfil its terms of reference unhindered, particularly in regard to its Terms of Reference 3 – which has a preferred positon stated by Wollondilly Council below.

Term of Reference 3

Provide advice as required to the Department of Planning and Environment on mining activities in the Greater Sydney Water Catchment Special Areas which may include but is not confined to:

- *A Subsidence Management Plan application for Longwall 16 at the Dendrobium Mine*
- *An Extraction Plan application for Longwall 33 at the Metropolitan Mine*
- *An Environmental Impact Statement for the Dendrobium Extension Project*
- *A Preferred Project Report for the Russell Vale Underground Expansion Project.*

The inclusion of a Term of Reference Item that refers to current mining related applications within the Drinking Catchment Area is recognised as being appropriate in providing a level of certainty to the respective proponents. However, the above, (as well as any other), applications, is viewed as having strong relevance to the outcomes of the investigation by the Panel and its final Report.

The Panel is requested to note in relation to this matter that Council resolved at its meeting on 18th June 2018 in endorsing this submission to request the *DPE "not issue a Determination for any mining related application until such time it has received and reviewed the final Report by the Independent Expert Panel".* **It is consequently the preferred position of Council Staff that specific detailed advice regarding the above projects by the Panel be contained in its final report to the DPE.**

Clearly this did not happen with the DPE quietly announcing its approval on Monday 30 July for the Dendrobium Mine Long Walls 14 and 16 to go ahead with extraction and subsidence management near the Avon and Cordeaux reservoirs. On 3 August WAG commented in a media release:

In March, the government appointed an Independent Panel of experts to investigate and report on the impacts of mining in the Sydney Catchment areas with wide terms of reference. The said panel produced advice in April on the Dendrobium mine that:

"Longwall 14 should not proceed without confirmation that the expanded monitoring network is being implemented. ... Longwall 15 should not proceed without resubmission of plans reflecting the expanded monitoring network."

Brian Williams of WAG: 'This is an utterly irresponsible and reckless decision by the DPE because with government investigations already under way, you should never compromise such an investigation before it has delivered its findings.'

We therefore urge the Independent Panel that its final report takes this into account and if satisfied that any conditions for these approvals are likely to not be adhered to and breached by the mining company to recommend the revocation of this approval by the DPE.

Community Opposition to Mining in the Catchment - Political response

The feeling on these issues of the broader Wollondilly community was recently demonstrated at a panel discussion hosted by the Battle for Berrima in Berrima on Saturday 20 October on the question of why Sydney was the sole known city to permit mining under its catchment. Dr Ian Wright's presentation of the impact on the Wingecarribee River of the closure of the Boral Medway colliery had a huge response and it is a warning for the legacy of future mine closures in the Upper Nepean catchment.

https://www.southernhighlandnews.com.au/story/5714480/community-sceptical-about-mining-decision-process/?cs=262&fbclid=IwAR394NHOLfamNY7byy-2Br-BpBRDprqXEAVOrW796IhM7L3qHLHdJ2CFREA

Quote:

"The fact is, in NSW we don't have a mining assessment process, we have a mining approvals process. You can count on one hand the number of mining projects that have actually been refused," Mr Searle said.

"The Labor party has made the commitment: If we're elected to office next year, we will reinstate a neutral or beneficial effect test," he said.

NSW Greens mining spokesperson, Jeremy Buckingham called for a ban on all mining projects in the water catchment area, a promise first made in 2011 by the former O'Farrell government.

Whilst adhering to its position on no mining under the catchment, WAG agreed with shadow Minister for Resources Adam Searle that if Labor would not support WAG's call made at this Berrima forum for a Royal Commission into the Department of Planning and Environment they would support a thorough review of its processes and decision making processes for mining in particular.

WAG concerns and recommendations to the Independent Expert Panel are in summary:

(1) The coming collision between the need to service a vastly increased population at Wilton and surrounds with a water supply that could be significantly compromised by future mining impacts on water quality and supply needs to be taken into account. We agree with following statement by NPA Illawarra in its 2016 submission to the DPE on the Dendrobium mine proposed new mining activities - appendix

" Sydney has grown far faster than anticipated...Although the Warragamba Dam provides the majority of Sydney's water, the smaller dams provide an important resource with regards to the flexibility and resilience of the water supply. If the Warragamba supply is temporarily contaminated (as it was by cryptosporidium in 1998) then the other smaller dams provide a backup resource. The quantity of water available from catchment land has not increased to keep pace with increased population, and the catchment is being incrementally damaged by subsidence, cracking of creek and stream beds and loss of upland swamp areas. Uplands swamps perform important functions relating to water quality and quantity, as well as supporting amazing biodiversity."

We also note the recent evidence of the CEO of Water NSW about record low inflows into the catchment

> The inflows into the system over the past 15 months have been worse than the lowest on record. Let me give you some figures to illustrate what that means. The previous lowest annual inflows were in 1944 and they were 136 gigalitres. The second lowest inflows were in 2004 during the Millennium Drought at 234 gigalitres. So 136 gigalitres was the worst and 234 gigalitres was the second worst. By the way, it is a big gap which shows that it is a long tail. If the inflows continue along the path they have been going in the past few months, this year's inflows in total will be 83 gigalitres. So 99 per cent lowest was 136 gigalitres; this year's will be 83.[12]

[12] Transcript, Friday 31 August 2018. Estimates hearings of Portfolio Committee No. 6 Planning and Environment.

Our calculations indicate that with an average daily household water consumption of 90 litres a day, the addition of at least 15,000 homes/ 50,000 people will reduce the existing net supply to Wilton New Town by a factor of 30 days (1 month) per year through increased demand, without allowing for the increased evaporation and other water used by industry, mining etc.

(2) The urgent need for the Independent Panel to report and publicise the full impact of mining in the Nepean River catchment at least
(3) The need for a comprehensive hydro/ hydrogeological study for the Nepean River system under the impacts of future mining and housing development
(4) The need for the mining approvals process of the DPE to be thoroughly reviewed and much greater weight to be given to environmental concerns in the assessment of future mining applications in general. This includes the DPE's relationship with bodies like Water NSW and Office of Environment and Heritage
(5) WAG is in full agreement with the recommendations to the Independent Expert Panel of the Lock the Gate Alliance – pp3-4
(6) Impact of mining on water quality and supply on agricultural production and 'the sequencing of various activities such as mining and urban development' – see Appendix 2 p.9
(7) Our concerns also include the Independent Expert Panel to examine under its terms of reference the following issues as laid out in the following pages as appendices and questions we raise therefrom

- Climate change – impacts on the future supply for the Nepean Catchment Area
- The previous Resource Mining Framework for the Greater Macarthur Area
- As per the Independent Expert Panels TOR 2 previous studies of mining impacts in the catchment and evaluation of further damage that has been done since the 2008 Southern Coalfields Review and including the concerns of the NPA Illawarra as per their submission as part of the Avon Dam Dendrobium mining application in 2016 in particular its referral to the alleged breach by Dendrobium of SEP 2011 for protection of the Sydney Water catchment:
- Water quality analysis of the Dendrobium mine especially elevated levels of tritium discovered in 2016 by consultants HydroSimulations
- Impacts of Long Wall mining and recommendations re surface water and ground water monitoring
- Nepean River – most recent full system water quality analysis and recommendations

Appendix 1. Future Sydney Water Supply - Climate Change impact NSW/Australian government report 2010

https://www.metrowater.nsw.gov.au/sites/default/files/publication-documents/climatechange_impact_watersupply_summary.pdf

Climate change impacts on water availability and supply

The total operating storage of the Sydney dams is about 2,600 gigalitres (GL). The Warragamba catchment is responsible for around 80 percent of the total inflows into Sydney's water supply, with the dam having a capacity of around 2,027 GL. The majority of the other 20 percent of the inflows come from the Upper Nepean, Woronora and Blue Mountains catchments. Recent changes to the water supply system will see this balance shift to 60–70 percent and 40–30 percent. The contribution of the Shoalhaven catchment varies depending on when pumping occurs. The Blue Mountains Catchment was excluded from the study area for the water availability and supply modelling because its flows represent less than one percent of Warragamba's inflow.

In general, projections suggest that inland regions (the majority of the Warragamba and Shoalhaven catchments) may get drier, while coastal regions (Upper Nepean, Wingecarribee, eastern section of Warragamba and parts of the Shoalhaven catchments) may tend to be slightly wetter.

The majority of impacts to inflow, under A2 emission scenario, are projected to occur by 2030. Projections under the A2 emissions scenario for 2030 suggest reduced rainfall and inflows in Warragamba and the Shoalhaven, but increases in the region surrounding the four Upper Nepean dams (Cataract, Cordeaux, Avon and Nepean) and Woronora. Projections also indicate evaporation could increase by around three percent at Warragamba, Nepean, and Wingecarribee dams and around seven percent at Goulburn. Warragamba, Nepean and Wingecarribee provide representation of evaporation at major storages and near coastal catchments, while Goulburn provides an indication of the evaporation changes to the inland catchments.

Under the A2 scenario, in 2070 rainfall and inflows may reduce for Warragamba and Shoalhaven and increase for the catchments of the Upper Nepean dams. Evaporation is projected to increase for Warragamba, Nepean, and Wingecarribee dams by around 10 percent and at Goulburn by around 22 percent. Overall for 2030 and 2070 there is a projected decrease in inflows from the downscaled current climate by around 25 percent for Warragamba and Shoalhaven dams and a five percent increase for the Upper Nepean dams.

Sydney's water supply system is designed to ensure that the annual volume of water supplied does not compromise system security or trigger an unacceptable frequency of water restrictions. Currently the maximum volume of water that can be safely drawn from the system (known as the system yield) is 570 GL/year.

This suggests how critical the Upper Nepean dams will be in the future given the drop in inflows to Warragamba etc. The current drought has seen record levels of evaporation across the catchments according to the BOM and record low inflows as per the evidence of the CEO of Water NSW – quoted on p.7

Therefore how can the Upper Nepean supply be augmented without a huge investment in finding and engineering another water supply?

Appendix 2 - Resource Mining Framework Greater Macarthur Land Release - 2015

https://www.planning.nsw.gov.au/-/media/Files/DPE/Reports/resource-mining-framework-and-its-application-to-the-greater-macarthur-investigation-2015-06.ashx

To quote Action 4.1.2 from '*A Plan for Growing Sydney*': 'The strategic framework will balance the MRA's significant conservation, economic and social values. The framework will assist decision makers by establishing criteria to:

- Minimise the adverse economic impacts on existing primary industry and productive agriculture
- Consider critical natural resource constraints
- Provide adequate public open space and recreational activities and avoid creating unsustainable pressure on existing Crown Land areas and State Forests
- Consider natural hazards, such as the need to evacuate people from flood/bushfire prone areas; how flood-prone areas will be avoided and not increasing flood risks in new housing areas (through early planning for stormwater management)
- Consider and plan to protect significant natural resources including water quality, riparian and aquatic habitats and marine estates.

In the longer term, the development of demand and supply data sets for agriculture and resource extraction industries will be explored.

The Government will work with councils to develop a detailed planning framework for the area that:

- Protects the Greater Blue Mountains World Heritage Area and other natural areas across the Metropolitan Rural Area, while fostering opportunities for international tourism, including a review of management and monitoring of impacts and cumulative effects of surrounding land uses on the World Heritage environmental values
- Identifies and protects the productive mineral, energy and construction material needs and provides appropriate buffers
- Protects productive agricultural land to keep fresh food available locally by planning for the infrastructure and land use needs of agricultural activity and providing appropriate buffers between different land uses to minimise conflicts
- Protects the Sydney drinking water catchment by requiring new development in the catchment to have a neutral or beneficial effect on water quality (consistent with Government policy)
- Manages the risk from natural hazards, particularly flooding in the Hawkesbury-Nepean Valley and bushfires, by mapping where geophysical factors impose constraints on economic activity and urban development
- Considers how all these activities can be best accommodated, including the sequencing of various activities, such as mining and urban development'.

This framework requires consideration of the broad range of environmental, economic and social values associated with the rural lands in particular its role and relationship to the greater metropolitan area of Sydney.

Should the Independent Panel consider these factors in recommending future mining in the catchment – e.g. impact of water quality and supply on agricultural production and 'the sequencing of various activities such as mining and urban development'?

Appendix 3 - Recent analysis of damage from long wall mining

IESC - Dept. of the Environment – August 2015

iesc
Independent Expert Scientific Committee
on Coal Seam Gas and Large Coal Mining Development

Australian Government
Department of the Environment

Monitoring and management of subsidence induced by longwall coal mining activity

This report was commissioned by the Department of the Environment on the advice of the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development. The review was prepared by Jacobs Group (Australia) with input from Mine Engineering Subsidence Consultants and Strata Control Technology.

August 2015

2.4.4.2 Cataract River, NSW

The Cataract River is a tributary of the Upper Nepean River in NSW. Nine longwall panels were mined directly under the Lower Cataract River from 1988 to 2000. Damage to the river was reported by local residents in 1994. Surface water had drained from the river through hundreds of cracks in the river bed, and fish kills were reported. Methane began to vent from the river bed from 1996 (Total Environment Centre 2007). The dam wall at Broughton's Pass Weir was cracked in four places leading to leakage across its face. A pump house adjoining the weir was also damaged. The Nepean tunnel and the upper canal were cracked but the extent of water loss was not established (Total Environment Centre 2007). In the 2003/04 financial year the SCA spent $5.58 million on the upper canal; $2.23 million of which was for 'extensive mining related preventative work' (Sydney Morning Herald 2005).

Cracking has affected the quantity and quality of surface water in the Cataract River. The NSW Department of Land and Water Conservation estimated that the Cataract River had lost 50 per cent of its flow to bedrock cracks (Total Environment Centre 2007). Total Environment Centre (2007) note that environmental flow releases of 1.7 ML per day are no longer sufficient to keep the river flowing or to maintain acceptable water quality. Further detailed information on the impacts of subsidence on the Cataract River is documented in DIPNR (2002).

WAG: Can the Panel advise on the current state of the Cataract River?

2.4.4.6 Thirlmere Lakes, NSW

Tahmoor Colliery is an underground coal mining operation situated in the Southern highlands Region of NSW, just south of the Tahmoor Township and approximately 75 km southwest of Sydney. It targets the Bulli coal seam and mining began in 1979. The primary method of coal extraction until 1987 was bord and pillar mining, after which longwall mining was introduced. The mine currently has development approvals to produce up to three million tonnes Run of Mine (ROM) coal per annum (Tahmoor Coal 2013).

The mine is located adjacent to Thirlmere Lakes, which are described as a unique wetland believed to be 15 million years old. The Lakes are within Thirlmere Lakes National Park, part of the Greater Blue Mountains World Heritage Area. Over the last 10 years, the water levels in Thirlmere Lakes have declined and members of the community have expressed concern. The NSW Government announced an independent inquiry in 2011 into the reductions in the level of Thirlmere Lakes, which delivered a final report in August 2012 (ITLIC 2012). The inquiry found that the lakes have fluctuated between dry and full conditions over recorded history and that climate change is 'undoubtedly responsible' for the majority of the changes in lake level that have been experienced over the last 40 years. The inquiry found that there is no direct evidence that mining and associated subsidence has breached geological containment structures beneath the lakes. However, it concluded that there is substantive evidence of the steepening of the hydraulic groundwater gradients and lowering of the groundwater table towards the east of the lakes. The inquiry further concluded that there is some evidence to suggest that mining has contributed to changes in water table and groundwater gradients but it is not possible to distinguish changes due to mining from changes due to extraction of groundwater from bores and climate change (Riley et al. 2012).

Pells Consulting (2011) considered the available information on groundwater, geology and mining to provide three hypotheses to help explain lake level observations:

1. that the lakes have dried due to recent drought
2. that longwall mining at the neighbouring Tahmoor Colliery has resulted in increased downward seepage from the lakes
3. erosion of a palaeochannel beneath Lake Nerrigorang has allowed greater seepage and leakage to groundwater from the lake.

Pells Consulting (2012) considered more recent climate and lake level observations and concluded that recent water levels in Lake Nerrigorang are atypical of its historic behaviour, which points to factors other than climate for its current dry condition.

Can the Panel advise on the current hydro/hydrogeological study for Thirlmere Lakes

Appendix 4 - Southern Coalfield Strategic Review - 2008

Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield

Strategic Review

July 2008

Pp 58

Figure 22: Buckling of Near-Surface Strata due to Upsidence, Waratah Rivulet, late 2004

Note: Iron staining within the water course.

Figure 23: Shearing along Bedding Planes, Causing Override of Bedding Slabs, Waratah Rivulet, September 2007

Note: Iron staining within the water course.

WAG: Current state of Waratah Rivulet?

Pp59-61

It is only in the last 15 to 20 years that the effects of underground mining on valley closure and upsidence, on a regional scale, have come to be widely recognised, particularly in the Southern Coalfield where the nature of the surface topography leads to such effects. Whilst a fundamental understanding of the mechanisms which cause this type of behaviour has been developed, the detailed mechanism(s) and hence full extent of this type of behaviour requires further research.

4.1.3.5 Regional Far-Field Horizontal Displacement

In the last 20 years, mining induced, en-masse horizontal displacement of the surface has been detected in the Southern Coalfield for up to several kilometres from the limits of mining. These regional-scale movements are generally greatest at the goaf edge and decrease with increasing distance from the goaf. One of the first publications on the issue was by Reid (1998), who noted horizontal movements of some 25 mm up to 1.5 km from mine workings. Hebblewhite et al (2000) reported horizontal displacements in excess of 65 mm towards mine workings that were 680 m away (where mining was at a depth of approximately 450 m). These movements reduced to 60 mm at a distance of 1.5km from the workings, see Figure 19. Most of the horizontal movement takes place toward the gorges and active mining areas, although some has been recorded towards old goaf areas.

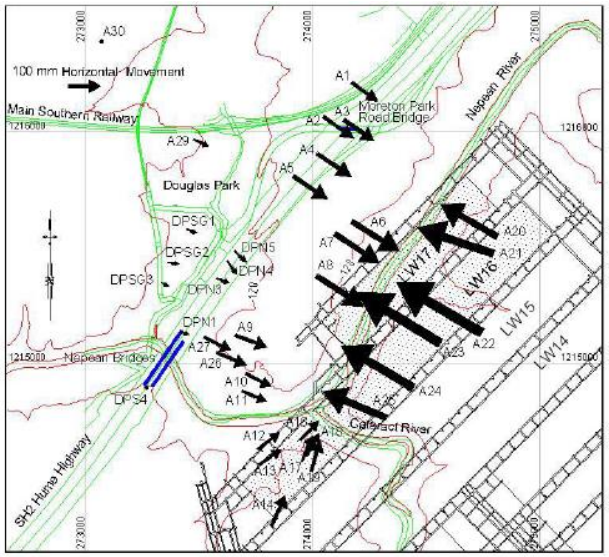

Figure 25: Valley Closure and Far-field Horizontal Movements near Cataract and Nepean Gorges

Source: Hebblewhite et al, 2000

This behaviour is not fully understood by subsidence engineers. A range of possible causes of valley closure, upsidence and far-field horizontal movements are under review. These causes include one or a combination of:

- simple elastic horizontal deformation of the strata within the exponential 'tail' of the subsidence profile that applies in conventional circumstances;
- influence of valleys and other topographical features which remove constraints to lateral movement and permit the overburden to move 'en masse' towards the goaf area, possibly sliding on underlying weak strata layers;
- unclamping of near-surface horizontal shear planes;
- influence of unusual geological strata which exhibit elasto-plastic or time dependent deformation;
- stress relaxation towards mining excavations;
- horizontal movements aligned with the principal *in-situ* compressive stress direction;
- valley notch stress concentrations;
- movements along regional joint sets and faults; and
- unclamping of regional geological plates.

It is important to note that where this type of far-field horizontal displacement has been detected, the levels of horizontal strain are very low. In other words, the differential horizontal movements over a particular length of surface are minimal. Consequently, there has been no evidence to date, of any significant adverse impacts on any natural features from this far-field behaviour. Nonetheless, the recognition of far-field horizontal movements is understood to have been the basis on which some community groups sought a buffer of 1 km between mining and rivers and significant streams.

WAG: Current evaluation of far field horizontal displacement in the Cataract and Nepean Gorges as result of mining?

p.64 -

Table 9. Subsidence Impacts and Consequences for Significant Natural Features in the Southern Coalfield, Summary

Natural Feature	Physical Subsidence Impacts	Primary Consequences for Natural Features	Secondary Consequences
Watercourses	• Tensile cracking of stream rock bars; tensile/shear movement of joint and bedding planes in the stream bed (see Figures 23 and 28)	• Loss of surface water flow into subsurface flow path (see Figure 28) • Loss of standing pools/connectivity (see Figure 29) • Additional groundwater inflows, commonly carrying ferrous iron from freshly broken rock (see Figure 30) • Adverse water quality, impacts eg iron bacterial mats (see Figure 36) • Localised adverse visual impacts	• Aquatic ecology loss (connectivity) • Loss of recreational amenity • No evidence of regional loss of water supply
	• Localised uplift and buckling of strata in the stream bed (eg lifting/ mobilising of stream bed rock plates – see Figure 22)	• Loss of surface water flow into subsurface flow path • Loss of standing pools/connectivity • Additional groundwater inflows, commonly carrying ferrous iron from freshly broken rock • Adverse water quality, impacts eg iron bacterial mats • Localised adverse visual impact	
	• Tilting of stream beds (both dynamic/incremental and final outcome)	• Stream bank and bed erosion • Changes in flow rates • Migration of flow channels	
	• Gas releases from near surface strata (see Figure 31)	• Temporary gas releases to the water column, with water quality impacts • (Rarely) riparian vegetation dieback	• Appears to have no significant long term impact
Cliffs	• Tensile surface cracking - close behind and (sub)parallel to cliffs, or within cliff faces (see Figure 33)	• Cliff falls • Instability of cliffs and overhangs, etc	• Adverse visual impact • Public safety implications • Loss of recreational amenity and public access • Potential damage or destruction of Aboriginal heritage sites • Loss of habitat for cliff-dependant species and damage to GDEs or riparian vegetation
Swamps	• ***Valley infill swamps***: Tensile cracking, tensile/ shear movement of joint and bedding planes, and buckling and localised upsidence in the stream bed below the swamp	• Draining of swamps, leading to: ➢ Drying and potential erosion and scouring of dry swamps (see Figures 34 and 35) ➢ Loss of standing pools within swamps ➢ Vulnerability to fire damage of dry swamps ➢ Change to swamp vegetation communities ➢ Adverse water quality impacts, eg iron bacterial matting • Loss of stream base flow	• Loss of swamp ecology (terrestrial and aquatic) • Loss of flow leads to the full range of downstream consequences
	• ***Headwater swamps***: Tensile cracking and tensile/ shear movement of joint and bedding planes in the rocks below the swamp	• Potential drop in perched water tables, leading to draining of swamps • Impacts are likely to be similar in character but less extensive and significant than for valley infill swamps	
Groundwater reservoirs	• Tensile cracking and tensile/ shear movement of strata • Bending of strata and horizontal separation of bedding planes • Depressurisation of groundwater from the coal seam	• Re-direction of subsurface flows • Mixing of aquifers or groundwater with surface water • Change in aquifer storage characteristics • Depressurisation of strata overlying extracted coal seam	• Failure of GDEs • Cross-aquifer contamination • Minewater inflows, and consequent water management issues • Loss of available aquifer resource

WAG: Can the Panel provide a full updated report of the current impacts of mining on the watercourses, cliffs, swamps and groundwater reservoirs in its report?

Appendix 5 - DPE – Dendrobium Mine – Avon Dam – Response to Agency and other Submissions - 2016 - NPA Illawarra

	Submission			DPE response
p.15				
A83	NPA Illawarra	Page 1 Paragraph 3&4	" The conditions of the creeks and streams which flow from the escarpment are a visual testament to the adverse environmental impacts. This mine is situated in the Metropolitan Special Area of the Sydney Water Catchment. The increasing loss of water quantity and quality in our water supply is unacceptable." " Sydney has grown far faster than anticipated...Although the Warragamba Dam provides the majority of Sydney's water, the smaller dams provide an important resource with regards to the flexibility and resilience of the water supply. If the Warragamba supply is temporarily contaminated (as it was by cryptosporidium in 1998) then the other smaller dams provide a backup resource. The quantity of water available from catchment land has not increased to keep pace with increased population, and the catchment is being incrementally damaged by subsidence, cracking of creek and stream beds and loss of upland swamp areas. Uplands swamps perform important functions relating to water quality and quantity, as well as supporting amazing biodiversity."	A detailed assessment has been carried out to determine if it is feasible to reduce impacts to the surface by reduci the area mined and/or altering the mining parameters. The focus of this assessment was upland swamps and the conclusions are outlined in Section 5.3 of the SIMMCP. This analysis demonstrates that the reduction in resource recovery necessary to reduce impacts to upland swamps was approximately 45% of the total resource available within Area 3B. To reduce the level of impacts to WC15 IC propose to provide a minimum set-back distance of 50r from the Longwall 14 take off-road (goaf). Providing a minimum 50m setback of Longwall 14 to WC15 will reduce t level of impacts to the lower reaches of this stream. The adaptive management options proposed in the submissions, such as reduced longwall width and other restrictions on mining would be less effective on reducing environmental impacts within the mining area.
A84	NPA Illawarra	Page 1 Paragraph 5	"The executive summary of the report makes it very clear that the impacts of mining are not minor or insignificant and are permanently altering the physical environment. The report presents scientific evidence rather different to that provided by the consultants paid by the mining companies. It also evidences the widespread nature of the damage which has occurred in the past and names the impacted rivers and streams. This report has apparently been ignored."	A summary of previous impacts for Longwalls 9 – 11 and recent impacts from Longwall 12 is provided as Attachment C. Over 100 impacts and triggers have been reported during the mining of Dendrobium Area 3B, including triggers associated with previous mining in Area 3. The previous and predicted impacts comply with relevant conditions and performance criteria within Dendrobium DA-60-03-2001 Approval Conditions and the SMP Approval Conditions as outlined in Attachment C.
A85	NPA Illawarra	Page 1 Paragraph 6	"climate change will lead to decreased inflows to reservoirs due to longer and more severe droughts and reservoir levels will drop due to increased evaporation on the more frequent extremely hot days...our water situation now is quite different to that which existed when the mine development was initially assessed." " The World Resources Institute research, published in their online Atlas in 2015, views the Southern Sydney catchment area as being extremely highly stressed: their definition measures the ration of total annual water withdrawals to total annual renewable supply. Mining uses large volumes of water and the impacts of exposing rock faces underground lead to iron staining and increased alkalinity"	Concerns are noted. While localised changes to water quality have been observed, no significant changes in wate quality have been observed at downstream gauging station (HydroSimulations, 2016c). Along with offsets provided to WaterNSW, this would constitute a 'neutral' effect on water quality. Mining (by Dendrobium) occurred around Lake Cordeaux between 2005-2009, and water level records indicate that there is no signs of the lake level declining.
A86	NPA Illawarra	Page 1 Paragraph 6	"Mine inflows at Dendrobium are reported to be 2263ML/year, yet the company presently holds a groundwater entitlement of only 1537 ML/year. Who has been monitoring their groundwater usage without a licence?	Illawarra Coal hold more than one groundwater licence and these cover the predicted take of groundwater. Illawarr Coal are in regular contact with DPI Water, the relevant authority and keep them appraised of current and predicte groundwater inflow.
p.16				
A87	NPA Illawarra	Page 2 Paragraphs 1,2,3	"The State Environmental Planning Policy SEPP 2011 should protect the Sydney Water Catchment. The aims of this Policy are: "(a) to provide for healthy water catchments that will deliver high quality water while permitting development that is compatible with that goal, and (b) to provide that a consent authority must not grant consent to a proposed development unless it is satisfied that the proposed development will have a neutral or beneficial effect on water quality, and (c) to support the maintenance or achievement of the water quality objectives for the Sydney drinking water catchment." The policy further states that: "(1) A consent authority must not grant consent to the carrying out of development under Part 4 of the Act on land in the Sydney drinking water catchment unless it is satisfied that the carrying out of the proposed development would have a neutral or beneficial effect on water quality" Surely this policy is clearly being violated by the Dendrobium mine development.	Reporting of recent effects on surface water flow and quality is carried out in the End of Panel (EOP) reports. The latest report, EOP-11 (HydroSimulations, 2016c) shows some local-scale and temporary changes to in-stream wat quality (usually iron, pH), but no significant downstream effects. Along with environmental offsets provided to WaterNSW by IC these local impacts are consistent with "neutral" effects on catchment water quality.
A88	NPA Illawarra	Page 2 Paragraphs 5	"The Sydney Basin Coastal upland swamp areas need to be conserved and protected for future generations and should not be exposed to any subsidence whatsoever. The swamps perform an essential function with regards to water quality as well as quantity. " " It is our view that no amount of modelling, monitoring or impact assessment is sufficient. What is the logic of declaring these swamps to be Ecologically Endangered Communities and then permitting them to be irretrievably damaged?" "We submit that monitoring is not an appropriate procedure since any damage is known to be irreversible." "We believe that the community expectation is now for the conservation and protection of the upland swamps and for the protection of our water supply."	A Strategic Biodiversity Offset located at Maddens Plains is proposed to meet the biodiversity offsetting requirements pursuant to Condition 2.15 of the Dendrobium Mine Development Consent. Dendrobium Mine proposes to transfer the entire 598 ha Maddens Plains site to the NSW Government for inclusion into the National Parks Estate. The Maddens Plains site secures an important biodiversity corridor and establishes connectivity between the Illawarra Escarpment State Conservation Area and the Dharawal Nature Reserve. The Strategic Biodiversity Offset proposes to provide like-for-like physical environmental offsets for the predicted impacts, includ 140 ha of upland swamp. The Maddens Plains site also includes additional environmental attributes such as; threatened flora and fauna, Aboriginal cultural heritage sites, waterways and cliff lines are also present at the Strategic Biodiversity Offset site.
A89	NPA Illawarra	Page 3 Paragraph 3	In Area 3B 600m of a watercourse (WC21) has no water in it in wet periods and an even longer dry length when there is little rain, due to cracking of the creek bed, yet the 2015 Report claims this is within the predicted impacts. Similarly with the impacted swamps, use of terms like "minor" and "negligible" minimise the real impacts. How can this be reconciled with Neutral or Beneficial effects?	Predicted impacts and proposed management activities associated with extraction of Longwalls 14 - 18 is provide in the SMP, SIMMCP, WIMMCP and MSEC 792. A summary of previous impacts for Longwalls 9 – 11 and recent impacts from Longwall 12 is provided as Attachment C. The previous and predicted impacts comply with relevant conditions and performance criteria withi Dendrobium DA-60-03-2001 Approval Conditions and the SMP Approval Conditions as outlined in Attachment C.
A90	NPA Illawarra	Page 3 Paragraph 2	We believe that the community expectation is now for the conservation and protection of the upland swamps and for the protection of our water supply.	Noted.

Appendix 6 - **WATER QUALITY - ANALYSIS AND MONITORING**

Dendrobium Mine

Monthly report on water quality sampling
for the NSW Dams Safety Committee:
February 2016

FOR

South32 (Illawarra Coal)

BY
Stuart Brown & Wendy McLean
Heritage Computing Pty Ltd
trading as
HydroSimulations

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4 WATER RESULTS

4.1 WATER CHEMISTRY

Water results for the January 2016 sampling period are summarised in Table 4.1, compared with results for the previous two years. Time series plots for each water source category are shown in Figures 4.1 to 4.10. The plots show all water quality analyses and are colour coded to show individual sample sites.

Note that for mine water inflow, analyses are classified as either *seepage* when the sample is collected directly from water dripping or flowing from a discrete water source, or *goaf water* for samples collected from sites where waters from different sources may have mixed (e.g. from water supply). Mine inflow sites are distinguished on time series plots as '•' (seepage) and '+' (goaf water) symbols. A list of sample location descriptions is in Appendix 2.

Table 4.1. Summary of water quality results for the current period compared with previous

DSC condition	Sampling points	Samples	Median EC (µS/cm)	P5-95 EC previous 2 years	Median Na/Cl (in meq/L)	P5-95 Na/Cl previous 2 years	Median tritium (TU)	P5-95 TU previous 2 years
Entering workings	DWS190 (Area 2 goaf)	1	1640	1594 - 1762	19	13. 8 - 25.1	N/A	0.31 - 0.6
	DWS162B (Area 3B goaf)	1	1850	1783 - 1994	30	24.2 - 39.1	N/A	0.02 - 0.13
	DWS28A (water supply)	1	1760	1596 - 1837	15	12.7 - 18.8	N/A	0.44 - 1.39
Adjacent workings	Not sampled this period							
Groundwater in overlying strata	Not sampled this period							
Surface water	Not sampled this period							
	Not sampled this period							

*Note: Median of three samples collected in July and August 2015, for which results became available during the current reporting period.

In summary, all samples collected during the January 2016 sampling period fall within the 5th to 95th percentile range of results from the previous two years.

No additional Tritium analyses were obtained in this reporting period. Tritium levels in the 8 most recent samples collected from Mine Area 2 between July and October 2015 are the highest since 2008 with a mean of 0.50 TU (n = 8), and exceed the 95th percentile value for Area 2 goaf waters over the last 2 years (P95 = 0.40 TU).

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5 RECOMMENDATIONS

The following recommendations are made with respect to future monitoring rounds:

1. Investigate the source of water with elevated Tritium at location DWS190 in Mine Area 2. This may include inspection of water flow pathways to the sampling location and additional sampling and analysis.

WAG QUESTIONS: Has this investigation been undertaken? What does any current analysis reveal of the level of the elevated tritium level discovered in mine area 2 in 2015/16? What are the implications for public health and safety, if any? Could this elevated tritium level be an ancient water inflow from an underground aquifer which may have been breached by mining activity?

Appendix 7. Impacts of Long Wall mining on surface and groundwater

From 2007 Report - see p32 Recommendations

Impacts of longwall mining on surface water and groundwater, Southern Coalfield NSW

Greg McNally and Rick Evans

Prepared by eWater CRC for
NSW Department of Environment and Climate Change

Recommendations

1. As a first step towards developing an improved water monitoring system for the Southern Coalfield, the existing fragmented one should be carefully examined. This would involve collation and analysis of information presently held by the Department of Primary Industry, the Sydney Catchment Authority, the Dams Safety Committee and the mining companies themselves, especially BHP Billiton. The aim would be present a regional view of surface and groundwater distribution, flow and quality throughout the coalfield.
2. Plan and implement an upgraded network of observation bores, water sampling points and gauging stations. Such a network would primarily be directed towards:

- Investigating surface-groundwater interaction, flow and water quality in shallow sandstone aquifers, stream beds and upland swamps.
- Providing baseline data for new or proposed mining areas up to 20 years ahead of mining.
- Providing post-mining assessments of water in and around closed mines, the extent of natural remediation and potential groundwater hazards.
- Devising consistent and cost-effective monitoring and sampling techniques for both groundwater and surface water.
- Performing numerical modelling of surface and groundwater as required.

WAG comment: WAG agrees on most of the recommendations above

In respect of providing baseline data for new or proposed mining areas and providing post mining assessments see the link below which has an embedded video of Dr Ian Wright's recent presentation to Wingecarribee Council on the impact of the closure of the Medway mine on the Wingecarribee River amongst others:

https://www.southernhiglandnews.com.au/story/4953352/report-colliery-pollutes-river-video/

Appendix 8 -Overall water quality - Hawkesbury Nepean River system -

From the most recent independent comprehensive analysis of the water quality in the Hawkesbury Nepean River system. https://researchdirect.westernsydney.edu.au/islandora/object/uws%3A36606

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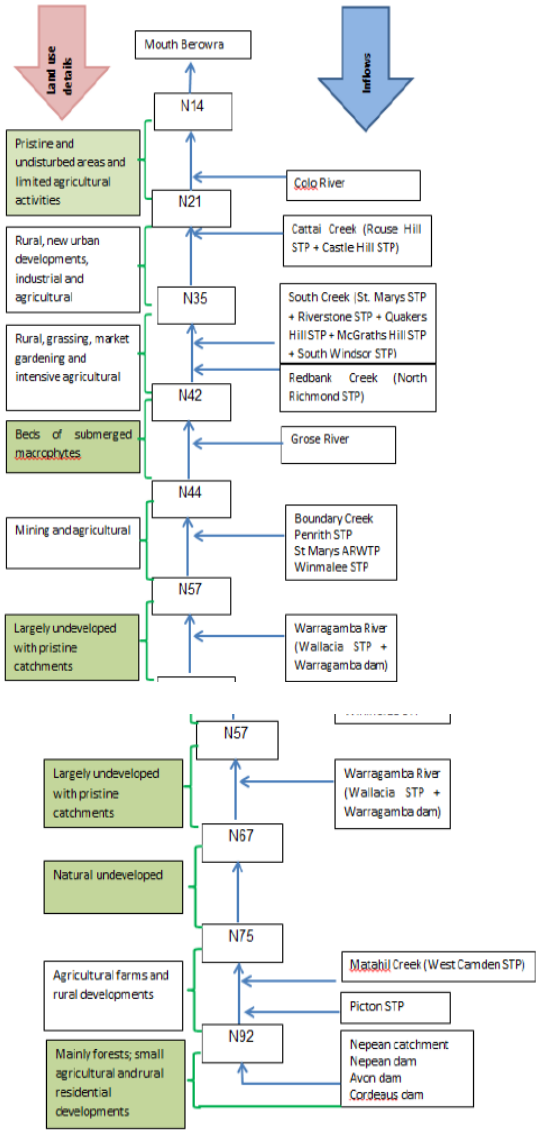

Figure 4.1. Schematic diagram of the HNRS with land use details.

WAG comment: the N92 location land use does not include mining in the Nepean Catchment area.

p.127 - Nepean River Water Quality thesis

6.6 CONCLUSION

The following conclusions can be drawn from this study.

- The concentrations of total phosphorus, nitrogen oxides and chlorophyll-a are higher than those recommended by the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines.
- An increasing trend has been detected for turbidity, chlorophyll-a, alkalinity, dissolved organic carbon, total iron, total aluminium, total manganese and reactive silicate for majority of the monitoring stations.
- Application of Canadian Water Quality Index method shows the water quality at 9 stations fall under either poor or marginal category.
- Stations N14 and N35 are found to be the most polluted stations in the HNRS among the 9 stations.
- Although an improvement in water quality can be seen at some stations at downstream of the undisturbed parts of the catchment, there has been an overall water quality deterioration in the HNRS during the last decade.
- The developed prediction equations for three important water quality parameters (chlorophyll-a, total nitrogen and total phosphorous) can be used to predict these water quality parameters for the HNRS.

WAG: The above analysis underlines the urgency of a full hydrological analysis for Wilton and the Nepean River Catchment to be undertaken.

See also

https://www.wollondillyadvertiser.com.au/story/5475205/plan-to-protect-nepean-river/?cs=12

Appendix 9 – Nepean Action Group (NAG) - Submission 2005

Finally a community action predecessor of WAG, the Nepean Action Group/ NAG made a submission to the Minister for Primary Industries on 10. 11. 05 RE: BHP BILLITON'S SUBSIDENCE MANAGEMENT PLAN APPLICATION FOR APPIN COLLIERY LONGWALLS 301A TO 302.

It is worth reading the extract below to reflect on how much or how little has changed in 13 years since the NAG submission.

Section Two. Problems with the Approval Process for Mining

Each mining development is assessed and approved one at a time. With each one that

wrecks rivers and/or creeks and/or wetlands, the catchments as a whole suffer water

loss, desiccation and degradation. For example, the Bargo and the Cataract Rivers, and their many tributaries, are in turn major tributaries of the Hawkesbury-Nepean. However, in the SMP approval process, the health and indeed the survival of the whole catchment is not taken into account. Thus the cumulative damage goes on unchecked. Who is responsible for such shortsightedness?

After the "water scare" of 1998 there were reforms in catchment management and extra funding, however the pace is too slow. The Regional Environmental Plan, "Sustaining the Catchments", has been drafted and then revised since 2000 but is still apparently only in draft form (the draft plan names mining as one threat to the catchments).

A Healthy Rivers Commission report commented in 2003: " ... it is a matter of concern that nearly four years after its commencement the second public exhibition of the Regional Plan is still awaited and a number of government decisions to advance this process are still pending."

This is still the case two years later.

The Sydney Catchment Authority at present seems not to have the funding or staffing or legislative powers to adequately protect and monitor the catchment areas. Appin 3 lies within one of the SCA's Special Areas, which are defined as environmentally sensitive and in need of special protection. The Upper Cataract acts as a channel taking water from the Cataract dam to be pumped to Sydney and Macarthur from Broughton Pass. This water needs to be protected from every kind of pollution or contamination. Accordingly SCA signage in the area, on padlocked gates, threatens trespassers with a fine of $11000. But the SCA seems powerless to protect the area from a destructive mine development, a million times worse than the occasional bushwalker, which is bound to pollute the river, and will certainly not have the "neutral or beneficial" effect on the water quality as called for in the draft REP.

The numerous agencies and authorities involved in catchment management and mining/development approval processes are not integrated sufficiently and in an

atmosphere of uncertainty much equivocation seems to occur. For instance, six NAG members attended a Camden meeting on 3rdOctober with representatives from the Hawkesbury Nepean Catchment Management Authority, largely in order to raise our concerns about the effects of longwall mining on rivers in our catchment.

We were informed that the HNCMA has no jurisdiction over water as such and that they were unable to support our opposition to mine damage to rivers in the catchment. Yet their home page on their web site announces that they "play a vital role in the management of one of the most important catchments in Australia." It was established in 2004, with a budget of approximately $14 million p.a. , mostly from the Commonwealth Government, to "ensure the protection and sustainable development of land, vegetation and water resources within the catchment." Its newsletter, Issue no. 3, claims it is producing a Draft Management Action Target for River Health, and a "theme team" for river health has been established. We remain confused.

There would seem to be no effective protection for this catchment. As the Healthy Rivers Commission report stated: "... in the absence of the drive to integrate around common goals, this process [of interagency discussions of planning and management] generally results in only loose co-ordination and collaboration rather than ... achieving significant progress towards 'whole-of-system' approaches to catchment and river management."

So we are not only faced with an unsatisfactory SMP/approvals process for this mining development, which takes no account of cumulative effects on the catchment as a whole, but we are also faced with a scandalously uncoordinated set of agencies and authorities which, though faced with a large scale threat to yet another river in their domain, are apparently able to do little other than run weed and rubbish removal programmes, virtuous as these may be.

The 1999 Williams Audit of the Sydney Catchment Authority comments: "Failure to support the Authority with adequate legislative powers and effective institutional arrangements is the paramount hazard facing the hydrological catchments that supply

Sydney's drinking water."

This judgment seems apt for every other agency as well, seemingly unable to carry out their charters of protection of catchments, river health, water quality, or threatened species.

(Note: The