March 2024

Institute for Energy Economics and Financial Analysis

The hidden costs of coalmines' unquenchable thirst

Water-related risks are eroding coal's profitability

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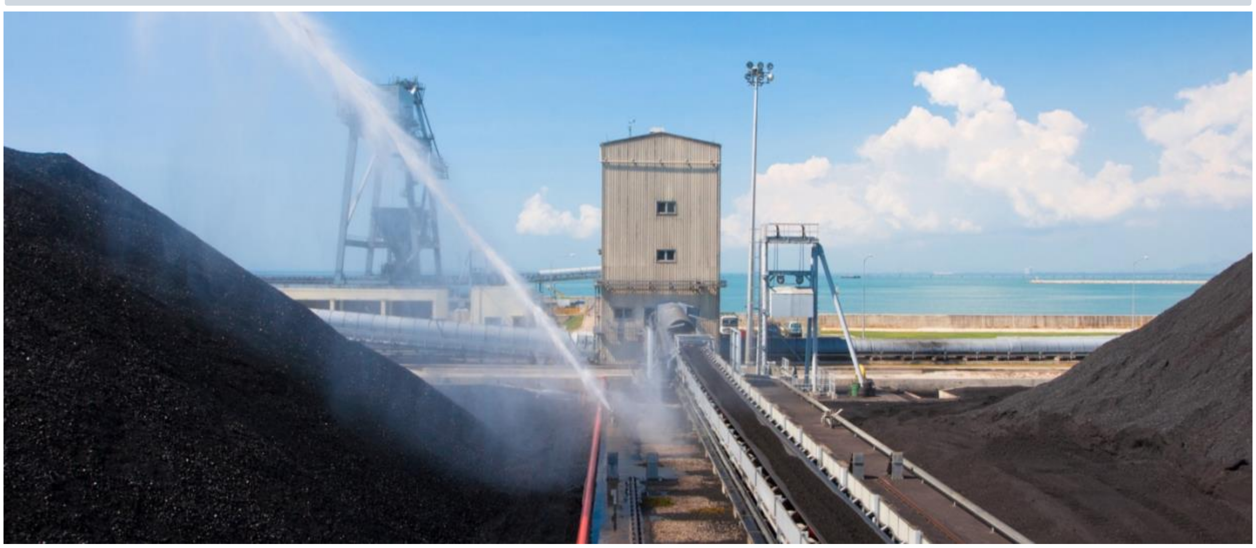
Key Findings

Australian coalminers lost more than 20 million tonnes in run-of-mine (ROM) coal production (approximately AU$5 billion in potential coal sales) across the 2022 calendar and financial years, largely due to flooding and severe weather.

Increasing scrutiny from governments on water-related issues in mining are causing delays or cancellations of mining approvals, in some cases driven by community opposition.

Coalmining consumes about 667 litres of water per tonne of coal produced – yet its total water take is unknown due to a lack of reporting, monitoring and transparency.

As water-related risks in Australian coalmining increase with the impacts of climate change, tighter regulatory frameworks and increased community opposition, the subsequent costs will become more material to investors and shareholders over time.



Definitions

Contaminated water	Water containing any physical, chemical, biological or radiological substance or matter in water.
Effluent Water	Wastewater from collection or treatment systems that are ancillary to various industries.
Freshwater	Naturally occurring water that is not salty and suitable for consumption if clean or processed. Includes rainwater and fresh water sources such as aquifers, streams, rivers and creeks.
Mine pit lake	When water enters a mine pit and ceases to be pumped out at the end of mining activities. Can occur from intentional filling of mine pits (pumping water into the pit) or unintentional filling from rainfall.
Mine Tailings	Materials left over after the process of separating the valuable fraction of ore from the uneconomic fraction(gangue). Usually, mixtures of crushed rock and processing fluids that remain after the extraction of minerals and ores.
Potable water	Water that is safe for ingestion, usually freshwater that has been treated to meet state and federal standards for drinking.
Sediment dam	A purpose-built dam designed to collect and settle sediment laden water
Surface tailings storage facilities (TSFs)	Refer to the collection and storage of mine wastes produced during the mining process.
Tailings dams	Typically, an earth embankment dam used to store byproducts of mining operations after separating ore from gangue.
Water access licence/ water licence	Refers to the licence granted by the relevant state government agency permitting water extraction from a particular water source for use permitted under that licence type. Volumetric limits apply.
Water allocation	The volume of water actually available to use or trade in a given year, includes new allocations and carryover
Water catchment	A catchment is an area of land where water collects when it rains, often bounded by hills.
Water consumption	Refers to the volume of water that is not returned to its original source after being withdrawn.
Water entitlement	Water entitlements are a permanent right to take up to a certain amount of water from a particular water source. These can include water licences.
Water make	Estimated water produced during mining, captured, or intercepted, includes unmeasurable groundwater inflows. May include runoff entering the mine or pumped into the mine for operational purposes.
Water pollution	Introducing any matter into waters which changes the physical, chemical or biological condition of the water. This includes pollutants that can fall, descend, be washed, blown or percolates into any waters such as soil that can be washed into a waterway.
Water take	Refers to the volume of water extracted
Water use	Refers to the volume of water used by

Executive Summary

Coalmining is the most water-intensive mining process in Australia. Coalmines face higher water-related risks than other mine types, and there is no viable alternative for water use in coalmine production processes. As water-related risks in Australian coalmining increase with the impacts of climate change, tighter regulatory frameworks and increased community opposition, the subsequent costs will become more material to investors and shareholders over time.

Investors need to better understand water-related risk exposure

Environmental, social and corporate governance (ESG) data screening and disclosure requirements are beginning to highlight the exposure to climate-related risks for investors, but water-related risks are frequently overlooked and underreported. These risks can no longer be overlooked. Over the past 10 years water risk factors have led to cases of stranded assets in the coal, energy, metals and mining, and oil and gas sectors.[1]

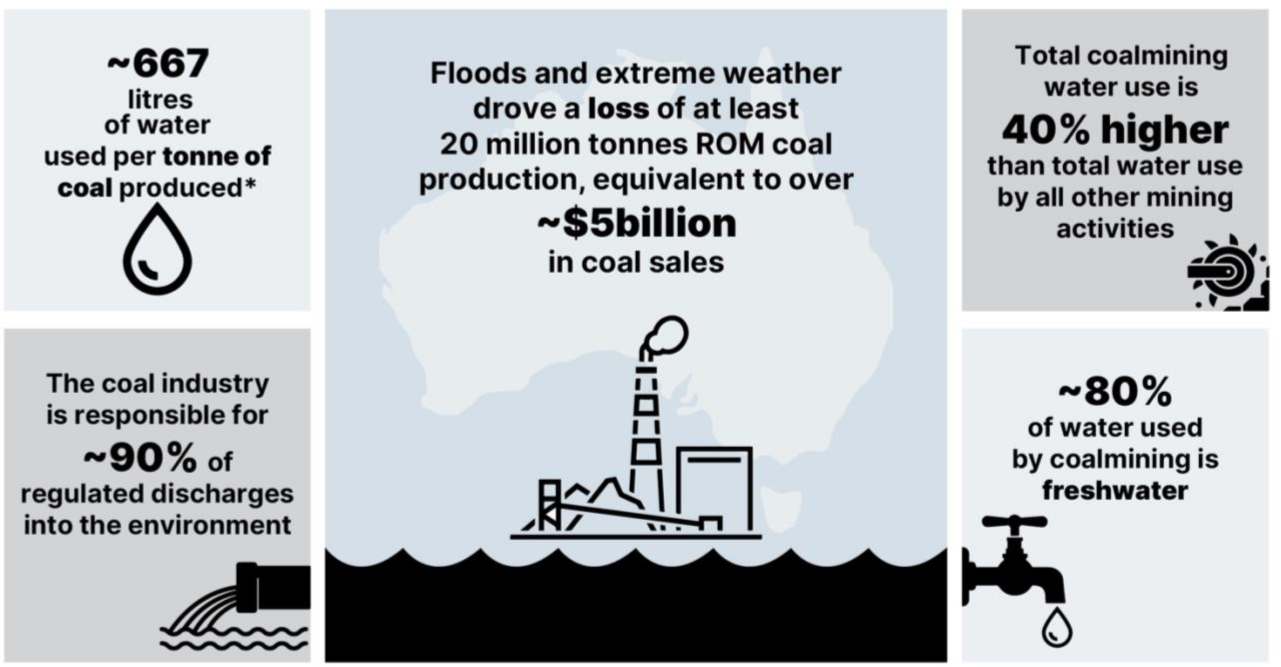
Water-related natural disasters are also the leading cause of loss of life and damages globally, making up 74% of natural disasters between 2001 to 2018.[2,3] Global losses from natural disasters in 2023 were valued at US$250 billion[4] and in 2022 US$270 billion.[5] Australian coalminers are estimated to have lost more than 20 million tonnes in run-of-mine (ROM) coal production (~AU$5 billion in potential coal sales) driven by flooding and severe weather across the 2022 calendar and financial years.

The top water-related risks in Australia are:

- Water access and increasing water costs
- Severe weather, flooding and operational disruption
- Contamination, salination and pollution
- Community opposition
- Tighter regulation and approval processes
- Rehabilitation and legacy issues

[1] Carbon Disclosure Project (CDP). High and dry, how water issues are stranding assets 2022. Page 4.
[2] World Meteorological Organization. Water. 2024.
[3] United Nations. Water-related hazards dominate list of 10 most destructive disasters. 23 July 2021.
[4] Munich RE. Record thunderstorm losses and deadly earthquakes: the natural disasters of 2023, 09 Jan 2024.
[5] Munich RE. Climate change and La Nina driving losses: the natural disaster figures for 2022, 10 Jan 2023.

Figure 1: Thirsty work – coalmining's water consumption in Australia



Sources: IEEFA analysis - Average water use per tonne of coal produced calculated from companies' annual reports; CSIRO. Water in mining and Industry. 2011. Chapter 10. Page 138 - Regulated discharges; IEEFA analysis – Calculation of ROM coal production losses and estimated costs; Overton. I (2020) The Conversation coal mining water use comparison to other mining types; Overton. I (2020) Water for Coal report, page 3 – percentage of freshwater used.

Australia is the driest inhabited continent on earth, prone to major flooding and drought events that are forecast to increase in both frequency and severity.[6] Coalmining's watering requirements cannot adapt smoothly to changes in water supply in wet and dry periods. Coalmines pose the highest risk to ecosystem service degradation, and face higher reputational water risks, flooding and water-quality risks than other mine types.[7]

Climate change is worsening drought events when they occur. Because Australian coalmines are concentrated in only a few regions, they face exacerbated risk of water shortages or substantially higher water prices during water shortages. There is evidence that water allocation prices in Australia are increasing, independent of climatic conditions, but increased instances of water scarcity and drought in the future will also drive increases in water prices for miners. Water entitlements across NSW have increased in value from more than AU$29 billion in 2021 to an estimated AU$34 billion in 2023. This is a 17% increase in just two years.[8]

Climate change is increasing the impact of flooding and severe wet weather events, which disrupt coalmine operations and the entire coal supply chain. These events are becoming the new normal in

[6] Intergovernmental Panel on Climate Change (IPCC). Sixth Assessment Report. Regional fact sheet – Australasia. 2022.
[7] World Wildlife Fund. An analysis of water risk in the mining sector. January 2020. Page 13.
[8] Marsden Jacob Associates. NSW Water Valuation Consultancy final report. 5 June 2023. Page 20.

the coalmining operating environment, and insurance for these risks is becoming harder to access and more expensive. Severe wet weather and flooding risks lead to direct costs to coalmining companies through decreasing production and increasing costs associated with contaminated water discharges. The increased frequency and severity of flooding and storms also means miners must manage higher levels of surface runoff, which must be controlled and treated, increasing water management costs. In 2011, Australia had the highest expenditure on mining-related infrastructure, accounting for 20% of the US$7.7 billion estimated spend globally.[9] Globally, water infrastructure spending by the mining sector increased by 252% from 2009-2013 while mine production increased by only 20-52% in the same period.[10]

Coalmines are subject to ongoing water-related risks associated with rehabilitation requirements. Water-related problems are the most common environmental impact when closing coalmines. Contamination risks from surface water tailings persist hundreds of years after coalmine closures – increasing rehabilitation costs and residual risks to operators, and creating intergenerational impacts on water sources for future domestic and industrial use. The real scale of mine rehabilitation risks is still unknown given that no large open-cut coalmine in Australia has completed rehabilitation and been fully relinquished.[11]

The coal industry is more likely than other mining types to incur costs from water pollution and water discharges. It is responsible for almost all (~90%) of regulated water discharges to the environment from mining activity in Australia.[12] Over the past 10 years, there have been at least 60 cases of illegal contaminated water discharges where legal action was taken or financial penalties issued to companies in Australia's coal industry, exceeding AU$7.6 million (listed in Appendix A). With stronger monitoring and enforcement, the financial consequences for these contamination events will increase over time.

There is also risk associated with the reliance on licence and work approval exemptions to access water. If government agencies tighten regulations, such as setting stricter volumetric limits on take or specifying purposes of use, mining operators would be required to source additional water for use onsite under an access licence or works approval at a higher cost.

Increasing scrutiny from governments on water-related issues in mining are causing delays or cancellations of mining approvals, in some cases driven by community opposition based on water-management concerns.[13] This is affecting development timelines for coalmine projects in Australia.

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[9] Columbia Centre on Sustainable Investment. Leveraging mining investments in water infrastructure for broad economic development: models, opportunities and challenges. March 2014. Page 5.
[10] Columbia Centre on Sustainable Investment. Leveraging mining investments in water infrastructure for broad economic development: models, opportunities and challenges. March 2014. Page 6.
[11] Australia Institute. Dark side of the boom – what we do and don't know about mines, closures and rehabilitation. April 2017. Page 2.
[12] CSIRO. Water in mining and3 Industry. 2011. Chapter 10. Page 138.
[13] Ecological Economics. The hydro-economics of mining. March 2018. Vol.145. Pages 368-379.

Overall, there is significant underreporting of water use and risks. Existing water data is commonly based on estimations using water modelling techniques that do not incorporate the impact of climate change or exclude extreme wet and dry periods.

While improving company disclosure standards on greenhouse gas (GHG) emissions is imperative for investors to understand their exposure to climate change risk, water-related risks must also be incorporated into standardised disclosure frameworks. From 2018-2022, there was an 85% increase in corporate water disclosure through the Carbon Disclosure Project (CDP), with a 16% increase in 2022 alone. Greater transparency on water use and impacts from coalmining companies is critical. In 2023, 8,477 companies were requested to disclose water data by their investors or their business customers.[14]

Overall, the trend is one of steadily increasing water-related costs for coalmines, greater scrutiny and oversight, tighter regulations and controls, and growing community opposition. This is against a backdrop of delays or cancellations of mine approvals, water licence restrictions, inflationary pressures, commodity price fluctuations, increasing rehabilitation requirements and production disruptions due to intensifying weather events caused by climate change. All of which call into question coalmines' long-term viability for operators and investors.

[14] Carbon Disclosure Project (CDP). Global Water Report. 2022. Page 6.

Introduction

Water is a vital component to almost all mining activities, with access to water critical to sustain mining production. Minerals are predominantly found due to or where water occurs, and access to secure and reliable water supply is critical to operations at all stages of the mining process.[15]

This report outlines why water-related risks are particularly stringent in Australian coalmining compared with other mining activities, and outlines how these translate into financial risks for companies and investors.

The research in this report is based on the best available information available to the author through publicly available penalty registers and companies' annual reports. However, data on water use by specific mining sites is not documented and accounted for in a standardised reporting framework, and government agencies do not report on total water take, use and consumption by industries below the generalised Australia and New Zealand Standard Industrial Classification (ANZSIC) code level. Therefore, the volumes shown in this report are likely an underestimate of the actual impacts and water use in the Australian coalmining sector.

Box 1: Lack of transparency in water accounting data in coalmining activities

Despite improvements in Australia's water accounting frameworks, detailed data on water take and use by all coalmines in Australia is not publicly available, and there is no standardised reporting framework applicable to all individual coalmining operators in Australia. This constrains the ability of researchers in this space to provide comprehensive analyses on the water-related risks of mining operations.

The water usage data referenced in this report is obtained from water balances reported in coalmining companies' annual reviews. Data on water use was not available for every coalmine in Australia, and reporting formats on mine water balances differ between companies. The data used in this report reflect water outflows or outputs reported on mines' water balances where available. Total water take and consumption is more difficult to quantify using the available data. While water take under water access licences is usually publicly available, coalmines can also take water under licence exemptions or basic landholder rights, and the actual volumes of this form of water take is rarely available. An estimate of this form of water take is sometimes generated based on water modelling for individual mine sites.

This report aims to provide a summary of financial risks to companies and investors based on the best available data to the author. Improvements in water accounting data by all mining companies and mine sites will enable improved analysis in this space in the future. Rio Tinto is the first mining company to actively disclose water usage through an interactive map on its website, which includes water allocated to each mining licence, estimates of rainfall runoff and information on historical water usage and water sources affected.[1] As governments increase water accounting reporting requirements, and more data becomes available to researchers, reporting on water-related financial risks will become more commonplace.[16]

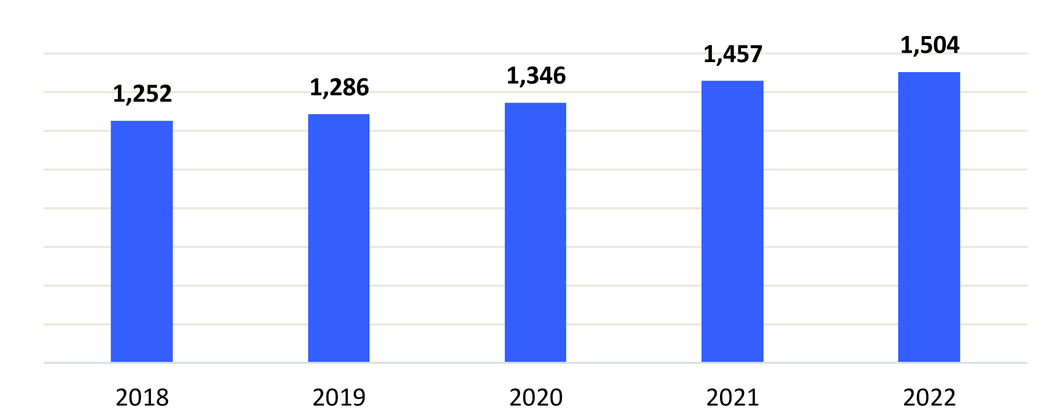
[15] Mining Environmental Management. Water for a sustainable minerals industry – A Review. 2003. Volume 11. Pages 6-10.
[16] Rio Tinto. Water Data Platform.

Mining's water use only surpassed by agriculture

Water consumption by the Australian mining industry has been increasing over the past five financial years, reaching 1,504 gigalitres (GL) in 2022, the equivalent of three Sydney Harbours. Self-extracted water use in the mining industry[17] was higher in Queensland with 181,640 megalitres (ML) in FY2021-22 financial year than in NSW with 117,343ML in the same period.[18]

While the direct water consumption by mining activities can seem relatively low compared with Australia's biggest water user – agriculture – mining activities often take place in fully allocated water catchments where competition between different users is high.

Figure 2: Water use in the Australian mining industry FY2018-2022 (GL)



Source: Australian Bureau of Statistics (2023) Water Account, Australia 2021-22

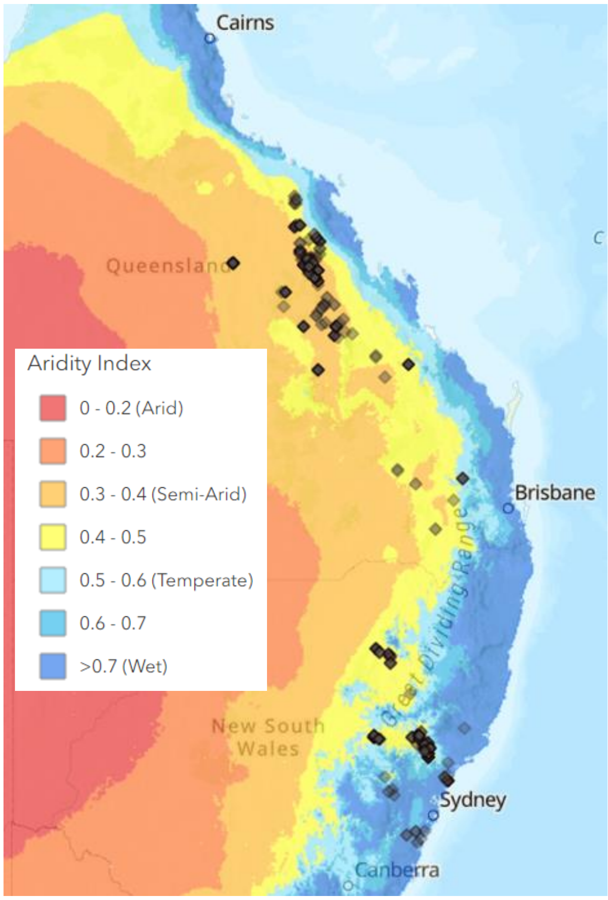
Most water used by coalmining is in semi-arid regions that experience water scarcity (Figure 3), with the main other competitors for water being agriculture and town water supplies.[19] The impacts of water use and contamination events caused by these activities is heavily concentrated in prominent coalmining regions such as the Hunter Valley, Darling Downs and Bowen Basin. These regions are also important for agricultural production, and therefore water use and discharges by coalmining can have direct impacts on other landholders and industries in these areas. Water withdrawn for coal activities in NSW and Queensland is more than double the domestic water use in these states and about 30% of the amount withdrawn for agriculture.[20]

Additionally, coalmining sometimes takes place in the same areas as coal-seam gas (CSG) activities. Competition for water between coalmining and CSG is likely to increase due to the rapid expansion of the CSG industry. For example, in the Surat Cumulative Management Area in Queensland, CSG

[17] This refers to the total water extraction reported on by division B- Mining category under the ANZSIC classification system, and does not disaggregate between total coalmining self-extracted water use with other mining types.
[18] Australian Bureau of Statistics (ABS). Water Account, Australia 2021-22. October 2023.
[19] CSIRO. Water in mining and Industry. 2011. Chapter 10. Page 135.
[20] Natural Economy/Australian Conservation Foundation. Water for Coal: Coal mining and coal-fired power generation impacts on water availability and quality in New South Wales and Queensland. April 2020. Page 3.

wells are projected to more than double from 8,600 in 2020 to about 22,000 by 2040.[21] In this area, water impacts from both CSG and coalmines are monitored on a cumulative basis by the Queensland Office of Groundwater Impact Assessment.

Figure 3: Placement of NSW and Queensland coalmines and Aridity index

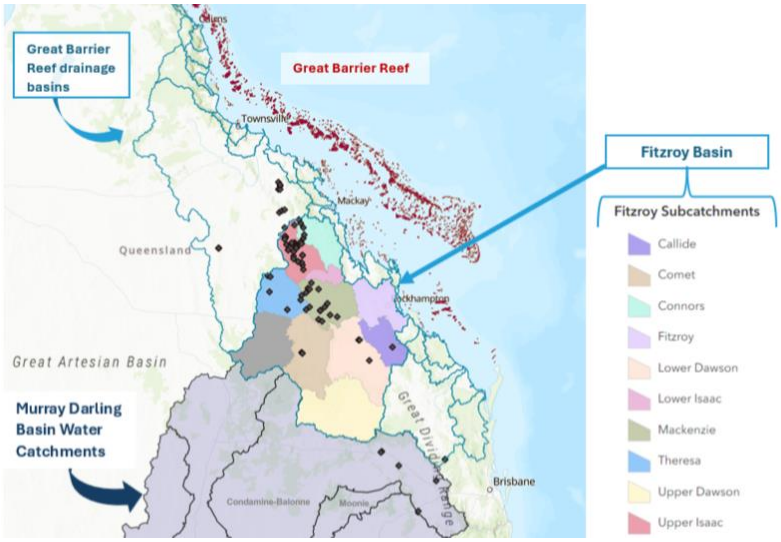


Sources: ArcGIS online Aridity index for Eastern Australia; Global Energy Monitor Operating coal mine locations Australia.

Almost all of Queensland's coalmines operate in Great Barrier Reef drainage basins (Figure 4). Only four are in the Murray Darling Basin. About 80% of Queensland's coalmines operate in the Fitzroy Basin, with the heaviest concentrations of coalmining in the Upper Isaac, Mackenzie and Connors sub-catchments.

[21] Queensland Government. Underground water impact report 2021 for the Surat Cumulative Management Area. 2021. Pages 15-16.

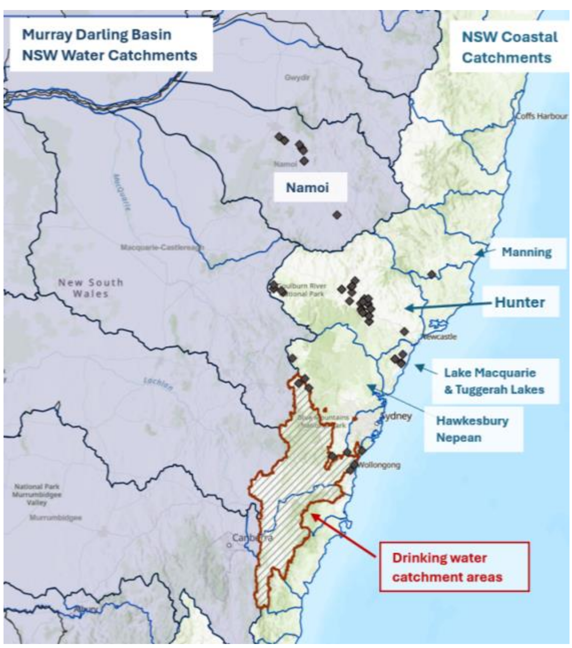
Figure 4: Coalmines in Queensland water catchments



Sources: ArcGIS online Great Barrier reef drainage basins (2023) WSS QGSP; Murray Darling Basin Authority MDBA plan regions (2023); Fitzroy Basin Authority (2019) Fitzroy Basement sub-catchments; Global Energy Monitor Operating coal mine locations Australia.

The majority of NSW coalmines are in the Hunter region, followed by the Namoi catchment area. There are coalmines active within or bordering Sydney's drinking water catchments (Figure 5).

Figure 5: Coalmines in NSW water catchments



Sources: ArcGIS online, Murray Darling Basin Authority MDBA plan regions (2023); WaterNSW (2018) Drinking water catchments; Global Energy Monitor Operating coal mine locations Australia.

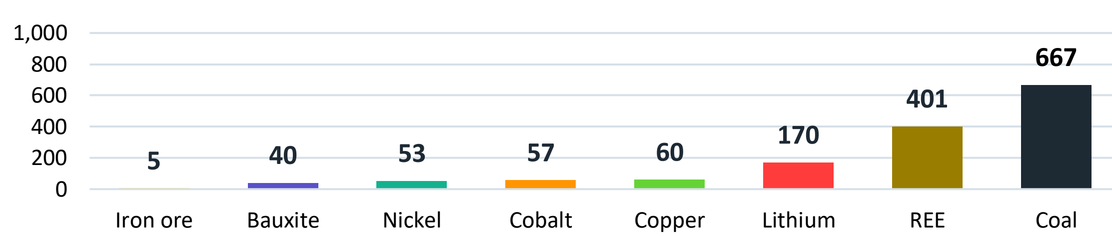
Figure 6: Coalmines in or near NSW drinking water catchments

Sources: ArcGIS online, WaterNSW (2018) Drinking water catchments; Global Energy Monitor Operating coal mine locations Australia.

Coal uses more water than all other mining activities

While water is a required input for almost all mining activities, coalmining is the most water-intensive mining activity in Australia.

Figure 7: Australian mining's average water requirements (m3/tonne)



Note: REE = Rare earth elements
Sources: Iron ore - Leong, Y. K. (2021); Bauxite - Williams, D. J. (2011); Nickel, Cobalt and Copper – Northey & Haque (2013); Lithium - Williams, C. A (2022); REE - Golroudbary, S. R et al (2022); Coal - Authors calculation based on average of mines' annual reports stated water use

Coal production reliant on secure water supply

Water is required for separating minerals from waste, dust suppression, cleaning mine equipment, for drinking water and onsite facilities.[22] There is no viable alternative. Unlike other mining, where some of the high water requirements are due to the energy intensity of their mining processes, and replacing the source of energy generation can significantly decrease a mine's water footprint, coalmines will continue to require large volumes of water in coal handling and preparation plants and for mandatory use in dust suppression. Coalmine operators are aware of the high water-use requirements of their operations, and have made strides to increase water efficiency.

> **Coalmine water requirements do not decrease when water becomes scarce. Instead they either remain constant or increase.**

Coalmine water requirements do not decrease when water becomes scarce. Instead, they either remain constant or increase during periods of extreme water shortages. Coalmine's adaptive capacities depend on their water storages, capacity to treat and recycle water and dust-suppression requirements. Coalmine production can be severely disrupted without consistent and sufficient access to water, meaning water demand from coalmining is relatively inelastic.

While coalmining operators in Australia have invested in water recycling and reuse on site, most water used by coalmining in Australia is freshwater. A 2020 study of water use in coal mining in Australia found that ~80% was freshwater captured from rainfall and runoff or extracted from surface or groundwater sources.[23] The remaining 20% usually came from tailings (mine residue), recycled water or seepage from mines.

The relationship between water use and run-of-mine (ROM) coal production is plotted in Figure 8. Large open-cut coalmines tend to have the greatest total water use. With Australian open-cut coalmine operations expanding, as shown in previous research by IEEFA,[24] this will likely translate into higher water requirements, and increase the water infrastructure requirements at these operations. The security of water storage on these sites is critical. There were at least 60 instances of illegal contaminated water discharges from coalmines and coal-fired power stations into the environment and nearby water sources from 2013-2023 in Australia.

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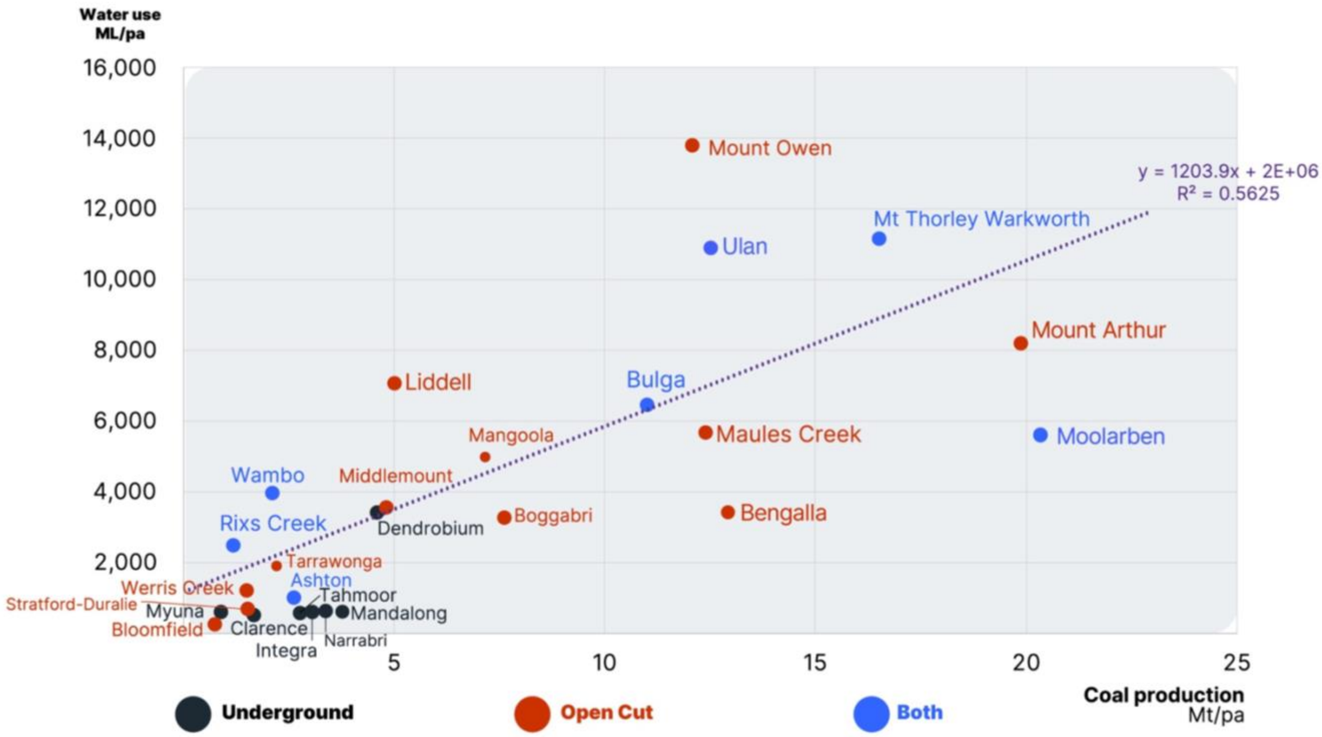
[22] Queensland Government. Underground water impact report 2021 for the Surat Cumulative Management Area. 2021. Pages 15-16.
[23] Natural Economy/Australian Conservation Foundation. Water for Coal: Coal mining and coal-fired power generation impacts on water availability and quality in New South Wales and Queensland. April 2020. Page 3.
[24] IEEFA. Why Australia's Coal mines are getting bigger. 22 November 2023.

Figure 8: Water use and ROM coal production (2021)



Sources: Company annual reports 2021, IEEFA.

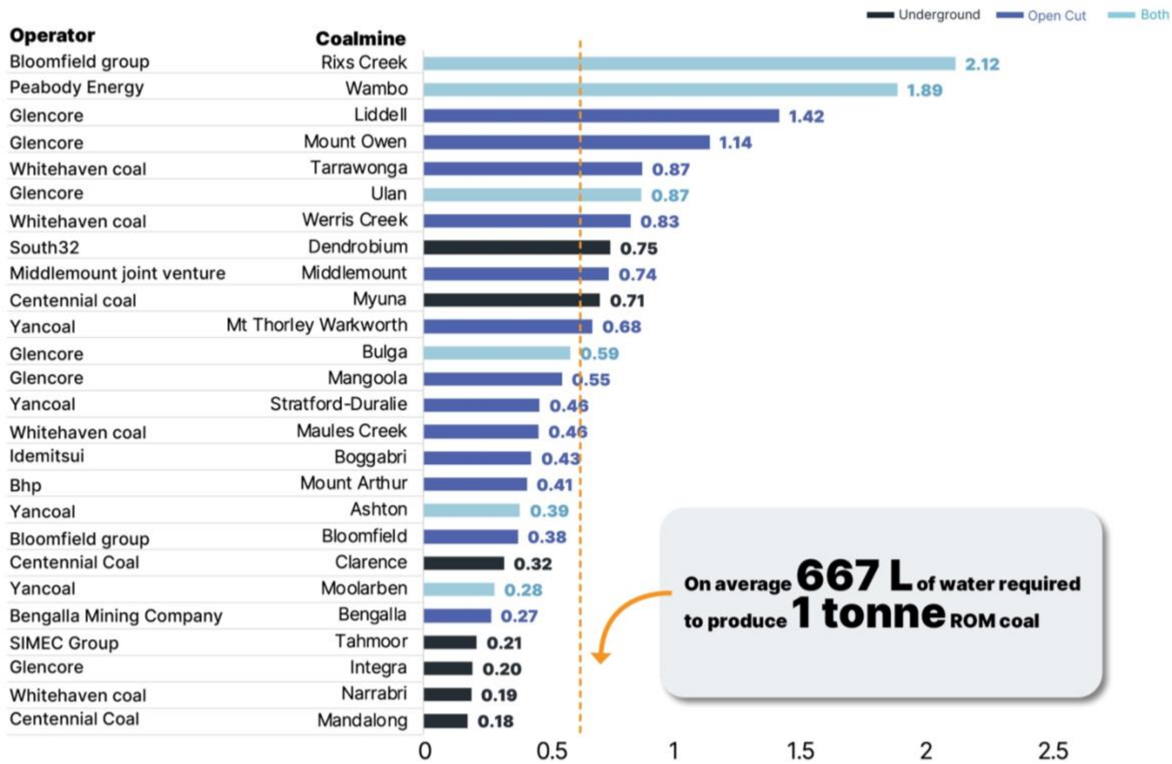
Coalmining requires large volumes of water

Water use per coalmine differs vastly depending on a range of factors (Figure 9). Ratios of water use for each activity varies depending on the mine's production capacity, location, type and quality of coal mined, stage of life and size of workforce.

The major water uses are:

1. Coal handling and preparation
2. Dust suppression
3. Evaporation
4. Potable water for onsite facilities
5. Vehicle washing and cleaning equipment
6. Cooling equipment
7. Irrigation for rehabilitation

Figure 9: Water use per tonne of coal produced (m3)



Sources: Company annual reports 2021, IEEFA.
Note: Water use, m3 – water used to produce 1 tonne of ROM coal

In general, coal handling and preparation plants (CHPP) consume the most water onsite when processing coal after it is mined.[25] It must be noted that some mines use plants on neighbouring mines, and so would report less water use on their site balance.

The second largest water use, and in some cases the highest use, is for dust suppression. Dust suppression is mandatory for coalmining activities. Failure to comply with relevant regulations can result in financial penalties under the Coal Mining Safety and Health Act 1999[26] in Queensland, and in NSW under the Environmental Planning and Assessment Act 1979,[27] the Mining Act 1992[28] and the Protection of the Environment Operations Act 1997.[29] Therefore, while coalmines can invest in more water recycling to increase reticulated water for dust suppression purposes and increase water efficiency, water use required for dust suppression remains a mandatory fixed input to their operations. These requirements are typically higher for open-cut mines than underground operations. Compared with global coalmining, Australia has a preference for open-cut mining. This

[25] Multotec. Coal processing.
[26] Queensland Government. Coal Mining Safety and Health Act 1999. December 2023.
[27] NSW Government. Environmental Planning and Assessment Act 1979. January 2024.
[28] NSW Government. Mining Act 1992. October 2023.
[29] NSW Government. Protection of the Environment Operations Act 1997. October 2023.

drives increased water consumption for dust suppression activities, with mining processes such as blasting, mining, hauling and crushing taking place in the open air. The impacts of climate change on the increasing frequency and intensity of heatwaves and higher average temperatures mean dust suppression requirements are likely to increase over time, as the amount of coal dust increases in hot and dry conditions.

Water is also required for washing and cleaning mining equipment and vehicles. Underground coalmines also require water to reduce fire hazards and explosions, to cool cutting surfaces of mining equipment and to prevent coal dust igniting.[30] There are constraints on the ability for coalmines to use non-freshwater sources for this purpose, with underground mines using freshwater to minimise corrosion of underground equipment and for miners' health and safety.[31]

Smaller ongoing uses include potable water requirements for domestic use by workers onsite or in accommodation onsite. These water uses usually require a potable water supply agreement.

Water is also lost from mine sites through evaporation, meaning mines must carefully manage water take and use. Because freshwater is of higher value to mining companies, the water infrastructure used to store it is less susceptible to evaporation and uncontrolled discharges. Dirty water sediment dams or mine tailings dams are more likely to lead to uncontrolled discharges because these storage dams are usually less secure with lower dam walls. This means it is more likely that uncontrolled discharges from coalmine sites contain mine waste, other contaminates or are highly saline.

Water-related risks in coalmining

Risks higher for coal than other mine types

Sixty-nine percent of listed equities, reported via CDP, stated that they are exposed to water risks that could generate a substantive change in their business. The potential value of these risks was valued at US$225 billion.[32] A 2020 analysis of water-related risks in global mining operations found that coalmines posed the highest risk to ecosystem service degradation compared with other mine types. Coalmines also faced higher reputational water risks, flooding and water quality risks than other mine types.[33]

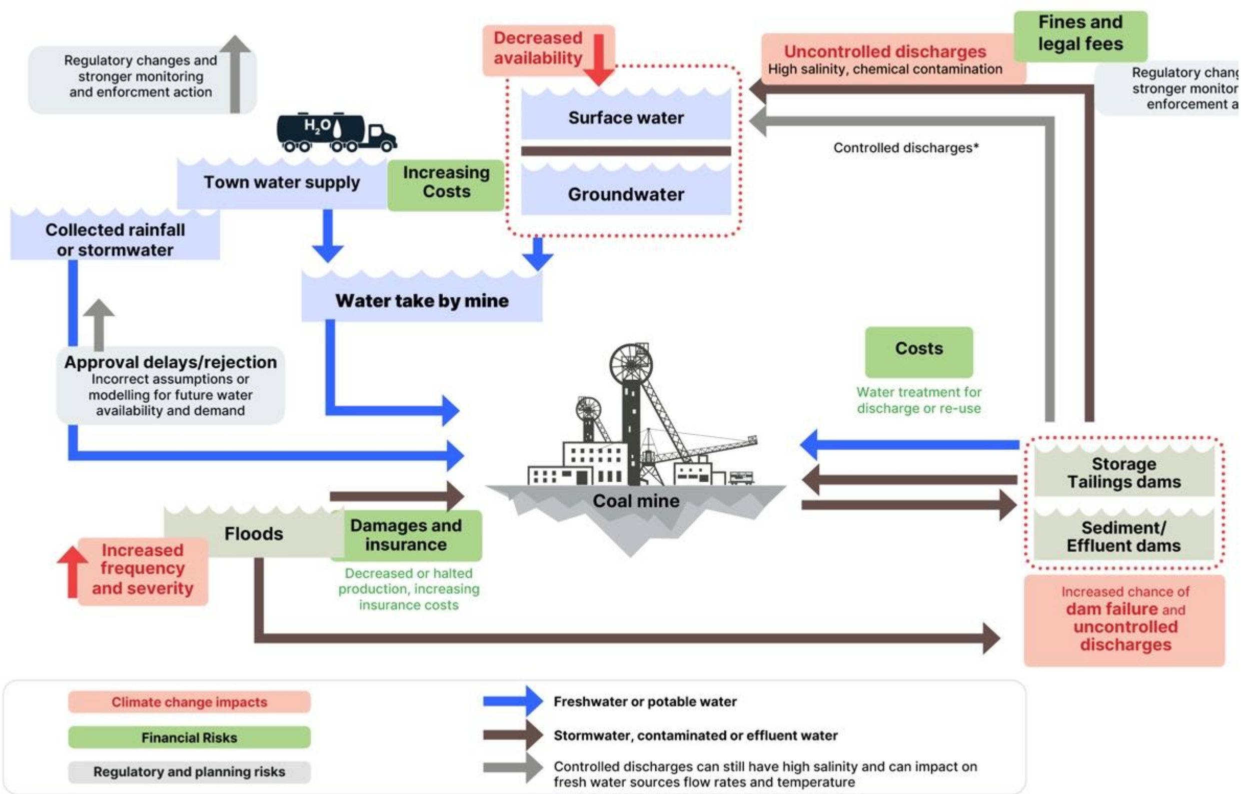
There are multiple dimensions of water-related financial risks to coalmining operators and investors that are likely to increase over time with the impacts of climate change.

[30] US Department of Energy. Water Use in Industries of the Future: Mining Industry. July 2003. Page 51.
[31] Environmental Modelling and Software. Systems modelling for effective mine water management. December 2010. Vol. 25 (12). Pages 1664-71.
[32] Carbon Disclosure Project (CDP). High and dry: How water issues are stranding assets 2022. Page 4.
[33] World Wildlife Fund. An analysis of water risk in the mining sector. 2020. Page 12.

Mining operators in Australia face significant costs and damages caused by flooding and increased intensity of rainfall events and significantly higher water costs during droughts. Both are increasing in severity and frequency due to climate change.[34] Coalmines are also subject to ongoing water-related risks associated with mine rehabilitation requirements. Increasing scrutiny from governments on water-related issues in mining are causing delays or cancellations of mining approvals, in some cases driven by community opposition to projects based on water management concerns.[35] Additionally, a tighter regulatory landscape could increase the financial consequences incurred by mining companies for the frequent water pollution and environmental disasters caused by contaminated water discharges from mine sites.

This uncertainty could be better addressed by mining companies including potential financial risks and the likelihood of these events occurring in their medium- and long-term hydrologic projections.[36]

Figure 12: Water-related financial risks in coalmining



Source: IEEFA

[34] Global Water Monitor. 2023 Summary Report. Page 10. 2024.
[35] Ecological Economics. The hydro-economics of mining. March 2018. Vol.145. Pages 368-379.
[36] Ibid.

Investment in water infrastructure critical

Coalmines face the challenge of maintaining critical water supplies while minimising excess water as either can incur costs to operators. Water shortages and excess water can both decrease mine production, transforming water into a liability rather than an asset.

Coalminers incur costs associated with managing excess water because this can result in flooding and disruption to production and transport as well as increase the risk of contaminated water discharges. Coalmines require continuous investment in upgrading and installing water infrastructure onsite to increase storage capacity, improve water efficiency and to reduce risks of unintentional spillages or seepage of contaminated water. Mine operators respond to these risks by increasing capital expenditure on water infrastructure and securing dams onsite, such as installing remote monitoring systems and upgrading dams by increasing wall heights and drainage works.

A 2014 study by Global Water Intelligence found that water infrastructure spending to improve access and efficient water use increased by 252% between 2009-2013, while mine production increased only between 20-52% in the same period.[37]

Water access

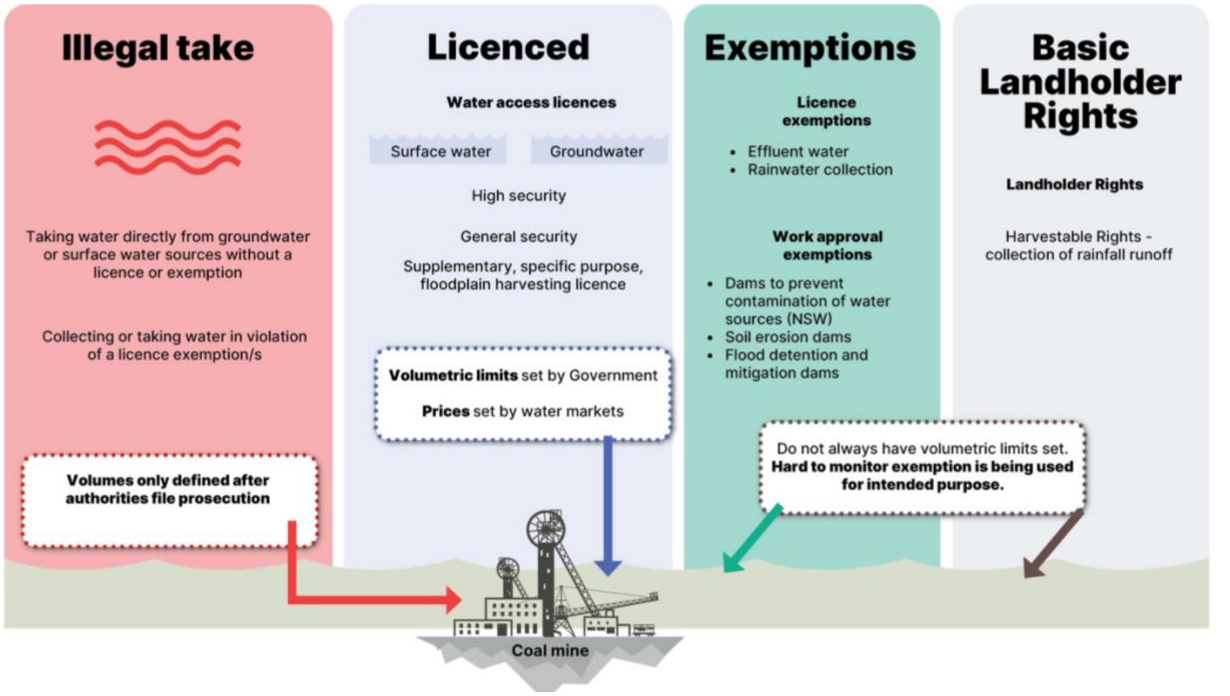
Coalmine operators in Australia can access and use water legally through a water access licence or licence exemption and through basic landholder rights for specific purposes. Some coalmining companies have accessed water resources for less than market price or for free through regulatory exemptions.[38] Data on the total proportion of water take under licence and work approval exemptions by coalmining activities in Australia is not available. However, this may be a significant form of water take by coalmining. If the reliance on these exemptions for a mine site is high, this places significant risks to the operators if there is any change in government regulation or if enforcement and monitoring increase.

Most mines also require a pipeline connection and a long-term water supply agreement. This can be cheaper than trucking in water, but it can also tie miners to long-term financial "take or pay" commitments for water supply. About 15% of raw water supply was sourced from commercial suppliers through take or pay contracts in 16 mines analysed in Queensland's Bowen Basin.[39] However, these contracts are inflexible to supply and demand fluctuations. This means buyers assume the majority of risk as they pay for a fixed quantity of water over a fixed term, independent of water storage levels during wet and dry periods. In Queensland, SunWater supplies more than 40%

[37] Columbia Centre on Sustainable Investment. Leveraging mining investments in water infrastructure for broad economic development: models, opportunities and challenges. March 2014. Page 6.
[38] The Sydney Morning Herald. 'Barbaric': Adani's giant coal mine granted unlimited water licence for 60 years. 5 April 2017.
[39] International Water Centre, Australia. Assessing the Impact of Take or Pay Water Contracts in the Mining Sector using IWM Principles – A Queensland Perspective. January 2017. Page 27.

of the state's commercial water and is a major supplier to BHP, Glencore, Anglo Coal and MacArthur Coal, with many of these contracts on take or pay agreements.[40]

Figure 10: How coalmines access water in Australia



Source: IEEFA analysis

Understanding the water licence categories held by coalmines

Coalmines usually have a combination of high security and general security access licences to take water from surface and underground sources. Mining companies often also need to hold a relevant water access licence to take or interfere with water that would otherwise flow or seep into freshwater sources. They can also hold supplementary water access licences or specific purpose access licences, and in some cases can connect to town water supplies for potable water onsite.

Drought or periods of water scarcity affect water availability for coalmines depending on the composition of entitlements held and their water storage infrastructure capacities to capture, treat and reuse rainfall, main tailings or effluent water.

Water access licences and entitlements each have a specified maximum take for a year, which changes year on year depending on water availability in the licensed water source. This means that the same water access licence or entitlement may grant a user a 100% allocation of 50ML from a

[40] International Water Centre, Australia. Assessing the Impact of Take or Pay Water Contracts in the Mining Sector using IWM Principles – A Queensland Perspective. January 2017. Page 27.

specific ground or surface water source one year and a 50% allocation of 25ML the next. Allocations given at the start of the water year that are below 100% can potentially increase if sufficient water becomes available. High security access licences have priority over general security access licences, meaning that in drier years general security licence holders are more likely to receive a low or zero allocation. Consequently, high security access licences carry higher costs, but in concentrated mining and agricultural areas there can also be shortages of high security entitlements.

For example, the NSW Greater Hunter Regional Water Strategy highlighted that, "demand for water access for mining outstripped the availability of high security access rights. As a result, the majority of mines in the upper catchment have developed with general security access licences. This means there is a significant risk that these mines will not have enough allocation available during drought periods and mine operations and output will be constrained and/or deferred."[41]

Box 2: Assigning priority between water users in NSW

Town water supplies: Opening allocations for domestic, stock and town water supply are generally 100% unless conditions are very dry with low water in storage.

High security access licences: Full or near full high security allocations are made at the start of all but the very dry years, and conveyance allocation is made commensurate with other allocations. This means that the operation of high security water delivery will align with a reduced conveyance allocation.

General security access licences: General security licences are the last to receive allocations, and are therefore the least secure licence category. They can start the year with low or zero allocation, and typically receive incremental improvement as the year unfolds commensurate with rainfall and runoff. General security licences are the most susceptible to seasonal climatic variations.[42,43]

Water use by the mining industry in Australia can also be regulated separately from the water entitlement system or water supply utilities that provide water for other users.[44]

Coalmine granted unlimited water until 2077

The Queensland government granted an unlimited 60-year water licence to the Carmichael mine in the Galilee Basin. According to the mine's supplementary environmental impact statement, it is likely to draw 26ML of water a day as it ramps up production,[45] which would equate to 9.49GL of water

[41] NSW Department of Planning, Industry and Environment (DPIE). Greater Hunter regional water strategy: Securing the future water needs of the Hunter, Central Coast and Mid-Coast areas. 2018. Page 56.
[42] NSW DPIE. How water is allocated. 2024.
[43] Conveyance allocation refers to allocation for water required primarily to operate regulated rivers and utility supply networks to enable the delivery of water.
[44] CSIRO. Water in mining and Industry. 2011. Chapter 10. Page 137.
[45] Adani Mining. Carmichael Coal mine and rail project SEIS. 13 November 2013. Vol. 4, Appendix K1. Mine Hydrogeology Report. Page 101.

inflows each year.[46] Landholder rights and exemptions for water licences and works approvals don't always have volumetric limits set.

Coalminers can utilise a large range of water access licence exemptions or landholder rights. These allow mines and other users to take water legally without a water access licence, but in most instances this form of water take is not reported publicly. While water access licences have defined volumes, not all licence exemptions or landholder rights do. Therefore, it is not possible to report accurately the volume of water taken by coalmines annually under licence and work approval exemptions. Additionally, accurate monitoring of the use of water access licence and work approval exemptions is difficult due to the remote location of many mines and resourcing capabilities of government departments. This means regular monitoring of water take by individual users under licence exemptions can be exceptionally difficult.

Collecting and using water without a licence

Coalmines require a relevant works approval or works approval exemption to build infrastructure to take or pump water to site for use (such as to construct and use a bore to access groundwater or to install a pump to take water from a regulated river) or to store water, such as a rainwater tank or dam. These work approvals will usually have volumetric estimates or limits set on the amount of water that can be captured and, in some cases, will specify the purposes for which the water can be used. However, coalmines can also build dams that are exempt from a works approval. In NSW, these include dams to prevent contamination of a water source, soil erosion dams, flood detention and mitigation dams, and environmental management dams. A common works approval exemption utilised by coalmining companies are "dams to prevent contamination of a water source" in NSW, allowing the capture and use of clean and effluent water. The captured water can be used for any purpose, provided it does not contaminate a water source, and there are generally no volumetric limits or reporting requirements imposed on this form of water take and use.[47]

Additionally, in NSW, mines can capture and use rainfall collected under harvestable rights. This allows landholders (owners or occupiers) to capture and store a proportion of the rainfall runoff from their landholding in one or more harvestable rights dams without a water access licence, water supply work approval or water use approval.[48] The proportion of rainfall runoff that can be collected depends on the location but is generally 10% of the average annual regional rainfall. This water may be captured and used for any purpose. At the Mount Thorley Warkworth mine, Yancoal reported that rainfall runoff was the largest input to the site's water balance in 2021, with the mine capturing 10,014ML of rainfall runoff from developed, disturbed and mining catchments.[49]

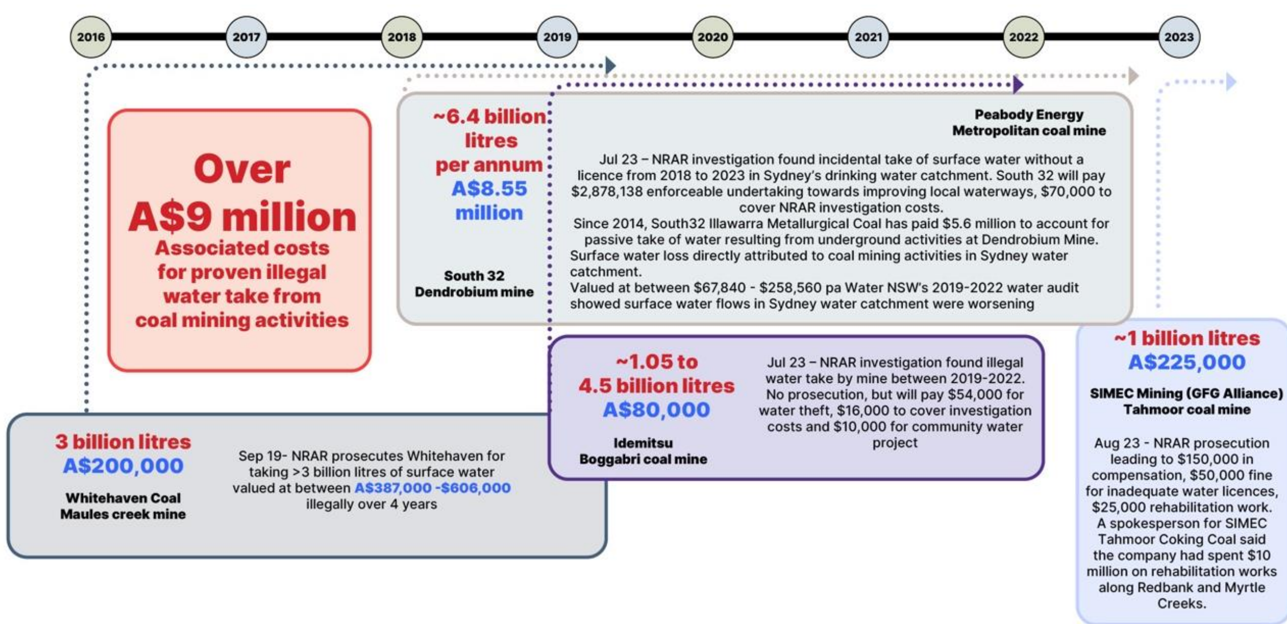
46 Adani Mining. Carmichael Coal Mine and Rail Project SEIS. 13 November 2013. Vol. 2. Page 5.
47 NSW DPIE. Fact sheet Interpreting excluded works dams. 2023. Pages 1-2.
48 NSW DPIE. Harvestable Rights. September 2023.
49 Yancoal. Mt Thorley Warkworth annual report 2022. Page 53.

These work approval exemptions allow coalmining operators to capture and use large volumes of water onsite, and these volumes are almost never reported on publicly. There is significant risk associated with the reliance on these exemptions. If government agencies tighten regulation in this space, such as setting volumetric limits on take or specifying purposes of use, mine operators would be required to source additional water at a higher cost for use onsite under an access licence. Additionally, if water-related disclosure standards were mandated, coalmines would be required to report how much water they capture and use under these exemptions, which may instigate greater scrutiny by government regulatory bodies.

Coalmines' illegal water take exceeds 12 gigalitres

There have been multiple instances of coalmines taking water illegally without a licence exemption or above the amount permitted by their licence allocations or for unauthorised purposes. This includes Whitehaven Coal's Maules Creek mine, Idemitsu's Boggabri mine, SIMEC's Tahmoor mine and South32's Dendrobium. This has cost coalminers at least AU$9 million in fines, legal fees, compensation payments and enforceable undertakings,[50] and rehabilitation costs. These occurrences also damage a mine's reputation, and can have indirect impacts such as higher scrutiny paid by government agencies to future applications, and increased community opposition.

Figure 11: Costs of illegal water take for Australian coalminers (2016-23)



Source: IEEFA

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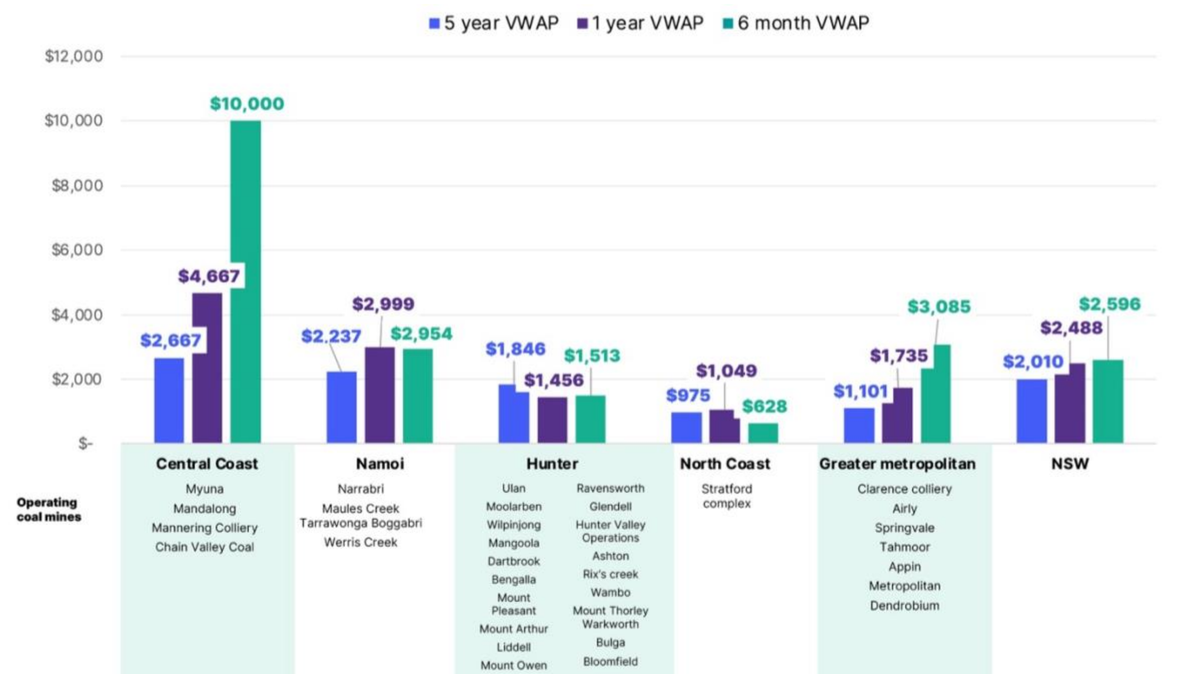
[50] Enforceable Undertakings are a tool the EPA can use as an alternative to prosecution. Through an enforceable undertaking, the EPA may secure outcomes such as environmental restoration measures or contributions to environmental projects. The undertaking is enforceable by the Land and Environment Court.

Surge in water costs

Water is a fixed input for coalmining operations, but its cost is volatile to changing climatic conditions and demand from other users. There is evidence that the prices of water entitlements are increasing over time in NSW and Queensland. In late 2023, the Natural Resources and Access Regulator for NSW (NRAR) commissioned its second report on the value of water entitlements in the state. It showed that water entitlements across NSW had increased in value from more than AU$29 billion in 2021 to an estimated AU$34 billion in 2023. This is a 17% increase in just two years.[51]

In FY2022-23 the NSW six-month volume weighted average price (VWAP) of tradeable entitlements was about AU$2,596/ML, an increase from the five-year VWAP of AU$2,010/ML.[52] The increase was significantly higher in some regions, such as the Central Coast management area (Figure 16).

Figure 12: Volume-weighted average prices (VWAP) by water sharing plan region



Sources: Marsden Jacobs Associates (2023); IEEFA
Note: These VWAPs include average prices for high, general and other categories of entitlement trades.

Assessing the average prices paid per ML sheds light on the overall trend of increasing costs of water. However, these trades often downplay the significantly high costs incurred for any high security/reliability entitlement, which are worth significantly more. High security/reliability entitlements are rarely traded due to the high water allocations guaranteed to these entitlement

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[51] Marsden Jacob Associates. NSW Water Valuation Consultancy final report. 5 June 2023. Page 20.
[52] Ibid. Page 19.

types even in dry years. Most high security/reliability entitlements are owned by mining or utility companies. For example, in Queensland's Fitzroy Basin, where about 80% of Queensland coalmines operate, the average price of high priority allocation trades increased from AU$2,500/ML in 1998 to AU$7,500/ML in 2005.[53] More recent data from the Bureau of Meteorology shows buyers paying hundreds of thousands of dollars per ML to secure high reliability entitlements.[54]

Water scarcity leads to higher access costs

Periods of drought and water scarcity can translate into financial impacts for coalmines by increasing or decreasing water availability in water markets and changes in the price and volumes of allocations under water access licences. As outlined in the previous section, the amount of water a user can take under a water access licence varies year to year depending on water availability. Mines operating in regions with high water-stress require considerable investment in water-efficient processes, reduction of water losses and investigating alternative water sources.

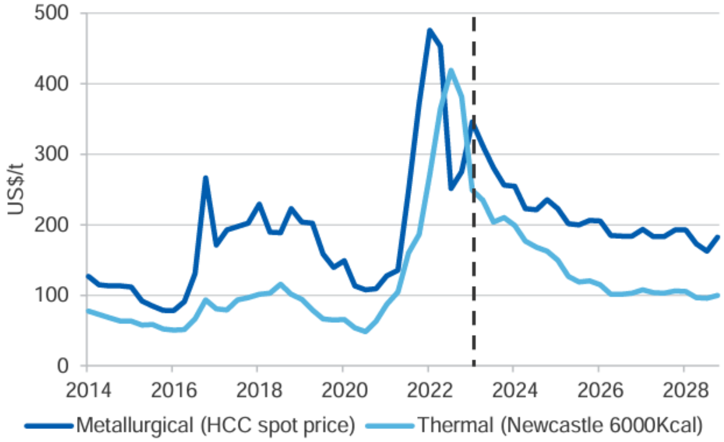
Mining activities themselves can also exacerbate water stress during periods of drought and water shortages. The Commonwealth Government's Hunter Bioregional Assessment[55] in the Upper Hunter area was identified as being "very likely" to experience significant drops in groundwater levels and significant shortfalls of water (up to 12GL) in the Hunter River as a direct result of mining activity.[56]

> **Water-related costs are more acute when commodity prices fall, and are compounded by other inflationary pressures.**

Water-related costs are more acute when commodity prices fall, and are compounded by other inflationary pressures. Like any other input, the costs coalmining companies must pay to access water become more of a risk when the prices paid for thermal and metallurgical coal decrease.[57] While coalmining companies have benefitted from the short-term commodity price spikes in the two years since Russia's invasion of Ukraine, prices are already stabilising, and are forecast to continue to decline through to 2027-28 (Figure 13).[58] Combined with the likelihood of water cost increases over time, this places greater risk on coalmining companies' underlying cash balance, which is compounded by other cost inflation pressures, as highlighted previously by IEEFA. These include: higher diesel and explosives prices; higher port fees and royalty rates; and labour shortages leading to increased labour costs.[59]

[53] Cooperative Research Centre for Irrigation Futures. Informing reform: Scoping the affects, effects and effectiveness of high-level water policy reforms on irrigation investment and practice in four irrigation areas. 2006. Page 33.
[54] Bureau of Meteorology. Water information dashboard. National water market summary. March 2024.
[55] Australian Government. Bioregional Assessments. Hunter subregion. July 2018.
[56] Australian Government. Bioregional assessments. Hunter subregion. Fact sheet. December 2018.
[57] Global Water Intelligence. Water for Mining. 2011. Page 9.
[58] Department of Industry, Science and Resources (DISR). Resources and energy quarterly. March 2023. Page 69.
[59] IEEFA. Rising Costs to impact Australian coal miners' margins sooner than expected. 13 December 2023.

Figure 13: Metallurgical and thermal coal price forecasts, FY2013-2028



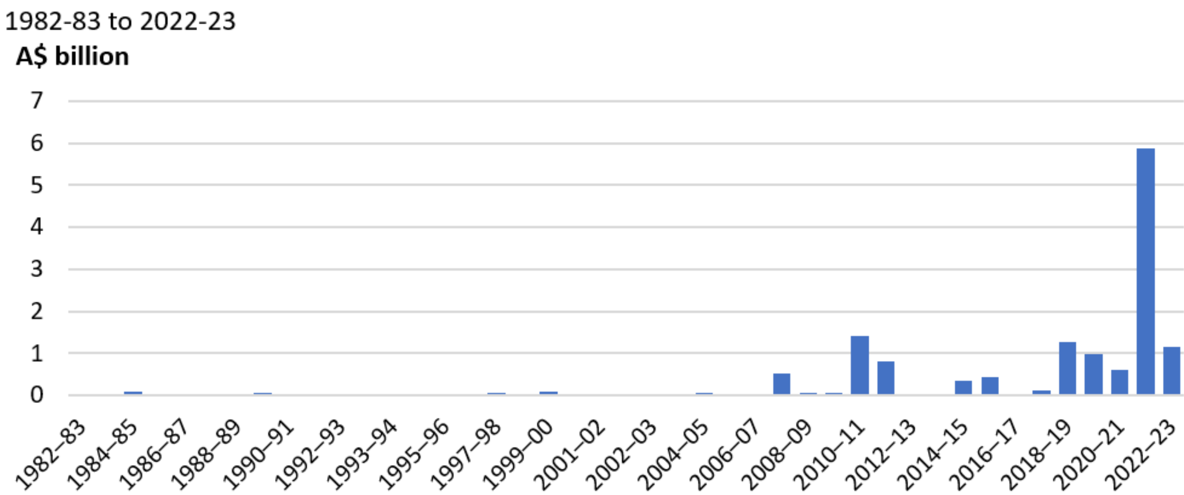
Note: Taken from Department of Industry, Science and Resources and Energy Quarterly forecasts March (2023).
Source: McCloskey (2023)

Severe weather, flooding and operational disruption

Wide-scale flooding and severe rainfall events can be expected to occur more frequently and more severely – significantly increasing unit costs for coalminers. Severe wet weather and flooding risks lead to direct costs to coalmining companies through decreasing production and increasing insurance costs, and contaminated water discharges. Flooding in south-eastern Australia in February, March and October 2022 was the second most costly natural disaster in the world that year, international reinsurer Munich RE reported. The losses were US$8.1 billion, of which US$4.7 billion was insured.[60] The increased financial risks associated with flooding are also shown in the Australian Treasury's Intergenerational Report 2023[61] where a spike in insurance losses caused by flooding is evident in FY2021-22.

[60] Munich RE. Climate change and La Niña driving losses: the natural disaster figures for 2022. January 2023.
[61] Australian Government. Intergenerational Report. 2023.

Figure 14: Insurance losses caused by flooding in Australia



Source: Australian Treasury; Insurance Council of Australia, Historical Catastrophere Data (2023); IEEFA
Note: This graph represents only insurance losses. Changes to insurance payout ratios, policy coverage and rates of insurance coverage also contribute to total insurance losses independent of natural disaster losses.

In coalminers' annual reporting for the 2022 calendar and financial years, many companies reported decreased production largely attributable to the increased intensity of rainfall events and flooding. IEEFA's independent analysis of Australia's largest coalmining companies' reported production found there was an estimated loss of about 20 million tonnes of production in that period, which equates to over AU$5 billion in lost coal sales, based on conservative estimates.

Significant impacts are also felt along the coal supply chain during these events, slowing rail and port activities. Flood hazards include road closures both to mine sites and on haulage routes, damaged infrastructure and equipment, and coal supply chain disruptions (ports and rail). While some mining companies have strategies in place to minimise the effects of flooding, this requires increased expenditure. Whitehaven Coal has employed strategies such as "transporting reduced shifts of employees to site via helicopter when roads are closed, and contracting additional haulage capacity when haulage roads are open", adding to costs to ensure production continues.[62] These adaptation measures have the compounding effect on unit costs by both adding to costs as well as reducing production. Flooding contributed to a 22% increase in unit costs to major Australian thermal coalminers in the first half of 2022.[63] Additionally, coalmines are more likely to have larger declines in ROM coal production during and after severe wet weather events if they have less or poor quality water storage infrastructure onsite.

[62] Whitehaven Coal. Quarterly Report Q1 FY23. October 2022. Page 8.
[63] IEEFA. Coal cost trends: Climate impacts on coal mining likely long term. November 2022.

Figure 15: Reported losses in Australian coalmine production 2022 and FY22

Sources: Compnay annual reports (2022, 2023)
Notes: 1. All companies pointed to wet weather impacting on production losses, other causes referenced as impacting on production included labout shortages and absenteeism, impacts from COVID-19, blast overburden and changing in stripping ratios.
2. BHP coal production figure includes total coal production reported by BMA Australian coal operations of which BHP owned 100% share of the Mouth Arthur thermal coalmine, and 80% in the South Walker Creek and Poitrel mines and a 50% share in all metallurgical coalmines during 2022. BHP's interest in the South Walker Creet and Poitrel mines were acquired by Stanmore Resources in May 2022.

Box 3: Impact of flooding on Mt Thorley Warkworth mine

Yancoal's 2022 annual report outlined how heavy rains experienced during the La Niña weather pattern from 2020-23 affected mining output in several ways: "Initially, production is lost when mining ceases during the rain event; additional time is lost pumping water out of the active mining pits and off benches where mining needs to resume. Furthermore, productivity is lost due to operating in wet and boggy conditions following the rain event. Where the water storage dams are at capacity, water must then be stored in operating locations (sacrificial pits), inhibiting mining operations." Examples of this include the Mount Thorley Warkworth mine and Hunter Valley operations, which had to sacrifice operating pits for water storage, significantly decreasing production. Yancoal reported it lost 8.3 million tonnes (Mt) of ROM coal production to extreme wet weather in 2022 alone.[64]

Flooding impacts also increase mining unit costs through increased absolute costs for water management. In 2022, miners' interests in the 2022 Hunter River Salinity Trading Scheme – used by mining companies in the area to manage water releases – was oversubscribed and well up on previous years.[65] The increasing severity and frequency of wet weather events and floods also increases the risk of uncontrolled discharges from mines, including surface runoff and seepage of contaminated water into freshwater sources. In 2008-09, the coal industry was responsible for 90% of the 37GL of water discharged into the environment from the mining industry in Australia.[66]

[64] Yancoal. Annual report 2022. 2023. Pages 16 and 46.
[65] IEEFA. Coal cost trends: Climate impacts on coal mining likely long term. November 2022.
[66] CSIRO. Water in mining and Industry. 2011. Chapter 10. Page 138.

Box 4: Impact of severe weather events at Burton Complex

Bowen Coking Coal's quarterly activities report for Q4 2023 stated that ROM coal production at the Burton Complex had been hindered by double the planned weather impact in November and December.

"With wet weather and a second cyclone continuing into January, the site's ability to recover the shortfall could be limited, resulting in the Company lowering full year ROM coal guidance slightly. Similarly logistical delays throughout December and particularly through the festive season, coupled now with actual and forecast disruptions to rail and shipping in the early March 2024 quarter from the forming Cyclone Kirrily off the Queensland Coast, means shipping shortfalls from the December quarter, and more accurately the delayed December vessels, are unlikely to be recovered prior to the end of the FY, leading the Company to revise guidance ranges for its Managed Coal Sales which has a flow on effect to unit cash costs (FOB)."[67]

Contaminated discharges, salination and pollution

Coalmines generate large amounts of wastewater and have multiple water storages onsite that can spill or seep into freshwater sources, leading to significant water contamination and pollution events.

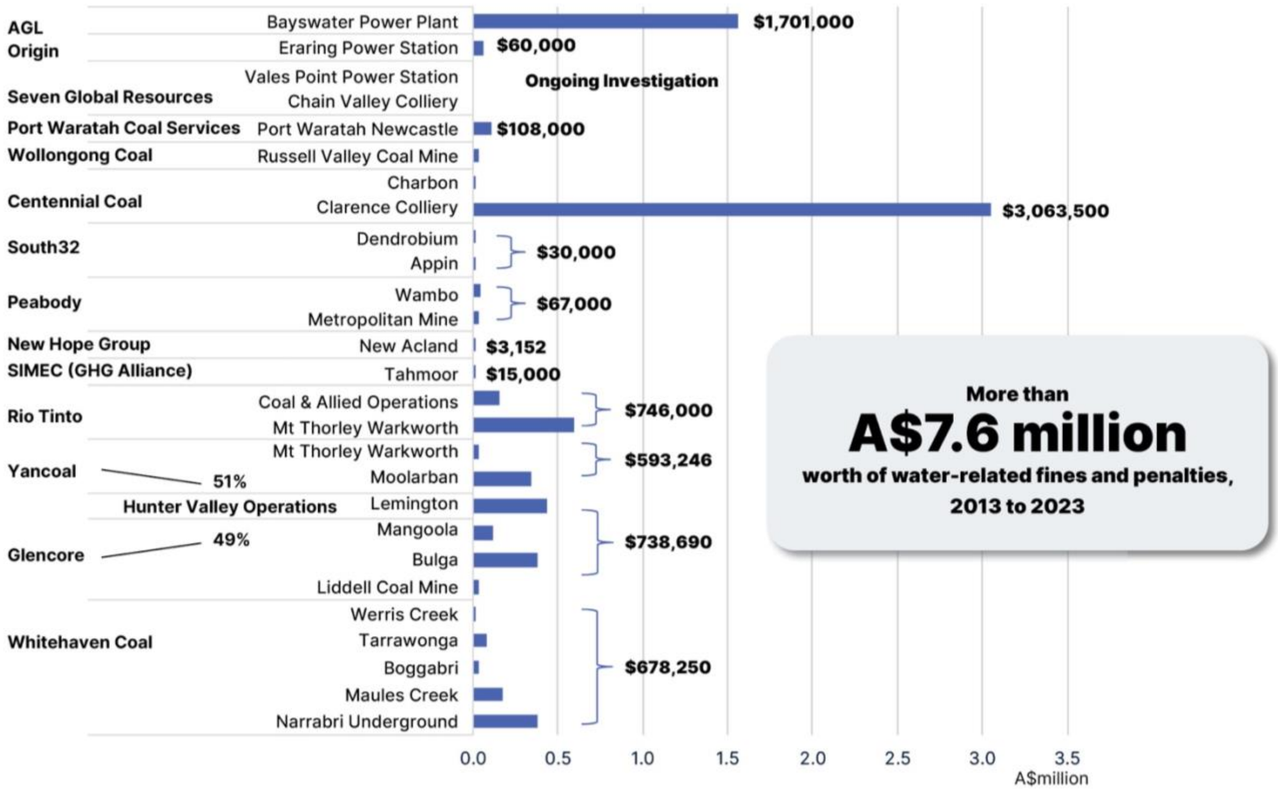
These events are not rare occurrences in Australia, with more than 60 examples of illegal contaminated water discharges occurring from 2013-2023. Coalmine operators and coal-fired power stations were issued more than AU$7.6 million in fines, penalties and enforceable undertakings for these offences (Figure 16). In most instances, mining companies are also liable to cover the legal fees and investigation costs of relevant environment protection agencies.

To minimise the risk of these events occurring, coalmines require water management strategies and capital expenditure into water infrastructure onsite for monitoring, treatment, pumping, heating/ cooling systems and storage purposes.

There are more reported cases of fines being issued and companies being prosecuted for uncontrolled contaminated discharges in NSW than in Queensland. This is likely due to higher community and organisational monitoring in Sydney's drinking water catchments and Hunter Valley, and therefore these mines are subject to greater surveillance and monitoring.

[67] Bowen Coking Coal. Quarterly Report Q4 2023. 29 January 2024.

Figure 16: Water pollution penalties* issued to Australian coalmines 2013-23



Sources: NSW EPA penalty registry (2023); Queensland EPA registry (2023); media reports. For details on sources for calculating total financial penalties see Appendix A.
**Note: Penalties include fines and enforceable undertakings.*

Coalmine water release data from Queensland and NSW show large volumes of water discharged legally by coalmines into freshwater sources.[68] Water releases from coalmines increase during periods of high rainfall and flooding. These releases can disrupt aquifers, and increase water and soil salinity, with significant effects on agriculture and the environment.[69]

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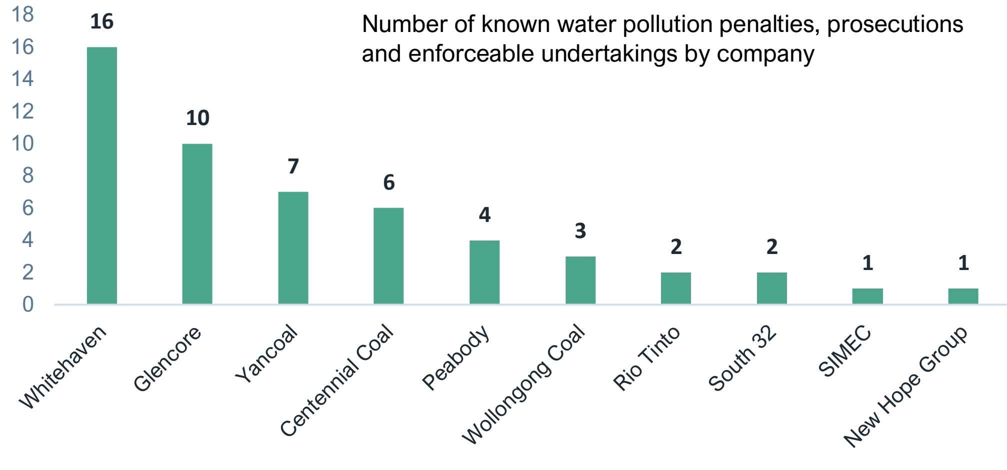
[68] Queensland Department of Environment, Science and Innovation. Fitzroy Basin Coal mine water releases 2020-2021. November 2021.
[69] Australia Institute. Coal and gas mining in Australia. 2013. Page 1.

Figure 17: Repeat offenders – Australian coalminers' poor record on water



Sources: NSW EPA penalty registry (2023); Queensland EPA registry (2023); Media reports. For details on sources for calculating total financial penalties see *Appendix A**.*

This report examines the financial risk of these pollution events to coalmining operators. It does not attempt to calculate the economic valuation of damages to the environment, neighbouring properties, businesses and other users incurred due to water contamination. However, research into the economic valuation of negative environmental impacts from coalmining has found that these environmental costs are significant and can outweigh the economic benefits generated by coalmining activities when factored into cost-benefit analyses.

Research in Queensland's Bowen Basin found that when the negative externalities of coalmining were factored into their cost benefit analysis, the net present value (NPV) of coalmining would be negative, -AU$2.78 trillion dollars between 2016-2047.[70] This calculation excluded the estimated rehabilitation costs associated with coalmining. A study of a coalmine in the Mentougou region of China found that over the past 50 years, the economic valuation of the loss of ecosystem services was US$2 billion, more than double the total value of coal mined, about US$870 million.[71] This study was consistent with another analysis of coalmining in Colombia,[72] where the socio-environmental liabilities produced per ton of extracted coal were valued at US$110.10-US$161.01, higher than the market price of extracted coal at US$90.3-US$100.57. These studies demonstrate the environmental and social costs of coalmining activities can outweigh the economic value generated by coal production.

[70] Resources Policy. Does coal mining benefit local communities in the long run? A sustainability perspective on regional Queensland, Australia. June 2021. Vol 71. Page 32.
[71] Ecological Complexity. Evaluating and modelling ecosystem service loss of coal mining: A case study of Mentougou district of Beijing China. 2011. Vol. 8(2). Pages 139-142.
[72] Ecological Economics. Behind the life cycle of coal: Socio-environmental liabilities of coal mining in Cesar, Colombia. December 2015. Vol.120. Pages 75 and 79.

Dendrobium Mine's impact on threatened species

The impacts of coalmines on water-dependent threatened species have come under scrutiny by the Independent Scientific Committee (IESC) on Coal Seam Gas and Large Coal Mining Development. For example, the IESC's advice on the Dendrobium Mine Extension, stated: "The IESC believes that no offsetting measure can appropriately compensate for the predicted loss of EPBC-Act listed species and TECs (Shale Sandstone Transition Forest, Coastal Upland Swamps of the Sydney Basin Bioregion) in their current landscape context. These species, TECs [threatened ecological communities] and surrounding matrix of vegetation and water-associated assets are in near-pristine condition because of their historical protection within the catchment of Sydney's drinking water storage. Collectively, these aspects occur nowhere else in such good condition outside already-protected areas which means that suitable equivalent offset areas do not exist."[73]

> **"Existing mining by the proponent has already left undesirable and long-term environmental legacies**

The IESC also highlighted the permanent environmental damage already caused by the mine: "Existing mining by the proponent has already left undesirable and long-term environmental legacies (e.g., contaminated mine-water discharge into perpetuity, swamps and streams whose ecological values have been permanently lost through subsidence-induced drying)."[74]

Mining approvals and community opposition

Water contamination events also damage mines' social licence to operate, and increase pressure from governments and community groups on mining operations. This can lead to tighter regulatory frameworks and increased approval times and more mining licence applications being declined.

Responsible water management is integral to maintaining a mine's social licence to operate and has impacts on planning approval decisions, leading to rejections or significant delays. While community opposition can be due to a number of factors, water-related risks and impacts are a growing reason for local opposition and delays to coalmining project approvals. Mismanagement of water by coalmining companies can increase conflict with local communities, stakeholders and environmental groups, which can arise from actual or perceived impacts. This diminishes a coalmine's social licence to operate and can affect the success of a project.[75,76]

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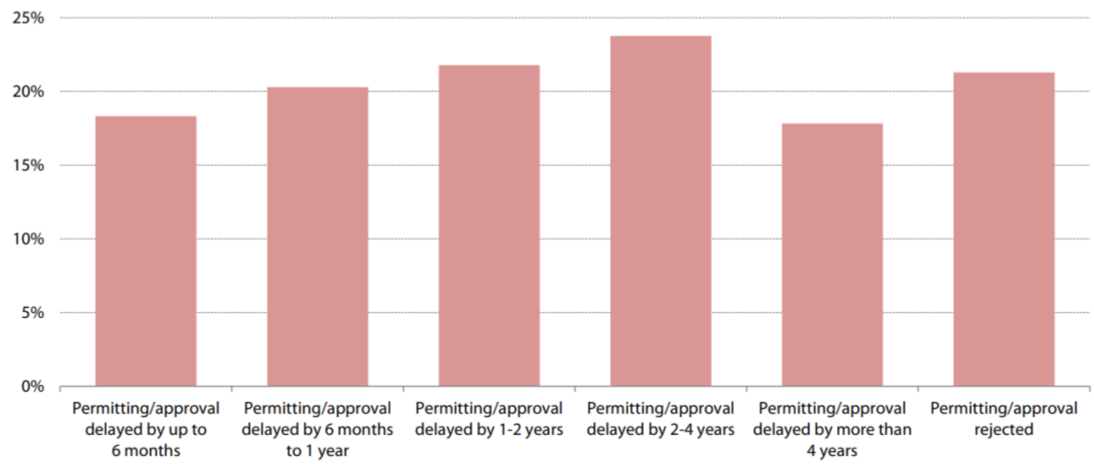
[73] IESC. Advice to decision maker on coal mining project IESC 2022-132: Dendrobium Mine Extension Project. June 2022. Page 6.
[74] Ibid. Page 7.
[75] Journal of Hydrology. Legal disputes as a proxy for regional conflicts over water rights in Chile. April 2016. Vol. 535. Pages 36-45.
[76] Journal of Cleaner Production. Mining, water and human rights: making the connection. November 2010. Vol. 18(15). Pages 1553-1562.

Instances of community groups and local community members campaigning against coalmines have risen over the past 10 to 15 years.[77] This is resulting in greater scrutiny by government agencies, with mining development approval decisions becoming more influenced by projected water take and impacts. In its 2013 annual global mining survey, the Fraser Institute analysed how public opposition affected permit approval timeframes. The biggest cause (~60% of respondents) referenced for community opposition was "environmental or water usage" issues.[78] In its 2022 survey, it found that 40% of respondents in four Australian jurisdictions indicated that the time for mining permit approvals had increased over the past 10 years.[79]

Figure 18: In what ways did public opposition affect permitting/and or approvals?



Source: Fraser Institute (2013)

Over the past 10 years in Australia, there have been numerous cases of mining approvals being delayed, cancelled or rejected due to opposition from planning agencies or communities related to water management concerns. More rigorous assessments of coalmines' watering requirements are already acting as a barrier to mine approvals (Figure 19).

[77] Fraser Institute. Annual Survey of Mining Companies 2013. March 2014. Page 77.
[78] Ibid.
[79] Fraser Institute. Annual Survey of Mining Companies 2022. March 2023. Page 54.

Figure 19: Timeline of mine rejections or delays due to water issues

	Glencore Ravensworth North Mine	Delayed	Ravensworth North mine incurred additional delays under the federal Environment Protection and Biodiversity Conservation (EPBC) Act 1999.
2023			
	New Hope Group New Acland Mine	Delayed +2 years	New Acland mine expansion plans were stalled for ~2 years due to community opposition over groundwater impact concerns.
	Whitehaven Coal Narrabri expansion	Delayed	The NSW Independent Planning Commission has imposed 152 conditions on the project related to emissions, groundwater impacts and other environmental impacts. Whitehaven had to resubmit water modelling component of their proposal after NSW Department of Planning, Industry and Environment found issues with their claims on groundwater impacts. Local landholders also submitted on groundwater risks of the project.
2022			
	Waratah Coal Waratah Coal Mine	Rejected	Clive Palmer's proposed Waratah Coal mine in the Galilee Basin was rejected by Federal Government because of its proximity to the Great Barrier Reef as well as impacts to groundwater and creeks in addition to its projected greenhouse gas emissions.
	Bravus (formerly known as Adani) North Galilee Water Scheme	Rejected	The Federal Court applied the 'water trigger' to Bravus's North Galilee Water Scheme, and rejected the North Galilee Water Scheme, a critical component to supply water to the Carmichael mine, planned to pump 12.5 billion litres of water a year from Queensland's Sutton River.
	South32 Dendrobium Mine	Rejected	The NSW Independent Planning Commission refused the extension proposal due to risks of irreversible damage to Sydney's drinking water catchment.
2021	**Centennial Coal** Angus Place Coal Mine	Application Withdrawn	Application withdrawn after long-term community opposition due to impact on local water sources and after Centennial admitted to submitting inaccurate data in their proposal.
	MetRes Millennium & Mavis Downs mine	Delayed + 1 year	Underground mining planned to begin in 2022, but flood damage and geological variations have pushed back first development coal to July-December 2023.
	Posco Steel Hume Coal Project	Rejected proposal	The NSW Independent Planning Commission rejected the Hume Coal Project's new underground mine proposal citing numerous reasons. They ultimately concluded that the impact on water resources and the social impacts of the proposal were significant enough to warrant refusal.
	KEPCO Bylong Coal Project	Rejected	After a significant community campaign the proposed KEPCO Bylong Coal Project, NSW (SSD 6367)v was refused on the basis that the impacts on groundwater would be unacceptable.
2019			
	Centennial Coal Newstan colliery	Postponed indefinitely	Approval postponed indefinitely.
2016	**Centennial Coal** Springvale Mine	Delayed	Springvale mine expansion delayed due to community opposition over water concerns.
	Yancoal Ashton Coal Mine Extension	Cancelled after 12 years	Initially rejected by the NSW planning assessment commission due to concerns about health and water impacts. After a private landholder refused to sell their property, in April 2022 the approval lapsed and the extension was cancelled.
2013			
	Hancock Prospecting Kevin's Corner Project	Delayed	Kevin's Corner Project in Galilee Basin, proposed in 2009, is delayed due to groundwater concerns and doubts about the long-term viability of thermal coal. Though approved with conditions in 2013, the applications for the Alpha coal mine and Kevin's Corner coal mine are stalled. Despite almost a decade of inactivity, the lease applications for the project remain active.

Sources: For a detailed list with links to sources, see Appendix C.

Financial impacts of regulatory changes

The increased scrutiny of water issues in mining application decisions highlights the financial impacts that regulatory changes pose to coalmining operations. Additionally, regulatory changes to water allocation and licensing processes, and increased scrutiny in water accounting and monitoring, can increase the financial risks to coalmines for breaching licence conditions. Higher accuracy in monitoring mine water take could lead to mines being issued with fines if they are found to have exceeded water take permitted under their licensed allocations. Increased reporting requirements to calculate water take under licence exemptions with a corresponding increase in monitoring could also increase the chances of miners being fined for illegal water take or asked to pay more for their water.

Additionally, if regulatory changes occur in response to the environmental degradation caused by contaminated water releases from mines, this could lead to increased water treatment costs for operators. The costs incurred by mining companies to treat mine water are based on the water quality required by Australian regulations. If these regulations are amended to increase the quality of water required, or if monitoring of water quality increases, coalmining companies will face higher water treatment costs and require greater capital expenditure on water infrastructure.

Box 5: Metropolitan Collieries' licence restricted after repeated contamination

The NSW EPA inspected Peabody Energy's Metropolitan Collieries premises on several occasions in 2022, and observed that coal material had deposited on the banks and bed of Camp Creek. A review of the collieries' Environment Protection Licence imposed the following requirements:

- A water impact discharge assessment that examines the mine's water discharges and its impacts on receiving waterways; this information will be used to examine the pollutants and their limits in the licence.
- Investigation of further ways to prevent or minimise the frequency of discharges, and an options assessment of water treatment for those discharges.
- Routine measurement and removal of sediment from the sediment basins.
- More stringent monitoring conditions, including testing of chemicals of concern, with the information to be reported on the licensee's website.
- Real-time water quality testing, including upstream and downstream in Camp Gully Creek, with results to be made publicly available on the licensee's website.
- Revisions to the Surface Facilities Water Management Plan based on updated information in water management infrastructure, processes and monitoring.[80]

[80] IESC water committee and NSW Department of Water.

Water modelling issues and possible regulatory changes

There are numerous examples of low-quality water modelling that do not take into account the impacts of climate change.[81] Water modelling presented in the application process for mining approvals for new developments or expansions have historically failed to accurately predict the impact on local water sources or to incorporate extreme climatic variations that are increasing in frequency with climate change. Mine water modelling usually uses average wet/dry events to predict water use requirements and impacts – rather than designing models that incorporate the risks posed by extreme weather.

Disparities between government and mining companies' water modelling results demonstrate that the quality of hydrologic and hydrogeological modelling techniques may become an increasingly important factor in mine approval decisions.

Whitehaven's proposed Narrabri coalmine stage 3 extension has faced opposition from the NSW Department of Planning, Industry and Environment (DPIE). NSW DPIE asserted that it did not have confidence that Whitehaven Coal could predict the impact of the extension project on water supplies. Government models estimated there was a risk the project could decrease the Namoi Alluvial aquifer by 10 metres whereas Whitehaven Coal's estimate was only 2 metres.[82,83]

Additionally, modelling the impacts of coalmining on groundwater sources has a poor track record. Loss of stream base flows from porous and fractured rock groundwater sources are modelled based on estimates. Changes to these flows are almost impossible to measure with any certainty. This means that the interception of base flows from porous rock groundwater sources is underestimated and under-regulated. Water modelling for coalmining projects in the upper Goulburn catchment has repeatedly failed to predict the full impacts on groundwater inflows, significantly underestimating mine water take and the interception of potable groundwater. Since approval, the modelling results have been revised several times.[84]

For example, when underground mining commenced in 2016 at Moolarben coalmine in the Goulburn catchment, the modelled groundwater inflows were initially predicted to be less than 1ML/day,[85] but exceeded 5ML/day within the first few months.[86] This triggered a major recalibration, including a

[81] IESC water committee and NSW Department of Water.
[82] NSW DPIE Water. Narrabri Underground Mine groundwater model review. Page 4. 19 April 2021.
[83] ABC News. Whitehaven Coal's water modelling for Narrabri mine extension 'counterintuitive', department says. 24 May 2021.
[84] Australian National University (ANU). Imrie, J. PhD Thesis. Changing land use in an uncertain climate: impacts on surface water and groundwater in the Goulburn River, NSW. 2019. Page 111.
[85] Yancoal. Moolarben Coal. Page 8.
[86] ANU. Imrie, J. PhD Thesis. Changing land use in an uncertain climate: impacts on surface water and groundwater in the Goulburn River, NSW. 2019. Page 111.

change in the model used.[87] Underground water make has since increased substantially to more than 17ML/day in 2020.[88]

What the federal 'water trigger' means for coalmines

At the federal level, a "water trigger" has been in place since 2013 under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999. The 2013 amendment added the protection of water resources from coal-seam gas and large coalmining developments as an additional matter of national environmental significance under the EPBC Act. Under the amendment, an action that involves a coal seam gas development or a large coalmining development now requires approval from the Minister for the Environment if the action has, will have, or is likely to have a significant impact on a water resource.[89] A "large coal mine development" refers to any coalmining activity that has, or is likely to have, a significant impact on water resources (including any impacts of associated salt production and/or salinity): in its own right; or when considered with other developments, whether past, present, or reasonably foreseeable developments. The federal government's rejection of the North Galilee Water Scheme project highlights that large coalmining developments could face the federal water trigger assessment even if their water infrastructure is listed as a separate project.[90]

On 15 December 2023, the water trigger was expanded to include unconventional gas.[91] In addition to the expansion of the water trigger, the government is overhauling the EPBC Act (Nature Positive Reforms) to introduce new environmental standards for decisions on matters of national environmental significance, including groundwater and surface water.[92]

The EPBC Act Nature Positive Plan, which is an overhaul of the EPBC Act, will introduce new standards for decision-making on matters of national environmental significance, including water resources. There is likely to be increased scrutiny by the IESC on the impacts of water extraction by coalmines on water-dependent threatened species under the EPBC Act.[93]

These reforms will likely increase the reporting requirements for coalmine operators across Australia on the risks posed to water resources, and could present greater barriers to expansions, extensions and greenfield development approvals.

[87] ANU. Imrie, J. PhD Thesis. Changing land use in an uncertain climate: impacts on surface water and groundwater in the Goulburn River, NSW. 2019. Page 111.
[88] Yancoal. Moolarben Coal. Page 7
[89] Department of Climate Change, Energy, the Environment and Water (DCCEEW). Independent review of the 2013 EPBC Act amendment – Water Trigger. June 2017.
[90] Brisbane Times. Adani loses billions of litres of water in Federal Court decision. 25 May 2021.
[91] DCCEEW. Updated water trigger in our environmental law. 20 December 2023.
[92] DCCEEW. EPBC Act Reform. 2024. Page 15.
[93] DCCEEW. EPBC Act Reform. Significant Impact Guidelines 1.3. 2022. Page 17.

Rehabilitation costs

Long-term water-related environmental risks after mine closures

Water-related problems are the most common environmental impact when closing mines.[94] These impacts can last for decades or centuries due to the gradual physical and chemical weathering of rocks exposed to water and the atmosphere.

Mining companies need to include long-term water-related environmental risks in their hydrological predictions. The life of a coalmine is often longer than 50 years, can be preceded by decades of exploration and planning, and proceeded by decades of rehabilitation and post-closure management.[95] The negative externalities produced by coalmining can continue during and after mine rehabilitation, and in some cases require significant remediation efforts by mining companies or governments, often funded by taxpayers. Modelling for the Ulan and Moolarben mines predict that the groundwater network will be permanently altered, and levels will not recover for more than 300 years.[96,97]

There are approximately 60,000 abandoned mines in Australia with legacy environmental issues, up to 300 of which are coalmines,[98] and Australian governments collectively hold more than AU$10 billion in rehabilitation bonds.[99] These bonds are supposed to cover the total costs associated with all rehabilitation and mine-closure activities required if a mining company defaults on its rehabilitation obligations. However, large open-cut mines, which create significant landform alterations, can cost hundreds of millions or billions to rehabilitate.[100,101] Mining impacts on the Sugarloaf State Conservation Area (SCA) in the NSW Hunter region from longwall mining remedial grouting caused permanent damage, and is an example of severe damage to waterways from subsidence-induced longwall mining.[102] The NSW Mining Act 1992 allows regulators to pursue companies and executives for the cost of clean-up if their rehabilitation bonds are not sufficient to cover the cost. This includes being able to direct a former holder of an exploration licence or mining lease to complete rehabilitation works even after a mining title has been relinquished.[103]

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[94] Australian Centre for Geomechanics. Why do mines close? 2006. Page 92.
[95] Ecological Economics. The hydro-economics of mining. 2016. Vol. 145. Page 370.
[96] ANU. Imrie, J. PhD Thesis. Changing land use in an uncertain climate: impacts on surface water and groundwater in the Goulburn River, NSW. 2019. Page 25.
[97] Ulan Coal Mines. Mackie Environmental Research report continued operations North 1 modifications – groundwater assessment 2011. June 2011. Page 22.
[98] CRC for Transformations in Mining Economics. Towards an inventory of abandoned mines in Australia: risk, prioritisation, and opportunities. Page 19. April 2022.
[99] Australia Institute. Dark side of the boom – what we do and don't know about mines, closures and rehabilitation. April 2017. Page 2.
[100] Proceedings of the Royal Society of Queensland. Rehabilitation of mining and resources projects as it relates to Commonwealth responsibilities. 2016. Vol. 121. Page 42.
[101] Australia Institute. Dark side of the boom – what we do and don't know about mines, closures and rehabilitation. April 2017. Page 2.
[102] The Sydney Morning Herald. Mine subsidence devastates Sugarloaf conservation area. 28 August 2013.
[103] Natural Resources Regulator. Mine Rehabilitation. 2024.

The environmental risks from mines put into care and maintenance is compounded by a lack of reporting and regulation. Mines self-regulate and are required to report non-compliance. However, many reported contamination events were only detected after community monitoring, reporting and complaints. According to official estimates, there are between 206 and 972 mines in care and maintenance across Australia, but it is difficult to ascertain which of these mines are mothballed and likely to resume operations and which are permanently closed.[104] After mining ceases, the site must be rehabilitated, at which point it can be formally relinquished for other purposes.

Not one large open-cut coalmine in Australia has completed rehabilitation and been fully relinquished.[105] Given Australia's preference for open-cut mining and the scale of these operations, the prospects of complete rehabilitation of these mine sites, if any, needs further investigation. The alternative is these mine sites are abandoned, meaning taxpayers may become responsible for funding their rehabilitation. Therefore, coalmining companies' hydrological predictions and associated water-related environmental risks, including potential financial risks, must be examined beyond the mine's operating life expectancy. The cumulative effects from adjacent mines and subsequent mine expansions should also be considered. Uncertainty in long-term forecasting of water supply and other components of costs and revenues mean that these models need to account for the uncertainty and variability of these water-related financial risks.[106]

Changes in regulation will force mining companies to increase rehabilitation risk reporting. The NSW resources regulator implemented new reforms for all new and existing mining leases in NSW in 2021. These reforms included standardising rehabilitation reporting, and requiring transparent reporting on progressive mine site rehabilitation throughout the entire mine lifecycle.[107]

Acid mine drainage

An analysis of 800 mine closures in Australia from 1981-2005 found that the most significant environmental impact was acid mine drainage, followed by mine tailings, open-pit voids, waste dumps and water quality issues.[108] Acid mine drainage can cause pollution to water sources that lasts for hundreds or thousands of years. It can occur anywhere on the mine site where sulphides are exposed to water, including in open pits, tailings and waste piles. A 2008 literature review on acid mine drainage found that there were no existing hard rock open-cut mines that could demonstrate that acid mine drainage could be successfully treated once it occurred at a large scale.[109] There is limited data on the scope and potential of acid mine drainage from coalmines in Australia. A government-commissioned report in 1997 found that the average coalmine site in Australia had 69

[104] Australia Institute. Dark side of the boom – what we do and don't know about mines, closures and rehabilitation. April 2017. Page 2
[105] Ibid.
[106] Journal of Coal Science and Engineering. Geological uncertainty and risk: implications for the viability of mining projects. 2008. Vol. 14. Pages 176-177.
[107] NSW Resources Regulator. New standard rehabilitation conditions on mining leases. July 2021.
[108] Australian Centre for Geomechanics. Why do mines close? 2006. Page 92.
[109] US Fish and Wildlife Service. Acid Mine Drainage and Effects on Fish Health and Ecology: A Review. June 2008. Page 19.

hectares of tailings where there was significant potential for acid-generating wastes.[110] More recent analysis of the risk of acid mine drainage from coalmines in Australia was not available, suggesting far more research and reporting is required to understand the likelihood and scale of these risks both during the mining and rehabilitation phases.

Mine tailings dams

Surface tailings storage facilities (TSFs) collect and store waste produced during the mining process. Mine tailings contain considerable concentrations of minerals that are not amenable to recovery at the time of mining. These wastes cannot be directly discarded or discharged by mines without treatment because they typically contain high levels of contaminants that would cause pollution to local water sources or the environment. Therefore, mining companies typically collect and store these tailings in dams to prevent contamination.

Tailings dams are required to remain stable and produce no detrimental impacts to the environment post mine closure. Poorly designed and managed TSFs increase the costs associated with mine closure and rehabilitation.[111] There are numerous instances of tailings dams failing during high rainfall or flooding where these contaminants spread into nearby water sources. This can occur while the mine is operational or after production has ceased. Adopting best practice guidelines for managing tailings can reduce these risks.[112] However, uncertainties in long-term climate, hydrology and performance of mitigation strategies mean that residual risks always exist, including the potential for catastrophic events such tailings dam failures.[113]

Mine 'pit lakes'

After mining is complete a void remains, and in some cases multiple voids can be left from a mine site. A mine void is a mined area, typically a pit, that remains as a depressed landform feature after rehabilitation of a mine is complete.[114] The size of these pits is increasing as opencut mines in Australia continue to expand. Because these voids are depressions, they fill with water either naturally through rainfall or a combination of rainfall and intentional pumping of water to turn them into mine pit lakes. Filling mine voids with water is a common practice during the rehabilitation stage.

Without adequate treatment and management, mine pit lakes have a high potential to contaminate ground and surface water sources due to the contaminates within the mine pit. Due to the small

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[110] DCCEEW (then Dept of the Environment). Acid Mine Drainage in Australia: Its extent and potential future liability, Section 3 Survey of acid mine drainage at mine sites in Australia. 1997. Page 28.
[111] Department of Foreign Affairs and Trade. Tailings management: leading practice sustainable development program for the mining industry. December 2016. Page 1.
[112] European Commission. JRC Science for Policy Report. Best available techniques reference document for the management of waste from extractive industries. 2018. Page 41.
[113] Applied Geochemistry. Contamination of surface waters by mining wastes in the Milluni Valley (Cordillera Real, Bolivia): Mineralogical and hydrological influences. May 2008. Vol. 23(5). Pages 1299-1324.
[114] NSW Mining. Mine Voids. NSW Minerals Council Fact Sheet. 2018. Page 1.

number of fully rehabilitated coalmines in Australia, there is not sufficient research to show how the contamination and pollutants within mine pits can be treated or managed to avoid contamination of water sources and the environment.[115]

Additionally, when mine operators or rehabilitators want to create pit lakes they can have significantly high water requirements, which can persist for several years. The Hazelwood coalmine closure is one example of this. The mine is proposed to use 638GL of water (almost double Melbourne's annual consumption) to fill in the mine pit as part of its rehabilitation strategy, plus an additional 5GL a year to offset evaporation for 20 years.[116]

Legacy groundwater discharges

Post-production, mines that operated below the groundwater table are likely to leave legacy discharges into groundwater sources for an indefinite timeframe. Mines can intercept and drain groundwater, and this drawdown is significantly wider than the mining footprint, and the impacts can continue far beyond the life of the mine. The closure of WCL's Russell Vale Colliery, one of the oldest coalmines in Australia, and bordering Sydney's drinking water catchment, demonstrates this problem. After mining ceases in 2024, it is proposed that the void will be filled with water, which may take until 2057.[117] WCL has committed to fund 10 years of monitoring and treatment of discharged water, including the possible construction of a reverse osmosis (RO) plant to treat 110MLpa of water to a potable standard over 10 years at a cost of about AU$2.4 million.[118] However, water modelling has shown that there will be escalating discharge from the mine for at least 160 years, with water likely to continue flowing indefinitely.[119]

The Independent Expert Panel for Mining in the Catchment report in 2019 found that perpetual water loss was likely from mine entrances at an elevation below the groundwater table that cannot be effectively and safely sealed.[120] The NSW EPA points out in its comments on the project that "recent experience in the Southern Highlands demonstrates the difficulty in finding a long-term solution to legacy groundwater discharges".[121] The NSW EPA submission raised ongoing problems with the management and treatment of water discharges from the site, including:

- Dissolved copper concentrations up to 311 times the ANZG (2018) default guideline values for freshwater aquatic ecosystems (95% species protection level).
- Nickel 35 times and zinc 10 times their default guideline values in ANZG (2018).

[115] Proceedings of Water in Mining. Water resources in Australian mine pit lakes. 2009. Pages 205-206.
[116] Environmental Justice Australia. Federal government pulls 'water trigger' over controversial plan to flood Victorian open-cut coal mine. 22 February 2023.
[117] Ibid. Page 19.
[118] NSW Government. Russell Vale Revised Underground Expansion Project (MP09_0013) | Secretary's Final Assessment Report. 2020. Page 49.
[119] Independent Planning Commission. Submission from Illawarra Residents for Responsible Mining, Wollongong Coal's revised underground expansion project report to Russell Vale Mine. 2020. Page 11.
[120] NSW Chief Scientist. Independent Expert Panel for Mining in the Catchment Report: Part 1, review of specific mining activities at the Metropolitan and Dendrobium coal mines. 2019. Page 101.
[121] NSW EPA. Russell Vale Colliery – Revised Underground Expansion Project (09_0013) External Correspondence. 2019. Page 7.

- Existing mine water quality is alkaline pH (8.4-8.55), fresh to brackish (1,390-2,210µS/cm) and has slightly elevated levels of sulphate and metals (copper, nickel, and zinc).[122]

Conclusion

Overall, this report demonstrates that the water-related risks in coalmining in Australia can no longer be overlooked. These water-related financial risks are significant and are only going to increase over time with the impacts of human-induced climate change.

This report has shown the frequency of water contamination and water theft in Australia. While many companies have not received large financial penalties for these offences so far, government agencies have the ability to increase the penalties imposed for these occurrences under existing legislation.

Additionally, water management and water impact modelling requirements for mine expansions and new mine developments are increasing, meaning projects are more likely to be delayed, rejected or cancelled due to increased scrutiny over the impacts on water sources from coalmining operations. Concurrently, community opposition on the basis of water impacts of coalmining is rising, and this is affecting coalmines' social licence to operate.

Due to the lack of transparency on water accounting data in the mining industry, it has been difficult for investors to accurately identify all the water components of risk in their investment portfolios. As reporting requirements become tighter and better data becomes available, the water-related impacts and risks of these investments could be incorporated into reviewing Environmental, social and corporate governance (ESG) investment strategies. At least 11 water-related disclosures are mentioned in the new framework published by the Taskforce on Nature Related Financial Disclosures (TNFD),[123] meaning investors may increase their expectations on the water-related risks they seek to see disclosed.

As Australian governments implement new company climate-related disclosure requirements, mandatory standardised water reporting frameworks may also become a requirement. This would bring greater attention to the water use and consumption of coalmining in Australia.

Additionally, the actions of even a small number of shareholders exercising voting rights could have a significant impact in driving mining companies to improve their reporting and valuation of water resources. Improvements in water accounting data by mining companies will enable improved analysis in this space in the future.

[122] NSW Government. Russell Vale Revised Underground Expansion Project (MP09_0013) | Secretary's Final Assessment Report. September 2020. Page 49.
[123] Taskforce on Nature-related Financial Disclosures. Recommendations of the taskforce on nature-related financial disclosures. Pages 145-146. September 2023.

Appendix A: Water-related penalties and enforceable undertakings issued to Australian coal industry

Date	Company	Mine/Port/ Power Station	Financial Penalty or Remuneration (AU$)	Description
Aug-13	Port Waratah Coal Services	Port Waratah Newcastle	15,000	EPA fine of $15,000 for coal fine spillage.
Apr-14	Port Waratah Coal Services	Port Waratah Newcastle	30,000	EPA fine of $30,000 for two incidents of discharging coal pollutants into harbour.
Jul-19	Port Waratah Coal Services	Port Waratah Newcastle	38,000	EPA fine and court costs $38,000 for coal contaminated water leak into harbour in Oct 2012.
Dec-22	Port Waratah Coal Services	Port Waratah Newcastle	25,000	EPA fine of $25,000 for over 13,000 litres of water contaminated with slurry and coal fines washing into Hunter River in April 2012.
Aug-16	AGL	Liddell Coal Mine	-	Failure to report flooding.
Aug-17	AGL	Liddell Coal Mine	-	Failure to test chlorine levels on 12 occasions.
Aug-17	AGL	Liddell Coal Mine	-	Leak of ash slurry from pipeline into freshwater sources.
Aug-17	AGL	Liddell Coal Mine	-	Pump failure caused effluent water to flow into freshwater sources.
Mar-18	AGL	Liddell Coal Mine	15,000	EPA fine of $15,000 for toxic ash slurry flow into endangered ecological community.
Jun-19	AGL	Liddell Coal Mine	15,000	EPA fine of $15,000 for discharging sediment water into Hunter Valley waterway.
Feb-13	AGL	Bayswater Power Plant	15,000	EPA fine of $15,000 for pump failure, and contaminated water discharge.
Nov-15	AGL	Bayswater Power Plant	15,000	EPA fine of $15,000 for ammoniated water washing into Tinkers Creek.
Nov-15	AGL	Bayswater Power Plant	30,000	EPA fine of $30,000 for 6,000 litres of sulphuric acid entering two stormwater drains flowing to Lake Liddell. Detection of *Naegleria fowleria* (a fatal brain-eating virus) found in Lake Liddell following incident and lake permanently closed to public.
Since Feb 2015	AGL	Bayswater Power Plant	-	52 incidents of non-compliance with licence conditions.
May-18	AGL	Bayswater Power Plant	30,000	EPA fine $30,000 for diesel spill into Tinkers Creek.
Feb-19	AGL	Bayswater Power Plant	15,000	EPA fine $15,000 for slurry discharge into Wisemans Creek tributary.
Dec-20	AGL	Bayswater Power Plant	1,108,000	EPA enforceable undertaking of $1.108 million issued after ash waste pollutes Hunter Valley Creek, plus $320,000 in clean-up and rehabilitation costs.
Jul-21	AGL	Bayswater Power Plant	15,000	EPA fine of $15,000 for water pollution.
Feb-23	AGL	Bayswater Power Plant	15,000	EPA fine $15,000 for saline water discharge.
Jul-16	Wollongong Coal	Russell Vale Coal Mine	30,000	EPA fine $30,000 contaminated water discharge into Bellambi Gully.
2005-2023	Delta electricity & Origin Energy	Chain Valley Colliery	-	Thermal pollution

2021	Delta electricity & Origin Energy	Chain Valley Colliery	-	Contamination of heavy metals in off-site groundwater.
Since 2015	Delta electricity & Origin Energy	Vales Point Power Station	-	11 violations relating to water pollution.
Sep-23	Delta electricity & Origin Energy	Vales Point Power Station	-	Ongoing EPA prosecution of Delta Electricity regarding fish kill in September 2022.
Feb-14	Wambo Coal	Wambo Coal Mine	37,000	EPA enforceable undertaking over 250-500 tonnes of sediment discharge into North Wambo Creek. Wambo contributed $30,000 for rehabilitation works, EPA investigation and legal fees of $7,000.
Sep-15	Rio Tinto	Coal & Allied Operations	150,000	EPA enforceable undertaking for contaminated discharge of underground mine water into nearby freshwater source: $130,000 rehabilitation cost, $16,255 legal fees, $3,745 legal costs.
Aug-13	Rio Tinto	Mt Thorley Warkworth mine	596,000	EPA fine of $45,000 plus $51,000 in legal fees and $500,000 in water infrastructure and monitoring investment after 6ML contaminated water discharge into Hunter River tributary.
Aug-21	Yancoal	Mt Thorley Warkworth mine	30,000	EPA issued 2 fines of $15,000 each for contaminated discharges during heavy rainfall in Jan 21.
2012	Yancoal	Moolarben coalmine	166,632	EPA penalty of $105,000 plus costs of $61,632 for 3 contaminated water discharges.
2012	Yancoal	Moolarben coalmine	175,814	EPA fine $112,500 plus $63,314 costs for contaminated water discharge.
2013	Yancoal	Moolarben coalmine	1,500	EPA fine of $1,500 for unauthorised water discharge.
May-20	Hunter Valley operations (51% Yancoal, 49% Glencore)	Lemington Road mine	430,000	EPA enforceable undertaking for preventable contaminated water discharge into Hunter River tributary caused by rainfall runoff. HV Operations will pay $100,000 to a project to improve conservation and management of soil erosion on travelling stock reserves in the Singleton area. It is also required to develop and implement a remediation plan for an area within the mine site with an estimated cost of $250,000, and conduct an annual inspection of all rehabilitation areas across the mine site, at a cost of about $50,000. HV Operations is also required to pay the EPA's legal, investigation and monitoring costs of approximately $30,000.
Feb-11	Xstrata (Now Glencore)	Mangoola mine	115,000	EPA enforceable undertaking over discharge of about 46ML of dirty dam water into nearby creek. following heavy rainfall, including $100,000 in environmental improvement actions and EPA's investigation and legal costs $15,000.
May-14	Xstrata (Now Glencore)	Bulga Coal Mine	352,990	EPA prosecution over coal slurry discharge. Clean-up costs $287,990 and fine of $65,000.
Dec-19	Xstrata (Now Glencore)	Bulga Coal Mine	15,000	EPA fine of $15,000 for contaminated water discharge into freshwater source.
Dec-22	Xstrata (Now Glencore)	Bulga Coal Mine	15,000	EPA fine of $15,000 for contaminated water spill into freshwater source.
Feb-12	BHP, Illawarra Coal, Endeavour Coal	West Cliff Coal Mine	-	EPA aware of water pollution from mine since 2002. Licence conditions do not set salinity thresholds for discharges. No fines issued.
Feb-13	BHP, Illawarra Coal, Endeavour Coal	West Cliff Coal Mine	-	Licence variation by EPA to set concentration limits on discharges.

Jun-23	South32	Appin Coal Mine	15,000	Mine contractor fined by EPA for water pollution.
Apr-21	South 32	Dendrobium Coal Mine	15,000	EPA fine of $15,000 after stormwater pit beneath dirty water dam collapsed after heavy rainfall, leading to discharge of contaminated water.
Dec-12	Centennial Coal	Charbon Coal Mine	13,500	EPA notices issued for contaminated discharges after sediment dams spilled following rainfall.
Jul-17	Centennial Coal	Clarence Colliery	3,050,000	EPA prosecution of Tier 1 offence: coalmine collapse caused significant water contamination in 2015. The company, a subsidiary of Centennial Coal, was fined $720,000 for the first offence, a record amount for the EPA. The second offence carried a penalty of $330,000. The company was also ordered to pay investigation and legal costs, which could bring the total to almost $1.5 million. Centennial Coal oversaw a year-long clean-up operation that cost $2 million.
2000-2013	Centennial Coal	Springvale coalmine	-	Between 2000-2013 Centennial Coal issued 900 pollution notices for Springvale coalmine.
Nov-21	Idemitsu & Whitehaven Coal	Boggabri mine	30,000	EPA fine of $30,000 after third alleged illegal discharge of contaminated water since 2020. High levels of metal and bicarbonates discharged from the mine site were found in nearby Goonbri Creek.
Feb-20	Whitehaven Coal	Maules Creek Mine	15,000	Fine of $15,000 for construction of 3 water pipelines without consent.
May-22	Whitehaven Coal	Maules Creek Mine	158,750	EPA prosecution for 3 events of contaminated water discharges in Jan, Feb 2020 following heavy rainfall – $158,750 plus EPA's investigation and legal fees.
May-12	Whitehaven Coal	Tarrawonga coalmine	6,000	Water pollution fine of $6,000.
Feb-20	Whitehaven Coal	Tarrawonga coalmine	15,000	Failed sediment dam fine of $15,000.
Aug-20	Whitehaven Coal	Tarrawonga coalmine	30,000	Pollution of local creek fine of $30,000.
Nov-21	Whitehaven Coal	Tarrawonga coalmine	30,000	EPA fine of $30,000 after third illegal contaminated discharge since 2020.
Mar-12	Whitehaven Coal	Narrabri Underground	6,000	EPA fine $6,000 for 4 instances of water pollution in 3 months.
Aug-21	Whitehaven Coal	Narrabri Underground	372,500	NSW Resources Regulator prosecution of $240,000 and fine of $132,500 for drilling illegal bore holes.
Sep-12	Whitehaven Coal	Werris Creek Mine	?	EPA penalty for water pollution in March 2012.
Oct-20	Whitehaven Coal	Werris Creek Mine	15,000	EPA fine of $15,000 for uncontrolled water discharge after heavy rainfall.
Sep-20	SIMEC Group (GHG Alliance)	Tahmoor mine	15,000	EPA fine of $15,000 for contaminated water discharges into Bargo River.
Sep-23	Peabody Energy	Metropolitan mine	30,000	EPA prosecution of Peabody Energy's Metropolitan coalmine for failing to maintain surface water facilities. Increased rainfall resulted in 2 contaminated water discharges. As of Nov 2022, the EPA is reviewing Metropolitan's environmental protection licence after repeated discharges of coal material into freshwater sources.
2018	New Hope Group	New Acland Mine	3,152	27 illegal bores drilled in Darling Downs in 2018.

Appendix B: Known illegal water take from coalmining 2016-2023

Year/s	Amount stolen	Mine	Operator	Description
2016-2020	3GL	Maules Creek Mine	Whitehaven Coal	Sep 19: NSW Natural Resources Access Regulator (NRAR) prosecutes Whitehaven for taking >3 billion litres of surface water valued at between AU$387,000 - $606,000 illegally over 4 years.
2018-2023	~6.4GLpa	Dendrobium Mine	South32	Jul 23: NRAR investigation finds incidental take of surface water without a licence from 2018-2023 in Sydney’s drinking water catchment. South32 will pay $2,878,138 enforceable undertaking towards improving local waterways, $70,000 to cover NRAR investigation costs. Since 2014, South32 Illawarra Metallurgical Coal has paid $5.6 million to account for passive take of water resulting from underground activities at Dendrobium Mine. Surface water loss directly attributed to coalmining activities in Sydney water catchment valued at $67,840-$258,560pa. Water NSW’s 2019-2022 water audit showed surface water flows in Sydney water catchment were worsening.
2019-2022	~1.05-4.5GL	Boggabri Coal Mine	Idemitsu	Jul 23: NRAR investigation finds illegal water take by mine from 2019-2022. No prosecution, but will pay $54,000 for water theft, $16,000 to cover investigation costs and $10,000 for community water project.
2023	~1GL	Tahmoor Coal Mine	SIMEC mining (GFG Alliance)	Aug 23: NRAR prosecution leading to $150,000 in compensation, $50,000 fine for inadequate water licences and$25,000 for rehabilitation work. A spokesperson for SIMEC Tahmoor Coking Coal said the company had spent $10 million on rehabilitation works along Redbank and Myrtle creeks.

Appendix C: List of impacts on mine approvals due to water-related planning approval decisions or community opposition

Year	Impact	Mine	Operator	Description
2013	Delayed	Kevin's Corner Project	Hancock Prospecting	The proposed Kevin's Corner Project in Galilee Basin has been delayed due to concerns over Groundwater impacts and long-term outlook for thermal coal. The mine began the application process in 2009 for three unground longwall mines and two open-cut pits. The project was approved with conditions in 2013, however applications for the Alpha and Kevin's Corner coalmines have stalled. The project had been mothballed for almost a decade, but the lease applications are still active.
2013	Cancelled	Ashton Coal Mine Extension	Yancoal	In 2010, Yancoal proposed an extension project for an open-cut mine called Ashton South East – an $83 million project to extract 16.5 million tonnes of coal over seven years. An initial objection on grounds of air and water pollution was overturned on appeal in 2012, and the expansion was approved by the NSW government's Planning Assessment Commission. In 2013, EDO's client the Hunter Environment Lobby (HEL) successfully appealed against the commission's decision to approve the mine. In 2015, the project was approved for a seven-year extension, however, the NSW Court of Appeal decided to uphold a condition that no development work associated with the project could occur until Ashton Coal Operations had acquired a privately owned property that forms part of the proposed mining area. The private landholder refused to sell, and in April 2022 the approval lapsed, and the extension was cancelled.
2016	Delayed	Springvale Mine	Centennial coal	Springvale mine expansion delayed due to community opposition over water concerns.
2019	Postponed indefinitely	Newstan colliery	Centennial Coal	Approval postponed indefinitely
2019	Rejected	Bylong Coal Project	KEPCO (Korea Electric Power Corp.)	After a significant community campaign the proposed KEPCO Bylong Coal Project, NSW (SSD 6367) was refused on the basis that the impacts on groundwater would be unacceptable.
2021	Application withdrawn	Angus Place Coal Mine	Centennial Coal	Application withdrawn after long-term community opposition due to impact on local water sources and after Centennial admits submitting inaccurate data in its proposal.
2021	Rejected	Hume Coal Project		The NSW Independent Planning Commission rejects the Hume Coal Project's new underground mine proposal, citing numerous reasons. Commission ultimately concludes that the impact on water resources and the social impacts of the proposal are significant enough to warrant refusal.
2021	Delayed +1 year	Millennial and Mavis Downs Mine	MetRes	Underground mining planned to begin in 2022, but flood damage and geological variations pushed back first development coal to July-December 2023.
2021	Rejected	Dendrobium mine extension project	South32	The NSW Independent Planning Commission refuses extension proposal due to risks of irreversible damage to Sydney's drinking water catchment.
2021	Rejected	North Galilee Water Scheme.	Bravus (formerly known as Adani)	Federal Court applies "water trigger" to Bravus's North Galilee Water Scheme, and rejects the scheme, a critical component to supply water to the Carmichael mine, planned to extract 12.5GLpa of water from Central Queensland's Sutton River.

2022	Delayed	Narrabri Expansion	Whitehaven Coal	NSW Independent Planning Commission imposes 152 conditions on the project related to greenhouse gas emissions, groundwater impacts and other environmental impacts. Whitehaven has to resubmit water modelling component of its proposal after NSW Department of Planning and Environment finds issues with its claims on groundwater impacts. Local landholders also submit on groundwater risks of the project.
2022	Rejected	Waratah Coal Mine	Waratah Coal	Federal government rejects Clive Palmer's proposed Waratah Coal mine in the Galilee Basin because of its proximity to the Great Barrier Reef as well as impacts to groundwater and creeks in addition to its projected greenhouse gas emissions.
2023	Delayed	Ravensworth Mine	Glencore	Ravensworth North mine incurs additional delays under the federal Environment Protection and Biodiversity Conservation (EPBC) Act.
2023	Delayed +2 years	New Acland Mine	New Hope Group	New Acland Mine expansion plans stalled for ~2 years due to community opposition over groundwater impact concerns.
2019	Rejected	Bylong Coal Project	KEPCO (Korea Electric Power Corp.)	After a significant community campaign, the proposed KEPCO Bylong Coal Project is refused due to unacceptable impacts on groundwater.

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The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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