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Summary: Ecological impacts of Lake Macquarie power station

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Thermal power stations have operated on the shores of Lake Macquarie since 1956.¹ Currently there are two power stations using lake water for condenser cooling - Eraring (2640 MW) and Vales Point (1320 MW). Cooling water is discharged from Eraring into Myuna Bay, and that from Vales Point into Wyee Bay, which has had, and continues to have, a significant impact on the southern Lake ecosystems.

1. Lake water is drawn into the power stations and discharged back into the Lake which impacts on hydrodynamic processes of the southern area of the Lake.² Eraring power station's cooling water system drives water circulation in the central section of the lake, at a daily inflow rate equivalent to a 1 in 40-year ARI rainfall event.³ We estimate the two power stations pump about 6 times the equivalent volume of Lake Macquarie each year for condenser cooling.⁴
2. The cooling water intakes screens capture over 125,000 fish and a further 500,000 fish larvae and 4 million juvenile prawn - as well as an unknown number of other marine creatures that include sea turtles - every year are entrained through the cooling water systems,⁵ The mortality of marine organism larvae trapped or taken through the power station condensers is likely to be 100 percent.⁶ Eraring estimated impinged (captured) adult fish have a mortality of about 50 percent.⁷ The number of fish killed or damaged by Eraring has been estimated by NSW Fisheries to be over 25 percent of the 500,000 fish caught in Lake Macquarie by recreational fishers each year.⁸
3. The discharge of the water used to cool the power station condensers is discharged into Wyee and Myuna Bays to a maximum temperature of 38.5°C which increasing the

¹ Marshman NA, Hodgson BR (1991) Thermal discharges from power stations to Lake Macquarie. In: Whitehead JH, Kidd RW, Bridgman HA (eds) Lake Macquarie: an environmental reappraisal. University of Newcastle, New South Wales, p 9-16

² Umwelt, 2014.

³ *ibid.*

⁴ Lake Macquarie contains about 880 GL (surface area of 11,000ha x 8m average depth) and the two power stations collectively pump about 15 GL per day (5,475GL/pa). The volume pumped from the Lake is more accurately characterised as 12 times the volume of southern Lake Macquarie a year, which is effectively isolated from the northern Lake.

⁵ Damon Cronshaw, 2008. Power station kills Lake Macquarie fish. Newcastle Herald. November 7 2008 - 10:43AM

⁶ *ibid*

⁷ *ibid*

⁸ *ibid*

temperature of waters by between 4°C and 10°C.⁹ Thermal discharge into Lake Macquarie has a localised impact that increases the diversity and abundances of sponge and ascidian assemblages,¹⁰ but reduce phytoplankton,¹¹ the cover of some seagrasses,¹² and alters the species of fish, favouring some and hindering others.¹³

4. The 1996 Estuary Management Study of Lake Macquarie¹⁴ referred to studies undertaken by UNSW (1972)¹⁵, Sidabutar (1992)¹⁶, and Negarestan (1993)¹⁷ which assessed the aquatic ecological impacts of the increased water temperature near the power station discharge points. These studies found:
 - Loss of seagrass in the vicinity of cooling water outlets;
 - Replacement of *zostera* beds by *halophila* in Wyee Bay;
 - Changes in fish distribution as snapper, squid, tailor, flat-tail mullet, leather jackets, cardinal fish, glassy perchlets, goatfish, and toadfish were all less abundant in the cooling field, while tarwhine, silver biddy, bream and southern butterfish were more abundant in the cooling field.

5. Both power stations have altered seagrass assemblages and reduced seagrass cover near to the thermal outfalls, but Vales Point, due to the more enclosed receiving waters, has had the greatest impact. Last October, the EPA reduced allowable discharge temperatures from 38.5°C to 35°C due to the almost complete loss of seagrass from Wyee Bay. We estimate that since 2001 about 50ha of seagrass has been lost from Wyee Bay and about 15ha from Myuna Bay. However, historical losses could be much greater.

Conclusion

Origin Energy has announced that Eraring will stop producing thermal electricity in 2025, and Vales Point is expected to operate to 2029, at the latest. Consideration must be given to potential thermal shock and other ecological consequences of sudden reductions in water temperatures. Planning and consultation should also begin for how best to rehabilitate the impacts on seagrass beds in Myuna and Wyee Bays.

⁹ Garthwin, Ruby & Poore, Alistair & Vergés, Adriana. (2013). Seagrass tolerance to herbivory under increased ocean temperatures. *Marine pollution bulletin*. 83. 10.1016.

¹⁰ Peter Brendan Barnes, 2009. Environmental impacts and the ecology of sponges and ascidians in south-eastern Australian coastal lakes and lagoon. PhD Thesis, University of Wollongong Thesis Collections University of Wollongong.

¹¹ Ingleton, Timothy & McMinn, Andrew. (2012). Thermal plume effects: A multi-disciplinary approach for assessing effects of thermal pollution on estuaries using benthic diatoms and satellite imagery. *Estuarine, Coastal and Shelf Science*. 99. 132–144. 10.1016

¹² PH, Gruber RK, Hill R, Ralph PJ, Booth DJ and Macreadie PI 2013, Physiological and morphological responses of the temperate seagrass *Zostera muelleri* to multiple stressors: investigating the interactive effects of light and temperature, *PLoS one*, 8, p.e76377

¹³ WMB, 2011. lake Macquarie estuary management study. Prepared by WBM Oceanics Australia for Lake Macquarie City Council

¹⁴ WMB, 1996. Lake Macquarie Estuary Management Study (LMEMS) Volume 2.

¹⁵ UNSW (1972) Ecology of selected estuarine organisms Data List No. 1 and No.2. Project 12- 045-16. School of Zoology, University of NSW, Sydney.

¹⁶ Sidabutar, T (1992). Zooplankton in the cooling field and in the vicinity of Vales Point Power Station in the southern part of Lake Macquarie, M.Sc Thesis - University of New South Wales.

¹⁷ Negarestan, H (1993). A comparison among benthic macrofauna in three environments around Vales Point Power Station, Lake Macquarie. M. Sc. Thesis - University of New South Wales.