Healing the 'scar' of the landscape: post-mining landscape in Anglesea

Conference Paper

Healing the 'Scar' of the Landscape: Post-Mining Landscape in Anglesea

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Abstract

The nexus between environmental bio-remediation and environmental design, as it pertains to disused coal mining sites in Australia, is little investigated. Increasingly, many of these open cut extraction holes around south-eastern Australia, are becoming redundant as their resources are exhausted or non-economic viability creeps into the industry or are becoming management 'nightmares'. The recently announced March 2017 cessation of the Yallourn Power Station and associated brown coal Open Cut, and the recent fires and insurance liability legal determinations of the Yallourn Open Cut are exemplar of the former and latter respectively.

This paper surveys the deeper bio-remediation and ecological transformative issues directly associated with the Anglesea brown coal Open Cut, and offers an ecological design lens insight as to possible treatments and scenarios that can be offered to guide the future use and management of the site. The lens demonstrates the richness that interdisciplinary design and applied research offers in assisting the healing and mediation of sites. The extraordinary nature and scope of the Anglesea coal mine site provides an opportunity to create a range of cultural attractions, natural succession treatments, natural bio-remediation strategies and educational opportunities. One scenario, for an Anglesea Lake Eco-Resort, proposes to incorporate an integrated Aboriginal cultural destination, performance centre, art installations and recreational venues, engaging the Anglesea community, visitors, researchers and students towards creating a vibrant and unique environment.

Keywords: Environmental bio-remediation, environmental design, Anglesea open cut, ecological determinism

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1 Introduction

The Anglesea Power Station comprised a brown coal–powered thermal power station with open cut located at Anglesea, Australia, that was closed in late 2014. The Power Station involved 1 steam turbine with a capacity of 150 megawatts of electricity. The complex was previously managed by Alcoa to supply almost 40% of the electricity used by Alcoa's nearby Point Henry aluminium smelter. The Power Station operation commenced in March 1969, employed about 80 people, with coal supplied by the adjacent open cut mine transported to the power station along a 3km long private road.

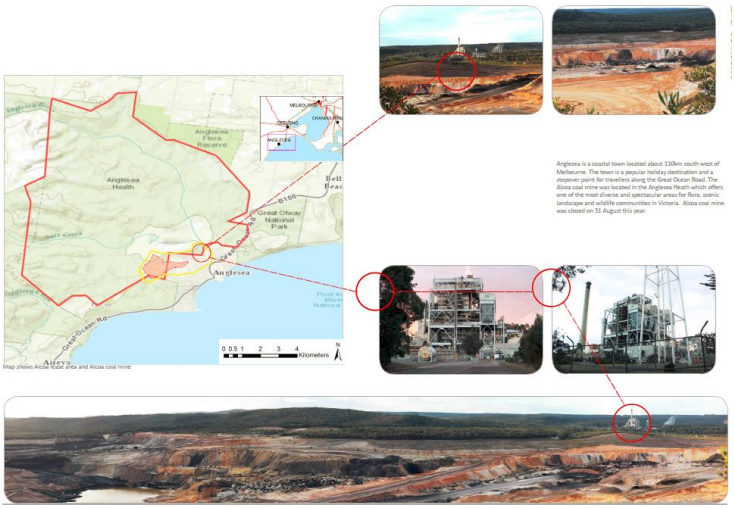

Figure 1: SITE LOCATION AND EXTANT SITE CHARACTERISTICS.

Earthmoving contractors stripped and backfilled the burden into the mined area using conventional power shovels and trucks.

Historically, the Roche Brothers discovered extensive coal deposits 2km to the north of Anglesea in 1955. Commencing mining in 1959, Western Mining Corporation acquired the mining rights in 1961 to supply power to the smelter planned by Alcoa. The *Mines (Aluminum Agreement) Act 1961* granted Alcoa a 50–year exclusive leasehold right to explore and mine over some 7,350ha of Crown land, nestled with a highly biodiverse-rich and unique heathland ecosystem, and commenced accessing a coal reserve estimated of 50 million long tonnes, about 140m thick, with an economic mineable reserve estimated at 70 million long tonnes in the upper seam, and a further 90 million long tonnes in lower seams. In 1992 the overburden to coal ratio averaged around 2.5 to 1, with an average coal thickness of 27m. Following negotiations with the Victorian government in 2011, Alcoa took up a 50-year extension of the Agreement under the *Mines (Aluminium Agreement) Act 1961*, allowing for continued operation of the mine and Power Station until 2016. But, with the closure of the smelter in 2015, Alcoa also announced that it would close the Open Cut complex in August 2015. A key question that Alcoa, and the Crown, is yet to face is how to remediate the Open Cut with its associated ecological, riparian and water issues.

2 Challenges

2.1 Anglesea Open Cut Mine Site Context

The nexus between environmental bio-remediation and environmental design, as it pertains to disused coal mining sites in Australia, is little investigated. Increasingly, many of these open cut extraction holes around south-eastern Australia are becoming

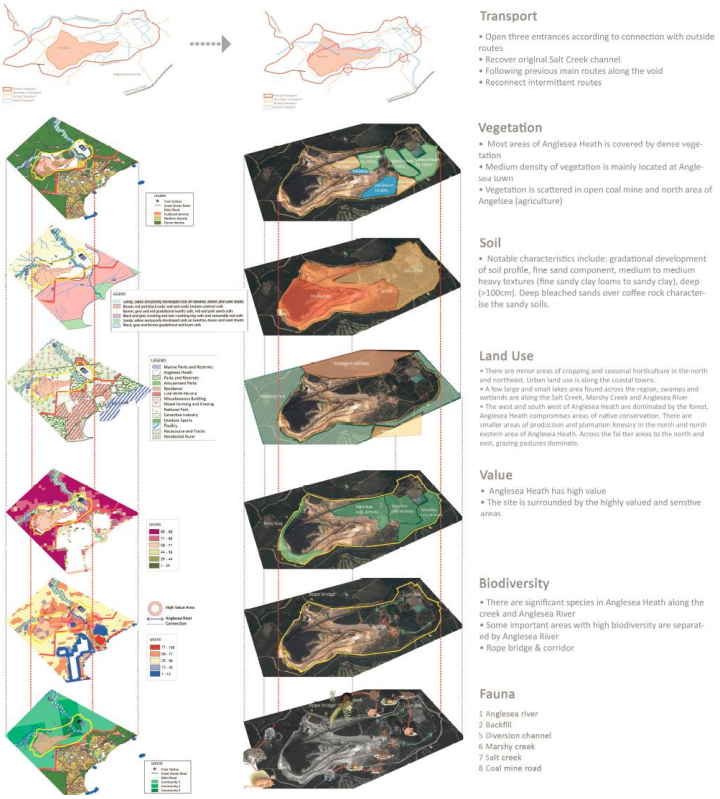

Figure 2: MAPPING OF SITE VARIABLES.

redundant as their resources are exhausted or non-economic viability creeps into the industry thereupon becoming management 'nightmares'. The recent fires and insurance liability legal determinations of the Yallourn open cut is an exemplar of the latter. The Anglesea Open Cut's sole purpose, to provide a direct supply of secure electricity to the Alcoa Point Henry complex, has now ceased, and years of peripheral and little discussed environmental actions at the site to deal with ground water seepage and dispersal, surface water management, water quality security of the Anglesea River and its estuary health, peripheral and on-site biodiversity enhancement given its location inside a highly valued heathland ecological system, are all starting to unfold and 'come to the surface' as serious questions as to what to do with the 'hole' and its associated infrastructure are now being raised.

Operationally, by 2005 approximately 35 million tonnes of coal had been mined, with about 1.1 million tonnes of brown coal mined annually feeding a boiler that consumed 144 tonnes of pulverised brown coal an hour. While possessing a high quality heat value in comparison to other brown coals that produce electricity in Victoria, the coal at Anglesea has much higher levels of sulphur of around 3%, resulting in high levels of sulphur dioxide (SO_2) emissions. Carbon Monitoring for Action estimated this power station was emitting 1.21 million tonnes of greenhouse gases each year by burning the coal (CARMA 2016). In addition, the mine was drawing its cooling water from

6 sub-artesian well bores, supplemented with rainwater, thus affecting the regional groundwater system.

Since 2011 Alcoa, and its Anglesea power station and brown coal open cut has been subject to considerable local and environmental criticism about the health impacts of air pollution and acid-influenced ground-water seepage and intrusion into the Anglesea River catchment arising from the mine practice and its power station operation. The local municipality, the Surf Coast Council, has been keenly aware of these implications, constraints and opportunities, has enabled a spirited community engagement process to consider the future of the site, the ecological and fire risk issues, recognizing that the site's complex ecological issues have been little studied in a holistic manner.

2.2 Land Capability Assessment and Ecological Determinism

While soil classification and land capability assessments, coupled with separate water hydraulic systems research and evaluations, have been beneficial in investigating applied science themes in and around this site (Kentish 1983, Sharley *et al.* 2012, Tutt 2008, William 2011), such have lacked a holistic approach to knowledge about mediation for the site; as also concluded by the Surf Coast Council. What these investigations have been lacking is an ecological deterministic methodological approach that weaves together multiple themes of information and expert rating of variables and attributes as to consider landscape values and sensitivities and risks of development and redevelopment of which bio-mediation is a central thread for this site. A second facet is the static nature of these applied science inquiries that have been little informed by contemporary climate change adaptation and resilience information of which there is now quite specific appraisals of the human and ecological climate change patterns and risks relevant to this locality (Roös 2014; Roös & Jones 2015).

While soil classification, which deals with the systematic categorization of soils based on distinguishing characteristics, it embodies criteria that dictate choices in use including being informed by development and exploitation principles. But such approaches seek to treat soils as resources rather than as platforms to heal and renourish, despite the fact that soil scientists argue for a natural systems approach to classification (i.e. grouping soils by their intrinsic property (soil morphology), behaviour, or genesis) that would enable interpretation of soil classes for many diverse uses.

In contrast McHarg, in his *Design with Nature* (1969), pioneered the peer-acclaimed concept of ecological planning or ecological determinism. This method, illustratively articulated in the publication, set forth basic concepts that underpin the basis of geographic information systems today. *Design with Nature* (1969) provided step-by-step instructions on how to dissect a region into its appropriate uses, promoted an ecological view in which the designer becomes very familiar with the area through analysis of soil, climate, hydrology, etc., was the first text to define the problems of modern development and present a methodological process prescribing compatible solutions.

Figure 3: A POSSIBLE SCENARIO FOR THE ANGLESEA OPEN CUT.

The text has subsequently affected a variety of disciplines and ideas including environmental impact assessment, new community development, coastal zone management, brownfields restoration, zoo design, river corridor planning, and ideas about sustainability and regenerative design.

3 Design-informed Eco-Remediation

The methodological strategy for this project (Su 2015) therefore sought to apply ecological determinism, as advocated by McHarg (1969), with the latest domestic and international mine site rehabilitation practices for discussed coal mine site bio-remediation approaches and strategies (Baida 2014; Berger 2002, 2007; Zhang *et al.* 2001). The socio-political decision-making context of this investigation was informed by recent coal mine fire events at Yallourn, the subsequent Inquiry (Ashurst 2015; Victoria 2015), relevant conservation-interest submissions for the former Inquiry that carried allied discussions about the Anglesea Open Cut (CARMA 2016; GEC 2011), specific applied science investigations as to the site's carrying capacity, limitations, acid and hydraulic variables (Tutt 2008), and biodiversity risks and opportunities (Kentish 1983; Sharley *et al.* 2012; William 2011).

The aims of the investigation sought to:

- *Create opportunities for recreational activities*: biking, walking, running, marathons, mountainbiking, mountain climbing, horsing riding, lawn concert, large scale meadows for picnicking, kite flying, river amphitheatre and community events;
- *Create opportunities for waterfront recreation*: canoeing, kayaking, fishing, bird watching, picnicking and rowing;

- *Improve natural resources*: Anglesea lake will become a buffer area to restore acidic water, infiltration of stormwater, creating diverse habitats, improving ecology and creating wide open space;
- *Create educational opportunities*: exhibition & gallery to explain coal mine history and its transformation to a lake; Aboriginal centres provide experiments for researchers and students;
- *Create opportunities for art and culture*: the special nature and site provide opportunities for environmental art, performance art and cultural event programming, artwork installations, workshops, museum, amphitheatre and displays; and
- *Generate commercial development*: restaurants, cafe, art workshops and accommodations.

This methodological process analysed mapped variables (Figure II) including transport, vegetation, soils, land use, water/hydraulic systems, aesthetic values, biodiversity and fauna in a sequence of overlays to test and evaluate landscape sensitivities, risks and opportunities.

Explicitly, the project used a holistic planning process to value and performance evaluate design decisions. Included were options of shifting soils, mediating and transforming coal wall embankments and edges, reinstatement and re-use of the overburden, strategic storage and re-use of extant water collection and purification measures and facilities, use of novel ecosystem and conventional restoration ecology vegetation succession strategies as well as broad-acre re-seeding, that were all introduced by the author, and groundwater seepage and water-based pollutant mediation strategies together with simplistic biodiversity re-establishment strategies as suggested by Kentish (1983), Sharley *et al.* (2012), Tutt (2008) and William (2011).

4 Summary and Conclusion

The extraordinary nature and scope of the Anglesea coal mine site provides a major opportunity to craft and succession stage/plan a bio-mediation-informed master plan that is not simply a strategy to revegetate a disused coal open cut. In the contemporary context of seeking alternate strategies to mediate, transform, nurture and heal devastated landscapes, this investigation project (Su 2015) offers a challenging ecologically deterministic-informed scenario resulting a stage remediation process aided by flora succession that progressively realises a site that could support range of cultural attractions, natural succession exemplars, and natural bioremediation and education venues and research areas. The 'Anglesea Lake Eco-Resort' may also serve as an Aboriginal cultural destination, a regional performance centre, support environmental art installations and recreational venues, while engaging directly with the Anglesea community, visitors, researchers and students and creating a vibrant and unique environment.

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