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Beneficial and award-winning re-use of a quarry site – landform design for sustainable closure

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Abstract

The shortage of available land for housing within established urban areas is a challenging contemporary issue. This paper examines the strategic need and opportunity to return degraded land to higher order end land uses and the obstacles presented by the planning system when remediation and rehabilitation is involved. The opportunity to overcome these obstacles is exemplified by the rehabilitation of a former clay quarry and brick manufacturing plant in Melbourne, Australia.

Over 50 years ago, when Austral Bricks opened a quarry and brick manufacturing operation at Scoresby, east of Melbourne, the site was over an hour away from the nearest residential area. Now, the 58 ha site sits within a growing urban community. Many such legacy sites have been identified as potential opportunities for contributing to the supply of urban residential land to meet growing demands. In reality, conversion of former industrial land can be challenging and requires an integrated approach to be successful.

After ceasing operation at Scoresby, Austral Bricks envisaged rehabilitating the site for residential use, a transformation that would create a beneficial opportunity to meet growing demand for new and affordable housing. In 2004, Austral Bricks asked Golder Associates Pty Ltd (Golder) to create and implement a strategy to transform the quarry site by re-creating a natural landform suitable for development as a premier new residential neighbourhood incorporating natural habitat and high environmental standards. The strategy would include filling the quarry pits and remediating on-site waste. In developing a sustainable solution, Golder worked closely with the Environmental Protection Authority (EPA) to gain permission to re-use over 1,000,000 m^3 of site-derived waste (predominately soil and bricks) as engineered fill in the quarry pits. Remediating on-site waste eliminated transportation costs and allowed the project to move away from the traditional method of battering the sides of the pits which would have rendered them of little use to the community for a considerable time. The integrated approach included town and environmental planning, geotechnical engineering, environmental remediation engineering, community consultation and ecology. In late 2009, the project received the Victorian Department of Primary Industries 'Strzelecki Award', which recognised 'overall excellence and innovation in sustainable earth resource development in a large resource development operation'. The project also received a Commendation from the Planning Institute of Australia for sustainable development.

Environmental, social and economic drivers for post-mine planning end uses are not exclusive to existing urban areas. As our urban centres expand, populations demand a wide range of amenities and facilities within easy reach. Typically this has been assumed to be a return to some sort of 'natural' landform or naturalistic state. However, post mine end uses offer a wider range of opportunities that can contribute to improved quality of life, including passive and active recreational facilities and infrastructure including food, water and energy provision.

1 Introduction

Degraded former industrial land is a valuable resource that could be recycled to help to improve urban residential and industrial land supply and contain or slow metropolitan growth. As our cities expand, land becomes scarce and property values rise. The supply shortages of developable land, especially residential land in and around urban centres, are becoming critical.

Many governments have not recognised that sustainable land re-use and urban redevelopment requires a concerted policy and regulatory environment that will encourage and facilitate land recycling in the quickest most economical way. Political, societal and government interest in sustainability is not being led or matched by a willing legislative framework.

It is time for wide spread improvements to regulatory mechanisms that governments rely on to deliver their policy objectives so that the intended delivery of land for development can be achieved more efficiently and cheaply. Our personal view is that improvements to planning systems could enhance efforts to rehabilitate, remediate and convert degrade land to new more sustainable uses.

By 'degraded land', we mean properties such as former industrial land, exhausted mines and quarries, or land that has been contaminated or excavated by past use. By 'sustainable', we mean the efficient re-use of land, rather than leaving it vacant, or unused.

We will refer to the length of time involved under the planning system in the State of Victoria, Australia, to obtain approval for a large urban renewal project – Austral Bricks Scoresby quarry – that was coordinated by Golder Associates Pty Ltd (Golder). Despite the cost and time challenges, this case study, which is presented below exemplifies an excellent outcome that could be a model for other urban mine rehabilitation opportunities.

Our rural and peri-rural mining sites should not be forgotten, but let's think more widely than pursuing a simple return to nature. In many instances farming and forestry has changed natural landscapes although the perception often is that these manmade settings are natural. The reality is that many rural mine sites could be transformed into new landscape features that fulfil a new role. Some examples are shown later in this paper.

Human interaction with town, city and rural landscapes is not static and there is a wide range of emotional responses to any landscape where quarrying or mining operations exist or are proposed. Planning, including community participation for post-mine activity can be a positive intervention and become part of the story by design, rather than 'accident'. This may be a process to building truly sustainable design outcomes.

2 Containment of urban growth

2.1 The issues: land scarcity, housing cost and diversity

In Victoria there is a plethora of policies dealing with environmental management and urban land use and development, but a dearth of policy encouragement towards recycling degraded land. Around the world, cities are booming with urbanisation. Recently we saw, for the first time, the majority of the world's population living in cities. Some new cities, such as those proposed in the UAE (Masdar City) and Dongtan (near Shanghai in China) will be based on the principle of containing the spread of the future urban area as a contribution towards minimising energy consumption and environmental impact.

Nothing similar is on the radar for Australia. The last federal initiative was the Australia's Department of Urban and Regional Development Growth Centre Programme of 1973–1975, which proposed a series of expanded or new growth centres such as Monarto (SA), Bathurst-Orange (NSW), Albury-Wodonga (Vic-NSW) and Geelong, near Melbourne. This programme did not focus on the creation of compact energy efficient cities, and little came to fruition. Monarto, outside of Adelaide was abandoned and only now is the future growth of Geelong being tackled by the proposal to add two urban areas adjacent to the edge of metropolitan Geelong. However, this and other examples of 'edge cities' around Melbourne and other Australian cities still feature an approach that utilises primarily quite low densities. The predominance of low density growth at the edges is not accompanied by attention to opportunities that may be present for renewal within the established urban areas.

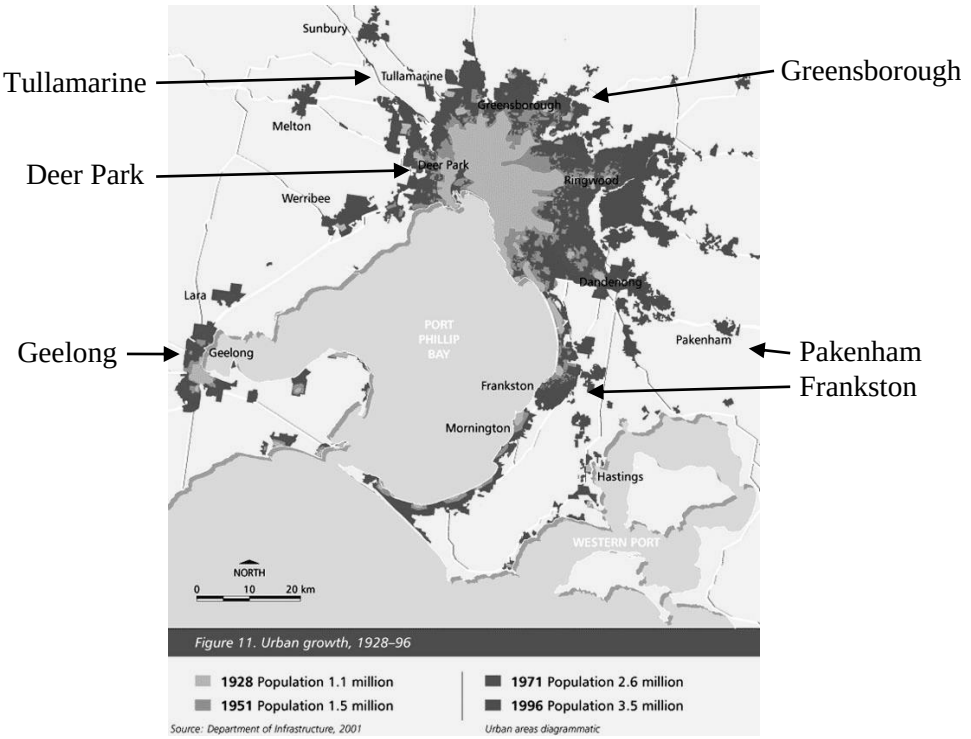

Figure 1 Urban growth of Melbourne, Australia

Typically, urban growth occurs by incremental circumferential or radial growth, typified by Melbourne since the 1920s, almost 100 years ago. As Australian governments attempt to limit growth by containment strategies, battles are being fought over proposals to intensify densities in inner or middle suburbs. An example is the Urban Growth Boundary (UGB) around Melbourne, which is based upon the concept behind the UGB that defines the metropolitan area of Portland, Oregon. In Australia, inadequate funds are being allocated to essential public transport, and the density intensification necessary to lower the land cost component in redevelopments is controversial. Similar issues and discussions are common around the world.

There is much talk about the cost of housing and the shortage and cost of land that has contributed to a crisis in housing affordability. Measures that could speed up the rezoning process in outer growth corridors have recently been introduced in Victoria as a hope for means of increasing land supply in those areas, but the metropolitan area has been dramatically increased in size by pushing out the UGB in an effort to supply 'affordable lots'. Development charges and travel demands are adding significant costs for the first-time home buyer. One wonders if this approach will be sustainable for much longer.

There is also talk about the need to supply a greater variety of housing types and jobs close to public transport, to contain the cities and utilise better the existing infrastructure. Industry is decentralising from inner areas to new large estates that have good accessibility to freeway infrastructure and offer large sites. While this relocation of industry paves the way for increased provision of housing in established and serviced suburbs, fast track mechanisms for re-cycling vacated often contaminated land are not yet in place.

Sometimes it can be challenging to engage the legislation and agencies in an effort to facilitate quick approvals for the transformation of degraded land into clean, vacant land that can be re-used for a new purpose. Disconnects between Federal, State and Local governments and regulatory agencies, systemic impediments, and a plethora of controlling regulations and policies can magnify the cost of land and development, making difficult the achievement of 'affordable' housing.

2.2 A solution: the opportunity offered by brownfield industrial and mining sites

The need for land within the urban areas, combined with a few government initiatives to clean up mining, port-side and industrial areas to create a more people friendly environment in our cities, has created significant interest in brownfield or legacy mining and industrial sites. There is increasing recognition by

those companies and agencies that own such land that these sites may offer the potential to contribute towards the urban land supply and relieve them of lazy assets on the balance sheet.

Conversion of brownfield sites to new uses represents sound, sustainable land use. However, conversion of such land can be difficult, time consuming, expensive, possibly risky, and a candidate for a winding path through the regulatory environment. In many cases, only a determined client with a deep pocket, adequate time and the prospect of high land values would be interested in embarking on a rehabilitation project that will lead to a high order new end use, especially where remediation is involved.

2.3 Rehabilitating mined land – the traditional approach

Extractive industry is a long term land use. For many sites, regulations will have changed since commencement, leading to new requirements that complicate and increase the cost of rehabilitation. Given the long time frames over which extractive industries operate, it can be difficult when obtaining the initial planning approval, to anticipate the ultimate end use.

In the past, exhausted quarry holes have usually been rehabilitated by land fill, using waste, or simply by battering the sides to make them safe. In the latter case, in an urban location, the potential for a site to be used for new uses would be restricted if the rehabilitation works were to be limited to minimal battering.

Waste is now increasingly been seen as a resource that can be recovered or used for new purposes, and landfills are not considered to be a wise or environmentally appropriate land use. If a quarry hole is to be filled with scarce and expensive clean fill, the value of a rehabilitated hole will usually need to be recoverable by the sale of the land for a new urban use.

These challenges offer many opportunities to take a new approach to minimise land wastage by transforming mining sites into developable land, as at the Austral Bricks Scoresby property.

3 A new approach: Austral Bricks – Scoresby project

The success of the Austral Bricks – Scoresby quarry rehabilitation and redevelopment project exemplifies the opportunity to convert a large urban quarry / industrial site into a major housing estate. The project was time consuming and a complex approval process was involved.

Over 50 years ago, when Austral Bricks' predecessors established a quarry and brick manufacturing plant at Scoresby, east of Melbourne, the site was over an hour's drive from the nearest residential area. Now, the 58 ha property sits within a growing community. A major district centre has been developed nearby.

After ceasing operation at Scoresby, Austral Bricks envisaged rehabilitating the site for residential use, a transformation that would create a beneficial opportunity for the City of Knox to meet growing demand for new and affordable housing, in accordance with the municipality's Knox Housing Statement.

In 2004, Austral Bricks asked Golder to create and implement a strategy to transform the quarry site by re-creating a natural land form suitable for development as a premier new residential neighbourhood incorporating natural habitat and high environmental standards. The strategy would include filling the quarry pit and remediating on–site waste to allow the property to be redeveloped as a 1,000 house neighbourhood. To facilitate a sustainable solution, Golder worked closely with the Environment Protection Agency (EPA) to gain permission to re-use over 1,000,000 m^3 of site-derived waste (predominantly solid and bricks) as engineered fill in the quarry pits. Remediating on-site waste eliminated transportation costs and allowed the project to move away from the traditional method of battering the sides of the pits, which would have rendered the site of little use to the community. The integrated approach included town planning and environmental planning, geotechnical engineering, environmental engineering, community consultation and ecology.

The project involved a two year planning phase. Rehabilitation took three years. In late 2009 the project received the Victorian Department of Primary Industries 'Strzelecki Award', which recognised 'overall excellence and innovation in sustainable earth resource development in a large resource development operation'. The project also received a Commendation from the Planning Institute of Australia for sustainable development.

3.1 Statutory approvals and notable aspects of the project

The following is a generalised summary of the approvals required to rehabilitate, remediate and rezone the Scoresby site. All approvals were achieved without any third party or proponent appeals or agency objections. Notable aspects of the five year project are also discussed.

3.1.1 Earthworks for remediation of contamination and rehabilitation of quarry hole– planning permit required

Town planning permission was required for earthworks involved in remediating the contaminated soils, moving soil around the site, filling the quarry and changing the levels. The earthworks involved:

- Planning permit for cut and fill earthworks, including:
    - Construction Environmental Improvement Plan approved by EPA and City of Knox.
    - Approval of final levels contours by City of Knox, DPI.
    - Approval by City of Knox of geotechnical specification for engineering of fill material requiring continual testing of material being placed.
- Removal and replacement, to defined engineered compaction standards, of large volumes of unconsolidated fill to provide suitable conditions for residential development.
- A large volume of cut and fill to create final levels suitable for residential use.

3.1.2 EPA consent to remediation

The consent of the EPA was required to allow contaminated material to be placed within the quarry hole. Remediation required:

- Remediation of the ground conditions, which at some locations were affected by residual manganese, an additive to clay that is used to produce dark brown bricks. Material containing manganese and rubble had been allowed by the EPA under the site licence to be retained on site as uncompacted ‘Waste’ residual to an industrial process. The environmental auditor directed that this material, including the bunds around the site, be placed at depth within the quarry hole, and then covered by a minimum of five metres of clean material.
- Demolition of the asbestos sheeted factory and manganese contaminated related storage areas.

3.1.3 Geotechnical testing and compliance

The standard of compaction of materials placed in the quarry needed to be confirmed by a comprehensive testing programme in accordance with Australian Standard AS3798 (2007).

3.1.4 Environmental Audit

Environmental and planning legislation required an Environmental Audit of the works to be undertaken by an independent environmental auditor. The audit confirmed that the remediated site would be suitable for the residential development, which is considered to be a sensitive use.

3.1.5 Permit for removal of vegetation

The removal of planted native vegetation around the site was subject to native vegetation offset provisions and required a permit.

3.1.6 Approval of rehabilitation

Approval from the agency responsible for extraction industry (Department of Primary Industries – DPI)) was required, as the proposal involved a major change to the approved rehabilitation works.

3.1.7 Rezoning of land

A planning scheme amendment was prepared by Golder. This led to a change in the zoning of the land to allow it to be redeveloped as a new neighbourhood. This was a complex amendment that included an outline development plan (ODP). The ODP included principles and design and development guidelines applicable to the road network and connectivity, pedestrian and cycle paths, water sensitive urban design, housing densities and types, built form, establishment of public open space and vegetation that would have high ecological values, community services and infrastructure, and contribution of a site for development by a housing association.

3.2 Community consultation

During the project it became clear that many residents in the surrounding area welcomed the proposal to develop the site for housing, but were concerned about the potential amenity impacts of the filling works. Many residents felt that the loss of the screen planting that had been established around the perimeter of the site would reduce ecological values. Some residents were fearful of the prospect of being adjoined by high density housing. These concerns were addressed in the master plan and urban design principles that were written into the rezoning approval.

During the planning permit and amendment process, there was extensive public consultation, which assisted the avoidance of any appeals. However, the combined time involved in the approval process amounted to about 24 months. Had appeals occurred, this time could have been extended by a further 12 months.

3.3 Master plan for residential development

A master plan was prepared to provide for development of approximately 1,000 residential lots at a variety of sizes and density, 10% public open space linked to the adjoining residential neighbourhood, establishment of habitat with high ecological values, water sensitive urban design, a component of affordable housing, and a small neighbourhood centre. In summary:

- Preparation and processing of a major amendment to the Knox Planning Scheme, rezoning the land from Industrial 1 Zone (IN1Z) to Residential 1 Zone (R1Z) with a Development Plan Overlay and Urban Planning Principles.
- The co-operation between Austral Bricks, the City of Knox, Environment Protection Authority, Department of Primary Industry (Minerals and Petroleum Division) and a multi-disciplinary consultant team managed by Golder facilitated the strategic planning, approval and implementation of the complex project.
- Filling has almost been completed and the land has been sold to a major land developer who has commenced development in accordance with the principles enunciated in the Development Plan Overlay.

Figure 2 Left: Austral Bricks Scoresby Quarry before 2005; Right: Austral Bricks Scoresby Quarry after 2005 showing first stage of roads under construction (NearMap, 2011)

Figure 3 Left: Austral Bricks Scoresby existing site topography; Right: Austral Bricks Scoresby topography post filling operations

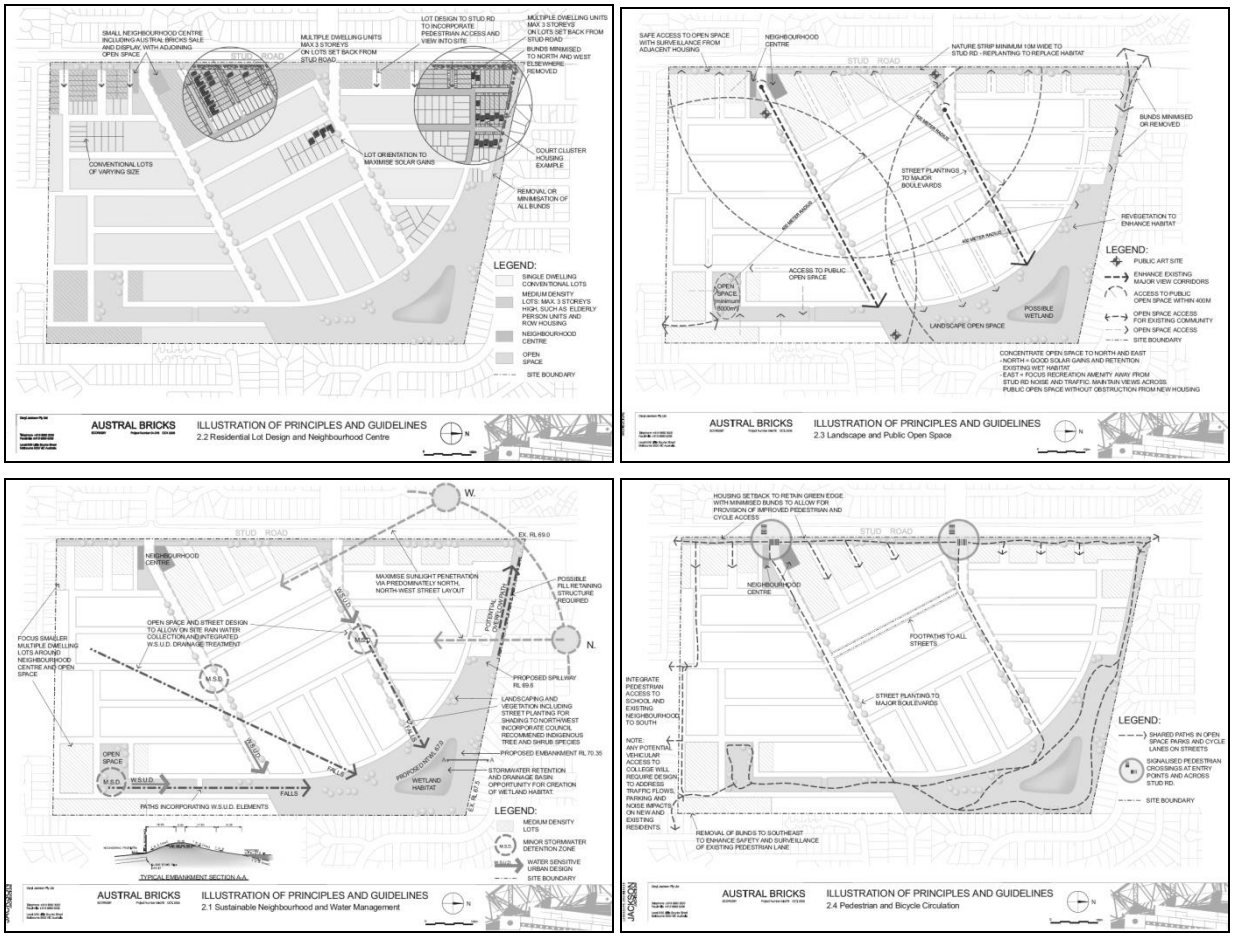

Figure 4 Austral Bricks Scoresby master plan and urban design principles

4 Examples of post mining rural sites

The following photographs show examples of Golder projects show a range of solutions for post mining re-use:

Figure 5 Edlington Park (UK)

Figure 6 shows the redesign of Edlington Pit as a country park located on the outskirts of a city. The ecological based design approach includes waterbodies, walking and cycle trails, woodland.

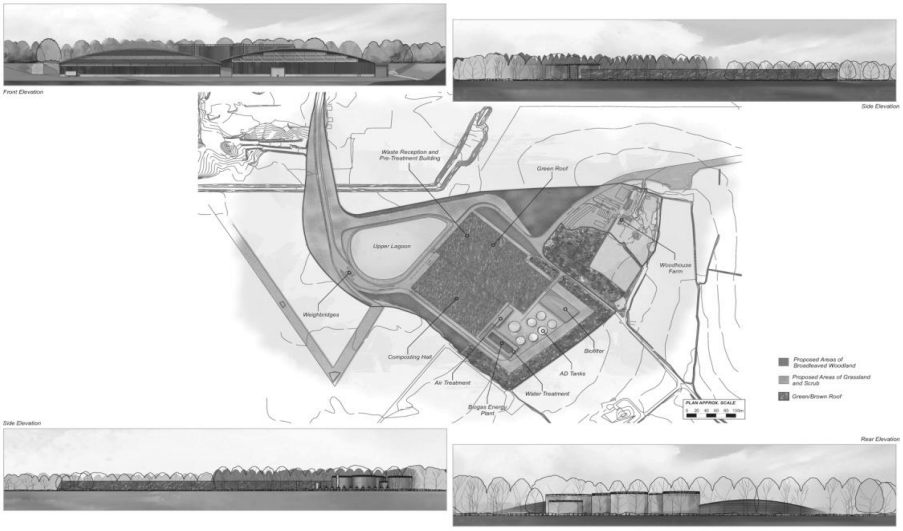

Figure 6 Energy to waste – proposed development (UK)

'Hole in the ground' quarries often provide an opportunity to hide or partially hide other major processing or manufacturing facilities relatively close to residential areas. This is a proposal to locate an energy from waste (EFW) facility in the bottom of a mineral extraction area.

In addition, opportunities include:

- New cultural landmark features to celebrate and educate the community about quarries, mines, and their operations both during operation and upon cessation.
- Conversion to venues for public gatherings, celebrations and performances.
- Transformation to landform monumental scale attractions using overburden or waste material.

One of the best known examples of post-mine development is the Eden Project in Cornwall, UK, a major visitor destination in a disused clay mine, transformed into a rich, global garden where visitors can learn about nature and get inspiration about the world around them.

5 Conclusions

Changes in urban patterns have led to the relocation of industrial uses and a shortage of residential land within established urban areas. Former legacy or degraded mining sites can be returned to a sustainable use, but this process often involves complex remediation and rehabilitation works.

The Austral Bricks – Scoresby quarry rehabilitation and redevelopment project demonstrates how planning and environmental controls that can inhibit permitting, adding costs and delays to the process, can be overcome to transform urban mine sites into new residential land. Similar opportunities exist to return rural or peri-urban mine sites into outstanding landscape and recreational assets.

Acknowledgements

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References

Australian Standard AS3798 (2007) Guidelines on Earthworks for Commercial and Residential Development.

NearMap Pty Ltd (2011) Photomaps – Aerial Photograph – Austral Bricks Scoresby Quarry, viewed 29 April 2011, https://www.nearmap.com.