



Douglas Partners

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Integrated Practical Solutions

Earthworks Specification

Oakdale East Estate - Precincts 2 to 5
Old Wallgrove Road, Horsley Park

Prepared for
BGMG 14 Pty Ltd

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Appendix A: Specification Work Methods and Intents

Earthworks Specification

Oakdale East Estate - Precincts 2 to 5

Old Wallgrove Road, Horsley Park

1. Introduction

This specification presents the requirements for earthworks control and geotechnical management of the placement and compaction of fill within Precincts 2, 3, 4 & 5 of the Austral Bricks Plant 3 site located at 224-398 Burley Road, Horsley Park.

The specification was prepared by Douglas Partners Pty Ltd (DP) at the request of The Austral Brick Co Pty Ltd (Austral Bricks) and Goodman Ltd (Goodman). It does not cover all possible scenarios. It has been based upon probable site conditions and materials and may be amended if circumstances require.

This specification does not cover any contamination, environmental, sedimentation or erosion issues. These potential issues are covered elsewhere in the project's various environmental reports. It also does not address health, safety, security or environmental management issues. These are the responsibility of the Contractor.

2. Project Description

The Oakdale East Industrial Estate is to be expanded to include Precincts 2, 3, 4 & 5 across land to the north and east of the existing Precinct 1. The development of Precincts 2, 3, 4 & 5 will include extensive earthworks to bench the site for the construction of warehouses. The area of the proposed works is shown on Figure 1.



3. General

3.1 Objectives

The aim of the specification is to ensure that all fill on the site is placed in a carefully controlled manner so that the final condition of the filled site is suitable for the proposed development.

This specification provides the necessary requirements and procedures for controlling fill quality, placement, compaction and approval on the site.

3.2 Available Information

This specification has been prepared based on the following information:

- DP Report on Preliminary Assessment of Rock Depth, Oakdale East Earthworks (Stages 2 to 4), Ref: 86545.13.R.001.Rev0, dated 30 April 2022.
- DP Report on Geotechnical Assessment, Oakdale East Industrial Estate (Precincts 2 to 4), Ref: 86545.13.R.002.Rev1, dated 23 July 2022.
- DP Earthworks Specification, Oakdale East Earthworks – Quarry West, Ref: 86545.13.R.003.Rev0 dated 30 November 2021.
- AT&L Drawings – Oakdale East, 1000-Series Infrastructure, Civil Works Package, State Significant Development Application, SSD-37486043 (103 Drawing Set, dated 25 May 2022).
- AT&L Drawings – Oakdale East, 000-Series, Rehabilitation Master Plan, Development Approval (19 Drawing Set, dated 13 July 2022).
- AT&L Drawings – Oakdale East, 000-Series, Rehabilitation Works, DA 347.1/2021, Issued for S4.55 (27 Drawing Set, dated 27 September 2022).
- Cardno Drawings – Plant 3 Remediation, Ground Surface Level Models, Drawing No. 111783559 Rev4 Sheets 1 to 8 of 8.

3.3 Project Team and Responsibilities

The companies (or people) who will be part of the project team are listed in Table 1, together with their responsibilities.

Table 1: Responsibilities

Role	Company	Responsibilities
Project Owner (the 'Principal')	Austral Bricks & Goodman	Engages contractors and consultants to carry out the works and ensures that they comply with the project specifications and contracts.
Superintendent (the 'Superintendent')	Arcadis	Co-ordinates the earthworks contractor, the consultants, GITA and surveyor. Issues formal contractual instructions and facilitates request for information and extension of time requests etc.

Role	Company	Responsibilities
Earthworks Contractor (the 'Contractor')	Mulgoa Quarries & Burton Contractors (MQB)	Sources and coordinates the supply of fill materials from on-site and off-site (if required) which comply with the requirements of this specification. Places and compacts fill materials in a controlled manner that complies with the project design and specification. Provides specified reports, surveys and test results to the Superintendent and Consultants for review as the project progresses.
Geotechnical Consultant	Douglas Partners	Specifies the earthworks procedures and monitors all the processes and testing involved in compaction of fill at the site.
Environmental Consultant	JBS&G	Monitors the processes affecting the quality and contamination of fill placed at the site.
Geotechnical Inspection & Testing Authority (GITA)	Douglas Partners	Undertakes inspections of stripped surfaces and fill compaction, observes proof rolling, samples and tests materials at the specified rates. Prepares weekly testing and inspection reports.
Surveyor	Mulgoa Quarries & Burton Contractors (BMQ)	Provides regular surveys of the progressive fill, showing grid control lines to allow tracking and placement of individual fill deliveries. Undertakes precise survey monitoring of settlement plates after construction is completed.

3.4 Summary of Monitoring Procedures and Hold Points

A summary of the procedures for the overall control of the earthworks is outlined in Table 2, with Hold Points identified where information should be provided to the Superintendent and/or Geotechnical Consultant prior to continuing with the works. Details for each step listed in Table 2 are presented in the specification. All Hold Points must be released by formal written notification from the Superintendent.

Table 2: Summary of Processes and Monitoring Procedures

Step	Description	Section	Hold Point
1	Contractor is to strip the site to expose natural ground, or previously approved fill layers and remove any unsuitable material.	4.1, 4.2	
2	Contractor is to excavate level benches or steps into inclined slopes and remove any loose scree from quarry walls.	4.3	
3	Geotechnical Consultant is to review all temporary excavation faces steeper than 1H:1V and issue reports on face stability. Superintendent to issue written approval for each approved excavation face.	4.5, 4.6	Hold Point
4	Geotechnical Consultant and/or GITA is to inspect stripped surfaces and observe proof rolling for approval for fill placement. Superintendent to issue written approval for each approved area.	4.8	Hold Point
5	Contractor is to manage the movement and on-site tracking of all unsuitable materials.	5.1, 5.2	

Step	Description	Section	Hold Point
6	Geotechnical Consultant and Environmental Consultant are to inspect / assess any excavated material for re-use or classify for disposal offsite.	6.1	
7	Environmental Consultant and Geotechnical Consultant are to inspect / assess the proposed fill materials and issue reports on material suitability.	6.1	Witness Point
8	Contractor is to only use approved fill materials for placement in layers in accordance with this specification.	6.2, 6.3	
9	Contractor is to deliver, spread and compact approved fill in layers.	7	
10	GITA is to inspect and test each layer of fill for compaction and material suitability. GITA is to issue the results of density tests each day for the preceding day's tests with notification of any non-conformances. GITA is to issue weekly reports that include a summary of the daily reports. Superintendent is to issue written approval for all fill areas and fill layers covered by the daily results and weekly report.	7.6	Hold Point
11	Steps 9 and 10 are to be repeated until design fill surface levels are achieved.	-	
12	Contractor is to over-excavate and prepare quarry batter extensions once fill levels in the quarry exceed a level equal to 2 m below top of rock in the adjoining quarry batters.	9	
13	Geotechnical Consultant is to inspect the prepared batter extensions for suitability and issue reports. Superintendent to issue written approval for each approved batter area.	9	Hold Point
14	Contractor is to install settlement monitoring plates in the fill surface at locations to be advised by the Geotechnical Consultant.	10	
15	Geotechnical Consultant is to inspect the installation of settlement monitoring plates and provide an approval report. Superintendent to issue written approval for each settlement monitoring point.	10	Hold Point
16	Surveyor is to commence periodic survey of all settlement monitoring points and issue reports for review by the Geotechnical Consultant and Superintendent.	10	
17	Contractor is to grade the finished surface to design levels and grades and maintain the surface condition to protect from adverse weather effects.	7.9	

3.5 Work Instructions

All works performed on site will be directed by the Superintendent using formal written work instructions. The Superintendent will confirm the geotechnical or environmental requirements with the relevant consultant prior to issuing the work instruction. Any verbal instructions must be confirmed in writing by the Superintendent.

3.6 Site Reference Control

Prior to commencing the works, a three-dimensional grid reference system shall be developed and agreed by all parties. This reference system will act to identify the location of all inspection and test locations at the site in three dimensions. The system shall use MGA coordinates and Australian Height Datum (AHD).

3.7 Measurement and Testing

All fill volumes must be measured by accurate survey readings performed by the project's surveyor on a fortnightly basis or as otherwise instructed by the Superintendent.

All geotechnical testing must be undertaken at a laboratory that holds NATA accreditation for the test methods performed. Tests not displaying the NATA endorsement will not be accepted. An exception to this applies to testing of soils impacted by asbestos. Non-NATA endorsed test reports will be accepted for testing performed on asbestos-impacted soils.

3.8 Site Security

Prior to commencing works on the site, the Contractor must secure the site, and keep it secured, to prevent access by unauthorised parties. Controls on site security must be maintained during the entirety of the project to ensure no adverse actions are undertaken or delivery of unapproved materials occurs.

4. Site Preparation

4.1 Site Stripping

Prior to the placement of approved fill, the site should be cleared of all unsuitable material and materials not proposed for use by the project. Unsuitable materials may include but are not limited to:

- Soils with a high silt content (i.e. topsoils, sediments or similar);
- Vegetation or organic matter (i.e. plants, root affected soil, or similar);
- Existing fill (i.e. stockpiled materials, existing in situ fill, or similar);
- Any foreign objects, scattered or buried waste, or dumped materials, unless specific soil encapsulation works are proposed (if required, and subject to specific geotechnical and environmental controls); and
- Contaminated soils (if present), unless specific soil encapsulation works are proposed (if required, and subject to specific geotechnical and environmental controls).
- Unsatisfactory or excessively wet soils.

Unsuitable and deleterious materials shall be assessed by the Geotechnical Consultant and Environmental Consultant and disposed of offsite or in an approved onsite encapsulation cell unless otherwise approved for re-use or on-site processing by the Superintendent.

4.2 Quarry Floors, Dams and Temporary Basins

All existing quarry floors, dams and temporary basins are to be drained, desilted and deconstructed so as to expose the underlying natural stiff clay or bedrock, or previously approved fill layers. The following general procedure forms the minimum requirements:

- All existing ponded waters are to be pumped out or otherwise drained to a discharge area that is located at least 50 m away from any existing waterway, or as otherwise required by Fairfield City Council.
- All vegetation and other deleterious material (such as saturated silt and clay) is to be excavated to expose the underlying stiff clay, weathered rock or unaffected underlying previously approved fill.
- All existing dam and basin walls formed in fill are to be removed.
- The exposed surfaces are to be benched to a near-horizontal surface (<10% grade) prior to fill placement.
- Exposed surfaces are to be proof rolled with six passes of a 10-tonne dead weight roller operating in static mode, with the final pass undertaken in the presence of the Geotechnical Consultant or GITA (as delegated by the Geotechnical Consultant) in order to identify areas requiring additional work.
- Saturated 'organic' soils from the dam and basin sides and base can be spread out and dried at a suitable location away from the general fill placement area. Once dried the material can be blended with other suitable granular fills (ripped rock) at a ratio of 1 in 20 (i.e. maximum 5% organic soils) and mixed into the lower fill layers. Organic soils are to be stripped of vegetation and significant roots prior to blending.
- Any saturated 'non-organic' soils can be spread out and dried. Once moisture conditioned the material can be blended with other suitable fills (clays and ripped rock) at a ratio of 1 in 5 (i.e. maximum 20% non-organic soils) and used as engineered fill below a depth of 3 m below finished bulk earthworks level (BEL).

Prior to discharging, an assessment of the water should be undertaken to confirm the suitability of the above disposal method, particularly with regard to erosion. The assessment should include (as a minimum) pH and turbidity testing in accordance with Fairfield City Council's requirements.

4.3 Inclined Stripped Surfaces

Where fill is to be placed on an inclined surface with an initial grade steeper than 10H:1V, the inclined surface shall be benched flat with each bench to be cut at least 300 mm deep on its high side and to be at least 2 m wide. Where fill is to be placed on an inclined surface with an initial grade steeper than 4H:1V, the inclined surface shall be benched flat with each bench to be cut at least 600 mm deep on its high side and to be at least 2 m wide.

Benching is not required when placing fill against inclined quarry batters formed in low strength or stronger rock.

Where fill is to be placed adjacent to existing rock or clay quarry walls, the existing faces must be stripped of any loose scree material. Removal of any loose or weathered material shall continue until fill is placed and compacted over the face.

4.4 Stripped Surfaces in Approved Fill

Where new fill is to be placed on and/or immediately adjacent to existing already approved fill or ground formations, the existing faces shall be cut into steps or benches to allow lateral keying of the new fill into the existing ground. The base of each step or bench is to be flat, at least 1.2 m wide and is to be excavated at least 600 mm on its high side. The overall average and smoothed grade line of the benching is not to exceed a grade of 2H:1V.

4.5 Excavation

Following site stripping, further bulk excavation is not anticipated, although some limited areas of cutting may become evident during the works, such as the flattening of existing quarry batters, particularly those underlying future warehouses.

Material that is excavated from the site shall be geotechnically and environmentally categorised for beneficial re-use on the site, or for offsite disposal.

Any materials that are to be disposed of off-site will require classification in accordance with current *Waste Classification Guidelines* (NSW EPA 2014). Further advice is to be obtained from the project's Environmental Consultant.

4.6 Excavation Stability

Although not anticipated, if new excavations are required, then the natural soils having a stiff consistency (or better) and the underlying weathered rock would be expected to stand close to vertical in the short-term, however, unsupported near-vertical excavations or trenches may undergo slumping, or other rapid slope failures, particularly if they become affected by water (i.e. rainfall, seepage, or similar).

Any short-term excavations that have slopes steeper than those recommended below must have appropriate exclusion zones provided on both their upper and lower sides to prevent access by personnel and plant or storage of materials. The extents of the exclusion zones should be confirmed by the Geotechnical Consultant.

Where personnel are to enter excavations, short-term excavations shall be benched or battered at grades not exceeding 1H:1V or alternatively, temporary lateral support should be provided. Short-term excavations within more competent rock may potentially be battered at steeper slopes subject to specific geotechnical review and assessment to ensure there are no unfavourable discontinuities that could lead to failure.

Long-term excavations shall be either battered at 2H:1V or flatter and protected from erosion or supported by an engineered wall. For excavations in competent rock, steeper batters may be acceptable, subject to specific geotechnical review and authorisation.

HOLD POINT	Approval of Excavations
Release by:	Superintendent

4.7 Groundwater

The regional groundwater table is unlikely to be encountered within the excavation depths on the site. However, it is the Contractor's responsibility to manage any groundwater issues, such as intermittent side wall seepage from the quarry batters, if encountered. Seepage into excavations may be encountered particularly at the soil/rock interface. Provision should be made to control and direct any seepage to temporary basins.

4.8 Preparation and Approval of Stripped Surfaces

Prior to placement of fill, the condition and suitability of all stripped areas shall be assessed by the Geotechnical Consultant. Stripped surfaces will contain one of the following soil types:

- Natural in situ clayey soils of at least a stiff consistency;
- Controlled fill previously placed and compacted in accordance with this specification, if there are delays between the placement of successive fill layers;
- Natural in situ rock.

Prior notice of at least 48 hours shall be provided to the Superintendent and Geotechnical Consultant that a stripped area is ready for inspection.

At the agreed time of inspection the Contractor shall provide a suitable smooth-drum roller of at least a 10 tonne mass for proof rolling. Proof rolling shall be undertaken in the presence of the Geotechnical Consultant or the GITA (as delegated by the Geotechnical Consultant) after the Contractor has already completed at least five passes of the roller across the prepared area (not required for stripped areas in rock). The Geotechnical Consultant shall confirm that the stripped area has been prepared in accordance with this specification and that no adverse deflections were present during proof rolling.

If excessive deflections are recorded during proof rolling, then the Geotechnical Consultant shall provide advice to the Superintendent on appropriate rectification of the affected areas. Soft, weak, loose or yielding areas shall be excavated and replaced with suitable compacted fill. The Superintendent shall provide instructions to the Contractor to undertake the rectifications.

As part of the stripped surface assessment process, the Geotechnical Consultant shall confirm whether the stripped surface is suitable, or can be made suitable, in terms of in situ moisture content (wet or dry), including the effects of rainfall or desiccation.

HOLD POINT	Approval of Stripped Surfaces
Release by:	Superintendent

Fill shall not be placed on the stripped surface until the stripped surface has been approved by the Superintendent. The Contractor shall be responsible for maintaining the condition of the stripped surfaces during the works.

4.9 Survey

All approved stripped surfaces are to be surveyed for extent and level so as to provide a basis for the base level of all engineered fills placed on the site. A copy of each individual stripped surface survey is to be provided to the Geotechnical Consultant and Superintendent. A combined stripped surface survey for the whole of the site is to be provided to the Geotechnical Consultant and Superintendent. It is the Contractor's responsibility to ensure that on completion of the work all individual stripped surfaces are combined to show that no areas of the site have been missed.

5. Management of Fill Materials

5.1 Material Tracking

The Contractor is responsible for tracking the movement of all materials relocated or otherwise used during the bulk earthworks operation. Existing organic topsoils and other soils that are subject to blending shall be tracked and blending ratios measured by volume. All soils that are relocated for the purposes of the bulk earthworks shall be tracked from their source to their destination. Tracking will include reference to cut and fill areas, and with zonation within the fill. A project-specific material management system is to be developed by the Contractor to monitor and track all material movements.

5.2 Survey

All soil movement on the site, whether by cut or fill, shall be surveyed by volume as a record of the work undertaken. Surveys shall be undertaken at a minimum fortnightly frequency or as instructed by the Superintendent. Fortnightly and cumulative cut and fill volumes shall be recorded and provided to the Geotechnical Consultant and Superintendent.

5.3 Material Blending

In addition to the blending of organic and inorganic materials sourced from the desilting of quarry floors, dams and temporary basins (Section 4.2), the bulk earthworks operation will target the ongoing blending of topsoils and the various natural clay and ripped rock to form a uniform granular fill.

The upper organic part of all topsoil is to be stripped from the site and either disposed of offsite, or otherwise stockpiled and adjusted to remove the organics. Removal of organics may require the use of biodegradable weed killers. After removal of the organic matter, the soil may then be blended with other suitable fills (i.e. approved stockpiled and natural clays and ripped rock) sourced from on the site at a blend ratio of 1 in 20 (i.e. maximum 5%). The underlying inorganic component of the topsoil layer is to be excavated and bended with other suitable fills (i.e. approved stockpiled and natural clays and ripped rock) sourced from on the site at a blend ratio of 1 in 10 (i.e. maximum 10%).

For the underlying natural clays and clays sourced from onsite stockpiles, further blending is required to avoid the placement of fill that comprises only clay. A minimum fill blend comprising at least one part of ripped rock for every two parts of clay shall be adopted.

6. Fill Materials

6.1 General

Fill materials are to include the dedicated sources of fill that have been identified in several stockpiles present within the area identified as Oakdale East Precincts 2, 3, 4 & 5. In addition, fill materials could comprise site won soils, ripped rock and subject to additional geotechnical and environmental controls, imported VENM and ENM (refer below). Site materials are expected to require moisture conditioning, subject to the prevailing weather conditions and in situ moisture content prior to and during construction. Specifically, fill materials are expected to include:

- Existing Stockpiled Materials: Generally includes ripped shale, ripped sandstone and predominantly clay-based soil. The stockpiles are undergoing progressive assessment for suitability and approved sources will be identified for use.
- Site Won Ripped Rock: Generally all site-won ripped rock would be suitable for re-use as engineered fill following particle size breakdown and moisture conditioning.

Additional fill materials (if approved) are likely to include:

- Site-won Soils: Generally, natural soils excavated on site, excluding topsoil and soils of an unsuitably high silt content (unless stripped and blended in accordance with Section 5.3). Site-won soils may need to be blended with other granular fill materials before being deemed suitable for placement.
- Imported Materials: Classified as Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM). It is likely that there will be some need to import VENM and/or ENM to complete the fill placement in Precinct 5.
- Imported Pavement Materials: Including unbound roadbase (DGB20 or similar) and cement treated fine crushed rock (CTFCR) for use in pavement layers and hardstand subgrade capping.
- Imported Ripped Sandstone and DGB20: Including materials used in the reinforced zone of reinforced soil retaining walls and for retaining wall foundation improvement layers.

Environmental approval of suitable fill will occur following completion of specific contamination testing and reporting for each fill source/stockpile. Geotechnical approval of suitable fill will be based on a visual assessment prior to use, and when deemed necessary, prior testing of the fill source/stockpile for assessment of compliance with the various fill zones outlined in Section 6.3, including any requirement for blending with other materials to achieve compliance with the various fill zones.

WITNESS POINT	Approval of Fill Materials
Process to be Witnessed:	Inspection and assessment of nominated fill sources by environmental consultant and geotechnical consultant.
Submission Details:	Environmental assessment report presenting results of environmental testing and material reuse classification. Geotechnical report, when required, presenting advice for material reuse and initial blending ratios.

6.2 Unsuitable Material

Materials considered unsuitable for use as fill include:

- Soils with vegetation including tree stumps, roots, high root fibre content or other organic or deleterious matter.
- Silts or soils with a predominant portion of silt.
- Existing on-site fill, unless otherwise approved by way of specific geotechnical and environmental assessment.
- Ripped rock comprising oversize material with particle sizes of greater than 150 mm or half of the compacted layer thickness (i.e. following compaction).

The above list is not exhaustive and other materials may also be deemed unsuitable for use if their condition is considered adverse to, or inconsistent with, the project requirements.

6.3 Fill Materials

6.3.1 Fill Zones and Material Requirements

The placement of fill and the selection of fill materials will be undertaken with consideration to the following fill zones:

- Upper Zone of Fill – this zone includes the upper 2 m of fill below design BEL. The minimum requirements for this zone include:
 - o Maximum liquid limit of 50%.
 - o Maximum particle size of 150 mm.
 - o Maximum weighted plasticity index (WPI) of 1750.
 - o Maximum salinity value of 4 dS/m (i.e. slightly saline or lower).
 - o pH value within the range of 4.5 to 10.
- General Fill Zone – this zone includes all fill below the upper zone of fill and above the approved stripped surface. The minimum requirements for this zone include:
 - o Maximum particle size of 150 mm.
 - o Maximum WPI of 2000.
 - o Minimum fill blend of at least one part ripped rock to two parts clay.
 - o Maximum salinity value of 4 dS/m (i.e. slightly saline or lower) in the upper 2 m of this zone.
 - o pH value within the range of 4.5 to 10.
- Deep Fill Zone – this zone includes that part of the general fill zone that lies below a depth of 4 m below finished BEL. This zone is identified as a location where moderately saline soils and / or blended topsoil and dried quarry base / dam / basin sediments may be placed, subject to approval by the Geotechnical Consultant and the Superintendent.

The WPI is defined as the product of the plasticity index and the percentage passing the 425 micron sieve.

$$WPI = Plasticity Index (\%) \times Percent Passing 425 micron sieve$$

6.3.2 Materials Testing

The following materials tests are to be completed during the bulk earthworks operation. Testing may be conducted on fill source materials prior to fill placement, however the monitoring for compliance is to be based on samples that are collected routinely during earthworks from the completed and blended fill layers after placement and compaction.

- CBR tests on pavement and hardstand subgrades (AS 1289.6.1.1):
 - o New public roads – Minimum 1 test per 80 m length of road.
 - o Internal roads and hardstands – Minimum 1 test per 1,000 m² of pavement.
- Plasticity Index tests on fill materials (AS 1289.3.1.1, AS 1289.3.2.1 & AS 1289.3.3.1):
 - o New public roads – Minimum 1 test per 160 m length of road.
 - o Internal roads and hardstands – Minimum 1 test per 2000 m² of pavement.
 - o Upper zone of fill – Minimum 1 test per 5,000 m³ of fill.
 - o General fill zone – Minimum 1 test per 10,000 m³ of pavement.
- Particle size distribution tests on fill materials:
 - o New public roads – Minimum 1 test per 160 m length of road.
 - o Internal roads and hardstands – Minimum 1 test per 2000 m² of pavement.
 - o Upper zone of fill – Minimum 1 test per 5,000 m³ of fill.
 - o General fill zone – Minimum 1 test per 10,000 m³ of pavement.
- Salinity and pH tests on fill materials (pH, chlorides, sulphates, electrical conductivity and texture):
 - o Fill materials from on-site stockpiles and cuts in natural soil – Minimum 1 test per 10,000 m³.

6.4 Imported Fill Materials

Importation of fill is currently not required within Precincts 2, 3 & 4. If fill importation becomes necessary, then further import and approval controls will need to be implemented by the Geotechnical Consultant and Environmental Consultant. Further advice will need to be sought at the time, however, as a minimum, all imported material would need to be accompanied by suitable waste classification reports that provide sufficient site history data and chemical analysis to confirm that each source of import can be assessed to be chemically suitable for use on industrial land. Any approval for the importation of fill to Precincts 2, 3 & 4 will first require the development of a Fill Importation Protocol (FIP) and would possibly require modifications to the Remediation Action Plan (RAP) that will govern the assessment process for all imported materials.

Importation of fill will be required to complete the earthworks within Precinct 5. When fill importation becomes necessary, all importation will need to comply with the requirements of this specification and the control measures outlined in the RAP (RAP – Oakdale East industrial Estate Precinct 5, JBS&G Report R02 Rev A, prepared by the Environmental Consultant), which includes a FIP. As a minimum, all imported material must be accompanied by suitable waste classification reports that provide sufficient site history data and chemical analysis to confirm that each source of import can be assessed to be chemically suitable for use on industrial land.

Imported fill materials shall not include any unsuitable material, such as described in Section 6.2. Where importation of fill is proposed, consideration should be given to placing low reactivity, non-saline to slightly saline soil or rock, and ripped shale/sandstone that complies with this specification. Granular fill should be prioritised in near-surface fill layers or pavement subgrades to assist economical construction of pavements and to benefit foundations.

Importation of pavement materials, including unbound roadbase (DGB20 or similar) and cement treated fine crushed rock (CTFCR) for use as subgrade capping is subject to environmental approval. When purchased from a reputable material supplier, the importation of roadbase and CTFCR gravels does not trigger the development of a FIP.

6.5 Importation of Material

The Superintendent shall be notified of the intent to import material and if the importation is approved by the Superintendent, they shall in turn notify the Environmental Consultant, the Geotechnical Consultant and the GITA (where relevant) at least two weeks prior to importation.

All importation shall comply with the requirements of the FIP, relevant RAP and this Specification. Environmental requirements for imported fill must be outlined in a project approved FIP and RAP prepared by the Environmental Consultant.

Any material delivered to site prior to approval being granted by the Environmental Consultant, the Geotechnical Consultant and the GITA (as relevant) shall be deemed a risk to be borne by the Contractor until the material has been suitably validated and approved. Any material that is imported to site and found to be not suitable shall be removed at the Contractor's expense. Records of the importation of any fill shall, as a minimum, include:

- The source of the material;
- The day and date of delivery;
- The location of the material on site;
- The record of the transporting company and truck registration number; and
- The estimated volume of the material imported.

Such records shall be kept by the Contractor and passed on to the Superintendent, Environmental Consultant and Geotechnical Consultant. Additional records in relation to the waste classification of the imported material must also be retained, as per the requirements of the FIP and relevant RAP.

6.6 Disposal of Material

Should unsuitable material require removal from the site (including illegally dumped materials), or the quality of any imported or site-won material be deemed inadequate, the Superintendent will direct the removal of the material to an appropriate facility. The following records of disposal shall be kept as a minimum:

- Identification of the material (imported or site-won);

- The reason the material is deemed unsuitable;
- The estimated volume of the material;
- The day and date of removal from site;
- The record of the transporting Company and truck registration numbers; and
- Details of the waste facility (receipt of material).

Such records shall be kept by the Contractor and passed on to the Superintendent and the Environmental Consultant.

In the event that material is imported without approval or dumped on the site, the Contractor shall be responsible for removal (and the costs of removal) of such material together with any validation testing required for disposal and remediation of the affected areas on site.

7. Fill Placement

7.1 General Methodology

Fill should be placed and compacted in accordance with this specification and in accordance with AS 3798-2007 *Guidelines on Earthworks for Commercial and Residential Structures*, in conjunction with the methodology described below:

- Appropriate site preparation, proof rolling and foundation treatments as outlined in Section 4.
- Spreading of material in uniform, horizontal layers in maximum compacted thicknesses of 300 mm but appropriate for the plant used and effectiveness of the compaction achieved. Spreading shall achieve good distribution and avoid segregation or pockets of non-homogeneous material. Each layer of material shall not differ substantially from the surrounding material.
- Compaction of each layer to achieve a uniform density throughout the layer.
- Care is required to ensure that compaction is achieved over the entire fill area, particularly adjacent to any inclined or vertically excavated faces. This will require 'keying in' or 'benching' to allow compaction equipment to achieve full compaction to the edge of the fill.
- All fill should be supported by properly designed and constructed retaining walls or battered at a maximum grade of 2H:1V (max 4 m high, or otherwise subject to geotechnical assessment) and protected from erosion by vegetation, geosynthetics or other suitable measures.
- During construction, adequate cross-fall should be provided to allow drainage, prevent ponding and to avoid scour or erosion. Contour drains and suitably placed temporary or permanent drop structures may be used to aid in the prevention of batter erosion.

7.2 Construction Control

All fill shall be placed under a programme of Level 1 inspection and testing, as defined in AS3798-2007. The following survey control shall also be conducted by the Contractor as a minimum, the extent of which should be confirmed prior to the works.

- Set out and record existing levels in areas of proposed excavations, followed by survey of stripped surface levels; and
- Final earthworks levels and completed construction levels.

7.3 Compaction

7.3.1 Compaction and Other Plant

The compaction method and plant utilised will be suitable for the materials being placed, the construction sequence and location. Suitable plant may include 20-30 tonne static compactors, smooth drum and pad-foot rollers, together with scrapers, spreaders, water carts and dump trucks. Light-weight and handheld equipment may also be required in the vicinity of underground services or structures that may be subject to vibratory induced distress.

7.3.2 Field Density Tests

Field density testing shall be carried out in accordance with AS 1289.5.8.1 or by an alternative method approved by the Superintendent.

7.3.3 Compaction Requirements

The compaction requirements for fill are outlined in Table 3.

Table 3: Compaction Requirements

Material / Layer	Compaction Criteria (Test Method)
Stripped Surfaces and Cut Floors (only when formed in approve fill)	Minimum 95% SMDD ⁻¹ (AS 1289.5.1.1), or 95% Hilf density ratio (AS 1289.5.7.1), or 65% DI ⁻² (AS 1289.5.6.1)
General Fill Zone	Minimum 98% SMDD ⁻¹ (AS 1289.5.1.1), or 98% Hilf density ratio (AS 1289.5.7.1), or 70% DI ⁻² (AS 1289.5.6.1)
Upper Fill Zone	Minimum 98% SMDD ⁻¹ (AS 1289.5.1.1), or 98% Hilf density ratio (AS 1289.5.7.1), or 70% DI ⁻² (AS 1289.5.6.1)
Pavement and Hardstand Subgrades (Formed in Upper Fill Zone)	Minimum 100% SMDD ⁻¹ (AS 1289.5.1.1), or 100% Hilf density ratio (AS 1289.5.7.1), or 75% DI ⁻² (AS 1289.5.6.1)
Pavement and Hardstand Subgrades (Formed in unbound DGB20 or CTFCR ⁻⁴)	Minimum 98% MMDD ⁻³ (AS 1289.5.1.1)
Pavement Layers – Private Pavements (Subbase and Base Layers)	Minimum 98% MMDD ⁻³ (AS 1289.5.1.1)
Pavement Layers – Public Pavements (Subbase and Base Layers)	In accordance with Fairfield City Council's requirements

Material / Layer	Compaction Criteria (Test Method)
Trench Backfill	In accordance with the asset owner or relevant authorities' requirements.

Notes: 1. SMDD: Standard Maximum Dry Density. 2. DI: Density Index. 3. MMDD: Modified Maximum Dry Density.
 4. CTFCR: Materials are to be placed and compacted, with density test results available within 4 hours of delivery to site.

The maximum compaction value for fill shall not exceed 104% SMDD or 104% Hilf density ratio.

7.3.4 Moisture Content

The moisture content requirements for fill are outlined in Table 4.

Table 4: Moisture Content Requirements

Material / Layer	Moisture Content
All Fill Zones and Subgrades	±2% of SOMC ⁻¹
Pavement Layers	±2% of MOMC ⁻¹
Trench Backfill	±2% of SOMC ⁻¹

Notes: 1. SOMC: Standard Optimum Moisture Content or maximum ±2% Hilf moisture variation.
 2. MOMC: Modified Optimum Moisture Content.

7.3.5 Testing Frequency

The testing frequency of engineered fill shall comply with Table 5.

Table 5: Compaction Testing Frequency

Material / Layer	Compaction Test Frequency
All Fill Zones	1 test per layer per material type per 1500 m ² , or 1 test per 500 m ³ evenly distributed
Subgrades and Pavement Layers (Public Pavements)	1 test per 50 m linear metres (or part thereof), or in accordance with Fairfield City Council's requirements
Subgrades and Pavement Layers (Private Pavements)	1 test per 50 m linear metres (or part thereof), or 1 test per layer per material type per 500 m ²
Trench Backfill	Greater of, 1 test per layer per 50 linear metres, or Minimum 2 tests per layer between pits, or in accordance with the asset owner or relevant authorities' requirements.

7.4 Layer Thickness Control

A maximum compacted layer thickness of 300 mm applies to all fill zones. Maximum compacted layer thicknesses in pavements are to be as per the pavement thickness design but not more than 200 mm.

Maximum compacted layer thicknesses in trench backfill is 300 mm, or as per the asset owner's or relevant authorities' requirements.

7.5 Reworking

All test results shall satisfy the compaction and moisture content specifications outlined above. Areas that do not satisfy the specified compaction and moisture criteria shall be reworked prior to the placement of additional fill at the Contractor's expense, or alternatively, removed and replaced with suitable material. Following reworking or replacement, the non-conforming area shall be retested by the GITA to confirm compliance with this Specification.

Survey of the non-conforming area shall be conducted to allow retesting. Records of the locations of the original test, the reworked area and all retests shall be kept.

7.6 Hold Point

No material is to be placed on a filled area until the previously placed layer has been tested and satisfactory results obtained, including any retests to be conducted on reworked areas of fill that previously failed. Placement of new fill on previously placed fill prior to receiving satisfactory test results is at the Contractor's risk. Earthworks operations may continue after confirmation has been received that the tests undertaken on the previous fill layers have passed. Test results are to be reported daily by the GITA with all non-conformances identified. Test results are to be included in the GITA's Weekly Report, which is to identify non-conformances and rectification works. The HOLD POINT shall be removed on a weekly basis by the Superintendent following their review of the daily test reports, the GITA's Weekly Report and their satisfaction that all non-conformances have been addressed.

HOLD POINT	Weekly Approval of Compacted Fill Layers
Release by:	Superintendent (or as delegated)

7.7 Non-conformances

The Contractor shall develop and maintain a project quality plan to reduce or eliminate the incidence of non-conformances.

The GITA shall record all non-conformances in relation to the earthworks and the geotechnical requirements or otherwise that may affect the geotechnical design. Where the non-conformance is apparent to the GITA and can be readily rectified, the GITA shall notify the Contractor without delay and, where appropriate, report to the Superintendent.

The Contractor shall report non-conformances and following review of the reason for non-conformance corrective action shall be developed, and where required, modification of the project quality plan or Quality System should be conducted accordingly.

Details of corrective actions made should be reported by the Contractor (and GITA where appropriate), and the details shall be provided to the Superintendent within the appropriate timeframe in order to

reduce any implications and potential future non-conformances. The Superintendent should consult the Geotechnical Consultant to determine the potential effect on the design and develop remedial measures where the non-conformance is not able to be readily rectified. Costs of rectifying any non-conformance shall be borne by the Contractor.

7.8 Site Drainage

During earthworks, all exposed stripped and filled surface areas shall be graded with a minimum 1% fall towards temporary catch drains that discharge to temporary detention basins. Should temporary drainage be disturbed during daily earthworks, rectification or reconstruction of the drainage system shall occur prior to the completion of the day's work. The temporary drainage system shall be maintained during the course of the full earthworks program.

As the sediment basins are located within the fill volume, there will be the requirement from time to time to create a new sediment basin within the placed fill in order to fill the old sediment basin. This is to avoid the detention basin becoming progressively deeper during the site work. All temporary basins are to be properly sized so that they adequately manage stormwater runoff volumes. All temporary basins are to be lined with compacted clay to at least 400 mm thickness across their base and sides.

When a sediment basin is decommissioned, the base of the basin will be stripped in accordance with Section 4.2. The Earthworks Contractor should anticipate a significant depth of wet material, which will require removal and treatment in accordance with Section 4.2.

7.9 Protection of Completed Fill Layers

It is the responsibility of the Earthworks Contractor to maintain the integrity of all completed fill layers following their completion and until practical completion is reached. If the surface of any approved fill layers is damaged by heavy rainfall (or similar), the Earthworks Contractor is to rework the affected area and undertake new testing to confirm the layer has been reinstated or repaired in accordance with this specification.

7.10 Plate Load Tests

When the level of the fill reaches the top of the General Fill Zone, the site is to be progressively made available to the Geotechnical Consultant to undertake plate load tests at a frequency of one test per 5,000 m². Plate load tests will also be undertaken at the same frequency at the midpoint of the Upper Fill Zone (1 m below BEL) and on the surface of the Upper Fill Zone (at BEL). The testing frequency can be reduced to one test per 10,000 m² in site areas outside of proposed building footprints if final building positions are known.

8. GITA Supervision

8.1 Scope

A full-time programme of Level 1 geotechnical inspection and testing shall be undertaken in accordance with AS 3798-2007. The works performed by the GITA shall, as a minimum, include the following:

- Daily supervision and assessment of earthworks procedures in accordance with the Specification;
- Observation, inspection and preliminary approval of excavations and stripped surface/foundation preparation;
- Compaction and density testing in accordance with the Specification, including the required frequency and methodology. Testing should be conducted by a suitably qualified and experienced NATA accredited laboratory;
- Materials testing in accordance with this Specification, including the required frequency and methodology. Testing should be conducted by a suitably qualified and experienced NATA accredited laboratory;
- Advising the Superintendent and Contractor where non-conformance occurs;
- Recording of site preparation procedures and outcomes;
- Observation and approval of proof rolling of all stripped areas and subsequent fill layers prior to placement of fill, with records kept of observations and the location and extent of areas that require treatment; and
- Recording of the condition of the fill, including the suitability in accordance with the Specification and any requirements for moisture conditioning, treatment or processing.

8.2 Reporting and Record Keeping

The GITA shall prepare the following reports and documentation during and on completion of the earthworks. Where the earthworks are to be completed in stages, separate and complete reports shall be prepared for each stage. The reports should provide a summary of the works undertaken, compaction and materials testing and provide an opinion of the compliance of the works and, where applicable, non-conformance including remedial measures or actions taken.

The GITA, as a minimum, shall keep written records of the following:

- Daily Reports – summarising the work undertaken on site each day, including the source of materials being used, operational plant, weather, volume of material placed, tests completed, and any other item in accordance with AS3798. Daily photographs should be taken of the site areas worked on any given day.
- Stripped Area Approvals (unless prepared by the Geotechnical Consultant) – summarising all areas of the site progressively approved, including the tracking of areas 'yet to be approved' to ensure no areas are missed. This is to be a back-up to the records produced by the Earthworks Contractor.
- Compaction Test Reports – presenting the results of all tests undertaken during the earthworks.
- Materials Test Reports – presenting the results of all tests undertaken during the earthworks.

- Imported Source Site Approvals (unless prepared by the Geotechnical Consultant) – presenting a summary of all approved external sources of fill.
- Weekly Summary Reports (unless prepared by the Geotechnical Consultant) – presenting a summary of all activities undertaken, site observations and test results obtained during the preceding week. The report shall provide a comparison of the number of tests completed with the volume of material placed. Non-conformances are to be listed. The report shall be presented to the Geotechnical Consultant prior to 5 pm each Monday. A weekly report shall be issued for every week during which Level 1 testing was undertaken.

The Geotechnical Consultant shall review the Weekly Reports and provide written comments on compliance of the works, non-conformances and any rectification actions required prior to issuing the report to the Superintendent by 5 pm each Wednesday.

9. Over-excavation of Quarry Batters

Where the placement of fill is undertaken within the existing quarry, the lower layers of fill are to be placed directly against the inclined quarry batters following preparation and stripping in accordance with Section 4.3. At the lower layers of fill, horizontal benching and 'keying in' of the fill layers is restricted by the presence of higher strength in situ rock. As rock strengths reduce within the upper reaches of the quarry batters, horizontal benching is achievable and the extent of the fill is to be extended beyond the quarry batter so as to step the fill / batter interface and thus provide an appropriate seal against moisture ingress from the fill surface to the quarry base.

Once the surface of the fill reaches a level equal to the top of low strength rock, the quarry batters shall be laterally over-excavated to create a level bench of a minimum 6 m width. Over-excavation will be required on all sides of the quarry, unless otherwise advised by the Geotechnical Consultant following a detailed review of final project earthworks drawings. Over-excavation is to be completed in accordance with the following methodology:

- The Earthworks Contractor is to advise the Superintendent and Geotechnical Consultant when the fill surface is nearing the top of low strength rock.
- The Geotechnical Consultant is to inspect the site and provide a report advising the appropriate benching levels and extent along the quarry perimeter.
- The Earthworks Contractor is to provide suitable plant to site and is to excavate a level bench of at least 6 m width along the required perimeter of the quarry.
- The batter faces created in rock above the bench is to be battered to a temporary grade of 1H:1V.
- The batter faces created in soil above the bench is to be excavated to a temporary grade of 2H:1V by cutting 1.2 m wide additional horizontal benches at 0.6 m height intervals (i.e. at every second fill layer) as the fill height increases.
- All excavated natural material is to be re-used as fill after approval for re-use is obtained;
- All new fill layers are to be keyed into the new batter profiles during placement and compaction.

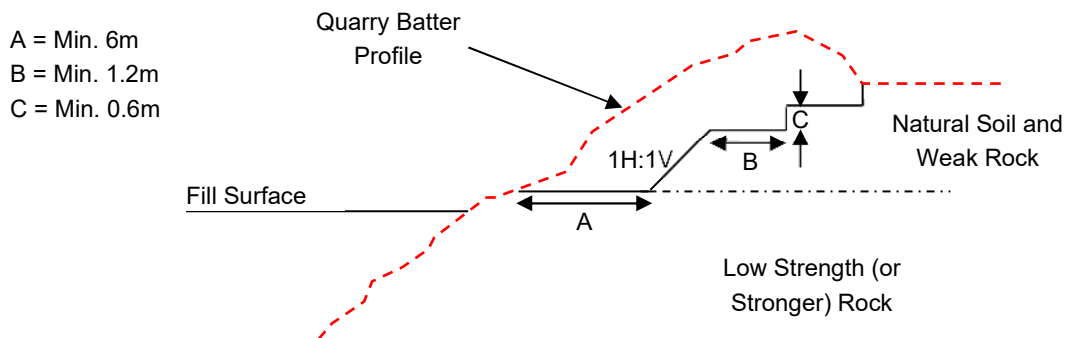


Figure 1: Over-excavation of Quarry Batter

All quarry batter over-excavation works are to be measured by survey. All batter over-excavation works are to be inspected and approved by the Geotechnical Consultant.

HOLD POINT	Approval of Over-excavation of Quarry Batters
Release by:	Superintendent (or as delegated)

10. Post-Construction Monitoring of Settlement

On completion of fill placement and in areas of more than 10 m in total fill thickness, the Earthworks Contractor is to install settlement plates and engage a registered surveyor to undertake monthly surveys to report on the total and progressive creep settlement of deep fill.

The Geotechnical Consultant is to provide details for manufacture and installation of the settlement plates and is to advise on the number of and locations for installation. Settlement plates will include vertical steel tubes welded to a horizontal steel plate that is concreted at a depth of at least 1.5 m below the completed fill surface level. The steel tubes are to extend above the ground surface.

Installation of the settlement plates is to be supervised by the Geotechnical Consultant. The Earthworks Contractor is responsible for the long-term protection of the settlement plates.

The surveyor is to undertake precise levelling (sub-millimetre) surveys at monthly intervals (fortnightly for the first three months) as is to establish sufficient fixed benchmarks nearby all settlement monitoring locations. The survey report is to be issued to the Superintendent and the Geotechnical Consultant within three days of each survey. Surveys are to be undertaken for a period of at least 24 months.

Installation of the settlement plates is to be completed as soon as practicable following completion of the fill, including staged installation, where appropriate.

HOLD POINT	Approval of Settlement Plate Installations
Release by:	Superintendent (or as delegated)

11. Variations to Works

The following items have changed from tender and should they occur will be considered as a variation to the contract scope. The items are:

- The provision of settlement plates.
- Any excavation or treatment of existing batters.
- Should MQBJV be following the directions from Douglas Partners, any re-work due to unsuitable material properties in the placed fill.
- Any increase of any blending ratio greater than 1:8.
- Plate load testing to any layer other than the final layer.

Douglas Partners Pty Ltd

Appendix A

Specification Work Methods and Intent

Project 86545.13
12 May 2023
R.019.Rev0
RCB

Email: Megan.Kublings@brickworks.com.au

The methodology and intent of the specification is that all existing excavations and new excavations formed by the contractor at slopes steeper than 1H:1V are to be inspected by a geotechnical engineer to confirm that they are in a satisfactory condition prior to undertaking work nearby. The intent is to ensure that the excavations do not require any further treatment to mitigate risk of instability (i.e. slope failure, rock fall, or similar) and/or do not require the establishment of work exclusions zones prior to commencing bulk earthworks. The work methodology will require the contractor to notify the geotechnical consultant who will promptly inspect the excavation and provide a report stating whether the face is satisfactory or if further work is required.

The intent is that this clause applies to inspections of existing quarry side walls, new side walls formed in containment cells (or similar) and excavations formed in uncontrolled fill (i.e. deep stockpiles buried within the Quarry Central pit). It is not the intent of the specification that inspections are required for batters formed in fill during normal earthworks operations.

As a minimum, it is likely that the loose scree materials on the face of the excavations in rock will need to be trimmed and overlying batters in soil may require flattening. Further works are to be assessed on a slope-by-slope basis, as it is not possible to define or quantify the scope of work ahead of inspection and assessment.

3.2 Assessment of Excavated Materials for Reuse

This relates to Section 3.4, Table 2, Steps 6 and 7 and Section 6.1 of the specification. The following sections are separated based on material types (i.e. natural ground and stockpiled material) to clarify that the process applies to all materials either currently identified or future areas of cutting that may be required.

3.2.1 Site-Won Soil and Rock

The methodology and intent of the specification is that all site-won natural soil and rock is to be assessed and approved by the environmental consultant prior to being used by the contractor as fill. This, in effect, constitutes a Witness Point in that the contractor must not use site-won soil and rock that has not yet been assessed, although the work methodology will typically result in areas of site-won soil and rock being assessed well in advance of their use. It is the responsibility of the contractor to identify these areas sufficiently in advance of their programmed use and to take receipt of an environmental assessment report for each source area prior to using the material as fill in accordance with the environmental consultant's advice.

In addition, site-won soil and rock is to be inspected by the geotechnical consultant prior to being used as fill by the contractor. This, in effect, is a Witness Point to allow the opportunity to the geotechnical consultant to provide a high-level preliminary assessment of the likely material suitability in relation to the fill zones outlined in Section 6.3 of the specification, including any preliminary comment on the requirements/suitability/opportunities for material blending. Further, the inspection would also assess the requirements for vegetation and topsoil stripping, and management of any foreign inclusions (i.e. unexpected pockets of timber, boulders, bricks or similar). It is the responsibility of the contractor to

notify the geotechnical consultant in advance of their programmed use and to use the material as fill in accordance with the geotechnical consultant's advice, where issued.

The intent is that this process would not unduly delay the contractor in using approved site-won soil and rock whilst allowing for the opportunity for their best and most efficient use. It is not the intent of the specification that the contractor is to be delayed or prevented from using the materials once they have been environmentally approved.

3.2.2 Existing Stockpiled Materials

The methodology and intent of the specification is that all materials stockpiled on the site and proposed for use as fill is to be assessed and approved by the environmental consultant prior to being used by the contractor. This, in effect, constitutes a Witness Point in the same manner as outlined in Section 3.2.1. It is the responsibility of the contractor to nominate the stockpiles intended for use sufficiently in advance of their programmed use and to take receipt of an environmental assessment report for each stockpile prior to using the material as fill in accordance with the environmental consultant's advice.

In addition, all materials stockpiled on the site and proposed for use as fill is to be inspected by the geotechnical consultant prior to being used by the contractor. This, in effect, is a Witness Point in the same manner as outlined in Section 3.2.1. It is the responsibility of the contractor to notify the geotechnical consultant in advance of their programmed use and to use the material as fill in accordance with the geotechnical consultant's advice, where issued.

The intent is that this process would not unduly delay the contractor in using approved stockpiled materials whilst allowing for the opportunity for their best and most efficient use. It is not the intent of the specification that the contractor is to be delayed or prevented from using the materials once they have been environmentally approved.

For clarity, a stockpile is defined as existing materials stored on the site excluding in situ soil and rock. Stockpiles generally contain materials previously identified for brick manufacture and may be stored on the site's surface or as uncontrolled quarry backfill.

3.3 Use of Approved Fill Materials

This relates to Section 3.4, Table 2, Step 8 and Sections 6.2 and 6.3 of the specification.

The methodology and intent of the specification is that after the various forms of proposed fill sources (i.e. natural cuts or stockpiled materials) have been environmentally approved and geotechnically inspected, the contractor will use only the approved materials and generally in accordance with the preliminary geotechnical advice pertaining to material suitability and best and efficient usage.

The intent is that this process will prevent the use of unapproved materials and will provide support to the contractor in deciding where materials might best be placed subject to the availability of the various fill zones being worked on site at any given time (i.e. if the contractor is placing fill in upper and/or general

fill zones). It is not the intent that this process will form the final step in material compliance with Section 6.2 or 6.3 of the specification. Compliance with Section 6.2 of the specification will be primarily determined during the environmental approval and geotechnical inspection process outlined above but will be continually monitored during routine fill placement. Compliance with Section 6.3 of the specification will be by way of materials testing undertaken on samples of the fill after placement with the results monitored for compliance and adjustments made to the earthworks/materials used if and when non-conformances are identified. Non-conformances will serve to guide better use and blending of the available fill materials in subsequent earthworks layers. Significant and/or continued non-conforming results would be subject to further geotechnical advice and intervention.

3.4 Issuing of Work Instructions

This relates to Section 3.5 of the specification.

The methodology and intent of the specification is that all instructions issued for work, including variations to work, will be issued by the superintendent under the applicable contractual arrangements with the contractor. Documents issued by the project's consultant team are to be treated as advice and recommendation to be reviewed and actioned by the superintendent. All instructions to be actioned by the contractor arising from documents prepared by the project's consultant team are to be issued by the superintendent. The consultant team does not have the authority under their various contractual arrangements on the project to issue directions directly to the contractor.

The intent is that this process will prevent work from being undertaken without the superintendent's authority or Principal's agreement and knowledge. The superintendent's authority on certain matters could be delegated to specific consultant representatives, as agreed by the superintendent and Principal. The intent is that all documents issued by the consultants will be issued to the wider project team so all parties are aware of any impending instructions, corrective works and changes in work scope or methodologies.

3.5 Site Reference Control

This relates to Section 3.6 of the specification.

The methodology and intent of the specification is that all material movement across the site will be tracked within a three dimensional grid coordinate system with the balance of the work to be recorded in a similar method. Specifically, all work is to be tracked, measured and surveyed in accordance with survey coordinates (eastings and northings) and reduce levels (to Australian height datum). The minimum frequency of survey is to be fortnightly in relation to Sections 3.7 and 5.2 of the specification. The minimum frequency of survey is to be one survey for each stripped area in relation to Section 4.9 of the specification.

The intent is to avoid duplicate reference datums (i.e. local datums) being confused with standardised and conventionally used reference datums. It is understood that general survey and earthworks volume

measurement will be by way of survey adopting a Map Grid of Australia (MGA) coordinate system and Australian height datum (AHD). Fill material tracking will be recorded by the environmental consultant, in conjunction with the contractor, with reference to a database material tracking system. The intent is not for a project specific grid to be developed, or for a three-dimensional model of the work to be created.

3.6 Blending of Wet Sediments and Soft Soils from Quarry Floors, Dams and Basins

This relates to Section 4.2 of the specification.

The methodology and intent of the specification is that all quarry floors, existing dams and temporary basins are to be decommissioned, emptied and stripped back to expose the underlying natural soil (or rock), including the removal of uncontrolled fill in perimeter walls and wet or saturated sediments and underlying water-affected soils. Specifically, wet and saturated sediments and underlying affected soils are to be moisture conditioned (preferably by removal to a temporary drying location) and then reused as fill after blending with other on-site materials. A blending ratio of 1:20 is nominated for 'organic soils' (i.e. those affected by minor inclusions of fibrous roots after vegetation stripping, other vegetative matter such as remnant small diameter roots, and soils of a high silt and topsoil content). A blending ratio of 1:5 is nominated for 'non-organic soils' (i.e. those that comprise soil only that would otherwise be deemed to be suitable fill if dry).

It is anticipated that most quarry floors, dams and temporary basins will not contain vegetation or topsoil layers, thus sediments and wet underlying soils will typically comprise silts and clays. Once dried, these can be blended at higher blend ratios, potentially equal to 1:5, subject to geotechnical inspection and the content of silt soil particles in the overall sediment and water affected soil mix. Lower blend ratios would apply to materials removed from quarry floors, dams and temporary basins that have topsoil layers and reedy vegetation growing within the water body.

The intent is that this process would include inspection of the materials by the geotechnical consultant so that initial blend ratios could be adopted, trialled and adjusted, if necessary. Final blend ratios will be dependent on the materials with which the moisture conditioned soils are being blended with (i.e. highly granular/gravelly fills may allow high blend ratios).

It is noted that the opportunity is available for the contractor to raise an RFI requesting a higher blend ratio, which would reasonably be assessed by the geotechnical consultant and approved wherever possible. A trial blend area may be required to demonstrate that the higher blend ratio is acceptable.

Any sediments or underlying water-affected soils that are classified as contaminated by the environmental consultant must not be blended.

3.7 Inclined Stripped Surfaces

This relates to Section 4.3 of the specification.

The methodology and intent of the specification is that any stripped surface with a surface grade steeper than 10H:1V, after stripping of topsoil and uncontrolled fill, will be flattened by way of minor over-cutting of the stripped surface. Over-cutting is to include the creation of steps in the stripped surface of 300 mm in depth grading to nothing every 2 m width, increasing to 600 mm depth grading to nothing every 2 m when the stripped surface grade is steeper than 4H:1V. This method of flattening the stripped surface does not apply to stripped surfaces formed in rock.

The intent is that the creation of the steps would be completed by scrapers during site stripping, or by dozer following initial stripping, so that the base of the fill is placed on a flatter surface. It is not intended that the flattening of the strip surface should apply to adjoining batters formed in controlled fill that has already been placed. Fill placed against such batters should be keyed into the adjoining fill in accordance with Section 4.4 of the specification.

3.8 Stripped Surfaces in Approved Fill

This relates to Section 4.4 of the specification.

The methodology and intent of the specification is that any stripped surface formed in approved fill already placed under the contract works will be flattened by cutting of steps to allow keying in of the new fill layers. Cutting is to include the creation of steps in the adjoining fill of 600 mm in height for a width of 2 m.

The intent is that all previously placed fill will have a temporary finished surface that is relatively flat with sufficient surface grade to facilitate protective interim drainage measures. Accordingly, it is anticipated that stepping of the surface of a previously completed layer of fill will not be required. In the situation when fill is placed against adjoining (i.e. not underlying) fill, the new fill is to be keyed into the existing to ensure all fill on either side of the joint is properly compacted without risk of uncompacted materials being left in place on the surface of the previously placed fill batter (i.e. the edge of the previous fill area).

The intent is that keying in would be done in step heights equivalent to two layers of fill placed, and that any temporary fill batters would be gently graded (i.e. approx. 3H:1V) to facilitate generous keying in for future adjoining fills. The expectation is that the compactor blade would cut the steps into adjoining batters sufficiently to intersect previously compacted ground removing any loose fills.

3.9 Additional Excavation in Natural Ground Following Site Stripping

This relates to Section 4.5 of the specification.

The methodology and intent of the specification is that if any additional excavation is required in natural ground after the site has been stripped (e.g. for containment cells, temporary basins, achieving finished surface levels, or similar), then the additional material to be excavated is to be assessed by the environmental consultant and geotechnical consultant in the same manner as that outlined above in Section 3.2.

Presently, there is no specific need to undertake additional excavation, except for the over-excavation of the upper portion of the existing quarry batters (discussed elsewhere herein).

It is understood that it is not possible to determine the extent of additional excavations required, or the to quantify the required works to complete the additional excavations until such time that the scope is made known to the contractor. Where the additional excavation work is in addition to the contracted scope of work, the additional work will be deemed a variation.

3.10 Preparation and Approval of Stripped Surfaces

This relates to Section 4.8 of the specification.

The methodology and intent of the specification is that if any soft, weak, loose or yielding surfaces are identified after an area of the site has been stripped, then the contractor will undertake additional rectification earthworks to make good the affected areas. Rectification works are most likely to include the over-excavation of the affected ground and backfilling of the excavation with controlled fill using on-site available approved fill.

Presently, it is anticipated that such occurrences will occur from time to time, however, it is understood that it is not possible to determine the extent of the rectification works prior to site stripping and assessment by the geotechnical consultant. The intent is that where rectification works are required, the additional work will be deemed a variation.

3.11 Fill Zones, Materials and Materials Testing

This relates to Sections 6.3.1, 6.3.2 and 7.5 of the specification.

The methodology and intent of the specification is that the contractor will liaise with the geotechnical consultant during the works and will use only the approved fill materials as fill and generally in accordance with the preliminary geotechnical advice pertaining to material suitability and best and efficient usage. This liaison will occur during the geotechnical consultant's initial inspection of the contractor's proposed fill materials (refer Section 3.3 above).

The intent is that the contractor will then place fill into the two identified fill zones in accordance with experience and the preliminary advice provided by the geotechnical contractor to satisfy the requirements of Section 6.3.1 of the specification. It is not intended that compliance with Section 6.3.1 of the specification will be based on a pass or fail measure. Instead, the results of ongoing materials testing by the geotechnical consultant (as outlined in Section 6.3.2 of the specification), on samples collected from the finished surface layer of the fill, will be used to measure, monitor and guide ongoing earthworks compliance. Where non-compliances are identified, the geotechnical consultant and contractor will work together to make adjustments to the work (i.e. adjusting blend ratios or using alternative fill sources) to achieve compliance in ongoing fill layers.

It is generally anticipated that the available materials on the site will generally comply with the requirements of one or more fill zones, particularly with moderate effort of material blending. It is understood that some non-conformances are likely and where minor in nature and frequency will generally be accepted. Significant and/or continued non-conforming results would be subject to further geotechnical advice and intervention, which may include reworking of completed fill layers, although only when significant and ongoing non-conformances have not been addressed. It is noted that Section 7.5 of the specification primarily relates to non-conformances relating to fill compaction and moisture content control.

3.12 Plate Load Tests

This relates to Section 7.10 of the specification.

The methodology and intent of the specification is that plate load tests will be undertaken by the geotechnical consultant at three levels within the upper 2 m of the completed fill surface (i.e. finished surface level [FSL], FSL -1 m and FSL -2 m) to assess the in situ stiffness of the completed fill and inform the detailed design of buildings and pavements. A testing frequency of 1 per 5,000 m² is outlined in Section 7.10 of the specification, which can be reduced to 1 in 10,000 m² for precinct areas outside of proposed warehouse buildings (if such locations become known).

The intent is that the contractor will provide access to the fill layers to allow plate load tests to be conducted. In addition, the contractor will provide suitable plant (excavator or similar) to act as a reaction load whilst testing is being undertaken. A preliminary estimate is that one plate load test will take between 60 and 90 minutes to complete and that several tests would be undertaken during each site visit (say at least 3 or 4 tests, or at least a half day testing duration). A total of 330 tests is estimated assuming a total site area of 55 hectares with testing undertaken at one per 5,000 m².

3.13 Over-excavation of Quarry Batters

This relates to Section 9 of the specification.

The methodology and intent of the specification is that once the quarry backfilling operations reach a level near to the top of in situ rock (defined as top of low strength rock), as exposed in the quarry wall face, the contractor is to over-excavate the existing quarry walls so as to offset the inclined interface between placed fill and natural ground. The specification outlines specific requirements for over-excavation and benching. The geotechnical consultant is to provide specific details to the contractor in advance of the work so that the contractor can quantify the scope of work and plan commencement to allow the work to be completed as part of the ongoing raising of the fill surface.

The intent is that the contractor will notify the geotechnical consultant when the fill reaches a level of approximately 4-5 m below the top of rock in the quarry wall, with over-excavation typically required from a level of approximately 2 m below the top of rock. The geotechnical consultant will provide drawings outlining cross sections of the work to be completed in a similar format to that presented as

Attachment A. It is noted that the example drawings presented in Attachment A is from a similar quarry backfilling project previously undertaken for Austral Bricks on land to the north of Precincts 2 to 4 (i.e. backfilling of Vineyard Pit 1, completed during 2005-2009).

A hold point is applied to the completion of the over-excavation works so that they can be inspected by the geotechnical consultant and approved by the Superintendent prior to fill being placed. The intent of the hold point is that the work will be regularly inspected by the geotechnical consultant during the over-excavation process so that approval can be given with delaying the ongoing placement of fill.

It is understood that it is not possible to determine the extent of the quarry batter over-excavation works, or to quantify the required works to complete the over-excavations until such time that the scope is made known to the contractor. Where the over-excavation work is in addition to the contracted scope of work, the additional work will be deemed a variation.

3.14 Installation and Survey of Settlement Plates

This relates to Section 10 of the specification.

The methodology and intent of the specification is that once the quarry backfilling operations reach finished surface level (on a staged basis) settlement monitoring will commence in areas of the site underlain by 10 m or more of fill. To monitor the settlements, settlement plates will be installed at a depth of 1.5 m below the finished surface level in small excavation made by an excavator. The excavations will be a minimum of 1.2 m square. The settlement plate comprises a flat steel base plate that is at least 0.8 m square and a steel pipe of minimum 50 mm diameter will be welded centrally to the plate. The pipe is to be at least 2.2 m long.

The process of installing the plate will be to:

- Excavate the 1.5 m deep hole.
- Place 0.2 m of wet 20 MPa concrete in the base and then set the flat steel settlement plate on the concrete surface.
- The place a subsequent 0.2 m thick layer of wet 20 MPa concrete over the top of the plate and allow to set.
- After the concrete is set, the remaining depth of excavation is to be backfilled with controlled fill.
- The steel pipe is to stick up at least 0.9 m above the reinstated fill surface.

A surveyor is to be engaged to then undertake the monthly survey, as outlined in Section 10 of the specification.

The intent is that the contractor will have the settlement plates made and will install them in the presence of the geotechnical consultant. The contractor will also engage the surveyor and procure monthly reports that will be passed on to the geotechnical consultant for review.

A hold point is applied to the completion of the settlement plate installations, although as this work is occurring at the finished fill surface, delays are not anticipated. The intent of the hold point is that the installation of the settlement plates is to be supervised by the geotechnical consultant.

It is understood that it is not possible to determine the extent of the settlement plate installation works, or to quantify the number of settlement plates required until such time that the scope is made known to the contractor. Where the over-excavation work is in addition to the contracted scope of work, the additional work will be deemed a variation. A preliminary estimate is that settlement plates will be installed at a frequency of approximately 1 per 10,000 m².

Please contact the undersigned if you have any questions on this matter.

Yours faithfully
Douglas Partners Pty Ltd



Ray Blinman
Principal

Reviewed by



Scott Easton
Principal

Attachments: A – Example of Requirements for Over-excavation of Quarry Batters



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cc: LION QUARRIES P/L	Ali	9747 0613
From: Ray Blinman	Date: 2 August 2007	Total pages: 7

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Subject: VINEYARD PIT BATTER EXCAVATION WORKS	Project No: 37893
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Chris,

Perimeter Benching Works

Filling works at site have now reached a surface level close to that of the low strength shales, siltstones and residual clays exposed within the upper portions of the adjacent quarry perimeter batter faces. Accordingly, benching of the quarry batters for a greater width is now possible and this work should be commenced as soon as possible.

To date, filling has been placed and compacted within the confines of the existing quarry batters with horizontal benching restricted by and unnecessary due to the presence of higher strength in-situ rock. As rock strengths reduce within the upper reaches of the batters, benching should now be extended to ensure a relatively uniform degree of compaction is provided across the filling/batter interface and to step the interface alignment so as to provide an appropriate seal against moisture ingress.

This work was previously discussed with Austral Bricks Pty Ltd (Austral) and Mulgoa Quarries Pty Ltd (Mulgoa) during earlier stages of the filling project. Benching will be required on all four sides of the pit and should be completed in accordance with the following recommendations and attached plan and cross sections:

- Provide to site a suitable dozer capable of excavating and ripping low strength rock;
- Excavate a near level benches of at least 4 m to 5 m width along the full eastern and southern sides of the pit between the two existing access ramps (i.e. east and south ramp);
- Excavate similar near level benches along the full western side of the pit between the western ramp and southern ramp;
- Excavate similar near level benches along the full northern side of the pit between the western ramp and eastern ramp (Note – further batter profile information is required before these works can commence);
- Batter the exposed faces above the benches at a grade of 1H:1V (45°);

Integrated Practical Solutions



- Place all excavated material within the general pit filling volume, preferably at the eastern end of the site to facilitate backfilling of the previous temporary site dam;
- Spread and compact all filling in accordance with the project's earthworks specification;
- Continue to import filling from external source sites and place, spread and compact in accordance with the project's earthworks specification.
- Key all filling layers into the new batter profiles during placement and compaction.

Attached is a plan showing the site conditions and filling levels as at the June 2007 survey date. Also attached are four cross sections (north, south, east and west batters) detailing the approximate extent of the excavation and benching works. Douglas Partners Pty Ltd (DP) advises that the final extent of the work will need to be determined on site as in-situ rock strengths may warrant alterations to the proposed excavation reduced levels shown on the cross sections.

Benching works along the northern batter potentially clash with the proposed location of the future road, Capicure Drive. Similarly, finished surface levels at the northern side of Vineyard Pit 1 are not clear and therefore batter excavations along this face require further consideration to resolve the required finished surface levels. It is possible that commencement of the northern batter excavations can be delayed, at least while batter excavations are performed elsewhere across the site.

DP recommends that the above works commence immediately, so that excavation spoil can be used as filling in a controlled manner without interference of additional imported volumes.

Preliminary discussions with Mulgoa suggest a period of about two to three weeks would be required to complete the works, although Mulgoa are better positioned to advise on their required timeframe.

It is recommended that all excavation works be measured by survey.

Other Site Works

With respect to other site works, DP advises that rectification of the pit floor following the June/July rainfall is currently underway. Stripping of excessively wet materials from the lower eastern end of the pit also requires use of a dozer, so that the excavated filling can be pushed aside and allowed to dry whilst further filling works take place.

Further site inspections will take place over the next week or so to ensure the pit floor is returned to a suitable condition prior to placement of further filling.

DOUGLAS PARTNERS PTY LTD



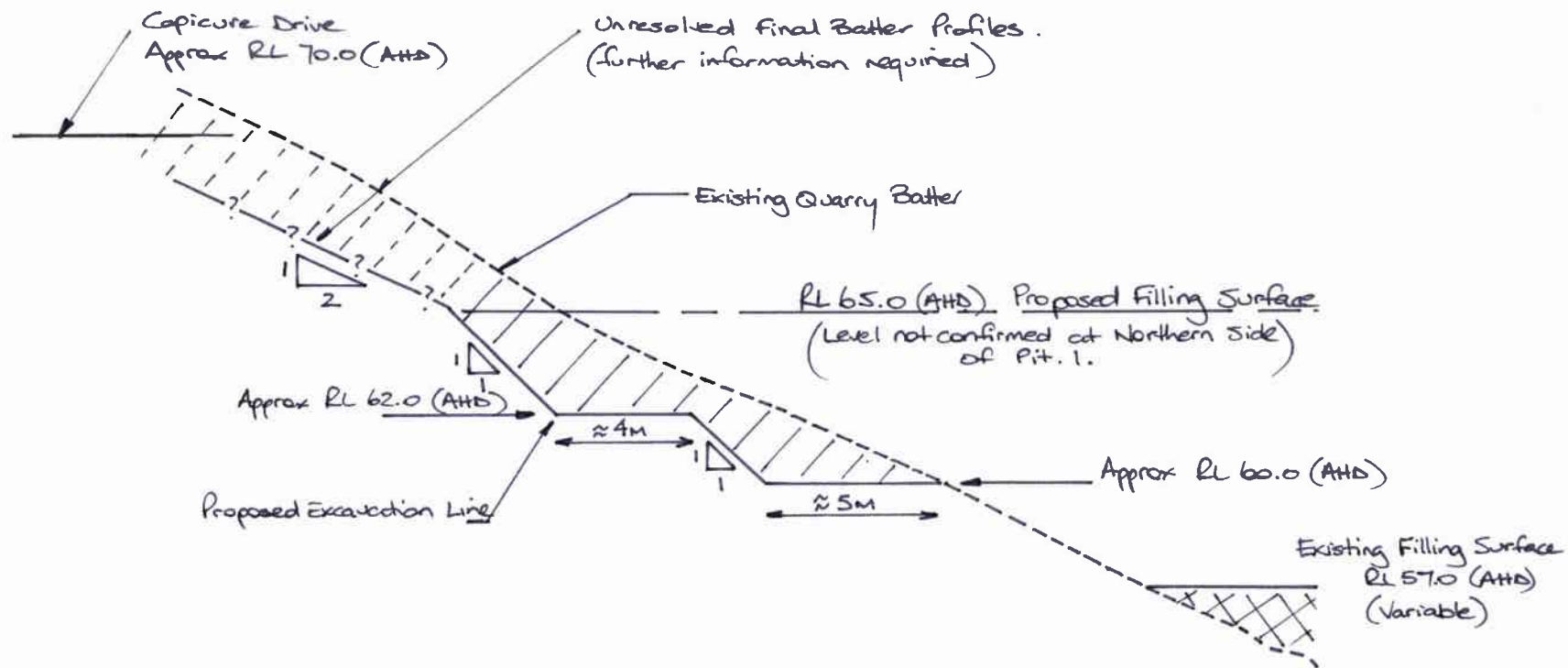
Ray Blinman
Senior Associate

Reviewed by

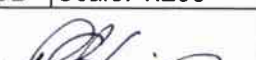


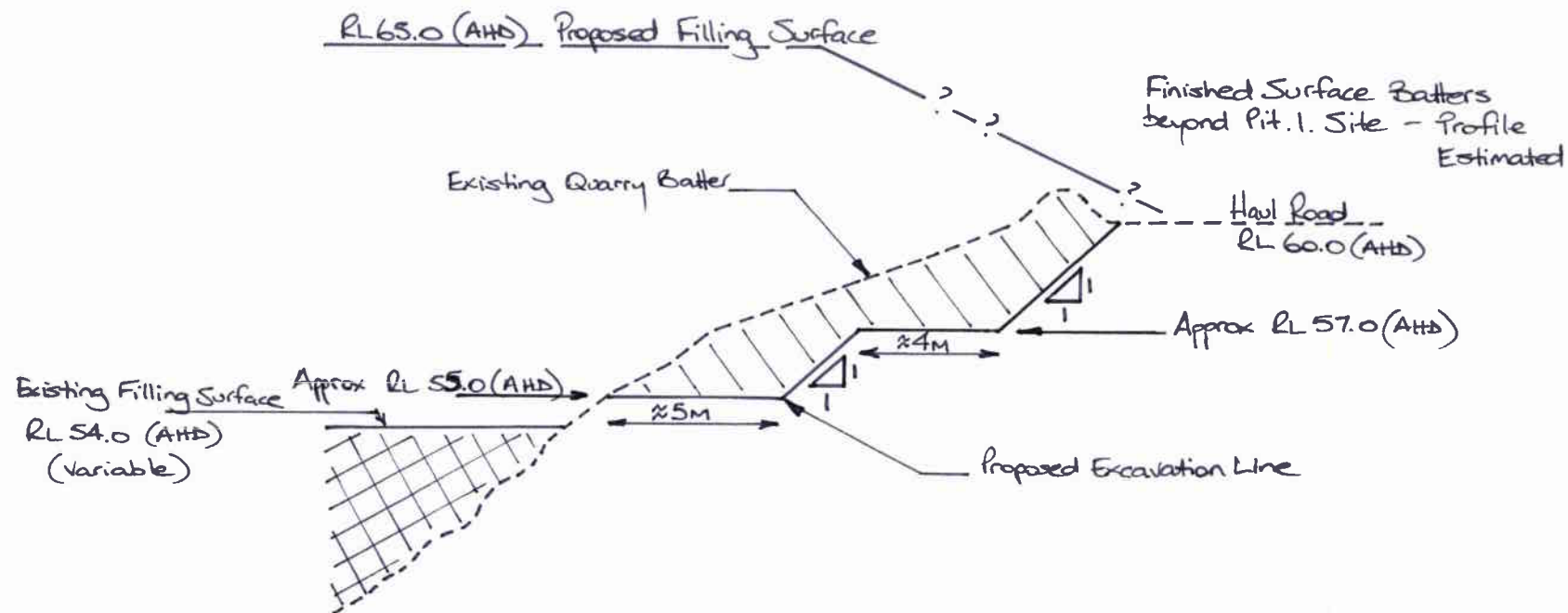
T J Wiesner
Principal

Encl: Drawing No. 111096001 Rev 27 – June 2007 Survey Plan (Hard & Forester P/L)
Drawing No. 5 – Cross Section (Northern Batter)
Drawing No. 6 – Cross Section (Southern Batter)
Drawing No. 7 – Cross Section (Eastern Batter)
Drawing No. 8 – Cross Section (Western Batter)

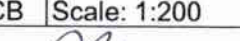


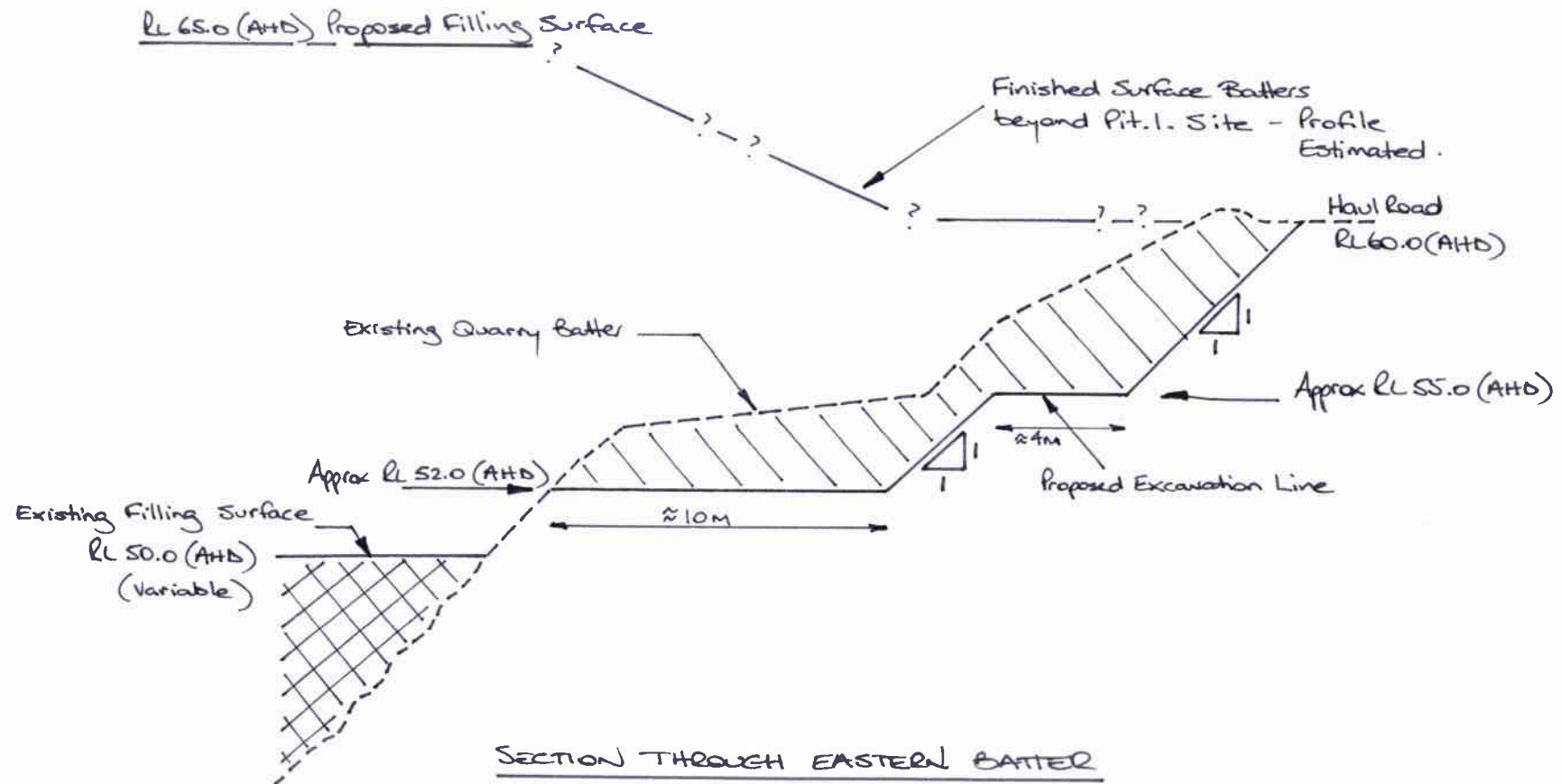
SECTION THROUGH NORTHERN BATTER

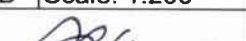
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		Date: 2 August 2007			Melbourne, Wyong, Townsville, Cairns, Gold Coast
Drawn by: RCB	Scale: 1:200	Office: Sydney			Wollongong, Campbelltown, Darwin, Sunshine Coast
Approved by: 		Drawing No. 5		Title	Cross Section (Northern Batter) Vineyard Pit 1 Old Wallgrove Road, Eastern Creek

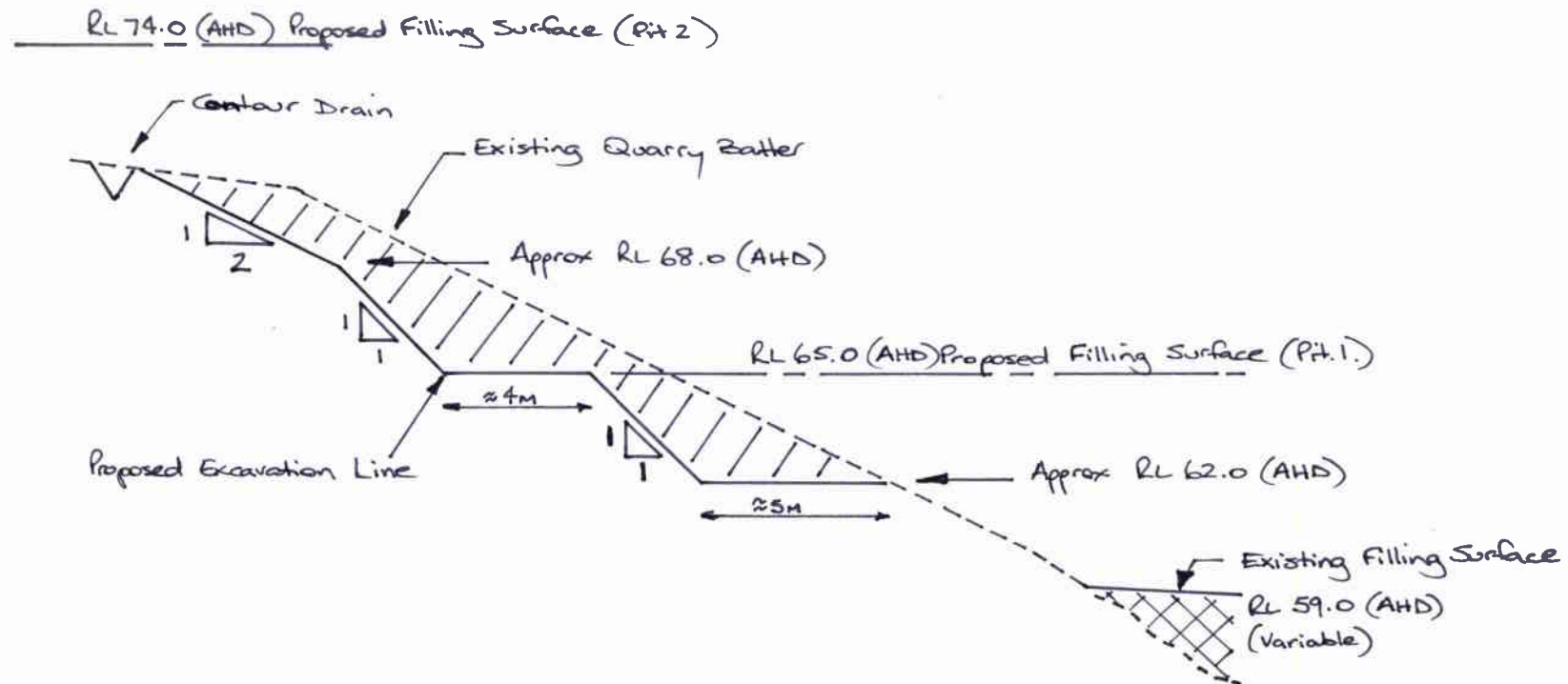


SECTION THROUGH SOUTHERN BATTER

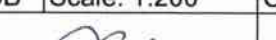
Client: Austral Bricks Pty Ltd		Project Number: 37893		 Douglas Partners <i>Geotechnics · Environment · Groundwater</i>	Sydney, Newcastle, Brisbane, Wollongong, Perth Melbourne, Wyong, Townsville, Cairns, Gold Coast Wollongong, Campbelltown, Darwin, Sunshine Coast
		Date: 2 August 2007			
Drawn by: RCB	Scale: 1:200	Office: Sydney			
Approved by: 		Drawing No. 6		Title Cross Section (Southern Batter) Vineyard Pit 1 Old Wallgrove Road, Eastern Creek	



Client: Austral Bricks Pty Ltd		Project Number: 37893		 Douglas Partners <i>Geotechnics · Environment · Groundwater</i>	Sydney, Newcastle, Brisbane, Wollongong, Perth
Date: 2 August 2007		Office: Sydney			Melbourne, Wyong, Townsville, Cairns, Gold Coast
Drawn by: RCB	Scale: 1:200				Wollongong, Campbelltown, Darwin, Sunshine Coast
Approved by: 		Drawing No. 7		Title	Cross Section (Eastern Batter) Vineyard Pit 1 Old Wallgrove Road, Eastern Creek



SECTION THROUGH WESTERN BATTER

Client: Austral Bricks Pty Ltd		Project Number: 37893		 Douglas Partners <i>Geotechnics - Environment - Groundwater</i>	Sydney, Newcastle, Brisbane, Wollongong, Perth
		Date: 2 August 2007			Melbourne, Wyong, Townsville, Cairns, Gold Coast
Drawn by: RCB	Scale: 1:200	Office: Sydney			Wollongong, Campbelltown, Darwin, Sunshine Coast
Approved by: 		Drawing No. 8		Title	Cross Section (Western Batter) Vineyard Pit 1 Old Wallgrove Road, Eastern Creek

