Douglas PARTNERS

GROUNDED EXPERTISE

Report on Geotechnical Assessment

Oakdale East Estate - Precinct 5

Old Wallgrove Road, Horsley Park NSW

Prepared for BGMG 14 Pty Ltd

Project 86545.14

26 September 2025

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Document History

Details

Project No.	86545.14
Document Title	Report on Geotechnical Assessment
Site Address	Old Wallgrove Road, Horsley Park NSW
Report Prepared For	BGMG 14 Pty Ltd
Filename	86545.14.R.401.Rev0

Status and Review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Ray Blinman	Scott Easton	26 September 2025

Distribution of Copies

Status	Issued to
Revision 0	Luke Ridley, BGMG 14 Pty Ltd

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.

Signature	Date
Author	26 September 2025
Reviewer	26 September 2025

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Report on Geotechnical Assessment
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1. Introduction

This report presents the results of a geotechnical assessment undertaken by Douglas Partners Pty Ltd (DP) for Precinct 5 of the Oakdale East Estate located on the north-eastern part of the estate and accessed off the eastern end of Estate Road 02. The assessment and advice provided herein has been prepared to support Development Application No. 118.1/2025 and to respond to Fairfield City Council's letter dated 21 August 2025 in relation to the item 'Geotechnical Investigation'.

The advice presented in this report may be updated during the project, subject to final project requirements and the outcomes of the bulk earthworks operations currently underway on the site. The report was commissioned by Luke Ridley of Goodman Property Services (Aust) Pty Ltd, on behalf of BGMG 14 Pty Ltd.

2. Site Details

2.1 Site Identification

The greater Oakdale East Estate development site is identified as Lot No. 1 Burley Road (DP 843901) within Horsley Park and has a street address of 224-398 Burley Road, Horsley Park. Subdivision of the site into five precincts is being progressively undertaken with Precinct 1 (now complete) occupying the south-western part of Lot 1. Precincts 2 to 4 (under construction) will occupy most of the remaining site area with Precinct 3 situated across the balance of the street frontage to Old Wallgrove Road and extending eastwards for approximately 600 m. Precincts 2 and 4 are situated on the eastern part of the estate and will be accessed via new public dedicated estate roads. Precinct 5 lies in the north-eastern corner of the estate and is the subject of this report.

The proposed development layout, estate and precinct boundaries are shown on the attached estate masterplan (Drawing No. OAK E MP02 (F) dated 26 October 2023) and precinct plan (Drawing Nos. OAK MP03 (C) dated 26 October 2023), both prepared by SBA Architects (SBA). Precinct 5 encompasses the area to be occupied by the warehouse layout shown on Drawing OEE_DA100 (E), dated 23 September 2025, also by SBA. All three drawings are presented in Appendix B.

2.2 Site Description

Precinct 5 covers an irregularly shaped area of approximately 30.9 hectares. The site is approximately 230 m long (north-west to south-east) and 140 m wide (north-east to south-west) at its longest and widest points.

The greater Oakdale East Estate site was previously occupied in part by the Austral Bricks Plant 3 brickmaking facility, which included a large warehouse (with kilns, etc.) that was surrounded by concrete hardstands and other supporting buildings. Beyond the brick-making facility, an extensive array of large stockpiles was present that comprised materials of 'stock-in-trade' for the manufacture of bricks and pavers. In addition, several brick quarries are scattered throughout parts of Precincts 2, 3 and 4 that were excavated to various depths of up to 30 m (possibly more). Plant 3, situated in the western part of Precinct 3 has been demolished and the various stockpiles are being progressively removed for beneficial reuse as engineered fill following geotechnical and environmental (contamination) assessment. Excavation of the quarry in Precinct 5 was commenced recently and is continuing. Although most of the quarry footprint has reached its base excavation level, excavations are ongoing in the eastern part. It is understood that the target maximum base depth for the quarry is at a reduced level of RL36, relative to Australian height datum (AHD).

Precinct 5 quarry, known as Quarry East, is currently undergoing bulk earthworks to backfill completed quarry areas, with the southern and western parts nearing finished design bulk earthworks levels.

Pre-development ground surface levels within Precinct 5 generally ranged between reduced levels of RL55 and RL60. Ground surface levels are currently undergoing significant adjustment due to quarrying, although are immediately being backfilled to pre-quarry levels by controlled fill associated with bulk earthworks for quarry rehabilitation and for the subsequent precinct building pad and fronting road formation.

3. Bulk Earthworks

Bulk earthworks have commenced within Precinct 5 with most of the site subject to significant fill thicknesses to reinstate quarry lands and peripheral areas outside of the quarry subject to minor cut to fill earthworks associated with the proposed development application. Development plans indicate the creation of a single building pad within Precinct 5, with plans showing finished floor levels for the new warehouse of RL62.7 requiring a nominal bulk earthworks level of RL62.3. Accordingly, it is estimated that the bulk earthworks will include limited and relatively minor excavation and filling around the outside of the quarried area of generally less than 4 m, and the placement of engineered fill of up to 25 m within the quarry footprint. It is noted that the deep fill area has been deliberately designed to underlie the proposed building footprint to mitigate differential settlements at the reinstated ground surface post fill placement.

Bulk earthworks are ongoing and are estimated to be completed during 2026. All earthworks are subjected to a programme of geotechnical inspections and tests consistent with a Level 1 standard, as defined in AS3798. An earthworks specification was prepared by DP prior to commencement and an on-site soils testing laboratory has been established on the site to cater to the project's needs. For details on the earthworks specification, refer to:

- Earthworks Specification (Ref: 86545.13.R.008.Rev3 dated 7 December 2023), in Appendix C.

In summary, the specification requires all fill to be compacted to a dry or Hilf density ratio of between 98% and 104%, relative to Standard compaction. The field moisture content of the fill at the time of compaction is to be maintained within ±2% of the Standard optimum moisture content. A minimum testing frequency of 1 density test per 500 m^3 of fill placed is specified.

Additional requirements covering inspection and proof rolling of stripped surfaces by geotechnical engineers, materials quality testing, plate load testing, fill volume recording and survey (etc.) are all outlined in the specification.

Fill materials are being sourced from on-site cuts and previous stock-in-trade stockpiles spread throughout Precincts 2 to 5 and comprise predominantly silty clay and ripped shale. Some on-site sourced ripped sandstone is also being used as bulk fill and further crushed or ripped sandstone is being imported to site for use within the reinforced zones of reinforced soil retaining walls, some of which will provide grade separation support to the perimeter of Precinct 5.

The specification and testing processes associated with the bulk earthworks aim to achieve a building pad that is suitable for the structural founding of the warehouse and hardstand storage areas. Similarly, they are to be suitable for the formation of road subgrades and embedment of subdivisional services.

4. Interim Geotechnical Design Advice

The following interim geotechnical design advice is provided as a guide for the design of new structures and pavements within Precinct 5 of the Oakdale East Estate. The advice applies to all areas of the site where earthworks are being undertaken in accordance with the earthworks specification referenced in Section 3. Where site work is undertaken in accordance with an alternative specification or criteria, adjustments to the design advice may be necessary.

4.1 Site Classification

The Australian Standard AS2870 *Residential Slabs and Footings* is applicable to residential dwellings and similar lightweight structures. Whilst not relevant to the specific structures proposed within Precinct 5, the characteristic ground surface movements provide useful information to designers of footing systems, slabs, pavements, other lightweight footing systems (light poles, or similar) and services (flexibility of pipe joints, etc.).

Materials testing undertaken on samples of the natural soils within the site have identified medium and high plasticity silty clay. Accordingly, natural soils in cuttings and fill comprising these materials, as well as those sourced from on-site stockpiles, once compacted in accordance with the earthworks specification, are considered representative of Class H1 soils, as defined in AS2870. Characteristic ground surface movements are therefore anticipated to be within the range of 40 mm to 60 mm.

It is understood that Precinct 5 will be almost entirely covered with concrete warehouse/building slabs and hardstand/pavements. It is therefore likely that the limited amount of unsealed ground surface area will reduce the opportunity for significant variations in soil moisture contents and thus may also reduce effects of shrink and swell ground surface movements. Irrespectively, all new structures should be designed and detailed to ensure rainfall runoff and other potential sources of near-surface waters are adequately collected through sufficient surface and subsoil drains to limit the likelihood of future localised wetting and drying of the underlying soil profiles. Seasonal changes in soil moisture contents will still occur and thus protection and specific design of slab/pavement edges should consider the effects of shrink and swell movements in recognition that ground movements along slab/pavement edges are likely to be greater and more variable than those below slab/pavement centres.

The following design parameters are suggested:

- Characteristic ground movement: ys = 50 mm for movements at perimeters and edges of openings.
- Differential mound movement: ym = 15 mm for local movements in areas away from slab edges.
- Tilts: 1 in 300, assuming ym applies over a typical interval of 4.5 m.

Areas of Precinct 5 may also comprise cuts that, on completion of earthworks, may expose in situ weathered rock or natural silty clay with rock present at shallow depth. Such areas of the site are expected to be of relatively limited extent but may coincide with the northern and southern parts of the warehouse. These areas may classify as Class M in accordance with AS2870, although their localised extent means this lower classification can likely be ignored. Where relevant, these areas would need to be specifically investigated and designs adjusted to suit the investigation results, with such outcomes likely to relate only to small and isolated structures.

To reduce the magnitude of shrink and swell movement on new structures, consideration could be given to placing a 0.3 m to 0.5 m thick layer of ripped rock across the surface of the natural clay and fill areas.

4.2 Site Sub-soil Class

On completion of the bulk earthworks, the ground conditions across Precinct 5 will include in situ rock exposed at the site surface (limited areas only), natural silty clay (also limited) at the surface where excavation extends only to shallow depths below natural ground surface levels and engineered fill typically to a thickness of up to 25 m (approx.). As per the requirements of AS1170.4-2007, two site sub-soil classes are potentially relevant, including:

- B_e – for site areas exposing rock or less than 3 m of natural clay, extremely low strength rock or engineered fill (unlikely to be relevant).
- C_e – for all other site areas (likely relevant to almost the whole of the site).

It is recommended that Class C_e is adopted. If there is a requirement to adopt Class B_e, then it will be necessary to undertake a detailed survey across the site to identify which areas are underlain by less than 3 m of soil cover over the underlying in situ rock. It is noted that this is only likely to be relevant for marginal areas about the precinct perimeter and as such the adoption of B_e is unlikely to be warranted.

4.3 Footings

Foundations for the warehouse (etc.) are likely to be formed on exposed natural soil and rock in cuttings (limited extent) and engineered fill elsewhere (most common).

Subject to final design levels and the proposed footing types, it is anticipated that footings for the new warehouse will most likely comprise shallow pads founding within the upper 1 m of the new engineered fill, natural clays and weathered bedrock. Alternatively, bored piles founding within the bedrock could be adopted, particularly in areas of deep filling, subject to column loads and settlement criteria. The parameters listed in Table 1 are suggested for preliminary footing design.

Table 1: Suggested Preliminary Footing Design Parameters

Soil / Rock Profile	End Bearing		Shaft Adhesion		Young's Modulus E (MPa)
	Allowable	Ultimate	Allowable	Ultimate	
Compacted Filling	150	500	15	20	Section 4.4
Stiff / Very Stiff Clay	150	500	15	20	
ELS (Class V) Bedrock	700	3000	50	100	100
VLS / LS (Class IV) Bedrock	1000	3500	100	150	200

Notes: The values listed in Table 1 are subject to confirmation during construction.
Values for Extremely Low Strength (ELS) bedrock assume a minimum 0.3 m penetration into bedrock.
Values for Very Low Strength / Low Strength (VLS / LS) bedrock assume a minimum 1 m penetration into bedrock, although actual depths to Class IV bedrock must be confirmed during construction.

The ultimate pressure and modulus values should be used where piles/footings are designed using the limit-state design approach. An appropriate geotechnical strength reduction factor (Φg) should be applied when using the limit-state approach, and serviceability design usually governs the design in competent rock and must be considered.

All pad and pile footing excavations should be inspected by a geotechnical engineer and footing excavations in soils should be subjected to dynamic cone penetrometer (DCP) tests to verify that the listed allowable bearing pressures have been achieved.

The design of shallow footings founding near excavations (i.e., lift wells, service trenches or similar), including temporary excavations, must have all loads transferred to below an influence line inclined upwards at 45 degrees commencing from the lowest and closest side of the excavation or trench base. Pad footings should be deepened to accommodate this load transfer or alternatively pile footings should be used.

4.4 Soil Modulus

The design of concrete slabs based on soil modulus (elastic) can be undertaken with consideration to the following short-term and long-term Young's modulus values:

- Long term Young's Modulus (ELT) – 15 MPa.
- Short term Young's Modulus (EST) – 25 MPa.

These values are suggested for the design of slabs over natural stiff silty clay and engineered fill. Values applicable for foundations formed in rock are listed above in Table 1. The above values are also appropriate for the calculation of settlements below footings in stiff natural clay/engineered fill and include a 0.8 downgrade factor.

For the design of slabs and pavements using a modulus of subgrade reaction, caution is expressed due to the inherent variability of the value under slightly differing soil and design conditions. The modulus of subgrade reaction will vary due to soil type, degree of compaction/in situ density, magnitude of the applied load and the area over which the load is applied. For this site, it is suggested that the modulus of subgrade reaction is likely to lie within the range of 10 – 30 kPa/mm, however further advice should be sought before adopting any

modulus of subgrade reaction value so the relevant variables can be considered and the resulting value adjusted to suit. It is noted that the modulus of subgrade reaction is not a pure soil property.

To determine the modulus of subgrade reaction (i.e., the modulus relative to wheel loadings or other loading), it will be necessary to carry out plate load tests on the basecourse under the floor/pavement slabs. Plate load tests usually overestimate the modulus, particularly if the subgrade is dry of its long-term equilibrium value. Accordingly, the designer will need to factor down the test value in consideration of the soil moisture content of the underlying subgrade and with relevance to its long-term equilibrium moisture content. Plate load tests can also be undertaken directly on the fill surface.

It is recommended that a thorough programme of plate load tests be completed shortly prior to construction of all floor and pavement slabs. Plate load tests currently form part of the earthworks specification but these results should be considered as a guide only, as there is a high potential for soil disturbance at the bulk earthworks surface level due to rainfall and construction related activities.

4.5 Unsupported Batters and Retaining Walls

For unsupported slopes it is recommended that temporary batter slopes do not exceed a grade of 1H:1V (45 degrees) within the fill and natural clay soils for batters up to 4 m high. For permanent batters, a maximum grade of 2H:1V (26 degrees) is suggested, reducing to 3H:1V (18 degrees) or flatter if maintenance access is required (i.e., mowing, or similar). These assume no surcharge loads or movement sensitive assets are located near the crest of the batter, and that adequate erosion protection is provided.

The design of batter slopes should account for surcharge loads, including storage of construction materials, adjacent pavements, access roads, buildings or similar. Design should also consider the effects of plant operating above the excavation and/or retaining wall during construction.

With reference to the project's site plan and warehouse plan, it is noted that two retaining walls are proposed and extend along the northern, southern and part eastern sides of the development. Both walls are currently proposed as reinforced soil walls with segmental block facing units. Wall heights are understood to be up to 3 m high, possibly slightly higher.

For the preliminary design of gravity retaining walls, it is suggested that an average unit weight of 20 kN/m^3 is adopted for the fill and natural clays, with a triangular earth pressure distribution calculated using an active earth pressure coefficient (K_a) value of 0.3 where some wall movement is acceptable, or an 'at-rest' earth pressure coefficient (K_o) value of 0.5 where wall movement is to be reduced. A coefficient of passive earth pressure (K_p) equal to 2.5 may be assumed within very stiff to hard clay and well compacted filling, to which a factor of safety must be applied in recognition of the fact that large movements are required to mobilise the full passive resistance. Additional advice can be provided following specific geotechnical investigations undertaken for each individual wall alignment.

The pressure distribution given above does not include hydrostatic pressure due to groundwater behind retaining walls, which should be included in the design unless adequate drainage is provided to prevent the build-up of hydrostatic pressures.

The design of batter slopes and retaining walls should account for surcharge loads, including storage of construction materials, adjacent pavements, access roads, buildings or similar. Design should also consider the effects of plant operating above the excavation and/or retaining wall during construction.

4.6 Settlements

4.6.1 Elastic Settlements

Footings proportioned based on the allowable bearing pressures listed in Table 1 would be expected to experience total elastic settlements of less than 1% of the footing width under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value. Limit state design using the ultimate values in Table 1 will need to consider serviceability which often governs the design.

4.6.2 Creep Settlements

There is a significant variance in the total thickness of fill that will be placed within Precinct 5. Fill thicknesses are likely to vary between 0 m and 25 m (possibly more). Gradual long-term creep settlement is therefore anticipated in areas of fill that exceed 5 m in thickness, and it is suggested that the designer considers the effects of creep settlements, which are in addition to possible shrink-swell/characteristic surface movements and total elastic settlements.

For estimation of settlements due to creep it is suggested that an allowance of 0.35% of the total fill depth, excluding the upper 5 m, is adopted for each log-period of time (e.g., 0 to 1 year, 1 to 10 years, 10 to 100 years, etc.) or part thereof. For the Oakdale East Estate, it is understood that all structures are to be designed for a period of 50 years.

Creep settlement occurs due to the self-weight of the fill resulting in constant high stresses that cause consolidation of lower fill layers. Creep settlements will continue for many years after completion of earthworks and they are directly related to the type of fill, thickness of fill and the degree of compaction applied. Creep settlement can be expressed as:

$$Creep\ Settlement = C\alpha \times filling\ thickness \times change\ in\ log\ time$$

Cα typically lies within the range of 0.25% to 0.5% for well compacted granular and clayey fill.

Important to the effects of creep settlement is the timing of fill placement and the change in thickness of fill across a site. The change in log time needs to consider the difference in time over the design period (including the construction period) and should exclude any period that has already passed since the completion of fill placement and prior to construction commencing. The thickness of fill across the site should be determined from the difference between the work-as-executed stripped survey levels and the design finished surface levels.

For preliminary purposes, it is considered that creep settlements at the site can be based on an average creep settlement coefficient (Cα) of 0.35%. The validity of this value will be subject to further verification and assessment once the results of settlement monitoring on the site becomes available. Table 2 presents estimates for the total creep settlements likely to occur for a range of development design periods and fill thicknesses following placement of the fill. The values presented in Table 2 assume that development of structures within the estate areas occurs immediately after the bulk earthworks are completed. Table 3 presents similar estimates for total

creep settlements but assumes that there is a delay of one year (i.e. one log cycle of time) between the completion of bulk earthworks and the construction of structures.

It is noted that settlement monitoring points have been established in the southern half of Precinct 2 and coincide with the locally deepest fill locations (approx. 9 m to 10 m thick). The monitoring points were established in December 2023 and monitoring currently indicates reasonable compliance with the advised preliminary average creep settlement coefficient. Similar monitoring within Precinct 5 is to be undertaken in accordance with the earthworks specification.

Table 2: Estimates of Total Creep Settlement – No Construction Delay (Cα = 0.35%)

Fill Thickness (m)	Estimated Creep Settlement (mm) / Design Period				
	10 years	20 years	30 years	40 years	50 years
<5	Nil	Nil	Nil	Nil	Nil
6	7.0	8.1	8.7	9.1	9.4
8	21.0	24.2	26.0	27.3	28.3
10	35.0	40.3	43.3	45.5	47.2
12	49.0	56.4	60.7	63.8	66.1
14	63.0	72.5	78.0	82.0	85.0
16	77.0	88.6	95.4	100.2	103.9
18	91.0	104.7	112.7	118.4	122.8
20	105.0	120.8	130.0	136.6	141.7
22	119.0	136.9	147.4	154.8	160.6
24	133.0	153.0	164.7	173.0	179.5
26	147.0	169.1	182.1	191.3	198.4

Table 3: Estimates of Total Creep Settlement – 1 Year Construction Delay (Cα = 0.35%)

Fill Thickness (m)	Estimated Creep Settlement (mm) / Design Period				
	10 years	20 years	30 years	40 years	50 years
<5	Nil	Nil	Nil	Nil	Nil
6	3.6	4.6	5.2	5.6	6.0
8	10.9	13.9	15.7	16.9	17.9
10	18.2	23.1	26.1	28.2	29.9
12	25.5	32.4	36.5	39.5	41.8
14	32.8	41.6	47.0	50.8	53.8
16	40.1	50.9	57.4	62.1	65.7
18	47.4	60.2	67.9	73.4	77.7
20	54.7	69.4	78.3	84.7	89.6

Fill Thickness (m)	Estimated Creep Settlement (mm) / Design Period				
	10 years	20 years	30 years	40 years	50 years
22	62.0	78.7	88.7	96.0	101.6
24	69.3	87.9	99.2	107.3	113.6
26	76.5	97.2	109.6	118.5	125.5

The difference between the two assumptions for the timing of construction commencement is one year, which occurs as the first year after fill placement. Therefore, if construction is delayed, then the initial log cycle of time is not experienced by the new structures. Similarly, for the subsequent design periods, one additional year would need to be added at the end of the design period to ensure that the same overall period is compared (i.e., a design period of 10 years would be adjusted from years 0 to 10, to years 1 to year 11, and so on). Table 4 provides the difference in creep settlements between the values outlined in Tables 2 and 3, which can be considered as the benefit, in terms of total creep settlement, of delaying construction by one year. It is noted that the benefit is the same for all design periods, as it is year one that is removed from the calculation.

Table 4: Total Creep Settlement Benefit Due to 1 Year Construction Delay ($C\alpha$ = 0.35%)

Fill Thickness (m)	Estimated Creep Benefit All Design Periods (mm)
<5	Nil
6	3.4
8	10.1
10	16.8
12	23.5
14	30.2
16	36.9
18	43.6
20	50.3
22	57.0
24	63.7
26	70.5

Importantly, any estimation of creep settlement is prone to a high degree of uncertainty. The estimates presented in Tables 2 to 4 should be considered as having a potential variation of ±25%.

Differential settlements can be estimated by calculating the difference in total creep settlements for any two given points of known fill thickness. Where fill thicknesses change rapidly over short plan distances, differential settlements will be high and potentially close to the total creep value. Large changes in fill thickness over short distances are expected within the north-eastern part of Precinct 5, and around the quarry perimeter.

To alleviate the effects of creep settlement on the design of structures, consideration could be given to stiffening foundations across site areas underlain by deep fill and the intervening fill

depth transition zones. The installation of controlled modulus columns could be used to reduce settlements by improving the overall strength and modulus of the fill placed, although this would be challenging when considering the construction of pavements and services lines. Additionally, the use of geosynthetic reinforcing grids in near surface layers of the fill below pavements could be considered to reduce the effects of creep settlements.

4.7 Pavements

Laboratory testing on samples of the natural soils on the site (undertaken during previous project works) have generally indicated California bearing ratio (CBR) values of between 1% and 6%. The typical average of all results is approximately 3%. Based on the frequency of results that were less than 3%, it is suggested that all pavements are designed using a CBR value of 2% unless site specific CBR tests from the actual pavement subgrades demonstrate that a higher value can be adopted. It is unlikely, however, that the design value would exceed 3%. The recommended design value is applicable to the whole of the site but may warrant adjustment for areas that expose in situ rock at subgrade level.

To improve the condition of the subgrade, consideration could be given to placing a 0.3 m to 0.5 m thick (approx.) layer of ripped rock (sandstone, or similar) across the surface of the natural clay and filled areas. This would form a select subgrade that could be designed to achieve an effective CBR of say 5%. This provision is currently outside of the requirements of the earthworks specification, although the specification could be amended to include this provision.

Subsoil drains should be installed along both sides of the new estate roads and along all edges of hardstands/pavements, including internal penetrations, although internal penetrations should be avoided wherever possible. Subsoil drains should be installed at a depth of 0.6 m below subgrade levels and should discharge to the nearest available stormwater pit.

4.8 Salinity

Preliminary testing indicates that the materials being used as engineered fill are predominantly of a non-saline to slightly saline composition, although some moderately saline test results are occurring. More comprehensive investigations should be considered if concrete strengths of less than 32 MPa are adopted for structures, or pipe classifications unsuitable for moderately saline soils are proposed for use in direct contact with the ground. Based on the results of any additional salinity studies, the need for a site-specific Salinity Management Plan (SMP) can be ascertained.

4.9 Soil Aggressivity

Preliminary testing has indicated that the natural soils are generally non-aggressive to buried steel elements and mildly aggressive (based on pH) to buried concrete elements. Further testing should be considered on completion of the bulk earthworks to verify this preliminary assessment.

4.10 Erosion

Soils on the site are typically moderately to highly erodible. The design of surface and subsurface drains needs to avoid concentrated run-off flows which could accelerate the effects of soil erosion.

4.11 **Groundwater**

Excavation work for quarrying on the site has resulted in deep excavations to well below the in-situ rock surface. Excavations extend to RL36 resulting in cuts of up to 25 m depth. At all times during the quarrying period (some 7-8 years) the quarry has remained a dry site, with all water experienced in the quarry being direct rainfall and runoff from surrounding catchment areas. Excavations and reinstatement of the quarry is not experiencing any adverse effects of subsurface groundwater seepage. Accordingly, the quarry reinstatement and subsequent development application works can be considered as not interfering with or be influenced by the local groundwater regime, which lies many metres below the influence of the proposed development.

5. Limitations

Douglas Partners (DP) has prepared this report for this project at Old Wallgrove Road, Horsley Park NSW in accordance with instructions received from Mr Luke Ridley of Goodman Property Services (Aust) Pty Ltd, on behalf of BGMG 14 Pty Ltd. The work was carried out under the agreed contractual terms outlined in the professional services agreement for the project. This report is provided for the exclusive use of BGMG 14 Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

DP's advice is based upon the conditions encountered during several previous investigations undertaken across the site and our knowledge of the soil conditions contained in the various stockpiles on the site. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others, by site accessibility and by site information yet to be obtained.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Appendix A

About this Report

About this Report

October 2024

Introduction

These notes have been provided to amplify Douglas' report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

Douglas' reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

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Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, Douglas will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, Douglas cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, Douglas will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, Douglas requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. Douglas would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Appendix B

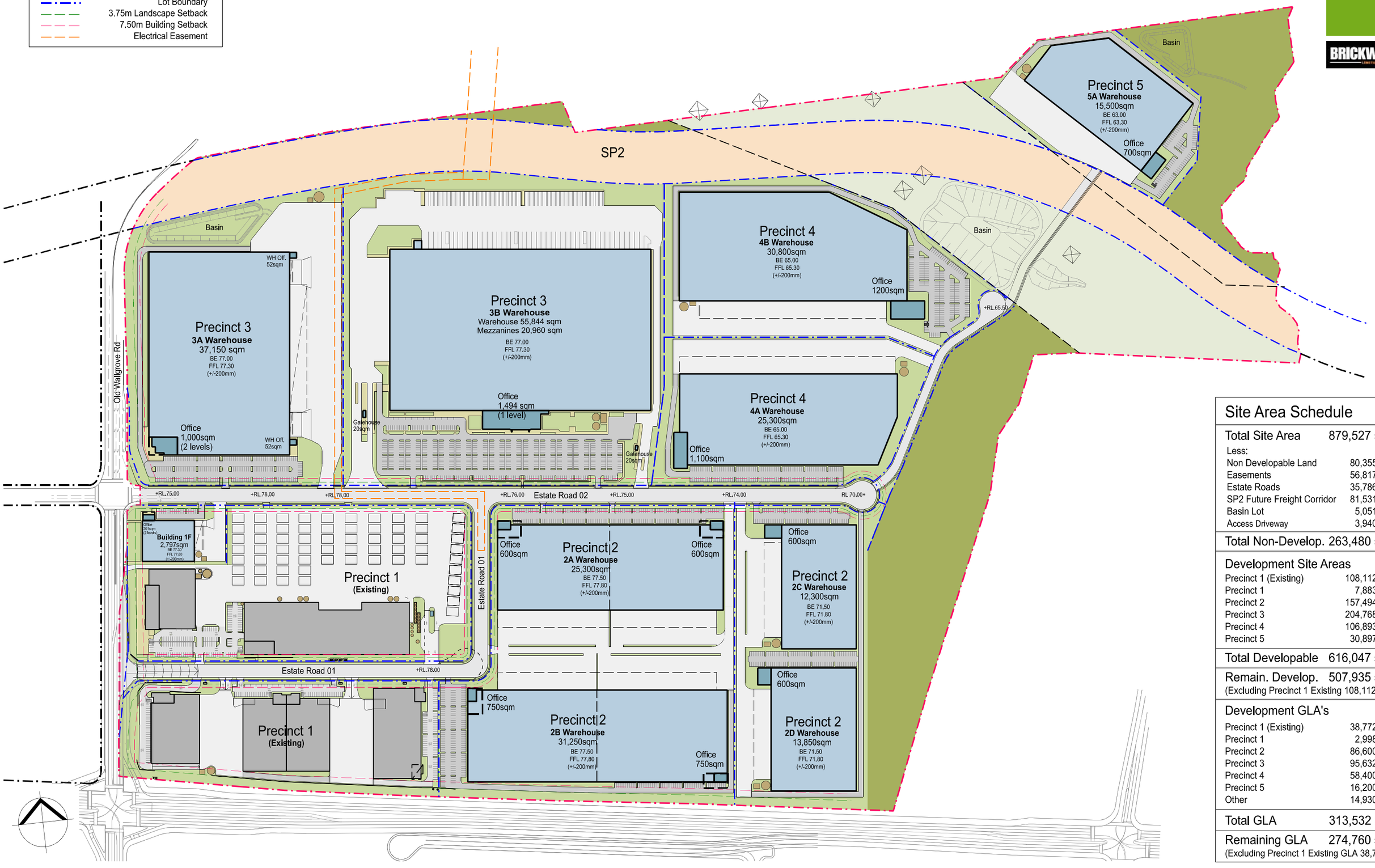
Drawings

Goodman

BRICKWORKS LIMITED

Legend

- Site Boundary
- Lot Boundary
- 3.75m Landscape Setback
- 7.50m Building Setback
- Electrical Easement



Site Area Schedule

Total Site Area	**879,527 sqm**
Less:	
Non Developable Land	80,355 sqm
Easements	56,817 sqm
Estate Roads	35,786 sqm
SP2 Future Freight Corridor	81,531 sqm
Basin Lot	5,051 sqm
Access Driveway	3,940 sqm
Total Non-Develop.	**263,480 sqm**
Development Site Areas	
Precinct 1 (Existing)	108,112 sqm
Precinct 1	7,883 sqm
Precinct 2	157,494 sqm
Precinct 3	204,768 sqm
Precinct 4	106,893 sqm
Precinct 5	30,897 sqm
Total Developable	**616,047 sqm**
Remain. Develop. (Excluding Precinct 1 Existing 108,112 sqm)	**507,935 sqm**
Development GLA's	
Precinct 1 (Existing)	38,772 sqm
Precinct 1	2,998 sqm
Precinct 2	86,600 sqm
Precinct 3	95,632 sqm
Precinct 4	58,400 sqm
Precinct 5	16,200 sqm
Other	14,930 sqm
Total GLA	**313,532 sqm**
Remaining GLA (Excluding Precinct 1 Existing GLA 38,772 sqm)	**274,760 sqm**

SBA ARCHITECTS

Oakdale East Industrial Estate

Horsley Park

Estate Masterplan

0 40 200

1:2000 @ A1
1:4000 @ A3

26 October 2023

OAK E MP02 (F)
Project No: 23192

Legend

Site Boundary
Lot Boundary

Goodman

BRICKWORKS LIMITED

Existing electrical staunchions

Precinct 5

New Basin

New Basin

New Basin

Precinct 3

Precinct 4

Old Wallgrove Rd

Millner Ave

Estate Road 02

Estate Road 01

Precinct 1

Precinct 2

Estate Road 01

Future Southern Link Road

Precinct Area Schedule	
Precinct 1	115,995 sqm
Precinct 2	157,494 sqm
Precinct 3	204,768 sqm
Precinct 4	106,893 sqm
Precinct 5	30,897 sqm
Total Developable Area	616,047 sqm

SBA ARCHITECTS

Oakdale East Industrial Estate

Horsley Park

Precinct Plan

0 40 200

1:2000 @ A1
1:4000 @ A3

26 October 2023

OAK MP 03 (C)
Project No: 23192

LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- TRANSGRID EASEMENT
- 5m BUILDING SETBACK
- BAL - BUSHFIRE ATTACK LEVEL
- 40m REEDY CREEK SETBACK
- ECOLOGICAL NO-GO ZONE
- SG SLIDING GATE
- FNC-1 CHAINWIRE FENCE
- INDICATIVE STREET LIGHTS

REMOVE REFERENCES AND LINEWORK FOR THE EXTEND OF WORKS

1 OEE_DA055

BAL - 12.5

STANCHION

STANCHION

STANCHION

BASIN

BAL - 19

BAL - 29

BAL - 40

PRECINCT 5 WAREHOUSE

ADD SUB-STATION

STANCHION

SP2 CORRIDOR

VEHICLE CROSSING FOR TRANSGRID, LOCATION SUBJECT TO DETAILED DESIGN.

TRANSGRID EASEMENT

40m SETBACK

40000

TOP OF BANK

BAL - FLAME ZONE

WAREHOUSE 3B (UNDER CONSTRUCTION)

TRANSGRID EASEMENT

BASIN

ACCESS ROAD

FNC-1

FNC-1

FNC-1

FNC-1

ADD SETBACK

BAL - 12.5

STANCHION

ECOLOGICAL NO GO ZONE

PRECINCT 4

SG

Truck&Car Entry/Exit

BAL - 19

BAL - 29

BAL - 40

BAL - FLAME ZONE

BAL - 12.5

APPROVED ROAD

ADD STREETLIGHTS

ISSUE FOR DA

SBA ARCHITECTS

Commercial Industrial Residential Retail Interior Design

Phone: 02 9929 9988 Web: www.sbaarch.com.au

Oakdale East Industrial Estate

Horsley Park

PRECINCT 5

Development Application

PRECINCT PLAN

1:1000@ A1
1:2000 @ A3

23.09.2025

OEE_DA050 (D)

Job No 24194

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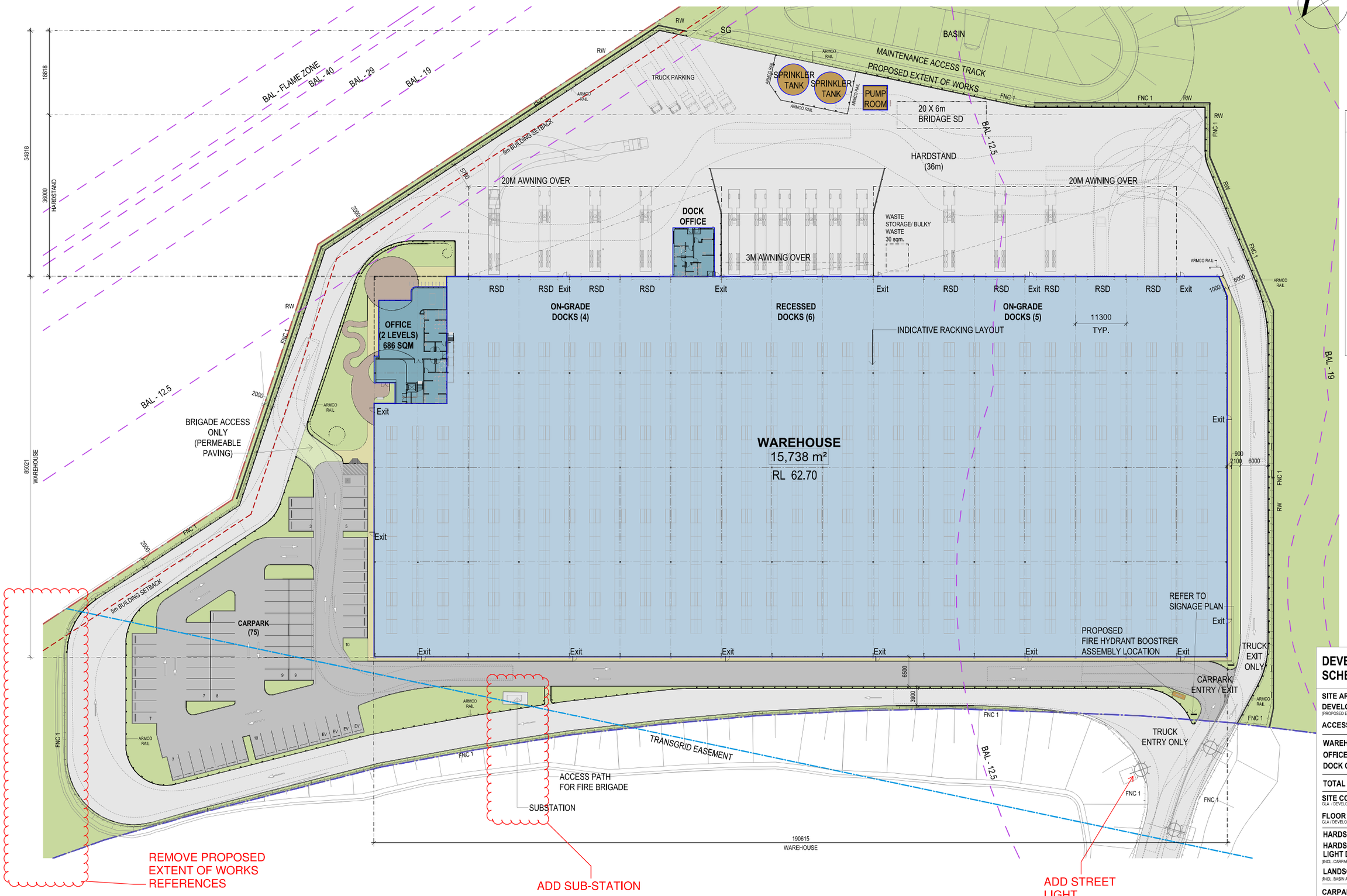

LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- TRANSGRID EASEMENT
- 5m WNSW WATER PIPELINES CORRIDOR BUILDING SETBACK
- BAL - BUSHFIRE ATTACK LEVEL
- FNC-1 — CHAINWIRE FENCE
- FNC-2 — PALISADE FENCE
- RW — RETAINING WALL
- ARM — ARMCO RAILING
- SH — SPEED HUMP
- SG — SLIDING GATE

NOTE : REFER TO CIVIL DESIGN FOR LEVELS.

DEVELOPMENT AREA SCHEDULE - PRECINCT 5

SITE AREA	69669 m²
DEVELOPABLE SITE AREA (PROPOSED EXTENT OF WORKS)	33581 m²
ACCESS ROAD AREA	2768 m²
WAREHOUSE	15738 m²
OFFICE AREA	686 m²
DOCK OFFICE	101 m²
TOTAL BUILDING GLA	16525 m²
SITE COVERAGE GLA / DEVELOPABLE SITE AREA (EXCL. BASIN AREA)	49%
FLOOR SPACE RATIO GLA / DEVELOPABLE SITE AREA (EXCL. BASIN AREA)	0.49 : 1
HARDSTAND AREA	9989 m²
HARDSTAND AREA	15 m²
LIGHT DUTY AREA (INCL. CARPARK, FOOTPATH, RWT CONCRETE PAD)	3616 m²
LANDSCAPE (INCL. BASIN AREA AND PERMEABLE PAVING AREA)	38113 m²
CARPARKING REQUIRED	75
CARPARKING PROVIDED (INCL. 1 NO. DISABLED SPACE + 04 (5%) NO. EV CHARGING SPACE)	75
BICYCLES PARKING	18

PRELIMINARY

SBA ARCHITECTS

Oakdale East Industrial Estate | PRECINCT 5 | **SITE PLAN & WAREHOUSE PLAN** | 1:400@ A1 1:800 @ A3 | OEE_DA100 (E)

Horsley Park | Development Application | 23.09.2025 | Job No 24194

23/09/2025 11:56:36 AM

Appendix C

Earthworks Specification

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Earthworks Specification

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

Prepared for
BGMG 14 Pty Ltd

Project 86545.13
October 2024

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	86545.13	Document No.	R.008.Rev4
Document title	Earthworks Specification Oakdale East Estate - Precincts 2 to 5		
Site address	Old Wallgrove Road, Horsley Park		
Report prepared for	BGMG 14 Pty Ltd		
File name	86545.13.R.008.Rev4		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Rev 0	Ray Blinman	Scott Easton	24 November 2022
Rev 1	Ray Blinman	Scott Easton	17 February 2023
Rev 2	Ray Blinman	Scott Easton	12 May 2023
Rev 3	Ray Blinman	Scott Easton	7 December 2023
Rev 4	Ray Blinman	Scott Easton	23 October 2024

Distribution of copies

Status	Electronic	Paper	Issued to
Rev 0	1	0	Megan Kublins, The Austral Brick Co. Pty Ltd Alasdair Cameron, Goodman Ltd
Rev 1	1	0	Megan Kublins, The Austral Brick Co. Pty Ltd Alasdair Cameron, Goodman Ltd
Rev 2	1	0	Megan Kublins, The Austral Brick Co. Pty Ltd Alasdair Cameron, Goodman Ltd
Rev 3	1	0	Lachlan O'Reilly, Goodman Property Services (Aust) Pty Ltd
Rev 4	1	0	Lachlan O'Reilly, Goodman Property Services (Aust) Pty Ltd

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.

	Signature	Date
Author		23 October 2024
Reviewer		23 October 2024

bsi ISO 9001 Quality Management Systems CERTIFIED
FS 604853

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Table of Contents

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.

Figure 1: Aerial view of site

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:
  - Maximum liquid limit or 50%.
  - Maximum particle size of 150 mm.
  - Maximum weighted plasticity index (WPI) of 1750.
  - Maximum salinity value of 4 dS/m (i.e. slightly saline or lower).
  - 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:
  - Maximum particle size of 150 mm.
  - Maximum WPI of 2000.
  - Minimum fill blend of at least one part ripped rock to two parts clay.
  - Maximum salinity value of 4 dS/m (i.e. slightly saline or lower) in the upper 2 m of this zone.
  - 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 (%) x 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):
  - New public roads – Minimum 1 test per 80 m length of road.
  - Internal roads and hardstands – Minimum 1 test per 1,000 m^2 of pavement.
- Plasticity Index tests on fill materials (AS 1289.3.1.1, AS 1289.3.2.1 & AS 1289.3.3.1):
  - New public roads – Minimum 1 test per 160 m length of road.
  - Internal roads and hardstands – Minimum 1 test per 2000 m^2 of pavement.
  - Upper zone of fill – Minimum 1 test per 5,000 m^3 of fill.
  - General fill zone – Minimum 1 test per 10,000 m^3 of pavement.
- Particle size distribution tests on fill materials:
  - New public roads – Minimum 1 test per 160 m length of road.
  - Internal roads and hardstands – Minimum 1 test per 2000 m^2 of pavement.
  - Upper zone of fill – Minimum 1 test per 5,000 m^3 of fill.
  - General fill zone – Minimum 1 test per 10,000 m^3 of pavement.
- Salinity and pH tests on fill materials (pH, chlorides, sulphates, electrical conductivity and texture):
  - Fill materials from on-site stockpiles and cuts in natural soil – Minimum 1 test per 10,000 m^3.

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 or 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' 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 m^2. 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 m^2 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.

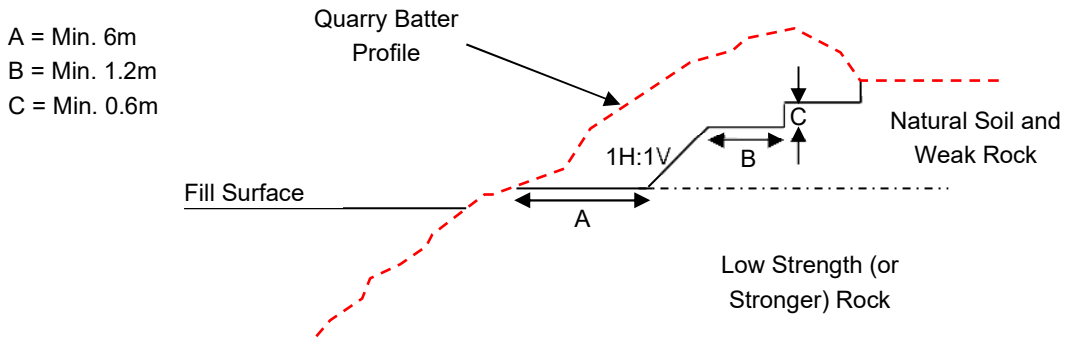

Figure 1: Over-excavation of Quarry Batter

All quarry batter over-excavation works are to be measured by survey. All batter over-excavation works are to be inspected an 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