Technical Specification

North Bannister Resource Recovery Park – Cell 7 Bulk Earthworks

Prepared for Veolia Recycling and Recovery (Perth) Pty Ltd

November 2024

Project Number: TW23075

DOCUMENT CONTROL

Version	Description	Date	Author	Reviewer	Approver
0.1	Internal Review	22/04/2024	JW	CS	
1.0	Draft Issue	09/05/2024	JW	CS	CS
2.0	Tender Issue	15/05/2024	JW	CS	CS
3.0	Tender Issue (pavement update)	30/05/2024	JW	CS	CS
4.0	Tender Issue (box culvert update)	3/10/2024	JW	CS	CS
5.0	Issue for Construction	8/11/2024	JW	CS	CS

Approval for Release

Name	Position	File Reference
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Signature	[redacted]	

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1. Introduction

The work under this Technical Specification consists of all work associated with the bulk earthworks, drainage, and road works (the Works) for the development of Cell 7 at the North Bannister Resource Recovery Park (NBRRP), located 6364 Albany Highway, North Bannister, Western Australia (WA) (the Site) for Veolia Recycling and Recovery (Perth) Pty Ltd (Veolia/the Principal).

Talis Consultants Pty. Ltd. (Talis) has been engaged by Veolia to design Cell 7 and produce the associated tender documentation which includes this Specification and Drawings, and assist with seeking the relevant approvals for development from the Department of Water and Environmental Regulation (DWER). Construction works will be split into two phases, the Bulk Earthworks (the Works) and the Lining and Leachate Management Works (the Lining Works), the latter commencing following DWER approval.

This document forms part of the Contract Documents with the full list described in Section ?.

1.1 Site Description

Currently, the facility comprises six cells (Cell 1 to Cell 6) with a further seven more cells being proposed. The Site is licenced to accept up to 400,000 tonnes of Class III putrescible waste and 100,000 tonnes of organic waste per year (including up to 30,000 tonnes of biosolids). The compost manufacturing and soil blending facility handles solid green waste, food processing waste and biosolids.

1.2 Location

The NBRRP site (the Site) is located approximately 94km south south-east of Perth along Albany Highway. The Site is a Prescribed Premise under Schedule 1 of the Environmental Regulations 1987 and operates in accordance with Licence No. L8871/2014/1 (the Licence) issued under Part V of the Environmental Protection Act 1986 (the Act).

Construction of Cell 7 is required for ongoing operations at NBRRP. Cell 7 is located within the Phase 2 footprint area of NBRRP, upgradient of Cells 1 to 5.

1.3 Geology and Hydrogeology

1.3.1 Regional Geology

The Site is located on the Dartling Plateau, to the east of the Darling Fault. The Pinjarra Geological Series map indicates the local geology comprises Archean granitic and gneissic rocks of the Yilgarn Block.

1.3.2 Local Geology

The Pinjarra Map indicates the following geology should be present at the site:

- Colluvium, including valley-fill deposits, variably laterized and podsolised;
- Laterite – chiefly massive (averaging 4m thick) with upper portions potentially consisting of locally uncemented pisolitic gravel and laterized soil; and

- Even-grained granitic rocks, fine to coarse-grained granodiorite, adamellite and granite.

The underlying lithology encountered during the Geotechnical Investigation Proposed Future Cells, NBRRP, Golder, 2017 (the GI Report), is summarised as follows:

- SAND/Clayey SAND, fine to medium grained, grey, grey-brown, yellow, low to medium plasticity fines, dry, medium dense to very dense, weakly to moderately cemented in parts, extending to depths between 0.1 m below ground level (bgl) and 5.7 m bgl; or
- Gravel/Clayey GRAVEL, fine to coarse gravel, rounded to subrounded (pisolite), laterite, and sub-rounded to sub-angular cemented gravel, pale brown, red brown low to medium plasticity fines, dry, medium dense to very dense, extending to depths of between 0.9m to 5.7m bgl, not encountered at all locations; underlain by
- LATERITE, red brown, yellow brown and grey weekly to well cemented, very low to very high strength, extending between 2.0 m and 10.56m bgl; overlying
- Clayey SAND/Sandy CLAY (SAPROLITE), low to medium plasticity, orange-brown, dark red, pale grey, fine to medium gained sand, with fin coarse gravel, generally very weakly to moderately cemented, with some well cemented zones, very dense/very stiff o hard, becoming brown and pale grey, extending to the maximum depth investigated of 15.5m.

The GI Report is enclosed in Appendix C. Variations in the above profile do occur and depths may be different due to excavations which have occurred in the area following the 2017 GI Report.

Due to presence of laterite and cemented soils, rock blasting was required during the development of previous cells. The GI Report assessed the excavatability of the aforementioned horizons which can be excavated using either appropriately sized excavators, must be ripped prior to excavation, or must be blasted prior to excavation. The surfaces of the aforementioned strata types; excavatable, rippable and that requiring blasting have been mapped by Golder (shown on Drawing 18107817 F003 enclosed in Appendix C) and the surfaces are included in the 3D models provided for tender purposes.

The GI Report identified laterite gravels suitable for use in pavement construction. Previous grading analysis found the gravel to meet Main Road WA (MRWA) grading limits for sub-base (MREWA Specification 501) and half the sample to meet the limits for basecourse.

During excavation, the different soil types in the overburden must be extracted carefully and stockpiled separately in the allocated stockpile area for re-use in the works where suitable.

1.3.3 Acid Sulphate Soils

Acid Sulphate Soils (ASS) are naturally occurring soils that contain iron sulphide (iron pyrite) minerals that, if disturbed by soil excavation, dewatering or drainage, can then oxidise resulting in the release of contaminants and potentially cause environmental impacts.

A review of the Perth Groundwater Map (PGM) indicates that the entire Site is located in an area with a moderate to low risk of ASS and a small portion in the southeast corner of the Site has a high to moderate risk.

During the site investigation undertaken by Western Environmental in February 2021, groundwater samples were taken from existing wells, two of which are located within the Site (B07 and B09). The results from these wells showed exceedances in ASS parameters that is consistent with the surrounding areas which were previously investigated in 2008 (Western Environmental, 2021).

1.4 Scope of Works

This Specification has been developed for the construction of the Cell 7 Bulk Earthworks and does not cover other construction works at the Site.

The works to be carried out under this Specification include, but are not limited, to the following:

- General bulk cut earthworks to develop landfill Cell 7, including:
  - Trimming and removal of the composite lining system over the eastern portion of the Cell 4 to Cell 5 intercell bund and Cell 6 to Cell 7 intercell bund to facilitate bulk earthworks;
  - Excavation, ripping and blasting of rock within Cell 7 to the formation level, 500mm below the Final Subgrade Level;
  - Filling within Cell 7 base to the stormwater drainage levels. Final subgrade surface level to be prepared by others;
- Excavation to approximately RL 354m for the turning circle area located to the south of Cell 7 and construction of wearing course;
- Extension of the western cut-off swale drain to the southern boundary of Cell 9 including construction of box culvert;
- Extension of the 12m wide western access road to the southern boundary of Cell 7 and construction of wearing course; and
- Extension of the 12m wide southern access road to the turning circle area located to the south of Cell 7 and construction of wearing course.

1.5 Tender Documentation

The following form the Tender Documentation for this Project:

- This Specification;
- Bill of Quantities;
- Drawings;
- Request for Tender;
- Construction Quality Assurance Plan; and
- Conditions of Contract.

1.6 Drawings

Please refer to Appendix A for a full list of Drawings that form part of this Specification, and the Document Transmittal for their issue date, revision and status.

1.7 Interpretation

Whether or not the words ‘provide,’ ‘install’ and/or ‘supply’ appear in the Specification, all equipment for the complete installation shall be provided and installed by the Contractor. Where equipment is to be provided and installed by others, it will be stated.

Terms in use within this Specification are clarified as follows:

- ‘The Principal’ for the Works will be Veolia Recycling and Recovery (Perth) Pty Ltd. (Veolia);

- 'The Superintendent/CQA Consultant' for the Works will be Veolia or their appointed representative;
- 'The Contractor' shall mean the future company contracted by the Principal to execute and
- 'Approved', 'directed', 'required', 'rejected', and similar expressions, shall mean approved, directed, required, rejected, and the like, by the Superintendent/CQA Consultant;
- 'Provide' shall mean the supply and complete installation of the item to the satisfaction of this Specification;
- 'Supply' shall mean supply and delivery without installation;
- 'Install' shall mean complete installation of the item to the satisfaction of this Specification excluding supply;
- Manufacturer's Specifications – applied as directed by the Manufacturer by an experienced person with the nominated product; and
- 'Give notice', 'submit', 'furnish', and similar expressions, shall mean given notice, submit, furnish, and the like, to the Superintendent/CQA Consultant.

2 General and Site Works

2.1 Compliance with the DWER Licence and Works Approval

An application for a Works Approval/Licence Amendment has been submitted to the Department of Water and Environmental Regulation (DWER) website (www.dwer.wa.gov.au).

The Contractor shall comply with the relevant conditions of the Licence/Works Approval and any subsequent conditions issued by the DWER as part of the Licencing process during the contract.

2.2 Clearing

While the majority of the development footprint has been historically cleared, clearing of small amounts of remnant vegetation comprising shrubs and planation trees will be required along the eastern and southern edges in the drainage swale, as part of the Works.

Cleared vegetation will be stockpiled at a suitable location approved by the Superintendent/CQA Consultant, representing a Hold Point.

2.3 Quality Management

For all works the Contractor shall plan, develop, document and implement a Quality System based on the principles and practices specified in the AS/NZS ISO 9000 series.

The Quality Plan shall include, but not be limited to the following:

- Inspection and test plans for all materials and construction work;
- Items that require approval of the Superintendent/CQA Consultant/CQA Consultant before proceeding (Hold Points);
- Non-conformance identification and action procedures;
- Details of quality personnel and relationship to the company; and
- Safety procedures and checklists.

Works shall not commence until the Superintendent/CQA Consultant has approved in writing the Contractor's Quality Plan, comprising a Hold Point.

2.4 Hold Points

The critical hold points for completed works that require the Superintendent/CQA Consultant/CQA Consultant to check and sign off before the preceding works commence are listed in Table 2-1.

Table 2-1: Works Hold Points

Item	Description
Approval of Cleared Vegetation Stockpile Location	Section 2.2
Approval of Quality Management Plan	Section 2.3
Pre-Commencement Survey	Section 2.6.1

Item	Description
Approval of Finished Surface Levels Survey including road, drainage swale and culvert	Section 2.6.2 and 5.4
Acceptance of Over Excavation Surface Survey	Section 2.6.2, 3.3.3, and 3.3.4
Approval of Engineered Fill Field Compaction Trial	3.5.2.1
Approval of Engineered Fill Testing Results	Section 3.5.3
Protection of Geosynthetic Lining Materials	Section 3.6.1
Drainage Swale and Culvert Survey	Section 5.4

2.5 Safe Work Method Statements

Safe Work Method Statements (SWMS) are required for all major works to include, but not be limited to, the Scope of Works outlined in Section 1.4. The Contractor must submit relevant SWMS to the Superintendent/CQA Consultant prior to the works commencing that at a minimum must address the following:

- Identifies the job steps and describes how the work is carried out;
- Identifies the work activities potential hazards and consequences associated with each step;
- States what the health and safety, and environmental risks are; Describes the control measures that will be applied to the work activities to control risks to the environment and ensure the health and safety of the Contractor personnel and other personnel;
- Describes how control measures will be implemented, monitored and reviewed to do the work in a safe and environmentally sound manner;
- Outlines the legislation, standards and codes to be complied with; and
- Includes a description of the equipment used in the work, the qualifications of the personnel doing the work and the training required to do the work in a safe and environmentally sound manner.

The cost of providing the method statements is to be included in the rates associated with the aspects of the work the method statement relates. If the Superintendent/CQA Consultant considers that the SWMS submitted does not show sufficient details, is impracticable or does not conform to the requirements set out above, the Superintendent/CQA Consultant may direct the Contractor to amend and resubmit the SWMS.

2.6 Drawings and Schedules

The Contractor shall be responsible for checking all Drawings prior to the commencement of the works. If the Contractor discovers any discrepancies between the various Contract Documents they shall inform the Principal in accordance with the contract.

2.6.1 Setting out the Works

The Contractor shall be responsible for setting out the works associated with this Specification. The Contractor shall be supplied with electronic information, in the form of digital terrain model (DTM), with which to establish the lines and levels of the works.

The Map Grid of Australia Zone 50, using GDA94 shall be used for the setting out of the works.

The Contractor shall provide all necessary hardware and software on-site, a drawing package compatible with AutoCAD, electronic surveying equipment and suitably qualified staff, which will enable it to determine setting out co-ordinates at locations deemed necessary.

All control points and reference points shall be clearly marked and where appropriate bedded in concrete. They shall be adequately protected during the construction of the works. Where it is necessary to remove a control point, additional reference points shall be provided to the satisfaction of the Superintendent/CQA Consultant.

Upon possession of the Site, and prior to commencing any construction, the Contractor shall undertake a pre-commencement survey to check all centre lines, prominent footprints and grid lines in sufficient detail to ensure that the works are fully compatible with existing features and identify any discrepancies with the survey provided at the tender stage. This will constitute a **Hold Point**.

The setting out of the works shall be perfectly co-ordinated with and shall be continuous with that of any adjacent works. The Contractor shall, when instructed by the Superintendent/CQA Consultant, make any adjustments necessary to satisfy these requirements. Where appropriate, reference points shall be adjusted to take account of the new locations of the master control points.

Subsequently, the Contractor shall be fully responsible for the setting out of the works and the Superintendent/CQA Consultant accepts no responsibility for replacing any of the master control points or master levels where given.

2.6.2 As-Built Drawings

The Contractor shall supply as-built records, Drawings, details and surveys etc. of all completed work. These records are to be submitted in full to the Superintendent/CQA Consultant/CQA Consultant within one month of practical completion of the works in AutoCAD and PDF electronic formats.

The following is a list of minimum criteria to be adhered to when creating the as-built drawings:

- Line types and colours shall be set 'By Layer';
- Layer names should not be abbreviated, and must be self-explanatory;
- All break lines to identify toes and crests of earthwork slopes;
- Units shall be in metres;
- Levels to Australian Height Datum (AHD); and
- Common Site layouts such as surveys, as-built buildings and road layouts shall be externally referenced to all relevant drawings (insert 0, 0, 0 (X, Y, Z) and to Map Grid of Australia Zone 50, using GDA94).

The as-built drawings must detail the following:

- Top of Finished surface levels in Cell 7, roads and drainage swale;
- Construction details including levels and slope angles;
- New extent of geosynthetic lining system.

2.7 Surface Water and Groundwater Management

Where not included in the permanent works, the Contractor shall make allowances in the Contractor's system of working and pricing for dewatering both surface and subsurface water if required and permitted.

The Contractor shall sequence the works to minimise the build-up of surface water within and outside the Site as a result of its actions and allow for all arrangements for evaporation on-site. Where it is necessary and permitted to discharge water or groundwater, the Contractor shall not cause overtopping and erosion of any part of the downstream surface water network. In any case, measures shall be implemented to prevent silt entering the offsite surface water network.

Unless permitted, the build-up of any surface water may not be discharged to the groundwater regime.

2.8 Works Affecting Watercourses

The Contractor shall be responsible for maintaining watercourses within and adjacent to the Site in effective working condition at all times and shall take all practicable measures, which shall be to the prior approval of the Superintendent/CQA Consultant, to prevent the deposition of silt or other materials in existing watercourses. Settling ponds shall be installed prior to all water discharges to watercourses. Settling ponds shall have a minimum 5-day retention capacity.

2.9 Engineering Control

All verbal instructions given by the Superintendent/CQA Consultant/CQA Consultant shall be accompanied by a written site instruction prior to undertaking in writing or by email. Verbal instructions or verbal requests for information alone shall not be considered binding.

Technical Queries (TQs) from the Contractor to the Superintendent/CQA Consultant are to be issued electronically in a format to be agreed with the Superintendent/CQA Consultant.

2.10 Site Climatic Conditions

The Contractor shall inform itself fully of the climatic conditions likely to be experienced at the Site, and shall make its own assessment of the effect that such conditions may have on the execution of the works and make due allowances for it in the Construction Programme. The rainfall and other weather conditions details for the Site, can be accessed Bureau of Meteorology website (www.bom.gov.au).

2.11 Protection Against Damage

The Contractor shall take all necessary precautions to avoid causing any unwarranted damage to roads, lands, properties, trees, monitoring boreholes and other features during the currency of the Contract, and shall deal promptly with any complaints by owners or occupiers.

Where any portion of the works is close to, across or under any existing apparatus of public utilities or other parties, the Contractor shall temporarily support and work around, under or adjacent to all apparatuses in a manner designed to avoid damage, leakage or danger, and to ensure uninterrupted operation.

If any damage occurs, the Contractor shall, at once, notify the Superintendent/CQA Consultant and the Statutory Authority or owner concerned.

The Contractor shall take all reasonable precautions necessary to avoid damage to its own works, by its own employers, domestic and nominated Sub-Contractors, until such time as the works have been handed over and accepted by the Principal.

Where deemed necessary by the Superintendent/CQA Consultant, stockpiled materials shall be covered with tarpaulin to avoid contamination of adjacent streams.

2.12 Location of Existing Services

The Contractor shall be responsible for the maintenance and protection of existing services which may be affected by the contract works. Prior to commencing any works, the Contractor should make such investigations with all service authorities and Dial Before You Dig (http://www.1100.com.au/)) that are necessary to locate all services on-site or within the work areas adjacent to the Site.

Existing private and public statutory services such as water mains, gas mains, cables, house drains, culverts, etc., shall be located insofar as possible before commencement of the works. The Contractor shall proceed with the works in such a manner that the works shall be constructed without interference.

3 Earthworks

All works carried out under this section of the Specification shall comply with the following standards, and those specified therein, which shall be held to be incorporated in the Specification:

- AS 3798: Guidelines on earthworks for commercial and residential developments; and
- AS 1289: Methods for testing of soils.

3.1 Definitions

The following definitions of earthworks material shall apply to this and other clauses of the Specification in which reference is made to the defined materials.

“Topsoil / Growth Medium” shall mean the top layer of soil that can support vegetation.

“Suitable materials” imported or site-won material complying with the requirements for use in the permanent works.

“Un-suitable material” shall mean material other than suitable material and shall include:

- Peat materials from swamps, marshes or bogs;
- Logs, stumps and perishable material;
- Material susceptible to spontaneous combustion;
- Material in a frozen condition;
- Clay of liquid limit exceeding 80% and/or plasticity index <10% or exceeding 55%;
- Material having a moisture content greater than the maximum permitted for such materials in the Contract, unless otherwise permitted by the Superintendent/CQA Consultant; and/or
- Non-hazardous material other than those permitted in the Contract.

“Unacceptable Hazardous Material” shall be material having hazardous chemical or physical properties requiring special measures for its excavation, handling, storing, transportation, deposition and disposal.

“Rock” shall mean hard rock in mass formation which can only be removed by the use of a rock breaker or explosives. “Rock” shall also be defined as all material which cannot be ripped and excavated with a track dozer in good condition with matching hydraulic single shank ripper of combined mass not less than 52 tonnes at a rate in excess of 90m^3 (solid) per hour. Boulders in excess of 0.25 m^3 volume in pipe trenches or in excess of 1.0 m^3 in mass excavation shall be deemed to be rock excavation.

“Cohesive Soil” shall include clays and marls with up to 20% of gravel or rock and have a moisture content not less than the value of the plastic limit minus 4.

“Well-graded granular and dry cohesive soils” shall include clays and marls containing more than 20% of gravel or rock and/or having a moisture content less than the value of the plastic limit minus 4 and well-graded sands and gravels with the uniformity coefficient exceeding 10.

“Uniformly-graded material” shall include sands and gravels with uniformity coefficient of 10 or less, and all silts. Any soil containing 80% or more of material in the practical size range 0.06-0.002 mm will be regarded as silt for this purpose.

3.2 Products and Materials

3.2.1 Use of Materials

Engineered Fill material shall be excavated from the Cell 7 and 9 footprints or designated stockpile areas at the Site as shown in the Drawings, or as approved by the Superintendent/CQA Consultant.

The Contractor shall be responsible for any assumptions made by the Contractor in relation to the nature and types of materials encountered in excavations/stockpiles and the bulking and compaction characteristics of materials incorporated in any earthworks. The summary of the estimated quantity for general earthworks provided includes all types of materials that may be encountered in the cuttings.

3.2.2 Unsuitable Material

Some materials are unsuitable for forming structural fill and should be either removed to spoil or used in non-critical areas. In addition to the definition in Section 3.1, unsuitable materials, as detailed in AS 3798 may include:

- Organic soils, such as many topsoils, severely root-affected subsoils and peat;
- Materials contaminated through past Site usage which may contain toxic substances or soluble compounds harmful to water supply or agriculture;
- Materials containing substances that can be dissolved or leached out in the presence of moisture (e.g., gypsum), or which undergo volume change or loss of strength when disturbed and exposed to moisture (e.g., some shales and sandstones), unless these matters are specifically addressed in the design;
- Silts, or materials that have the deleterious engineering properties of silt;
- Other materials with properties that are unsuitable for the forming of structural fill; and
- Fill that contains wood, metal, plastic, boulders or other deleterious material, in sufficient proportions to affect the required performance of the fill.

In some circumstances a design may allow for the use of some of these materials in structural fill. Before allowing for such use, the Contractor must supply specialised advice from a geotechnical professional. The use of any material in structural fill not specified in the Drawings or otherwise must be approved by the Superintendent/CQA Consultant before using such materials.

3.2.3 Engineered Fill

Engineered Fill will comprise of suitable site-won soil material from the borrow pit, which will be used to form the Bulk Earthworks. The specification of Engineered Fill is detailed in Section 3.5.

3.2.4 Imported Fill

Engineered Fill may also be comprised of Imported Fill, provided is it a suitable material, and meets the requirements of Table 3-1 when tested in accordance with Main Roads WA Test Method WA 115.1-2019.

Table 3-1: Particle Size Distribution (Imported Fill Material)

AS1152-1993 Sieve Size (mm)	Minimum % Passing by Mass	Maximum % Passing by Mass
37.5	100	100
19	80	100
4.75	45	100
2.36	30	100
0.0075	1	10

3.3 Excavation

The bulk earthworks will require excavation in the various geological strata described in Section 1.3. The GI Report, enclosed in Appendix C, describes the method of determining the effort required to excavate the colluvium deposits, laterite, cemented soils, and saprolite which will be encountered during the earthworks. The GI Report defined the excavatability of the strata under the categories described in the following sections.

3.3.1 Topsoil

Any existing topsoil/growth medium shall be stripped from all areas within the earthworks to a minimum depth of 150mm, or as required.

Prior to the commencement of the removal of topsoil from all designated and other areas, the Contractor shall certify to the Superintendent/CQA Consultant that:

- Topsoil/growth medium to be stripped and stockpiled or removed to spoil is correctly pegged on-site;
- The location of stockpile sites for topsoil and other materials are correctly pegged on-site, including any alternative locations as nominated by the Contractor;
- Environmental controls are in place to mitigate any environmental harm.

The Contractor shall ensure that appropriate plant and equipment are utilised by competent operators to ensure that the subsoil and topsoil layers are not mixed, and the subgrade integrity is not affected during the stripping and stockpiling process.

The Contractor shall protect and stabilise stockpiles by appropriate measures, to minimise erosion and loss of materials, as approved by the Superintendent/CQA Consultant.

3.3.2 General Excavation Conditions

Material which may be excavated using a 30 tonne excavator are soils which are weak to moderately cemented. Noting that since resistance will increase more significantly with depth, working from and exposed face may allow zones of moderately to well cemented material to be removed with greater ease. The GI Report indicates that the shallow sandy gravelly soils overlying the laterite, and weakly cemented saprolite soils underlying it may be excavatable without the need for ripping.

3.3.3 General Ripping Conditions

Material which may need to be ripped using a D6 Dozer (or larger) with a single tine prior to excavation are lateritic soils which are moderately to well cemented. Very hard ripping conditions are likely to

exist and localised zones of well to very well cemented material may require cross ripping to encounter a point of weakness within the rock.

Where the laterite is consistently well to very well cemented and defect spacing is greater than 1 m, the additional use of a hydraulic breaker or alternatively a D11 dozer with a single tine may be more effective.

Where the underlying saprolite becomes moderately cemented it may also require ripping.

Where material which requires ripping is present in the finished surface, it must be ripped to 750m below the finished surface level and reinstated to the finished surface level with suitable fine grained material. This over excavation shall be surveyed prior to backfill to enable the Superintendent/CQA Consultant to quantify the variation.

3.3.4 General Blasting Conditions

Material which may need to be blasted prior to excavation may be high to very high strength laterite rock in layers greater than the depth of the ripping tine or where defect spacing is greater than 1 m. material.

Where material which requires blasting is present in the finished surface, it must be blasted to 750m below the finished surface level and reinstated to the finished surface level with suitable fine grained material. This over excavation shall be surveyed prior to backfill to enable the Superintendent/CQA Consultant to quantify the variation.

3.3.5 Excavated Materials

Excavated material shall be separated by material type and stockpiled of in accordance with the Contract and Drawings. No excavated materials, suitable for use in the works shall be removed from the Site except on the direction, or with the permission, of the Superintendent/CQA Consultant.

3.3.6 Protection of Excavations

The Contractor shall provide all the necessary supports to secure the sides of any excavations whether mass excavation or trench excavation. Except where required by or permitted under the Contract, sides of the excavations shall not be battered. The Contractor shall be responsible for all trench boxes, planking and strutting necessary to ensure the stability of the side slopes of excavation. The Contractor will be responsible for the costs associated with such temporary works. Any battering or collapsed excavations shall be backfilled with material approved by the Superintendent/CQA Consultant.

All excavations shall have adequate warning lights, handrail and guarding to allow safe work within and on top of the excavations.

3.3.7 Water in Excavations

The Contractor shall not allow water to lie in any part of the works unless required to do so under the Contract. Water arising from or draining into the works shall be drained to the temporary sump for pumping to the western swale drain or other approved disposal point.

No excavation shall occur in water without the area first being dewatered in accordance with this Section.

3.3.8 Excavation below Formation Level

If the Contractor encounters ground below formation or finished surface level which is considered unsuitable (including that described in Sections 3.3.3 and 3.3.4) or if the formation level is damaged

and allowed to deteriorate, the Superintendent/CQA Consultant shall be promptly informed. Any unauthorised excavation to a depth greater than is necessary for the proper execution of the works shall be filled with suitably approved fill material to bring it to the correct formation level.

3.3.9 Hand Excavation

Hand excavation shall be used in confined spaces where the use of excavating machinery is unsuitable and for other operations such as trimming the formation to final level whether in open cut or in trench. Hand excavation shall be used around and adjacent to existing services or geosynthetic lining materials to expose and locate them to ensure no damage occurs to the underlying liner system.

3.3.10 Excavation to Formation Levels

After removal of topsoil (where present), the Contractor shall cut to the design formation levels shown on the Drawings and transport the material to the areas to be filled, or designated stockpiles. The Contractor shall take precautions that prior to any subsequent works placed on top of the formation the surface shall be protected from trafficking, storage, rainfall and any other climatic condition.

Where necessary, the Contractor shall temporarily stockpile all cut material in areas to be agreed with the Superintendent/CQA Consultant.

Any areas that are over excavated shall be refilled in accordance with Section 3.4 to the correct design levels and compacted as specified in Section 3.5.1.

Indigenous materials to be used as fill shall be assessed in-situ for its suitability for re-use by the Contractor and agreed by the Superintendent/CQA Consultant. Where appropriate, in-situ or laboratory testing shall be conducted to confirm the material's suitability for use in the permanent works. The material shall be designated as being Unsuitable or Suitable for incorporation into the permanent works.

3.4 Formation Preparation

Formation preparation shall be completed in all areas where Engineered Fill is to be placed, and where cut has occurred to achieve final levels. The formation surface shall be constructed to the shape and levels as shown in the Drawings and to the specified requirements and tolerances of Section 3.5. The completed formation shall be in a homogeneous uniformly bonded condition with no evidence of layering or disintegration.

Soft spots shall be excavated and disposed of as directed by the Superintendent/CQA Consultant and filled with approved Engineered Fill. The acceptance of the formation levels constitutes a **Hold Point**.

The completed formation surface shall be maintained in its conforming condition until construction commences and shall be watered as necessary to prevent shrinkage cracking, dusting or loosening of its surface.

3.5 Engineered Fill

All filling required at the Site under the Works shall be Engineered Fill. Placement of Engineered Fill will be subject to Level 2 Sampling and Testing as defined in AS 3798, with additional inspections as required within this specification.

3.5.1 General Filling

Filling shall, wherever practicable, be undertaken immediately after the specified operations preceding it have been completed. Filling shall not, however, be commenced until the works to be covered have achieved a strength sufficient to withstand all loading imposed thereon.

Filling around tanks and other structures shall be undertaken in such a manner as to avoid uneven loading.

No filling shall take place in water.

3.5.2 Compaction

A vibratory steel drum roller (sheepsfoot/padfoot) or other suitable compaction plant approved by the Superintendent/CQA Consultant should be used for construction of Engineered Fill. The Contractor shall submit with its completed Tender, a method statement detailing the plant, conditioning and compaction techniques it proposes to use. Uncompacted lift thickness must not exceed 300mm.

Engineered Fill shall be compacted to >95% MMDD with a moisture content, during compaction, within the range of optimum moisture content (OMC) -3% to +3% as determined by the test methods of AS1289.

3.5.2.1 *Field Trial*

To assess the Contractor's proposed placement and compaction procedures, a Field Trial of Engineered Fill construction will be carried out. The trial should be carried out in an area not less than 15m x 10m and consist of two lifts of fill placement.

The purpose of the Field Trials shall be to provide field verification of the moisture/density relationships as determined from the characterisation testing. The following aspects of the mineral liner installation shall be evaluated for each layer of the field trial.

- Material handling and placement requirements;
- Compaction equipment and procedures;
- Number of passes of equipment necessary to achieve the required results; and
- Testing of the fill shall be undertaken after each lift has been placed and compacted.

If a Nuclear Density gauge is utilised for field testing the trial shall be used to calibrate the gauge against adjacent sand replacement or core cutter in-situ density test methods, with a minimum of five (5 No.) corresponding samples. One (1 No.) bulk sample shall be submitted to the laboratory for grading and Atterberg testing.

The calibration will only be applicable to the actual nuclear density gauge as verified by serial number, used as part of the field trial. The results of the Field Trial shall be submitted to the CQA Consultant for approval.

If the results of Field Trials are unsatisfactory, the Field Trial area shall be excavated and removed. The Contractor shall then submit the Contractor's proposals for a revised procedure to the Superintendent/CQA Consultant/CQA Consultant for approval before continuing with further field trials.

The contractor may also propose to remediate the unsatisfactory trial area through further compactive effort / conditioning, followed by re-testing, until the clay meets the performance specification for all criteria. Once the trial liner has been proven to meet the specification, the trial area may be incorporated into the works. The acceptance of the Engineered Fill field trial constitutes a **Hold Point**.

3.5.3 Testing

The Contractor shall undertake the following compliance tests:

Table 3-2: Engineered Fill Testing Requirements

Test	Frequency
In-situ dry density/moisture	1 per 500 m^3 or 1 per 2,500 m^2 per layer or 3 tests per lot (whichever the highest)
Laboratory permeability tests (water)	1 per 5,000 m^3
Laboratory permeability tests (50,000 ppm NaCl)	1 per 5,000 m^3
Grading Analysis (to clay size / inc hydrometer)	1 per 2,500m^3
Plasticity Index/Atterberg Limits	1 per 2,500 m^3
MMDD Compaction	1 per 2,500 m^3

Note: Permeability to be assessed when compacted to a Dry Density Ratio of 95% for MMDD in accordance with AS1289

All laboratory testing shall be undertaken by a NATA accredited laboratory, approved by the Superintendent/CQA Consultant.

The in-situ field dry density shall be measured using either the sand replacement method, core cutter method, or by a nuclear density gauge.

All test results shall be submitted to the Superintendent/CQA Consultant/CQA Consultant, detailing sample location, level, depth and date taken, for approval. Approval of all testing by the Superintendent/CQA Consultant/CQA Consultant comprises a **Hold Point**.

3.5.4 Rectification of Works

If the field testing demonstrates that the compaction requirements are not being attained the required standard the Contractor must carry out the following at their own expense:

- Undertake additional works on the layer as necessary such that subsequent testing of the layer meets the required compaction requirement. This may include such measures as wetting up or drying of placed materials, additional passes of the compacting plant or other measures as deemed suitable by the Superintendent/CQA Consultant.
- Remove the part of the layer demonstrated to have not met the required compaction requirement and replace it to the satisfaction of the Superintendent/CQA Consultant.

3.5.5 Tolerances

The Contractor should ensure all survey data is passed to the Superintendent/CQA Consultant/CQA Consultant for approval to demonstrate the required installation levels have been met, comprising a **Hold Point**.

The tolerances for the final Finished Surface Levels are: -50mm /+50mm.

3.5.6 Finishing of Batters and Ground Surfaces

Except during the construction of benched or stepped batters, batter slopes shall be smoothly shaped to a uniform plane from top to bottom as shown on the Drawings.

The surface of all slopes/batters shall be excavated and filled, shaped and/or graded as necessary to achieve the finished soil levels and contours nominated in the Drawings, prior to any surface preparation and soil improvements.

The toe of mounds shall be graded evenly to meet adjoining surface levels. The ground surface shall be shaped and/or graded evenly to avoid abrupt changes in levels abutting structures and paved surfaces.

The final surface shall be rolled with a smooth drum roller to seal it from the weather.

3.6 Geosynthetic Lining Materials

Earthworks are required to be undertaken beneath the lined embankment between Cells 4 and 5. To facilitate this the composite lining system which comprises (from top to bottom); protection geotextile overlying, 2.0mm high density polyethylene geomembrane overlying, geosynthetic clay liner, will need to be cut and removed to the extent shown in the Drawings.

3.6.1 Protection of Geosynthetic Lining Materials

The Contractor must notify the Superintendent/CQA Consultant if any damage occurs to the lining system at the perimeter and/or outside the extent of its works. The Contractor must protect the open edge of the composite lining system from weather at all times during its works by installing sandbags at 1m spacings and wrapping the open edge of the lining system using builder's film or similar membrane to the approval of the Superintendent/CQA Consultant. This constitutes a **Hold Point**. A survey of the modified liner edge must also be provided to the Superintendent/CQA Consultant for approval.

4 Pavement

4.1 Products and Materials

4.1.1 Gravel Wearing Course

Site-won laterite gravel provided by the Principal shall consist of durable pebble in soil mortar. The material shall be free from cobbles greater than 75.0mm and free from clods, stumps, roots, sticks, vegetable matter or other deleterious materials.

The pavement material does not contain more than 20% by mass of material retained on a 37.5mm sieve.

4.1.2 Water

The water shall be clean and substantially free from detrimental impurities such as oils, salts, acids, alkalis and vegetable substances.

4.2 Construction

4.2.1 General

Pavement construction includes the placing, compacting and finishing of pavement materials supplied by the Principal in accordance with the Specifications and Drawings to the prepared Subgrade surface.

Prior to the construction of any Pavement Layer, the Contractor shall certify to the Superintendent/CQA Consultant that the underlying layer has been constructed as specified.

4.2.2 Spreading

The Pavement Layer worked shall be generally parallel to the finished pavement surface and shall extend the full width of the layer.

It shall be worked in compacted layers not greater than 250mm nor less than 100mm. Where less than 100mm is required to be worked the underlying subgrade shall be scarified to such a depth that the resulting compacted thickness of the layer to be worked is not less than 100mm.

4.2.3 Compaction

Pavement material shall be spread, mixed and compacted to achieve uniformity free from any evidence of segregation.

Compaction shall be carried out at a Construction Moisture Content, at any point in the Lot within the range of 90% - 110% of the Optimum Moisture Content and with a uniform compactive effort applied longitudinally and transversely to the road alignment to achieve the width, shape, level and surface finish.

4.3 Acceptance

4.3.1 Surface Shape

The grain size of the site-won laterite gravel shall be visually assessed during placement against the criteria in Section 4.1.1.

The shape of the pavement shall be judged to be acceptable when the maximum deviation from a 3 metre straight edge placed in any position on the surface does not exceed 50mm.

4.3.2 Surface Finish

Completed pavement layers shall be in a homogeneous, uniformly bonded condition with no evidence of layering, cracking, disintegration or surface tearing. The finished surface should appear as a stone mosaic interlocked with fine material and shall be dense, even textured and tightly bonded.

4.4 Maintenance

4.4.1 Maintenance of Compacted Layers

The surface of any compacted pavement layer or prepared subgrade shall be maintained in such a way as to minimise dust, prevent ravelling, erosion, deformation or any other damage to the layer resulting from environmental conditions, traffic or construction activities. The layer shall be kept free from contamination until subsequent pavement work under is commenced.

Watering shall be continued as necessary to prevent, dusting or loosening of the surface.

5 Drainage

The works in this section consist of the construction of drainage swales and the supply and installation of reinforced concrete pipe culverts and associated end treatments.

5.1 Perimeter Swale

The western perimeter swale shall be open earthen channel swales with dimensions as detailed on the Drawings.

5.2 Concrete Box Culverts

Unless otherwise detailed in the Specification or Drawings, installation of all pre-cast reinforced concrete boxes shall comply with the requirements of AS 1597 Section 6 - Installation.

Reinforced concrete box culvert units, including link slab units, shall be placed in position on a mortar bed in accordance with the Drawings. Unless specified otherwise on the Drawings, cement mortar is to be 0.4 : 1, water : cement ratio by mass and 3 : 1, sand : cement ratio by mass.

Cement stabilised backfill shall not be placed until the cement mortar used to seal culvert crown units and link slabs has cured for 48 hours.

If the base slabs are in-situ, then they shall comply with the following requirements:

- Dimensions shall be within 10mm of those shown on the Drawings. Surface irregularities shall be less than 5mm abrupt and 8mm over a 3 metre straight edge.
- No construction equipment or public traffic is permitted to travel or work on or over the concrete base slab within seven days of the placement of concrete in the base slabs.
- The Contractor shall not operate any plant directly on the concrete base slabs without prior approval from the Superintendent/CQA Consultant.
- Reinforced concrete box culvert units shall not be placed on concrete base slabs within 24 hours of completing the concrete base slabs.

5.3 End Treatments

Unless otherwise shown on the Drawings, all culvert end treatments shall be constructed of prefabricated concrete, with mortared rock pitching surround in accordance with Drawings.

Table 5-1: Rock Pitching Specification

Item	Dimension
Rock Diameter D50 (mm)	155
Minimum depth of rock pitching (mm)	248

The dimensions of the end treatments shall be within 10mm of those shown on the Drawings when measured in accordance with AS 3610. Surface irregularities of the concrete end walls, wing walls, cut-off walls and aprons shall be less than 5mm abrupt and 8mm over a 3m straight edge. Unless otherwise shown on the Drawings, mortar for mortared rock pitching shall comprise a 6 to 1 mix of builder's sand and ordinary Portland cement, with all sand being from the same source.

5.4 Acceptance Criteria

Culverts shall be laid with the connections kept clean and shall be laid with the inverts true to the lines and levels shown on the Drawings and to the following tolerances:

- Horizontal alignment ±25mm
- Vertical level ±10mm

Table 5-2 - Drainage Acceptance Criteria

Product/Process	Test	Limit	Minimum Test Frequency
Culvert Barrel	Line and Level / Grade	As above	Every 5 metres
	Inlet / Outlet Invert Level	±10mm	Each
	Inlet / Outlet Easting and Northing	±25mm	Each

As part of the Quality Assurance programme, the CQA Consultant/Superintendent/CQA Consultant must verify the perimeter swale and culvert elevations. The Contractor should ensure all survey data is passed to the Superintendent/CQA Consultant within 3 days of undertaking the survey, for approval to demonstrate the required elevations have been met. This constitutes a **Hold Point**.

The Contractor shall provide an as-built survey of the completed swales to the Superintendent/CQA Consultant for approval.

APPENDIX A
Figures

Figure 1: Site Locality

APPENDIX B
Drawings

Drawing W-100: Site Layout

Drawing W-101: Current Topography Cell 7 and Stockpile Area

Drawing W-102: Bulk Earthworks, Road and Drain Layout

Drawing W-103: Bulk Earthworks Over Blast and Stormwater Drainage Levels

Drawing W-201: Landfill Cross-Sections 1 of 2

Drawing W-202: Landfill Cross-Sections 2 of 2

Drawing W-203: Drainage Swale Long Sections

Drawing W-301: Road and Drain Sections

Drawing S-303: Culvert Schedule

Drawing S-304: Culvert Structural Details 1 of 2

Drawing S-305: Culvert Structural Details 2 of 2

APPENDIX C
Geotechnical Information