Oakdale Central Precinct, Stage 1B
Bio-Retention Basin and Estate Road

BULK EARTHWORK SPECIFICATION
FILLING, CUTTING AND TESTING

PSM1541-020S Rev0 **March 2012**

CONTENTS

ATTACHMENTS

1. SCOPE

This specification details the requirements for the earthworks to be undertaken at Stage 1B of the Oakdale Central Precinct industrial development, in particular for the proposed bio-retention basin and Estate Road extension from CH280 m to CH720 m. The area where this specification is applicable is shown in Figure 1. We note that for the Estate Road extension, this specification is applicable for earthworks to the subgrade level of the pavement and excludes the pavement itself.

Fill placed in accordance with this specification is denoted as Engineered Fill.

This specification does not address any environmental, contamination or erosion issues with respect to the fill material.

There is a **HOLD POINT** on placing fill in Section 2.4 of this specification.

2. FILLING WORKS

2.1. Subgrade Preparation

The condition of the subgrade should be assessed immediately prior to filling commencing.

All Engineered Fill is to be placed on one of the following four materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Engineered compacted fill placed in accordance with this or other approved specifications for which the Geotechnical Inspection and Testing Authority (GITA) has a Level 1 certificate certifying compliance with that approved specification.
4. Other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM. PSM may also direct a bridging layer of Engineered Fill be placed and compacted to a Dry or Hilf Density Ratio (Standard Compaction) of between 95% and 102%. Any such layer shall be a Lot under Clause 5.3.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be moisture conditioned and compacted to be in accordance with Clauses 2.5 and 2.6 of this specification.

Engineered Fill shall be placed only on subgrade approved by the GITA as being in accordance with this specification.

2.2. Base Geometry

The slope of any buried batter shall be less than 1H:1V unless otherwise directed by PSM.

The contractor shall remove or flatten any geometrical obstructions (e.g. protrusions or holes) such that subsequent Engineered Fill can be placed to achieve the requirements of this specification.

Engineered Fill shall be placed only on areas where the base geometry has been approved by the GITA.

2.3. Material – Bio-retention Basin

2.3.1. Imported Fill

Imported Engineered Fill is to conform to the definition of "virgin excavated natural material" (VENM) as defined by the Protection of the Environment Operations Act 1997 No 156, Schedule 1, on Page 209:

> *"Virgin excavated natural material (eg clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:*
>
> *a) has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphide ores or soils, or*
>
> *b) consists of excavated natural materials that meet such criteria as may be approved by the EPA".*

2.3.2. All Fill

The Engineered Fill shall:

1. Be approved by the GITA as suitable for use in a structural fill.
2. Not comprise unsuitable material as defined by Clause 4.2 of AS3798-2007 "Guidelines on earthworks for commercial and residential developments" as:

    a) "organic soils, such as many topsoils, severely root-affected subsoils and peat;

    b) materials contaminated through past site usage which may contain toxic substances or soluble compounds harmful to water supply or agriculture;

    c) materials containing substances which can be dissolved or leached out in the presence of moisture (eg: gypsum), or which undergo volume change or loss of strength when disturbed and exposed to moisture (eg: some shales and sandstones), unless these matters are specifically addressed in the design;

    d) silts, or materials that have the deleterious engineering properties of silt;

e) other materials with properties that are unsuitable for the forming of structural fill; and

f) fill that contains wood, metal, plastic, boulders or other deleterious material, in sufficient proportions to affect the required performance of the fill."

3. Not comprise a proportion of deleterious material in each Lot greater than 0.25% by weight. Deleterious material is defined by Table 3015.3 of the RTA QA Specification 3051 (Edition 5 June 1998) as:

   "Type III: Rubber, Plastic, Bitumen, Paper, Cloth, Paint, Wood and Other Vegetable Matter"

   The GITA shall assess the above criterion. If the GITA is not able to visually assess the above criterion, the GITA shall arrange appropriate testing.

4. Comprise particles which are able to be incorporated within a single layer. Further, less than 30% of particles shall be retained on the 37.5 mm sieve.

5. Be able to be tested in accordance with the Standard Compaction method (AS1289.5.4.1) or Hilf test method (AS1289.5.7.1). These methods require less than 20% retained on the 37.5 mm sieve. Where between 20% and 30% of particles are retained on the 37.5 mm sieve the above test methods shall still be adopted and test reports annotated appropriately. These requirements should be met by the material after placement and compaction.

6. Be non-dispersive, that is, classified as Emerson Class 5 and above (AS1289 3.8.1).

7. Have a Plasticity Index of greater than 7%

8. Have a Liquid Limit of less than 70%

Only material approved by the GITA shall be placed as Engineered Fill.

2.4. Material – Estate Road

Material for the Estate Road extension bulk earthwork shall comprise material as specified in Clause 2.3 of this specification with exemptions from the following clauses:

- Clause 2.3.2 Point 6
- Clause 2.3.2 Point 7
- Clause 2.3.2 Point 8

2.5. Fill Zonation and Placement

HOLD POINT

PROCESS HELD	PLACING OF FILL
Submission detail	The Contractor / GITA submit to PSM a Weekly Certificate as defined in Clause 6.2.1 of this specification for the earthworks completed to the previous Saturday no later than 5 pm of the subsequent Wednesday.
Release of Hold Point	PSM to confirm receipt of Weekly Certificate and release Hold Point if initial assessment of the Weekly Certificate indicates it complies with requirements of this specification.

Engineered Fill shall be placed in accordance with the following requirements:

1. In near horizontal, laterally extensive layers of uniform material and thickness, deposited systematically across the work area as determined by the GITA.
2. For the Bio-retention Basin earthworks, the compacted thickness of each layer shall be equal to or less than 200 mm.
3. For the Estate Road extension earthworks, the compacted thickness of each layer shall be equal to or less than 300 mm.

Engineered Fill shall only be placed on subgrade in accordance with this specification and approved by the GITA.

2.6. Compaction

Engineered Fill shall be placed and compacted to a Dry or Hilf Density Ratios (Standard Compaction) of between 98% and 102%.

The insitu density shall be measured over the full depth of each layer placed.

2.7. Moisture Control

The placement moisture variation or Hilf moisture variation shall be controlled to be between 2% dry of optimum and 2% wet of optimum.

Placement moisture content of the Engineered Fill shall be measured.

3. CUTTING

3.1. Subgrade Condition

The subgrade is to comprise one of the following materials:

1. Bedrock.
2. Natural insitu material of at least stiff consistency.
3. Other materials as approved by PSM.

Proof rolling shall only be undertaken under the direction of PSM.

The GITA should satisfy itself that the subgrade has not been desiccated, affected by rain or disturbed. If the GITA cannot so satisfy itself, then the subgrade should be excavated and filled to the BEL in accordance with this specification.

4. SURVEY

4.1. Filling areas

The survey requirements are as follows:

1. Any approved subgrade shall be surveyed prior to first filling such that subgrade levels are established to within ± 0.1 m. The area subject to approval shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
2. The Lot boundaries shall be assessed and shown on a plan drawing to an accuracy of at least +/- 5 m in plan.
3. The location of the field density tests shall be surveyed and shown on the Lot boundary plan drawing to an accuracy of at least +/-5 m in plan.
4. The elevation of the field density tests shall be surveyed to an accuracy of +/-0.05 m.

The plan drawing shall show the boundaries of the site and other identifiable site features, so as to allow the location of the lots and the test to be recoverable.

4.2. Cutting areas

Any approved subgrade for cut areas shall be surveyed such that subgrade levels are established to within ± 0.1 m.

5. INSPECTION AND TESTING

5.1. Role of the GITA

The Geotechnical Inspection and Testing Authority (GITA) shall be contracted to document and certify that the works undertaken by the contractor has been completed in accordance with the relevant design and specifications.

5.2. Level 1 Control

The GITA shall adopt Level 1 responsibility as described in Section 8.2 of AS 3798-2007 "Guidelines on earthworks for commercial and residential developments":

> *"The primary objective of Level 1 Inspection and Testing is for the geotechnical inspection and testing authority (GITA) to be able to express an opinion on the compliance of the work. The GITA is responsible for ensuring that the inspection and testing are sufficient for this purpose.*
>
> *The geotechnical inspection and testing authority needs to have competent personnel on site at all times while earthwork operations are undertaken. Such operations include:*
>
> - *Completion of removal of top soil*
> - *Placing of imported or cut material*
> - *Compaction and adding/removal of moisture*
> - *Trenching and backfilling*
> - *Test rolling*
> - *Testing*
>
> *The superintendent should agree a suitable inspection and testing plan prior to commencement of the works.*
>
> *On completion of the earthworks, the GITA will usually be required to provide a report setting out the inspections, sampling and testing it has carried out, and the locations and results thereof. Unless very unusual conditions apply, the GITA should also be able to express an opinion that the works (as far as it has been able to determine) comply with the requirements of the specification and drawings."*

For this particular contract, Level 1 responsibility includes:

1. Lot testing as per Clause 5.3 of this specification.
2. A frequency of testing not less than that specified in Clause 5.4 of this specification.
3. The GITA documenting and reporting its activity in the terms required by Clause 6 of this specification.
4. The GITA undertaking adequate inspections and testing to comply with the above requirements and to be able to certify the fill in the terms required by Clause 6 of this specification.

5.3. Lot Testing

This specification requires lot testing to be undertaken.

A Lot is defined as a single layer of Engineered Fill consisting of uniform material which has undergone similar treatment.

Lot testing comprises the following:

1. A Lot shall be identified by the Contractor or the GITA with a Lot Number and presented for testing.
2. A Lot shall be deemed to be in accordance with the specification if all the tests undertaken within the Lot are in accordance with the specification, i.e. "a none to fail basis".
3. If any one test undertaken within a Lot fails, the whole of the Lot shall be reworked and retested.

Any portion of the placed Engineered Fill must be part of a single lot and all Lots will require approval by the GITA.

5.4. Testing Frequency

5.4.1. Emerson Class and Atterberg Limits

The frequency of Emerson Class and Atterberg Limits tests shall not be less than 1 test per 400 m^3 of the stockpiled Engineered Fill for the Bio-retention Basin earthworks with sampling distributed reasonably evenly.

If any one test undertaken within a stockpile fails, the whole stockpile shall be rejected or specific advice from PSM should be sought. This material may still comply with the material requirements of Clause 2.4 of this specification and be used for the Estate Road earthworks.

5.4.2. Compaction Testing

For the Bio-retention Basin earthworks, the frequency of compaction testing for each lot shall not be less than the greater of:

1. 1 test per 200 m^3 of material placed.
2. 1 tests per lot.

For the Estate Road extension earthworks, the frequency of compaction testing for each lot shall not be less than the greater of:

1. 1 test per 500 m^3 of material placed.
2. 3 tests per lot.

A laboratory moisture content test shall be undertaken for each field density test.

5.5. Inspection, Testing and Survey

The GITA shall at least undertake the following tasks:

1. Identify the subgrade as one of the three (3) subgrade types listed in Clause 3.1 of this specification and assess that the subgrade condition of cut areas is in accordance with the subgrade condition requirements of Clause 3.1 of this specification.
2. Should Engineered Fill be required to fill overcut areas, assess that filling has been placed in accordance with this specification.
3. Identify the subgrade as one of the four (4) subgrade types listed in Clause 2.1 of this specification and assess that the subgrade condition of any area prior to placement of fill material is in accordance with the subgrade preparation requirements of Clause 2.1 of this specification.
4. Assess that the base geometry of any area prior to placement of fill material is in accordance with the base geometry requirements of Clause 2.2 of this specification.
5. Assess that the material placed is in accordance with the fill material requirements of Clause 2.3 and Clause 2.4 of this specification.
6. Assess that the Engineered Fill has been placed in accordance with the requirements for fill zonation and placement of Clause 2.5 of this specification.
7. Assess that each Lot as presented for approval by the contractor is in accordance with the requirements for Lot definition of Clause 5.3 of this specification.
8. Ensure that the survey requirements in Clause 4 of this specification have been completed.
9. Estimate the approximate volume of Engineered Fill placed in each Lot presented for approval.
10. Conduct Lot testing in accordance with the construction control testing requirements of Clauses 5.3 and 5.4 of this specification.
11. Assess that the compaction of each Lot is in accordance with the requirements of Clause 2.6 of this specification. The GITA shall select a depth of in situ density tests that allows the density of the full layer to be assessed.
12. Assess that the moisture variation of each Lot is in accordance with the requirements for moisture control in Clause 2.7 of this specification.
13. Conduct material property testing in accordance with the material testing requirements in this specification.

6. REPORTING AND CERTIFICATION

6.1. Reporting

The GITA shall produce at least the following reports:

1. *Subgrade Approval Reports* (a sample is attached). Such a report shall:
   - Document assessments undertaken for tasks 1 and 3 of Clause 5.5 including reporting the subgrade type.
   - Document the subgrade survey that has been undertaken.
   - Approve or reject the subgrade condition and base geometry for filling, based on tasks 2 and 4 of Clause 5.5.
   - Approve or reject the subgrade condition for cut areas.
2. *Lot Approval Reports* (a sample is attached). Such a report shall:
   - Document assessments, testing and survey undertaken for tasks 3 to 13 of Clause 5.5.
   - Report the results of testing undertaken for task 10 of Clause 5.5.
   - Approve or reject lots based on tasks 11 and 12 of Clause 5.5.
3. *Material Testing Reports*. Such a report shall:
   - Report the results of material property testing undertaken for task 13 of Clause 5.5.
4. *Daily Reports* (a sample is attached). Such a report shall be completed daily and shall:
   - Document time spent on site by the GITA personnel.
   - List subgrade assessments and approvals undertaken each day with reference to relevant Subgrade Approval Report(s).
   - List Lots presented, accepted and approved or rejected each day, with reference to relevant Lot Approval Report(s).
   - List survey undertaken each day as for task 8 of Clause 5.5 and not already documented in the Subgrade or Lot Approval Reports.
   - Document other relevant activities undertaken on site that day (site instructions, breakdowns, compaction equipment used, etc.)

6.2. Certification

6.2.1. Weekly Certificates

The GITA shall produce a Weekly Certificate for any week in which earthworks are undertaken in accordance with this specification. The Weekly Certificate will cover all works from the previous Weekly Certificate until the end of work on a Saturday.

The Weekly Certificate shall transmit the following:

- Copy or reference to the complete specification document(s).
- Subgrade Approval Reports.
- Lot Approval Reports.
- Material property testing reports.
- Daily Reports.
- Survey of subgrade geometry prior to filling or in cut areas.
- Plan survey drawing showing lot boundaries and location of density tests.
- Survey documenting filling undertaken to date and showing location of testing.

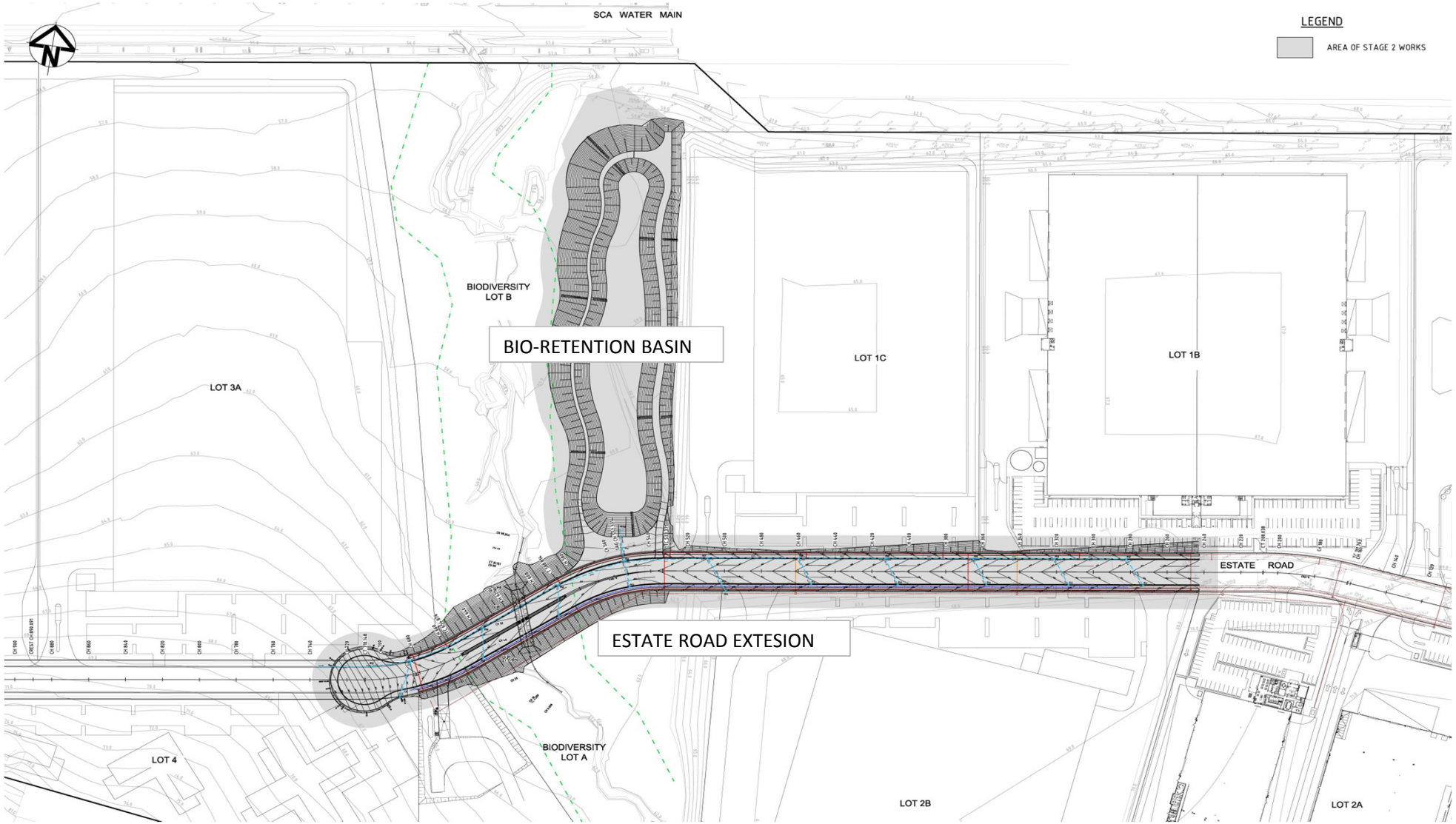
And certify that:

"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM1541-020S Rev0 dated 14 March 2012)."

6.2.2. Interim or Final Filling Certificate

At the completion of the bulk earthworks, or as requested by the Client, the GITA shall provide an Interim or Final Filling Certificate which shall:

1. Transmit a reference list of the Weekly Certificates.
2. Provide an Excel spreadsheet presenting the results of all the acceptance testing completed by the GITA.
3. Certify that *"All the earthworks undertaken and the subgrade condition in the cut areas [in the stated period] are documented in the above reports and have been undertaken in accordance with the Specification (Ref. PSM1543-020S Rev0 dated 14 March 2012)."*



Notes:

1. Plan adopted from AT&L Drawing SKC101 Issue P1, Stage 2 Overall Layout Plan, dated 29/2/2012

Pells Sullivan Meynink

Goodman

Oakdale Central Precinct East

EASTERN CREEK

BIO-RETENTION BASIN AND ESTATE ROAD

LOCALITY PLAN

PSM1541-020S	FIGURE 1

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GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

SUBGRADE APPROVAL REPORT

Client:	Contractor:
Job number:	Report number:
Project:	Technician:

Subgrade areas assessed:

Area ID	Date	Approximate extent	Subgrade description	Geometry summary	Specification reference	Compliance (Pass/Fail)	Survey reference	Approved (Yes/No)

COMMENTS:

Signed: Date:

GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

LOT APPROVAL REPORT

Client:	Report number:
Job number:	Report date:
Project:	Technician:
Contractor:	Test methods:

LOT ID: Sheet of

Retest (Yes/No) Original test report number:

Specification reference

Location:

Lot boundary survey reference/location:

Materials description: *(MATERIAL TYPE, colour, minor components, maximum particle size)*

Material identification: *(Identify the material as defined in Clause 2.3 or Clause 2.4 of the Specification)*

Deleterious material assessment: *(Report proportion of deleterious material)*

Layer thickness:

Accepted as Lot: (Yes/No) Date:

Approximate volume (m3) Number of tests required:

Test ID No.				
Test soil description				
Date tested:				
Grid reference				
Surveyed test locations (RL,E,N)				
Test depth (mm)				
Max size (mm)				
% Oversize material (wet)				
Field wet density (t/m^3)				
Field moisture content (%)				
PWCD (t/m^3)				
Compactive effort				
Moisture variation (%)				
HILF density ratio (%)				
TEST (Pass/Fail)				

LOT APPROVAL (Pass/Fail) Signed: Date:

GEOTECHNICAL INSPECTION AND TESTING AUTHORITY

NATA accreditation number

DAILY REPORT

Client:	Report number:
Job number:	Report date:
Project:	
Location:	Level of testing: Level 1
Contractor	Technician:

Time on site:
Time off site:

1. Subgrade Approval

Areas ID	Subgrade Approval Report No:	Comments

2. Lot Approval

Lot ID	Lot Approval Report No:	Comments

3. Survey

Type of survey	Survey undertaken by:	Reference

4. Instructions received on site

5. Instructions given on site

COMMENTS:

Signed: Date:

SAMPLE INTERIM (OR FINAL) FILLING CERTIFICATE

Letter Ref:
Date:

Addressed to GOODMAN
ATTENTION: GOODMAN REPRESENTATIVE

Dear Sir

RE: INTERIM (OR FINAL) FILLING CERTIFICATE
HUNTINGWOOD EAST INDUSTRIAL DEVELOPMENT, BULK EARTHWORKS
STAGE 1B INFRASTRUCTURE, BIO-RETENTION BASIN AND ESTATE ROAD
CERTIFICATION OF EARTHWORKS
BETWEEN [DATE OF COMMENCEMENT] AND [DATE OF COMPLETION]

In the period between [date start] and [date finish] the contractor has undertaken earthworks in areas XXX and XXX.

During the above period:

- The GITA has prepared the following Subgrade Approval Reports:
  1. Subgrade Approval Report No 1
  2. ……
- The GTA has prepared the following Lot Approval Reports:
  1. Lot Approval Report No 1
  2. …..
- The GTA has prepared the following Daily Reports:
  1. Daily Report No 1…….
  2. ……
- The following subgrade survey was undertaken:
  1. Subgrade Survey reference……
  2. ……
- The following weekly survey was undertaken:
  1. Weekly survey of week ending …….reference……..
  2. …….

Copies of all the above documents are attached.

The GITA certifies that all the earthworks undertaken in the above stated period are documented in the above reports and have been undertaken in accordance with the Specifications (ref. PSM1541-020S Rev0, dated XXX) a copy of which is attached, with the exception of:

1. List outstanding issues (not approved subgrade, lots, unsuitable material etc.)
2. ……..

Signed

GITA