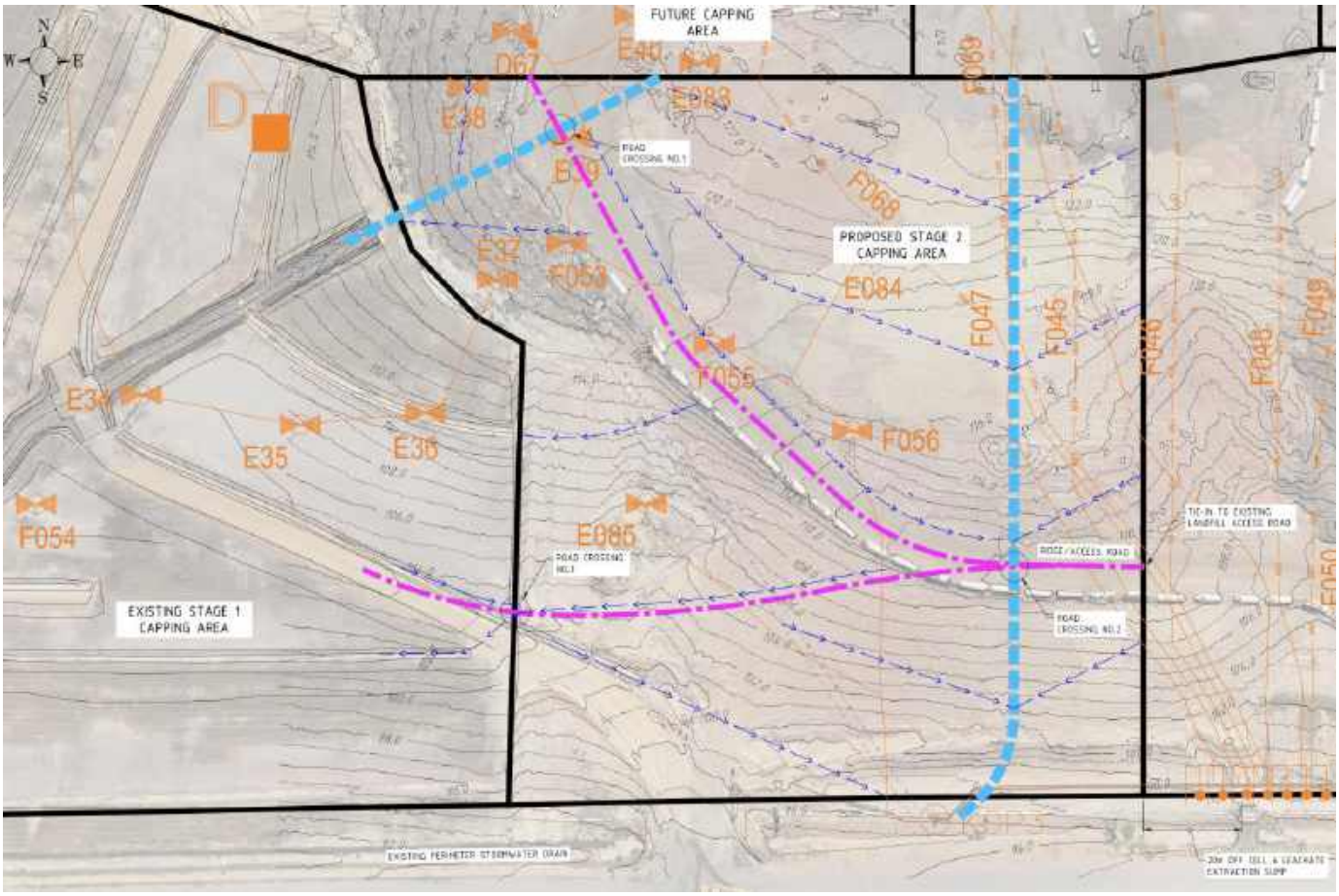
BANKSIA ROAD LANDFILL, DARDANUP

LANDFILL STAGE 2 CAPPING

CONSTRUCTION QUALITY ASSURANCE PLAN



Proposed Stage 2 Capping Areas

Prepared for

CLEANAWAY SOILD WASTE PTY LTD

IW Projects Pty Ltd

[redacted]

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1 Introduction

The Construction Quality Assurance (CQA) is defined as a planned system of activities that provide assurance that the landfill capping and associated Works were constructed as specified in the design and documentation. It is an important factor in ensuring that design and installation of the Works is done in accordance with the Environmental Approval, Specification and Drawings.

For this purpose, an independent CQA Consultant(s) with experience in earthworks and landfill capping construction and more specifically synthetic liner performance characteristics will be appointed to verify that the Works have been carried out to the agreed standards. The duties of the CQA Consultant(s) will include:

- Inspections;
- Verification;
- Audits and evaluation of materials and workmanship;
- Provision of advice on the interpretation of the Drawings and Specification, including; installation, testing, repair and covering of the critical aspects of construction (not design or contractual advice); and,
- Issuing a final CQA Validation Report documenting the quality of the constructed facility.

The CQA Plan will verify that:

- Materials used comply with the Specification; and,
- Method of construction/installation is appropriate and, as a result the design requirements have been met.

The CQA Plan including reference to the construction Drawings and Specification contains the material/construction Specification, testing methods, testing frequency, corrective action and provides for appropriate documentation procedures.

The final CQA Validation Report will be prepared by the CQA Consultant in accordance with the requirements of the Environmental Approval, to demonstrate that all requirements of the project Drawings and Specification and CQA Plan have been complied with.

2 Related Activities

This CQA Plan covers the following landfill capping related construction activities:

- Earthworks;
- GCL, LLDPE, geocomposite drainage material installation;
- Cap penetrations; and,
- Access tracks and stormwater drains.

3 Critical Aspects of Construction

The critical aspects of construction relating to this particular project include the following:

- Confirmation of the actual material properties in comparison to the design assumption material properties used during the design stability assessment (shear box testing of on-site materials) if the material supplied differs from the materials that were used for design stability shear box testing;
- Extent of fill during landfill surface recontouring;
- Sub-Grade preparation;
- Fill placement;
    - Growing medium;
    - Access tracks and stormwater drains;
- Geosynthetic Clay Layer (GCL) installation;
- Geomembrane installation;
- Geocomposite drainage material installation; and,
- Landfill cap penetrations.

4 Construction Drawings and Specification

The construction Drawings and Specification forming part of the construction Works set out the following requirements:

- Location, lines and levels of all Works;
- Material and construction Specification;
- Applicable Standards;
- Testing methods and procedures;
- Inspections;
- Testing Frequencies;
- Corrective actions; and,
- Documentation Procedures.

The construction Drawings and Specification are to be read in conjunction with this CQA Plan. The CQA Consultant is to confirm that the Works are carried out in accordance with the construction Environmental Approval, Drawings and Specification. The construction Drawings and Specification are not repeated within this CQA Plan.

5 Confirmation of Material Properties

In assessing the stability of the capped side slope, the Design Consultant used data from previous shear box testing of the various interfaces between the soil and synthetic liner materials. The materials and products used for the shear box testing included:

- Insitu silty clay soil;
- GCL – ELCOSEAL X2000;
- LLDPE – Solmax 1.5 mm double textured; and,
- Geocomposite Drainage Material – Interdrain geonet with top and bottom A39.

The Principal is to provide samples of the synthetic liner material to the CQA Consultant, which will be used to undertake shear box testing to confirm that the actual liner materials used during construction provide equivalent or greater slope stability to that used in the design stability assessment.

The CQA Consultant is to liaise with the Design Consultant (IW Projects) to determine which materials need to be sourced in order to undertake the necessary site-specific materials testing to confirm the design assessment assumptions.

The CQA Consultant is to:

- Liaise with Design Consultant (IW Projects) and the Superintendent on the type and quantity of site-specific materials required for testing;
- Source the necessary materials and deliver them to the appropriate NATA laboratory to undertake the testing;
- Obtain test results from the NATA laboratory and provide them to the Design Consultant;
- Obtain testing outcome results from the Design Consultant, including an interpretation of the suitability thereof in comparison to the original project assumptions;
- If the results are acceptable to the Design Consultant, include the results and the Design Consultant’s conclusion in the CQA Validation Report;
- If the results are not acceptable, liaise with the Design Consultant and the Superintendent to identify the preferred way forward; and,
- Document the ultimate outcome in the CQA Validation Report.

6 Earthworks Construction

The earthwork's associated with the landfill cap construction must be accompanied by Level 2 (part-time) geotechnical inspection and testing as set out in the Specification and AS 3798-2007, *Guidelines of Earthworks for Commercial and Residential Development*. This entails, among other requirements, testing and part-time inspection of all earthworks by the geotechnical testing authority, a geotechnical engineer independent of the construction Contractor and its sub-contractors. The geotechnical testing authority must provide a report of all testing and, prior to the liner being accepted as appropriately constructed, must express the opinion that the works comply with the requirements of the Drawings and Specification.

For further details refer to the construction Drawings and Specification under the Earthworks section.

Material Specification and Quality Control

The material Specification and quality control is to be in accordance with the requirements of the construction Specification.

Non-Conformances

If there are any non-conformances identified or any changes to the construction Drawings or Specification that have a material effect on the outcome of the Works, the CQA Consultant is to determine:

1. The nature of the non-conformance or change and its level of effect on the project;
2. If the non-conformance is an isolated incident or a recurring problem;
3. How amendments to procedures to prevent future occurrences of the non-conformance can be implemented;
4. The nature of corrective action(s) to be applied to rectify the specific non-conformance;
5. The procedures and persons to be notified of the non-conformance and corrective measures; and,
6. Procedures for reporting to the DWER major exceptions/variations to the approved Drawings or Specification.

Inspection Activities

The CQA Consultant is to confirm that the following information and procedures are available, and the relevant activities have been carried out in accordance with the construction Drawings and Specification:

1. Definitions to be used throughout the project to avoid confusion on acronyms and wording;
2. Descriptions of responsibilities, qualifications, and obligations for each party involved in the CQA Plan;
3. The lines of communication and authority for the project;
4. Identify and define the process for addressing request for information, design modifications or changes in the project Drawings and Specification;
5. A formal process on handling deficiencies which defines responsibilities and the minimum documentation required to correct deficiencies;

6. A project meeting schedule;
7. The proposed level of supervision and quality control;
8. Details of the Conformance Quality Control tests the CQA Consultant will undertake on the earthworks. Any laboratory tests must be performed at a third-party independent accredited laboratory;
9. Details of actions to take if Works fail a Conformance Quality Control tests;
10. Approval procedure for the completed Works;
11. Measures to take to protect the Works if inclement weather occurs during construction;
12. Frequency of testing and evaluation;
13. Procedures for inspecting the Works including the details of the nominated accredited laboratory for offsite testing;
14. Verification process of testing equipment calibration;
15. Details of actions to take in the event of defective Works, including retesting procedures;
16. Rejection criteria of the Works if test results indicated failure;
17. Details of actions to take in case of defective Works and corrective measures;
18. Details of actions to take if Works have been damaged by adverse weather conditions;
19. Details of actions to take to protect the Works following installation;
20. CQA Consultant daily recordkeeping. The daily log should contain the following:
    - Weather and site conditions;
    - Description of any material received at the site, including quality control data provided by Contractor (if applicable);
    - Recording of construction and testing activities;
    - Location of daily construction activities and progress;
    - Photographs of construction Works and any items of specific interest. The captions of all photographs should contain the name of the project, the date on which the photograph was taken and the identity of the feature being photographed;
    - Type of equipment used in each work task (e.g. handling equipment, construction equipment, on-site testing equipment);
    - Calibrations or recalibration of test equipment;
    - Testing conducted and test methods used;
    - Record of any material or workmanship that does not meet specified designs and corrective actions taken to remediate the problem;
    - Details of site visits;
    - Summaries of any meetings held, and action taken; and,
    - Signature of CQA Consultant.
21. As required, periodic acceptance reports summarising daily reports.

The Contractor shall provide the CQA Consultant with the necessary documentation and within an agreed timeline to enable the above CQA activities to be adequately undertaken.

Any major deviations from the approved CQA Plan must be noted and explained and approved by the DWER.

7 GCL Installation

Manufacturing Specification and Quality Control

The manufacturing Specification and quality control is to be in accordance with the requirements of the construction Specification.

Non-Conformances

If there are any non-conformances identified or any changes to the construction Drawings and Specification that have a material effect on the outcome of the Works, the CQA Consultant is to determine:

- The nature of the non-conformance or change and its level of effect on the project;
- If the non-conformance is an isolated incident or a recurring problem;
- How amendments to procedures to prevent future occurrences of the non-conformance can be implemented;
- The nature of corrective action(s) to be applied to rectify the specific non-conformance;
- The procedures and persons to be notified of the non-conformance and corrective measures; and,
- Procedures for reporting to the DWER major exceptions/variations to the approved technical Drawings and Specification.

Inspection Activities

The CQA Consultant is to confirm that the following information and procedures are available, and the relevant activities have been carried out in accordance with the construction Drawings and Specification:

1. Definitions to be used throughout the project to avoid confusion on acronyms and wording;
2. Descriptions of responsibilities, qualifications, and obligations for each party involved in the CQA Plan;
3. The lines of communication and authority for the project;
4. Identify and define the process for addressing request for information, design modifications or changes in the project Drawings and Specification;
5. A formal process on handling deficiencies which defines responsibilities and the minimum documentation required to correct deficiencies;
6. A project meeting schedule;
7. The proposed level of supervision and quality control;
8. Verification process and review of the quality control certificates of the manufacturers of the GCL, the bentonite and the geotextile;
9. Verification process and review of the property values certified by the GCL manufacturer;
10. Verification process that the measurements of properties by the manufacturer are properly documented, test methods are acceptable, sampling procedure detailed and verification that the geosynthetic clay liner, the geotextile and the bentonite meet the project Specification;
11. Verification process and review of the quality control certificates of the geosynthetic clay liner rolls assigned to the project (note: this includes a need to agree with the manufacturer on the frequency of the tests);

12. Details of the delivery, handling and storage of the geosynthetic clay liner on site prior to installation;
13. Verification process of the geosynthetic clay liner handling equipment and restraining methods used on the site;
14. Rejection criteria of the geosynthetic clay liner rolls;
15. Details of the installation staff's accreditations and verification of their experience;
16. Details of the Conformance Quality Control tests the CQA Consultant will undertake on the geosynthetic clay liner rolls delivered to site. Any laboratory tests must be performed at an accredited, independent third-party laboratory;
17. Details of actions to take if geosynthetic clay liner fails Conformance Quality Control tests;
18. Approval procedure of the subgrade and anchor trench including details of testing;
19. Establishment of a field geosynthetic clay liner panel identification;
20. Details of actions to take to ensure that field panels and overlap orientation are as indicated in the layout plan;
21. Measures to take to protect the liner if inclement weather occurs during installation;
22. Procedure for sampling and evaluation;
23. Procedures for inspecting overlaps preparation;
24. Details of actions to take in case of defects and or damages to the surface of the laid geosynthetic clay liner are identified and corrective measures;
25. Details of actions to take to minimise geosynthetic clay liner wrinkles and bridging;
26. Verification process of the geosynthetic clay liner installation around areas of protrusions and penetrations is made according to the Drawings and Specification;
27. Details of actions and procedure to take to protect and to confine the geosynthetic clay liners following installation;
28. Procedure for ensuring that the GCL does not exceed the manufactured moisture content;
29. CQA Consultant daily recordkeeping. The daily log should contain the following:
    - Weather and site conditions;
    - Quality of subgrade;
    - Description of any material received at the site, including quality control data provided by suppliers;
    - Location of daily construction activities and progress;
    - Conformance to panel layout design;
    - Recording of installation activities consisting of panel placement, roll numbers, overlap locations, repairs and testing results for all Works;
    - Records (including photos) of the geosynthetic clay liner at the time that geomembrane is placed over the geosynthetic clay liner;
    - Photographs of construction Works and any items of specific interest. The captions of all photographs should contain the name of the project, the date on which the photograph was taken and the identity of the feature being photographed;
    - Type of equipment used in each work task (e.g. handling equipment);
    - Testing conducted and test methods used for remedial action on GCL defects or overlap defects;
    - Placement of temporary protection to installed GCL;

- Record of any material or workmanship that does not meet specified designs and corrective actions taken to remediate the problem;
- Details of site visits;
- Summaries of any meetings held, and action taken;
- Signature of CQA Consultant; and,

30. Periodic acceptance reports summarising daily reports.

The Principal and the Contractor shall provide the CQA Consultant with the following listed test certificates and records prior to, during and at the completion of the Works as each report and record is required:

- Principal:
  - Certification and test results of bentonite used in the production of the rolls from bentonite material supplier;
  - Certification and test results of geotextiles, fibres used in the production of the rolls;
  - Roll test data reports, for each roll of material;
  - Accessory bentonite test reports; and,
  - Any other documentation as required by the Specification.
- Contractor:
  - Completed As-Constructed drawing, including roll numbers, panel layout, overlap locations and repair locations; and,
  - Any other documentation as required by the Specification.

Any major deviations from the approved CQA Plan must be noted and explained and approved by the DWER.

CQA Testing

Table 1 – GCL CQA Testing provides the test properties and minimum testing frequencies. Higher testing frequencies might be required in certain applications (i.e. need to identify the importance of the GCL for the safety of the Works, construction and stability included). The onus is on the CQA Consultant and/or design engineer to establish if higher requirements are more appropriate.

Table 1 - GCL CQA Testing

Item	Property	Standard	Frequency
Construction Quality Assurance testing (sampled at the point of manufacture or on Site, as determined by the Superintendent)	Mass per unit area of bentonite component of GCL	ASTM D5993	1 sample per 2,500 m^2
	Mass per unit area of GCL	ASTM D5993	1 sample per 1,000 m^2
	Mass per unit area of Bentonite in overlaps	ASTM D5993	1 sample per 1,000 m^2
	Montmorillonite content	XRD (X-ray diffraction) Quantitative Mineralogy Analysis	1 sample per 10,000 m^2

Item	Property	Standard	Frequency
	Cation exchange capacity of bentonite	Methylene blue method	1 sample per 1,500 m^2
	Moisture content of bentonite	ASTM D5993 AS1289.2.1.1	1 sample per 2,500 m^2
	Swell index/free swell of clay	ASTM D5890	1 sample per 1,500 m^2
	Water absorption	ASTM D5891	1 sample per 1,500 m^2
	Peel strength (for needle-punched products only)	ASTM D6496	1 sample per 1,000 m^2
	Tensile strength	ASTM D6768	1 sample per 10,000 m^2
	Index flux	ASTM 5887	1 sample per 10,000 m^2
	Permeability	ASTM 5887	1 sample per 10,000 m^2
Visual inspection of GCL	Colour, needle punching, presence of needles or broken needles, and sewing density or other faults in the material.	N/A	Every roll during placement
Thickness of GCL (i.e. uniformity of bentonite distribution) and apparent variations in the as placed moisture distribution.	On-Site	N/A	Each roll during placement. If thickness appears to be variable a check of the variability of the mass per unit area shall be conducted

Note:

1. All Conformance Quality Control tests must be reviewed, accepted, and reported by the CQA Consultant before deployment of the GCL.
2. All testing must be performed on samples taken from the GCL delivered to Site or at the supplier's/manufacturer's premises under the CQA Consultant's inspection or delegated authority.
3. All laboratory tests must be performed in a third-party independent NATA accredited laboratory.
4. The required testing frequencies may be revised by the Superintendent to conform with improvements in testing methods and/or in the state-of-the-art practice and/or to account for the criticality of the application (i.e to account for the importance of the GCL for the stability of Works).

8 Geomembrane Installation

Manufacturing Specification and Quality Control

The manufacturing Specification and quality control is to be in accordance with the requirements of the construction Drawings and Specification.

Non-Conformances

If there are any non-conformances identified or any changes to the construction Drawings and Specification that have a material effect on the outcome of the Works, the CQA Consultant is to determine:

- The nature of the non-conformance or change and its level of effect on the project;
- If the non-conformance is an isolated incident or a recurring problem;
- How amendments to procedures to prevent future occurrences of the non-conformance can be implemented;
- The nature of corrective action(s) to be applied to rectify the specific non-conformance;
- The procedures and persons to be notified of the non-conformance and corrective measures; and,
- Procedures for reporting to the DWER major exceptions/variations to the approved technical Drawings and Specification.

Inspection Activities

The CQA Consultant is to confirm that the following information and procedures are available, and the relevant activities have been carried out in accordance with the construction Drawings and Specification:

1. Definitions to be used throughout the project to avoid confusion on acronyms and wording;
2. Descriptions of responsibilities, qualifications, and obligations for each party involved in the CQA Plan;
3. The lines of communication and authority for the project;
4. Identify and define the process for addressing request for information, design modifications or changes in the project Drawings and Specification;
5. A formal process on handling deficiencies which defines responsibilities and the minimum documentation required to correct deficiencies;
6. A project meeting schedule;
7. The proposed level of supervision and quality control;
8. Verification process and review of the quality control certificates of the resin and the quality of the resin used to manufacture the geomembrane rolls assigned to the project. The same applies to the extrudate rod;
9. Verification process and review of the property values certified by the manufacturer. The same applies to the extrudate rod;
10. Verification process that the measurements of properties by the manufacturer are properly documented, test methods are acceptable, sampling procedure detailed and verification that the geomembrane meets the project Specification. The same applies to the extrudate rod;

11. Verification process and review of the quality control certificates of the geomembranes rolls assigned to the project (note: need to agree with manufacturer on the frequency of the tests);
12. Details of the planned geomembrane storage on site prior to installation;
13. Verification process of the geomembrane handling equipment used on the site;
14. Rejection criteria of the geomembrane sheets;
15. Details of the installation staff's accreditations and verification of their experience;
16. Details of the Conformance Quality Control tests the CQA Consultant will undertake on the geomembrane delivered to site. Any laboratory tests must be performed at a third-party independent accredited geosynthetics laboratory;
17. Details of actions to take if geomembrane fails a Conformance Quality Control tests;
18. Approval procedure of the underlying geomembrane, including details of testing;
19. Establishment of a field geomembrane panel identification;
20. Details of actions to take to ensure that field panels and seam orientation are as indicated in the layout plan;
21. Measures to take to protect the liner if inclement weather occurs during installation.
22. Frequency of trial welds and procedure for sampling and evaluation;
23. Procedures for inspecting seam preparation, trial welds, welds, testing and sampling welds; including the details of the nominated geosynthetic accredited laboratory for offsite testing;
24. Verification process of welding equipment, calibration and welding conditions;
25. Details of actions to take after cutting of each destructive test sample from the production seam;
26. Details of actions to take in the event of a defective weld, including retesting procedures;
27. Rejection criteria of the laid geomembrane if test results indicated failure;
28. Details of actions to take in case of defects and or damages to the surface of the laid geomembrane are identified and corrective measures;
29. Details of actions to take if geomembranes have been damaged due to shifting by wind;
30. Details of actions to take to minimise geomembrane wrinkles and bridging;
31. Verification process of the geomembrane installation around areas of protrusions and penetrations is made according to Drawings and Specification;
32. Details of actions to take to protect the geomembrane following installation;
33. CQA Consultant daily recordkeeping. The daily log should contain the following:
    - Weather and site conditions;
    - Quality of underlying GCL;
    - Description of any material received at the site, including quality control data provided by suppliers;
    - Location of daily construction activities and progress;
    - Conformance to panel layout design;
    - Recording of installation activities consisting of panel placement, roll numbers, seam/weld locations, repairs and testing results for all Works;
    - Records (including photos) of the wrinkling in the geomembrane at the time that geocomposite drainage material is placed over the geomembrane;

- Photographs of construction Works and any items of specific interest. The captions of all photographs should contain the name of the project, the date on which the photograph was taken and the identity of the feature being photographed;
- Type of equipment used in each work task (e.g. handling equipment, welding equipment, on-site testing equipment);
- Calibrations or recalibration of test equipment and weld equipment;
- Testing conducted and test methods used;
- Record of any material or workmanship that does not meet specified designs and corrective actions taken to remediate the problem;
- Details of site visits;
- Summaries of any meetings held, and action taken; and,
- Signature of CQA Consultant.

34. Periodic acceptance reports summarising daily reports.

The Principal and the Contractor shall provide the CQA Consultant with the following listed test certificates and records prior, during and at the completion of the Works as each report and record is required:

- Principal:
  - Certification and test results of raw materials from raw material supplier;
  - Certification and test results of raw materials from membrane manufacturer;
  - Roll test data reports, for each roll of material; and,
  - Any other documentation as required by the Specification.
- Contractor:
  - Daily installation reports for each welder and technician:
    - Trial test weld record;
    - Wedge weld records;
    - Surface extrusion weld records;
    - Weld peel and tensile test records;
    - Wedge air-tunnel pressure test records;
    - Vacuum box test records; and,
    - Repair records.
  - Completed As-Constructed drawing, including roll numbers, panel layout, seam locations and repair locations; and,
  - Any other documentation as required by the Specification.

Any major deviations from the approved CQA Plan must be noted and explained and approved by the DWER.

CQA Testing

Table 2 – Geomembrane CQA Testing provides the test properties and minimum testing frequencies. Higher testing frequencies might be required in certain applications (i.e. need to identify the importance of the geomembrane for the safety of the Works, construction and stability included). The onus is on the CQA Consultant and/or design engineer to establish if higher requirements are more appropriate.

Table 2 - Geomembrane CQA Testing

Item	Property	Standard	Frequency
Construction Quality Assurance testing (sampled at the point of manufacture or on Site, as determined by the Superintendent)	Thickness	ASTM D5994	Each roll
	Asperity Height	ASTM D 7466	One sample per 5,000 m^2, or every five rolls delivered to Site whichever is the greatest number of tests
	Density	ASTM D1505, ASTM D792	
	Tensile properties (break stress and break elongation)	ASTM D6693 type IV	
	Puncture resistance	ASTM D4833	
	Tear resistance	ASTM D1004	
	Carbon black content	ASTM D4218	
	Carbon black dispersion	ASTM D5596	
	Axi-Symmetric Break Resistance Strain (min.)	ASTM D5617	Per formulation
	Oxidative induction time	ASTM D3895, ASTM D5885	One sample every 10,000 m^2, or resin type or manufacturing run
Start-up test weld	Welding equipment	N/A	Checked daily at start of Works, and whenever the welding equipment is shut-off for more than one hour. Also after significant changes in weather conditions
	Weld conditions	N/A	Test weld strips will be required whenever personnel or equipment are changed and/or wide temperature fluctuations are experienced. Minimum 1.5 m

Item	Property	Standard	Frequency
			continuous seam
Destructive weld testing	On-Site, hand tensiometer in peel and shear	ASTM D6392	Every 150 m (if fusion weld), every 120 m (if extrusion weld)
	Off-Site — weld seam strength in peel and shear	ASTM D6392	Every 150 m (if fusion weld), every 120 m (if extrusion weld)
Non-destructive weld testing	N/A	Air pressure test, ASTM D5820 Vacuum box test, ASTM D5641	All seams over full length
Visual inspection of geomembrane	Smooth edges on both sides, tears, punctures, abrasions, cracks, indentations, thin spots, or other faults in the material.	N/A	Every roll

Note:

1. All Conformance Quality Control tests must be reviewed, accepted, and reported by the CQA Consultant before deployment of the geomembrane.
2. All testing must be performed on samples taken from the geomembrane delivered to Site or at the supplier's/manufacturer's premises under the CQA Consultant's inspection or delegated authority.
3. All laboratory tests must be performed in a third-party independent NATA accredited laboratory.
4. The required testing frequencies may be revised by the Superintendent to conform with improvements in testing methods and/or in the state of the art practice and/or to account for the criticality of the application (i.e. to account for the importance of the geomembrane for the stability of Works).

9 Geocomposite Drainage Material Installation

Manufacturing Specification and Quality Control

The manufacturing Specification and quality control is to be in accordance with the requirements of the construction Specification.

Non-Conformances

If there are any non-conformances identified or any changes to the construction Drawings and Specification that have a material effect on the outcome of the Works, the CQA Consultant is to determine:

- The nature of the non-conformance or change and its level of effect on the project;
- If the non-conformance is an isolated incident or a recurring problem;
- How amendments to procedures to prevent future occurrences of the non-conformance can be implemented;
- The nature of corrective action(s) to be applied to rectify that specific non-conformance;
- The procedures and persons to be notified of the non-conformance and corrective measures; and,
- Procedures for reporting to the DWER major exceptions/variations to the approved technical Drawings and Specification.

Inspection Activities

The CQA Consultant is to confirm that the following information and procedures are available, and the relevant activities have been carried out in accordance with the construction Drawings and Specification:

1. Definitions to be used throughout the project to avoid confusion on acronyms and wording;
2. Descriptions of responsibilities, qualifications and obligations for each party involved in the CQA Plan;
3. The lines of communication and authority for the project;
4. Identify and define the process for addressing request for information, design modifications or changes in the project Drawings and Specification;
5. A formal process on handling deficiencies that defines responsibilities and the minimum documentation required to correct deficiencies;
6. A project meeting schedule;
7. The proposed level of supervision and quality control;
8. Verification process and review of the quality control certificates of the geocomposite drainage material manufacturers, the fibre suppliers and the polymer manufacturers, with a list of characteristics of the material;
9. Verification process and review of the property values certified by the geocomposite drainage material manufacturer;
10. Verification process that the measurements of properties by the manufacturer are properly documented, test methods are acceptable and sampling procedure detailed, and verification that the polymer, fibres, geotextile, geonet and geocomposite drainage material meet the project Specification;

11. Verification process and review of the quality control certificates of the geocomposite drainage material rolls assigned to the project (note: need to agree with manufacturer on the frequency of the tests);
12. Details of the delivery, handling and storage of the geocomposite drainage material on site prior to installation;
13. Verification process of the geocomposite drainage material handling equipment and restraining methods used on the site;
14. Rejection criteria for the geocomposite drainage material rolls;
15. Details of the installation staff's accreditations and verification of their experience;
16. Details of the Conformance Quality Control tests the CQA Consultant will undertake on the geocomposite drainage material rolls delivered to site. Any laboratory tests must be performed at an accredited, independent, third-party laboratory;
17. Details of actions to take if geocomposite drainage material fails Conformance Quality Control tests;
18. Approval procedure of the underlying geomembrane, including details of testing;
19. Establishment of a field geocomposite drainage material panel identification;
20. Details of installation and jointing techniques;
21. Details of actions to take to ensure that field panels and jointing orientation are as indicated in the layout plan;
22. Procedure for inspecting, testing and sampling joints, if appropriate;
23. Measures to take to protect the geocomposite drainage material if inclement weather occurs during installation;
24. Procedure for sampling and evaluation;
25. Procedures for inspecting jointing preparation;
26. Details of actions to take in case defects and/or damage to the surface of the laid geocomposite drainage material are identified, and corrective measures;
27. Details of actions to take to minimise geocomposite drainage material wrinkles and bridging;
28. CQA Consultant daily recordkeeping. The daily log should contain the following:
    - Weather and site conditions;
    - Quality of underlying geomembrane;
    - Description of any material received at the site, including quality control data provided by suppliers;
    - Location of daily construction activities and progress;
    - Conformance to panel layout design;
    - Recording of installation activities, consisting of panel placement, roll numbers, overlap locations, repairs and testing results for all Works;
    - Records (including photos) of the geocomposite drainage material at the time that cover material is placed over the geocomposite drainage material;
    - Photographs of construction Works and any items of specific interest. The captions of all photographs should contain the name of the project, the date on which the photograph was taken and the identity of the feature being photographed;
    - Type of equipment used in each work task (e.g. handling equipment);
    - Testing conducted and test methods used;
    - Remedial action on geocomposite drainage material defects or jointing defects;
    - Placement of temporary protection to installed geocomposite drainage material;

- Record of any material or workmanship that does not meet specified designs and corrective actions taken to remediate the problem;
- Details of site visits;
- Summaries of any meetings held, and action taken; and,
- Signature of CQA Consultant.

29. Periodic acceptance reports summarising daily reports.

The Principal and Contractor shall provide the CQA Consultant the following listed test certificates and records prior to, during and at the completion of the Works as each report and record is required:

- Principal:
  - Certification and test results of the fibres, polymer, geotextiles, geonet and geocomposite drainage material used in the production of the rolls;
  - Roll test data reports, for each roll of material, and,
  - Any other documentation as required by the Drawings and Specification.
- Contractor:
  - Completed As-Constructed drawing, including roll numbers, panel layout, overlap locations and repair locations; and,
  - Any other documentation as required by the Drawings and Specification.

Any major deviations from the approved CQA Plan must be noted and explained and approved by the DWER.

CQA Testing

Table 3 – Geocomposite Drainage Material CQA Testing provides the test properties and minimum testing frequencies. Higher testing frequencies might be required in certain applications (need to identify the importance of the geocomposite drainage material for the safety of the Works, construction and stability included). The onus is on the CQA Consultant and/or Design Consultant to establish whether higher requirements are more appropriate.

Table 3 - Geocomposite Drainage Material CQA Testing

Item	Property	Standard	Frequency
Construction Quality Assurance testing (sampled at the point of manufacture or on Site, as determined by the Superintendent)	Thickness	ASTM D5199	1 sample per 2,500 m^2
	Tensile Strength	ASTM D7179	1 sample per 5,000 m^2
	Compressive Strength	ASTM D6364	1 sample per 5,000 m^2
	Ply Adhesion	ASTM D7005	1 sample per 5,000 m^2
Visual inspection of geocomposite drainage material	Colour, non-adhered or delaminated portions, tears, holes, presence of needles or broken needles, and other faults in the material.	N/A	Each roll during placement.

Note:

1. All Conformance Quality Control tests must be reviewed, accepted, and reported by the CQA Consultant before deployment of the geocomposite drainage material.
2. All testing must be performed on samples taken from the geocomposite drainage material delivered to Site or at the supplier's/manufacturer's premises under the CQA Consultant's inspection or delegated authority.
3. All laboratory tests must be performed in a third-party independent NATA accredited laboratory.
4. The required testing frequencies may be revised by the Superintendent to conform with improvements in testing methods and/or in the state of the art practice and/or to account for the criticality of the application (i.e. to account for the importance of the geocomposite drainage material for the stability of Works).

10 CQA Validation Report

On completion of the above CQA activities, a CQA Validation Report is to be prepared by the CQA Consultant in accordance with the requirements of the Environmental Approval, to demonstrate that all requirements of the project Drawings and Specification and CQA Plan have been complied with.

The report is to include any variations from the construction Drawings and Specification or the above CQA Plan and contain explanations of why the variations occurred and the potential impact on the construction Works.

The CQA Validation Report is to be provided to the DWER as part of the Compliance Certificate at the end of the landfill capping construction Works.