



**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report
Report Number 1807r3v1d0219

Commissioned by
JLA Recycling Limited
Palleg Road
Ystradgynlais
Lower Cwmtwrch
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Table of Contents

1	INTRODUCTION	1
1.1	Site Location	1
1.2	Site Development	1
1.3	Project Organisation	1
1.4	CQA Plan and Specification	2
2	OVERVIEW OF THE WORKS	3
2.1	Timescales	3
2.2	Design Changes	3
2.3	Preparatory Earthworks	3
2.4	Mineral Liner	3
2.5	Flexible Membrane Liner	3
2.6	Protector Geotextile	4
2.7	Aggregate Blinding Drainage Layer	4
2.8	Aggregate Leachate Drainage Layer	4
2.9	Geomembrane Leak Location Survey (GLLS)	4
2.10	Landfill Leachate Collection	4
2.11	Internal Gas Extraction System	4
3	DELIVERY AND STORAGE OF MATERIALS	5
4	SITE PREPARATION	6
4.1	Preparatory Earthworks	6
5	GEOLOGICAL BARRIER	7
5.1	Testing	7
6	MINERAL LINER	8
6.1	Placement	8
6.2	Testing	8
6.3	Test Results Observations	9
7	FLEXIBLE MEMBRANE LINER	10
7.1	Geomembrane Materials	10
7.1	Geomembrane Manufacture and Supply	10
7.2	Geomembrane Conformance Testing	10
7.3	Geomembrane Deployment	11
7.4	Geomembrane Seaming	11
7.4.1	Trial Seams	11
7.4.2	Fusion Welding	11
7.4.3	Extrusion Welding	11
7.4.4	HDPE Walkover Inspection	11
7.4.5	HDPE Repairs	12
7.5	Seam Testing	12
7.5.1	Air Pressure Testing	12
7.5.2	Vacuum Box Testing	12
7.5.3	Destructive Testing	12
8	PROTECTOR GEOTEXTILE	13
8.1	Geotextile Works	13

8.2	Manufacture and Supply	13
8.3	Cylinder Test	13
8.4	Conformance Testing	13
8.5	Deployment and Seaming	14
8.6	Geotextile Walkover Inspection	14
9	BLINDING AGGREGATE DRAINAGE LAYER	15
9.1	Supply and Importation	15
9.2	Compliance Testing	15
9.3	Placement	15
10	LEACHATE DRAINAGE LAYER	16
10.1	Supply and Importation	16
10.2	Compliance Testing	16
10.3	Placement	16
11	LANDFILL LEACHATE AND GAS COLLECTION SYSTEMS	17
11.1	Leachate Pipework	17
11.2	Leachate Pipework Conformance Testing	17
11.3	Gas Well	17
12	GEOMEMBRANE LEAK LOCATION SURVEY	18
13	CERTIFICATION	19
13.1	Earthworks	19
13.2	Mineral Liner	19
13.3	Flexible Membrane Liner	19
13.4	Protector Geotextile	19
13.5	Blinding Drainage Layer	19
13.6	Drainage Layer and Leachate Pipework	19
13.7	Verification	19

List of Tables

Table 6-1	Laboratory Test Results of Mineral Liner	9
Table 8-1	Protector Geotextile Testing	13
Table 9-1	Blinding Layer Particle Size Distribution	15
Table 10-1	Drainage Layer Particle Size Distribution	16

List of Figures

Figure 1	Site Location Plan
Figure 2	Site Plan
Figure 3	As-Built Formation
Figure 4	As-Built Mineral Liner
Figure 5	HDPE Panel Layout
Figure 6	HDPE Repairs and Tests
Figure 7	Protector Geotextile Panel Layout
Figure 8	As-Built Drainage Layer
Figure 9	As-Built Leachate and Gas Extraction Systems

List of Appendices

Appendix 1	Delivery Log for All Materials
Appendix 2	Photographic record of site works
Appendix 3	Mineral Liner Test Results and CQA Monitoring Records
Appendix 4	HDPE Manufacturers QC data
Appendix 5	HDPE Conformance Test Results
Appendix 6	HDPE Deployment Records
Appendix 7	HDPE Destructive Test Results
Appendix 8	Protector Geotextile Manufacturers QC data
Appendix 9	Protector Geotextile CQA Monitoring and Conformance Test Results
Appendix 10	Blinding Layer Test Results
Appendix 11	Drainage Layer Test Results
Appendix 12	Leachate Pipework Photographs
Appendix 13	Leachate Pipework Deflection Calculations
Appendix 14	Leak Location Survey Report
Appendix 15	Daily Site Records

1 INTRODUCTION

Geotechnology Ltd (Geotechnology) has been commissioned by JLA Recycling (JLA) to provide site supervision and CQA validation during key stages of the construction of Sub-cell 6, Palleg Non Hazardous Landfill.

This report documents the construction of the cell, deployment of the mineral liner and geosynthetic materials, placement of the leachate drainage layer and installation of the leachate collection pipe work.

1.1 Site Location

Palleg Non-Hazardous Landfill Phase is situated at Palleg Road, Cwmtwrch at OS Grid Reference SN 7739 1136, as shown on Figure 1. The site is situated immediately adjacent to an existing closed landfill known as Ty-Canol as well as a closed local authority landfill known as Tir Canol. The site occupies an area of approximately 2.73 hectares and is situated in a remote setting in the upper Swansea valley, through which the River Tawe flows.

Land to the north of the landfill is occupied by a tree enclosed plot that once housed a coal processing plant and also an unclassified road that leads from Cwmtwrch Isaf. The unclassified road also forms the eastern boundary of the whole site. The southern boundary to the permitted landfill is a surface water drain and a stock proof fence which encloses the adjacent field.

The site occupies high ground between the Tawe Valley and the Gwys valley. The watershed between the valleys is situated only 30m to the east of the landfill and consequently the site does not lie in proximity to any significant watercourses. The terrain in the vicinity slopes gently northwestward to a very shallow valley occupied by an unnamed tributary of the Afon Twrch. Land on the opposite side of the shallow valley rises only 3m over a distance of 150m before dropping sharply into the steep valley of Nant Gwys.

Investigations to support the design of the landfill have revealed that the site is underlain by a thick sequence of Glacial Till which is in turn underlain by mudstones and thin coal seams belonging to the Coal Measures. Available data reveals that the Glacial Till thickness varies from 12m to over 23m beneath the permitted landfill area.

1.2 Site Development

Palleg Landfill is permitted under PPC Permit No. BT19081X and has been operational for a period of approximately 12 years. During this time, 5 sub-cells have been completed as shown on the site plan provided in Figure 2.

1.3 Project Organisation

The Client for the contract was JLA Recycling Ltd. represented by Mr. John Adams

The Designer for the Works was Mr Ewan Thomas of Geotechnology.

The Engineer for the Works was Mr Arwel Jones of Geotechnology.

CQA inspectors for the works were Ben Rees, Arwel Jones and Keir Thomas of Geotechnology.

The Contractors involved with the project are listed below:

- Geomembrane Installer - Celtic Lining Ltd.
- Earthworks testing Laboratory –Apex Site Testing Services Ltd (ATS)
- Geosynthetic Testing Laboratory - BICS Laboratories Ltd.
- Leak location survey - Geotect Ltd.

The following suppliers were involved with the works:

- Geofabrics Ltd - Protector Geotextile
- MGS Ltd - Leachate Pipework
- GSE - HDPE Liner Materials
- SJ Griffiths and Sons Ltd – Blinding and drainage layer aggregate

1.4 CQA Plan and Specification

The installation of the lining system was carried out in accordance with the principles of the Construction Quality Assurance (CQA) Plan (Geotechnology Ref: 1807r2v1d0618) and Design and Specification (Geotechnology Ref: 1807r1v1d0618). These reports document the approach to be adopted for the approval of material suppliers, conformance testing of the materials supplied, approval of the lining system installer and monitoring of all processes involved with the installation, jointing and testing of the lining system. This report should be read in conjunction with these two documents.

2 OVERVIEW OF THE WORKS

2.1 Timescales

The main construction works for Sub-cell 6 were undertaken during the period June - October 2018.

2.2 Design Changes

The design of Sub-cell 6 has an approximate footprint of 4375m². The actual as-built sub-cell is 4075m².

2.3 Preparatory Earthworks

The earthworks comprised the stripping and removal of the upper glacial soil (ablation till) and excavation to level and fall within the glacial lodgement till geological barrier. Much of this work was undertaken by JLA during the Winter and Spring of 2018, and was completed to the correct levels in early June 2018.

2.4 Mineral Liner

The mineral liner comprised compacted site won material, which is the stiff lodgement till. The mineral liner was re-worked to remove large protruding cobbles and boulders. It was placed and rolled directly onto the geological barrier and tested. Testing of the mineral liner was completed in accordance with the Specification.

Whilst the aim is to achieve Specification limits, the main function of the mineral liner is to achieve a layer which is removed of larger cobble and boulders immediately underneath the HDPE liner.

2.5 Flexible Membrane Liner

A 2mm High Density Polyethylene (HDPE) Geomembrane was installed directly above the mineral liner. It was originally specified that a combination of both 2mm smooth geomembrane placed across the base of the cell and 2mm double textured liner on the side slope would be used. The double textured liner was used in these areas to provide adequate stability and resistance to sliding. However, due to a delay in the availability of smooth membrane from the manufacturer, the whole sub-cell was constructed using double textured liner. This will have no detrimental effect.

The HDPE terminates in anchor trenches on the crest of the side slope to provide anchorage to both the geomembrane and overlying protector geotextile.

Manufacturers Quality Control data for the lining membrane delivered to site was supplied by GSE Limited, who manufactured the rolls. Samples of the received materials were taken by Celtic Lining Ltd. The samples were sent to BICS Laboratories Limited for conformance testing.

Each deployed panel was assessed for flaws in the geomembrane and seaming. Non-destructive testing was undertaken on all seams and destructive samples collected from a

selection of seams. All flaws and areas from which destructive samples were taken were repaired prior to deployment of the protector geotextile.

2.6 Protector Geotextile

A protector geotextile was placed directly onto the HDPE geomembrane to provide protection from the overlying blinding and leachate drainage layers. The protection geotextile terminates in the same anchor trench as the geomembrane.

Geofabrics Ltd., the protector geotextile manufacturer, supplied quality control data for the geotextile rolls delivered to site. Samples were also taken by the lining contractor of the received materials and sent to BICS laboratories for conformance testing.

The protection geotextile was installed in accordance with the Specification and CQA Plan.

2.7 Aggregate Blinding Drainage Layer

The aggregate blinding drainage layer placed above the protector geotextile comprised a nominal 100mm thick layer 10-30mm aggregate. This is in accordance with the completed cylinder test.

2.8 Aggregate Leachate Drainage Layer

A 300mm thick leachate drainage stone layer was placed onto the blinding drainage layer. The drainage aggregate was carefully placed directly onto the blinding aggregate drainage layer using an excavator. The aggregate used was a nominal 20-40mm aggregate.

2.9 Geomembrane Leak Location Survey (GLLS)

Following placement of the aggregate drainage layer a GLLS was completed. The survey was undertaken by Geotect Ltd.

2.10 Landfill Leachate Collection

The landfill leachate collection system within Sub-cell 6 consists of two 180mm spur drains, and the continuation (and ending) of the main spine drain 225mm. The works for Sub-cell 6 required this one to be extended from the adjacent Sub-cells 3 and 5.

The leachate collection system was installed at the same time as the leachate drainage layer.

2.11 Internal Gas Extraction System

Two gas wells were installed into the sub-cell to complete the gas well installation for the landfill.

3 DELIVERY AND STORAGE OF MATERIALS

All materials used in the works were either directly delivered to site or to a prepared temporary storage area. A copy of the relevant delivery records is provided in Appendix 1.

Pipe materials delivered to site were stored in designated areas on or close to the working area. Visual inspections of all pipework and fittings were made following delivery and prior to incorporation into the works.

The geomembrane used for the lining works was handled and stored in accordance with the manufacturer's recommendations. A visual inspection of the rolls took place immediately after delivery and prior to deployment in the works.

Aggregate for use in the works were brought to site on an as-required basis during the construction, with each material being stockpiled separately.

4 SITE PREPARATION

4.1 Preparatory Earthworks

The development of the cell required excavation into in-situ glacial till from the existing natural ground. The Design and Specification for the works identified the required formation level within the naturally occurring geological barrier. This required the removal of unsuitable ablation till (brown clay) and exposure of the underlying lodgement till (grey clay). The nature and extent of the lodgement till provides a significant natural barrier to the landfill with regards to fugitive release of leachate and gas.

The excavation was set-out using a Topcon GR3 GPS base station and a Topcon GR3 GPS rover unit, allowing real time kinematic positioning to an accuracy of 3mm horizontally and 5 mm vertically. Survey markers and pegs were inserted at the toe and crest lines of side slopes to control line and level of key slope changes.

5 GEOLOGICAL BARRIER

Palleg Landfill sits above a thick layer of Glacial Till (boulder clay) which has been previously characterised for landfill engineering (see Geotechnology report 402.1/0103/0). This initial investigation indicated that at its minimum, the till beneath the liner will be between 8 - 14m thick. However, since the submission of the above report, three monitoring wells have been drilled to Coal Measures Bedrock along the western edge of the landfill and submitted under report No. 650.1/0/0308, in March 2008. During drilling, it was noted that the glacial till was substantially thicker than encountered in the previous investigation. In fact, on part of the western edge, rock-head was encountered at a depth of 26m below ground surface. This equates to a maximum thickness of approximately 22m of drift as opposed to the 14m originally stated.

Measurements of the in-situ (falling head tests) hydraulic properties of the till indicate a permeability of $1 \times 10^{-8} \text{ms}^{-1}$ though laboratory testing indicates much lower permeabilities. The clay content of the till ranges from 15% to 24% with a silt content ranging from 18% to 26% and the remaining fraction comprising sand and coarser particles.

In accordance with the Landfill Directive, the formation forms part of a natural geological barrier which extends beneath the base of the landfill and up the side slopes.

5.1 Testing

The geological barrier has been subjected to considerable characterisation testing (for use as a mineral liner) and accordingly the Design and Specification did not specify further testing. The excavation, however, was visually inspected prior to the commencement of the main lining works. The formation levels across the site prior to the construction of the liner are shown on Figure 3.

6 MINERAL LINER

The mineral liner at the site comprises re-compacted site won clay from the lower grey clay unit present across the site. Due to the presence of a significant natural geological barrier, the mineral liner layer construction provides an opportunity for reducing the opportunity of oversized stone or unsuitable materials coming into direct contact with the overlying geomembrane.

6.1 Placement

The surface of the 250mm grey clay mineral liner was visibly inspected to ensure that the material did not contain coarse particles that could potentially damage the geomembrane. Where required, cobbles and boulders were removed prior to the application of the geomembranes.

The mineral liner was placed during the first two weeks of June 2018. Some drying out of the upper surface of the mineral liner was noted, and was reflected in the (in-situ test) laboratory results obtained. A thin layer of dust had manifested itself during the in-situ soil testing i.e. the sand replacement tests. However, due to overnight rain on the evening of 1 July 2018, the dust duly "re-hydrated", and the surface was re-rolled to form a tight and sealed clay surface. Unfortunately, no further testing was completed after the rainfall event to confirm this. Scrutiny of photographs in Appendix 2 shows the difference, both in colour and appearance of the mineral liner pre and post rainfall.

6.2 Testing

Six mineral liner sand replacement tests (SRD) samples were collected on 27 June 2018 and submitted for testing to Apex Testing Solutions Services Ltd (ATS), in Pyle. In addition, samples were also taken from the mineral liner stockpile for other laboratory testing requirements as per the Specification. As ATS is not UKAS accredited for permeability determination, samples were sub-contracted for testing to Geosite Testing Services Ltd. at Bynea Llanelli. The results of the testing undertaken by ATS are provided in Appendix 3.

The results reported in Appendix 3 show that the material recorded in-situ moisture contents of between 4.9% and 9.8%. Five of the six were below the mc% requirement of 8%. In order to reflect these values, a range of re-compacted mc% from 5.2% to 9.9% were used for the permeability testing. The permeabilities range from 1.49 to 3.00×10^{-10} m/sec, well below the required 1×10^{-9} m/sec. A similar scenario occurred for Sub-cell 5 mineral liner testing and 6.6×10^{-11} m/sec was achieved at a moisture content of only 4.6%. This mc% is below the lowest of 4.9% obtained in Sub-cell 6, again with a satisfactory permeability.

In consideration and reflection, the Specification for Sub-cell 6 should have been modified to expand the mc% window as it was known that a mc% well below 8% (as in the Spec) could achieve the required permeability.

It should also be noted that mc% values taken from the stockpile indicate values above 9%mc, and that this was the condition in which the material was placed and rolled. The very hot dry period in which the testing was undertaken did not reflect the as-laid conditions.

In addition, the samples were tested for Atterberg Limits, and all results plot above the A line indicating a clay material. This was confirmed in Particle size distribution tests which indicated clay contents ranging between 18% and 20%.

In-situ density testing was also undertaken on the liner and dry density values of between 1.94 and 2.18 Mg/m³ were obtained.

Three of the samples (SRD1 to SRD3) were used for permeability determination and were re-compacted to reflect the density and moisture content as obtained in the field density tests. The three permeability values range from 1.49 to 6.6 x 10⁻¹⁰ ms⁻¹ and 3.0 x 10⁻¹⁰ ms⁻¹ for S1 and S3 respectively. Test results obtained are summarised below in Table 6-1.

6.3 Test Results Observations

Table 6-1 Laboratory Test Results of Mineral Liner

Property	Unit	Requirement	S1	S2	S3	S4	S5	S6
Clay Content	%	>10	23	15	18	-	-	-
Permeability	m/sec	<1 x 10 ⁻⁹	1.49x10 ⁻¹⁰	2.97x10 ⁻¹⁰	3.0 x 10 ⁻¹⁰	-	-	-
Re-compacted Moisture Content based on SRD results	%	>8% <15%*	9.9	7.2 ^{*1}	5.2 ^{*1}			
Laboratory Moisture Content (Bulk Samples) taken from stockpile	%	>8% <15%	11	9	10	9	7 ^{*1}	10
Shear Strength	kPa	>30	Not Feasible	Not Feasible	Not Feasible			

*1 Values below specification.

The permeability values are well within the required Specification of less than 1 x 10⁻⁹ m/sec and indicate that expansion of the acceptability window for both dry density and moisture content for the mineral liner at Palleg is acceptable. Moisture Content values as low as 4.6% have been shown in previously constructed sub-cells to achieve the required permeability.

Clay contents of the three samples tested for particle size distribution indicate values well within the specification. This is further substantiated by Atterberg tests which confirm the clay content, with values plotting above the A line. The stiffness and generally high granular content of the lodgement till also make the evaluation of shear strength via hand vane extremely difficult. No shear strength testing was completed as it was impossible to penetrate the vane into the mineral layer surface. As the shear strength is only required for trafficking purposes during construction, it is considered that no further testing is required.

The number of tests completed exceeds the frequency specified, as only 1018m³ of mineral liner was placed. An extra one test, over and above the requirement for each test method was completed for many of the tests.

7 FLEXIBLE MEMBRANE LINER

In combination, the CQA records provided in Appendix 4 to 7, document the complete deployment and satisfactory testing of the HDPE lining system.

7.1 Geomembrane Materials

The geomembrane used in the works comprised only 2mm double textured High Density Polyethylene (HDPE) on the slopes and base of the sub-cell.

7.1 Geomembrane Manufacture and Supply

The geomembrane was manufactured and supplied by GSE Ltd. who also provided the specification sheets for the material and the relevant reel certificates for each individual roll. Copies of the manufacturer's quality control test data are included in Appendix 4, demonstrating compliance with the Specification.

Nine rolls of double textured HDPE membrane were used in the project. A log of the geomembrane received is presented in Appendix 1.

7.2 Geomembrane Conformance Testing

Two conformance samples were taken from the textured rolls delivered to site. These results are included in Appendix 5 along with the conformance test results. As the total area lined was 4075 m², this testing frequency exceeds the required rate of 1 per 5000m² stated in the Specification.

HDPE samples were submitted for conformance testing to BICS Laboratories, Brighouse, West Yorkshire. Laboratory conformance test certificates are presented in Appendix 5 and a summary of results provided in Table 7-1. These indicate that the new materials delivered met the required performance specification. The results of the other conformance tests referred to above all are shown to be satisfactory.

Table 7-1 Textured 2.0mm HDPE Membrane Properties

Property	Test Method	Specification Requirement	Conformance Result - 303027596	Conformance Result - 404001375
Thickness (mm) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	D5199	nom. 2mm (-5%) - -10% - -15%	2.08	2.10
Asperity Height mils	GRI/M12	0.25 mm	0.59 & 0.70	0.59 & 0.69
Density	D1505-10	0.940 g/cc	0.941	0.941
Tensile Properties • Yield strength • Break strength • Yield elongation • Break elongation	D 6693 Type IV	29 N/mm 21 N/mm 12% 100%	38.9/40.2* 61.4/59.2* 19.0/18.0* 810/786*	37.2/37.4* 60.1/58.1* 20.0/18.0* 836/828*
Tear Resistance	D 1004	249 N	319/309*	326/308*
Puncture Resistance	D 4833	534 N	755	710
Carbon Black Content (range)	D 1603	2.0 – 3.0%	2.54	2.56
Carbon Black Dispersion	D5596		1	1
NOTE: Machine Direction (MD) / Cross Machine Direction (CMD) *				

7.3 Geomembrane Deployment

The geomembrane was installed in accordance with the requirements set out in the Specification following acceptance of the mineral liner. The geomembrane was installed on 2 and 3 July 2018, as confirmed by the records in Appendix 6 and 15.

The geomembrane was installed as a series of panels, numbered sequentially in order of deployment during good weather. The rolls were manoeuvred into place with a 360 degree tracked excavator fitted with a spreader bar. The geomembrane deployment was monitored and inspected by the Engineer ensuring compliance with the details set out in both the CQA plan and Specification.

The HDPE CQA data and the lining contractor's daily records for the deployment of the geomembrane are included in Appendix 6. The HDPE panel layout for the geomembrane is shown on Figure 5.

7.4 Geomembrane Seaming

The CQA data for the seaming activities in connection with the installation of the geomembrane is provided Appendix 6. In combination, the records provided in Appendix 6 confirm that all seams shown on Figure 5 were tested.

7.4.1 Trial Seams

Trial seams were carried out at the start of each seaming period and for each machine used.

Trial seams, with a minimum length of 1.50m were prepared from fragment pieces of geomembrane liner. Sample specimens 25mm wide were cut from trial seams, approximately 200mm apart. The samples were tested in the field for peel and shear strength. If any samples failed, machinery adjustments were made and the testing repeated.

7.4.2 Fusion Welding

Fusion welding was performed on the geomembrane for the lining works.

The Engineer inspected fusion welds in accordance with the CQA Plan. The CQA field seam records for the fusion welds are presented in Appendix 6.

7.4.3 Extrusion Welding

Extrusion welding was only undertaken in areas where it was not possible to use fusion welders. Typically these included short seams, beaded repairs, three way joints and all patched repairs.

The CQA data for the extrusion welds completed are shown in Appendix 7.

7.4.4 HDPE Walkover Inspection

Prior to the panels being covered over by the protector Geotextile, a walkover inspection was undertaken by the Engineer.

7.4.5 HDPE Repairs

Repairs to the geomembrane were undertaken during the liner installation. All defects noted were repaired in accordance with the Specification and CQA plan.

A total of 6 repairs were undertaken on the HDPE. Photographs of repairs are provided in Appendix 7 and the locations shown on Figure 6. Destructive samples were taken in sacrificial areas where repairs would not be required.

7.5 Seam Testing

7.5.1 Air Pressure Testing

Fusion seams were subjected to air pressure testing in accordance with the Specification. The CQA Data for the air testing of the fusion seams is included in Appendix 6.

7.5.2 Vacuum Box Testing

Extrusion welds were only undertaken in areas that required a repair and were vacuum box tested.

7.5.3 Destructive Testing

Samples were cut from installed seams to provide a method of obtaining quantitative results for the seam strength. Sample locations were selected at a frequency of approximately 1 test per 150m for fusion seams, exceeding the requirement of 1 per 200m. As only approximately 20m of extrusion welding was completed, only 2 extrusion seam test was taken to test the effectiveness of the extrusion welding as dummy welds. These tests are included in Appendix 7 and summarised in Table 7-2 below. The destructive samples were forwarded by the lining contractor to BICS Laboratories Ltd.

Table 7-2 Destructive Laboratory Test Results

Sample ID	Seam Reference	Weld Type	Peel (N/mm)		Shear (N/mm)	
			Mean	Lowest	Mean	Lowest
DS-1	P3/P4	Fusion	26.5	23.8	37.6	37.4
DS-2	Test Weld	Extrusion	24.4	23.5	35.3	34.0
DS-3	P6/P11	Fusion	26.4	24.3	39.6	38.6
DS-4	P1/P2	Fusion	25.1	22.3	37.3	36.9
DS-5	Test Weld	Extrusion	28.2	25.6	34.9	33.9
DS-6	P20/P21	Fusion	25.8	22.7	38.1	37.2
DS-7	P29/P30	Fusion	25.0	21.4	37.1	36.4

All the results indicate that the seams tested were satisfactory.

8 PROTECTOR GEOTEXTILE

8.1 Geotextile Works

The geotextile protection layer was placed directly onto the geomembrane to protect it from the overlying drainage layer blinding aggregate.

8.2 Manufacture and Supply

The geotextile used was primarily HPS11 which is a non-woven polypropylene needle punched fibre manufactured by Geofabrics Ltd. The manufacturers' quality control certificates for delivered HPS11 are included in Appendix 8. Two separate deliveries were made.

A log of the protector geotextile received is presented in Appendix 1.

8.3 Cylinder Test

A cylinder test was previously undertaken in accordance with Environment Agency Guidance to determine the suitability of the geotextile protection layer. As the source stone and Geotextile is unchanged a further cylinder test was not undertaken, as agreed with NRW. However, the results of the previous cylinder test are provided in Appendix 9 for completeness.

8.4 Conformance Testing

Three samples of the as delivered protector geotextile were taken at a frequency of approximately 1 per 1950 m², which is considerably greater than the Specification of 1 per 6000m² for the full suite of testing and slightly greater than the 1 per 2500m² for physical properties only. Results are included in Appendix 9.

The samples for conformance testing were sent to BICS Laboratories Ltd. in accordance with the Specification. The test certificates provided in Appendix 9 and the summary in Table 8-1 indicate that the samples met the requirements of the Specification.

Table 8-1 Protector Geotextile Testing

Property	Unit	Typical Mean Value	Allowable tolerance to 95% confidence limits	Conformance Test 20729/001	Conformance Test 20729/011	Conformance Test 20729/018
Static CBR Puncture resistance	kN	11	-10%	17.05	11.86	11.98
Plunger Displacement	Mm	65	n/a	66	72	71
Tensile strength (md)	kN/m	60	-10%	88.5	75.1	76.1
Tensile strength (cmd)	kN/m	60	-10%	114.0	74.0	73.7
Tensile Elongation (md)	%	80	+/-30%	67.1	74.3	81
Tensile Elongation (cmd)	%	80	+/-30%	64.4	76.4	74.1
Cone Drop	Mm	1	+3mm	0	0	0
Thickness @ 2kPa	Mm	6.7	n/a	6.37	6.43	7.57

8.5 Deployment and Seaming

The geotextile protection layer was deployed by hand by rolling across the base and down the slopes to avoid damage to the geomembrane. The geotextile was installed as a series of panels. Adjacent panels were overlapped and secured by heat seaming. Each panel was either a complete or partial roll. All CQA monitoring details for the protector geotextile are presented in Appendix 9.

The full protector geotextile panel layout is shown on Figure 7.

8.6 Geotextile Walkover Inspection

A visual inspection of the geotextile protection layer was made after deployment.

9 BLINDING AGGREGATE DRAINAGE LAYER

9.1 Supply and Importation

The aggregate for the blinding aggregate drainage layer was supplied by S.J. Griffiths and Son Ltd. from Penwyllt Quarry. The blinding aggregate was stockpiled near to the cell, before being transported into the cells via dumper.

9.2 Compliance Testing

The placed blinding drainage blanket was tested for particle size distribution in accordance with BS EN 933-1 1997. Tests results from the two samples tested are provided in Appendix 10 while Table 9-1 provides a comparison of the results with the Specification. The testing shows that the material satisfies the Specification.

Table 9-1 Blinding Layer Particle Size Distribution

British Standard Sieve Size (mm)	Specification (%)	Conformance Samples	
		Blinding A	Blinding B
63	-		
40	100	100	100
31.5	98 to 100	100	100
20	80 to 99	94	92
14	20 to 70 (+/- 15)	-	-
10	0 to 20	4	10
4	0 to 5	2	3

9.3 Placement

The leachate drainage blinding aggregate comprised a free draining 20mm single sized crushed limestone aggregate which was placed in a single layer to a thickness of at least 100mm.

Both samples are compliant with the Specification.

The blinding drainage layer was placed by backhoe excavator to a nominal thickness of 100mm though CQA monitoring revealed this was variable and typically exceeded. A minimum thickness of 500mm was maintained in areas where machinery needed to track. When placing the blinding drainage stone onto the fabric the machine swivelled as little as possible. Stone placement was achieved either by the excavator or bladed using a D5 dozer in the direction of geotextile panel placement.

10 LEACHATE DRAINAGE LAYER

10.1 Supply and Importation

The aggregate for the leachate drainage layer was supplied by Stone Supplies Ltd. from Penwyllt Quarry. The leachate drainage aggregate was stockpiled near to the cell, before being transported into the cells by dumper.

10.2 Compliance Testing

The placed leachate drainage layer was tested for particle size distribution. A total of two tests were required as per the Specification. The test certificates provided in Appendix 11 and summarised in Table 10-1 show that the material conforms to the specification.

Table 10-1 Drainage Layer Particle Size Distribution

British Standard Sieve Size (mm)	Specification (%)	Conformance Test Results	
		Drainage A	Drainage B
63	98-100	100	100
40	80 to 99	100*	100*
31.5	20 to 70 (+/-15)	93*	80
20	0 to 20	6	9
14	-		
10	0 to 5	1	1
4	-		

*- lies marginally outside Spec

10.3 Placement

The leachate drainage aggregate comprised a free draining 40mm single sized crushed limestone aggregate which was placed in a single layer to a thickness of at least 300mm.

The samples lie marginally outside one of the sieve sizes, whilst this is non-compliant, it is considered it will not have any derogatory effect on the geotextile (due to the blinding layer), and its effectiveness as a drainage blanket.

The drainage layer was placed by backhoe excavator to a nominal thickness of 300mm though CQA monitoring revealed this was variable and typically exceeded. A minimum thickness of 500mm was maintained in areas where machinery needed to track. When placing the drainage stone onto the fabric the machine swivelled as little as possible. Stone placement was achieved either by the excavator or bladed using a D5 dozer in the direction of geotextile panel placement.

The as-built drainage layer is presented as Figure 8.

11 LANDFILL LEACHATE AND GAS COLLECTION SYSTEMS

The leachate drainage pipe work used was fabricated from solid high density polyethylene. The pipe was supplied in lengths of 6m. Jointing was achieved via electro-fusion coupling which was digitally recorded during the fusion process. The pipes used were MGS Durodrain. The pipe manufacturer supplied standard ATV 127 static calculations with the MQC data to demonstrate the suitability of the pipe for use at Palleg. This information is presented in Appendix 12.

All pipework was slotted around its entire circumference, with slots of 3mm spaced at 25mm centres axially. A single pipe diameter was used within the leachate drainage blanket, together with junctions.

11.1 Leachate Pipework

Three leachate pipework extensions from Sub-cells 5 and 3 were installed within the blinding and drainage aggregate. The as-built location of the 225mm spine drain and 180mm spur drains is shown on Figure 9.

Thick single wall HDPE slotted pipework was used throughout, (Durodrain) supplied by MGS Ltd. The structural parameters of this material are included in Appendix 12 and the deflection calculations for these pipes in Appendix 13.

11.2 Leachate Pipework Conformance Testing

As a proprietary electrofusion collar system was used for the pipe lengths, no conformance testing was undertaken on the leachate pipework.

The Contractor supplied all the technical information for the pipework and fittings to the Engineer for approval, prior to any material being purchased.

11.3 Gas Well

The basal sections of two proprietary gas wells were installed within the blinding and drainage aggregate. This is shown on Figure 9.

12 GEOMEMBRANE LEAK LOCATION SURVEY

As detailed in the Specification, a geomembrane leak location survey was undertaken. The survey was completed by Geotect Ltd. on 21 August 2018 who provided a report confirming that a single 2mm defect was found in the liner system. The defect was immediately repaired by a member of staff from Celtic Lining Ltd. who applied (after grinding preparation) a small bead extrusion.

This report is provided in Appendix 14.

13 CERTIFICATION

13.1 Earthworks

It is confirmed on the basis of the inspection reported that the earthworks were completed in accordance with the principles of the Specification.

13.2 Mineral Liner

Testing of the permeability of the mineral liner has demonstrated compliance with the Specification.

13.3 Flexible Membrane Liner

It is confirmed on the basis of the inspection and testing, completed and reported, that the HDPE lining geomembrane has been installed in accordance with the Specification and CQA Plan. A GLLS completed post installation has also been completed and no defects in the lining system were found using this technique.

13.4 Protector Geotextile

It is confirmed on the basis of the inspection and testing completed and reported that the protector geotextile has been installed in accordance with the Specification and CQA plan.

13.5 Blinding Drainage Layer

It is confirmed on the basis of the inspection and testing completed and reported that the aggregate blinding drainage layer has been installed in accordance with the Specification and CQA plan.

13.6 Drainage Layer and Leachate Pipework

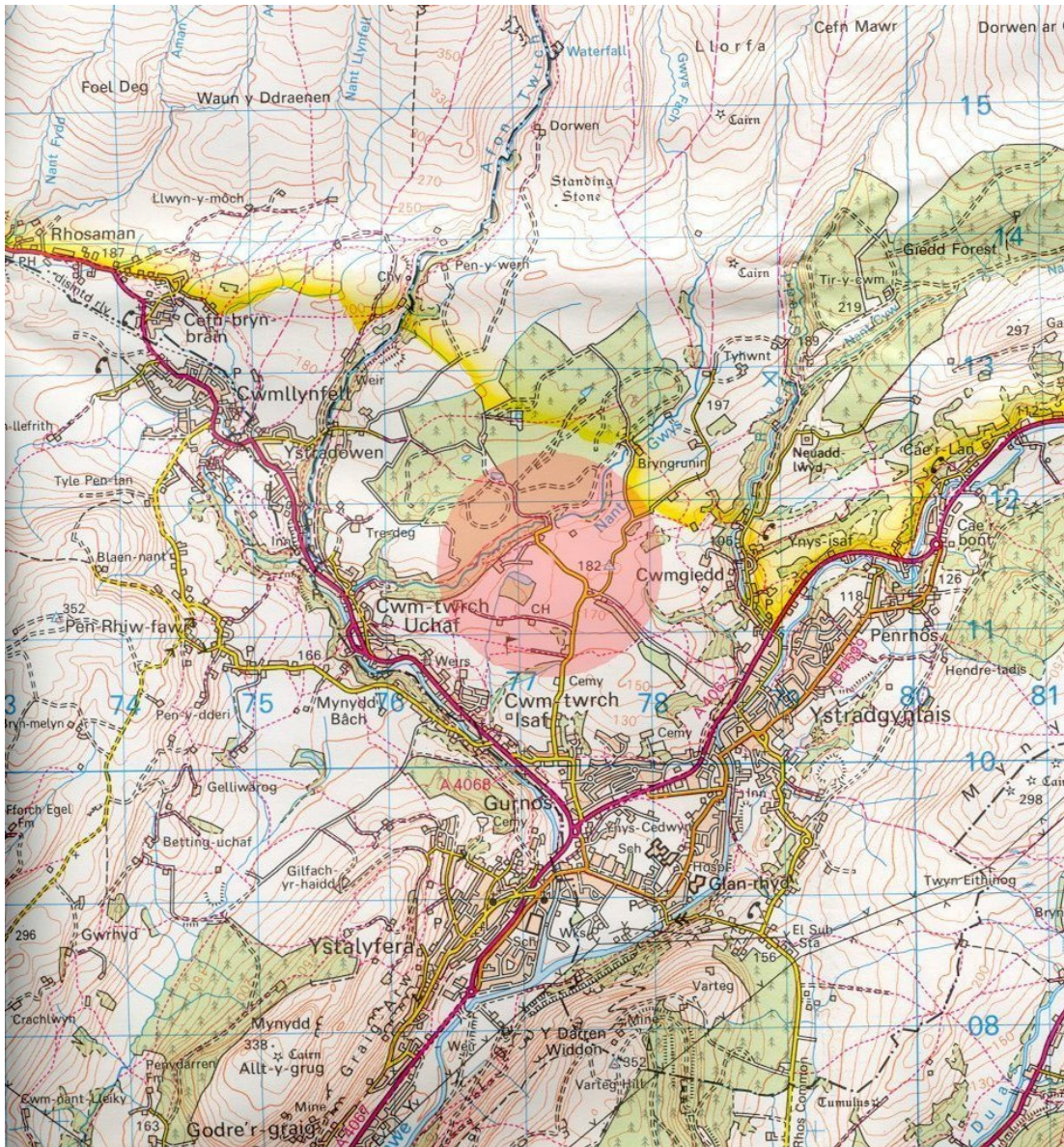
It is confirmed based on the testing that the material used in the drainage layer is acceptable. The leachate pipework located on the base of the cell has also been installed in accordance with the Specification and CQA Plan.

13.7 Verification

Based on the CQA inspection and testing undertaken at the site and the records available, it is confirmed that the development and associated lining works undertaken at Palleg Non-Hazardous Landfill Sub-cell 6 has been completed in accordance with the principles of the Specification and CQA Plan.

This is the last sub-cell to be constructed at the Palleg Landfill.

Figure 1 Site Location Plan



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Figure 2 Site Plan

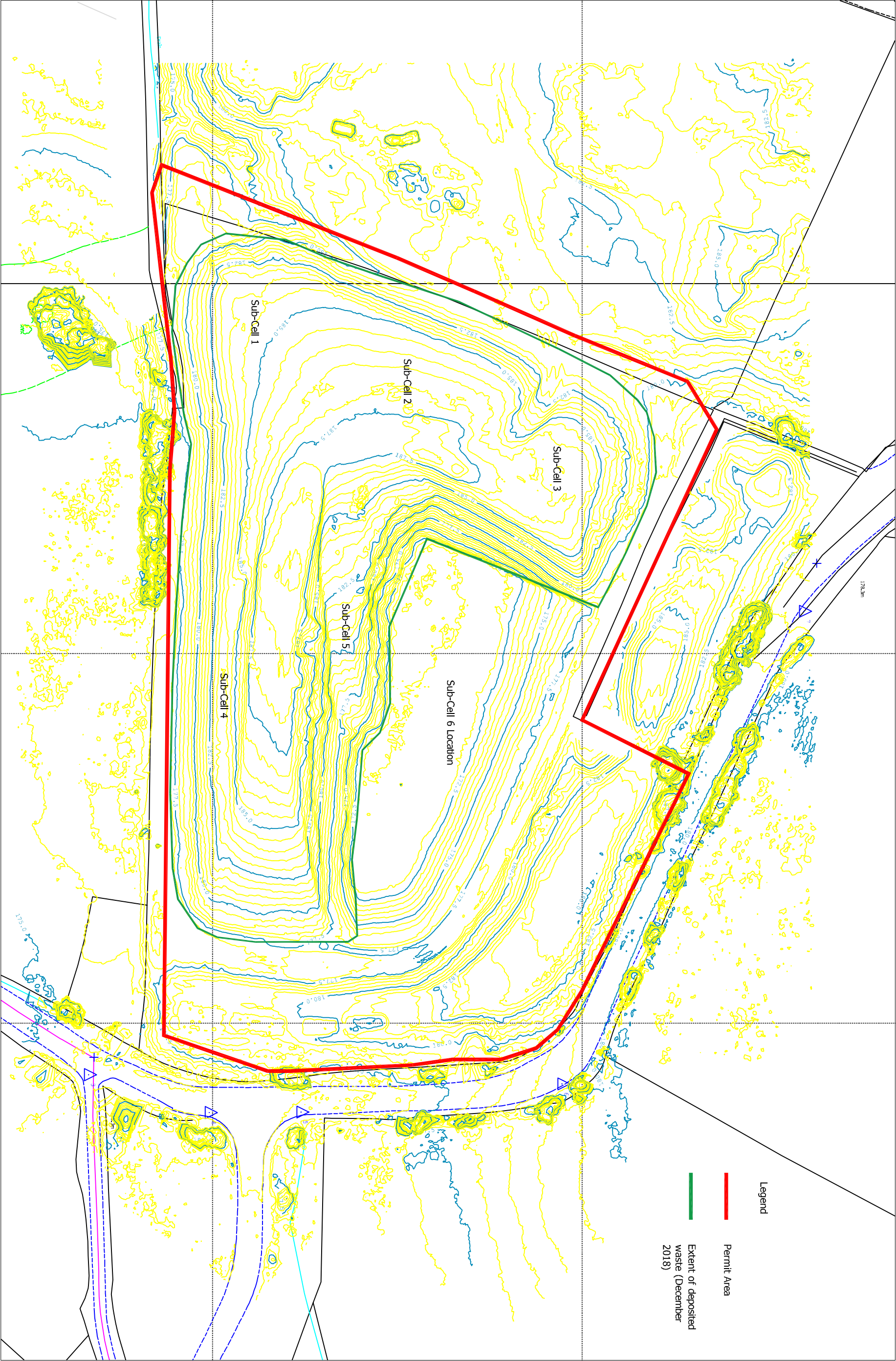


Figure 3 As-Built Formation

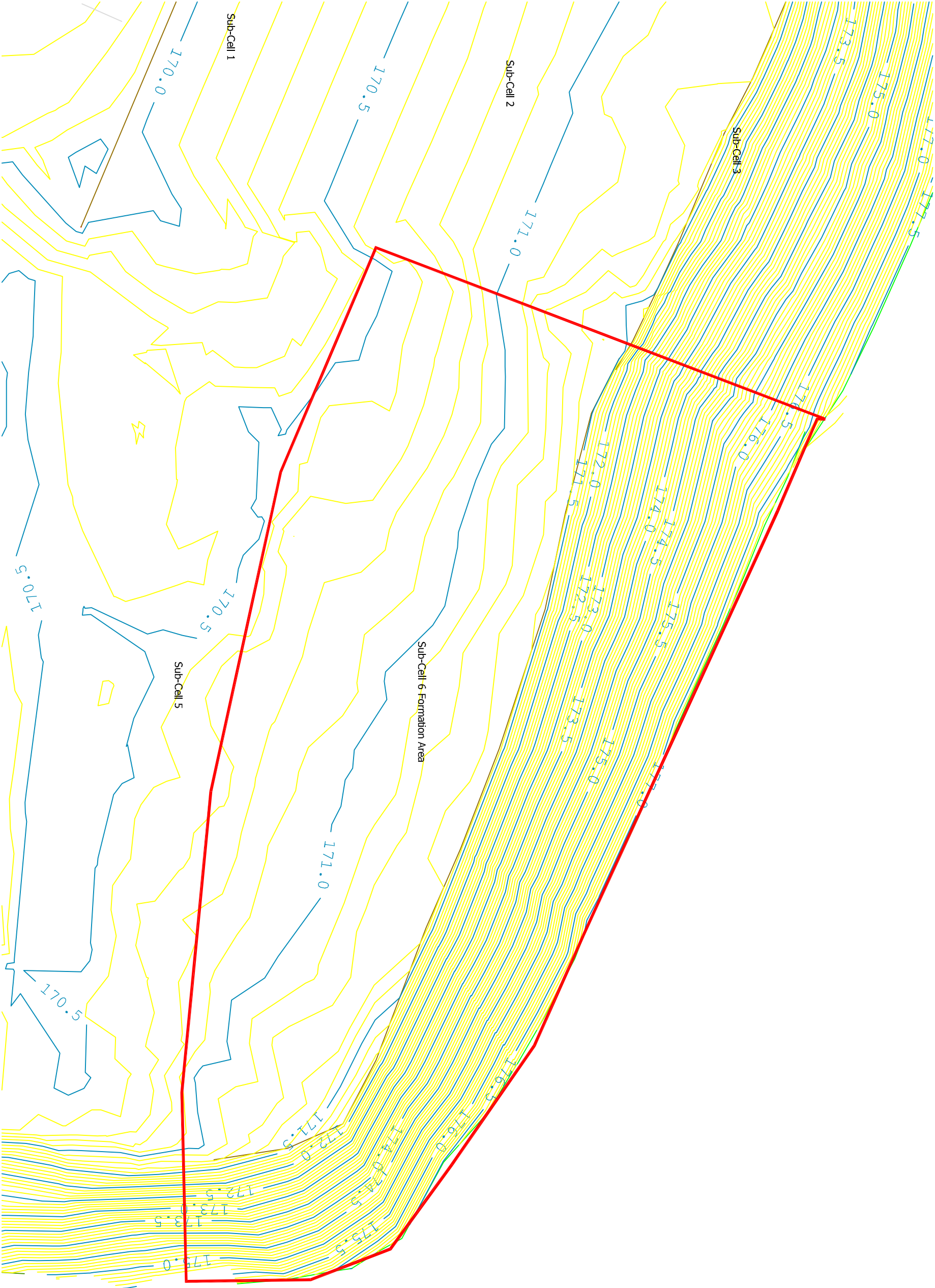


Figure 4 As-Built Mineral Liner

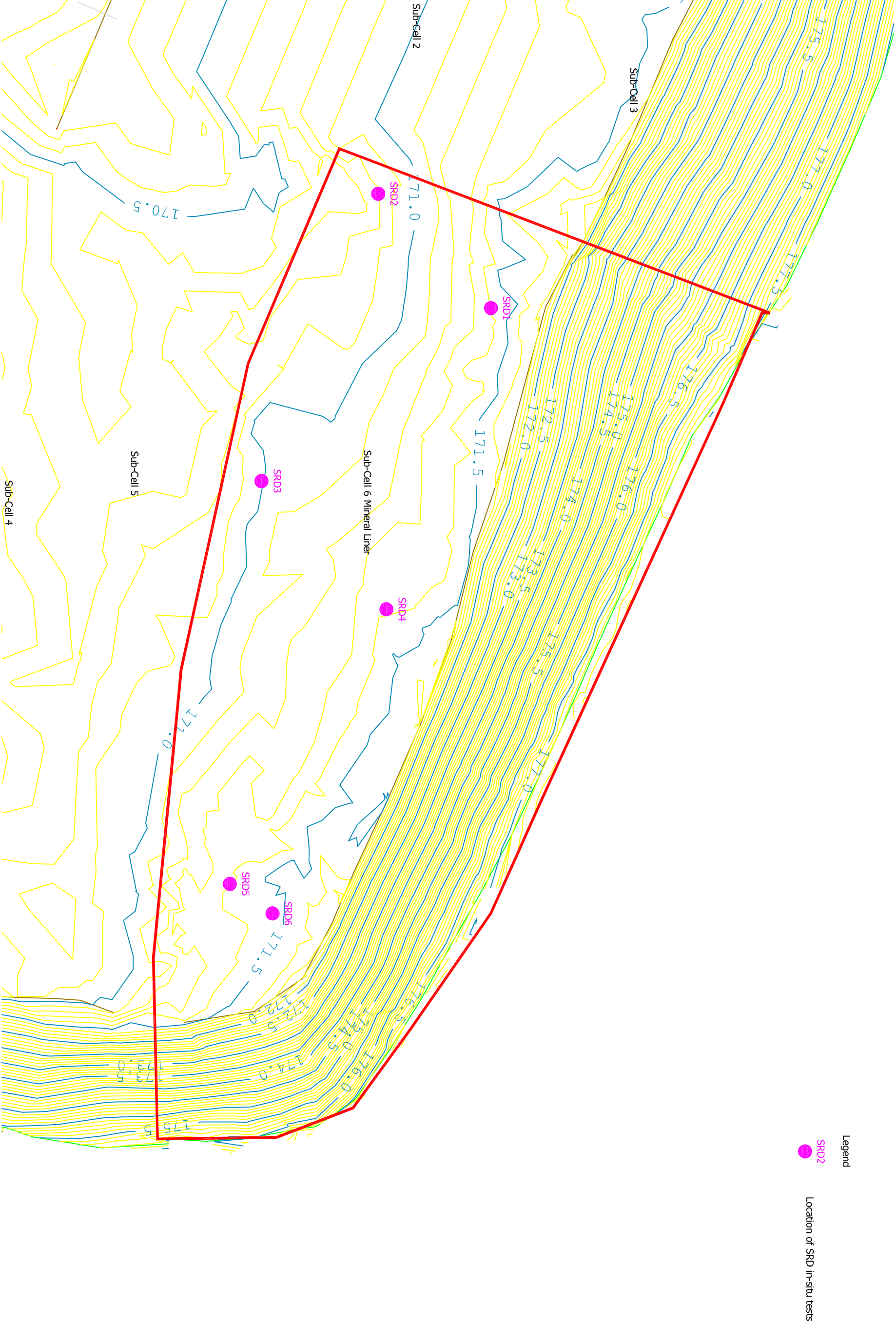


Figure 5 HDPE Panel Layout

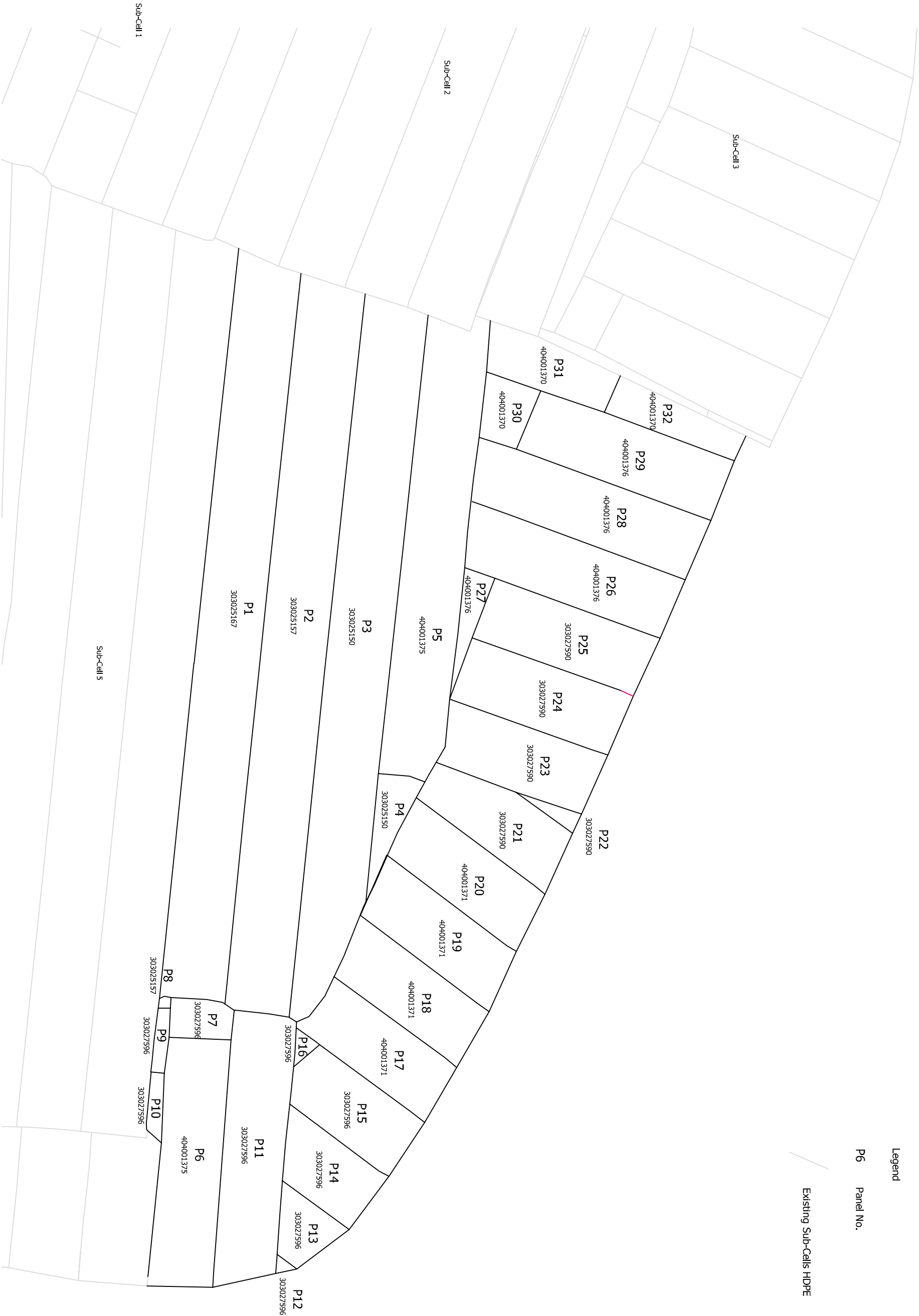


Figure 6 HDPE Repairs and Tests

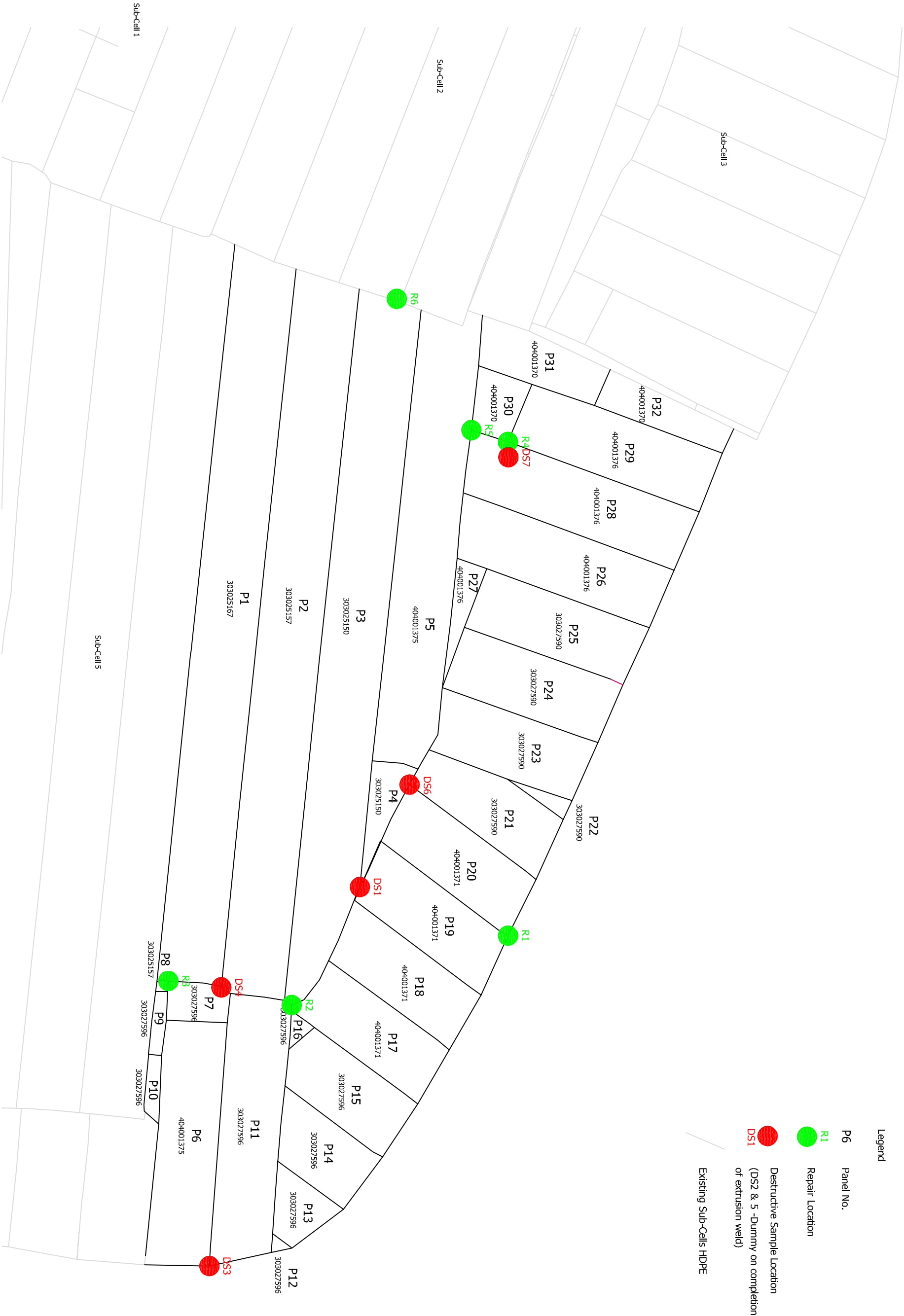


Figure 7 Protector Geotextile Panel Layout

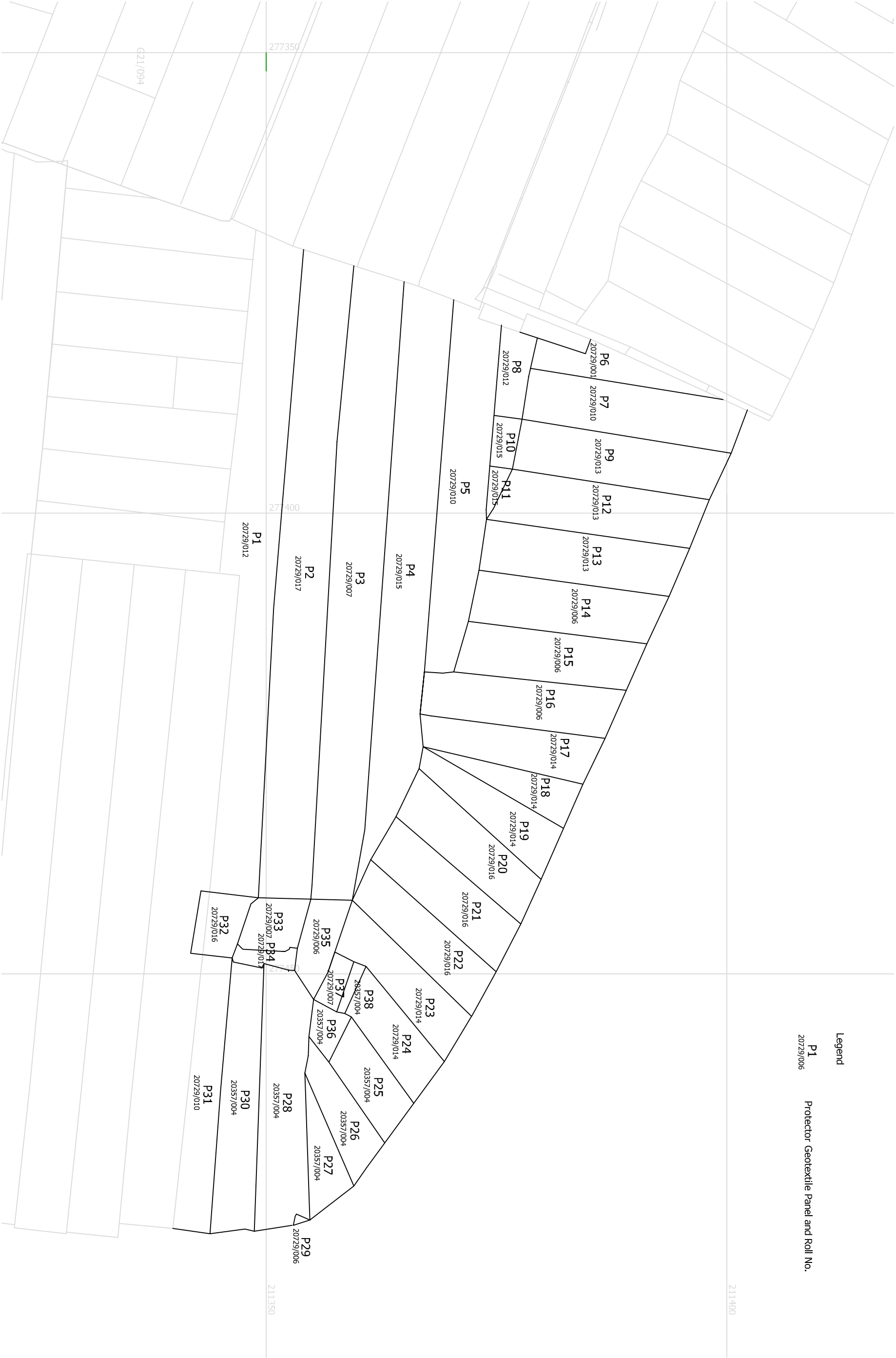


Figure 8 As-Built Drainage Layer

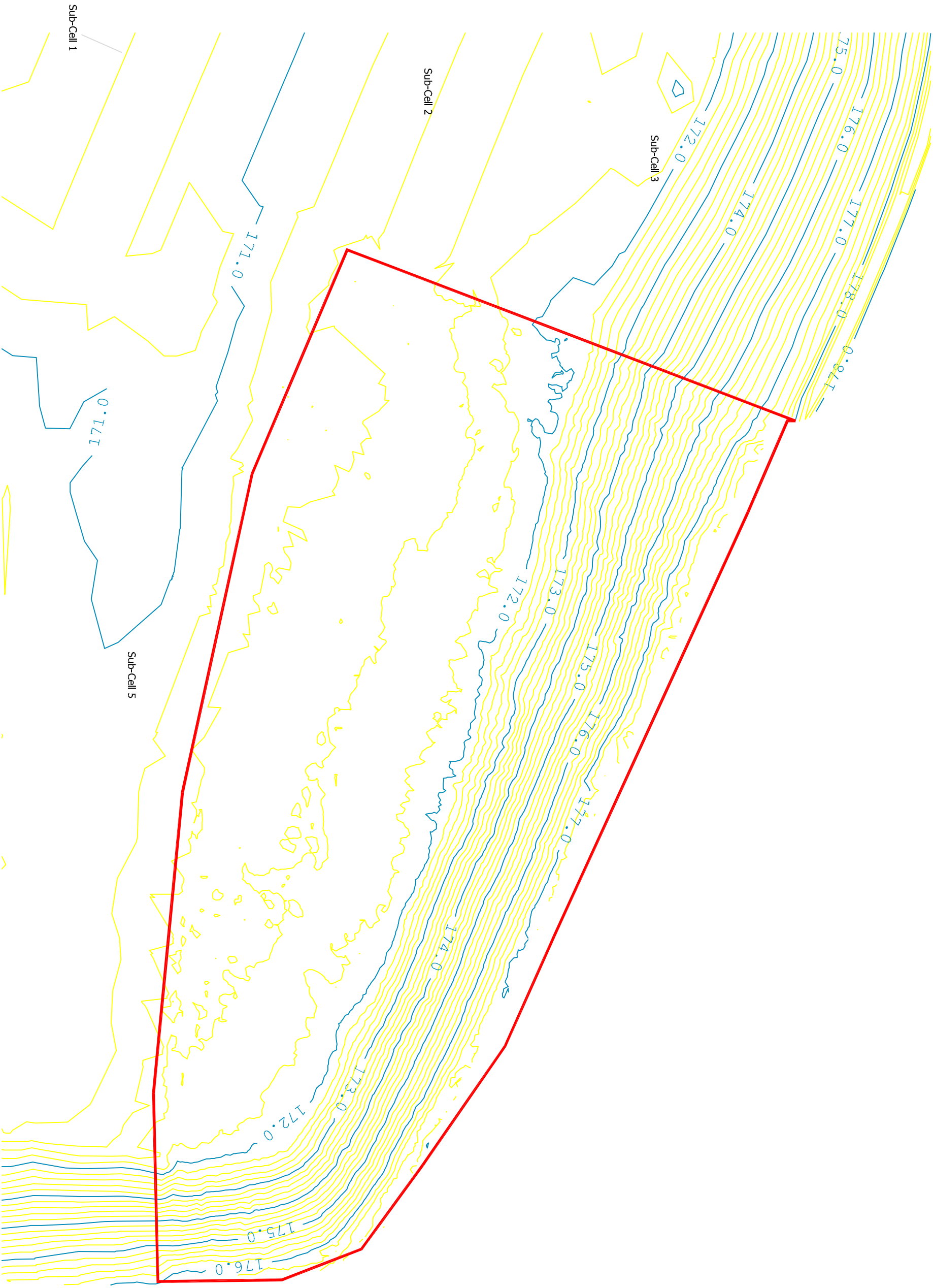
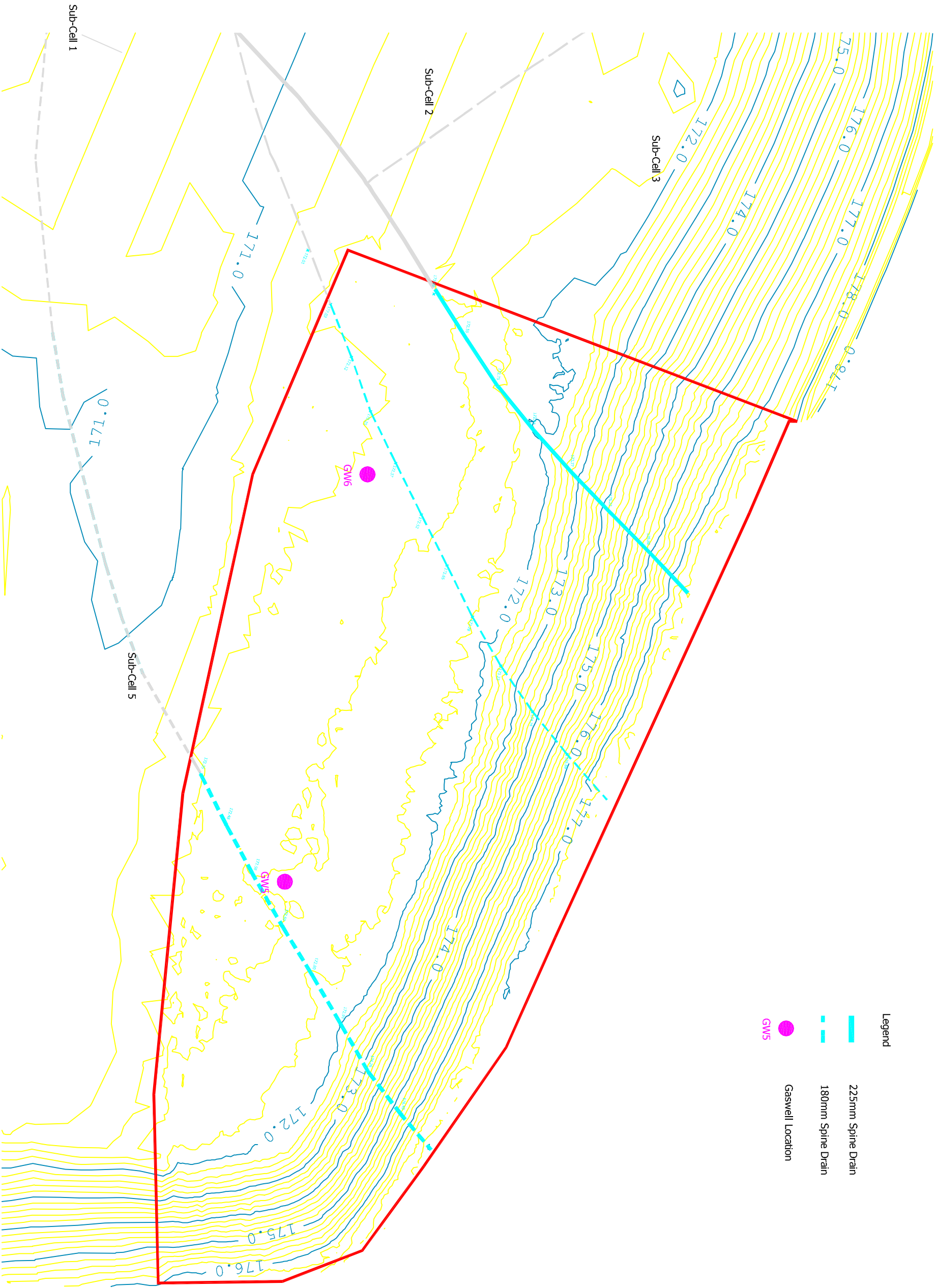


Figure 9 As-Built Leachate and Gas Extraction Systems



**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 1
Delivery Log for all
Materials

Report Number 1807r3v1d0219



Delivered Materials Inventory

CQA3

Site	Palleg Road Landfill Sub-Cell 6
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Date	Material	Manufacturer	Delivery Note	MQC Received?	MQC Pass?	Sample Number	Handle Store	Visual Check	Approved
19.06.2018	HPS11 -12 rolls	Geofabrics	61375	Y	Y		OK	OK	Y
19.06.2018	HPS11 - 1 roll	Geofabrics	61376	Y	Y		OK	OK	Y
20.06.2018	2mm DRS HDPE	GSE	VK110145	Y	Y		OK	OK	Y
5.7.18 - 10.10.18	Drainage Aggregates	S.J. Griffiths & Son	See attached aggregate summaries	n/a	n/a		OK	OK	Y
9.07.2018	Gas and Leachate Pipework	MGS Ltd.	41277	n/a	n/a		OK	OK	Y



Aggregate Delivery Record

CQA4

Site	Palleg Road Landfill Sub-Cell 6	Material	20mm Blinding Aggregate
-------------	--	-----------------	--------------------------------

Date	Delivery Note / Ticket No.	Tonnes	Cumulative (Tonnes)
05/07/2018	4025	19.60	19.60
05/07/2018	4026	19.60	39.20
05/07/2018	4027	19.14	58.34
05/07/2018	4028	19.06	77.40
05/07/2018	4029	19.12	96.52
05/07/2018	4030	19.44	115.96
06/07/2018	4031	19.32	135.28
06/07/2018	4032	19.40	154.68
06/07/2018	4033	19.18	173.86
06/07/2018	4034	19.16	193.02
06/07/2018	4035	19.18	212.20
06/07/2018	4036	19.16	231.36
10/07/2018	4047	19.36	250.72
10/07/2018	4048	19.44	270.16
10/07/2018	4049	19.36	289.52
10/07/2018	4050	19.44	308.96
10/07/2018	4153	19.50	328.46
10/07/2018	4154	18.54	347.00
10/07/2018	4155	18.52	365.52
10/07/2018	4156	18.42	383.94

10/07/2018	4157	18.54	402.48
10/07/2018	4201	19.40	421.88
11/07/2018	4158	18.54	440.42
11/07/2018	4159	18.64	459.06
11/07/2018	4160	17.66	476.72
11/07/2018	4161	18.72	495.44
11/07/2018	4162	18.08	513.52
10/08/2018	4217	19.14	532.66
10/08/2018	4218	19.20	551.86
10/08/2018	4219	19.28	571.14
10/08/2018	4220	19.20	590.34
10/08/2018	4221	19.12	609.46
10/08/2018	4222	19.20	628.66
13/08/2018	4224	15.16	643.82
13/08/2018	4225	19.30	663.12



Aggregate Delivery Record

CQA4

Site	Palleg Road Landfill Sub-Cell 6	Material	40mm Drainage Aggregate
------	---------------------------------	----------	-------------------------

Date	Delivery Note / Ticket No.	Tonnes	Cumulative (Tonnes)
22/08/2018	4234	19.24	19.60
22/08/2018	4235	19.44	39.04
22/08/2018	4236	19.24	58.28
22/08/2018	4237	19.16	77.44
22/08/2018	4238	19.32	96.76
22/08/2018	4239	19.44	116.20
24/08/2018	4242	19.04	135.24
24/08/2018	4243	19.26	154.50
24/08/2018	4244	19.26	173.76
24/08/2018	4245	19.26	193.02
24/08/2018	4246	19.34	212.36
24/08/2018	4247	19.44	231.80
28/08/2018	4248	19.44	251.24
28/08/2018	4249	19.42	270.66
28/08/2018	4250	19.34	290.00
28/08/2018	4101	19.26	309.26
28/08/2018	4102	19.10	328.36
28/08/2018	4103	19.42	347.78
30/08/2018	4106	19.14	366.92
30/08/2018	4107	19.26	386.18

30/08/2018	4108	19.40	405.58
30/08/2018	4109	19.20	424.78
30/08/2018	4110	19.26	444.04
30/08/2018	4111	19.12	463.16
31/08/2018	4112	19.26	482.42
31/08/2018	4113	19.22	501.64
31/08/2018	4192	18.50	520.14
31/08/2018	4114	19.16	539.30
31/08/2018	4193	18.30	557.60
31/08/2018	4115	19.36	576.96
31/08/2018	4116	19.12	596.08
31/08/2018	4117	19.04	615.12
31/08/2018	4194	18.44	633.56
31/08/2018	4195	18.56	652.12
05/09/2018	4123	19.36	671.48
05/09/2018	4124	19.44	690.92
05/09/2018	4125	19.20	710.12
05/09/2018	4126	19.44	729.56
05/09/2018	4127	19.16	748.72
06/09/2018	4128	19.34	768.06
14/09/2018	4130	19.44	787.50
14/09/2018	4131	19.28	806.78
14/09/2018	4132	19.38	826.16
14/09/2018	4133	19.22	845.38
14/09/2018	4134	19.24	864.62

20/09/2018	4135	19.42	884.04
24/09/2018	4138	19.28	903.32
24/09/2018	4139	19.42	922.74
24/09/2018	4140	19.36	942.10
25/09/2018	4143	19.08	961.18
25/09/2018	4144	19.40	980.58
25/09/2018	4146	19.32	999.90
04/10/2018	4251	19.44	1019.34
04/10/2018	4252	19.34	1038.68
04/10/2018	4253	19.34	1058.02
04/10/2018	4254	19.38	1077.40
04/10/2019	4255	19.22	1096.62
04/10/2018	4256	19.30	1115.92
05/10/2018	4257	19.34	1135.26
05/10/2018	4258	19.40	1154.66
05/10/2018	4259	19.24	1173.90
05/10/2018	4358	18.72	1192.62
05/10/2018	4359	18.70	1211.32
05/10/2018	4360	18.56	1229.88
05/10/2018	4260	19.14	1249.02
05/10/2018	4261	19.14	1268.16
05/10/2018	4361	18.56	1286.72
05/10/2018	4362	18.68	1305.40
05/10/2018	4262	19.34	1324.74
05/10/2018	4363	18.80	1343.54

08/10/2018	4263	19.20	1362.74
08/10/2018	4264	19.18	1381.92
08/10/2018	4265	19.34	1401.26
08/10/2018	4266	19.26	1420.52
08/10/2018	4267	19.34	1439.86
08/10/2018	4268	19.38	1459.24
10/10/2018	4269	19.32	1478.56
10/10/2018	4270	19.44	1498.00
10/10/2018	4271	19.38	1517.38
10/10/2018	4272	19.44	1536.82



Geosynthetic Materials Inventory

CQA2

Site	Palleg Road Landfill Sub-Cell 6	Manufacturer & Material Type	GEO Fabrics HPS11
-------------	--	---	-------------------

Date	Batch No	Roll No	Length	Width	MQC Received?	MQC Pass?	Sample Number	Handle Store	Visual Check	Approved
19.06.18	20357	4	75	6	Y	Y		OK	OK	Y
19.06.18	20729	1	75	6	Y	Y	S1	OK	OK	Y
19.06.18	20729	6	75	6	Y	Y		OK	OK	Y
19.06.18	20729	7	75	6	Y	Y		OK	OK	Y
19.06.18	20729	10	75	6	Y	Y		OK	OK	Y
19.06.18	20729	11	75	6	Y	Y	S2	OK	OK	Y
19.06.18	20729	12	75	6	Y	Y		OK	OK	Y
19.06.18	20729	13	75	6	Y	Y		OK	OK	Y
19.06.18	20729	14	75	6	Y	Y		OK	OK	Y
19.06.18	20729	15	75	6	Y	Y		OK	OK	Y
19.06.18	20729	16	75	6	Y	Y		OK	OK	Y

19.06.18	20729	17	75	6	Y	Y		OK	OK	Y
19.06.18	20729	18	75	6	Y	Y	S3	OK	OK	Y



Geosynthetic Materials Inventory

CQA2

Site	Palleg Road Landfill Sub-Cell 6	Manufacturer & Material Type	HDPE 2mm Textured
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Date	Batch No	Roll No	Length	Width	MQC Received?	MQC Pass?	Sample Number	Handle Store	Visual Check	Approved
20.06.18	39201089	303025150	80	7	Y	Y		OK	OK	Y
20.06.18	39201089	303025157	80	7	Y	Y		OK	OK	Y
20.06.18	39201089	303025167	80	7	Y	Y		OK	OK	Y
20.06.18	39201089	303027590	80	7	Y	Y		OK	OK	Y
20.06.18	39201089	303027596	80	7	Y	Y	S1	OK	OK	Y
20.06.18	39201089	404001370	80	7	Y	Y		OK	OK	Y
20.06.18	39201089	404001371	80	7	Y	Y		OK	OK	Y
20.06.18	39201089	404001375	80	7	Y	Y	S2	OK	OK	Y
20.06.18	39201089	404001376	80	7	Y	Y		OK	OK	Y
20.06.18	39201089	404001378	80	7	Y	Y		OK	OK	Y

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 2
Photographic Record of
Site Works
Report Number 1807r3v1d0219



Formation construction on 11/06/18



Mineral Liner with SRD test in foreground on 27/06/18



Mineral Liner on 29/06/18



Commencement of HDPE placement on 2/7/18



Deployment of Textured HDPE on side slopes



Vacuum box testing of HDPE



Drainage pipe with proprietary electrofusion collar



Drainage pipe runs on base

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 3
Mineral Liner Test Results
and CQA Monitoring
Records

Report Number 1807r3v1d0219



Daily Earthworks Record

CQA7

Site	Palleg Road Landfill Sub-Cell 6	Material	Mineral Liner
-------------	--	-----------------	----------------------

Date	Location	Layer	Visual Check	Volume Placed m ³	Cumulative Volume m ³	Layer Thickness	No. of Passes	Approved	Non-Con No.	Comment
27.06.2018	East of Cell	1	OK	356		250	10	Y		Very dry surface
29.06.2018	Centre	1	OK	450		250	10	Y		Very dry surface
02.07.2018	Whole Cell	1	OK	25		250	10	Y		Overnight rain - rerolled - satisfactory



Mineral Liner In-Situ Testing

CQA8

Site	Palleg Road Landfill Sub-Cell 6	Material	Mineral Liner
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Test Reference	Layer	Test Type	Test Date	Constant Head Permeability (P) m/sec	Clay Fraction (PSD) %	Particle Density (PD) kg/m ³	Atterberg Values LL/PI/PI %			In Situ Dry Density kg/m ³	Moisture Content (MC) %	Undrained Shear Strength (SS) kPa	Approved	Non-Con No
SRD1	1	In-situ	27.06.18							2.16	6.8	>120	Y	
SRD2	1	In-situ	27.06.18							2.16	5.5	>120	Y	
SRD3	1	In-situ	27.06.18							2.26	4.9	>120	Y	
SRD4	1	In-situ	27.06.18							1.77	9.8	>120	Y	
SRD5	1	In-situ	27.06.18							2.24	5.6	>120	Y	
SRD6	1	In-situ	27.06.18							2.13	4.9	>120	Y	
S1	ST	Laboratory	02.08.18	1.49 E-10		2.67				2.12	9.9		Y	
S2	ST	Laboratory	02.08.18	2.97 E-10		2.68				2.05	7.2		Y	
S3	ST	Laboratory	02.08.18	3.00 E-10		2.66				2.16	5.2		Y	
Sample 1		Laboratory	03/17.07.18		23.00		30	13	17		11.0		Y	
Sample 2		Laboratory	03/17.07.18		15.00		25	13	12		9.0		Y	

Sample 3		Laboratory	03/17.07.18		18.00		29	13	16		10.0		Y	
Sample 4		Laboratory	03/07/2018				30	14	16		9.0		Y	
Sample 5		Laboratory	03/07/2018				29	13	16		7.0		Y	
Sample 6		Laboratory	03/07/2018				29	10	19		10.0		Y	



Laboratory Report



Contract Number: 39923

Client Ref: **D8195-18**Report Date: **02-08-2018**

Client PO:

Client **Apex Drilling Services Ltd**
Sturmi Way
Village Farm Industrial Estate, Pyle
Bridgend
CF33 6BZ

Contract Title: **Palleg Landfill**
For the attention of: **Andrew Grogan**

Date Received: **05-07-2018**
Date Commenced: **05-07-2018**
Date Completed: **02-08-2018**

Test Description	Qty
Permeability in a Hydraulic Consolidation Cell up to 6 days duration Price for 75mm BS1377 : Part 6 : Clause 4 : 1990, PLEASE NOTE IT IS LIKELY THIS TEST WILL INCUR EXTRA OVER DAY CHARGES.	3
Particle Density (Gas Jar) BS 1377:1990 - Part 2 : 8.2 - * UKAS	3
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)
Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative/Accounts Assistant)
Wayne Honey (Administrative/Quality Assistant)

Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

Specimen Details

Borehole	S1
Sample No.	1
Depth	m
Date	
Disturbed / Undisturbed	Remoulded 4.5kg

Description of Specimen

Grey fine-coarse gravelly silty stiff CLAY

Initial Specimen Conditions

Height	mm	19.71
Diameter	mm	74.78
Area	mm ²	4391.98
Volume	cm ³	86.57
Mass	g	201.70
Dry Mass	g	183.50
Density	Mg/m ³	2.33
Dry Density	Mg/m ³	2.12
Moisture Content	%	9.9
Voids Ratio		0.250
Specific Gravity	kN/m ³	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	21
Density	Mg/m ³	2.56
Dry Density	Mg/m ³	2.12

Test Setup

Date started	11/07/2018
Date Finished	18/07/2018
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P1
Cell Number	C1

DP Gans

Checked and Approved By

Date

Client Ref



Palleg Landfill

Contract No

39923

Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

Specimen Details

Borehole		S1
Sample No.		1
Depth	m	
Date		

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	48.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	398.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	200.00
Back Pressure	kPa	100.00
Excess Pore Pressure	kPa	102.00
Pore Pressure at End	kPa	101.00
Consolidated Volume	cm ³	66.47
Consolidated Height	mm	18.18
Consolidated Area	mm ²	3712.13
Vol. Compressibility	m ² /MN	0.0383
Consolidation Coef.	m ² /yr.	2.2989
Final Voids Ratio		-0.040

Permeability

Cell Pressure	kPa	200.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00374
Average Temperature	°C	20

Vertical Permeability Kv	m/s	1.49 x 10⁻¹⁰
---------------------------------	------------	--------------------------------

D P Gnan

Checked and Approved By

Date

Client Ref



Palleg Landfill

Contract No

39923

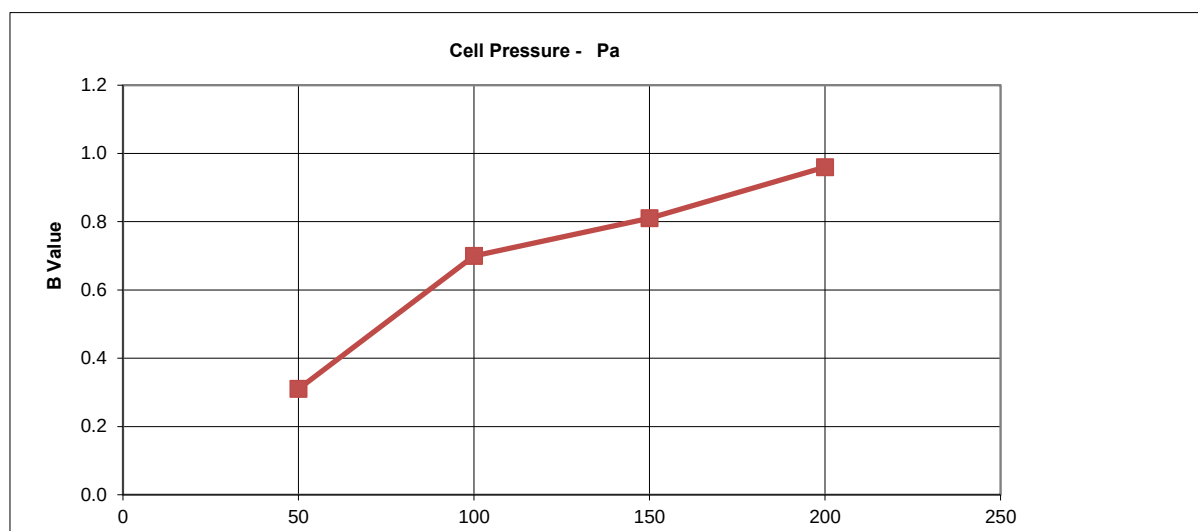
Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

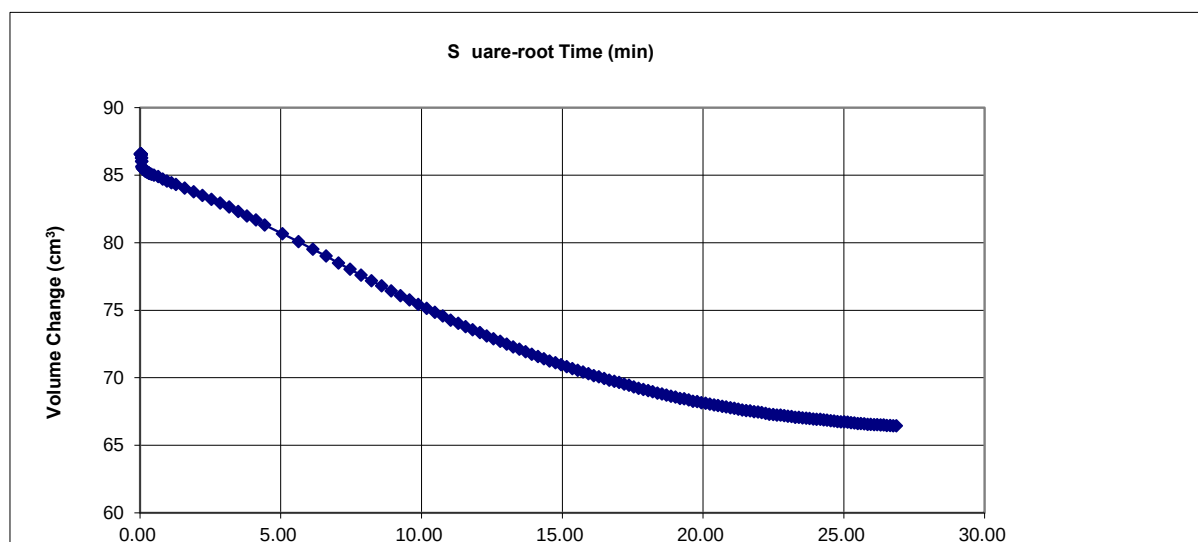
Specimen Details

Borehole	S1
Sample No.	1
Depth	m
Date	

Saturation Stage



Consolidation Stage



DP Gang

Checked and Approved By

Date

Client Ref

GSTL
GEO Site & Testing Services Limited

Palleg Landfill

Contract No

39923

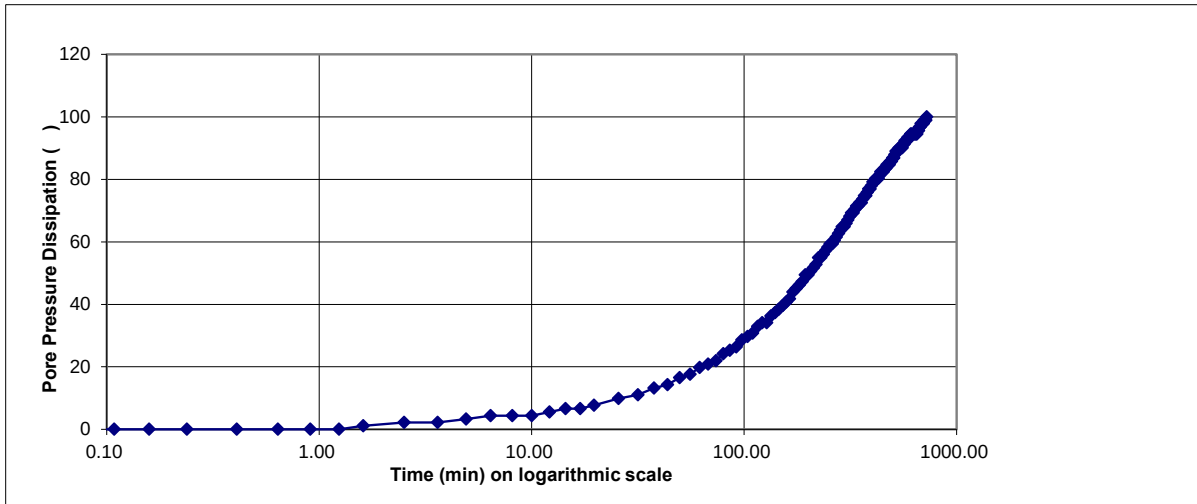
Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

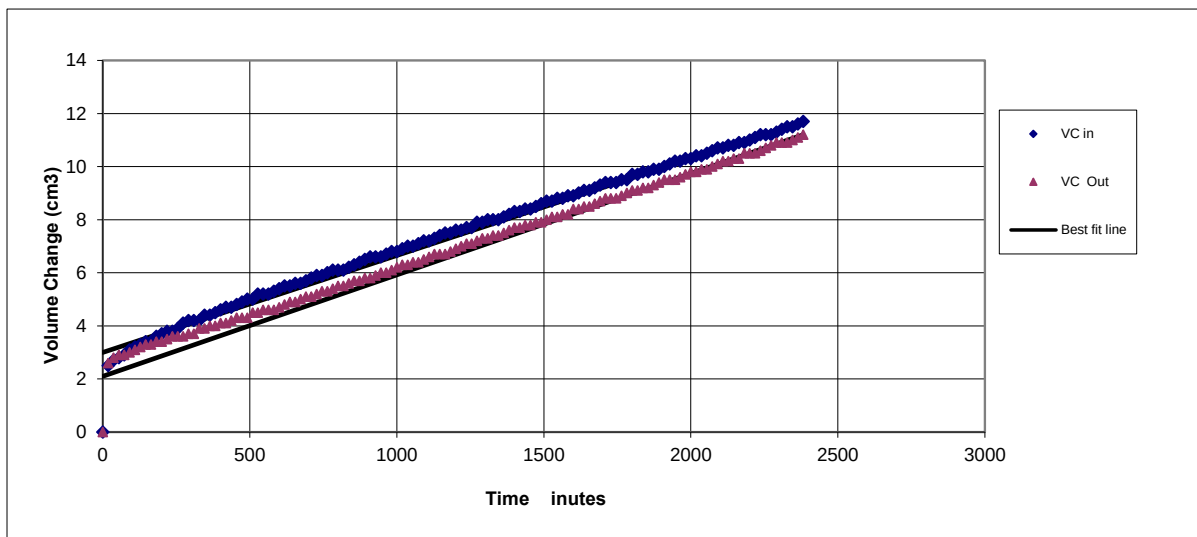
Specimen Details

Borehole	S1
Sample No.	1
Depth	m
Date	

Consolidation Stage



Permeability Stage



DP Gans

Checked and Approved By

Date

Client Ref

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GEO Site & Testing Services Limited

Palleg Landfill

Contract No

39923

Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

Specimen Details

Borehole	S2
Sample No.	
Depth	m
Date	
Disturbed / Undisturbed	Remoulded 4.5Kg

Description of Specimen

Grey fine-coarse gravelly silty stiff CLAY
--

Initial Specimen Conditions

Height	mm	19.79
Diameter	mm	74.86
Area	mm ²	4401.39
Volume	cm ³	87.10
Mass	g	191.60
Dry Mass	g	178.70
Density	Mg/m ³	2.20
Dry Density	Mg/m ³	2.05
Moisture Content	%	7.2
Voids Ratio		0.292
Specific Gravity	kN/m ³	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	16.84
Density	Mg/m ³	2.40
Dry Density	Mg/m ³	2.05

Test Setup

Date started	23/07/2018
Date Finished	
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P4
Cell Number	C4

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Date

Client Ref

Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

Specimen Details

Borehole		S2
Sample No.		
Depth	m	
Date		

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	48.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	195.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	50.00
Cell Pressure	kPa	250.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	50.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm ³	35.60
Consolidated Height	mm	15.89
Consolidated Area	mm ²	2666.50
Vol. Compressibility	m ² /MN	0.0339
Consolidation Coef.	m ² /yr.	11.8250
Final Voids Ratio		-0.472

Permeability

Cell Pressure	kPa	250.00
Effective Cell Pressure	kPa	50.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00613
Average Temperature	°C	20

Vertical Permeability K_v	m/s	2.97 x 10⁻¹⁰
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D P Gnan

Checked and Approved By

Date

Client Ref



Palleg Landfill

Contract No

39923

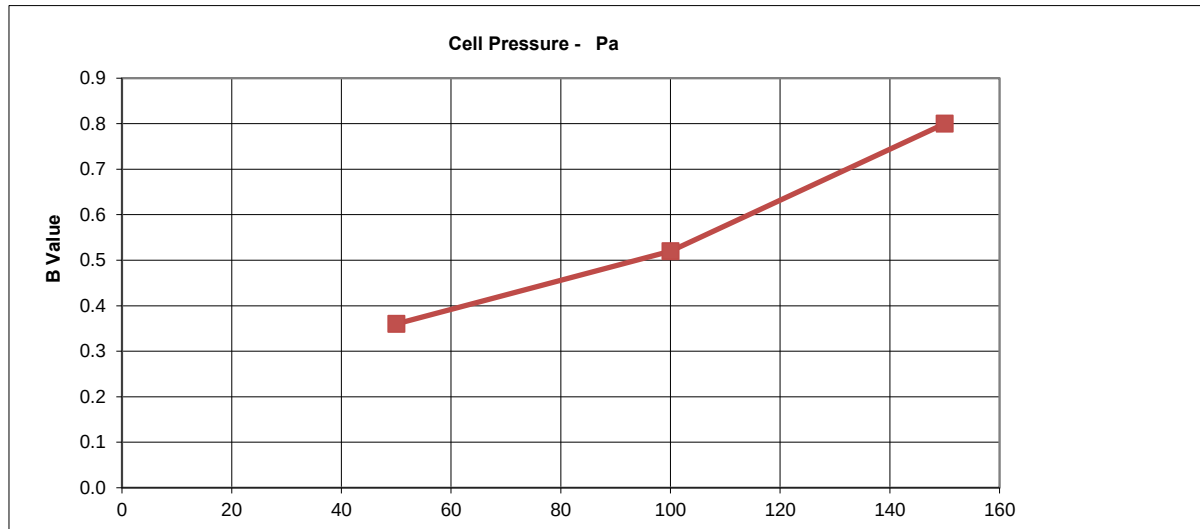
Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

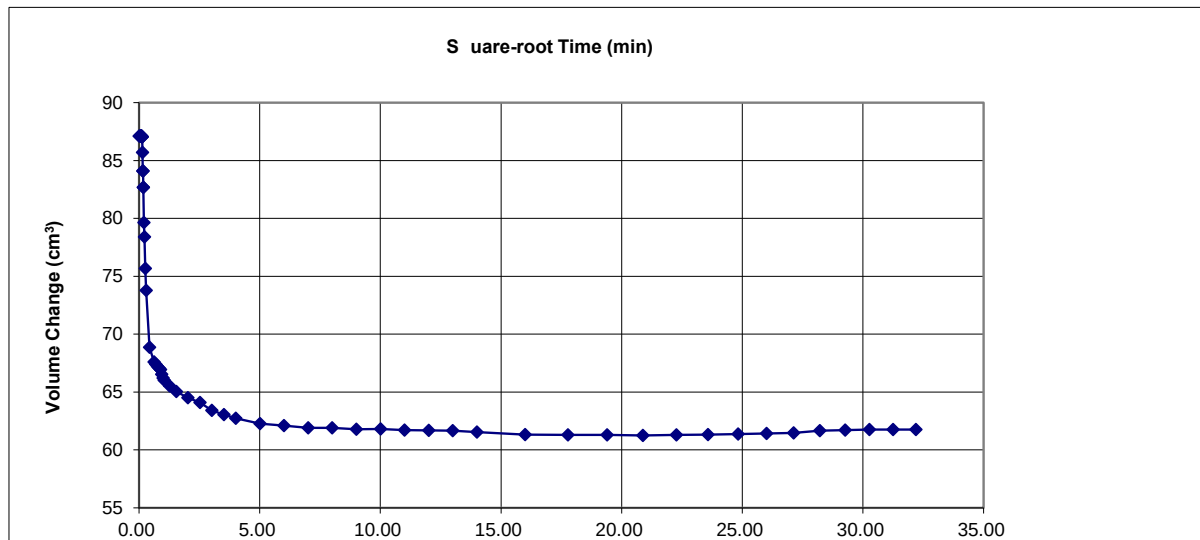
Specimen Details

Borehole	S2
Sample No.	
Depth	m
Date	

Saturation Stage



Consolidation Stage



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Checked and Approved By

Date

Client Ref

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GEO Site & Testing Services Limited

Palleg Landfill

Contract No

39923

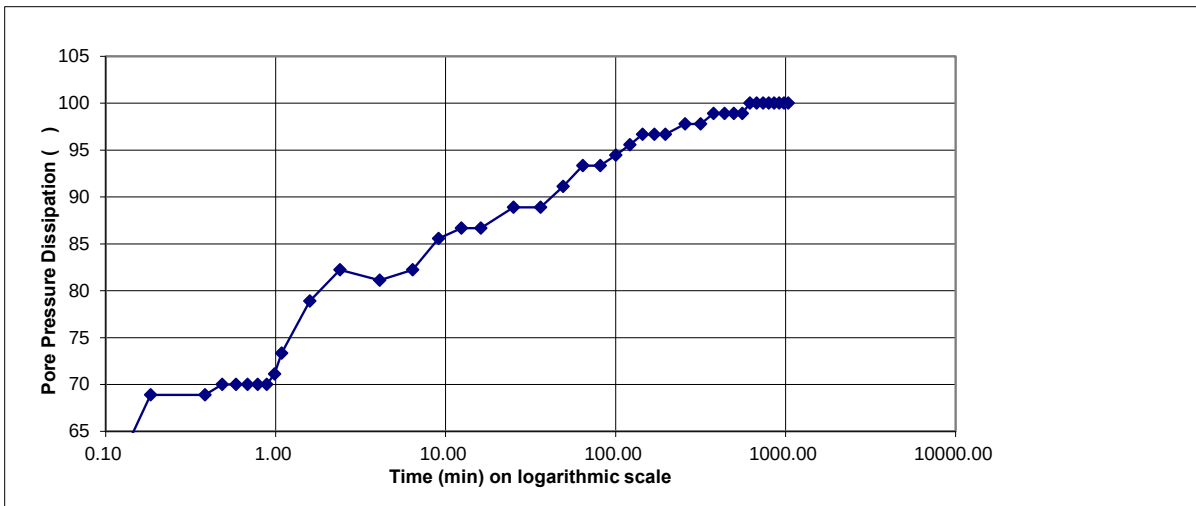
Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

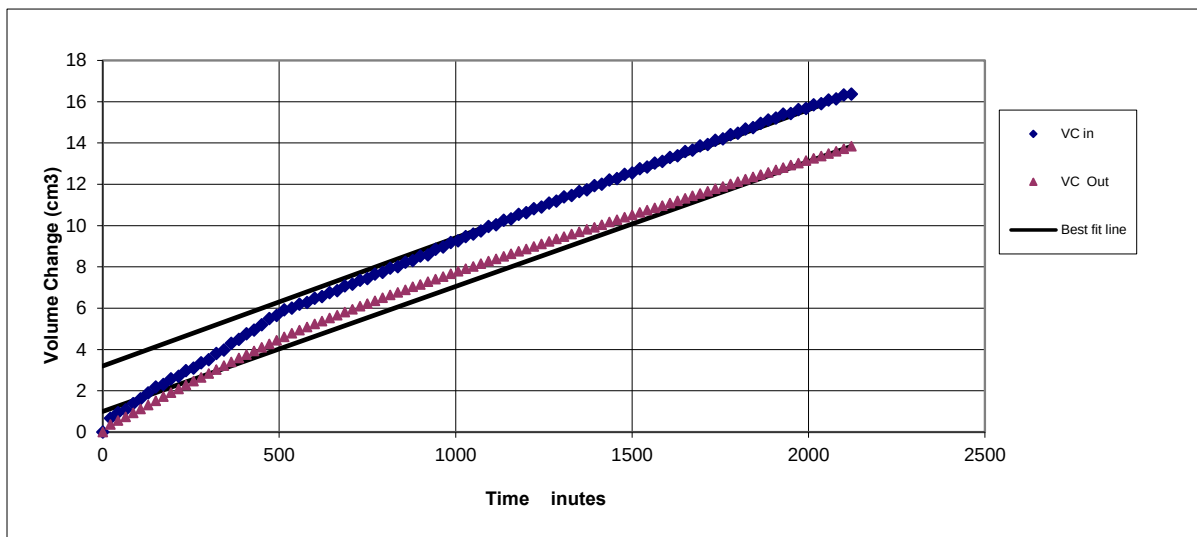
Specimen Details

Borehole	S2
Sample No.	
Depth	m
Date	

Consolidation Stage



Permeability Stage



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Date

Client Ref

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GEO Site & Testing Services Limited

Palleg Landfill

Contract No

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Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

Specimen Details

Borehole	S3
Sample No.	
Depth	0
Date	27/07/2018
Disturbed / Undisturbed	Remoulded 4.5Kg

Description of Specimen

Grey fine-coarse gravelly very silty stiff CLAY

Initial Specimen Conditions

Height	mm	19.80
Diameter	mm	74.69
Area	mm ²	4381.42
Volume	cm ³	86.75
Mass	g	197.30
Dry Mass	g	187.50
Density	Mg/m ³	2.27
Dry Density	Mg/m ³	2.16
Moisture Content	%	5.2
Voids Ratio		0.226
Specific Gravity	kN/m ³	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	10.67
Density	Mg/m ³	2.39
Dry Density	Mg/m ³	2.16

Test Setup

Date started	16/07/2018
Date Finished	24/07/2018
Top Drain Used	y
Base Drain Used	y
Pressure System Number	P1
Cell Number	C1

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27/07/18
Date

Client Ref



Palleg Landfill

Contract No

39923

Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

Specimen Details

Borehole		S3
Sample No.		
Depth	m	0
Date		27/07/2018

Saturation

Cell Pressure Incr.	kPa	50.00
Back Pressure Incr.	kPa	48.00
Differential Pressure	kPa	2.00
Final Cell Pressure	kPa	200.00
Final Pore Pressure	kPa	195.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	200.00
Back Pressure	kPa	100.00
Excess Pore Pressure	kPa	100.00
Pore Pressure at End	kPa	100.00
Consolidated Volume	cm ³	52.45
Consolidated Height	mm	17.19
Consolidated Area	mm ²	3226.54
Vol. Compressibility	m ² /MN	0.0365
Consolidation Coef.	m ² /yr.	3.9538
Final Voids Ratio		-0.259

Permeability

Cell Pressure	kPa	200.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.00693
Average Temperature	°C	20

Vertical Permeability Kv	m/s	3 x 10⁻¹⁰
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Date

Client Ref



Palleg Landfill

Contract No

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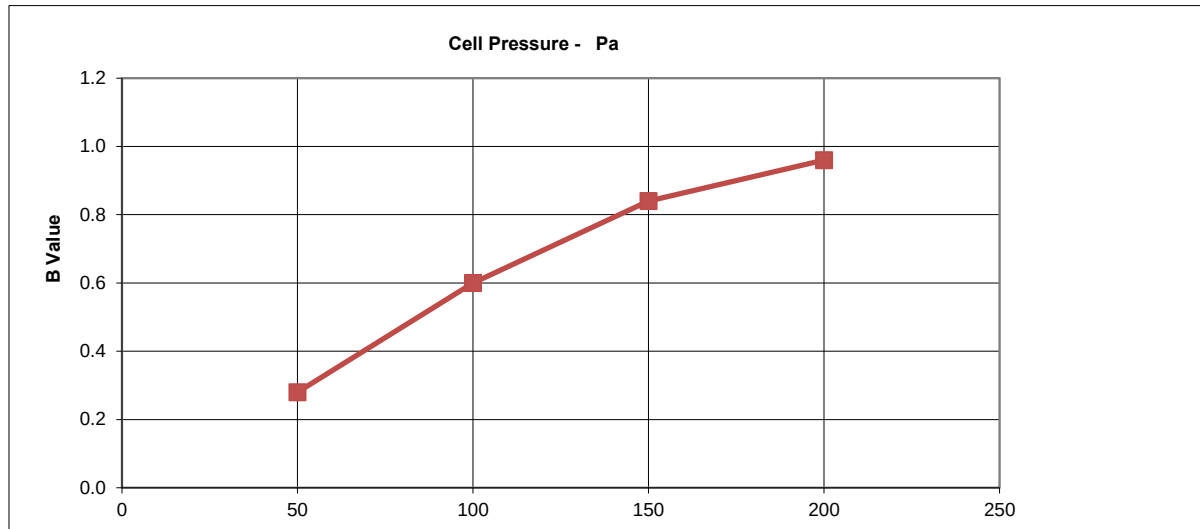
Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

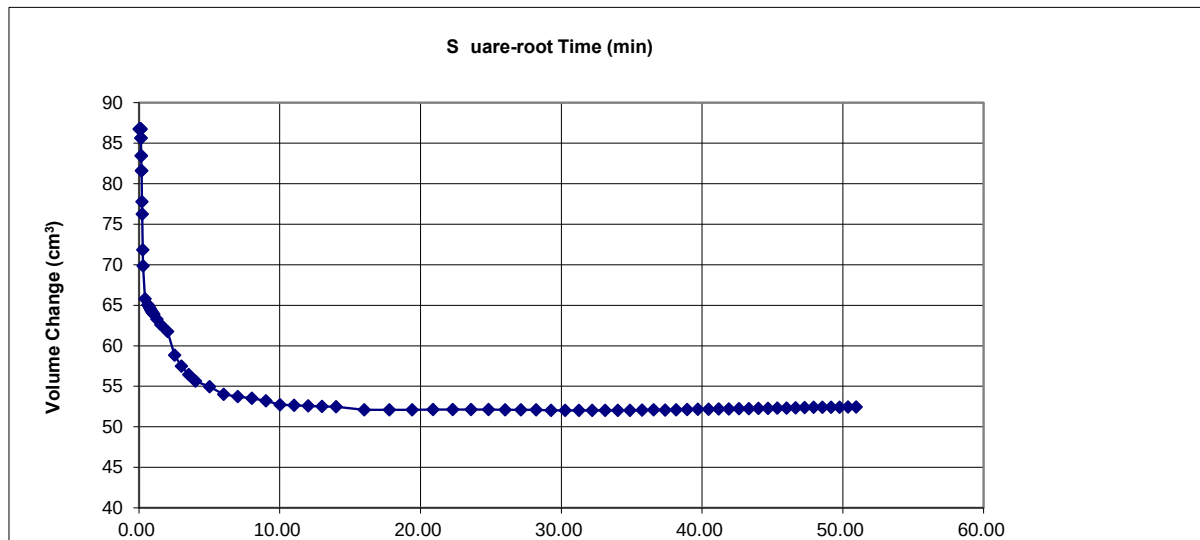
Specimen Details

Borehole	S3
Sample No.	
Depth	m
Date	27/07/2018

Saturation Stage



Consolidation Stage



DP Gang

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27/07/18
Date

Client Ref

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Palleg Landfill

Contract No

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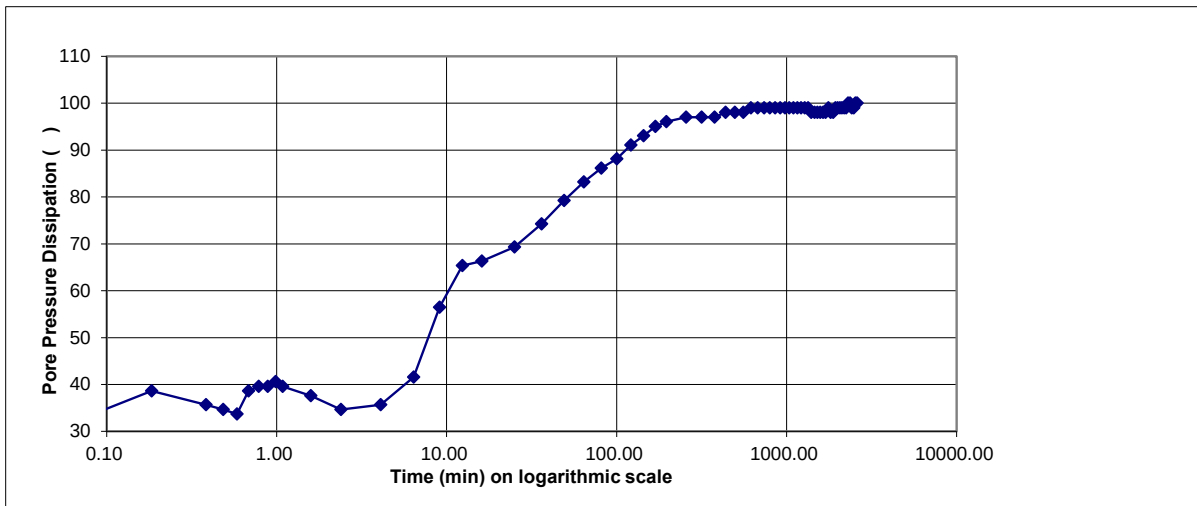
Permeability in a Hydraulic Consolidation Cell

BS 1377 : Part 6 : 1990 Clause 4

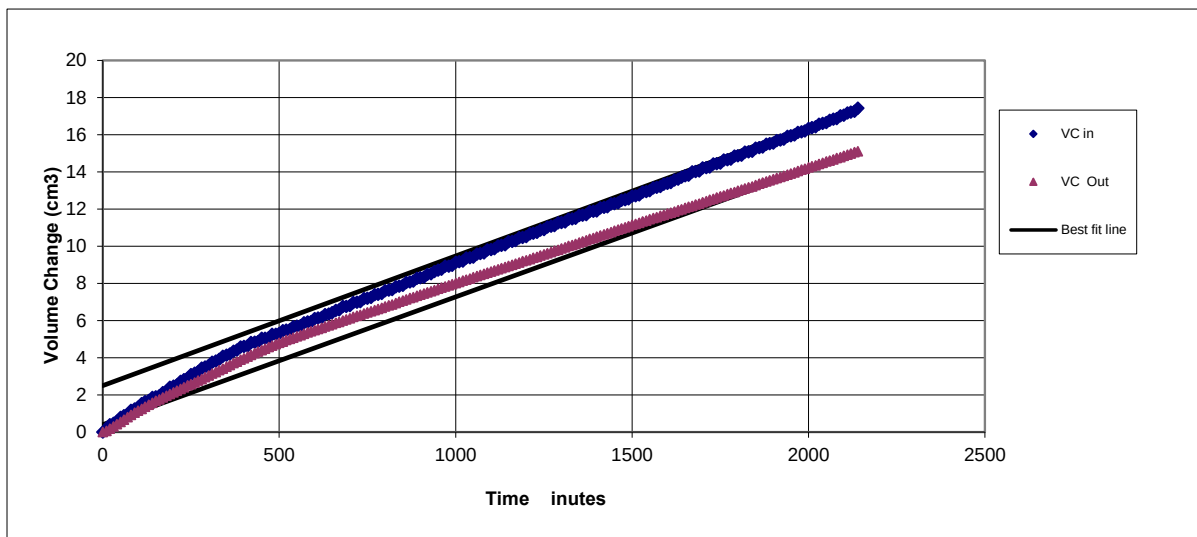
Specimen Details

Borehole	S3
Sample No.	
Depth	m
Date	27/07/2018

Consolidation Stage



Permeability Stage



D P Gans

Checked and Approved By

27/07/18
Date

Client Ref

Contract No

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Palleg Landfill

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TEST REPORT
Insitu Density Test (Sand Replacement)
BS 1377 : Part 9 : 1990
Clause 2.2 Large Cylinder

Project No.: **D8195-18** Client: **JLA Recycling**
 Project Name: **Palleg Landfill** Address: **Palleg Road**
 Sample No.: **SRD 1,2,3** **Cwmtwrch**
SA92UT

Site Reference: **Tests 1,2,3** Sample Type: **Insitu**
 Location in works: **SRD Tests 1.2.3** Material Description: **Grey slightly sandy**
Very gravelly CLAY
 Date Tested: **27/06/2018** Material Source: **Site Generated**
 Tested By: **K Lester** Material Supplier: **Site Generated**
 Environmental Conditions: **Sunny** Specification: **BS1377: Part 9 : 1990**

Test Results

Location Reference	1	2	3		
Bulk Density	2.31	2.28	2.37		
Moisture Content	6.8	5.5	4.9		
Dry Density	2.16	2.16	2.26		

Relative Compaction	#VALUE!	#VALUE!	#VALUE!		
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Relative compaction based on:-

Maximum Dry Density	N/A	Mg/m ³
Optimum Moisture Content	N/A	%
OMC/MDD relates to sample:-		

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BS 1377 Part 9 SR Rev. 1.0		<i>A Grogan</i>	03/07/2018	
		A Grogan, Quality Manager		

TEST REPORT
Insitu Density Test (Sand Replacement)
BS 1377 : Part 9 : 1990
Clause 2.2 Large Cylinder

Project No.: D8195-18	Client: JLA Recycling
Project Name: Palleg Landfill	Address: Palleg Road Cwmtwrch SA92UT
Sample No.: SRD 4,5,6	

Site Reference: Tests 4,5,6	Sample Type: Insitu
Location in works: SRD Tests 4.5.6	Material Description: Grey slightly sandy Very gravelly CLAY
Date Tested: 27/06/2018	Material Source: Site Generated
Tested By: K Lester	Material Supplier: Site Generated
Environmental Conditions: Sunny	Specification: BS1377: Part 9 : 1990

Test Results

Location Reference	1	2	3		
Bulk Density	1.95	2.37	2.23		
Moisture Content	9.8	5.6	4.9		
Dry Density	1.77	2.24	2.13		

Relative Compaction	#VALUE!	#VALUE!	#VALUE!		
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Relative compaction based on:-

Maximum Dry Density	N/A	Mg/m ³
Optimum Moisture Content	N/A	%

OMC/MDD relates to sample:-

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QA Ref. BS 1377 Part 9 SR Rev. 1.0	 Apex Testing Solutions Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	Approver <i>A Grogan</i>	Date 03/07/2018	Fig
		A Grogan, Quality Manager		

TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

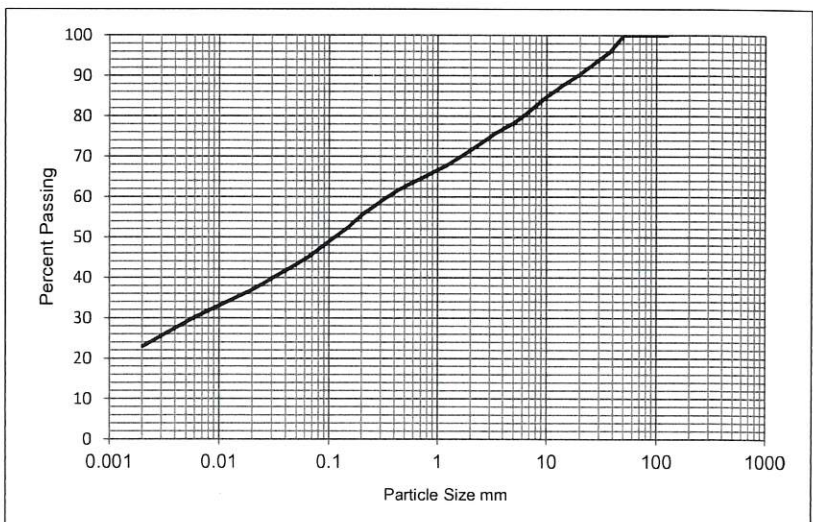
Project No:	D8195-18	Client:	JLA Recycling
Project Name:	Palleg Landfill	Address:	Palleg Rd Cwmtwrch SA9 2UT
ATS Sample No:	N/A		

Site Ref / Hole ID:	Sample 1	Depth (m):	N/A
Sample No:		Sample Type:	Bulk
Sampling Certificate Received:	Yes	Material Description:	Dark grey sandy gravelly CLAY
Location in Works:	Middle Of Stockpile	Material Source:	Site Generated
Date Sampled:	27 June 2018	Material Supplier:	Site Generated
Sampled By:	A Grogan	Specification:	BS 1377
Date Received:	27 June 2018	Date Tested:	17 July 2018

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	96
28	93
20	90
14	88
10	85
6.3	80
5.0	78
3.35	76
2.00	72
1.18	68
0.600	64
0.425	62
0.300	59
0.212	56
0.150	53
0.063	45

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	as BS1377



Sedimentation	
Particle Size mm	% Passing
0.0201	37
0.0060	30
0.0020	23

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient D_{60} / D_{10}
Cobbles / Boulders	0	2.65 assumed	
Gravel	28	Dry mass of sample, kg 12.0	
Sand	27		
Silt	22		
Clay	23		

Remarks:

TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

Project No: D8195-18	Client: JLA Recycling
Project Name: Palleg Landfill	Address: Palleg Rd Cwmtwrch SA9 2UT
ATS Sample No: N/A	

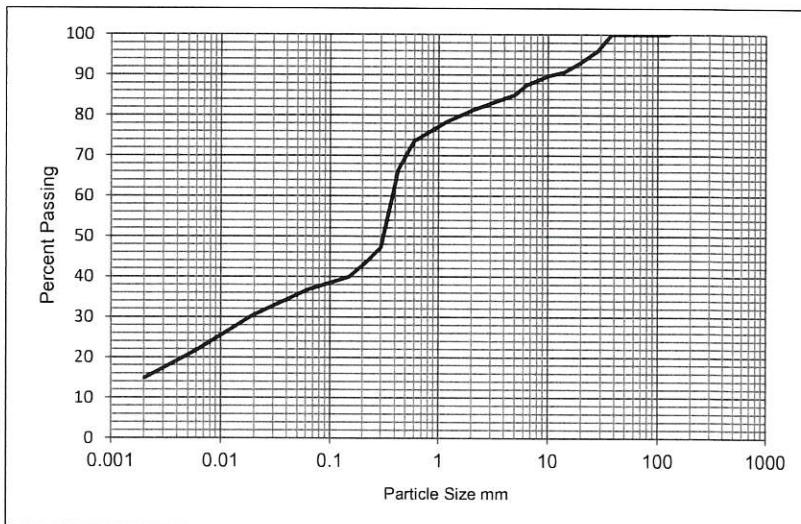
Site Ref / Hole ID: Sample 2	Depth (m): N/A
Sample No:	Sample Type: Bulk
Sampling Certificate Received: Yes	Material Description: Grey gravelly sandy CLAY
Location in Works: Middle Of Stockpile	Material Source: Site Generated
Date Sampled: 27 June 2018	Material Supplier: Site Generated
Sampled By: A Grogan	Specification: BS 1377
Date Received: 27 June 2018	Date Tested: 17 July 2018

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	96
20	93
14	91
10	90
6.3	88
5.0	85
3.35	83
2.00	81
1.18	78
0.600	74
0.425	66
0.300	47
0.212	43
0.150	40
0.063	37

Sedimentation	
Particle Size mm	% Passing
0.0201	31
0.0060	22
0.0020	15

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	as BS1377



Sample Portions		Particle Density Mg/m3	Uniformity Coefficient D ₆₀ / D ₁₀
Cobbles / Boulders	0	2.65 assumed	
Gravel	19		
Sand	44	Dry mass of sample, kg	
Silt	22	13.0	
Clay	15		

Remarks:

QA Ref.

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CF33 6BZ
Tel: 01656 746762 Fax: 01656 749096



Approver

A Grogan

A Grogan Quality Manager

Date

07/08/2018

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TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

Project No: D8195-18	Client: JLA Recycling
Project Name: Palleg Landfill	Address: Palleg Rd Cwmtwrch SA9 2UT
ATS Sample No: N/A	

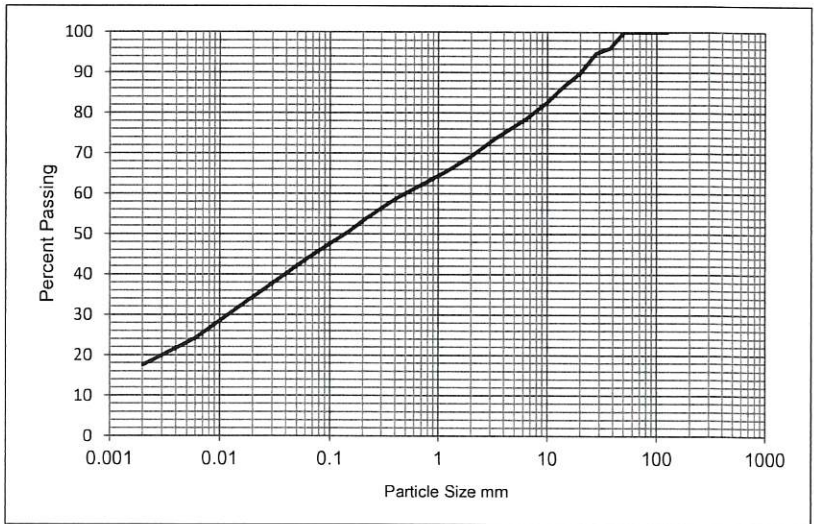
Site Ref / Hole ID: Sample 3	Depth (m): N/A
Sample No:	Sample Type: Bulk
Sampling Certificate Received: Yes	Material Description: Dark grey sandy gravelly CLAY
Location in Works: Middle Of Stockpile	Material Source: Site Generated
Date Sampled: 27 June 2018	Material Supplier: Site Generated
Sampled By: A Grogan	Specification: BS 1377
Date Received: 27 June 2018	Date Tested: 03 July 2018

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	96
28	95
20	90
14	87
10	83
6.3	78
5.0	77
3.35	74
2.00	69
1.18	66
0.600	61
0.425	59
0.300	56
0.212	54
0.150	51
0.063	44

Sedimentation	
Particle Size mm	% Passing
0.0201	34
0.0060	24
0.0020	18

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	as BS1377



Sample Portions		Particle Density Mg/m3	Uniformity Coefficient D ₆₀ / D ₁₀
Cobbles / Boulders	0	2.65 assumed	
Gravel	31	Dry mass of sample, kg 11.3	
Sand	25		
Silt	26		
Clay	18		

Remarks:

TEST REPORT
OIST RE CO TE T
BS1377: Part 2: 1990 : Clause 3.2

Project ID:	D8195-18	Client:	JLA Recycling
Project Name:	Palleg Landfill	Address:	Palleg Rd Cwmtwrch SA9 2UT
ATS Sample ID:	N/A		

Site Ref / Role ID:	Sample 1	Depth (m):	N/A
Sample ID:		Sample Type:	Bulk
Sampling Certificate Received:	Yes	Material Description:	Dark grey slightly sandy slightly gravelly CLAY
Location in Stores:	Middle Of Stockpile	Material Source:	Site Generated
Date Sampled:	27 June 2018	Material Supplier:	Site Generated
Sampled By:	A Grogan	Specification:	
Date Received:	27 June 2018	Date Tested:	03 July 2018

Test Results

Moisture Content (%)	11
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Remarks:

QA Ref.

BS1377-2
Rev. 2.0



Apex Testing Solutions

Sturmi Way, Village Farm Industrial Est,
Pyle, Bridgend, CF33 6BZ

Tel: 01656 746762 Fax: 01656 749096



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Approver

D Simon

Date

03/07/2018

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D Simon, Laboratory Manager

TEST REPORT

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BS 1377:Part 2:1990: Clause 4.3/5.3/5.4

Project ID: D8195-18
Project Name: Palleg Landfill
ATS Sample ID: N/A

Client: JLA Recycling
Address: Palleg Rd
 Cwmtwrch
 SA9 2UT

Site Ref / Sample ID: Sample 1

Depth (m): N/A

Sample ID:

Sample Type: Bulk

Sampling Certificate Received: No

Material Description: Dark grey slightly sandy slightly gravelly CLAY

Location in Store: Middle Of Stockpile

Material Source: Site Generated

Date Sampled: 27 June 2018

Material Supplier: Site Generated

Sampled By: A Grogan

Specification:

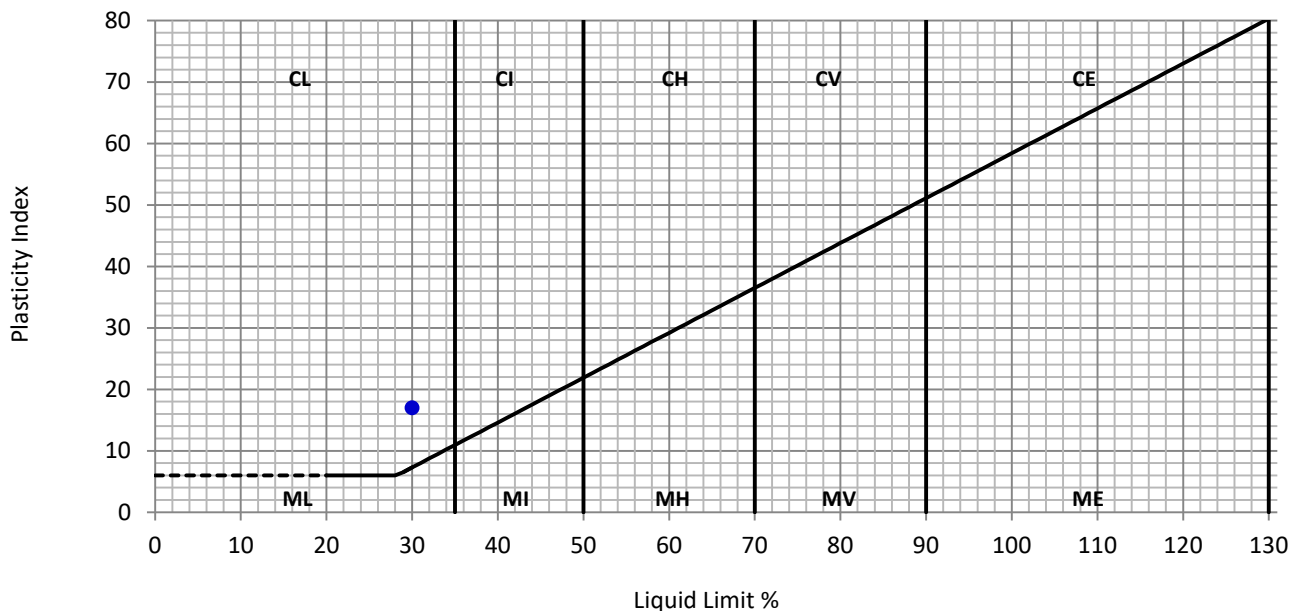
Date Received: 27 June 2018

Date Tested: 02 July 2018

Test Results

Liquid Limit	30	%
Plastic Limit	13	%
Plasticity Index	17	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	38 %



Remarks:

QA Ref.

BS1377-2
Rev 3.0



Apex Testing Solutions

Sturmi Way, Village Farm Industrial Est, Pyle,
 Bridgend, CF33 6BZ
 Tel: 01656 746762 Fax: 01656 749096



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Approver

D Simon

Date

03/07/2018

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D Simon, Laboratory Manager

TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

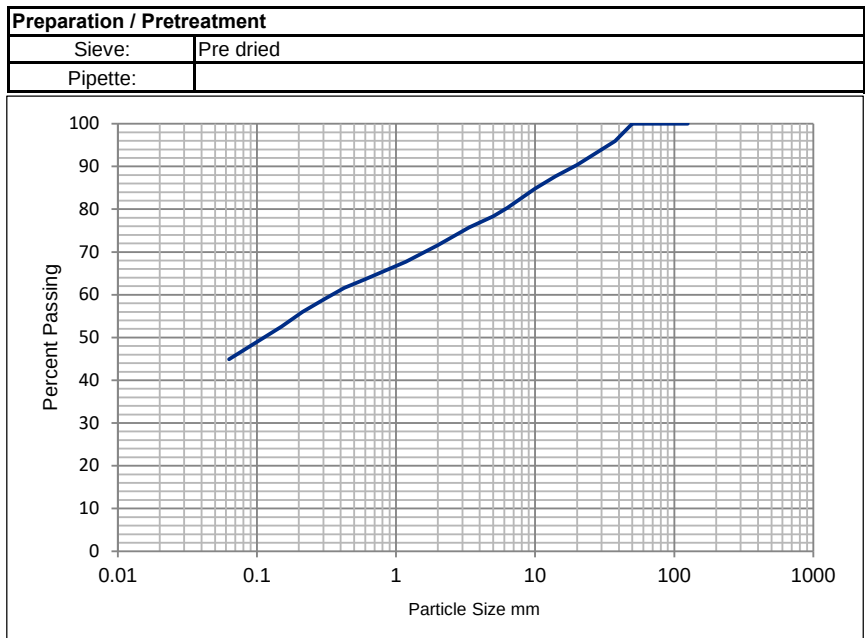
Project no: D8195-18 **Client:** JLA Recycling
Project name: Palleg Landfill **Address:** Palleg Rd
 Cwmtwrch
 SA9 2UT
ATS Sample no: N/A

Site Ref / Sample ID: Sample 1 **Depth (m):** N/A
Sample no: **Sample Type:** Bulk
Sampling Certificate Received: No **Material Description:** Dark grey slightly sandy slightly gravelly CLAY
Location in stores: Middle Of Stockpile **Material Source:** Site Generated
Date Sampled: 27 June 2018 **Material Supplier:** Site Generated
Sampled By: A Grogan **Specification:**
Date Received: 27 June 2018 **Date Tested:** 03 July 2018

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	96
28	93
20	90
14	88
10	85
6.3	80
5.0	78
3.35	76
2.00	72
1.18	68
0.600	64
0.425	62
0.300	59
0.212	56
0.150	53
0.063	45

Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	



Sample Portions		Particle Density g/m3	niformity Coefficient D₆₀ / D₁₀
Cobbles / Boulders	0	N/A	
Gravel	28		
Sand	27	Dry mass of sample, g	
Silt / Clay	45	12.0	N/A

Remarks: Material complies with 2A & 2B grading requirements of SHW series 600

QA Ref.

BS1377 - 2
Rev 3.0



Apex Testing Solutions

Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend,
 CF33 6BZ
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Approver

D Simon

D Simon, Laboratory Manager

Date

03/07/2018

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TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

Project no: D8195-18 **Client:** JLA Recycling
Project name: Palleg Landfill **Address:** Palleg Rd
 Cwmtwrch
 SA9 2UT
ATS Sample no: N/A

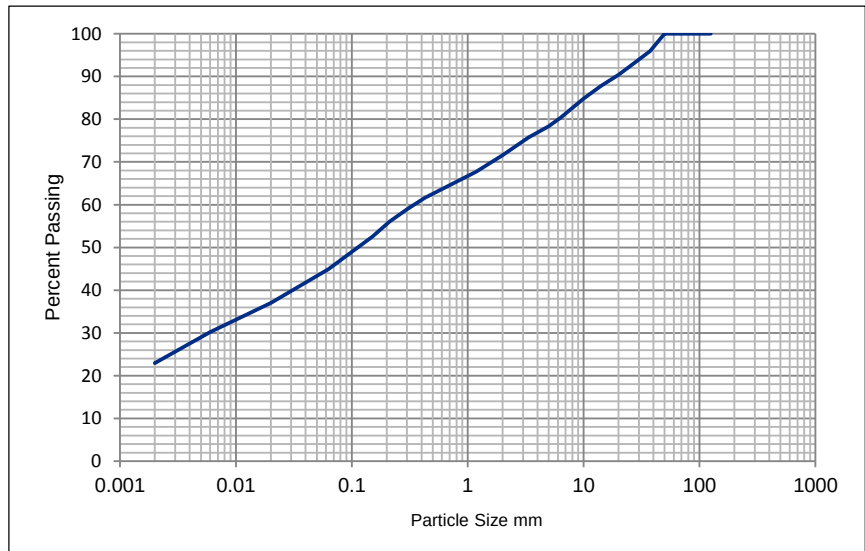
Site Ref / Sample ID: Sample 1 **Depth (m):** N/A
Sample no: **Sample Type:** Bulk
Sampling Certificate Received: Yes **Material Description:** Dark grey sandy gravelly CLAY
Location in stores: Middle Of Stockpile **Material Source:** Site Generated
Date Sampled: 27 June 2018 **Material Supplier:** Site Generated
Sampled By: A Grogan **Specification:** BS 1377
Date Received: 27 June 2018 **Date Tested:** 17 July 2018

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	96
28	93
20	90
14	88
10	85
6.3	80
5.0	78
3.35	76
2.00	72
1.18	68
0.600	64
0.425	62
0.300	59
0.212	56
0.150	53
0.063	45

Sedimentation	
Particle Size mm	% Passing
0.0201	37
0.0060	30
0.0020	23

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	as BS1377



Sample Portions		Particle Density g/m3	Uniformity Coefficient D_{60} / D_{10}
Cobbles / Boulders	0	2.65 assumed	
Gravel	28	Dry mass of sample, g	12.0
Sand	27		
Silt	22		
Clay	23		

Remarks:

QA Ref.

BS1377 - 2
Rev 3.0



Apex Testing Solutions

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Approver

A Grogan

A Grogan Quality manager

Date

07/08/2018

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TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

Project No:	D8213-18	Client:	Arwel Jones
Project Name:	97 Waterloo Road	Email:	5 Ty Coed Cefn Yr Allt Aberdulais Neath SA10 8HE
ATS Sample No:	N/A		

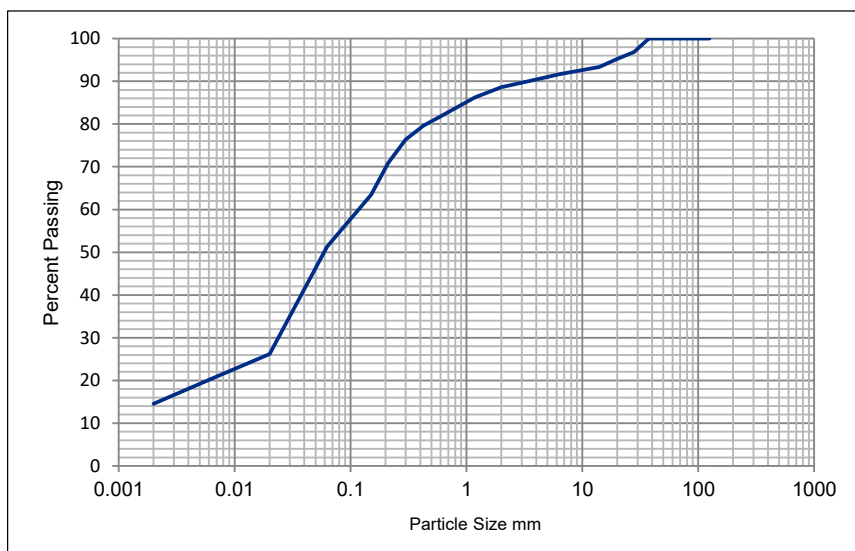
Site Ref / Hole ID:	Sample 1	Depth (m):	N/A - N/A
Sample No:	N/A	Sample Type:	Bulk
Sampling Certificate Received:	No	Material Description:	Brown slightly gravelly sandy SILT
Location in Works:	Unknown	Material Source:	N/A
Date Sampled:	09 July 2018	Material Supplier:	N/A
Sampled By:	N/A	Specification:	BS 1377
Date Received:	09 July 2018	Date Tested:	11 July 2018

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	97
20	95
14	93
10	93
6.3	92
5.0	91
3.35	90
2.00	89
1.18	86
0.600	82
0.425	80
0.300	76
0.212	71
0.150	63
0.063	51

Sedimentation	
Particle Size mm	% Passing
0.0201	26
0.0060	20
0.0020	15

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	as BS1377



Sample Portions		Particle Density Mg/m3	Uniformity Coefficient D_{60} / D_{10}
Cobbles / Boulders	0	2.65 assumed	
Gravel	11	Dry mass of sample, kg	
Sand	37		
Silt	37		
Clay	15	8.3	

Remarks:

TEST REPORT
OIST RE CO TE T
BS1377: Part 2: 1990 : Clause 3.2

Project no:	D8195-18	Client:	JLA Recycling
Project name:	Palleg Landfill	Address:	Palleg Rd Cwmtwrch SA9 2UT
ATS Sample no:	N/A		

Site Ref / Sample ID:	Sample 2	Depth (m):	N/A
Sample no:		Sample Type:	Bulk
Sampling Certificate Received:	Yes	Material Description:	Grey slightly gravelly clayey SAND
Location in stores:	Middle Of Stockpile	Material Source:	Site Generated
Date Sampled:	27 June 2018	Material Supplier:	Site Generated
Sampled By:	A Grogan	Specification:	
Date Received:	27 June 2018	Date Tested:	03 July 2018

Test Results

Moisture Content (%)	9
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Remarks:

QA Ref.

BS1377-2
Rev. 2.0



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Approver

D Simon

Date

03/07/2018

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D Simon, Laboratory Manager

TEST REPORT

LIQ ID LI IT, PLASTIC LI IT PLASTICITY I DE

BS 1377:Part 2:1990: Clause 4.3/5.3/5.4

Project o: D8195-18
Project ame: Palleg Landfill
ATS Sample o: N/A

Client: JLA Recycling
Address: Palleg Rd
Cwmtwrch
SA9 2UT

Site Ref / ole ID: Sample 2

Depth (m): N/A

Sample o:

Sample Type: Bulk

Sampling Certificate Received: No

aterial Description: Grey slightly gravelly clayey SAND

Location in or s: Middle Of Stockpile

aterial Source: Site Generated

Date Sampled: 27 June 2018

aterial Supplier: Site Generated

Sampled By: A Grogan

Specification:

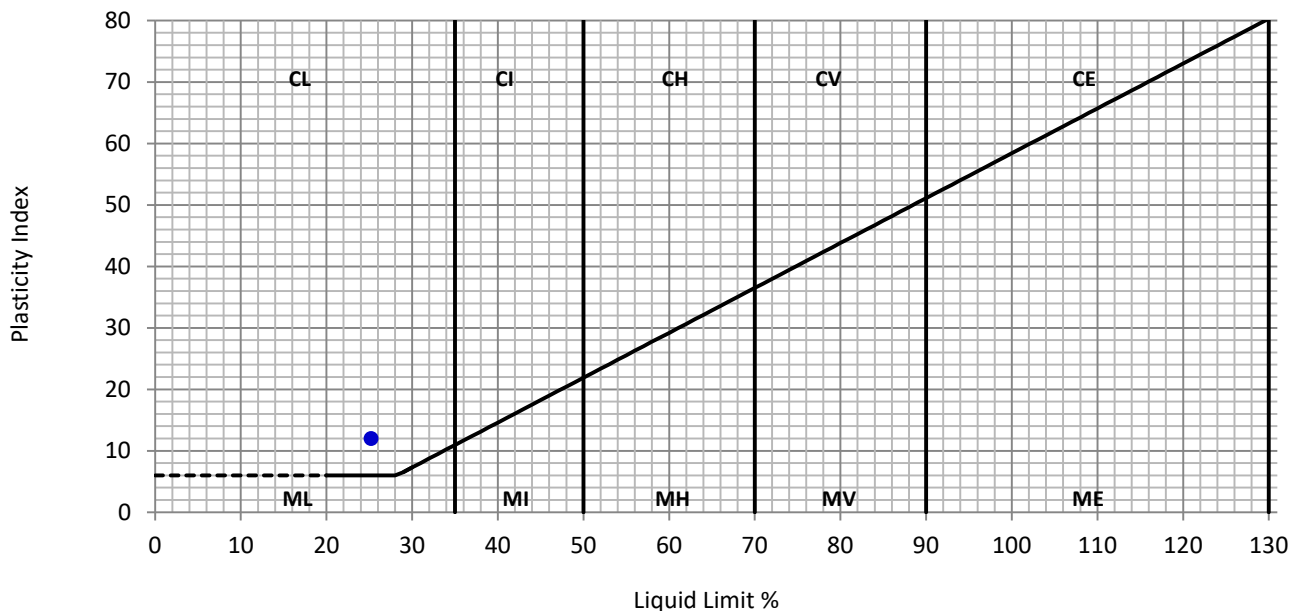
Date Received: 27 June 2018

Date Tested: 02 July 2018

Test Results

Liquid Limit	25	%
Plastic Limit	13	%
Plasticity Index	12	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	26 %



Remarks:

QA Ref.

BS1377-2
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D Simon, Laboratory Manager

TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

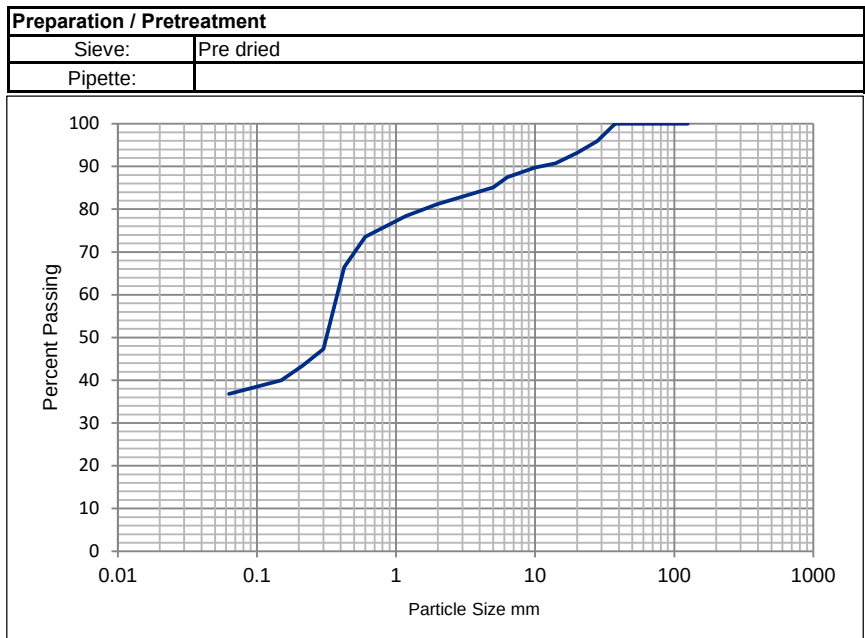
Project no: D8195-18 **Client:** JLA Recycling
Project name: Palleg Landfill **Address:** Palleg Rd
 Cwmtwrch
 SA9 2UT
ATS Sample no: N/A

Site Ref / Role ID: Sample 2 **Depth (m):** N/A
Sample no: **Sample Type:** Bulk
Sampling Certificate Received: No **Material Description:** Grey slightly gravelly clayey SAND
Location in stores: Middle Of Stockpile **Material Source:** Site Generated
Date Sampled: 27 June 2018 **Material Supplier:** Site Generated
Sampled By: A Grogan **Specification:**
Date Received: 27 June 2018 **Date Tested:**

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	96
20	93
14	91
10	90
6.3	88
5.0	85
3.35	83
2.00	81
1.18	78
0.600	74
0.425	66
0.300	47
0.212	43
0.150	40
0.063	37

Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	



Sample Portions		Particle Density g/m3	niformity Coefficient D₆₀ / D₁₀
Cobbles / Boulders	0	N/A	
Gravel	19		
Sand	44	Dry mass of sample, g	
Silt / Clay	37	13.0	N/A

Remarks: Material complies with 2A & 2B grading requirements of SHW series 600

QA Ref.

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Date

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TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

Project no: D8195-18 **Client:** JLA Recycling
Project name: Palleg Landfill **Address:** Palleg Rd
 Cwmtwrch
 SA9 2UT
ATS Sample no: N/A

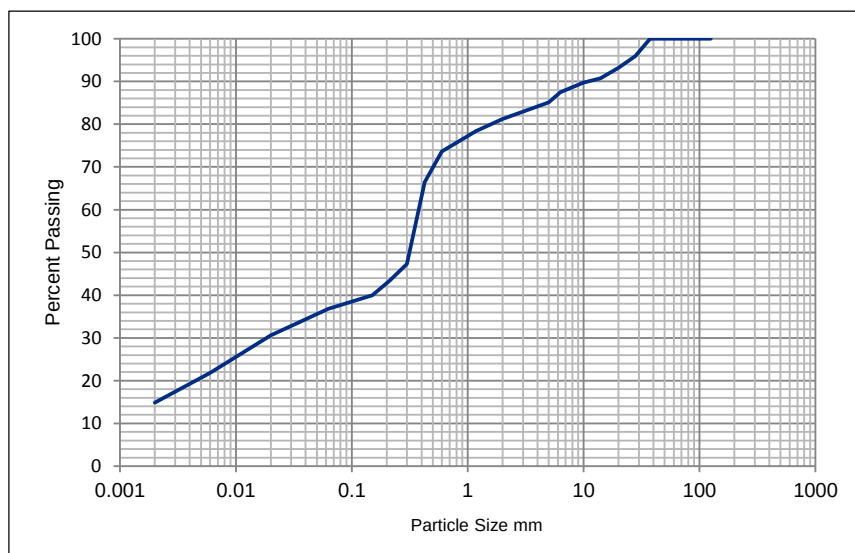
Site Ref / Sample ID: Sample 2 **Depth (m):** N/A
Sample no: **Sample Type:** Bulk
Sampling Certificate Received: Yes **Material Description:** Grey gravelly sandy CLAY
Location in stores: Middle Of Stockpile **Material Source:** Site Generated
Date Sampled: 27 June 2018 **Material Supplier:** Site Generated
Sampled By: A Grogan **Specification:** BS 1377
Date Received: 27 June 2018 **Date Tested:** 17 July 2018

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	96
20	93
14	91
10	90
6.3	88
5.0	85
3.35	83
2.00	81
1.18	78
0.600	74
0.425	66
0.300	47
0.212	43
0.150	40
0.063	37

Sedimentation	
Particle Size mm	% Passing
0.0201	31
0.0060	22
0.0020	15

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	as BS1377



Sample Portions		Particle Density g/m3	Uniformity Coefficient D_{60} / D_{10}
Cobbles / Boulders	0	2.65 assumed	
Gravel	19	Dry mass of sample, g	13.0
Sand	44		
Silt	22		
Clay	15		

Remarks:

TEST REPORT
OIST RE CO TE T
BS1377: Part 2: 1990 : Clause 3.2

Project ID:	D8195-18	Client:	JLA Recycling
Project Name:	Palleg Landfill	Address:	Palleg Rd Cwmtwrch SA9 2UT
ATS Sample ID:	N/A		

Site Ref / Role ID:	Sample 3	Depth (m):	N/A
Sample ID:		Sample Type:	Bulk
Sampling Certificate Received:	Yes	Material Description:	Dark grey slightly sandy slightly gravelly CLAY
Location in Stores:	Middle Of Stockpile	Material Source:	Site Generated
Date Sampled:	27 June 2018	Material Supplier:	Site Generated
Sampled By:	A Grogan	Specification:	
Date Received:	27 June 2018	Date Tested:	03 July 2018

Test Results

Moisture Content (%)	10
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Remarks:

QA Ref.

BS1377-2
Rev. 2.0



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Date

03/07/2018

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D Simon, Laboratory Manager

TEST REPORT

LIQ ID LI IT, PLASTIC LI IT PLASTICITY I DE

BS 1377:Part 2:1990: Clause 4.3/5.3/5.4

Project ID: D8195-18
Project Name: Palleg Landfill
ATS Sample ID: N/A

Client: JLA Recycling
Address: Palleg Rd
 Cwmtwrch
 SA9 2UT

Site Ref / Role ID: Sample 3

Depth (m): N/A

Sample ID:

Sample Type: Bulk

Sampling Certificate Received: No

Material Description: Dark grey slightly sandy slightly gravelly CLAY

Location in stores: Middle Of Stockpile

Material Source: Site Generated

Date Sampled: 27 June 2018

Material Supplier: Site Generated

Sampled By: A Grogan

Specification:

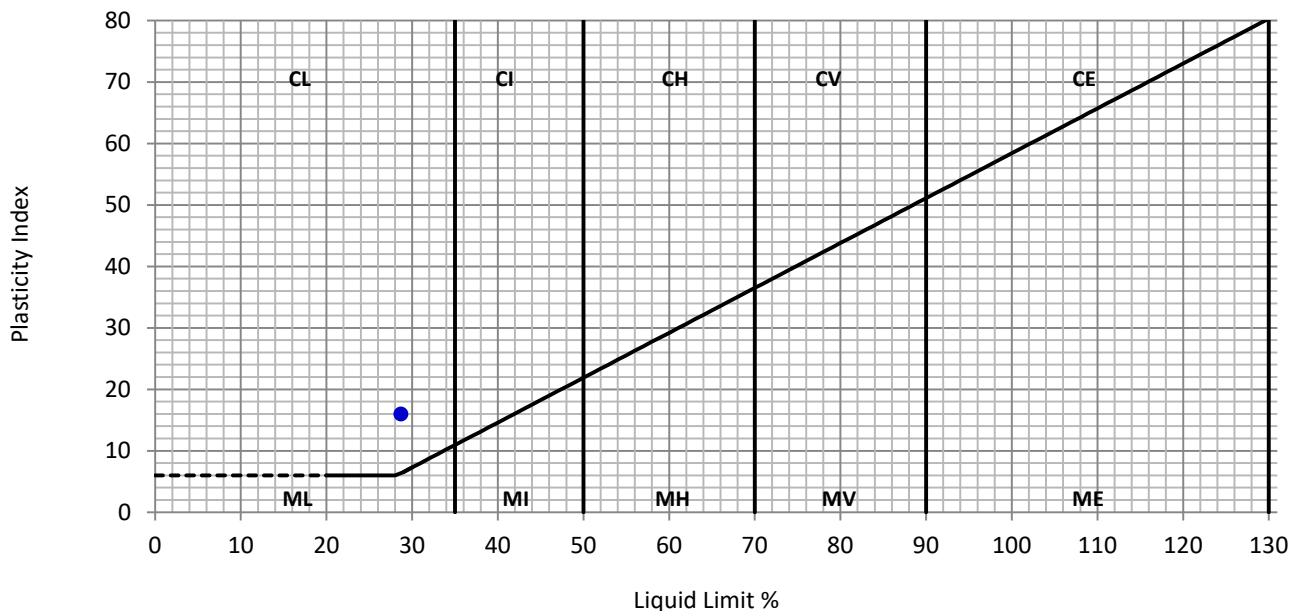
Date Received: 27 June 2018

Date Tested: 02 July 2018

Test Results

Liquid Limit	29	%
Plastic Limit	13	%
Plasticity Index	16	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	29 %



Remarks:

QA Ref.

BS1377-2
Rev 3.0



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D Simon

Date

03/07/2018

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D Simon, Laboratory Manager

TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

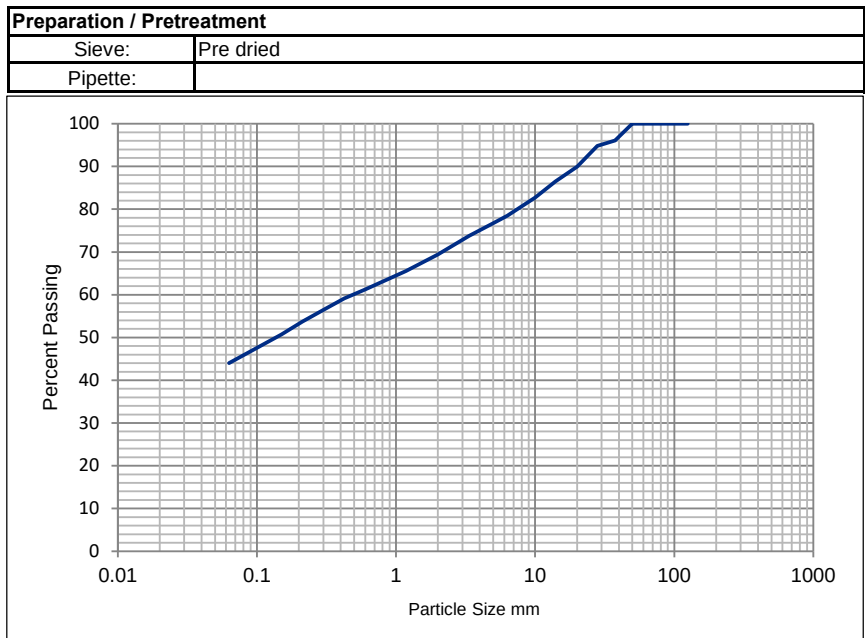
Project no: D8195-18 **Client:** JLA Recycling
Project name: Palleg Landfill **Address:** Palleg Rd
 Cwmtwrch
 SA9 2UT
ATS Sample no: N/A

Site Ref / Sample ID: Sample 3 **Depth (m):** N/A
Sample no: **Sample Type:** Bulk
Sampling Certificate Received: No **Material Description:** Dark grey slightly sandy slightly gravelly CLAY
Location in stores: Middle Of Stockpile **Material Source:** Site Generated
Date Sampled: 27 June 2018 **Material Supplier:** Site Generated
Sampled By: A Grogan **Specification:**
Date Received: 27 June 2018 **Date Tested:**

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	96
28	95
20	90
14	87
10	83
6.3	78
5.0	77
3.35	74
2.00	69
1.18	66
0.600	61
0.425	59
0.300	56
0.212	54
0.150	51
0.063	44

Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	



Sample Portions		Particle Density g/m3	niformity Coefficient D₆₀ / D₁₀
Cobbles / Boulders	0	N/A	
Gravel	31		
Sand	25	Dry mass of sample, g	
Silt / Clay	44	11.3	N/A

Remarks: Material complies with 2A & 2B grading requirements of SHW series 600

QA Ref.

BS1377 - 2
Rev 3.0



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Approver

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D Simon, Laboratory Manager

Date

03/07/2018

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TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

Project no: D8195-18 **Client:** JLA Recycling
Project name: Palleg Landfill **Address:** Palleg Rd
 Cwmtwrch
 SA9 2UT
ATS Sample no: N/A

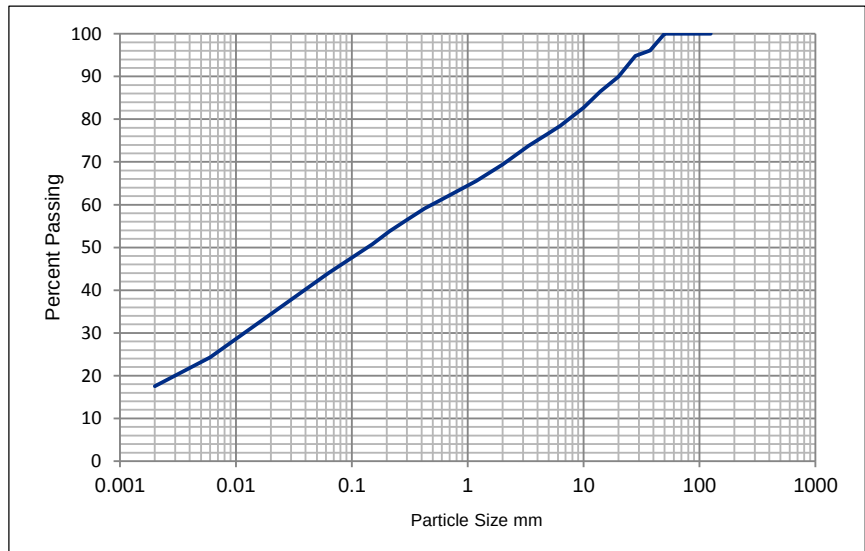
Site Ref / Sample ID: Sample 3 **Depth (m):** N/A
Sample no: **Sample Type:** Bulk
Sampling Certificate Received: Yes **Material Description:** Dark grey sandy gravelly CLAY
Location in stores: Middle Of Stockpile **Material Source:** Site Generated
Date Sampled: 27 June 2018 **Material Supplier:** Site Generated
Sampled By: A Grogan **Specification:** BS 1377
Date Received: 27 June 2018 **Date Tested:** 03 July 2018

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	96
28	95
20	90
14	87
10	83
6.3	78
5.0	77
3.35	74
2.00	69
1.18	66
0.600	61
0.425	59
0.300	56
0.212	54
0.150	51
0.063	44

Sedimentation	
Particle Size mm	% Passing
0.0201	34
0.0060	24
0.0020	18

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	as BS1377



Sample Portions		Particle Density g/m3	niformity Coefficient D ₆₀ / D ₁₀
Cobbles / Boulders	0	2.65 assumed	
Gravel	31		
Sand	25	Dry mass of sample, g	
Silt	26	11.3	
Clay	18		

Remarks:

QA Ref.

BS1377 - 2
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Approver

A Grogan

A Grogan Quality Manager

Date

07/08/2018

Fig

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TEST REPORT
OIST RE CO TE T
BS1377: Part 2: 1990 : Clause 3.2

Project ID:	D8195-18	Client:	JLA Recycling
Project Name:	Palleg Landfill	Address:	Palleg Rd Cwmtwrch SA9 2UT
ATS Sample ID:	N/A		

Site Ref / Sample ID:	Sample 4	Depth (m):	N/A
Sample ID:		Sample Type:	Bulk
Sampling Certificate Received:	Yes	Material Description:	Grey slightly sandy very gravelly CLAY
Location in Stores:	Middle Of Stockpile	Material Source:	Site Generated
Date Sampled:	27 June 2018	Material Supplier:	Site Generated
Sampled By:	A Grogan	Specification:	
Date Received:	27 June 2018	Date Tested:	03 July 2018

Test Results

Moisture Content (%)	9
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Remarks:

QA Ref.

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Rev. 2.0



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Approver

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Date

03/07/2018

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D Simon, Laboratory Manager

TEST REPORT

LIQ ID LI IT, PLASTIC LI IT PLASTICITY I DE

BS 1377:Part 2:1990: Clause 4.3/5.3/5.4

Project ID: D8195-18
Project Name: Palleg Landfill
ATS Sample ID: N/A

Client: JLA Recycling
Address: Palleg Rd
 Cwmtwrch
 SA9 2UT

Site Ref / Role ID: Sample 4

Depth (m): N/A

Sample ID:

Sample Type: Bulk

Sampling Certificate Received: No

Material Description: Grey slightly sandy very gravelly CLAY

Location in stores: Middle Of Stockpile

Material Source: Site Generated

Date Sampled: 27 June 2018

Material Supplier: Site Generated

Sampled By: A Grogan

Specification:

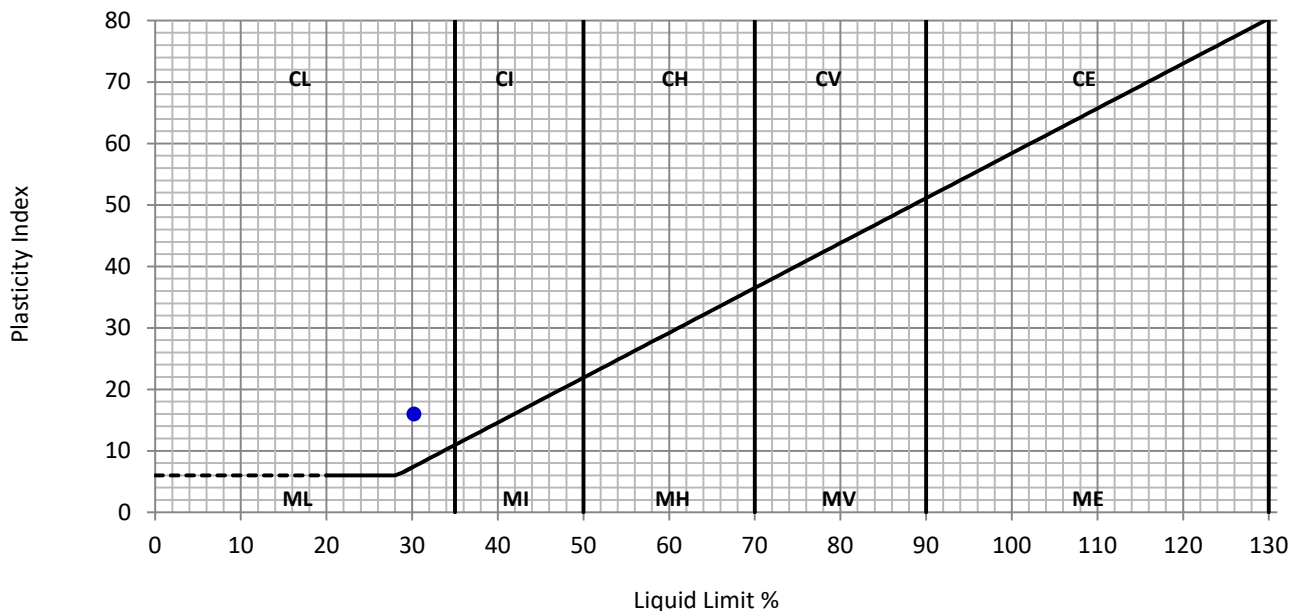
Date Received: 27 June 2018

Date Tested: 03 July 2018

Test Results

Liquid Limit	30	%
Plastic Limit	14	%
Plasticity Index	16	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	32 %



Remarks:

QA Ref.

BS1377-2
Rev 3.0



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Date

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D Simon, Laboratory Manager

TEST REPORT
OIST RE CO TE T
BS1377: Part 2: 1990 : Clause 3.2

Project ID:	D8195-18	Client:	JLA Recycling
Project Name:	Palleg Landfill	Address:	Palleg Rd Cwmtwrch SA9 2UT
ATS Sample ID:	N/A		

Site Ref / Role ID:	Sample 5	Depth (m):	N/A
Sample ID:		Sample Type:	Bulk
Sampling Certificate Received:	Yes	Material Description:	Grey slightly sandy very gravelly CLAY
Location in Stores:	Middle Of Stockpile	Material Source:	Site Generated
Date Sampled:	27 June 2018	Material Supplier:	Site Generated
Sampled By:	A Grogan	Specification:	
Date Received:	27 June 2018	Date Tested:	03 July 2018

Test Results

Moisture Content (%)	7
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Remarks:

QA Ref.

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Rev. 2.0



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Approver

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D Simon, Laboratory Manager

TEST REPORT

LIQ ID LI IT, PLASTIC LI IT PLASTICITY I DE

BS 1377:Part 2:1990: Clause 4.3/5.3/5.4

Project o: D8195-18
Project ame: Palleg Landfill
ATS Sample o: N/A

Client: JLA Recycling
Address: Palleg Rd
 Cwmtwrch
 SA9 2UT

Site Ref / ole ID: Sample 5

Depth (m): N/A

Sample o:

Sample Type: Bulk

Sampling Certificate Received: No

aterial Description: Grey slightly sandy very gravelly CLAY

Location in or s: Middle Of Stockpile

aterial Source: Site Generated

Date Sampled: 27 June 2018

aterial Supplier: Site Generated

Sampled By: A Grogan

Specification:

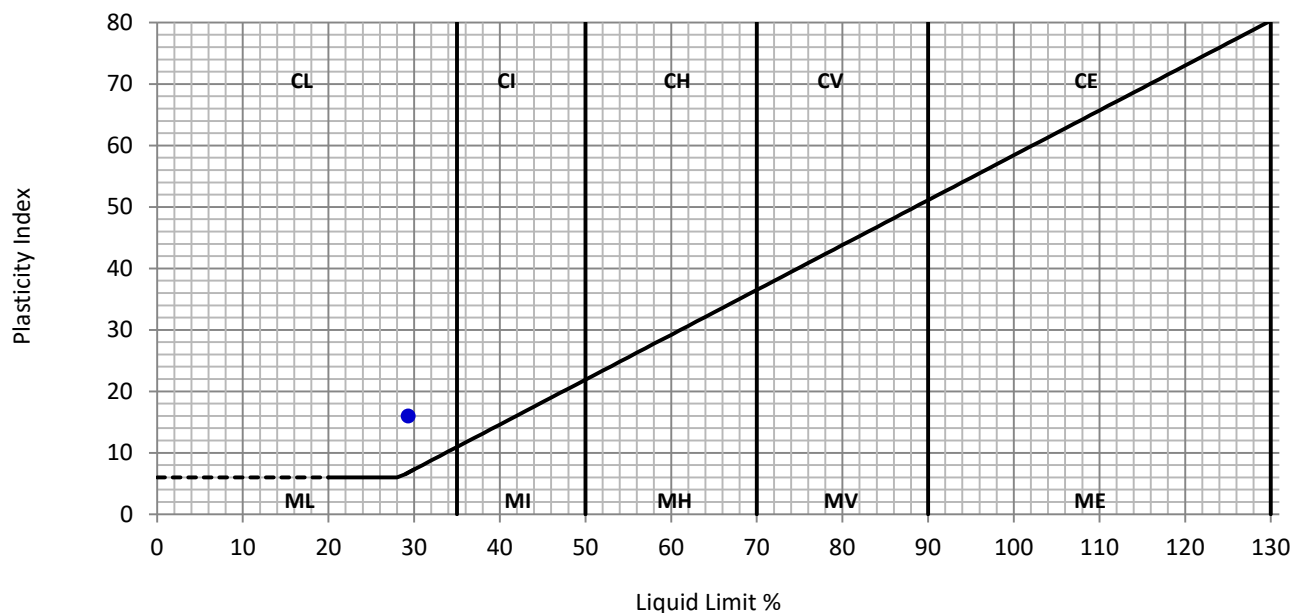
Date Received: 27 June 2018

Date Tested: 03 July 2018

Test Results

Liquid Limit	29	%
Plastic Limit	13	%
Plasticity Index	16	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	31 %



Remar s:

QA Ref.

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TEST REPORT
OIST RE CO TE T
BS1377: Part 2: 1990 : Clause 3.2

Project ID:	D8195-18	Client:	JLA Recycling
Project Name:	Palleg Landfill	Address:	Palleg Rd Cwmtwrch SA9 2UT
ATS Sample ID:	N/A		

Site Ref / Sample ID:	Sample 6	Depth (m):	N/A
Sample ID:		Sample Type:	Bulk
Sampling Certificate Received:	Yes	Material Description:	Grey slightly sandy very gravelly CLAY
Location in Store:	Middle Of Stockpile	Material Source:	Site Generated
Date Sampled:	27 June 2018	Material Supplier:	Site Generated
Sampled By:	A Grogan	Specification:	
Date Received:	27 June 2018	Date Tested:	03 July 2018

Test Results

Moisture Content (%)	10
----------------------	----

Remarks:

QA Ref.

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Rev. 2.0



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Approver

D Simon

Date

04/07/2018

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D Simon, Laboratory Manager

TEST REPORT

LIQ ID LI IT, PLASTIC LI IT PLASTICITY I DE

BS 1377:Part 2:1990: Clause 4.3/5.3/5.4

Project o: D8195-18
Project ame: Palleg Landfill
ATS Sample o: N/A

Client: JLA Recycling
Address: Palleg Rd
Cwmtwrch
SA9 2UT

Site Ref / ole ID: Sample 6

Depth (m): N/A

Sample o:

Sample Type: Bulk

Sampling Certificate Received: No

aterial Description: Grey slightly sandy very gravelly CLAY

Location in or s: Middle Of Stockpile

aterial Source: Site Generated

Date Sampled: 27 June 2018

aterial Supplier: Site Generated

Sampled By: A Grogan

Specification:

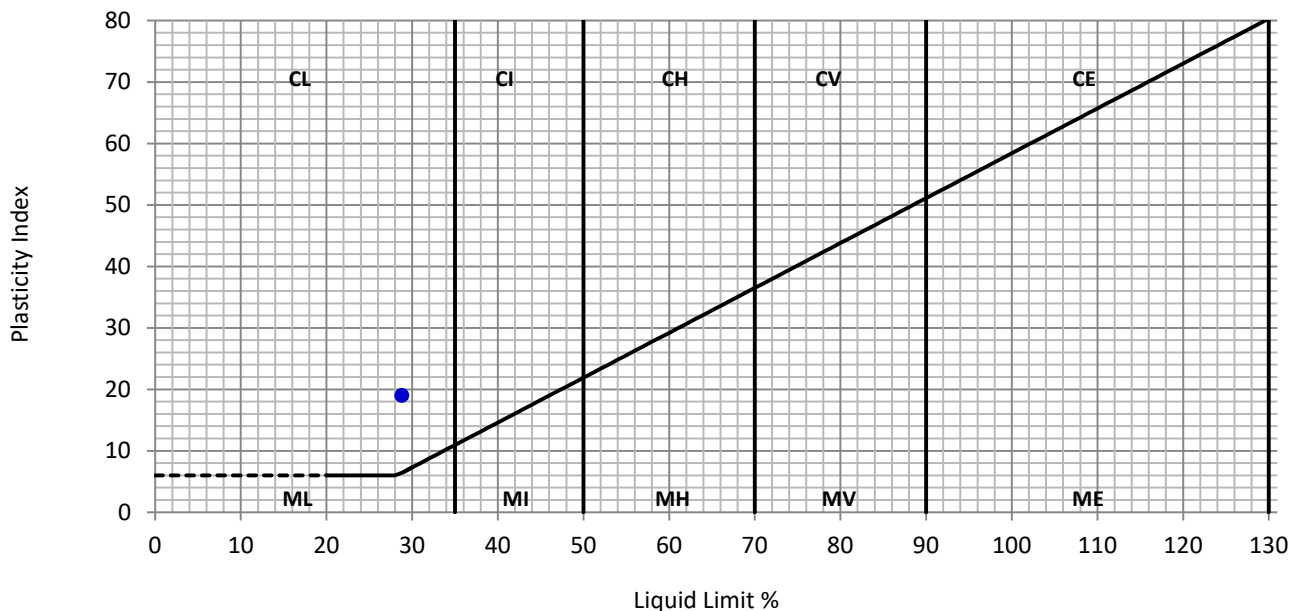
Date Received: 27 June 2018

Date Tested: 03 July 2018

Test Results

Liquid Limit	29	%
Plastic Limit	10	%
Plasticity Index	19	%

Preparation:	4.2.4 Sieved Specimen
Proportion retained on 425µm sieve:	31 %



Remar s:

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Rev 3.0



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**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 4
HDPE Manufacturers
QC Data

Report Number 1807r3v1d0219

GSE Lining Technology GmbH Warboys, HUNTINGDON

Number VKL+118254
Voucher VKL+118254

Received at **Warboys, HUNTINGDON** from GSE Lining Technology GmbH the property described below, in apparent good order, except as noted (contents and condition of packages unknown), marked, consigned, and destined as indicated below, which said Carrier agrees to carry to the place of delivery at said destination. It is mutually agreed as to each Carrier of all or any said property, over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service performed hereunder shall be subject to the rates and contract agreed to in writing by GSE Lining Technology GmbH and Carrier. GSE Lining Technology GmbH's obligation to pay freight charges for the shipment is conditioned on (1) the existence of a separate written contract with the Carrier transporting the freight and (2) the Carrier's name appearing on this Bill of Lading, and other carriers must look solely to a party other than GSE Lining Technology GmbH for payment.

Ship to:	CELTIC LINING Ltd. c/o JLA Disposals Ltd Palleg Road Ystradgynais Swansea SA9 2UT Great Britain	Ship date:	Jun 20, 2018
		Branch plant:	1815
		Sales order:	VK110145

Shipping instructions:

Line no.	Shipped quantity	Product code	Unit	Kind of Package, Description of Articles, Special Marks and Exceptions	Weight kg	Project
1	2.800,00	HDT-200AM-BBB-W-00	sqm	GSE HD textured 2.0 mm HS Code: 39201089 Country of Origin: Egypt	5.940,00	Freight charges are prepaid unless marked collect.
2				303025150 GSE HD textured 2.0 mm	1.230,00	Check box if collect
3				303025157 GSE HD textured 2.0 mm	1.208,00	☐
4				303025167 GSE HD textured 2.0 mm	1.193,00	
5				303027590 GSE HD textured 2.0 mm	1.213,00	Customer PO number
6	2.780,00	HDF-200AM-BBB-V-00	sqm	GSE HD textured 2.0 mm	1.221,00	JLA Swansea
7				GSE HD FrictionFlex 2.0 mm HS Code: 39201089	5.696,00	If this shipment is to be delivered to consignee, consignor shall sign the following statement.
8				404001370 GSE HD FrictionFlex 2.0 mm	1.183,00	Carrier may decline to deliver this shipment without payment of freight and all other lawful charges.
9				404001371 GSE HD FrictionFlex 2.0 mm	1.140,00	
10				404001375 GSE HD FrictionFlex 2.0 mm	1.129,00	
11	1.470,00	LDS-100AM-BBB-W-00	sqm	GSE HD FrictionFlex 2.0 mm	1.149,00	
				404001376 GSE HD FrictionFlex 2.0 mm	1.178,00	
				404001378 GSE HD FrictionFlex 2.0 mm	1.178,00	
				GSE UltraFlex Smooth 1mm Avg 7.00M HS Code: 39201089 Country of Origin: Egypt	1.397,00	
				304002245 GSE UltraFlex Smooth 1mm Avg 7.00M	1.422,00	Signature of Consignor
						Local Verification Signed
						PRO Number
						UK102952
						Seal numbers
						Truckers P.O. #
						PO750
Total quantity:		7.050,00	Total weight:		13.266,00	

Carrier name: **Manchett's Transport LTD**

Carrier signature: _____

Date: _____

GSE Lining Technology GmbH Warboys, HUNTINGDON

Number VKL+118254
Voucher VKL+118254

Received at **Warboys, HUNTINGDON** from GSE Lining Technology GmbH the property described below, in apparent good order, except as noted (contents and condition of packages unknown), marked, consigned, and destined as indicated below, which said Carrier agrees to carry to the place of delivery at said destination. It is mutually agreed as to each Carrier of all or any said property, over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service performed hereunder shall be subject to the rates and contract agreed to in writing by GSE Lining Technology GmbH and Carrier. GSE Lining Technology GmbH's obligation to pay freight charges for the shipment is conditioned on (1) the existence of a separate written contract with the Carrier transporting the freight and (2) the Carrier's name appearing on this Bill of Lading, and other carriers must look solely to a party other than GSE Lining Technology GmbH for payment.

Ship to:	CELTIC LINING Ltd. c/o JLA Disposals Ltd Palleg Road Ystradgynais Swansea SA9 2UT Great Britain	Ship date:	Jun 20, 2018
		Branch plant:	1815
		Sales order:	VK110145

Shipping instructions:

Line no.	Shipped quantity	Product code	Unit	Kind of Package, Description of Articles, Special Marks and Exceptions	Weight kg	Project
1	2.800,00	HDT-200AM-BBB-W-W0	sqm	GSE HD textured 2.0 mm HS Code: 39201089 Country of Origin: Egypt	5.940,00	Freight charges are prepaid unless marked collect.
2				303025150 GSE HD textured 2.0 mm	1.230,00	Check box if collect
3				303025157 GSE HD textured 2.0 mm	1.208,00	☐
4				303025167 GSE HD textured 2.0 mm	1.193,00	
5				303027590 GSE HD textured 2.0 mm	1.213,00	Customer PO number
6	2.780,00	HDF-200AM-BBB-V-00	sqm	GSE HD textured 2.0 mm	1.221,00	JLA Swansea
7				GSE HD FrictionFlex 2.0 mm HS Code: 39201089	5.696,00	If this shipment is to be delivered to consignee, consignor shall sign the following statement.
8				404001370 GSE HD FrictionFlex 2.0 mm	1.183,00	Carrier may decline to deliver this shipment without payment of freight and all other lawful charges.
9				404001371 GSE HD FrictionFlex 2.0 mm	1.140,00	
10				404001375 GSE HD FrictionFlex 2.0 mm	1.129,00	
11	1.470,00	LDS-100AM-BBB-W-00	sqm	GSE HD FrictionFlex 2.0 mm	1.149,00	
				404001376 GSE HD FrictionFlex 2.0 mm	1.178,00	
				404001378 GSE HD FrictionFlex 2.0 mm	1.178,00	
				GSE UltraFlex Smooth 1mm Avg 7.00M HS Code: 39201089 Country of Origin: Egypt	1.397,00	
				304002245 GSE UltraFlex Smooth 1mm Avg 7.00M	1.422,00	Signature of Consignor
						Local Verification Signed
						X
						PRO Number
						UK102952
						Seal numbers
						Truckers P.O. #
						PO750
Total quantity:		7.050,00	Total weight:		13.266,00	

Carrier name: **Manchett's Transport LTD**

Carrier signature: _____

Date: _____

GSE Lining Technology GmbH Warboys, HUNTINGDON

Number VKL+118254
Voucher VKL+118254

Received at Warboys, HUNTINGDON from GSE Lining Technology GmbH the property described below, in apparent good order, except as noted (contents and condition of packages unknown), marked, consigned, and destined as indicated below, which said Carrier agrees to carry to the place of delivery at said destination. It is mutually agreed as to each Carrier of all or any said property, over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service performed hereunder shall be subject to the rates and contract agreed to in writing by GSE Lining Technology GmbH and Carrier. GSE Lining Technology GmbH's obligation to pay freight charges for the shipment is conditioned on (1) the existence of a separate written contract with the Carrier transporting the freight and (2) the Carrier's name appearing on this Bill of Lading, and other carriers must look solely to a party other than GSE Lining Technology GmbH for payment.

Ship to:	CELTIC LINING Ltd. c/o JLA Disposals Ltd Palleg Road Ystradgynais Swansea SA9 2UT Great Britain	Ship date:	Jun 20, 2018
		Branch plant:	1815
		Sales order:	VK110145

Shipping instructions:

Line no.	Shipped quantity	Product code	Unit	Kind of Package, Description of Articles, Special Marks and Exceptions	Weight kg	Project
1	2.800,00	HDT-200AM-BBB-W-W0	sqm	GSE HD textured 2.0 mm HS Code: 39201089 Country of Origin: Egypt	5.940,00	Freight charges are prepaid unless marked collect.
2				303025150 GSE HD textured 2.0 mm	1.230,00	Check box if collect
3				303025157 GSE HD textured 2.0 mm	1.208,00	☐
4				303025167 GSE HD textured 2.0 mm	1.193,00	
5				303027590 GSE HD textured 2.0 mm	1.213,00	Customer PO number
6	2.780,00	HDF-200AM-BBB-V-00	sqm	GSE HD textured 2.0 mm	1.221,00	JLA Swansea
7				GSE HD FrictionFlex 2.0 mm HS Code: 39201089	5.696,00	If this shipment is to be delivered to consignee, consignor shall sign the following statement.
8				404001370 GSE HD FrictionFlex 2.0 mm	1.183,00	Carrier may decline to deliver this shipment without payment of freight and all other lawful charges.
9				404001371 GSE HD FrictionFlex 2.0 mm	1.140,00	
10				404001375 GSE HD FrictionFlex 2.0 mm	1.129,00	
11	1.470,00	LDS-100AM-BBB-W-00	sqm	GSE HD FrictionFlex 2.0 mm	1.149,00	
				404001376 GSE HD FrictionFlex 2.0 mm	1.178,00	
				404001378 GSE HD FrictionFlex 2.0 mm	1.178,00	
				GSE UltraFlex Smooth 1mm Avg 7.00M HS Code: 39201089 Country of Origin: Egypt	1.397,00	
				304002245 GSE UltraFlex Smooth 1mm Avg 7.00M	1.422,00	Signature of Consignor
						Local Verification Signed
						PRO Number
						UK102952
						Seal numbers
						Truckers P.O. #
						PO750

Total quantity: 7.050,00

Total weight: 13.266,00

Carrier name: Manchett's Transport LTD

Carrier signature: _____

Date: _____

GSE Lining Technology GmbH Warboys, HUNTINGDON

Number VKL+118254
Voucher VKL+118254

Received at **Warboys, HUNTINGDON** from GSE Lining Technology GmbH the property described below, in apparent good order, except as noted (contents and condition of packages unknown), marked, consigned, and destined as indicated below, which said Carrier agrees to carry to the place of delivery at said destination. It is mutually agreed as to each Carrier of all or any said property, over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service performed hereunder shall be subject to the rates and contract agreed to in writing by GSE Lining Technology GmbH and Carrier. GSE Lining Technology GmbH's obligation to pay freight charges for the shipment is conditioned on (1) the existence of a separate written contract with the Carrier transporting the freight and (2) the Carrier's name appearing on this Bill of Lading, and other carriers must look solely to a party other than GSE Lining Technology GmbH for payment.

Ship to:	CELTIC LINING Ltd. c/o JLA Disposals Ltd Palleg Road Ystradgynais Swansea SA9 2UT Great Britain	Ship date:	Jun 20, 2018
		Branch plant:	1815
		Sales order:	VK110145

Shipping instructions:

Line no.	Shipped quantity	Product code	Unit	Kind of Package, Description of Articles, Special Marks and Exceptions	Weight kg	Project
1	2.800,00	HDT-200AM-BBB-W-W0	sqm	GSE HD textured 2.0 mm HS Code: 39201089 Country of Origin: Egypt	5.940,00	Freight charges are prepaid unless marked collect.
2				303025150 GSE HD textured 2.0 mm	1.230,00	Check box if collect
3				303025157 GSE HD textured 2.0 mm	1.208,00	☐
4				303025167 GSE HD textured 2.0 mm	1.193,00	
5				303027590 GSE HD textured 2.0 mm	1.213,00	Customer PO number
6	2.780,00	HDF-200AM-BBB-V-00	sqm	GSE HD textured 2.0 mm	1.221,00	JLA Swansea
7				GSE HD FrictionFlex 2.0 mm HS Code: 39201089	5.696,00	If this shipment is to be delivered to consignee, consignor shall sign the following statement.
8				404001370 GSE HD FrictionFlex 2.0 mm	1.183,00	Carrier may decline to deliver this shipment without payment of freight and all other lawful charges.
9				404001371 GSE HD FrictionFlex 2.0 mm	1.140,00	
10				404001375 GSE HD FrictionFlex 2.0 mm	1.129,00	
11	1.470,00	LDS-100AM-BBB-W-00	sqm	GSE HD FrictionFlex 2.0 mm	1.149,00	
				404001376 GSE HD FrictionFlex 2.0 mm	1.178,00	
				404001378 GSE HD FrictionFlex 2.0 mm	1.178,00	
				GSE UltraFlex Smooth 1mm Avg 7.00M HS Code: 39201089 Country of Origin: Egypt	1.397,00	
				304002245 GSE UltraFlex Smooth 1mm Avg 7.00M	1.422,00	Signature of Consignor
						Local Verification Signed
						PRO Number
						UK102952
						Seal numbers
						Truckers P.O. #
						PO750
Total quantity:		7.050,00	Total weight:		13.266,00	

Carrier name: Manchett's Transport LTD

Carrier signature: _____

Date: _____



GSE Lining Technology – Egypt S.A.E
Street #28, 4th Industrial Zone, 6th of October
City, Egypt
gseegypt@gseworld.com

ROLL TEST DATA REPORT

Roll No 303025150

Bill of Lading DO-003531

شركة جي إس إي لتكنولوجيا التغليف - مصر ش.م.م

شارع ٢٨ - المنطقة الصناعية الرابعة

مدينة السادس من أكتوبر - جمهورية مصر العربية

تليفون : ٨٨٨٨ ٢٢٨٨ (٢٠٢) + فاكس : ٨٨٨٩ ٢٢٨٨ (٢٠٢) +

رقم السجل التجاري : ٥٨١٢

رقم التسجيل بضريبة المبيعات : ٩٨٥ - ٤٥٨ - ٦١١

Roll Identification

Roll Number	303025150	Length	80 meters	Sheet Area	560 sq meters
Product Name	HDT-200AM-BBB-W-W0	Width (Nominal)	7.00 meters	Weight	1,230 kilograms
Production Date	10/16/2017				

Resin Information

Batch number 4217298

Physical Properties

Test Method

Test Result

Average Thickness, mm	ASTM D5994 Avg	2.07
Minimum Thickness, mm	ASTM D5994 Min	1.96
Tensile Yield Strength, N/mm MD	ASTM D6693/YS	39
Tensile Yield Strength, N/mm CD	ASTM D6693/YS	40
Elongation at Yield, % MD	ASTM D6693/YE	17
Elongation at Yield, % CD	ASTM D6693/YE	17
Tensile Break Strength, N/mm MD	ASTM D6693/BS	49
Tensile Break Strength, N/mm CD	ASTM D6693/BS	50
Elongation at Break, % MD	ASTM D6693/BE	536
Elongation at Break, % CD	ASTM D6693/BE	505
Puncture Resistance, N	ASTM D4833	750
Tear Resistance, N MD	ASTM D1004	358
Tear Resistance, N CD	ASTM D1004	357
Density, g/cm ³	ASTM D792	0.946
Carbon Black Content, %	ASTM D4218	2.38
Carbon Black Dispersion (Views in Cat1-Cat2)	ASTM D5596	10
Asperity Height, mm Face A	ASTM D 7466/A	0.65
Asperity Height, mm Face B	ASTM D 7466/B	0.40

Sales Order No. SO-002785

Customer Name GSE Lining Technology, GMBH

Project Name GSE Lining Technology, GMBH

Location

* Modified

QCWF-0102





GSE Lining Technology – Egypt S.A.E
Street #28, 4th Industrial Zone, 6th of October
City, Egypt
gseegypt@gseworld.com

ROLL TEST DATA REPORT

Roll No 303025157

Bill of Lading DO-003531

شركة جي إس إي لتكنولوجيا التبطين - مصر ش.م.م

شارع ٢٨ - المنطقة الصناعية الرابعة

مدينة السادس من أكتوبر - جمهورية مصر العربية

تليفون : ٢٨٢٨ ٨٨٨٨ (٢٠٢) + فاكس : ٢٨٢٨ ٨٨٨٩ (٢٠٢) +

رقم السجل التجاري : ٥٨١٢

رقم التسجيل بضريبة المبيعات : ٩٨٥ - ٤٥٨ - ٦١١

Roll Identification

Roll Number	303025157	Length	80 meters	Sheet Area	560 sq meters
Product Name	HDT-200AM-BBB-W-W0				
Production Date	10/16/2017	Width (Nominal)	7.00 meters	Weight	1,208 kilograms

Resin Information

Batch number 4217298

Physical Properties

Test Method

Test Result

Average Thickness, mm	ASTM D5994 Avg	2.03
Minimum Thickness, mm	ASTM D5994 Min	1.85
Tensile Yield Strength, N/mm MD	ASTM D6693/YS	44
Tensile Yield Strength, N/mm CD	ASTM D6693/YS	44
Elongation at Yield, % MD	ASTM D6693/YE	17
Elongation at Yield, % CD	ASTM D6693/YE	17
Tensile Break Strength, N/mm MD	ASTM D6693/BS	51
Tensile Break Strength, N/mm CD	ASTM D6693/BS	52
Elongation at Break, % MD	ASTM D6693/BE	546
Elongation at Break, % CD	ASTM D6693/BE	527
Puncture Resistance, N	ASTM D4833	727
Tear Resistance, N MD	ASTM D1004	349
Tear Resistance, N CD	ASTM D1004	341
Density, g/cm ³	ASTM D792	0.945
Carbon Black Content, %	ASTM D4218	2.41
Carbon Black Dispersion (Views in Cat1-Cat2)	ASTM D5596	10
Asperity Height, mm Face A	ASTM D 7466/A	0.54
Asperity Height, mm Face B	ASTM D 7466/B	0.48

Sales Order No. SO-002785

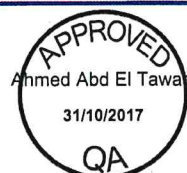
Customer Name GSE Lining Technology, GMBH

Project Name GSE Lining Technology, GMBH

Location

* Modified

QCWF-0102





ENVIRONMENTAL™

ROLL TEST DATA REPORT

GSE Lining Technology - Egypt S.A.E
Street #28, 4th Industrial Zone, 6th of October
City, Egypt
gseegypt@gseworld.com

Roll No 303025167

Bill of Lading DO-003531

شركة جي إس إي لتكنولوجيا التغليف - مصر ش.م.م

شارع ٢٨ - المنطقة الصناعية الرابعة

مدينة السادس من أكتوبر - جمهورية مصر العربية

تليفون : ٢٨٢٨ ٨٨٨٨ (٢٠٢) + فاكس : ٢٨٢٨ ٨٨٨٩ (٢٠٢) +

رقم السجل التجاري : ٥٨١٢

رقم التسجيل بضريبة المبيعات : ٩٨٥ - ٤٥٨ - ٦١١

Roll Identification

Roll Number	303025167	Length	80 meters	Sheet Area	560 sq meters
Product Name	HDT-200AM-BBB-W-W0				
Production Date	10/17/2017	Width (Nominal)	7.00 meters	Weight	1,193 kilograms

Resin Information

Batch number 4217298

Physical Properties

Test Method

Test Result

Average Thickness, mm	ASTM D5994 Avg	2.00
Minimum Thickness, mm	ASTM D5994 Min	1.90
Tensile Yield Strength, N/mm MD	ASTM D6693/YS	40
Tensile Yield Strength, N/mm CD	ASTM D6693/YS	42
Elongation at Yield, % MD	ASTM D6693/YE	17
Elongation at Yield, % CD	ASTM D6693/YE	17
Tensile Break Strength, N/mm MD	ASTM D6693/BS	50
Tensile Break Strength, N/mm CD	ASTM D6693/BS	52
Elongation at Break, % MD	ASTM D6693/BE	547
Elongation at Break, % CD	ASTM D6693/BE	558
Puncture Resistance, N	ASTM D4833	685
Tear Resistance, N MD	ASTM D1004	345
Tear Resistance, N CD	ASTM D1004	333
Density, g/cm ³	ASTM D792	0.945
Carbon Black Content, %	ASTM D4218	2.75
Carbon Black Dispersion (Views in Cat1-Cat2)	ASTM D5596	10
Asperity Height, mm Face A	ASTM D 7466/A	0.52
Asperity Height, mm Face B	ASTM D 7466/B	0.50

Sales Order No. SO-002785

Customer Name GSE Lining Technology, GMBH

Project Name GSE Lining Technology, GMBH

Location

* Modified

QCWF-0102





GSE Lining Technology - Egypt S.A.E
Street #28, 4th Industrial Zone, 6th of October
City, Egypt
gseegypt@gseworld.com

ROLL TEST DATA REPORT

Roll No 303027596

Bill of Lading DO-003695

مركة جى إس إى لتكنولوجيا التبطين - مصر ش.م.م

مارع ٢٨ - المنطقة الصناعية الرابعة

مدينة السادس من أكتوبر - جمهورية مصر العربية

ليفتون : ٣٨٢٨ ٨٨٨٨ (٢٠٢) + فاكس : ٣٨٢٨ ٨٨٨٩ (٢٠٢) +

رقم السجل التجارى : ٥٨١٢

رقم التسجيل بضريبة المبيعات : ٩٨٥ - ٤٥٨ - ٦١١

Roll Identification

Roll Number	303027596	Length	80 meters	Sheet Area	560 sq meters
Product Name	HDT-200AM-BBB-W-W0				
Production Date	02/11/2018	Width (Nominal)	7.00 meters	Weight	1,221 kilograms

Resin Information

Batch number SEN21070

Physical Properties

Test Method

Test Result

Average Thickness, mm	ASTM D5994 Avg	2.00
Minimum Thickness, mm	ASTM D5994 Min	1.87
Tensile Yield Strength, N/mm MD	ASTM D6693/YS	41
Tensile Yield Strength, N/mm CD	ASTM D6693/YS	44
Elongation at Yield, % MD	ASTM D6693/YE	16
Elongation at Yield, % CD	ASTM D6693/YE	16
Tensile Break Strength, N/mm MD	ASTM D6693/BS	45
Tensile Break Strength, N/mm CD	ASTM D6693/BS	46
Elongation at Break, % MD	ASTM D6693/BE	521
Elongation at Break, % CD	ASTM D6693/BE	523
Puncture Resistance, N	ASTM D4833	735
Tear Resistance, N MD	ASTM D1004	387
Tear Resistance, N CD	ASTM D1004	356
Density, g/cm ³	ASTM D792	0.945
Carbon Black Content, %	ASTM D4218	2.36
Carbon Black Dispersion (Views in Cat1-Cat2)	ASTM D5596	10
Asperity Height, mm Face A	ASTM D 7466/A	0.50
Asperity Height, mm Face B	ASTM D 7466/B	0.48

Sales Order No. SO-002912

Customer Name GSE Lining Technology, GMBH

Project Name Umlagerung 1800-TR-1815 c/o Manchett's Transport Ltd

Location

* Modified

QCWF-0102





ENVIRONMENTAL™

ROLL TEST DATA REPORT

GSE Lining Technology - Egypt S.A.E
Street #28, 4th Industrial Zone, 6th of October
City, Egypt
gseegypt@gseworld.com

Roll No 303027590

Bill of Lading DO-003695

مركة جى إس إى لتكنولوجيا التبلطين - مصر ش.م.م

مارع ٢٨ - المنطقة الصناعية الرابعة

مدينة السادس من أكتوبر - جمهورية مصر العربية

ليفون : ٢٨٢٨ ٨٨٨٨ (٢٠٢) + فاكس : ٢٨٢٨ ٨٨٨٩ (٢٠٢) +

رقم السجل التجارى : ٥٨١٢

رقم التسجيل بضريبة المبيعات : ٩٨٥ - ٤٥٨ - ٦١١

Roll Identification

Roll Number	303027590	Length	80 meters	Sheet Area	560 sq meters
Product Name	HDT-200AM-BBB-W-W0				
Production Date	02/10/2018	Width (Nominal)	7.00 meters	Weight	1,213 kilograms

Resin Information

Batch number SEN21070

Physical Properties

Test Method

Test Result

Average Thickness, mm	ASTM D5994 Avg	2.00
Minimum Thickness, mm	ASTM D5994 Min	1.87
Tensile Yield Strength, N/mm MD	ASTM D6693/YS	41
Tensile Yield Strength, N/mm CD	ASTM D6693/YS	42
Elongation at Yield, % MD	ASTM D6693/YE	17
Elongation at Yield, % CD	ASTM D6693/YE	17
Tensile Break Strength, N/mm MD	ASTM D6693/BS	44
Tensile Break Strength, N/mm CD	ASTM D6693/BS	43
Elongation at Break, % MD	ASTM D6693/BE	848
Elongation at Break, % CD	ASTM D6693/BE	431
Puncture Resistance, N	ASTM D4833	720
Tear Resistance, N MD	ASTM D1004	341
Tear Resistance, N CD	ASTM D1004	328
Density, g/cm ³	ASTM D792	0.944
Carbon Black Content, %	ASTM D4218	2.58
Carbon Black Dispersion (Views in Cat1-Cat2)	ASTM D5596	10
Asperity Height, mm Face A	ASTM D 7466/A	0.49
Asperity Height, mm Face B	ASTM D 7466/B	0.47

Sales Order No. SO-002912

Customer Name GSE Lining Technology, GMBH

Project Name Umlagerung 1800-TR-1815 c/o Manchett's Transport Ltd

Location

* Modified

QCWF-0102





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 404001370
Bill of Lading VKL+118254

ENVIRONMENTAL™

Roll Identification

Roll Number	404001370	Length	80 meters	Sheet Area	556,00 m²
Product Name	HDF-200AM-BBB-V-00	Width	6,95 meters	Weight	1.183 kilograms
Production Date	Nov 08, 2017				

Resin Information

Batch number BN17064-33172414

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	2,03
Core Thickness Minimum [mm]	ASTM D5994 MI	1,86
Core Thickness Maximum [mm]	ASTM D5994 MA	2,17
Carbon Black Content [%]	ASTM D4218.	2,4
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0,2
Density [g/cm³]	ASTM D792	0,949
Dimensional Stability [%] MD	ASTM D1204	-0,1
Dimensional Stability [%] CMD	ASTM D1204	-1,0
Yield Strength [N/mm] MD	ASTM D6693 SP	36,5
Yield Strength [N/mm] CMD	ASTM D6693 SP	38,3
Yield Elongation [%] MD	ASTM D6693 SD	16,6
Yield Elongation [%] CMD	ASTM D6693 SD	16,5
Break Strength [N/mm] MD	ASTM D6693 ZF	78
Break Strength [N/mm] CMD	ASTM D6693 ZF	69
Break Elongation [%] MD	ASTM D6693 BD	952
Break Elongation [%] CMD	ASTM D6693 BD	874
Tear Resistance [N] MD	ASTM D1004	290
Tear Resistance [N] CMD	ASTM D1004	280
Asperity Height [mm]	ASTM D7466 /A	0,57
Puncture Resistance [N]	ASTM D4833	739
Spraying Weight [g/m²] oben	GSE Test	45
Spraying Weight [g/m²] unten	GSE Test	46
OIT [min]	ASTM D3895	240
Stress Crack Resistance [h]	ASTM D 5397 SP-NCTL	500

Sales Order No. VK110145
Customer Name CELTIC LINING Ltd.
Project Name CELTIC LINING Ltd.
Location Swansea SA9 2UT
* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 404001371
Bill of Lading VKL+118254

ENVIRONMENTAL™

Roll Identification

Roll Number	404001371	Length	80 meters	Sheet Area	556,00 m²
Product Name	HDF-200AM-BBB-V-00	Width	6,95 meters	Weight	1.140 kilograms
Production Date	Nov 08, 2017				

Resin Information

Batch number BN17064-33172414

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	2,05
Core Thickness Minimum [mm]	ASTM D5994 MI	1,91
Core Thickness Maximum [mm]	ASTM D5994 MA	2,20
Carbon Black Content [%]	ASTM D4218.	2,4
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0,2
Density [g/cm³]	ASTM D792	0,949
Dimensional Stability [%] MD	ASTM D1204	-0,1
Dimensional Stability [%] CMD	ASTM D1204	-1,0
Yield Strength [N/mm] MD	ASTM D6693 SP	37,2
Yield Strength [N/mm] CMD	ASTM D6693 SP	41,4
Yield Elongation [%] MD	ASTM D6693 SD	16,8
Yield Elongation [%] CMD	ASTM D6693 SD	16,8
Break Strength [N/mm] MD	ASTM D6693 ZF	71
Break Strength [N/mm] CMD	ASTM D6693 ZF	72
Break Elongation [%] MD	ASTM D6693 BD	840
Break Elongation [%] CMD	ASTM D6693 BD	833
Tear Resistance [N] MD	ASTM D1004	321
Tear Resistance [N] CMD	ASTM D1004	321
Asperity Height [mm]	ASTM D7466 /A	0,55
Puncture Resistance [N]	ASTM D4833	800
Spraying Weight [g/m²] oben	GSE Test	42
Spraying Weight [g/m²] unten	GSE Test	45
OIT [min]	ASTM D3895	240
Stress Crack Resistance [h]	ASTM D 5397 SP-NCTL	500

Sales Order No. VK110145
Customer Name CELTIC LINING Ltd.
Project Name CELTIC LINING Ltd.
Location Swansea SA9 2UT
* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 404001375
Bill of Lading VKL+118254

ENVIRONMENTAL™

Roll Identification

Roll Number	404001375	Length	80 meters	Sheet Area	556,00 m²
Product Name	HDF-200AM-BBB-V-00	Width	6,95 meters	Weight	1.129 kilograms
Production Date	Nov 09, 2017				

Resin Information

Batch number BN17065-33172414

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	2,04
Core Thickness Minimum [mm]	ASTM D5994 MI	1,87
Core Thickness Maximum [mm]	ASTM D5994 MA	2,19
Carbon Black Content [%]	ASTM D4218.	2,4
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0,2
Density [g/cm³]	ASTM D792	0,947
Dimensional Stability [%] MD	ASTM D1204	-0,2
Dimensional Stability [%] CMD	ASTM D1204	-1,0
Yield Strength [N/mm] MD	ASTM D6693 SP	36,9
Yield Strength [N/mm] CMD	ASTM D6693 SP	36,8
Yield Elongation [%] MD	ASTM D6693 SD	16,5
Yield Elongation [%] CMD	ASTM D6693 SD	14,6
Break Strength [N/mm] MD	ASTM D6693 ZF	62
Break Strength [N/mm] CMD	ASTM D6693 ZF	67
Break Elongation [%] MD	ASTM D6693 BD	800
Break Elongation [%] CMD	ASTM D6693 BD	833
Tear Resistance [N] MD	ASTM D1004	314
Tear Resistance [N] CMD	ASTM D1004	271
Asperity Height [mm]	ASTM D7466 /A	0,57
Puncture Resistance [N]	ASTM D4833	772
Spraying Weight [g/m²] oben	GSE Test	45
Spraying Weight [g/m²] unten	GSE Test	45
OIT [min]	ASTM D3895	244
Stress Crack Resistance [h]	ASTM D 5397 SP-NCTL	500

Sales Order No. VK110145
Customer Name CELTIC LINING Ltd.
Project Name CELTIC LINING Ltd.
Location Swansea SA9 2UT
* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 404001376
Bill of Lading VKL+118254

ENVIRONMENTAL™

Roll Identification

Roll Number	404001376				
Product Name	HDF-200AM-BBB-V-00	Length	80 meters	Sheet Area	556,00 m²
Production Date	Nov 09, 2017	Width	6,95 meters	Weight	1.149 kilograms

Resin Information

Batch number BN17065-33172414

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	2,04
Core Thickness Minimum [mm]	ASTM D5994 MI	1,87
Core Thickness Maximum [mm]	ASTM D5994 MA	2,19
Carbon Black Content [%]	ASTM D4218.	2,4
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0,2
Density [g/cm³]	ASTM D792	0,947
Dimensional Stability [%] MD	ASTM D1204	-0,2
Dimensional Stability [%] CMD	ASTM D1204	-1,0
Yield Strength [N/mm] MD	ASTM D6693 SP	36,9
Yield Strength [N/mm] CMD	ASTM D6693 SP	36,8
Yield Elongation [%] MD	ASTM D6693 SD	16,5
Yield Elongation [%] CMD	ASTM D6693 SD	14,6
Break Strength [N/mm] MD	ASTM D6693 ZF	62
Break Strength [N/mm] CMD	ASTM D6693 ZF	67
Break Elongation [%] MD	ASTM D6693 BD	800
Break Elongation [%] CMD	ASTM D6693 BD	833
Tear Resistance [N] MD	ASTM D1004	314
Tear Resistance [N] CMD	ASTM D1004	271
Asperity Height [mm]	ASTM D7466 /A	0,57
Puncture Resistance [N]	ASTM D4833	772
Spraying Weight [g/m²] oben	GSE Test	45
Spraying Weight [g/m²] unten	GSE Test	45
OIT [min]	ASTM D3895	244
Stress Crack Resistance [h]	ASTM D 5397 SP-NCTL	500

Sales Order No. VK110145
Customer Name CELTIC LINING Ltd.
Project Name CELTIC LINING Ltd.
Location Swansea SA9 2UT

* Modified





ROLL TEST DATA REPORT

Inspection Certificate 3.1 (DIN EN 10204)

GSE Lining Technology GmbH

Roll No 404001378
Bill of Lading VKL+118254

ENVIRONMENTAL™

Roll Identification

Roll Number	404001378	Length	80 meters	Sheet Area	556,00 m²
Product Name	HDF-200AM-BBB-V-00	Width	6,95 meters	Weight	1.178 kilograms
Production Date	Nov 09, 2017				

Resin Information

Batch number BN17065-33172414

Physical Properties	Test Method	Test Result
Core Thickness Average [mm]	ASTM D5994 MW	2,02
Core Thickness Minimum [mm]	ASTM D5994 MI	1,85
Core Thickness Maximum [mm]	ASTM D5994 MA	2,15
Carbon Black Content [%]	ASTM D4218.	2,4
Carbon Black Dispersion [Cat]	ASTM D5596	1
MFR (190/2,16) [g/10min]	ASTM D1238(190/2,16)	0,2
Density [g/cm³]	ASTM D792	0,947
Dimensional Stability [%] MD	ASTM D1204	-0,2
Dimensional Stability [%] CMD	ASTM D1204	-1,0
Yield Strength [N/mm] MD	ASTM D6693 SP	41,2
Yield Strength [N/mm] CMD	ASTM D6693 SP	38,8
Yield Elongation [%] MD	ASTM D6693 SD	17,2
Yield Elongation [%] CMD	ASTM D6693 SD	15,9
Break Strength [N/mm] MD	ASTM D6693 ZF	80
Break Strength [N/mm] CMD	ASTM D6693 ZF	63
Break Elongation [%] MD	ASTM D6693 BD	917
Break Elongation [%] CMD	ASTM D6693 BD	760
Tear Resistance [N] MD	ASTM D1004	315
Tear Resistance [N] CMD	ASTM D1004	306
Asperity Height [mm]	ASTM D7466 /A	0,55
Puncture Resistance [N]	ASTM D4833	785
Spraying Weight [g/m²] oben	GSE Test	46
Spraying Weight [g/m²] unten	GSE Test	42
OIT [min]	ASTM D3895	244
Stress Crack Resistance [h]	ASTM D 5397 SP-NCTL	500

Sales Order No. VK110145
Customer Name CELTIC LINING Ltd.
Project Name CELTIC LINING Ltd.
Location Swansea SA9 2UT
* Modified



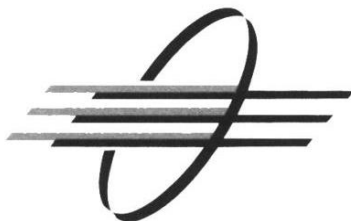
**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 5
HDPE Conformance
Test Results

Report Number 1807r3v1d0219



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REPORT

GEOSYNTHETICS TEST REPORT

REPORT REFERENCE: BS-P179/a

Report Date 11/07/2018
Client Celtic Lining Ltd, Blackwood, NP12 0SF
Contact Dyfed Jones
Contract Reference Palleg Landfill Site
Client PO/Ref No Verbal

Material Tested 2mm HDPE Textured Geomembrane
Date Received 04/07/2018
Sample IDs Roll No's: 303027596 & 404001375

Tests Requested Thickness - ASTM D5994-10
Density - ASTM D1505-10
Carbon Black Content - ASTM D1603-14
Carbon Black Dispersion - ASTM D5596-03
Tensile Properties - ASTM D6693-04
Puncture Resistance - ASTM D4833-07
Tear Resistance - ASTM D1004-13
Asperity Height - GRI GM12
Data Pending → Stress Crack - ASTM D5397-07

If you have any questions or require additional information, please do not hesitate to contact us.

Prepared by:

Shazeena Iqbal
Technical Director

Approved by:

Cliff Butt
Managing Director



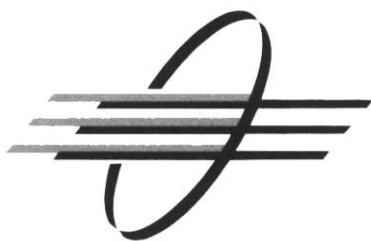
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Tests marked # have been subcontracted and are UKAS accredited. Tests marked F are accredited under the company's UKAS Flexible Scope.

This test report is in a condensed format, complete test details available upon request.

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GEOSYNTHETICS TEST RESULTS

CELTIC LINING LTD

P.O NO: Verbal

Contract Ref: Palleg Landfill Site

Material: 2mm HDPE Textured Geomembrane

Sample ID: Roll No: 303027596

Report Ref No: BS-P179/a

BICS Sample Ref: 01

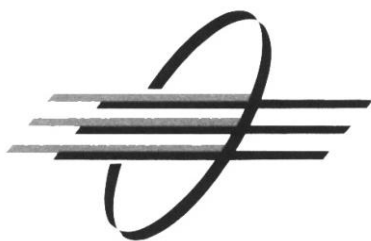
Dates Tested: 25/10/2017

PARAMETER	TEST SPECIMEN NUMBER										MEAN	Std Dev
Thickness (ASTM D5994-10)	1	2	3	4	5	6	7	8	9	10		
mm	2.09	2.09	2.12	2.13	2.09	2.08	2.06	2.06	1.96	2.13	2.08	0.05
Density (ASTM D1505-10)												
g/cc	0.941	0.941	0.941								0.941	0.000
Carbon Black Content (ASTM D1603-14)												
%	2.51	2.56									2.54	0.04
Carbon Black Dispersion (ASTM D5596-03)												
Category Rating - 1st Rf	1	1	1	1	1						1	0
Category Rating - 2nd Rf	1	1	1	1	1						1	0
Tensile Properties (ASTM D6693-04)												
Yield Strength N/mm (MD)	37.6	37.7	41.3	41.0	37.0						38.9	2.1
Yield Strength N/mm (CD)	43.6	43.0	40.6	37.1	36.8						40.2	3.2
Yield Elongation % (MD)	19	19	19	21	19						19	1
Yield Elongation % (CD)	18	18	18	18	18						18	0
Break Strength kN/m (MD)	59.5	51.9	68.0	70.6	57.2						61.4	7.8
Break Strength kN/m (CD)	58.8	61.3	73.1	53.3	49.7						59.2	9.0
Break Elongation % (MD)	810	720	860	880	780						810	64
Break Elongation % (CD)	740	780	950	750	710						786	95
Puncture Resistance (ASTM D4833-07)												
N	770	760	754	749	743						755	10
Tear Resistance (ASTM D1004-13)												
N (MD)	294	331	329	295	356	338	285	329	290	350	319	26
N (CD)	280	277	275	270.9	291	313	339	362	327	355	309	35
Asperity Height (GRI GM12)												
Side A mm	0.62	0.74	0.51	0.55	0.55	0.50	0.57	0.62	0.61	0.64	0.59	0.1
Side B mm	0.70	0.69	0.66	0.66	0.75	0.71	0.76	0.65	0.76	0.69	0.70	0.1

Atmospheric Conditions at Test / Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH

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GEOSYNTHETICS TEST RESULTS

CELTIC LINING LTD

P.O NO: Verbal

Contract Ref: Palleg Landfill Site

Material: 2mm HDPE Textured Geomembrane

Sample ID: Roll No: 404001375

Report Ref No: BS-P179/a

BICS Sample Ref: 02

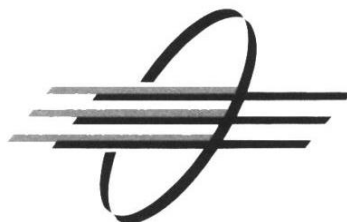
Dates Tested: 04-11/07/2018

PARAMETER	TEST SPECIMEN NUMBER										MEAN	Std Dev
Thickness (ASTM D5994-10)	1	2	3	4	5	6	7	8	9	10		
mm	2.05	2.09	2.16	2.06	2.09	2.15	2.04	2.03	2.17	2.14	2.10	0.05
Density (ASTM D1505-10)												
g/cc	0.941	0.941	0.941								0.941	0.000
Carbon Black Content (ASTM D1603-14)												
%	2.55	2.56									2.56	0.01
Carbon Black Dispersion (ASTM D5596-03)												
Category Rating - 1st Rf	1	1	1	1	1						1	0
Category Rating - 2nd Rf	1	1	1	1	1						1	0
Tensile Properties (ASTM D6693-04)												
Yield Strength N/mm (MD)	36.9	35.8	36.3	34.3	42.8						37.2	3.3
Yield Strength N/mm (CD)	37.1	37.5	37.5	36.6	38.5						37.4	0.7
Yield Elongation % (MD)	20	20	20	19	19						20	1
Yield Elongation % (CD)	18	18	19	19	18						18	1
Break Strength kN/m (MD)	56.4	59.0	52.8	60.7	71.5						60.1	7.1
Break Strength kN/m (CD)	57.7	60.8	52.8	58.9	60.3						58.1	3.2
Break Elongation % (MD)	810	850	760	880	880						836	51
Break Elongation % (CD)	830	870	760	830	850						828	41
Puncture Resistance (ASTM D4833-07)												
N	722	714	705	705	703						710	8
Tear Resistance (ASTM D1004-13)												
N (MD)	290	277	301	280	329	302	284	301	291	309	296	16
N (CD)	323	300	311	301	320	311	288	297	300	333	308	14
Asperity Height (GRI GM12)												
Side A mm	0.52	0.67	0.54	0.59	0.63	0.60	0.51	0.61	0.57	0.64	0.59	0.1
Side B mm	0.78	0.59	0.64	0.65	0.66	0.72	0.69	0.71	0.75	0.68	0.69	0.1

Atmospheric Conditions at Test / Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH

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REPORT

GEOSY T ETICS TEST REPORT

REPORT REFERENCE: BS-P179/a Supplementary¹

Report Date 02/08/2018
Client Celtic Lining Ltd, Blackwood, NP12 0SF
Contact Dyfed Jones
Contract Reference Palleg Landfill Site
Client PO/Ref no Verbal

Material Tested 2mm HDPE Textured Geomembrane
Date Received 04/07/2018
Sample IDs See Test Report

Tests Requested Stress Crack - ASTM D5397-07

¹ Supplementary Test Report - data pending test results

If you have any questions or require additional information, please do not hesitate to contact us.

Prepared by:

Anatolijus Jadovas
Quality Manager

Approved by:

Cliff Butt
Managing Director



4438

Page 1 of 2

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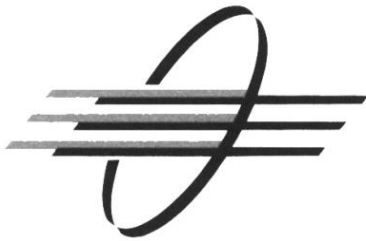
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Directors: Clifford Butt, Shazeena N. Iqbal Company Registration Number: 4213030



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GEOSY T ETICS TEST RES LTS CELTIC LI I G LTD P.O O: Ver al

Contract Ref: Palleg Landfill Site
aterial: 2mm DPE Textured Geomem rane
Sample ID: See Belo

Report Ref o: BS-P179/a Sup
BICS Sample Ref: See Belo
Dates Tested: 12/07-02/08/2018

PARAMETER	TEST SPECIMEN NUMBER										MEAN	Std Dev
	1	2	3	4	5	6	7	8	9	10		
Sample ID: Roll o: 303027596											BICS Sample Ref: 01	
Stress Crac Resistance (AST D5397-07)												
hrs	>500	>500	>500	>500	>500	Note: Test terminated without break, no failure					500	-
Sample ID: Roll o: 404001375											BICS Sample Ref: 02	
Stress Crac Resistance (AST D5397-07)												
hrs	>500	>500	>500	>500	>500	Note: Test terminated without break, no failure					500	-

Atmospheric Conditions at Test / Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH

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CO IDE TIAL TEST REPORT

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 6
HDPE Deployment
Records

Report Number 1807r3v1d0219



Geosynthetic Panel Deployment

CQA11

Site	Palleg Road Landfill Sub-Cell 6	Material	2mm HDPE DRS	Installer	Celtic Lining Ltd.
-------------	--	-----------------	---------------------	------------------	---------------------------

Date	Roll No	Panel No	Thickness L	Thickness R	Thickness F	Thickness B	Length	Width	Visual Check	Approved	Non-Con No
02/07/2018	303025167	P1	2.05	2.06	2.07	2.05	80	5.8	Yes	Yes	
02/07/2018	303025157	P2	2.08	2.07	2.05	2.05	80	5.8	Yes	Yes	
02/07/2018	303025150	P3	2.05	2.05	2.05	2.05	75	5.8	Yes	Yes	
02/07/2018	303025150	P4	2.05	2.08	2.08	2.06	7	5.8	Yes	Yes	
02/07/2018	404001375	P5	2.05	2.08	2.06	2.05	55	5.8	Yes	Yes	
02/07/2018	404001375	P6	2.06	2.09	2.05	2.08	7	5.8	Yes	Yes	
02/07/2018	303027596	P7	2.05	2.05	2.06	2.05	32	5.8	Yes	Yes	
02/07/2018	303027596	P8	2.05	2.08	2.07	2.05	9	5.8	Yes	Yes	
02/07/2018	303027596	P9	2.05	2.05	2.05	2.05	1	5.8	Yes	Yes	
02/07/2018	303027596	P10	2.05	2.08	2.08	2.06	14	5.8	Yes	Yes	
02/07/2018	303027596	P11	2.08	2.06	2.05	2.05	32	5.8	Yes	Yes	
02/07/2018	303027596	P12	2.05	2.05	2.05	2.08	3	5.8	Yes	Yes	

02/07/2018	303027596	P13	2.08	2.08	2.05	2.05	7.5	5.8	Yes	Yes	
02/07/2018	303027596	P14	2.08	2.05	2.05	2.08	7	5.8	Yes	Yes	
02/07/2018	303027596	P15	2.09	2.05	2.05	2.06	18	5.8	Yes	Yes	
02/07/2018	303027596	P16	2.05	2.05	2.05	2.05	18.5	5.8	Yes	Yes	
02/07/2018	404001371	P17	2.08	2.08	2.05	2.05	18.5	5.8	Yes	Yes	
02/07/2018	404001371	P18	2.05	2.08	2.08	2.05	19.5	5.8	Yes	Yes	
02/07/2018	404001371	P19	2.08	2.08	2.08	2.05	19.5	5.8	Yes	Yes	
02/07/2018	404001371	P20	2.05	2.05	2.05	2.05	19	5.8	Yes	Yes	
02/07/2018	303027590	P21	2.05	2.08	2.08	2.06	9	5.8	Yes	Yes	
02/07/2018	303027590	P22	2.05	2.08	2.06	2.05	19	5.8	Yes	Yes	
02/07/2018	303027590	P23	2.06	2.09	2.05	2.08	21	5.8	Yes	Yes	
02/07/2018	303027590	P24	2.05	2.05	2.06	2.05	7	5.8	Yes	Yes	
02/07/2018	303027590	P25	2.05	2.08	2.07	2.05	23	5.8	Yes	Yes	
02/07/2018	404001376	P26	2.05	2.05	2.05	2.05	25	5.8	Yes	Yes	
02/07/2018	404001376	P27	2.05	2.08	2.08	2.06	28	5.8	Yes	Yes	
02/07/2018	404001376	P28	2.08	2.06	2.05	2.05	24.5	5.8	Yes	Yes	

02/07/2018	404001376	P29	2.09	2.05	2.05	2.05	21	5.8	Yes	Yes	
03/07/2018	404001370	P30	2.05	2.05	2.05	2.08	7	5.8	Yes	Yes	
03/07/2018	404001370	P31	2.08	2.08	2.05	2.08	13	5.8	Yes	Yes	
03/07/2018	404001370	P32	2.05	2.08	2.08	2.08	14.5	5.8	Yes	Yes	



Geomembrane Seam Construction

CQA12

Site	Palleg Road Landfill Sub-Cell 6	Membrane	2mm HDPE DRS	Installer	Celtic Lining Ltd.
-------------	--	-----------------	---------------------	------------------	---------------------------

Date	Seam No	Panel Nos	Length	Machine	Operator	DS Number	NDT Type	APT Start	APT Finish	Approved	Non Con Num.
02/07/2018	Startup Test	Test		CL10	CG					Pass	
02/07/2018	Startup Test	Test		CL12	SJ					Pass	
02/07/2018	Ex/P1	Ex/P1	80	CL12	SJ		Air Pressure	2.1	2	Pass	
02/07/2018	1/2	1/2	80	CL10	CG	DS4	Air Pressure	2.2	2.1	Pass	
02/07/2018	2/3	2/3	75	CL12	SJ		Air Pressure	2.1	2	Pass	
02/07/2018	4/5	4/5	7	CL10	CG		Air Pressure	2.1	2	Pass	
02/07/2018	3/4&5	3/4&5	55	CL12	SJ	DS1	Air Pressure	2.1	2	Pass	
02/07/2018	6/7	6/7	7	CL10	CG		Air Pressure	2	1.9	Pass	
02/07/2018	Ex/6&7	Ex/6&7	32	CL12	SJ		Air Pressure	2.2	2.1	Pass	
02/07/2018	8/9	8/9	9	CL10	CG		Air Pressure	2.1	2	Pass	
02/07/2018	9/10	9/10	1	CL12	SJ		Air Pressure	2.1	2	Pass	
02/07/2018	Ex/8-10	Ex/8-10	14	CL10	CG		Air Pressure	2	1.9	Pass	

02/07/2018	6&7/11	6&7/11	32	CL12	SJ	DS3	Air Pressure	2.1	2	Pass	
02/07/2018	12/13	12/13	3	CL10	CG		Air Pressure	2	2	Pass	
02/07/2018	13/14	13/14	7.5	CL12	SJ		Air Pressure	2.2	2.1	Pass	
02/07/2018	15/16	15/16	7	CL10	CG		Air Pressure	2.1	2	Pass	
02/07/2018	14/15&16	14/15&16	18	CL12	SJ		Air Pressure	2	1.9	Pass	
02/07/2018	15&16/17	15&16/17	18.5	CL10	CG		Air Pressure	1.9	1.8	Pass	
02/07/2018	17/18	17/18	18.5	CL12	SJ		Air Pressure	1.9	1.8	Pass	
02/07/2018	18/19	18/19	19.5	CL10	CG		Air Pressure	1.9	1.9	Pass	
02/07/2018	19/20	19/20	19.5	CL12	SJ		Air Pressure	2	1.9	Pass	
02/07/2018	20/21	20/21	19	CL10	CG	DS6	Air Pressure	2	2	Pass	
02/07/2018	21/22	21/22	9	CL12	SJ		Air Pressure	2	1.9	Pass	
02/07/2018	21&22/23	21&22/23	19	CL10	CG		Air Pressure	2	1.9	Pass	
02/07/2018	23/24	23/24	21	CL12	SJ		Air Pressure	2.1	2	Pass	
02/07/2018	21-23/5	21-23/5	7	CL10	CG		Air Pressure	2	2	Pass	
02/07/2018	24/25-27	24/25-27	23	CL12	SJ		Air Pressure	2.2	2.1	Pass	
02/07/2018	25-27/26	25-27/26	25	CL10	CG		Air Pressure	1.9	1.8	Pass	

02/07/2018	24/22	24/22	28	CL12	SJ		Air Pressure	1.9	1.9	Pass	
02/07/2018	28/29	28/29	24.5	CL10	CG		Air Pressure	2	1.9	Pass	
03/07/2018	29/30	29/30	7	CL10	CG	DS7	Air Pressure	2.2	2.1	Pass	
03/07/2018	28/29-32	28/29-32	29.5	CL10	CG		Air Pressure	2.2	2.1	Pass	
03/07/2018	31/32	31/32	5	CL10	CG		Air Pressure	2.2	2.1	Pass	
03/07/2018	29-30/31-32	29-30/31-32	30	CL10	CG		Air Pressure	2.2	2.1	Pass	



Geosynthetic Repair Record

CQA13

Site	Palleg Road Landfill Sub-Cell 6	Material	HDPE Geomembrane	Installer	Celtic Lining Ltd.
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Date	Repair No	Location	Defect Type	Repair Type	Machine	Operator	NDT	Pass/Fail	Approved	Non Con Num.
03/07/2018	1	P19/20	End of seam	Patch	CL16A	SJ	Vacc	Pass	Y	
03/07/2018	2	P3/11/16/17	Panel Join	Patch	CL16A	SJ	Vacc	Pass	Y	
03/07/2018	3	P1/7/8	Panel Join	Patch	CL16A	SJ	Vacc	Pass	Y	
03/07/2018	4	P28/29/30	Panel Join / DS	Patch	CL16A	SJ	Vacc	Pass	Y	
03/07/2018	5	P5/28/30	Panel Join	Patch	CL16A	SJ	Vacc	Pass	Y	
03/07/2018	6	Esiting / P3	Panel Join	Patch	CL16A	SJ	Vacc	Pass	Y	



Repair 1 Patch



Repair 2



Repair 3



Repair 4



Repair 5



Repair 6



Approval Certificate

EN 13067 Plastics Welding Personnel - Approval Testing of Welders - Thermoplastic Welded Assemblies

CSWIP CERT NO 334811

This is to certify that:

Paul Campion

Date of birth 27 December 1984

has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 7th Edition, February 2017 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

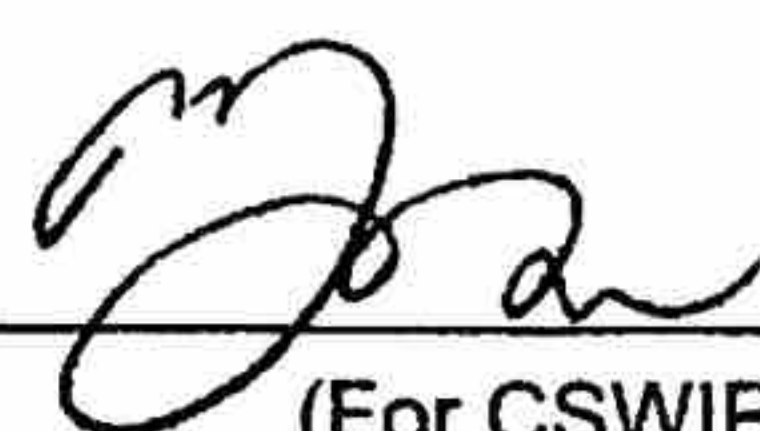
Geomembrane welding

7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 21 June 2018

Date of expiry 8 February 2019


EXAMINER

Signed 
(For CSWIP)

SIGNATURE OF HOLDER
(Person named above)



Date 19/7/18

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Approval Certificate

EN 13067 Plastics Welding Personnel - Approval Testing of Welders - Thermoplastic Welded Assemblies

CSWIP CERT NO 108740/3

This is to certify that:

Gareth Wyn Jones

Date of birth 6 March 1982

has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 6th Edition, April 2007 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

Geomembrane welding

- 7.4 Machine Hot Wedge welding of PE lining membrane.
- 7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 24 March 2018

Date of expiry 17 March 2019


EXAMINER

Signed 
(For CSWIP)

SIGNATURE OF HOLDER
(Person named above) 

Date 9/4/18

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Approval Certificate

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CSWIP CERT NO 109220/2

This is to certify that:

Sion Watkin Jones

Date of birth 31 December 1972

has demonstrated proficiency as a Plastics Welder Standard Level in accordance with CSWIP requirements published in Document CSWIP-PW-6-96, 6th Edition, April 2007 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

Geomembrane welding

7.4 Machine Hot Wedge welding of PE lining membrane (electric heated wedge)

Date of issue 20 May 2017

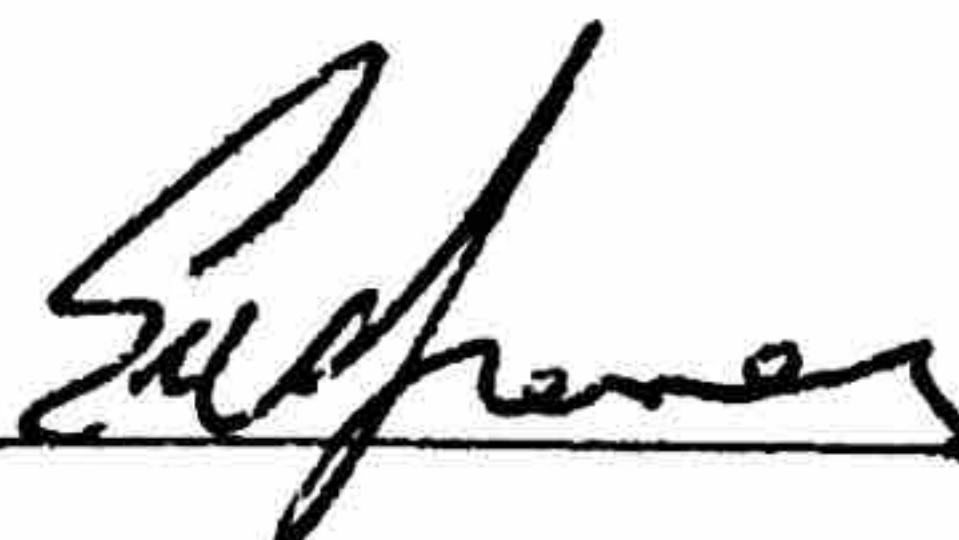
Date of expiry 26 May 2018


EXAMINER

Signed


(For CSWIP)

SIGNATURE OF HOLDER
(Person named above)



Date

21/6/18

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Approval Certificate

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CSWIP CERT NO 334811

This is to certify that:

Paul Campion

Date of birth 27 December 1984

has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 7th Edition, February 2017 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

Geomembrane welding

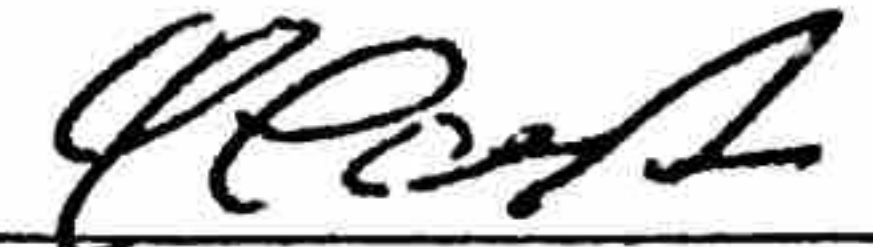
7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 21 June 2018

Date of expiry 8 February 2019


EXAMINER

Signed 
(For CSWIP)

SIGNATURE OF HOLDER
(Person named above) 

Date 19/7/18

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Approval Certificate

EN 13067 Plastics Welding Personnel - Approval Testing of Welders - Thermoplastic Welded Assemblies

CSWIP CERT NO 334813

This is to certify that:

Eifion Wyn Jones

Date of birth 20 March 1984

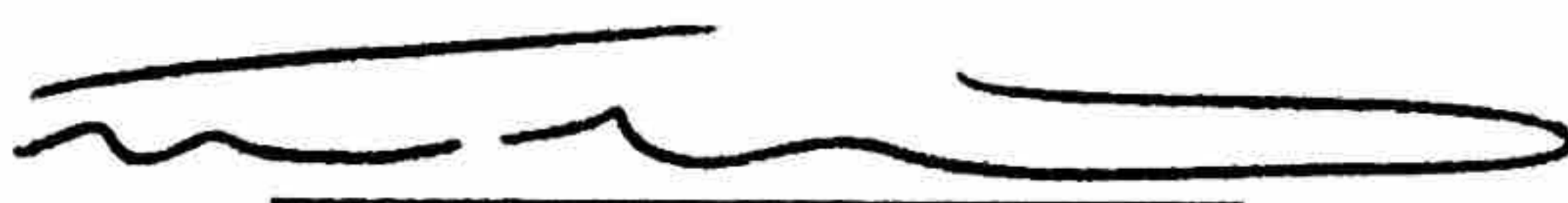
has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 7th Edition, February 2017 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

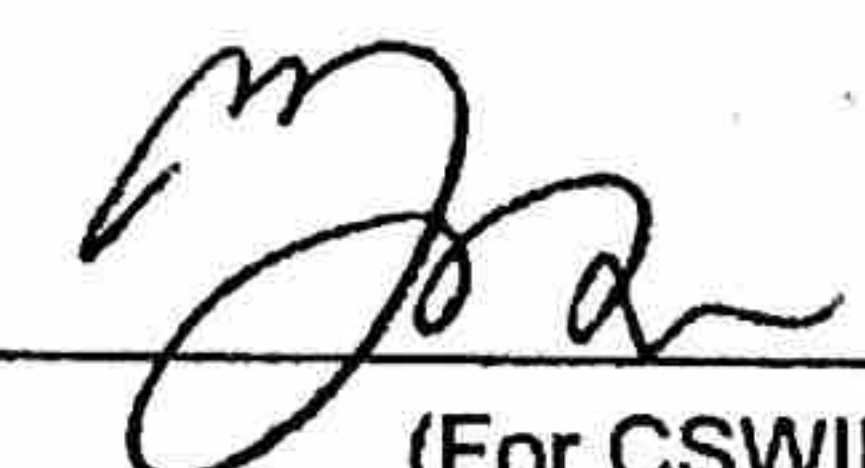
Geomembrane welding

- 7.4 Machine Hot Wedge welding of PE lining membrane (electric heated wedge)
- 7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 21 June 2018

Date of expiry 8 February 2019


EXAMINER

Signed 
(For CSWIP)

SIGNATURE OF HOLDER
(Person named above) _____ Date _____

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Approval Certificate

EN 13067 Plastics Welding Personnel - Approval Testing of Welders - Thermoplastic Welded Assemblies

CSWIP CERT NO 334822

This is to certify that:

Elgan Wyn Jones

Date of birth 14 March 1980

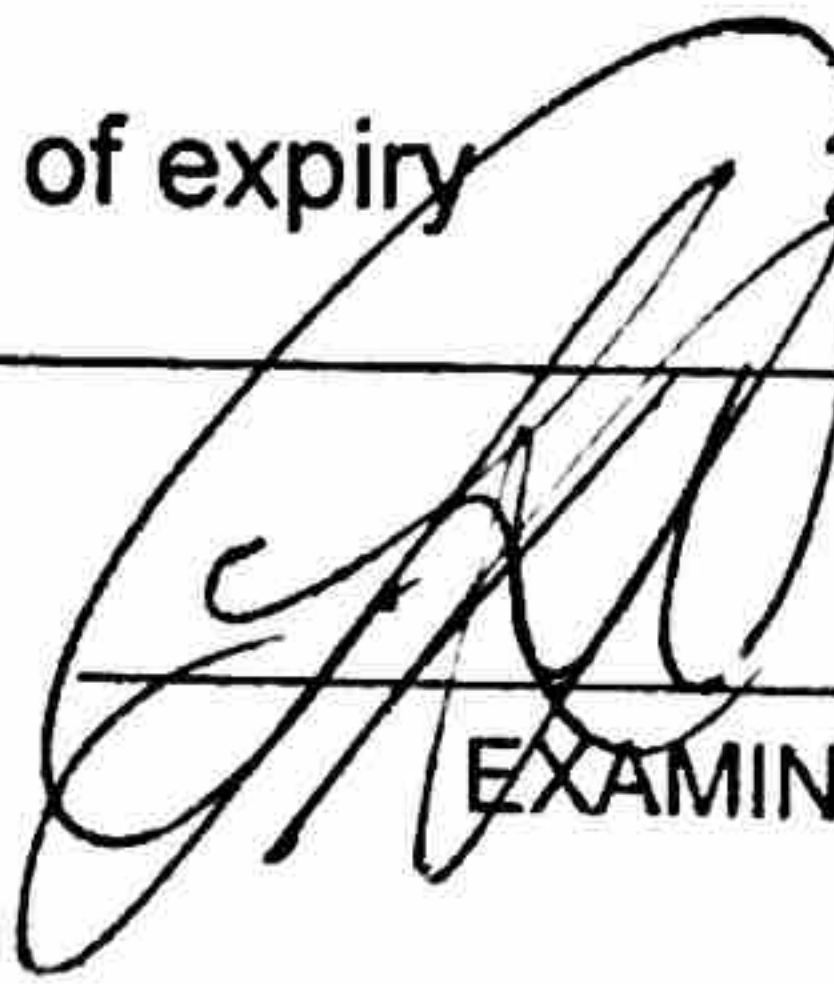
has demonstrated proficiency as a Plastics Welder Standard Level in accordance with the CSWIP requirements published in Document CSWIP-PW-6-96, 7th Edition, February 2017 and amendments in force on the examination date. This certificate is valid for the special categories mentioned below:

Geomembrane welding

- 7.4 Machine Hot Wedge welding of PE lining membrane (electric heated wedge)
- 7.5 Extrusion welded PE lining membrane lap joint.

Date of issue 22 June 2018

Date of expiry 24 March 2019


EXAMINER

Signed


(For CSWIP)

SIGNATURE OF HOLDER
(Person named above)

Date

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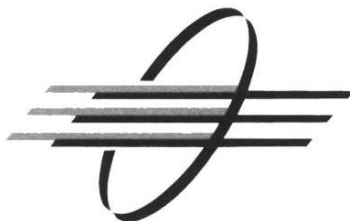
**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 7
HDPE Destructive
Test Results

Report Number 1807r3v1d0219



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REPORT

GEOSY T ETICS TEST REPORT

REPORT REFERENCE: BS-P181/a Revision²

Report Date 14/02/2019
Client Celtic Lining Ltd, Blackwood, NP12 0SF
Contact Dyfed Jones
Contract Reference Palleg Landfill Site
Client PO/Ref no Verbal

Material Tested 2mm HDPE Textured Geomembrane
Date Received 04/07/2018
Sample IDs DS-1 through to DS-7 {Fusion & Extrusion Welds}

Tests Requested Seam Integrity - (Peel & Shear) ASTM D6392-12

Revision 2 - Changed panel numbers on DS-3 and DS-4 at customer request.

If you have any questions or require additional information, please do not hesitate to contact us.

Prepared by:

Cliff Butt
Managing Director

Approved by:

Shazeena Iqbal
Technical Director



4438

Page 1 of 3

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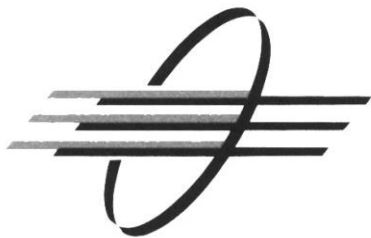
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This test report is in a condensed format, complete test details available upon request.

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BICS Laboratories Ltd, Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire, HD6 1SN

Directors: Clifford Butt, Shazeena N. Iqbal Company Registration Number: 4213030



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GEOSY T ETICS TEST RES LTS

CELTIC LI I G LTD

P.O O: Ver al

Contract Ref: Palleg Landfill Site

Report Ref o: BS-P181/a Revision²

Material: 2mm DPE Textured Geomem rane

Dates Tested: 04/07/2018

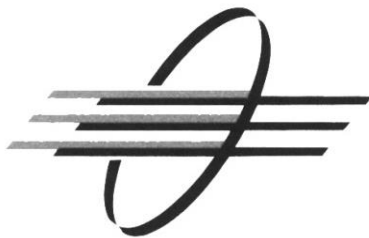
Test Method: Seam Integrity (AST D6392-12)

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
	1	2	3	4	5	6	7	8	9	10		
Sample ID: DS-1, P3/P4	usion eld										BICS Sample Ref: 01	
Peel Strength N/mm	24.4	26.6	25.6	27.3	27.0	29.3	26.3	28.2	23.8	26.1	26.5	1.6
Peel Separation %	0	0	0	0	0	0	0	0	0	0		
Peel Break Classification	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1		
Shear Strength N/mm	37.7	37.4	37.4	37.6	37.9						37.6	0.2
Shear Elongation %	>50	>50	>50	>50	>50							
Shear Break Classification	NO-BRK	NO-BRK	NO-BRK	NO-BRK	NO-BRK							
Sample ID: DS-2	Extrusion eld										BICS Sample Ref: 02	
Peel Strength N/mm	24.5	24.6	23.5	23.9	25.3						24.4	0.7
Peel Separation %	0	0	0	0	0							
Peel Break Classification	SE3	SE3	SE3	SE3	SE3							
Shear Strength N/mm	34.0	34.2	35.3	35.6	37.7						35.3	1.5
Shear Elongation %	>50	>50	>50	>50	>50							
Shear Break Classification	NO-BRK	NO-BRK	NO-BRK	NO-BRK	NO-BRK							
Sample ID: DS-3, P6/P11	usion eld										BICS Sample Ref: 03	
Peel Strength N/mm	25.2	27.8	28.4	25.3	24.3	25.6	30.3	24.9	26.4	25.6	26.4	1.9
Peel Separation %	0	0	0	0	0	0	0	0	0	0		
Peel Break Classification	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1		
Shear Strength N/mm	38.6	39.2	39.7	39.5	40.8						39.6	0.8
Shear Elongation %	>50	>50	>50	>50	>50							
Shear Break Classification	NO-BRK	NO-BRK	NO-BRK	NO-BRK	NO-BRK							
Sample ID: DS-4, P1/P2	usion eld										BICS Sample Ref: 04	
Peel Strength N/mm	22.9	27.2	28.8	27.3	23.9	24.3	22.3	23.2	23.1	28.1	25.1	2.5
Peel Separation %	0	0	0	0	0	0	0	0	0	0		
Peel Break Classification	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1		
Shear Strength N/mm	37.1	36.9	37.6	37.1	37.9						37.3	0.4
Shear Elongation %	>50	>50	>50	>50	>50							
Shear Break Classification	NO-BRK	NO-BRK	NO-BRK	NO-BRK	NO-BRK							

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CO IDE TIAL TEST REPORT



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GEOSY T ETICS TEST RES LTS CELTIC LI I G LTD P.O O: Ver al

Contract Ref: Palleg Landfill Site
aterial: 2mm DPE Textured Geomem rane
Test ethod: Seam Integrity (AST D6392-12)

eport Ref o: BS-P181/a Revision²
Dates Tested: 04/07/2018

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
	1	2	3	4	5	6	7	8	9	10		
Sample ID: DS-5 Extrusion eld											BICS Sample Ref: 05	
Peel Strength N/mm	28.8	28.6	26.6	25.6	31.4						28.2	2.3
Peel Separation %	0	0	0	0	0							
Peel Break Classification	BRK2	SE3	BRK2	BRK2	BRK2							
Shear Strength N/mm	35.3	34.8	34.9	33.9	35.5						34.9	0.6
Shear Elongation %	>50	>50	>50	>50	>50							
Shear Break Classification	NO-BRK	SE2	NO-BRK	SE2	SE1							
Sample ID: DS-6, P20/P21 usion eld											BICS Sample Ref: 06	
Peel Strength N/mm	27.2	27.0	27.1	26.3	27.4	26.2	24.5	22.7	23.1	26.7	25.8	1.7
Peel Separation %	0	0	0	0	0	0	0	0	0	0		
Peel Break Classification	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1		
Shear Strength N/mm	37.5	37.6	37.2	37.3	40.7						38.1	1.5
Shear Elongation %	>50	>50	>50	>50	>50							
Shear Break Classification	NO-BRK	NO-BRK	NO-BRK	NO-BRK	NO-BRK							
Sample ID: DS-7, P29/P30 usion eld											BICS Sample Ref: 07	
Peel Strength N/mm	21.4	21.4	22.6	26.7	27.8	25.6	28.4	24.4	22.7	29.1	25.0	2.9
Peel Separation %	0	0	0	0	0	0	0	0	0	0		
Peel Break Classification	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1		
Shear Strength N/mm	36.8	37.3	37.2	36.4	37.6						37.1	0.5
Shear Elongation %	>50	>50	>50	>50	>50							
Shear Break Classification	NO-BRK	NO-BRK	NO-BRK	NO-BRK	NO-BRK							

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
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REPORT

GEOSYNTHETICS TEST REPORT

REPORT REFERENCE: BS-P199/a

Report Date 11/07/2018
Client Celtic Lining Ltd, Blackwood, NP12 0SF
Contact Dyfed Jones
Contract Reference Palleg Landfill Site
Client PO/Ref No Verbal

Material Tested 2mm HDPE Textured Geomembrane
Date Received 11/07/2018
Sample IDs DS-6 {Fusion Weld}

Tests Requested Seam Integrity - (Peel & Shear) ASTM D6392-12

If you have any questions or require additional information, please do not hesitate to contact us.

Prepared by:

Cliff Butt
Managing Director

Approved by:

Shazeena Iqbal
Technical Director



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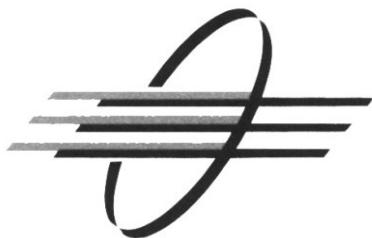
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Directors: Clifford Butt, Shazeena N. Iqbal Company Registration Number: 4213030



BICS Laboratories Ltd

Unit 2, Little John Mill, Oak Hill Road, Brighouse, West Yorkshire HD6 1SN

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E info@bics-labs.co.uk W www.bics-labs.co.uk



GEOSYNTHETICS TEST RESULTS

CELTIC LINING LTD

P.O NO: Verbal

Contract Ref: Palleg Landfill Site

Material: 2mm HDPE Textured Geomembrane

Test Method: Seam Integrity (ASTM D6392-12)

Report Ref No: BS-P199/a

Dates Tested: 11/07/2018

TEST METHOD	TEST SPECIMEN NUMBER										MEAN	Std Dev
	1	2	3	4	5	6	7	8	9	10		
Sample ID: DS-6 {Fusion Weld}												
Peel Strength N/mm	27.2	27.0	27.1	26.3	27.4	26.2	24.5	22.7	23.1	26.7	25.8	1.7
Peel Separation %	0	0	0	0	0	0	0	0	0	0		
Peel Break Classification	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1	SE1		
Shear Strength N/mm	37.5	37.6	37.2	37.3	40.7						38.1	1.5
Shear Elongation %	>50	>50	>50	>50	>50							
Shear Break Classification	NO-BRK	NO-BRK	NO-BRK	NO-BRK	NO-BRK							

Atmospheric Conditions at Test / Minimum 1 hour Conditioning : 21 ± 2 °C, Relative Humidity : 65 ± 5 % RH

BICS Laboratories Ltd. neither accepts responsibility for nor makes claim as to the final use and purpose of the material.
Unless otherwise detailed sample sizes and related test items comply with the listed test method. Test results relate only to the sample(s) supplied.
The company also observes and maintains client confidentiality.

CONFIDENTIAL TEST REPORT

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 8
Protector Geotextile
Manufacturers QC Data
Report Number 1807r3v1d0219



Quality Control Test Certificate

Our reference: 78967

Your reference: MJ/392

Delivery Date 19/06/2018

Product: GEOfabrics HPS11 6.00m wide black

Despatched to your site:

CELTIC LINING C/O JLA DISPOSALS
PALLEG ROAD
YSTRADGYNLAIS
SWANSEA
WEST GLAMORGAN

Serial roll number	m ²	Roll Length (m)
20357/004	450.00	75
20729/001	450.00	75
20729/006	450.00	75
20729/007	450.00	75
20729/010	450.00	75
20729/011	450.00	75
20729/012	450.00	75
20729/014	450.00	75
20729/015	450.00	75
20729/016	450.00	75
20729/017	450.00	75
20729/018	450.00	75

This product was sampled to BS EN ISO 9862:2005 & tested in accordance with BS EN ISO 10319, BS EN ISO 12236, BS EN ISO 9863-1, BS EN ISO 9864 & BS EN ISO 13433.

The Product named above complies with quality control requirements,

C. m. Harvey

Signed: Mrs C Harvey
Position: Laboratory Manager
Date: 19/06/2018

GEOfabrics Limited
Skelton Grange Road, Stourton
Leeds LS10 1RZ
United Kingdom

Tel: +44 (0)113 202 5678
Fax: +44 (0)113 202 5655
E-mail: info@geofabrics.com
www.geofabrics.com

Quality Control Test Certificate

Our reference: 78967

Your reference: MJ/392

Delivery Date 19/06/2018

Product: GEOfabrics HPS11 6.00m wide black

Despatched to your site:

CELTIC LINING C/O JLA DISPOSALS
PALLEG ROAD
YSTRADGYNLAIS
SWANSEA
WEST GLAMORGAN

Serial roll number	m ²	Roll Length (m)
20729/013	450.00	75

This product was sampled to BS EN ISO 9862:2005 & tested in accordance with BS EN ISO 10319, BS EN ISO 12236, BS EN ISO 9863-1, BS EN ISO 9864 & BS EN ISO 13433.

The Product named above complies with quality control requirements,



Signed: Mrs C Harvey
Position: Laboratory Manager
Date: 21/06/2018



Geosynthetic Panel Deployment

CQA11

Site	Palleg Road Landfill Sub-Cell 6	Material	Geofabrics HPS 11	Installer	Celtic Lining Ltd.
-------------	--	-----------------	--------------------------	------------------	---------------------------

Date	Roll No	Panel No	Thickness L	Thickness R	Thickness F	Thickness B	Length	Width	Visual Check	Approved	Non-Con No
03/07/2018	20729/012	P1					73	5.9	Yes	Yes	
03/07/2018	20729/017	P2					70	5.9	Yes	Yes	
03/07/2018	20729/007	P3					68	5.9	Yes	Yes	
03/07/2018	20729/015	P4					64	5.9	Yes	Yes	
03/07/2018	20729/010	P5					42	5.9	Yes	Yes	
03/07/2018	20729/001	P6					21	5.9	Yes	Yes	
03/07/2018	20729/010	P7					23	5.9	Yes	Yes	
03/07/2018	20729/012	P8					10	5.9	Yes	Yes	
03/07/2018	20729/013	P9					22	5.9	Yes	Yes	
03/07/2018	20729/015	P10					2.2	5.9	Yes	Yes	
03/07/2018	20729/015	P11					2	5.9	Yes	Yes	
03/07/2018	20729/013	P12					22	5.9	Yes	Yes	

03/07/2018	20729/013	P13					21	5.9	Yes	Yes	
03/07/2018	20729/006	P14					20	5.9	Yes	Yes	
03/07/2018	20729/006	P15					18.5	5.9	Yes	Yes	
03/07/2018	20729/006	P16					20	5.9	Yes	Yes	
03/07/2018	20729/014	P17					19	5.9	Yes	Yes	
03/07/2018	20729/014	P18					18	5.9	Yes	Yes	
03/07/2018	20729/014	P19					18	5.9	Yes	Yes	
03/07/2018	20729/016	P20					18	5.9	Yes	Yes	
03/07/2018	20729/016	P21					18	5.9	Yes	Yes	
03/07/2018	20729/016	P22					18	5.9	Yes	Yes	
03/07/2018	20729/014	P23					17	5.9	Yes	Yes	
03/07/2018	20729/0214	P24					12	5.9	Yes	Yes	
03/07/2018	20357/004	P25					11	5.9	Yes	Yes	
03/07/2018	20357/004	P26					14	5.9	Yes	Yes	
03/07/2018	20357/004	P27					15	5.9	Yes	Yes	
03/07/2018	20357/004	P28					28	5.9	Yes	Yes	

03/07/2018	20729/006	P29					1	5.9	Yes	Yes	
03/07/2018	20357/004	P30					30	5.9	Yes	Yes	
03/07/2018	20729/010	P31					30	5.9	Yes	Yes	
03/07/2018	20729/016	P32					6	5.9	Yes	Yes	
03/07/2018	20729/007	P33					2	5.9	Yes	Yes	
03/07/2018	20729/012	P34					2	5.9	Yes	Yes	
03/07/2018	20729/006	P35					10	5.9	Yes	Yes	
03/07/2018	20357/006	P36					4	5.9	Yes	Yes	
03/07/2018	20729/007	P37					6	5.9	Yes	Yes	
03/07/2018	20357/004	P38					1	5.9	Yes	Yes	

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 9
Protector Geotextile CQA
Monitoring and
Conformance Test Results
Report Number 1807r3v1d0219

Confidential EA Cylinder Test Report

Ref:	067-2101	Date:	10 th May 2010
-------------	----------	--------------	---------------------------

GEOfabrics Limited is UKAS accredited to perform this test in their laboratories

Site:	Palleg Landfill Site
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Client:	Geotechnology Limited	Waste depth (m):	12
Address:	55 Hendrefoilan Road	Waste density (kg/m³):	1100
	Sketty	Cap depth (m):	0.9
	Swansea	Cap density (kg/m³):	1700
	West Glamorgan	Applied pressure (kPa):	361
Postcode:	SA2 9LT	Duration of test (hrs):	100

Laboratory Conditions:	Test conducted dry in a standard atmosphere (20 ±2°C, 65 ±5% RH)
Sample Conditions:	Samples were conditioned for a minimum of 24 hours.

Test type: Cylinder test to Environment Agency document *Methodology for cylinder testing of protectors for geomembranes on landfill sites. A performance test to determine the protection afforded to a geomembrane by a geotextile or other protective materials, in site-specific conditions*, February 2007.

Apparatus: 330mm diameter segmental steel cylinder comprising (from bottom up):

Load cells:	Three electronic calibrated load cells accurate to 1% of the applied load	
Lower steel plate:	20mm (min) thick with 4mm (±1mm) diameter less than cylinder.	
Dense rubber pad:	25mm thick elastomeric pad 50A (±5A) Shore hardness	
Lead impression sheet:	1.3mm (±0.1mm) grade 3 lead plate to EN 12588– conforms to annex A of EA standard.	
Geomembrane:	2mm Double Smooth GSE Liner	Received: 5 th May 2010
Protector material:	Geofabrics HPS11	Received: 5 th May 2010
Proposed aggregate:	10-20mm Penwyllt Quarried Limestone	Received: 4 th May 2010
Separator geotextile:	Geotextile with diameter similar to the cylinder to prevent the sand from mixing with the aggregate.	
Sand:	50mm (min) thick builders sand.	
Upper steel plate:	20mm (min) thick with 4mm (±1mm) diameter less than the cylinder	
Loading device:	hydraulic jack	

Friction Liner:	2mm double smooth HDPE
------------------------	------------------------

Procedure: The apparatus was assembled as above using HDPE liner (as supplied), Geotextile, 300mm depth of drainage stone (as supplied), all loaded as specified including factors of safety.

The rig was dismantled at the end of the test duration and the lead plate measured to assess the localised strain produced in the geomembrane.

Condition of Liner after testing:	some small indentations, no holes
Condition of Geotextile after testing	some small deformations, no tears or rips

Measured strains (%):							
Strain 1	0.10	Strain 2	0.09	Strain 3	0.05	Mean	0.08

Indent	x-axis (%)	y-axis (%)	Mean (%)
A	0.04	0.06	0.05
B	0.04	0.05	0.05
C	0.04	0.04	0.04
D	0.11	0.08	0.09
E	0.13	0.06	0.10



Stone used

Deviations from test method: None

Note: The test results relate only to the behaviour of the specimens tested. They do not guarantee to represent the performance of other material even from the same source.

GEOfabrics Limited cannot be held responsible for sampling, which is outside of the Company's control.

For and on behalf of
GEOfabrics Limited

Andrew Leech
Quality Manager

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 10
Blinding Layer Test Results
Report Number 1807r3v1d0219



Drainage Material Test Record

CQA14

Site	Palleg Road Landfill Sub-Cell 6	Material	Blinding and Drainage Aggregate
-------------	--	-----------------	--

Test Reference	Layer	Test Type	Test Date	Percentage Passing %							Approved	Non. Con. Num.
				63mm	40mm	31.5mm	20mm	10mm	4mm	Fines		
16895	Blinding Aggregate	PSD to BS933-1	12/10/2018		100	100	94	4	2	0	Y	
16896	Blinding Aggregate	PSD to BS933-1	12/10/2018		100	100	92	10	3	2	Y	
16897	Drainage Aggregate	PSD to BS933-1	12/10/2018	100	100	93	6	1	1	1	Y	
16898	Drainage Aggregate	PSD to BS933-1	12/10/2018	100	100	80	9	1	1	1	Y	

TEST REPORT
PARTICLE SIZE DISTRIBUTION
BS EN 933-1

Project No.: **D8195-18**
Project Name: **Palleg Landfill**
Sample No.: **16895 (Blinding A)**

Client: **JLA Recycling**
Address: **Palleg Road**
Cwmtwrch
SA9 2UT

Site Reference: **Unknown**
Location in works: **Sub-cell 6**

Sample Type: **Bulk**
Material Description: **Grey GRAVEL**

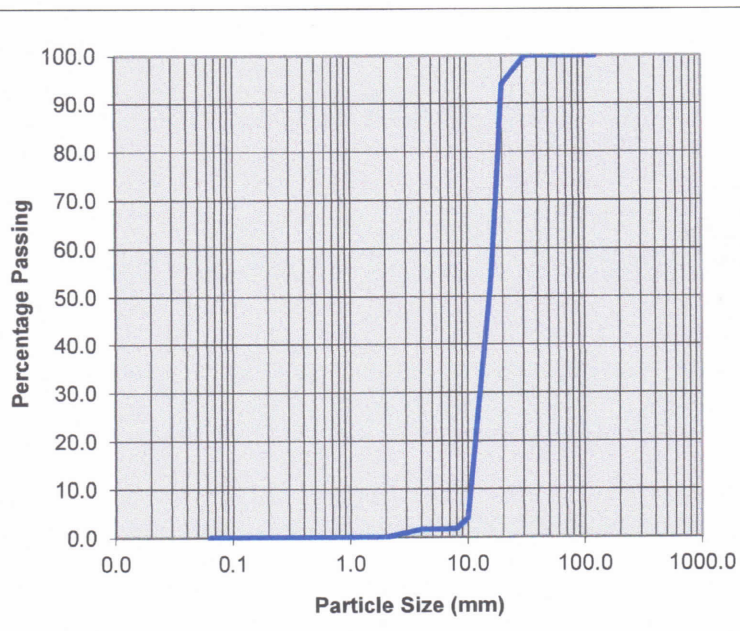
Date Sampled: **12 October 2018**
Sampled By: **Geotechnology Ltd**
Sampling Certificate Received: **No**
Date Received: **12 October 2018**

Material Source: **Geotechnology Ltd**
Material Supplier: **Unknown**
Specification: **BS EN 933-1 1997**
Date Tested: **17 October 2018**

TEST RESULTS

Particle Size (mm)	Percentage Passing	Specification
125.0	100	
80.0	100	
63.0	100	
40.0	100	100
31.5	100	98-100
20.0	94	80-99
16.0	54	
10.0	4	0-20
8.0	2	
6.3	2	
4.0	2	0-5
2.0	0	
1.0	0	
0.5	0	
0.250	0	
0.125	0	
0.063	0	

Moisture Content (%)	1.0
-----------------------------	------------



Remarks:

QA Ref.

EN 933-1
Rev. 1.0



Apex Testing Solutions

Sturmi Way, Village Farm Industrial Est,
Pyle, Bridgend, CF33 6BZ

Tel: 01656 746762 Fax: 01656 749096

Approver

R Figgis

Date

17/10/2018

Fig.

R Figgis, Laboratory Supervisor

TEST REPORT
PARTICLE SIZE DISTRIBUTION
BS EN 933-1

Project No.: **D8195-18**
Project Name: **Palleg Landfill**
Sample No.: **16896 (Blinding B)**

Client: **JLA Recycling**
Address: **Palleg Road
Cwmtwrch
SA9 2UT**

Site Reference: **Unknown**
Location in works: **Sub-cell 6**

Sample Type: **Bulk**
Material Description: **Grey GRAVEL**

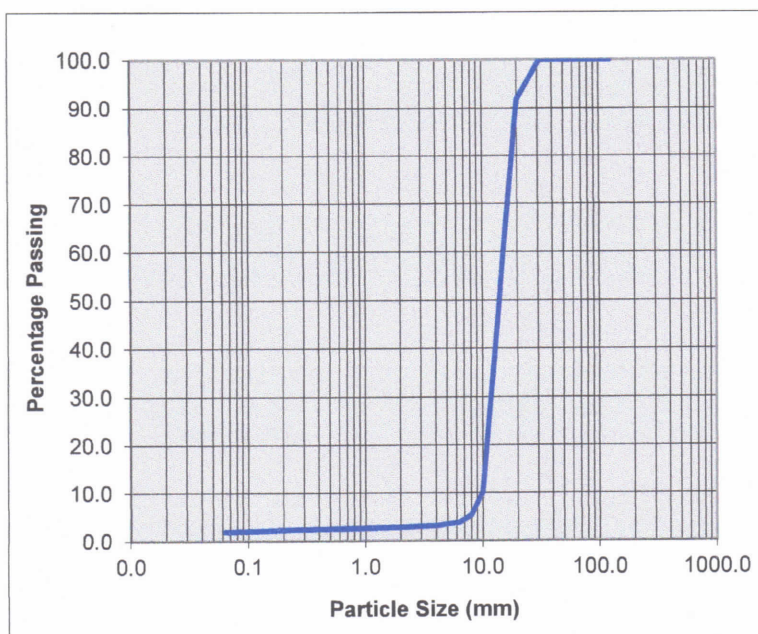
Date Sampled: **12 October 2018**
Sampled By: **Geotechnology Ltd**
Sampling Certificate Received: **No**
Date Received: **12 October 2018**

Material Source: **Geotechnology Ltd**
Material Supplier: **Unknown**
Specification: **BS EN 933-1 1997**
Date Tested: **17 October 2018**

TEST RESULTS

Particle Size (mm)	Percentage Passing	Specification
125.0	100	
80.0	100	
63.0	100	
40.0	100	100
31.5	100	98-100
20.0	92	80-99
16.0	67	
10.0	10	0-20
8.0	5	
6.3	4	
4.0	3	0-5
2.0	3	
1.0	3	
0.5	3	
0.250	2	
0.125	2	
0.063	2	

Moisture Content (%)	1.2
-----------------------------	------------



Remarks:

QA Ref.

EN 933-1
Rev. 1.0



Apex Testing Solutions

Sturmi Way, Village Farm Industrial Est,
Pyle, Bridgend, CF33 6BZ

Tel: 01656 746762 Fax: 01656 749096

Approver

R Figgis

Date

17/10/2018

Fig.

R Figgis, Laboratory Supervisor

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 11
Drainage Layer Test Results
Report Number 1807r3v1d0219



Drainage Material Test Record

CQA14

Site	Palleg Road Landfill Sub-Cell 6	Material	Blinding and Drainage Aggregate
-------------	--	-----------------	--

Test Reference	Layer	Test Type	Test Date	Percentage Passing %							Approved	Non. Con. Num.
				63mm	40mm	31.5mm	20mm	10mm	4mm	Fines		
16895	Blinding Aggregate	PSD to BS933-1	12/10/2018		100	100	94	4	2	0	Y	
16896	Blinding Aggregate	PSD to BS933-1	12/10/2018		100	100	92	10	3	2	Y	
16897	Drainage Aggregate	PSD to BS933-1	12/10/2018	100	100	93	6	1	1	1	Y	
16898	Drainage Aggregate	PSD to BS933-1	12/10/2018	100	100	80	9	1	1	1	Y	

TEST REPORT

PARTICLE SIZE DISTRIBUTION

BS EN 933-1

Project No.: **D8195-18**

Project Name: **Palleg Landfill**

Sample No.: **16897 (Drainage A)**

Client: **JLA Recycling**

Address: **Palleg Road
Cwmtwrch
SA9 2UT**

Site Reference: **Unknown**

Location in works: **Sub-cell 6**

Sample Type: **Bulk**

Material Description: **Grey GRAVEL**

Date Sampled: **12 October 2018**

Sampled By: **Geotechnology Ltd**

Sampling Certificate Received: **No**

Date Received: **12 October 2018**

Material Source: **Geotechnology Ltd**

Material Supplier: **Unknown**

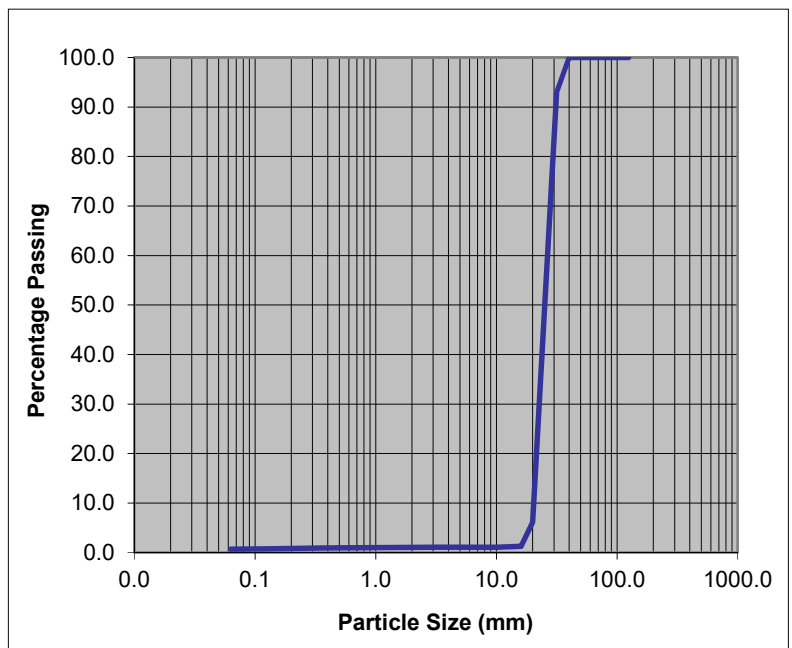
Specification: **BS EN 933-1 1997**

Date Tested: **17 October 2018**

TEST RESULTS

Particle Size (mm)	Percentage Passing	Specification
125.0	100	
80.0	100	
63.0	100	98-100
40.0	100	80-99
31.5	93	20-70
20.0	6	0-20
16.0	1	
10.0	1	0-5
8.0	1	
6.3	1	
4.0	1	
2.0	1	
1.0	1	
0.5	1	
0.250	1	
0.125	1	
0.063	1	

Moisture Content (%)	0.5
----------------------	-----



Remarks:

QA Ref.

EN 933-1
Rev. 1.0



Apex Testing Solutions

Sturmi Way, Village Farm Industrial Est,
Pyle, Bridgend, CF33 6BZ

Tel: 01656 746762 Fax: 01656 749096

Approver

R Figgis

Date

17/10/2018

Fig.

R Figgis, Laboratory Supervisor

TEST REPORT

PARTICLE SIZE DISTRIBUTION

BS EN 933-1

Project No.: **D8195-18**

Project Name: **Palleg Landfill**

Sample No.: **16898 (Drainage B)**

Client: **JLA Recycling**

Address: **Palleg Road
Cwmtwrch
SA9 2UT**

Site Reference: **Unknown**

Location in works: **Sub-cell 6**

Sample Type: **Bulk**

Material Description: **Grey GRAVEL**

Date Sampled: **12 October 2018**

Sampled By: **Geotechnology Ltd**

Sampling Certificate Received: **No**

Date Received: **12 October 2018**

Material Source: **Geotechnology Ltd**

Material Supplier: **Unknown**

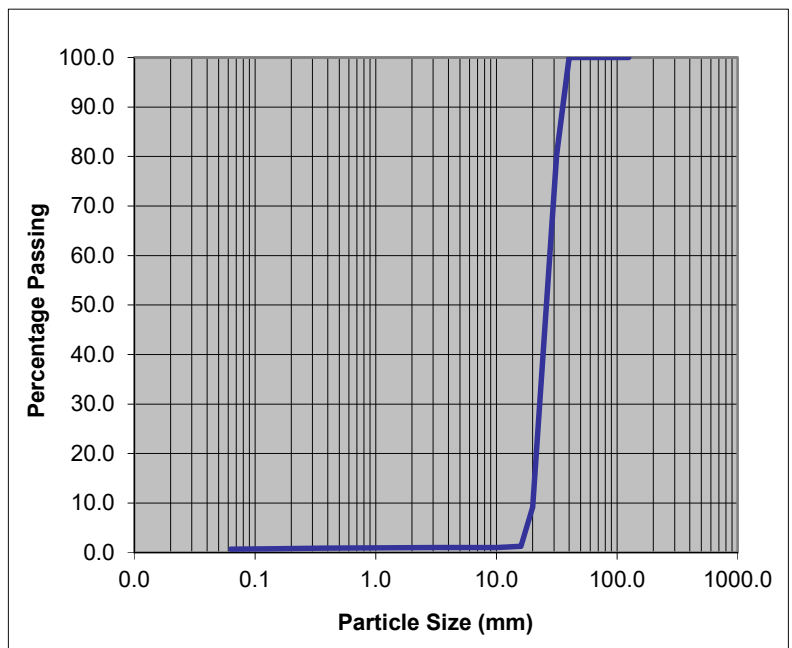
Specification: **BS EN 933-1 1997**

Date Tested: **17 October 2018**

TEST RESULTS

Particle Size (mm)	Percentage Passing	Specification
125.0	100	
80.0	100	
63.0	100	98-100
40.0	100	80-99
31.5	80	20-70
20.0	9	0-20
16.0	1	
10.0	1	0-5
8.0	1	
6.3	1	
4.0	1	
2.0	1	
1.0	1	
0.5	1	
0.250	1	
0.125	1	
0.063	1	

Moisture Content (%)	0.5
----------------------	-----



Remarks:

QA Ref.

EN 933-1
Rev. 1.0



Apex Testing Solutions

Sturmi Way, Village Farm Industrial Est,
Pyle, Bridgend, CF33 6BZ

Tel: 01656 746762 Fax: 01656 749096

Approver

R Figgis

Date

17/10/2018

Fig.

R Figgis, Laboratory Supervisor



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 41511

Client Ref:

Report Date: **20-11-2018**

Client PO: **D8195-18**

Client **Apex Drilling Services Ltd**
Sturmi Way
Village Farm Industrial Estate, Pyle
Bridgend
CF33 6BZ

Contract Title: **Palleg Landfill**
For the attention of: **Andrew Grogan**

Date Received: **06-11-2018**
Date Commenced: **06-11-2018**
Date Completed: **20-11-2018**

Test Description	Qty
Ten percent fines value (TFV)	2
BS 812-111:1990 - @ Non Accredited Test	
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)

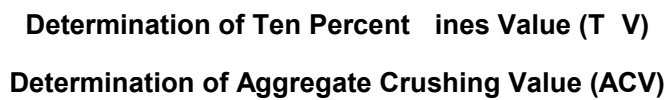
Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative/Accounts Assistant)

Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



Operators	Checked	26/11/2018	Wayne Honey	
JD	Approved	27/11/2018	Ben Sharp	

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 12
Leachate Pipework and
Gas Well Details and
Photographs of Welds
Report Number 1807r3v1d0219



Spine drain extending from sub-cell 3



Leachate pipes in base



225mm Spine drain extending upslope



Proprietary electrofusion collar



Proprietary electrofusion collar



Gas Wells in Sub-Cell Base



Gas Wells in Sub-Cell Base

+GF+ Made in Switzerland
ENGEF Plus

Muffe
Manchon
Coupler
Manicotto

Standards
EN ISO 15494
EN 1555-3
EN 12201-3

PN12
KM 501591
G 1.321
DV-806AC3258
W 1.229

753 911 618

d180

1 x

Batch No.
1304

931362

PE100

SDR11 PN16 GAS/W

Traceability/Product Identification

3736031802013041270501

Fusion Data

T °C	5-15	15-30	>30
39.5 V/t =	510s	440s	405s

950706331808400785440758

Georg Fischer Wavin AG 8201 Schaffhausen/Switzerland

www.piping.georgfischer.com

Additional product information

7 611704 368674

PN12

7 611704 368674

Additional product information

950706331808400785440758

Georg Fischer Wavin AG 8201 Schaffhausen/Switzerland

www.piping.georgfischer.com

+GF+ Made in Switzerland
ENGEF Plus

Muffe
Manchon
Coupler
Manicotto

Standards
EN ISO 15494
EN 1555-3
EN 12201-3

PN12
KM 501591
G 1.321
DV-806AC3258
W 1.229

753 911 618

d180

1 x

Batch No.
1217

929869

PE100

SDR11 PN16 GAS/W

Traceability/Product Identification

37360318020121712705040346

Fusion Data

T °C	<5	5-15	15-30	>30
39.5 V/t =	510s	475s	440s	405s

950706331808400785440758

Georg Fischer Wavin AG 8201 Schaffhausen/Switzerland

www.piping.georgfischer.com

Additional product information

7 611704 368674

PN12

7 611704 368674

Additional product information

950706331808400785440758

Georg Fischer Wavin AG 8201 Schaffhausen/Switzerland

www.piping.georgfischer.com

+GF+

Made in Switzerland
ELSEE Plus

Standards
EN ISO 15494
EN 1555-3
EN 12201-3

PN12
KM 501591
G 1.321
DV-886AQ328
W 1.229



Muffe
Manchon
Coupler
Manicotto

753 911 618

1 X

Batch No
1217 929869

d180

PE100 SDR11 PN16 GAS/W

Traceability/Product identification



37360318020121712705040346

Fusion Data

T °C	< 5	5-15	15-30	> 30
39.5 V/t =	510s	475s	440s	405s



950706331808400785440758

Georg Fischer Wavin AG 8201 Schaffhausen/Switzerland

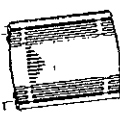
www.piping.georgfischer.com

+GF+

Made in Switzerland
ELSEE Plus

Standards
EN ISO 15494
EN 1555-3
EN 12201-3

PN12
KM 501591
G 1.321
DV-886AQ328
W 1.229



Muffe
Manchon
Coupler
Manicotto

753 911 618

1 X

Batch No
1304 931362

d180

PE100 SDR11 PN16 GAS/W

Traceability/Product identification



37360318020130412705010348

Fusion Data

T °C	< 5	5-15	15-30	> 30
39.5 V/t =	510s	475s	440s	405s



950706331808400785440758

Georg Fischer Wavin AG 8201 Schaffhausen/Switzerland

www.piping.georgfischer.com

RADUS **COUPLER BLACK 180 PE100** **MADE IN SWITZERLAND**

Application: WATER / GAS MDP Rating: 18 BAR / 10 BAR

Compatibility: 180 SDR11-17 PE100

Termination Pin Dia: 4.7

Fuelon Voltage: 40V

Fuse Time: 440

Cool Time: 20

Manufacturing Date: 2014/07

Batch Number: F28

Weight: 2.38kg

Quantity: 1

AS EN 1555 (Issue 1) EN 12201

CS/07

Fusion Barcode

Traceability Barcode

Install in accordance with National Standards and Radius Systems guidelines

Radius Systems Ltd, Radius House, Northampton, Northamptonshire, NN4 2JL, UK (t: +44 (0) 1778 511133 w: www.radius-systems.com)

+GF+ **Made in Switzerland** **ELGEF Plus**

Muffe

Manchon

Coupler

Manicotto

753 911 618 **1 x**

d180 **1304** **931362**

PE100 **SDR11** **PN16** **GAS/W**

Batch No

Expiry date

Standards:
EN ISO 15494
EN 1555-3
EN 12201-3

PN12

KM 501591

G 1.321

DV-608AC3258

W 1.229

Traceability/Product Identification

37360318020130412705010346

Fusion Data

T °C	<5	5-15	15-30	>30
39.5 V/t =	510s	475s	440s	405s

Additional product information

7 611704 1368674

950706331809490785440358

Georg Fischer Wavin AG 8201 St. Gallen Switzerland

www.pibing.georgfischer.com

+GF+

Made in Switzerland
ELGEF Plus

Muffe
Manchon
Coupler
Manicotto

753 911 618

d180

1 X

Batch No
1304 931362

PE100 SDR11 PN16 GAS/W

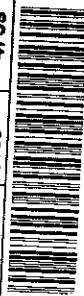
Traceability/Product Identification



37360318020130412705010346

Fusion Data

T °C	<5	5-15	15-30	>30
39.5 V/t =	510s	475s	440s	405s



950706331808400785440758

Georg Fischer Wavin AG 8201 Schaffhausen/Switzerland

www.plating.georgfischer.com

Standards
EN ISO 15494
EN 1555-3
EN 12201-3

PN12

KM 501591

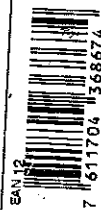
G 1.321

DN 608AQ328

W 1.229



C5/01



Additional product information



RADIUS

COUPLER BLACK 180 PE100

Application: WATER / GAS MOP Rating: 16 BAR / 10 BAR

Compatibility	180 SDR11-17 PE100		
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Terminal Pin Dia:	4.7	Manufacturing Date:	2014/07
Fusion Voltage:	40v	Batch Number:	F28
Fuse Time:	440	Weight:	2.324
Cool Time:	20	Quantity:	1



35 EN 1555

35 EN 12201

C5/02



Fusion Barcode

Traceability Barcode

Install in accordance with national standards and Radius Systems guidelines

For country specific information, please contact your local Radius Systems representative. Radius Systems Ltd, Market Village, Berrington Lane, South Normanton, Alfreton, Derby, DE53 3JX, UK. Tel: +44 (0) 1773 811133. www.radius-systems.com

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 13
Leachate Pipework
Deflection Calculations
Report Number 1807r3v1d0219

Calculations to ATV-DVWK-A 127, third edition, August 2000

Project: TIR CANOL LANDFILL SITE
 Client: GEOTECHNOLOGY LTD
 Date: 21/09/2010
 Contact: ARWEL JONES

Input:

Safety factors

Safety class:	A (normal case)	
Allowable deflection:	6% (normal case)	
A type predeformation:	$\delta_{v, TypeA}$	1.00 %
Local predeformation:	$\delta_{v, local}$	0.00 %

Pipe

Description:	Solid wall	
Inside diameter:	d_i	159.6 mm
Wall thickness:	s	10.20 mm
Perforationsart:	Fully perforated	
Perforation geometry:	Slitted	
Distance between apertures:	l_1	25.00 mm
Width of aperture:	b_W	3.00 mm

Pipe material

Material class:	Thermoplastic	
Description:	PE-HD (ATV-A 127)	
Density of pipe material	γ_P	9.40 kN/m ³
Transv. contr. coeff.	ν	0.38 [1]
E-Modulus, short	E_{st}	800.00 N/mm ²
E-Modulus, long	E_{lt0}	160.00 N/mm ²
Ultimate flexural tensile stress, short-term	$\sigma_{BT, st}$	21.00 N/mm ²
Ultimate flexural compressive stress, short-term	$\sigma_{BC, st}$	21.00 N/mm ²
Ultimate flexural tensile stress, long-term	$\sigma_{BT, lt}$	14.00 N/mm ²
Ultimate flexural compressive stress, long-term	$\sigma_{BC, lt}$	14.00 N/mm ²

Soil

E1: Backfilling:	Soil group: G1	
Value from Table 8 in ATV A127:	D_{PR1}	95.0 %
E20: Pipe zone:	Soil group: G1	
Value from Table 8 in ATV A127:	D_{PR2}	95.0 %
E3: Native soil:	Soil group: G1	
Proctor density:	D_{PR3}	97.0 %
E4: Below trench	$E4 = 10 \cdot E1$	

Installation

Trench width:	<Bank>		
Type of bedding:	loose		
Relative projection:	a	1.00	[1]
Bedding angle:	180°		

Load case combination 1

Description:	LEACHATE DRAINAGE PIPE		
Cover depth:	h	11,000	mm
Soil density:	γ	10.00	kN/m ³
Additional surface load:	P ₀	0.00	N/mm ²
Maximum groundwater level above pipe bed:	h _{W,max}	1,000	mm
Minimum groundwater level above pipe bed:	h _{W,min}	500	mm
Internal pressure:	P _i	0.00	bar
Water fill (e.g. damming channel)	Yes		
Density of medium:	γ_F	10.00	kN/m ³
Traffic load:	No traffic		

Proof for load case combination 1, Short term

Stress proof (with minimum groundwater):

Calculated ultimate flexural tensile stress, soil/traffic load:		$\sigma_{calc,BZ}$	21.0	N/mm ²	
Calculated ultimate flexural compr. stress, soil/traffic load:		$\sigma_{calc,BD}$	21.0	N/mm ²	
Ultimate flexural tensile stress due to other loads:		$\sigma_{all,BZ}$	21.0	N/mm ²	
Ultimate flexural compressive stress due to other loads:		$\sigma_{all,BD}$	21.0	N/mm ²	
Internal:					
		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh*,i}$	0.614	-1.575	0.614	N/mm ²
Stress due to other loads:	$\sigma_{other,i}$	-0.017	-0.091	0.014	N/mm ²
Safety coefficient:	γ_{BTi}	35.19	---	33.45	[1]
Safety coefficient:	γ_{BCi}	---	12.60	---	[1]
External:					
		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh*,a}$	-1.85	-0.13	-1.85	N/mm ²
Stress due to other loads:	$\sigma_{other,a}$	-0.08	-0.01	-0.09	N/mm ²
Safety coefficient:	γ_{BTe}	---	---	---	[1]
Safety coefficient:	γ_{BCe}	10.88	148.47	10.78	[1]
Required flexural tensile safety coefficient:		req γ_{BT}	2.50	[1]	
Required flexural compressive safety coefficient:		req γ_{BC}	2.50	[1]	

The stress safety coefficients determined are sufficient.

Stress proof (with maximum groundwater):

Calculated ultimate flexural tensile stress, soil/traffic load:	$\sigma_{calc,BZ}$	21.0	N/mm ²		
Calculated ultimate flexural compr. stress, soil/traffic load:	$\sigma_{calc,BD}$	21.0	N/mm ²		
Ultimate flexural tensile stress due to other loads:	$\sigma_{all,BZ}$	21.0	N/mm ²		
Ultimate flexural compressive stress due to other loads:	$\sigma_{all,BD}$	21.0	N/mm ²		
Internal:					
		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,i}$	0.614	-1.580	0.614	N/mm ²
Stress due to other loads:	$\sigma_{other,i}$	-0.070	-0.144	-0.039	N/mm ²
Safety coefficient:	γ_{BTi}	38.61	---	36.53	[1]
Safety coefficient:	γ_{BCi}	---	12.18	---	[1]
External:					
		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,a}$	-1.86	-0.13	-1.86	N/mm ²
Stress due to other loads:	$\sigma_{other,a}$	-0.12	-0.06	-0.14	N/mm ²
Safety coefficient:	γ_{BTe}	---	---	---	[1]
Safety coefficient:	γ_{BCe}	10.58	109.82	10.50	[1]
Required flexural tensile safety coefficient:	req γ_{BT}	2.50	[1]		
Required flexural compressive safety coefficient:	req γ_{BC}	2.50	[1]		

The stress safety coefficients determined are sufficient.

Deflection proof (with minimum groundwater):

Calculation method:	linear			
Ratio:	$l/(A_{rad} \cdot r_m^2)$	0.00120	[1]	
Ratio:	$l/(A_{rad} \cdot r_m^2) \cdot K_Q$	0.00144	[1]	
	q_v	q_h	q_h^*	
Deflection coefficient for bending moments:	c_v	-0.0833	0.0833	0.0640 [1]
Deflection coefficient for axial forces:	cN_v	-0.648	-0.681	-0.247 [1]
Deflection coefficient for lateral forces:	cQ_v	-0.335	0.335	0.243 [1]
Resultant deflection coefficient:	c'_v	-0.0854	0.0838	0.0647 [1]

Vertical diameter change:	Δd_v	1.4	mm
Horizontal diameter change:	Δd_h	0.9	mm
Relative vertical deformation:	δ_v	0.80	%
Allowable deflection:	all d_v	6.00	%

The deflection determined is less than the allowable deflection.

Deflection proof (with maximum groundwater):

Calculation method:	linear		
Ratio:	$I/(A_{rad} \cdot r_m^2)$	0.00120	[1]
Ratio:	$I/(A_{rad} \cdot r_m^2) \cdot K_Q$	0.00144	[1]
Deflection coefficient for bending moments:	c_v	q_v -0.0833	q_h 0.0833 q_h^* 0.0640 [1]
Deflection coefficient for axial forces:	cN_v	-0.648	-0.681 [1]
Deflection coefficient for lateral forces:	cQ_v	-0.335	0.335 0.243 [1]
Resultant deflection coefficient:	c'_v	-0.0854	0.0838 0.0647 [1]

Vertical diameter change:	Δd_v	1.4	mm
Horizontal diameter change:	Δd_h	0.9	mm
Relative vertical deformation:	δ_v	0.81	%
Allowable deflection:	all d_v	6.00	%

The deflection determined is less than the allowable deflection.

Stability proof (linear) (with maximum groundwater):

Total vertical load	q_v	87.4	kN/m ²
Reduction factor for soil/traffic load:	K_{v2}	0.87	[1]
Critical buckling load (soil/traffic load):	crit q_v	1,556.7	kN/m ²
Partial buckling safety coefficient (soil/traffic load):	$\gamma_{buckl,qv}$	17.80	[1]
External water pressure:	p_e	10.0	kN/m ²
Plus vacuum in the pipe:	p_i	0.0	kN/m ²
System stiffness without traffic load correction:	V_{RB}	0.0140	[1]
Input value δ_{v2} for determining K_{a2} :	δ_{v2}	1.81	%
Predeformation reduction factor for water pressure:	K_{r2}	0.87	[1]
Local predeformation reduction factor for water pressure:	K_{r1}	1.00	[1]
Parameter k^* (substitute for r_m/s) for determining α_D :	k^*	8.324	[1]
Perforation coefficient:	α_P	8.741	[1]
Critical buckling load (external water pressure):	crit p_e	812.9	kN/m ²
Partial buckling safety coefficient (ext. water pressure):	$\gamma_{buckl,pe}$	81.29	[1]
Buckling safety coefficient:	γ_{buckl}	14.61	[1]
Required buckling safety coefficient:	req γ_{buckl}	2.00	[1]

The buckling safety coefficients determined are sufficient.

Non linear stability proof (with maximum groundwater):

- n/a -

Proof for load case combination 1, Long term

Stress proof (with minimum groundwater):

Calculated ultimate flexural tensile stress, soil/traffic load:	$\sigma_{calc,BZ}$	14.0	N/mm ²		
Calculated ultimate flexural compr. stress, soil/traffic load:	$\sigma_{calc,BD}$	14.0	N/mm ²		
Ultimate flexural tensile stress due to other loads:	$\sigma_{all,BZ}$	14.0	N/mm ²		
Ultimate flexural compressive stress due to other loads:	$\sigma_{all,BD}$	14.0	N/mm ²		
Internal:	Crown	Springline	Bottom		
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,i}$	-0.333	-0.647	-0.333	N/mm ²
Stress due to other loads:	$\sigma_{other,i}$	-0.026	-0.081	0.004	N/mm ²
Safety coefficient:	γ_{BTi}	---	---	---	[1]
Safety coefficient:	γ_{BCi}	38.92	19.21	42.58	[1]
External:	Crown	Springline	Bottom		
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,a}$	-0.71	-0.47	-0.71	N/mm ²
Stress due to other loads:	$\sigma_{other,a}$	-0.07	-0.02	-0.09	N/mm ²
Safety coefficient:	γ_{BTe}	---	---	---	[1]
Safety coefficient:	γ_{BCe}	18.00	28.72	17.63	[1]
Required flexural tensile safety coefficient:	req γ_{BT}	2.50	[1]		
Required flexural compressive safety coefficient:	req γ_{BC}	2.50	[1]		

The stress safety coefficients determined are sufficient.

Stress proof (with maximum groundwater):

Calculated ultimate flexural tensile stress, soil/traffic load:		$\sigma_{calc,BZ}$	14.0	N/mm ²	
Calculated ultimate flexural compr. stress, soil/traffic load:		$\sigma_{calc,BD}$	14.0	N/mm ²	
Ultimate flexural tensile stress due to other loads:		$\sigma_{all,BZ}$	14.0	N/mm ²	
Ultimate flexural compressive stress due to other loads:		$\sigma_{all,BD}$	14.0	N/mm ²	
Internal:		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,i}$	-0.335	-0.650	-0.335	N/mm ²
Stress due to other loads:	$\sigma_{other,i}$	-0.080	-0.134	-0.049	N/mm ²
Safety coefficient:	γ_{BTi}	---	---	---	[1]
Safety coefficient:	γ_{BCi}	33.75	17.85	36.46	[1]
External:		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,a}$	-0.71	-0.47	-0.71	N/mm ²
Stress due to other loads:	$\sigma_{other,a}$	-0.12	-0.07	-0.13	N/mm ²
Safety coefficient:	γ_{BTe}	---	---	---	[1]
Safety coefficient:	γ_{BCe}	16.92	26.08	16.60	[1]
Required flexural tensile safety coefficient:		req γ_{BT}	2.50	[1]	
Required flexural compressive safety coefficient:		req γ_{BC}	2.50	[1]	

The stress safety coefficients determined are sufficient.

Deflection proof (with minimum groundwater):

Calculation method:	linear			
Ratio:	$I/(A_{rad} \cdot r_m^2)$	0.00120	[1]	
Ratio:	$I/(A_{rad} \cdot r_m^2) \cdot K_q$	0.00144	[1]	
	q_v	q_h	q_h^*	
Deflection coefficient for bending moments:	c_v	-0.0833	0.0833	0.0640 [1]
Deflection coefficient for axial forces:	cN_v	-0.648	-0.681	-0.247 [1]
Deflection coefficient for lateral forces:	cQ_v	-0.335	0.335	0.243 [1]
Resultant deflection coefficient:	c'_v	-0.0854	0.0838	0.0647 [1]

Vertical diameter change:	Δd_v	1.6	mm
Horizontal diameter change:	Δd_h	0.2	mm
Relative vertical deformation:	δ_v	0.92	%
Allowable deflection:	all d_v	6.00	%

The deflection determined is less than the allowable deflection.

Deflection proof (with maximum groundwater):

Calculation method:	linear		
Ratio:	$I/(A_{rad} \cdot r_m^2)$	0.00120	[1]
Ratio:	$I/(A_{rad} \cdot r_m^2) \cdot \kappa_Q$	0.00144	[1]
Deflection coefficient for bending moments:	c_v	q_v -0.0833	q_h 0.0833
Deflection coefficient for axial forces:	cN_v	-0.648	q_h^* 0.0640 [1]
Deflection coefficient for lateral forces:	cQ_v	-0.335	-0.681 [1]
Resultant deflection coefficient:	c'_v	0.335	0.247 [1]
		0.0838	0.243 [1]
Vertical diameter change:	Δd_v	1.6	mm
Horizontal diameter change:	Δd_h	0.2	mm
Relative vertical deformation:	δ_v	0.92	%
Allowable deflection:	all d_v	6.00	%

The deflection determined is less than the allowable deflection.

Stability proof (linear) (with maximum groundwater):

Total vertical load	q_v	58.7	kN/m ²
Reduction factor for soil/traffic load:	κ_{v2}	0.88	[1]
Critical buckling load (soil/traffic load):	crit q_v	702.7	kN/m ²
Partial buckling safety coefficient (soil/traffic load):	$\gamma_{buckl,qv}$	11.96	[1]
External water pressure:	p_e	10.0	kN/m ²
Plus vacuum in the pipe:	p_i	0.0	kN/m ²
Sytem stiffness without traffic load correction:	V_{RB}	0.0028	[1]
Input value δ_{v2} for determining κ_{a2} :	δ_{v2}	1.92	%
Predeformation reduction factor for water pressure:	κ_{r2}	0.90	[1]
Local predeformation reduction factor for water pressure:	κ_{r1}	1.00	[1]
Parameter k^* (substitute for r_m/s) for determining α_D :	k^*	8.324	[1]
Perforation coefficient:	α_P	12.128	[1]
Critical buckling load (external water pressure):	crit p_e	232.1	kN/m ²
Partial buckling safety coefficient (ext. water pressure):	$\gamma_{buckl,pe}$	23.21	[1]
Buckling safety coefficient:	γ_{buckl}	7.89	[1]
Required buckling safety coefficient:	req γ_{buckl}	2.00	[1]

The buckling safety coefficients determined are sufficient.

Non linear stability proof (with maximum groundwater):

- n/a -

Calculations to ATV-DVWK-A 127, third edition, August 2000

Project: TIR CANOL LANDFILL SITE
 Client: GEOTECHNOLOGY LTD
 Date: 21/09/2010
 Contact: ARWEL JONES

Input:

Safety factors

Safety class:	A (normal case)	
Allowable deflection:	6% (normal case)	
A type predeformation:	$\delta_{v,TypeA}$	1.00 %
Local predeformation:	$\delta_{v,local}$	0.00 %

Pipe

Description:	Solid wall	
Inside diameter:	d_i	199.4 mm
Wall thickness:	s	12.80 mm
Perforationsart:	Fully perforated	
Perforation geometry:	Slitted	
Distance between apertures:	l_1	25.00 mm
Width of aperture:	b_w	3.00 mm

Pipe material

Material class:	Thermoplastic	
Description:	PE-HD (ATV-A 127)	
Density of pipe material	γ_P	9.40 kN/m ³
Transv. contr. coeff.	ν	0.38 [1]
E-Modulus, short	E_{st}	800.00 N/mm ²
E-Modulus, long	E_{lt0}	160.00 N/mm ²
Ultimate flexural tensile stress, short-term	$\sigma_{BT,st}$	21.00 N/mm ²
Ultimate flexural compressive stress, short-term	$\sigma_{BC,st}$	21.00 N/mm ²
Ultimate flexural tensile stress, long-term	$\sigma_{BT,lt}$	14.00 N/mm ²
Ultimate flexural compressive stress, long-term	$\sigma_{BC,lt}$	14.00 N/mm ²

Soil

E1: Backfilling:	Soil group: G1	
Value from Table 8 in ATV A127:	D_{PR1}	95.0 %
E20: Pipe zone:	Soil group: G1	
Value from Table 8 in ATV A127:	D_{PR2}	95.0 %
E3: Native soil:	Soil group: G1	
Proctor density:	D_{PR3}	97.0 %
E4: Below trench	$E4 = 10 * E1$	

Installation

Trench width:	<Bank>		
Type of bedding:	loose		
Relative projection:	a	1.00	[1]
Bedding angle:	180°		

Load case combination 1

Description:	LEACHATE DRAINAGE PIPE		
Cover depth:	h	11,000	mm
Soil density:	γ	10.00	kN/m ³
Additional surface load:	P ₀	0.00	N/mm ²
Maximum groundwater level above pipe bed:	h _{W,max}	1,000	mm
Minimum groundwater level above pipe bed:	h _{W,min}	500	mm
Internal pressure:	P _I	0.00	bar
Water fill (e.g. damming channel)	Yes		
Density of medium:	γ_F	10.00	kN/m ³
Traffic load:	No traffic		

Proof for load case combination 1, Short term

Stress proof (with minimum groundwater):

Calculated ultimate flexural tensile stress, soil/traffic load:	$\sigma_{calc,BZ}$	21.0	N/mm ²
Calculated ultimate flexural compr. stress, soil/traffic load:	$\sigma_{calc,BD}$	21.0	N/mm ²
Ultimate flexural tensile stress due to other loads:	$\sigma_{all,BZ}$	21.0	N/mm ²
Ultimate flexural compressive stress due to other loads:	$\sigma_{all,BD}$	21.0	N/mm ²
Internal:			
	Crown	Springline	Bottom
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,i}$ 0.618	-1.580	0.618 N/mm ²
Stress due to other loads:	$\sigma_{other,i}$ -0.008	-0.101	0.030 N/mm ²
Safety coefficient:	γ_{BTi} 34.43	---	32.39 [1]
Safety coefficient:	γ_{BCi} ---	12.50	--- [1]
External:			
	Crown	Springline	Bottom
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,a}$ -1.85	-0.12	-1.85 N/mm ²
Stress due to other loads:	$\sigma_{other,a}$ -0.08	0.00	-0.10 N/mm ²
Safety coefficient:	γ_{BTe} ---	---	--- [1]
Safety coefficient:	γ_{BCe} 10.84	167.49	10.73 [1]
Required flexural tensile safety coefficient:	req γ_{BT}	2.50	[1]
Required flexural compressive safety coefficient:	req γ_{BC}	2.50	[1]

The stress safety coefficients determined are sufficient.

Stress proof (with maximum groundwater):

Calculated ultimate flexural tensile stress, soil/traffic load:		$\sigma_{calc,BZ}$	21.0	N/mm ²	
Calculated ultimate flexural compr. stress, soil/traffic load:		$\sigma_{calc,BD}$	21.0	N/mm ²	
Ultimate flexural tensile stress due to other loads:		$\sigma_{all,BZ}$	21.0	N/mm ²	
Ultimate flexural compressive stress due to other loads:		$\sigma_{all,BD}$	21.0	N/mm ²	
Internal:					
		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,i}$	0.619	-1.584	0.619	N/mm ²
Stress due to other loads:	$\sigma_{other,i}$	-0.061	-0.153	-0.023	N/mm ²
Safety coefficient:	γ_{BTi}	37.68	---	35.25	[1]
Safety coefficient:	γ_{BCi}	---	12.09	---	[1]
External:					
		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,a}$	-1.86	-0.13	-1.86	N/mm ²
Stress due to other loads:	$\sigma_{other,a}$	-0.13	-0.05	-0.15	N/mm ²
Safety coefficient:	γ_{BTe}	---	---	---	[1]
Safety coefficient:	γ_{BCe}	10.55	120.04	10.44	[1]
Required flexural tensile safety coefficient:		req γ_{BT}	2.50	[1]	
Required flexural compressive safety coefficient:		req γ_{BC}	2.50	[1]	

The stress safety coefficients determined are sufficient.

Deflection proof (with minimum groundwater):

Calculation method:	linear			
Ratio:	$I/(A_{rad} \cdot r_m^2)$	0.00121	[1]	
Ratio:	$I/(A_{rad} \cdot r_m^2) \cdot K_Q$	0.00146	[1]	
	q_v	q_h	q_h^*	
Deflection coefficient for bending moments:	c_v	-0.0833	0.0833	0.0640 [1]
Deflection coefficient for axial forces:	cN_v	-0.648	-0.681	-0.247 [1]
Deflection coefficient for lateral forces:	cQ_v	-0.335	0.335	0.243 [1]
Resultant deflection coefficient:	c'_v	-0.0854	0.0838	0.0647 [1]

Vertical diameter change:	Δd_v	1.7	mm
Horizontal diameter change:	Δd_h	1.1	mm
Relative vertical deformation:	δ_v	0.80	%
Allowable deflection:	all d_v	6.00	%

The deflection determined is less than the allowable deflection.

Deflection proof (with maximum groundwater):

Calculation method:	linear		
Ratio:	$I/(A_{rad} \cdot r_m^2)$	0.00121	[1]
Ratio:	$I/(A_{rad} \cdot r_m^2) \cdot K_Q$	0.00146	[1]
Deflection coefficient for bending moments:	c_v	q_v -0.0833	q_h 0.0833 q_h^* 0.0640 [1]
Deflection coefficient for axial forces:	cN_v	-0.648	-0.681 [1]
Deflection coefficient for lateral forces:	cQ_v	-0.335	0.335 0.243 [1]
Resultant deflection coefficient:	c'_v	-0.0854	0.0838 0.0647 [1]
Vertical diameter change:	Δd_v	1.7	mm
Horizontal diameter change:	Δd_h	1.1	mm
Relative vertical deformation:	δ_v	0.81	%
Allowable deflection:	all d_v	6.00	%

The deflection determined is less than the allowable deflection.

Stability proof (linear) (with maximum groundwater):

Total vertical load	q_v	87.6	kN/m ²
Reduction factor for soil/traffic load:	K_{v2}	0.87	[1]
Critical buckling load (soil/traffic load):	crit q_v	1,566.1	kN/m ²
Partial buckling safety coefficient (soil/traffic load):	$\gamma_{buckl,qv}$	17.87	[1]
External water pressure:	p_e	10.0	kN/m ²
Plus vacuum in the pipe:	p_{i-}	0.0	kN/m ²
System stiffness without traffic load correction:	V_{RB}	0.0142	[1]
Input value δ_{v2} for determining κ_{a2} :	δ_{v2}	1.81	%
Predeformation reduction factor for water pressure:	κ_{r2}	0.87	[1]
Local predeformation reduction factor for water pressure:	κ_{r1}	1.00	[1]
Parameter k^* (substitute for r_m/s) for determining α_D :	k^*	8.289	[1]
Perforation coefficient:	α_P	8.706	[1]
Critical buckling load (external water pressure):	crit p_e	819.8	kN/m ²
Partial buckling safety coefficient (ext. water pressure):	$\gamma_{buckl,pe}$	81.98	[1]
Buckling safety coefficient:	γ_{buckl}	14.67	[1]
Required buckling safety coefficient:	req γ_{buckl}	2.00	[1]

The buckling safety coefficients determined are sufficient.

Non linear stability proof (with maximum groundwater):

- n/a -

Proof for load case combination 1, Long term

Stress proof (with minimum groundwater):

Calculated ultimate flexural tensile stress, soil/traffic load:	$\sigma_{calc,BZ}$	14.0	N/mm ²		
Calculated ultimate flexural compr. stress, soil/traffic load:	$\sigma_{calc,BD}$	14.0	N/mm ²		
Ultimate flexural tensile stress due to other loads:	$\sigma_{all,BZ}$	14.0	N/mm ²		
Ultimate flexural compressive stress due to other loads:	$\sigma_{all,BD}$	14.0	N/mm ²		
Internal:		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,i}$	-0.331	-0.647	-0.331	N/mm ²
Stress due to other loads:	$\sigma_{other,i}$	-0.020	-0.088	0.019	N/mm ²
Safety coefficient:	γ_{BTi}	---	---	---	[1]
Safety coefficient:	γ_{BCi}	39.93	19.04	44.85	[1]
External:		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh^*,a}$	-0.71	-0.47	-0.71	N/mm ²
Stress due to other loads:	$\sigma_{other,a}$	-0.08	-0.01	-0.10	N/mm ²
Safety coefficient:	γ_{BTe}	---	---	---	[1]
Safety coefficient:	γ_{BCe}	17.88	29.20	17.43	[1]
Required flexural tensile safety coefficient:	req γ_{BT}	2.50	[1]		
Required flexural compressive safety coefficient:	req γ_{BC}	2.50	[1]		

The stress safety coefficients determined are sufficient.

Stress proof (with maximum groundwater):

Calculated ultimate flexural tensile stress, soil/traffic load:		$\sigma_{calc,BZ}$	14.0	N/mm ²	
Calculated ultimate flexural compr. stress, soil/traffic load:		$\sigma_{calc,BD}$	14.0	N/mm ²	
Ultimate flexural tensile stress due to other loads:		$\sigma_{all,BZ}$	14.0	N/mm ²	
Ultimate flexural compressive stress due to other loads:		$\sigma_{all,BD}$	14.0	N/mm ²	
Internal:		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh*,i}$	-0.333	-0.650	-0.333	N/mm ²
Stress due to other loads:	$\sigma_{other,i}$	-0.073	-0.141	-0.034	N/mm ²
Safety coefficient:	γ_{BTi}	---	---	---	[1]
Safety coefficient:	γ_{BCi}	34.53	17.71	38.14	[1]
External:		Crown	Springline	Bottom	
Stress due to soil and traffic loads:	$\sigma_{qv,qh,qh*,a}$	-0.71	-0.47	-0.71	N/mm ²
Stress due to other loads:	$\sigma_{other,a}$	-0.12	-0.06	-0.14	N/mm ²
Safety coefficient:	γ_{BTe}	---	---	---	[1]
Safety coefficient:	γ_{BCe}	16.82	26.49	16.42	[1]
Required flexural tensile safety coefficient:		req γ_{BT}	2.50	[1]	
Required flexural compressive safety coefficient:		req γ_{BC}	2.50	[1]	

The stress safety coefficients determined are sufficient.

Deflection proof (with minimum groundwater):

Calculation method:	linear			
Ratio:	$I/(A_{rad} \cdot r_m^2)$	0.00121	[1]	
Ratio:	$I/(A_{rad} \cdot r_m^2) \cdot \kappa_q$	0.00146	[1]	
	q_v	q_h	q_h^*	
Deflection coefficient for bending moments:	c_v	-0.0833	0.0833	0.0640 [1]
Deflection coefficient for axial forces:	cN_v	-0.648	-0.681	-0.247 [1]
Deflection coefficient for lateral forces:	cQ_v	-0.335	0.335	0.243 [1]
Resultant deflection coefficient:	c'_v	-0.0854	0.0838	0.0647 [1]

Vertical diameter change:	Δd_v	2.0	mm
Horizontal diameter change:	Δd_h	0.2	mm
Relative vertical deformation:	δ_v	0.92	%
Allowable deflection:	all d_v	6.00	%

The deflection determined is less than the allowable deflection.

Deflection proof (with maximum groundwater):

Calculation method:	linear		
Ratio:	$I/(A_{rad} \cdot r_m^2)$	0.00121	[1]
Ratio:	$I/(A_{rad} \cdot r_m^2) \cdot K_Q$	0.00146	[1]
Deflection coefficient for bending moments: c_v	q_v	q_h	q_h^*
Deflection coefficient for axial forces: c_{N_v}	-0.0833	0.0833	0.0640 [1]
Deflection coefficient for lateral forces: c_{Q_v}	-0.648	-0.681	-0.247 [1]
Deflection coefficient for lateral forces: c_{Q_v}	-0.335	0.335	0.243 [1]
Resultant deflection coefficient: c'_v	-0.0854	0.0838	0.0647 [1]
Vertical diameter change:	Δd_v	2.0	mm
Horizontal diameter change:	Δd_h	0.2	mm
Relative vertical deformation:	δ_v	0.92	%
Allowable deflection:	all d_v	6.00	%

The deflection determined is less than the allowable deflection.

Stability proof (linear) (with maximum groundwater):

Total vertical load	q_v	58.9	kN/m ²
Reduction factor for soil/traffic load:	K_{v2}	0.88	[1]
Critical buckling load (soil/traffic load):	crit q_v	707.0	kN/m ²
Partial buckling safety coefficient (soil/traffic load):	$\gamma_{buckl,qv}$	12.00	[1]
External water pressure:	p_e	10.0	kN/m ²
Plus vacuum in the pipe:	p_r	0.0	kN/m ²
System stiffness without traffic load correction:	V_{RB}	0.0028	[1]
Input value δ_{v2} for determining K_{a2} :	δ_{v2}	1.92	%
Predeformation reduction factor for water pressure:	K_{r2}	0.90	[1]
Local predeformation reduction factor for water pressure:	K_{r1}	1.00	[1]
Parameter k^* (substitute for r_m/s) for determining α_D :	k^*	8.289	[1]
Perforation coefficient:	α_P	12.080	[1]
Critical buckling load (external water pressure):	crit p_e	234.1	kN/m ²
Partial buckling safety coefficient (ext. water pressure):	$\gamma_{buckl,pe}$	23.41	[1]
Buckling safety coefficient:	γ_{buckl}	7.93	[1]
Required buckling safety coefficient:	req γ_{buckl}	2.00	[1]

The buckling safety coefficients determined are sufficient.

Non linear stability proof (with maximum groundwater):

- n/a -

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 14
Leak Location Survey Report
Report Number 1807r3v1d0219

GEOMEMBRANE LEAK DETECTION SURVEY REPORT

TIR CANOL LANDFILL SITE

CELL 6

SEPTEMBER 2018

Prepared For

JLA RECYCLING LTD

Prepared By

GEOTECH LTD



TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	SURVEY METHODOLOGY.....	2
2.1	Survey Principle	2
2.2	Data Acquisition	2
2.3	Wire Test	3
3.0	DATA PROCESSING	4
4.0	SURVEY RESULTS	5
4.1	General	5
4.2	Discussion of Anomalies.....	5
4.3	Repairs.....	5
5.0	CONCLUSIONS	6
6.0	CLOSURE.....	7

1.0 INTRODUCTION

Geotect Ltd was invited by JLA Recycling Ltd to undertake a Geophysical Leak Detection Survey (LDS) over Cell 6 at Tir Canol Landfill Site, Lower Cwmtwrch, Swansea.

The survey was performed by Geotect staff on 21 August 2018.

The purpose of the LDS was to locate any damage to the placed geomembrane liner. Cell 6 of Tir Canol Landfill Site had been subjected to a comprehensive CQA regime. It would be expected, therefore, that any damage would be restricted to minor perforations, or damage caused during the installation of the cover material.

This report describes the methodology used to acquire and process the data and presents the results of the survey in the form of colour contour plots.

2.0 SURVEY METHODOLOGY

2.1 Survey Principle

A leak detection survey exploits the insulating properties of the placed geomembrane.

Two electrodes are placed either side of the geomembrane. One electrode is placed in the underlying clay, or substrate, and the other is placed in the overlying cover material. For the survey to work effectively the two mediums should be electrically isolated from each other.

An electric potential is applied across the two electrodes. An intact geomembrane will act as an insulator and not allow any current to flow between the two mediums. The resulting potential field will be small and consistent over the survey area. Where a leak is present, a break in the insulating layer occurs allowing the current to pass through, resulting in a peak in the potential field.

By measuring the potential difference between two portable monitoring electrodes placed on the cover material, variations in the potential field can be measured and leaks can be located.

A leak in the geomembrane produces a peak in the potential field. As the monitoring electrodes approach the leak, they show a rise from background readings to increasing positive potential differences on one side of the hole. As the electrodes pass the hole the potential difference becomes negative, before rising to background readings with increasing distance from the hole.

2.2 Data Acquisition

Table 1 provides details of data acquisition. Data was acquired along a series of survey lines spaced at 1.0 metre intervals across the survey area. The survey lines had an northwest-southeast trend. Measurement spacing refers to the interval along the survey line the measurements were taken. For this survey measurements were taken every 1.0 metre along every survey line. Dipole spacing refers to the distance between the two portable monitoring electrodes. For this survey the potential difference was measured between electrodes spaced 1.0 metre apart, with an northwest-southeast orientation.

TABLE 1	
Details of Data Acquisition	
Survey Line Spacing	1.0 metre
Survey Line Direction	northwest-southeast
Measurement Spacing	1.0 metre
Dipole Spacing	1.0 metre
Dipole Orientation	northwest-southeast

2.3 Wire Test

Wire tests were performed after the initial set up of the current electrodes, on moving the electrodes and on completion of the survey, in order to ensure the sensitivity of the survey was maintained throughout.

For this test, one end of an insulated copper wire was buried at the base of the cover material. The other end was connected to an electrode established outside of the cell, remote from the external current electrode. This wire acted as a preferential current flow path, thus simulating the effect of a leak in the liner.

The location of the first wire test area is marked on Drawing No. 3. This wire test area was located approximately 60 metres from the first internal electrode set up. The wire test electrode, established at an arbitrary point outside the cell, was located approximately 100 metres from the external electrode.

The test results are presented as Drawing Nos. 1 and 2. Without the wire in place (Drawing No. 1), the potential field is uniformly distributed. This is in contrast to the data that was acquired with the wire in place (Drawing No. 2). This data clearly demonstrates the pattern associated with a leak in the liner.

All wire tests produced notable effects on the measured potential field. These tests confirmed the efficacy and sensitivity of the survey equipment and technique.

3.0 DATA PROCESSING

All data was logged on a Squirrel 400 series logger. The Squirrel logger has an integral high impedance voltmeter set with a range of +5.0 to -5.0 volts and a resolution of +/1millivolt. On the completion of each days work, the data was downloaded onto SquirrelView (Version 2.00) and converted into x (line number), y (position along line) and z (potential difference) format.

Files of the x,y,z data were then imported into Oasis MontajTM (Version 5.1.8) software, for processing and analysis. The data was plotted as profiles along each survey line and each profile was individually examined for the characteristic features relating to a leak in the liner. Examination of the profiles also enables an assessment of the quality of the data to be made. After examination of the profiles, the locations of all anomalous measurements were recorded and revisited. These areas were then resurveyed to either reject the anomaly or pinpoint the location of the suspected defect for further investigation.

On completion of the survey, the data was gridded and contoured. A contour plot of the measured potential differences acquired over Cell 6 is presented as Drawing No. 3.

4.0 SURVEY RESULTS

A coloured contour plot of potential differences is presented as Drawing No. 3, with positive measurements coloured pink and red. Negative measurements are coloured green and blue.

4.1 General

The positions of the external and internal electrodes are shown on Drawing No. 3. The output voltage across the current electrodes was 470 volts for the duration of the survey.

Wet weather conditions prior to conducting the survey meant the cover material was moist throughout. The condition of the cover material produced data with low levels of noise. There was approximately 0.1 amperes (A) of current draw throughout the survey, indicating the survey area was well isolated.

4.2 Discussion of Anomalies

One anomalous feature relating to a leak in the liner can be seen on Drawing No. 3.

- Defect 1 can be seen at grid location 20, -60. This is high in amplitude and acts over a radius of 4.0 metres. This was found to result from a puncture in the liner, approximately 2mm in diameter.

4.3 Repairs

Defect 1 was repaired and resurveyed on 21 August 2018. A resurvey was undertaken to confirm that no other anomalies were present which had been masked by the initial anomaly, and that the repair had been successfully completed. The resurvey confirmed that the repair was effective and no other anomalies were present.

5.0 CONCLUSIONS

The LDS undertaken over Cell 6 of Tir Canol Landfill Site identified one defect in the liner system. Following the repair of the defect a resurvey was undertaken, which confirmed the repair was effective and no other anomalies were present.

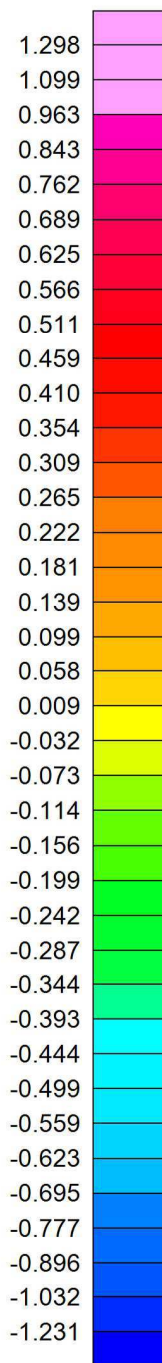
The effectiveness and sensitivity of the survey was assessed by performing wire tests. All wire tests produced noticeable effects on the measured potential field confirming the efficacy and sensitivity of the survey equipment and technique.

6.0 CLOSURE

The information contained in this report is based on the interpretation of the data collected during the survey. The ability of the leak detection survey technique to detect defects in the geomembrane liner is dependent on those defects having a configuration which allows electrical current to flow through the defects and between the current electrodes.

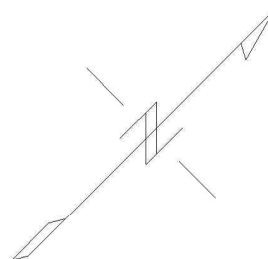
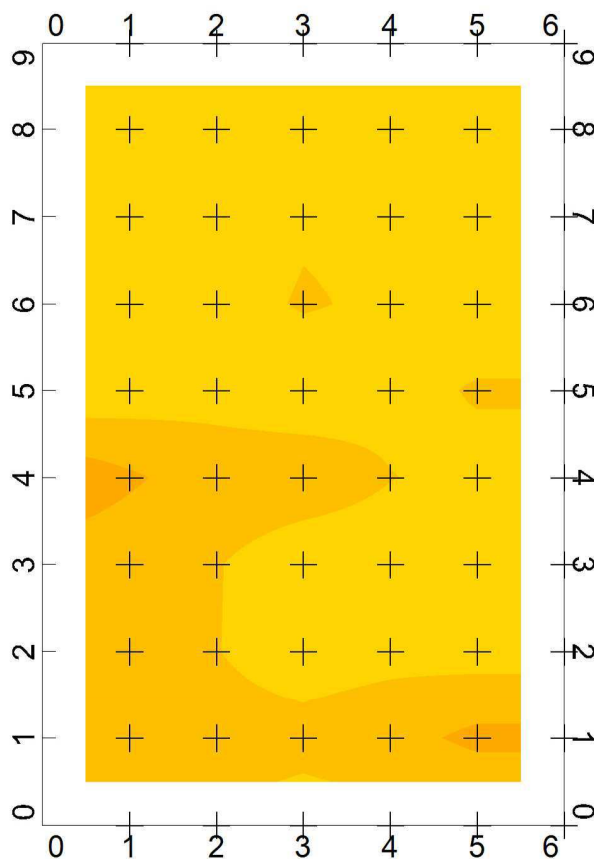
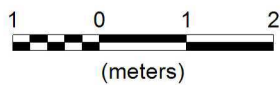
This report does not, therefore, offer a guarantee that the geomembrane liner of Cell 6 of Tir Canol Landfill Site is defect free. Best practises have however been adopted to give the highest possible confidence in the results of the survey.

This report is for the exclusive use of JLA Recycling Ltd and its agents. No warranties or guarantees should be assumed by any third parties.



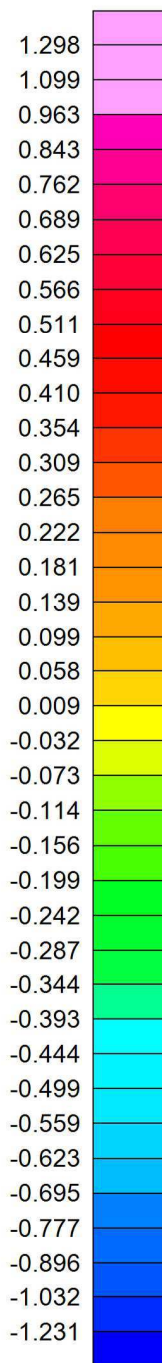
Potential Difference
(Volts)

Scale 1:100

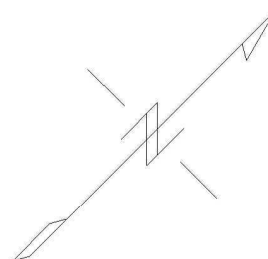
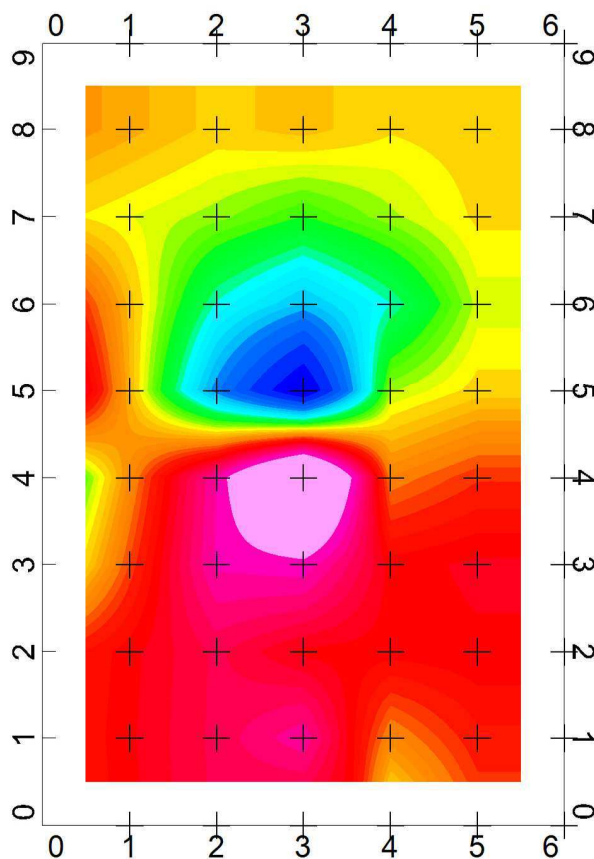
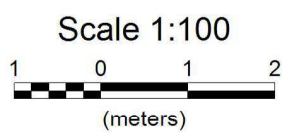


Drawing No. 1

**Tir Canol Landfill Site
Cell 6 Leak Detection Survey
Wire Test Not Connected**

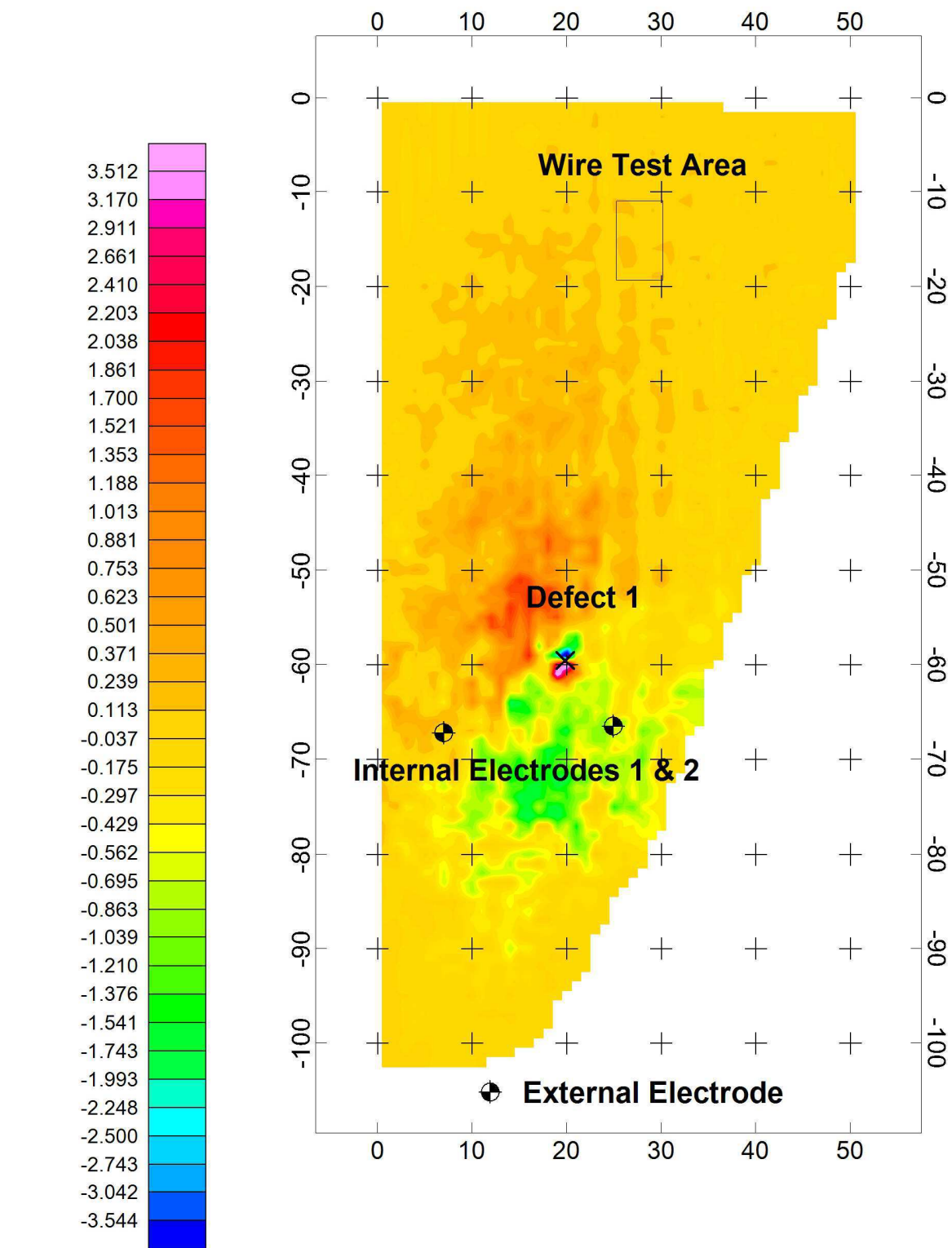


Potential Difference
(Volts)



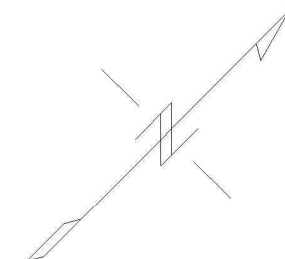
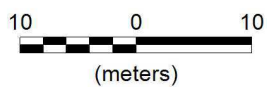
Drawing No. 2

**Tir Canol Landfill Site
Cell 6 Leak Detection Survey
Wire Test Connected**



Potential Difference
(Volts)

Scale 1:750



Drawing No. 3

Tir Canol Landfill Site
Cell 6 Leak Detection Survey
Main Survey

**PALLEG LANDFILL SITE
SUB-CELL 6**

PPC PERMIT BT19081X

Construction Quality
Assurance Validation Report

Appendix 15
Daily Record Sheets
Report Number 1807r3v1d0219



Daily Site Record Sheet

CQA1

Site	Palleg Road Landfill Sub-Cell 6	Date	27/06/2018
------	---------------------------------	------	------------

CQA Staff	Ben Rees			
Contractors	JLA Disposal Plant and Apex Testing Solutions			
Weather AM	Weather PM	Temp Max	Temp Min	Rainfall
Dry overcast	Dry overcast	-	-	0
Plant / Equipment	Hours of Operation	Comments		
13t Roller	8:30 - 4:30			
15t articulated dumper	8:30 - 4:30			
20t backhoe excavator	8:30 - 4:30			
Visitors	None			
Health and Safety	No issues			
Deliveries	None			
Work Undertaken				
In-situ tests on liner completed after additional rolling				
Prepared by	Ben Rees	Signed	SB Rees	



Daily Site Record Sheet

CQA1

Site	Palleg Road Landfill Sub-Cell 6	Date	29/06/2018
-------------	--	-------------	-------------------

CQA Staff	Ben Rees			
Contractors	JLA Disposal Plant			
Weather AM	Weather PM	Temp Max	Temp Min	Rainfall
Dry overcast	Dry overcast	-	-	0
Plant / Equipment	Hours of Operation	Comments		
13t Roller	8:30 - 4:30			
15t articulated dumper	8:30 - 4:30			
20t backhoe excavator	8:30 - 4:30			
Visitors	None			
Health and Safety	No issues			
Deliveries	None			
Work Undertaken				
Placement of mineral liner in parts to raise to correct level				
Prepared by	Ben Rees	Signed	SB Rees.	



Daily Site Record Sheet

CQA1

Site	Palleg Road Landfill Sub-Cell 6	Date	02/07/2018
-------------	--	-------------	-------------------

CQA Staff	Arwel Jones			
Contractors	JLA Disposal Plant			
Weather AM	Weather PM	Temp Max	Temp Min	Rainfall
Cold clear	Cold clear - windy	-	-	0
Plant / Equipment	Hours of Operation	Comments		
13t roller	9:00- 4:30	Final preparation of base after overnight rain		
20t backhoe excavator	9:00- 4:30	With liners		
Visitors	None			
Health and Safety	No issues			
Deliveries	None			
Work Undertaken				
Preparation of liner				
postponed Celtic Lining.				
Prepared by	Arwel Jones	Signed	<i>A. Jones</i>	



Daily Site Record Sheet

CQA1

Site	Palleg Road Landfill Sub-Cell 6	Date	03/07/2018
-------------	--	-------------	-------------------

CQA Staff	Arwel Jones			
Contractors	JLA Disposal Plant and Celtic Lining Ltd.			
Weather AM	Weather PM	Temp Max	Temp Min	Rainfall
Cold clear	Cold clear	-	-	0
Plant / Equipment	Hours of Operation	Comments		
20t backhoe excavator	9:00- 4:30	With liners		
Visitors	None			
Health and Safety	No issues			
Deliveries	None			
Work Undertaken				
Deployment of HDPE liner, testing and sampling, then deploying HPS 11 Geotextile				
Prepared by	Arwel Jones	Signed	<i>A. W. Jones</i>	



Daily Site Record Sheet

CQA1

Site	Palleg Road Landfill Sub-Cell 6	Date	04/07/2018
-------------	--	-------------	-------------------

CQA Staff	Arwel Jones			
Contractors	JLA Disposal Plant and Celtic Lining Ltd.			
Weather AM	Weather PM	Temp Max	Temp Min	Rainfall
Dry overcast	Dry overcast	-	-	0
Plant / Equipment	Hours of Operation	Comments		
Visitors	None			
Health and Safety	No issues			
Deliveries	None			
Work Undertaken				
Survey HDPE and HPS11 Geotextile layout.				
Prepared by	Arwel Jones	Signed	<i>A. W. Jones</i>	

Celtic Lining Ltd.

Project: Celtic SLA Recycling Location: PAULLE Date: 2-7-18
 Rep: [Signature] QA Client:

NAMES		TODAY HRS	B/F HRS	TOTAL HRS
SUPERVISOR	SS			
TECHNICIANS	+ 4			
LABOUR				
PLANT				
HOURS	INSTALLATION HRS	STANDING HRS	CUMULATING HRS	

DAILY PRODUCTION			
TYPE	M ² DEPLOYED	M ² WELDED	M ² QC
2mm DR	4318	4318	4318
Thin	101m	101m	101m

CUMULATIVE PRODUCTION			
TYPE	M ² DEPLOYED	M ² WELDED	M ² QC
2mm DR	4318	4318	4318
Thin	101m	101m	101m

PRE WELD					
MACH NO.	OPERATOR	TEMP	SPEED	TIME	RESULT
Ch12	SS	400	1.9	11:00	PASS
Ch10	CG	400	1.8	11:10	PASS
6367	SS	250	2.50	13:00	PASS

DESTRUCTIVE SAMPLES			
SEAM NO.	WELD DATE	WELDED BY	RESULT
1	27/5/17	SS	OK
2	27/5/17	SS	OK
3	27/5/17	SS	OK
4	27/5/17	SS	OK
5	27/5/17	SS	OK
6	27/5/17	SS	OK
7	27/5/17	SS	OK
8	27/5/17	SS	OK
9	27/5/17	SS	OK
10	27/5/17	SS	OK
11	27/5/17	SS	OK
12	27/5/17	SS	OK
13	27/5/17	SS	OK
14	27/5/17	SS	OK
15	27/5/17	SS	OK
16	27/5/17	SS	OK
17	27/5/17	SS	OK
18	27/5/17	SS	OK
19	27/5/17	SS	OK
20	27/5/17	SS	OK
21	27/5/17	SS	OK
22	27/5/17	SS	OK
23	27/5/17	SS	OK
24	27/5/17	SS	OK
25	27/5/17	SS	OK
26	27/5/17	SS	OK
27	27/5/17	SS	OK
28	27/5/17	SS	OK
29	27/5/17	SS	OK
30	27/5/17	SS	OK

DEPLOYMENT			
TYPE	PANEL NO.	ROLL NO.	AREA
2mm DR	1	25167	548
2mm DR	2	25157	548
2mm DR	3	25150	513
2mm DR	4	25150	34
2mm DR	5	01375	342
2mm DR	6	01375	191
2mm DR	7	27596	27
2mm DR	8	27596	4
2mm DR	9	27596	10
2mm DR	10	27596	10
2mm DR	11	27596	219
2mm DR	12	27596	7
2mm DR	13	27596	51
2mm DR	14	27596	89
2mm DR	15	27596	116
2mm DR	16	27596	4
2mm DR	17	01577	126
2mm DR	18	01371	126
2mm DR	19	01371	133
2mm DR	20	01371	133
2mm DR	21	27590	110
2mm DR	22	27590	20
2mm DR	23	27590	130
2mm DR	24	27590	143
2mm DR	25	27590	123
2mm DR	26	01376	171
2mm DR	27	01376	34
2mm DR	28	01376	192
2mm DR	29	01376	164

WELDING			
MACH NO.	TECH	SEAM NO.	LENGTH
Ch12	SS	Ex 1	80m
Ch10	CG	1/2	80m
Ch12	SS	2/3	75m
Ch10	CG	4/5	7m
Ch12	SS	3/4.5	55m
Ch10	CG	6/7	7m
Ch12	SS	6/7	32m
Ch10	CG	8/9	4m
Ch12	SS	9/10	1m
Ch10	CG	Ex 8.10	14m
Ch12	SS	6.7/11	32m
Ch10	CG	12/13	3m
Ch12	SS	13/14	7.5m
Ch10	CG	13/16	7m
Ch12	SS	14/15.6	18m
Ch10	CG	15.1/17	18.5m
Ch12	SS	17/18	18.5m
Ch10	CG	18/19.4	19.5m
Ch12	SS	19/20	14.5m
Ch10	CG	20/21	14m
Ch12	SS	21/22	19m
Ch10	CG	22/23	19m
Ch12	SS	23/24	21m
Ch10	CG	24/25	7m
Ch12	SS	25/27	23m
Ch10	CG	26/27	25m
Ch12	SS	27/28	28m
Ch10	CG	28/29	24.5m
Ch12	SS	29/30	164m

NON DESTRUCTIVE APT TESTING					
SEAM NO.	LENGTH	START TIME	END TIME	TECH	RESULT
1	80m	10:00	10:30	SS	OK
2	80m	10:30	11:00	CG	OK
3	75m	11:00	11:30	SS	OK
4	7m	11:30	12:00	CG	OK
5	55m	12:00	12:30	SS	OK
6	7m	12:30	13:00	CG	OK
7	32m	13:00	13:30	SS	OK
8	4m	13:30	14:00	CG	OK
9	1m	14:00	14:30	SS	OK
10	14m	14:30	15:00	CG	OK
11	32m	15:00	15:30	SS	OK
12	3m	15:30	16:00	CG	OK
13	7.5m	16:00	16:30	SS	OK
14	7m	16:30	17:00	CG	OK
15	18m	17:00	17:30	SS	OK
16	18.5m	17:30	18:00	CG	OK
17	19.5m	18:00	18:30	SS	OK
18	14.5m	18:30	19:00	CG	OK
19	14m	19:00	19:30	SS	OK
20	14m	19:30	20:00	CG	OK
21	19m	20:00	20:30	SS	OK
22	19m	20:30	21:00	CG	OK
23	21m	21:00	21:30	SS	OK
24	7m	21:30	22:00	CG	OK
25	23m	22:00	22:30	SS	OK
26	25m	22:30	23:00	CG	OK
27	28m	23:00	23:30	SS	OK
28	24.5m	23:30	24:00	CG	OK
29	164m	24:00	24:30	SS	OK

NON DESTRUCTIVE TESTING					
TYPE	SEAM NO.	LENGTH	LOCATION	RESULT	TECH
2mm DR	1	80m	10:00	OK	SS
2mm DR	2	80m	10:30	OK	CG
2mm DR	3	75m	11:00	OK	SS
2mm DR	4	7m	11:30	OK	CG
2mm DR	5	55m	12:00	OK	SS
2mm DR	6	7m	12:30	OK	CG
2mm DR	7	32m	13:00	OK	SS
2mm DR	8	4m	13:30	OK	CG
2mm DR	9	1m	14:00	OK	SS
2mm DR	10	14m	14:30	OK	CG
2mm DR	11	32m	15:00	OK	SS
2mm DR	12	3m	15:30	OK	CG
2mm DR	13	7.5m	16:00	OK	SS
2mm DR	14	7m	16:30	OK	CG
2mm DR	15	18m	17:00	OK	SS
2mm DR	16	18.5m	17:30	OK	CG
2mm DR	17	19.5m	18:00	OK	SS
2mm DR	18	14.5m	18:30	OK	CG
2mm DR	19	14m	19:00	OK	SS
2mm DR	20	14m	19:30	OK	CG
2mm DR	21	19m	20:00	OK	SS
2mm DR	22	19m	20:30	OK	CG
2mm DR	23	21m	21:00	OK	SS
2mm DR	24	7m	21:30	OK	CG
2mm DR	25	23m	22:00	OK	SS
2mm DR	26	25m	22:30	OK	CG
2mm DR	27	28m	23:00	OK	SS
2mm DR	28	24.5m	23:30	OK	CG
2mm DR	29	164m	24:00	OK	SS

WEATHER	
TYPE	TEMP
-	-
DELAYS TO WEATHER	-

Project: YLA Recycling
Rep: [Signature]
Location: PALMERS
O/A Client: [Signature]
Date: 3-7-18

1. QA Eng 2. Head Office 3. Client



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