

**ATLANTIC RECYCLING  
ECOPARK PAVING  
PROJECT**

**PHASE 3 CQA  
VALIDATION REPORT**

*Report Number 1379r6v1d1215*

*Commissioned by*  
Atlantic Recycling Ltd  
Ty-To-Maen Farm  
Newton Road  
Rumney  
Cardiff  
CF3 2EJ

*Prepared by*  
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# 1 INTRODUCTION

Atlantic Recycling Ltd (Atlantic) operates a waste transfer station on land at Newton Farm, Rhymney, Cardiff (Figure 1). Its associated company Neal Soil Suppliers operates a waste soil processing facility on adjacent land. Both activities require significant areas of land to be provided with infrastructure in order to reduce the risk of pollution to the protected watercourses that run through the sites. Environmental Permits require that areas used for storing non-hazardous and hazardous waste should be provided with an impermeable surface with a sealed drainage system. Until recently, small areas of the site met this requirement whilst large areas remained in need of paving.

This report describes the construction work and quality assurance monitoring carried out during the placement of a large cement bound aggregate pad measuring approximately 110 x 60m. This new impermeable surface with sealed drainage system is located on the northern side of the Atlantic Waste site in an area known as Field 1 (Figure 2).

This report details the third phase of the works which cover an area of approximately 5,650m<sup>2</sup>. Prior to this phase of construction, the first phase of works covering an area of approximately 13,500m<sup>2</sup> followed by a second phase covering approximately 8,830m<sup>2</sup> have been completed and documented in Geotechnology Reports 1379r4v1d0815 and 1379r5v1d1115 respectively. In order to create a sealed drainage system Phase 3 has tied into the western edge of Phase 2. Although the drainage culvert on the downslope edge of the slab has been extended as part of Phases 2 and 3, all 3 phases utilise the same outlet point and interceptor systems installed during Phase 1.

## 1.1 Project Organisation

The client for the contract is Atlantic Recycling Ltd.

The Principal Designer for the works is Geotechnology Ltd.

The Principal Contractor for the works is Neal Soil Suppliers Ltd.

The CQA Inspector for the works is Keir Thomas of Geotechnology Ltd.

Other Contractors involved in the project are:

- Construction of the Impermeable Slab – Darlow Lloyd and Sons Ltd.
- Construction of the Impermeable Slab – DCM Roadways
- Construction of Drainage Channel - Thames Valley Construction Ltd.
- Concrete Kerb Detail on Impermeable Slab – Thames Valley Construction Ltd.
- CBR Testing of Formation – Southern Ground Testing
- Coring for Testing of Impermeable Slab – Apex Testing Solutions

Laboratories used for validation testing were:

- Concrete Cube and PSD Testing - Apex Testing Solutions

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## **1.2 CQA Plan and Specification**

The construction of the impermeable surface and sealed drainage system was carried out in accordance with the Design and Specification (Geotechnology Report Ref: 1379r1v1d1114) and the Construction Quality Assurance (CQA) Plan (Geotechnology Ref: 1379r3v1d0615). This report should be read in conjunction with these two documents.

These reports provide the approach to be adopted for the approval of material suppliers, conformance testing of the materials supplied, and monitoring of all processes involved with the construction of the impermeable pad and sealed drainage system.

The CQA Plan was formally submitted to Natural Resources Wales for review and approval on 22 June 2015.

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## **2 SUMMARY OF WORKS COMPLETED**

### **2.1 Delays and Timescales**

Works on formation preparation began in September 2015 and were completed by mid October 2015. Once levels had been brought up to formation a check survey was carried out, along with CBR testing to determine the suitability of the surface. Failures of 5 CBR tests resulted in some material having to be removed and replaced before retesting. This work was carried out and completed between 21 & 28 October 2015. Once the repeat CBR testing found the formation surface to be acceptable the 200mm thick layer of unbound aggregate was placed over the whole of Phase 3. This work was largely completed between the last week of October and first week of November 2015.

Placement of the 300mm layer of material to be incorporated into the bound aggregate began soon after the completion of the unbound layer. This layer was complete by 25 November, after which the binding process commenced with the finished slab being completed on 4 December. The edge details, including concrete kerbing and landscaping was completed on 23 December.

### **2.2 Design Changes**

As seen in the previous phase it was not possible to place the slab as close to the edge of the culvert as specified in the design. Furthermore, the very edge of the prepared slab was only loosely bound and did not present an impermeable surface. To remedy this, the edge of the slab was cut away with a disk cutter and the excess material removed by hand. The Contractor then placed ready mix concrete to connect the slab edge to the concrete culvert. This results in a somewhat longer slope between the edge of the slab and the culvert than shown in the design.

### **2.3 Preparatory Earthworks**

Preparatory earthworks for the project consisted of the preparation of 3 distinct layers. The first layer is referred to as formation. The formation has been formed from cut and fill of the pre-existing ground at the site. This phase has seen very little material cut with the majority of the cut was at the southern edge of the slab whilst majority of the area was filled. In order to meet the required surface, significant quantities of material were imported.

The second layer of preparatory earthworks was the placement of an unbound sub-base layer comprising a 200mm thick layer of aggregate. This aggregate was placed and compacted using method compaction.

The final layer was a 300mm thick aggregate layer, incorporated into the cement bound slab. The aggregate used for construction of both the unbound and bound layers needed to be either primary or secondary source aggregate.

Majority of earthworks were completed by mid November 2015, with some additional placement of stone and grading to achieve the finished levels taking place between 25 November and 04 December 2015 during the placement of the slab.

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## **2.4 Concrete Works**

The majority of concrete works carried out on this phase consisted of construction of the cement bound pad, which was carried out by DLS between 25 November 2015 and 04 December 2015. The concrete culvert work carried out by TVC was largely completed as part of the Phase 2 slab and thus only required a small return to be completed in the south west corner of the slab.

The final phase of concrete works was the construction of the concrete kerb at the edge of the pad. This work has been completed during December 2015 and ties in with the small return in the south western corner.

## **2.5 Drainage**

The culvert constructed to convey the surface drainage from Phases 2 & 3 connects into the outfall constructed during Phase 1, the details of which can be seen in Geotechnology Report 1379r4v1d0815.

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### **3 EARTHWORKS**

All earthworks for the site were carried out by the principal contractor working to levels and positions set out by Geotechnology. Geotechnology attended site during the earthworks phase to check levels and setting out positions. Several methods of setting out were used during construction.

Initially, a combination of level and alignment pins were installed along the edge of Phase 2 to allow the set up of a grading laser which was then used by the contractor to check cut and fill levels. Once approximate levels were achieved, grading to reach the finished levels was carried out by a Bobcat utilising prism receivers to work with a spinning laser set up at the edge of phase 2. Levels were then checked frequently with a networked GPS survey system.

All setting out and survey work was carried out to national Ordnance datum and coordinates. For equipment without GPS, the principal survey station was STN1 located in the concrete pad surrounding the main office.

#### **3.1 Existing Ground**

Prior to the commencement of works, much of the site was occupied by RDF bales which were removed and placed on the previous phases of the slab. The natural ground beneath the site comprises clay and silt based tidal flat deposits. However, due to the nature of site use prior to the works, these have been largely covered by made ground comprising clay mixed with construction/demolition rubble.

#### **3.2 Formation Preparation**

Preparation of the formation commenced during September 2015 once the site had been cleared of RDF stockpiles. Initial cut/fill was carried out by excavators and dozers working to a grading laser set up on pins installed by Geotechnology. As none of the equipment on site was set up for receiving a grading laser, a banksman carrying a staff with receiver, worked alongside excavators and dozers to reach design levels. Largely imported materials were deposited over much of the site to build up levels. This material was placed using method compaction, and rolled repeatedly to provide a suitable formation surface.

A check survey has been carried out by Geotechnology using a dGPS system to confirm that levels are within tolerance of the design. This survey can be seen in Figure 3.

Following achievement of formation levels California Bearing Ratio (CBR) Tests were carried out on the formation at 10 locations. The location of each of these tests can be seen in Figure 3. The results of the testing are summarised in the Table 3-1 below and the test certificates are included in Appendix 1.

The “Thickness Design & Specification for Paving Using HBM” report produced by John Kennedy and included as Appendix 2 of the CQA Plan states that the subgrade should have a CBR result not less than 8%. As can be seen from the table below, five of the tests carried out on the 21 October 2015 failed to meet the 8% CBR value. To rectify this Geotechnology provided Neal Soils with a plan of the area requiring removal and replacement. This work was carried out over the following week, and the relevant areas retested on 28 October 2015. All 5 of these re-tests were well in excess of the 8% value required.

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**Table 3-1 CBR Testing Results**

| CBR Number | Date       | Test Depth                       | CBR Value (%) |
|------------|------------|----------------------------------|---------------|
| 1          | 21/10/2015 | 0.15                             | 5.3*          |
| 2          | 21/10/2015 | 0                                | 4.6*          |
| 3          | 21/10/2015 | 0                                | 6.9*          |
| 4          | 21/10/2015 | 0                                | 10.9          |
| 5          | 21/10/2015 | 0                                | 8.5           |
| 6          | 21/10/2015 | 0                                | 7*            |
| 7          | 21/10/2015 | 0                                | 5.9*          |
| 8          | 21/10/2015 | 0                                | 22.1          |
| 9          | 21/10/2015 | 0                                | 21.6          |
| 10         | 21/10/2015 | 0                                | 23.4          |
| 1          | 28/10/2015 | 0                                | 36.3          |
| 2          | 28/10/2015 | Exceeded Testing Apparatus Range |               |
| 3          | 28/10/2015 | 0                                | 13.7          |
| 4          | 28/10/2015 | 0                                | 30.6          |
| 5          | 28/10/2015 | 0                                | 21.9          |

*\* Ground surrounding failed test removed and remediated by placement new fill material, re-test then carried out on 28/10/2015.*

### **3.3 Unbound Sub-Base (200mm) Layer**

Above the formation a 200mm thick layer of sub-base was placed in accordance with the John Kennedy design assumptions described in Appendix 2 of the CQA Plan. The same methods of setting out and supervision were used for the unbound sub-base layer as for formation.

The material used in the placement of the unbound layer came from one of the sources used for Phase 2 both of which met the specification. It was therefore not required to send additional samples for particle size distribution testing.

### **3.4 Bound (300mm) Layer**

The bound 300mm thick layer of Aggregate was placed above the finalised 200mm layer to raise levels to the finished level of the slab. It is this material which is incorporated into the finished cement bound surface so it is important that final levels on the placement of this material match the finished design levels as closely as possible. The grading of this aggregate was not determined to be important at the time of placement as it would be crushed as part of the mixing and laying process.

Initial placement of the 300mm layer was carried out using a dozer in conjunction with a spinning laser and banksman with a staff and receiver. However, to achieve a finished surface as close to the design as possible, a Bobcat utilising a spinning laser and prism receiver was used for the final grading.

The material used for the 300mm layer consisted largely of demolition rubble comprising crushed concrete and bricks of highly variable sizes. A visual inspection of the placed

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300mm layer identified a generally uniformly graded material comprising crushed concrete and brick. However, some small quantities of contraries were also present including rebar and wood, although generally less than seen in previous phases.

A full survey of the 300mm layer was not carried out at this time as it was expected that levels would change during crushing and mixing of the cement. A final survey of the pad surface was completed post construction and used to generate an Isopachyte plan of the total thickness of the pad by subtracting the formation survey, this plan is shown in Figure 4.

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## **4 DRAINAGE CHANNEL CONSTRUCTION**

These aspects of the scheme were largely completed during Phase 2 of the slab construction and details of this installation can be found in Geotechnology Report 1379r5v1d1115. A small return has been completed in the south west corner of the slab to connect the drainage culvert and headwall to the outside kerb of the slab. This work was carried out based on the same design principals as the rest of the culvert.

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## **5 SLAB CONSTRUCTION**

Slab construction took place between 25 November 2015 and 04 December 2015. There were several elements to this work which were carried out by DLS and subcontractors in conjunction with TVC. Firstly, the slab was laid by DLS utilising an in-situ mixing method which lifted and crushed the 300mm thick recycled aggregate layer whilst mixing-in cement powder which had been placed on the surface of the aggregate. This mixture was then compacted and power floated in order to achieve a suitable finished surface.

Work commenced at the northern edge of the line between phases 2 & 3 and progressed in strips running down slope from the top of the slab towards the line marking the change of slope. This work progressed westwards until all of the 1:600 section of the slab was complete. The orientation of work then changed to run perpendicular to the slope as seen previously in phases 1 & 2, this method continued to completion of the slab on 04 December 2015.

Following completion of the slab, a kerb detail was constructed along the northern and western edges starting at the edge adjoining Phase 2 and tracking the edge of the slab to join the culvert headwall in the southwest corner. The kerb was constructed using shuttering and traditional concrete pouring techniques. The kerb was tied into the slab using dowels drilled at 300mm intervals.

Work was also carried out to connect the slab to the drainage culvert. This work was carried out by the principal contractor. In order to provide a continuous impermeable surface, it was first necessary to cut away a section of the slab which was only loosely bound in order to create a clean edge. This was achieved by first cutting a line with a disk cutter and then cleaning out the material between the newly cut edge and the drainage channel. All loose and excess material was removed by hand. Once this preparation work was complete the reinforcement bars protruding from the edge of the drainage channel were adjusted to the correct angle and concrete was poured into the gap. The concrete was then formed by Neal Soil Suppliers Ltd into a slope running from the edge of the slab into the drainage channel. This detail can be seen in Figure 5.

### **5.1 Visual Inspection**

Upon completion of the slab, a walkover and visual inspection has been carried out to determine the surface is of acceptable quality. Although some rare contraries were identified in the upper layer the general quality of the surface appears greatly improved compared with Phase 1 and comparable to that of Phase 2.

### **5.2 Particle Size Distributions**

As part of the validation of the crushing process, 4 samples of crushed material were collected prior to mixing with cement powder. These samples have been sent to Apex Testing Solutions to be tested for particle size distribution. The positions of each of the samples are identified on Figure 5.

---

## 5.3 Strength testing

In order to determine the long term durability of the slab it was necessary to carry out compressive strength testing on the finished product. In standard concrete design this is achieved by making a series of concrete cubes for testing. These cubes are generally created by pouring a small amount of the concrete from each pour into a standard sized steel mould. Once set and having been given time to cure, these cubes are broken out of the mould and taken to a laboratory for testing.

During the construction of Phase 1, tests were carried out on cubes created by sampling the mixed in-situ material and compacting this material into cube moulds to form cubes. The results for cube compressive strengths showed highly variable values which was considered to indicate that the method of compacting the mix into the cubes was not entirely representative of in-situ compaction with a roller. In order to gain more reliable indication of in-situ slab strengths, the decision was made to core the slab to obtain cores for compressive strength testing.

Due to the unreliability of the cube testing from the last phase, no attempt was made to create cubes during this phase. Instead, core testing has been chosen as a method of verifying both the depth of the bound aggregate and the strength of the resultant material.

### 5.3.1 Core Testing

On 16 December 2015 Geotechnology set out 10 randomly selected positions on the finished slab. Apex Testing Solutions drilled to obtain cores for testing of the in-situ bound material at these positions; these are identified on Figure 5. The cores were drilled through the pad and into the unbound material beneath in order to determine the full depth of the bound material. All core holes were then backfilled with poured concrete by Neal Soil Suppliers Ltd.

The cores retrieved have been submitted to Apex Testing Solutions laboratory to be tested for compressive strength. The field results of this investigation and testing are summarised in Table 5-1. Prior to testing, the maximum and minimum lengths of the core are measurements before the core is cut to the correct size for the test. A field measurement of the maximum depth of the cored hole has also been included in the table.

As can be seen from the table below the coring investigation found that of the 10 cores drilled only 1 failed to meet the specified 300mm by 40mm. However each of the remaining cores was in excess of 300mm with some significantly exceeding the specified thickness. Photographs of each of these cores are included in Appendix 3. Visual inspection of the retrieved cores found them to be in good condition with minimal crumbling even at depth. Several cores were fractured but it is likely this has occurred as a result of the coring exercise, rather than being representative of the in-situ condition of the slab. Furthermore, below these fractures the cores remain intact and in good condition showing that mixing of cement powder and compaction to sufficient depth has taken place.

These results are significantly improved from both Phases 1 & 2, and should result in improved durability for this part of the slab.

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**Table 5-1 Summary of Core Test Results**

| Core ID | Hole Depth | Location E | Location N | Pass/Fail |
|---------|------------|------------|------------|-----------|
| B1      | 400        | 323626.858 | 178623.898 | P         |
| B2      | 350        | 323597.247 | 178608.123 | P         |
| B3      | 260        | 323605.539 | 178630.340 | F         |
| B4      | 330        | 323581.851 | 178628.762 | P         |
| B5      | 310        | 323608.434 | 178652.558 | P         |
| B6      | 450        | 323595.578 | 178668.204 | P         |
| B7      | 340        | 323583.651 | 178657.808 | P         |
| B8      | 360        | 323577.220 | 178681.287 | P         |
| B9      | 410        | 323572.192 | 178701.611 | P         |
| B10     | 430        | 323554.769 | 178686.193 | P         |

#### **5.4 Finished Surface Topographic Survey**

A final topographic survey of the slab and associated drainage details was completed on 16 December 2015 and is presented in Figure 5. In this figure it can be seen that the final surface meets the nominal designed fall of 1:600 on the northern section with a nominal 1:100 fall down to the drainage channel in the south. The headwall on the drainage channel and return has an elevation of 6.8mAOD allowing the slab to flood to that level when the shut off valve is closed. The northern edge of the slab is enclosed by a concrete kerb 200mm high and 300mm wide.

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## **6 OUTLET, SHUT-OFF VALVE AND INTERCEPTORS**

The outlet which takes captured water from the slab through the headwall to the outfall comprises several components designed to control the flow of water and improve water quality before discharge to the ditch. These aspects of the scheme were installed during Phase 1 of the slab construction and details of this installation can be found in Geotechnology Report 1379r4v1d0815.

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## **7 NON CONFORMANCES AND RECTIFYING ACTION**

Of the 10 cores tested, 1 failed to meet the depth of bound material required by the specification. It has been shown that the slab is constructed over ground that provides more than adequate support (minimum CBR value 8.5% against a requirement of 8% with many results much higher). The fill materials meet the grading requirements of 6F2 and Type 1 and the full thickness has been confirmed by survey. Accordingly, the load bearing capacity of the slab is not in doubt. Whilst visual evidence indicates that the slab is currently fit for purpose as an impermeable surface, regular inspection over the coming years will be needed to confirm it remains so in the future.

It is recommended that once the slab comes into use it should be subjected to regular (3 monthly) inspections focussing on the integrity of the slab and aiming to identify any cracking which could lead to increased permeability and a failure of the sealed system.

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## **8      VALIDATION STATEMENT**

### **8.1      Earthworks**

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

### **8.2      Slab Construction**

It is confirmed on the basis of site records and inspection that the slab construction has created an impermeable surface across the area.

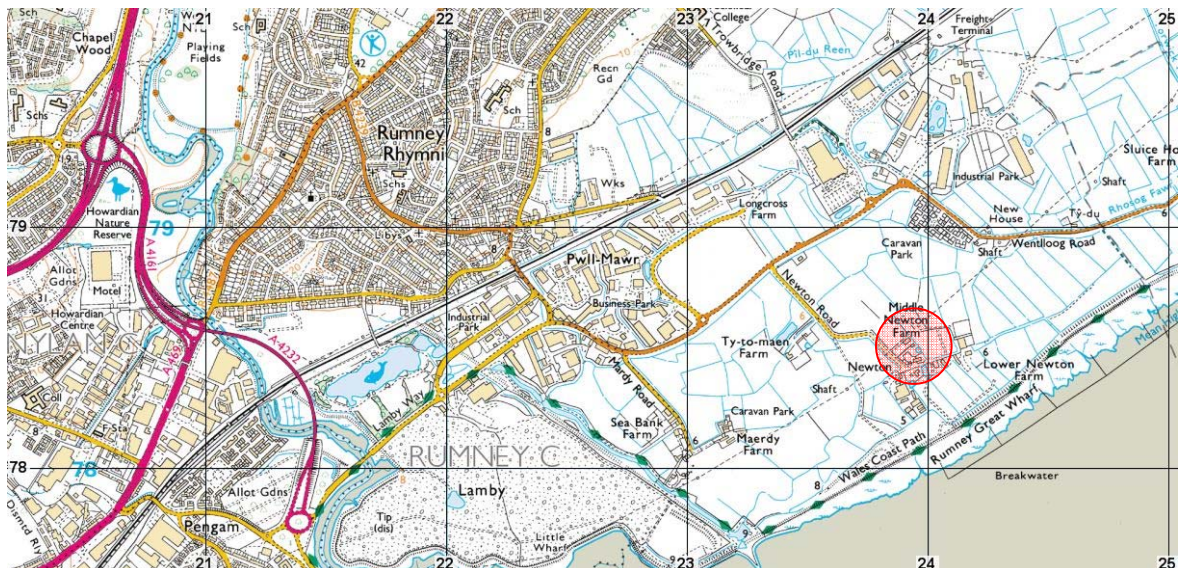
### **8.3      Drainage**

It is confirmed on the basis of the inspection reported that all components of the drainage system were installed in accordance with the Specification.

### **8.4      Impermeable Surface with Sealed Drainage System**

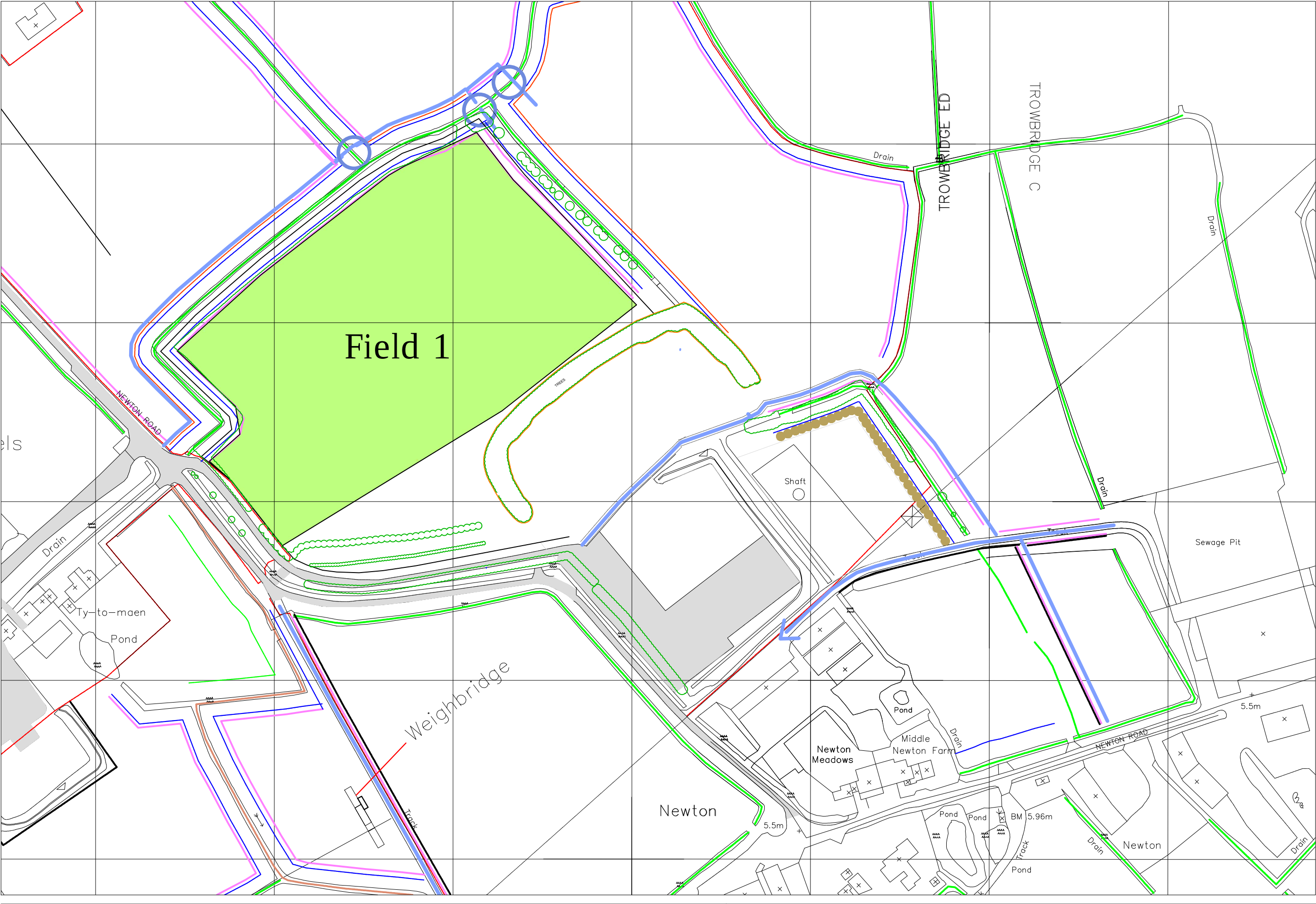
It is confirmed that the scheme constructed at Atlantic Recycling currently constitutes an impermeable surface with a sealed drainage system.

**Figure 1 Site Location Plan**



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Figure 2 Detailed Site Plan



**Figure 3 Formation Survey with CBR Testing Positions**

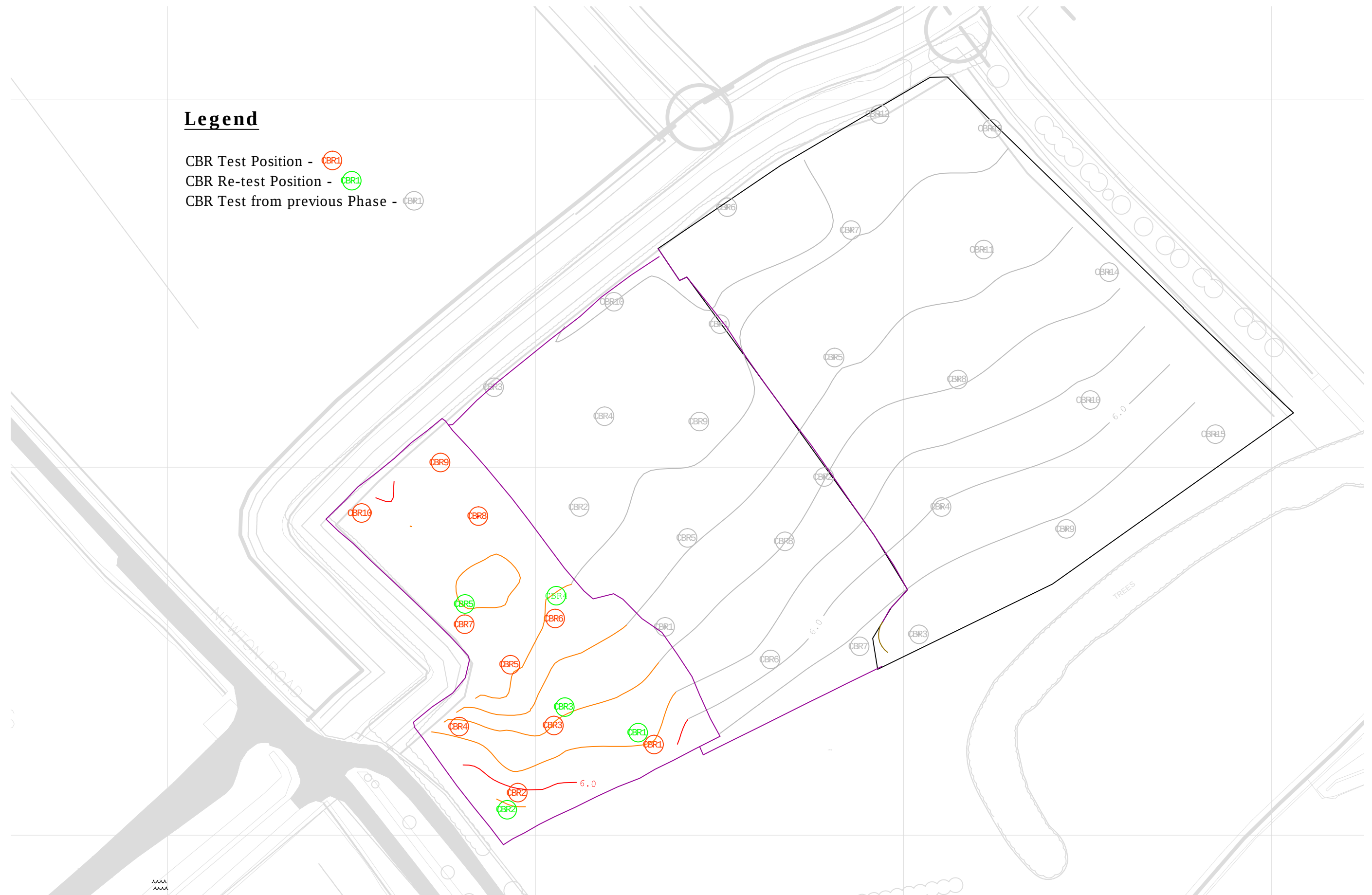


Figure 4 Total Pad Thickness Isopachyte Plan

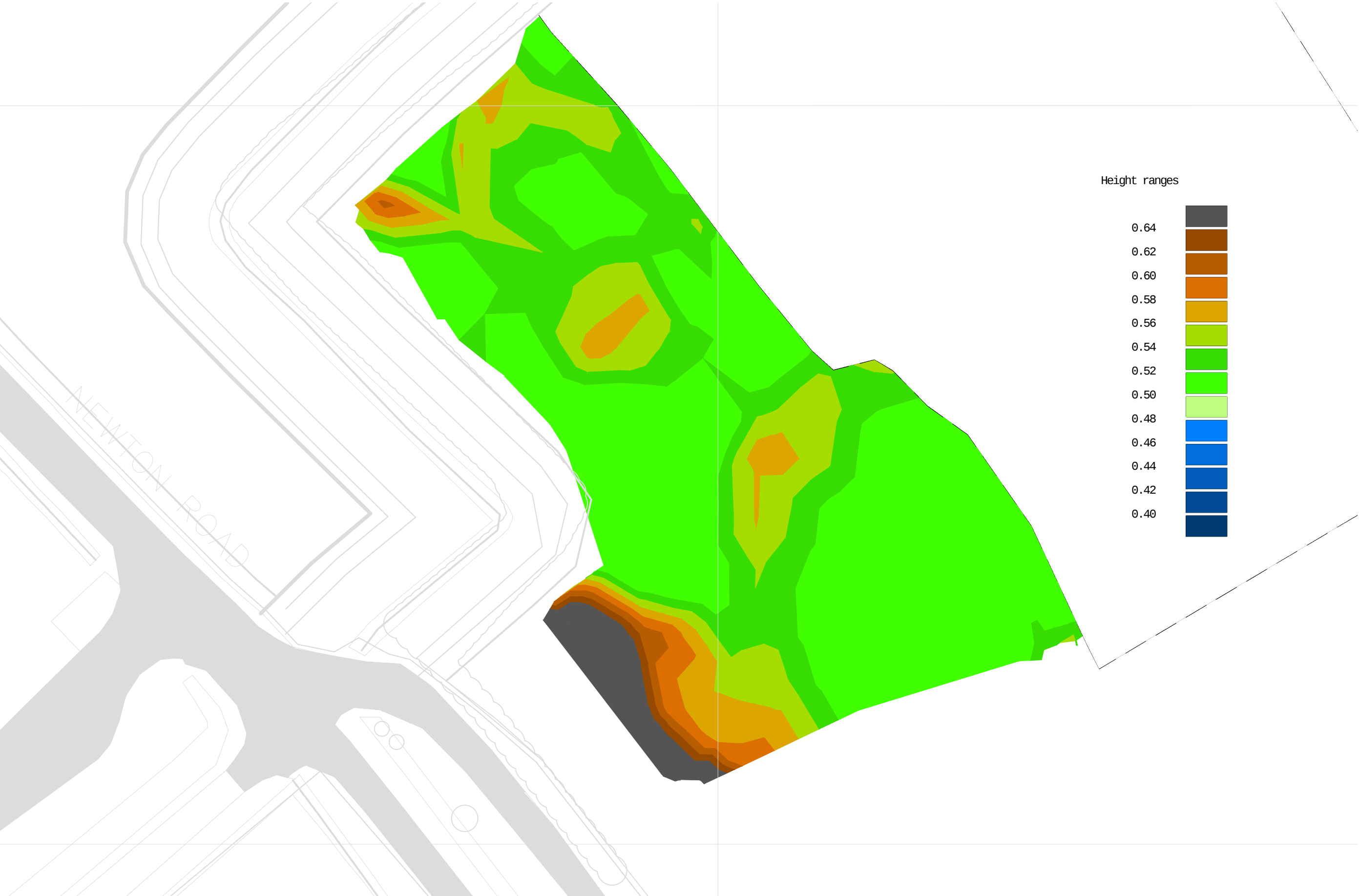


Figure 5 Final Topographic Survey of Slab with Bound Layer Testing Positions



**ATLANTIC WASTE  
ECOPARK PAVING  
PROJECT**

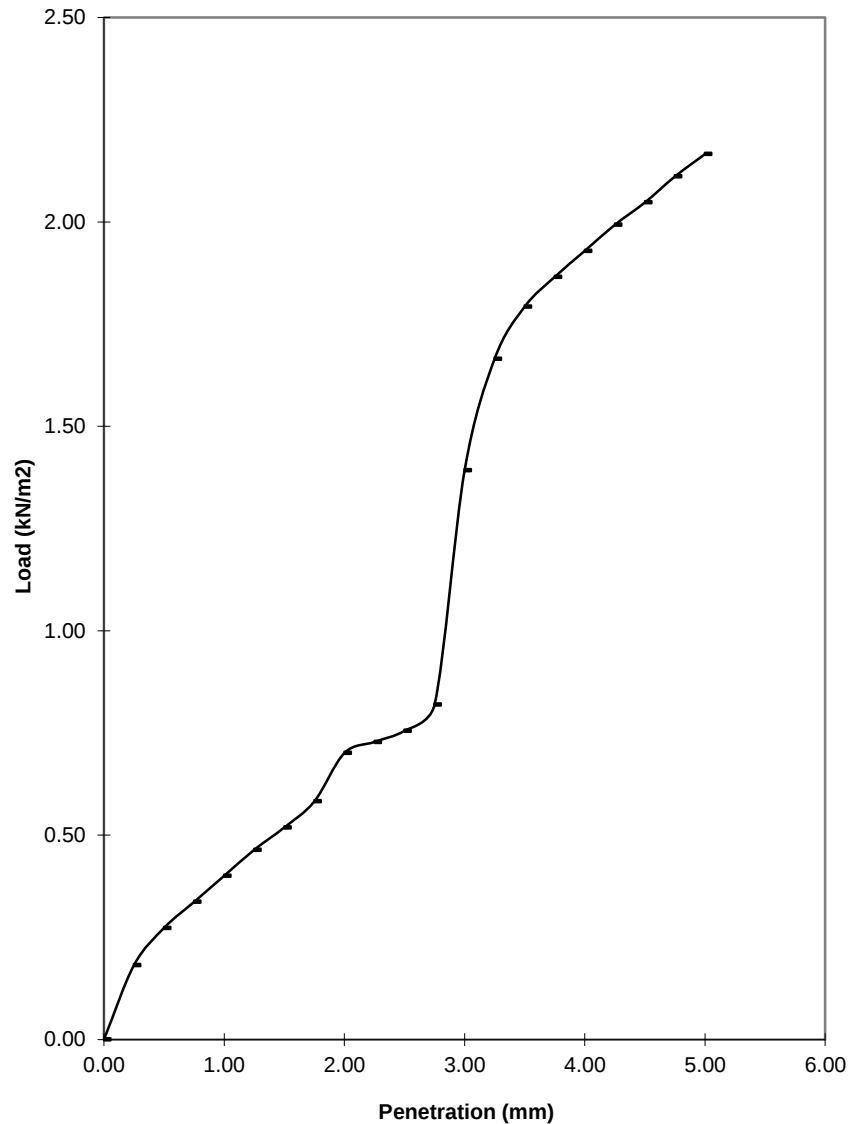
**PHASE 3 CQA  
VALIDATION REPORT**

**Appendix 1**  
**CBR Test Certificates**  
*Report Number 1379r6v1d1215*

[illegible]

[illegible]

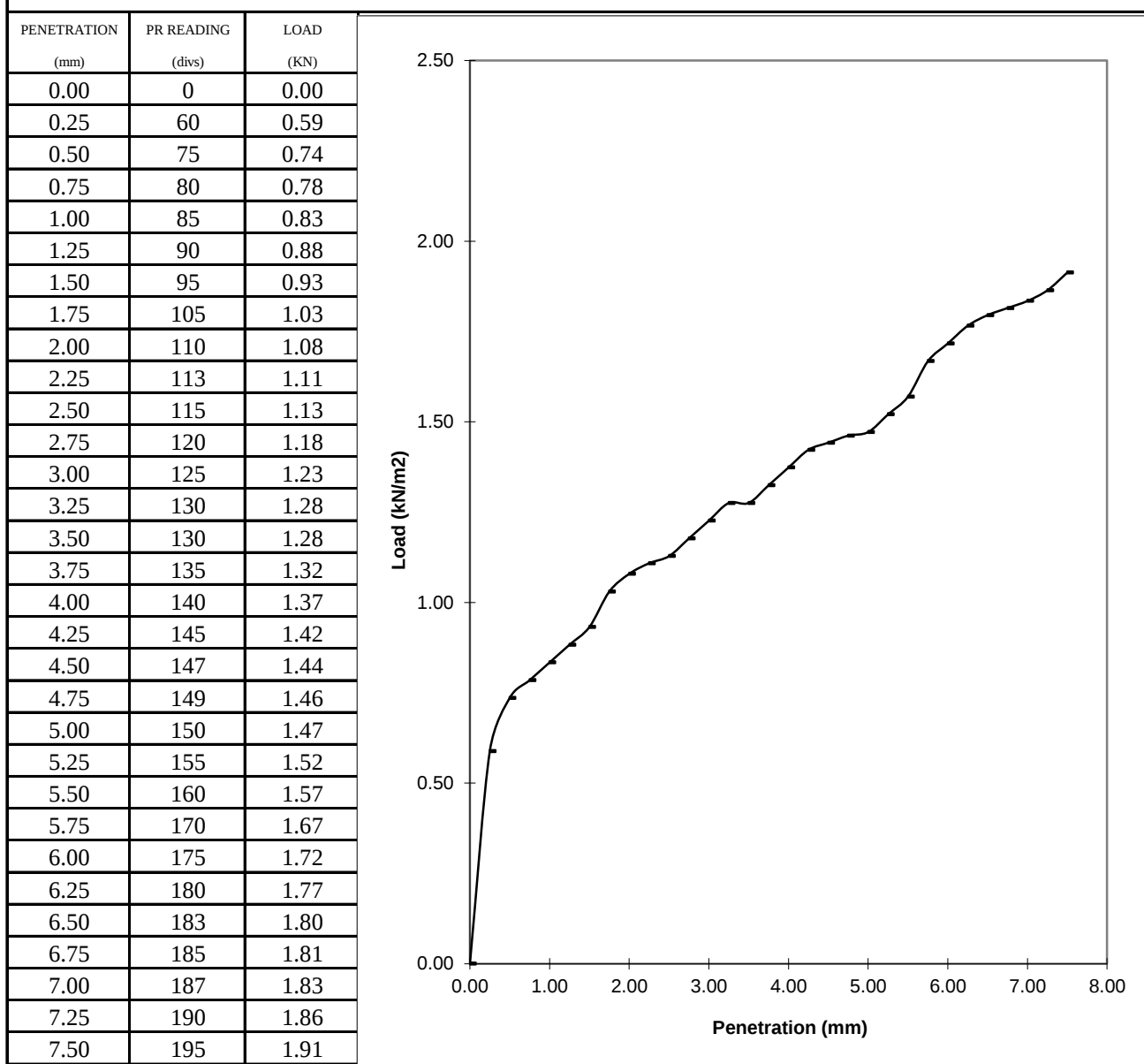
[illegible]

[illegible]

|                                        |                                                          |                                                               |               |
|----------------------------------------|----------------------------------------------------------|---------------------------------------------------------------|---------------|
| Test Depth: GL                         | Soil Description: Brown sandy Clay and demolition rubble | CBR at 2.50mm                                                 | 5.70 %        |
| Mass of Split Rings: 5Kg               |                                                          | CBR at 5.00mm                                                 | 10.85 %       |
| PR Factor: 9.1 N/Div                   |                                                          | <b>CBR Value:</b>                                             | <b>10.9 %</b> |
|                                        |                                                          | Checked By:                                                   | J.P.          |
| REMARKS:                               |                                                          |                                                               |               |
|                                        |                                                          | Carried out in accordance with BS1377: Part 9: 1990, Test 4.3 |               |
| CONTRACT: Atlantic Recycling, Cardiff. |                                                          | DATE: 21.10.15<br>TEST REFERENCE: 4                           |               |

# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

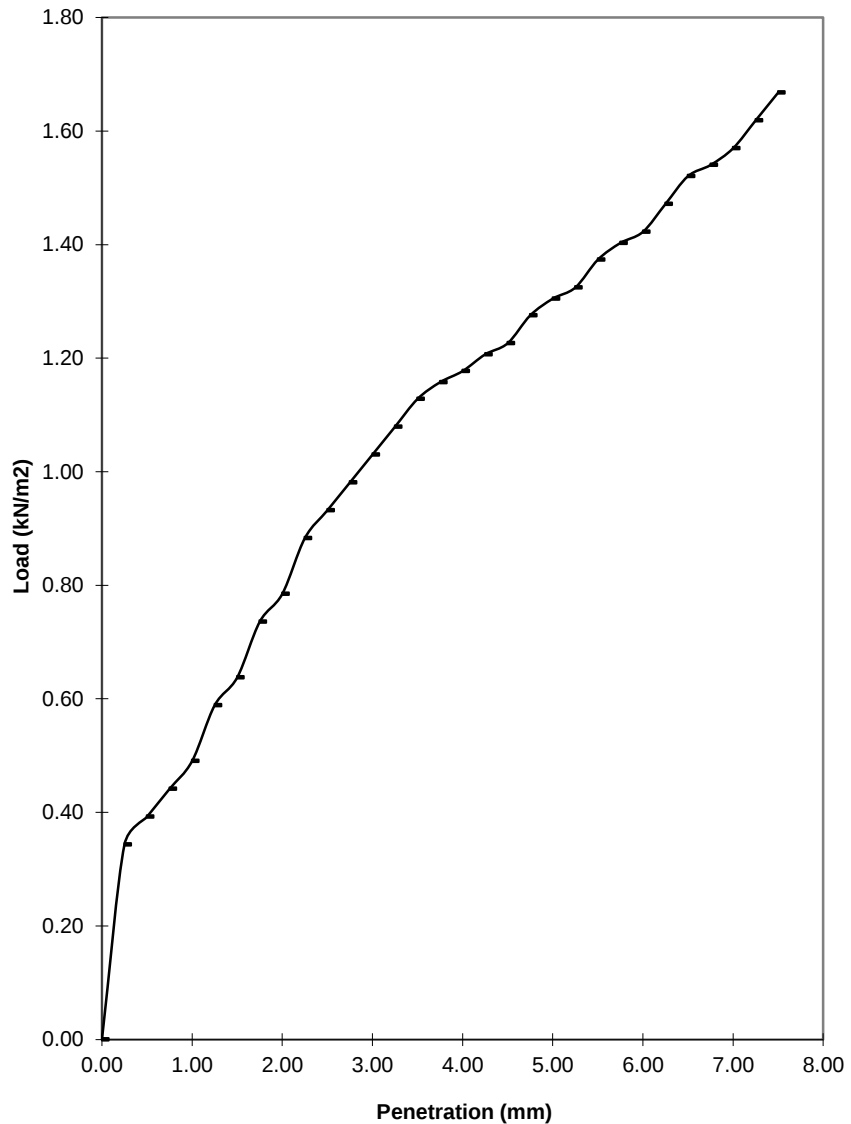


|                                                               |                                                           |                                                                                       |        |
|---------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------|--------|
| Test Depth: GL                                                | Soil Description: Brown clay with some demolition rubble. | CBR at 2.50mm                                                                         | 8.52 % |
| Mass of Split Rings: 5Kg                                      |                                                           | CBR at 5.00mm                                                                         | 7.37 % |
| PR Factor: 9.81 N/Div                                         |                                                           | CBR Value:                                                                            | 8.5 %  |
| Carried out in accordance with BS1377: Part 9: 1990, Test 4.3 |                                                           | Checked By:                                                                           | JP     |
| DATE: 21.10.15                                                | Remarks:                                                  |  |        |
| TEST REFERENCE: 5                                             |                                                           |                                                                                       |        |
| CONTRACT: Atlantic Waste, Cardiff.                            |                                                           |                                                                                       |        |

# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

| PENETRATION<br>(mm) | PR READING<br>(divs) | LOAD<br>(KN) |
|---------------------|----------------------|--------------|
| 0.00                | 0                    | 0.00         |
| 0.25                | 35                   | 0.34         |
| 0.50                | 40                   | 0.39         |
| 0.75                | 45                   | 0.44         |
| 1.00                | 50                   | 0.49         |
| 1.25                | 60                   | 0.59         |
| 1.50                | 65                   | 0.64         |
| 1.75                | 75                   | 0.74         |
| 2.00                | 80                   | 0.78         |
| 2.25                | 90                   | 0.88         |
| 2.50                | 95                   | 0.93         |
| 2.75                | 100                  | 0.98         |
| 3.00                | 105                  | 1.03         |
| 3.25                | 110                  | 1.08         |
| 3.50                | 115                  | 1.13         |
| 3.75                | 118                  | 1.16         |
| 4.00                | 120                  | 1.18         |
| 4.25                | 123                  | 1.21         |
| 4.50                | 125                  | 1.23         |
| 4.75                | 130                  | 1.28         |
| 5.00                | 133                  | 1.30         |
| 5.25                | 135                  | 1.32         |
| 5.50                | 140                  | 1.37         |
| 5.75                | 143                  | 1.40         |
| 6.00                | 145                  | 1.42         |
| 6.25                | 150                  | 1.47         |
| 6.50                | 155                  | 1.52         |
| 6.75                | 157                  | 1.54         |
| 7.00                | 160                  | 1.57         |
| 7.25                | 165                  | 1.62         |
| 7.50                | 170                  | 1.67         |



Test Depth: GL

Mass of Split Rings: 5Kg

PR Factor: 9.81 N/Div

Carried out in accordance  
with BS1377: Part 9: 1990, Test 4.3

DATE: 21.10.15

TEST REFERENCE: 6

CONTRACT: Atlantic Waste, Cardiff.

Soil Description: Brown clay with some  
demolition rubble.

Remarks:

CBR at 2.50mm 7.04 %

CBR at 5.00mm 6.54 %

**CBR Value: 7.0 %**

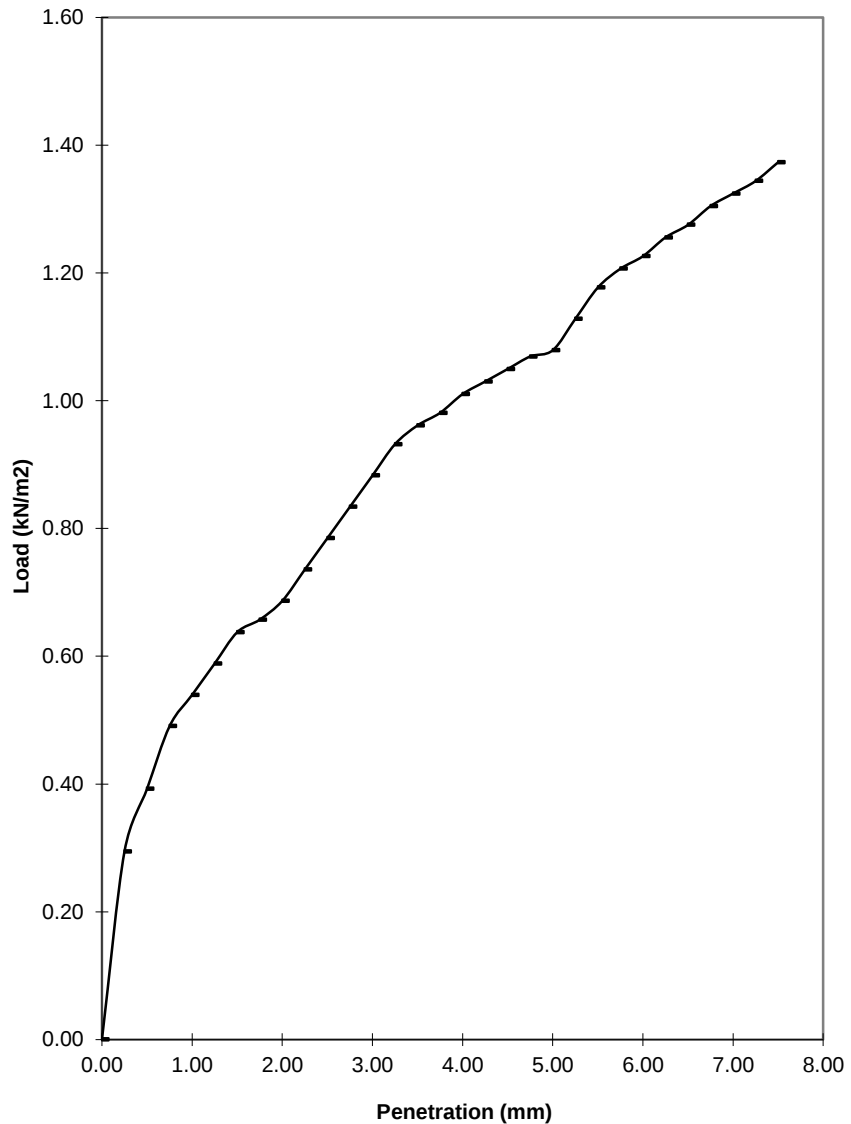
Checked By: JP



# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

| PENETRATION<br>(mm) | PR READING<br>(divs) | LOAD<br>(KN) |
|---------------------|----------------------|--------------|
| 0.00                | 0                    | 0.00         |
| 0.25                | 30                   | 0.29         |
| 0.50                | 40                   | 0.39         |
| 0.75                | 50                   | 0.49         |
| 1.00                | 55                   | 0.54         |
| 1.25                | 60                   | 0.59         |
| 1.50                | 65                   | 0.64         |
| 1.75                | 67                   | 0.66         |
| 2.00                | 70                   | 0.69         |
| 2.25                | 75                   | 0.74         |
| 2.50                | 80                   | 0.78         |
| 2.75                | 85                   | 0.83         |
| 3.00                | 90                   | 0.88         |
| 3.25                | 95                   | 0.93         |
| 3.50                | 98                   | 0.96         |
| 3.75                | 100                  | 0.98         |
| 4.00                | 103                  | 1.01         |
| 4.25                | 105                  | 1.03         |
| 4.50                | 107                  | 1.05         |
| 4.75                | 109                  | 1.07         |
| 5.00                | 110                  | 1.08         |
| 5.25                | 115                  | 1.13         |
| 5.50                | 120                  | 1.18         |
| 5.75                | 123                  | 1.21         |
| 6.00                | 125                  | 1.23         |
| 6.25                | 128                  | 1.26         |
| 6.50                | 130                  | 1.28         |
| 6.75                | 133                  | 1.30         |
| 7.00                | 135                  | 1.32         |
| 7.25                | 137                  | 1.34         |
| 7.50                | 140                  | 1.37         |



|                                                                  |
|------------------------------------------------------------------|
| Test Depth: GL                                                   |
| Mass of Split Rings: 5Kg                                         |
| PR Factor: 9.81 N/Div                                            |
| Carried out in accordance<br>with BS1377: Part 9: 1990, Test 4.3 |
| DATE: 21.10.15                                                   |
| TEST REFERENCE: 7                                                |

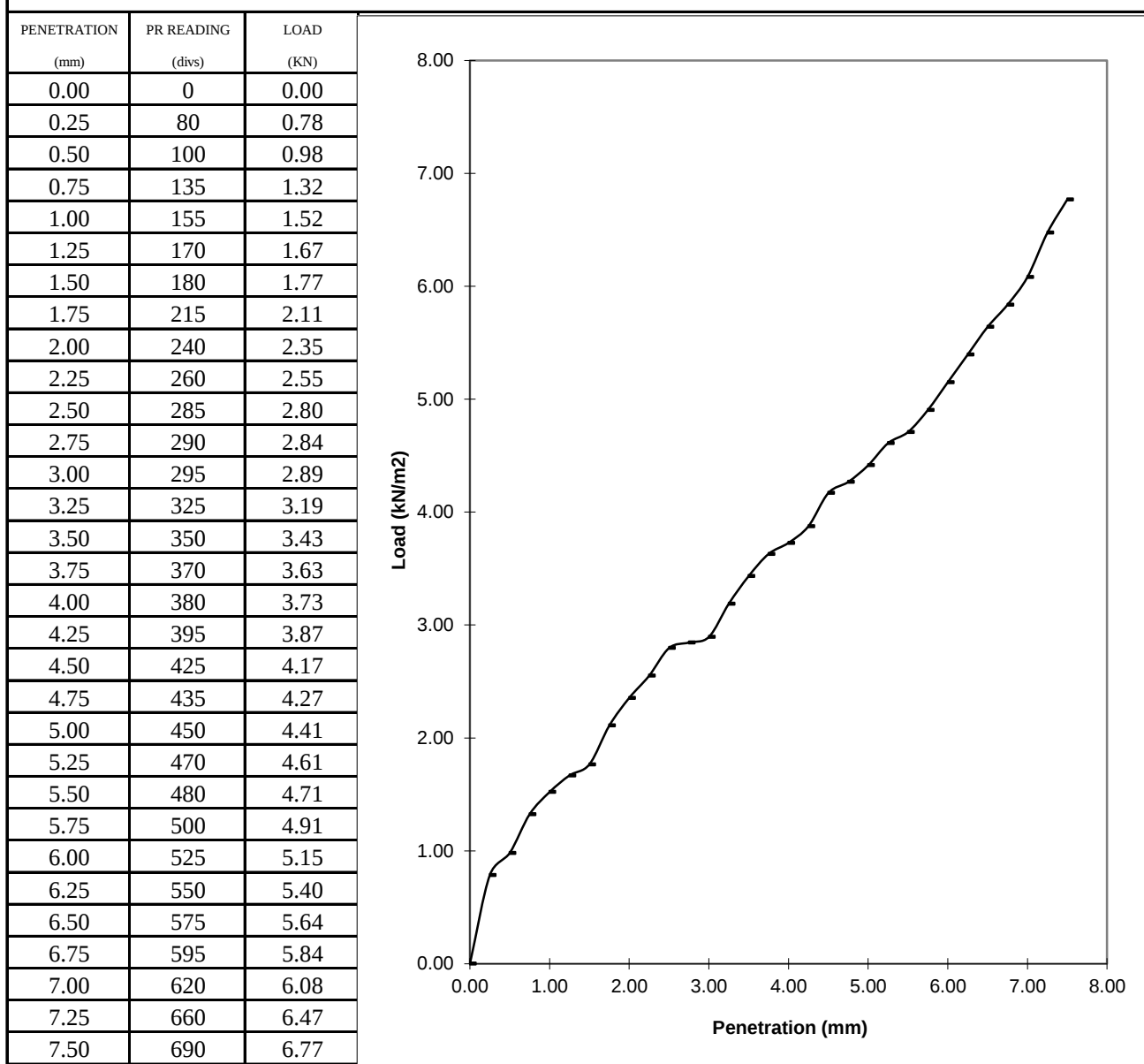
|                                                              |                   |              |
|--------------------------------------------------------------|-------------------|--------------|
| Soil Description: Brown clay with some<br>demolition rubble. | CBR at 2.50mm     | 5.93 %       |
|                                                              | CBR at 5.00mm     | 5.41 %       |
|                                                              | <b>CBR Value:</b> | <b>5.9 %</b> |
|                                                              | Checked By:       | JP           |
| Remarks:                                                     |                   |              |

CONTRACT: Atlantic Waste, Cardiff.



# SOUTHERN GROUND TESTING

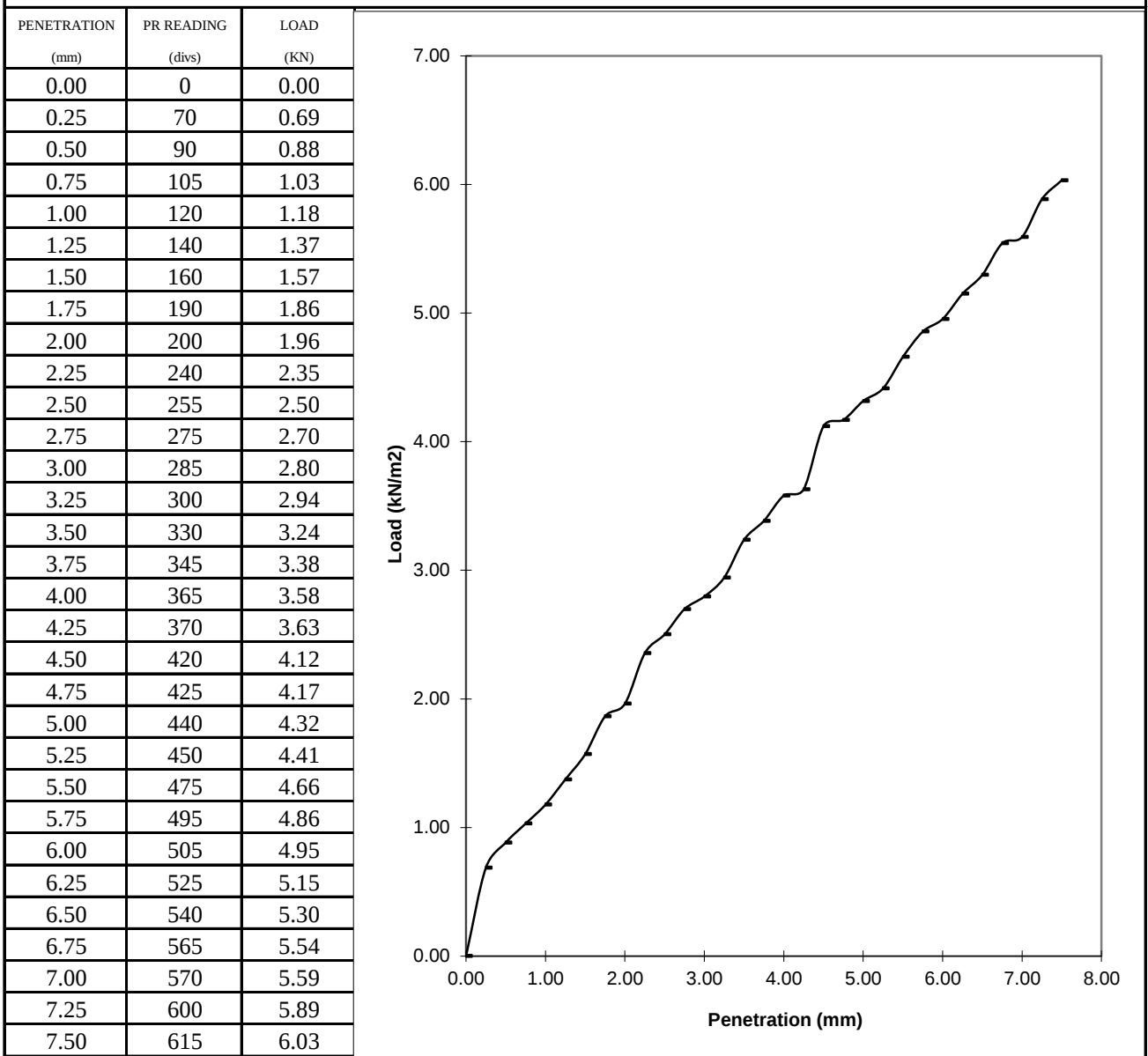
## IN SITU CBR TEST



|                                                               |                                                           |                                                                                       |               |
|---------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------|---------------|
| Test Depth: GL                                                | Soil Description: Brown clay with some demolition rubble. | CBR at 2.50mm                                                                         | 21.12 %       |
| Mass of Split Rings: 5Kg                                      |                                                           | CBR at 5.00mm                                                                         | 22.12 %       |
| PR Factor: 9.81 N/Div                                         |                                                           | <b>CBR Value:</b>                                                                     | <b>22.1 %</b> |
| Carried out in accordance with BS1377: Part 9: 1990, Test 4.3 |                                                           | Checked By:                                                                           | JP            |
| DATE: 21.10.15                                                | Remarks:                                                  |  |               |
| TEST REFERENCE: 8                                             |                                                           |                                                                                       |               |
| CONTRACT: Atlantic Waste, Cardiff.                            |                                                           |                                                                                       |               |

# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

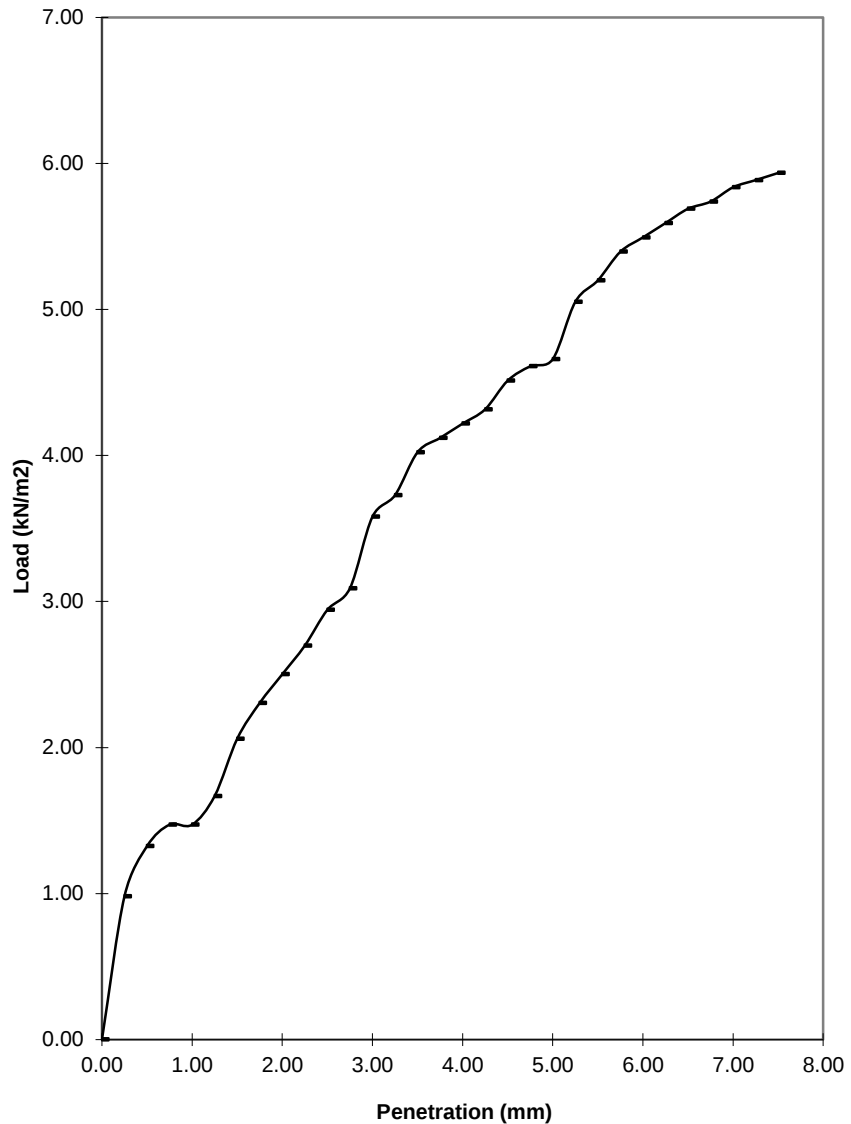


|                                                               |                                                           |                                                                                       |         |
|---------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------|---------|
| Test Depth: GL                                                | Soil Description: Brown clay with some demolition rubble. | CBR at 2.50mm                                                                         | 18.89 % |
| Mass of Split Rings: 5Kg                                      |                                                           | CBR at 5.00mm                                                                         | 21.63 % |
| PR Factor: 9.81 N/Div                                         |                                                           | CBR Value:                                                                            | 21.6 %  |
| Carried out in accordance with BS1377: Part 9: 1990, Test 4.3 |                                                           | Checked By:                                                                           | JP      |
| DATE: 21.10.15                                                | Remarks:                                                  |  |         |
| TEST REFERENCE: 9                                             |                                                           |                                                                                       |         |
| CONTRACT: Atlantic Waste, Cardiff.                            |                                                           |                                                                                       |         |

# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

| PENETRATION<br>(mm) | PR READING<br>(divs) | LOAD<br>(KN) |
|---------------------|----------------------|--------------|
| 0.00                | 0                    | 0.00         |
| 0.25                | 100                  | 0.98         |
| 0.50                | 135                  | 1.32         |
| 0.75                | 150                  | 1.47         |
| 1.00                | 150                  | 1.47         |
| 1.25                | 170                  | 1.67         |
| 1.50                | 210                  | 2.06         |
| 1.75                | 235                  | 2.31         |
| 2.00                | 255                  | 2.50         |
| 2.25                | 275                  | 2.70         |
| 2.50                | 300                  | 2.94         |
| 2.75                | 315                  | 3.09         |
| 3.00                | 365                  | 3.58         |
| 3.25                | 380                  | 3.73         |
| 3.50                | 410                  | 4.02         |
| 3.75                | 420                  | 4.12         |
| 4.00                | 430                  | 4.22         |
| 4.25                | 440                  | 4.32         |
| 4.50                | 460                  | 4.51         |
| 4.75                | 470                  | 4.61         |
| 5.00                | 475                  | 4.66         |
| 5.25                | 515                  | 5.05         |
| 5.50                | 530                  | 5.20         |
| 5.75                | 550                  | 5.40         |
| 6.00                | 560                  | 5.49         |
| 6.25                | 570                  | 5.59         |
| 6.50                | 580                  | 5.69         |
| 6.75                | 585                  | 5.74         |
| 7.00                | 595                  | 5.84         |
| 7.25                | 600                  | 5.89         |
| 7.50                | 605                  | 5.94         |



|                                                                  |
|------------------------------------------------------------------|
| Test Depth: GL                                                   |
| Mass of Split Rings: 5Kg                                         |
| PR Factor: 9.81 N/Div                                            |
| Carried out in accordance<br>with BS1377: Part 9: 1990, Test 4.3 |
| DATE: 21.10.15                                                   |
| TEST REFERENCE: 10                                               |

|                                                              |
|--------------------------------------------------------------|
| Soil Description: Brown clay with some<br>demolition rubble. |
| Remarks:                                                     |

|                   |               |
|-------------------|---------------|
| CBR at 2.50mm     | 22.23 %       |
| CBR at 5.00mm     | 23.35 %       |
| <b>CBR Value:</b> | <b>23.4 %</b> |
| Checked By:       | JP            |

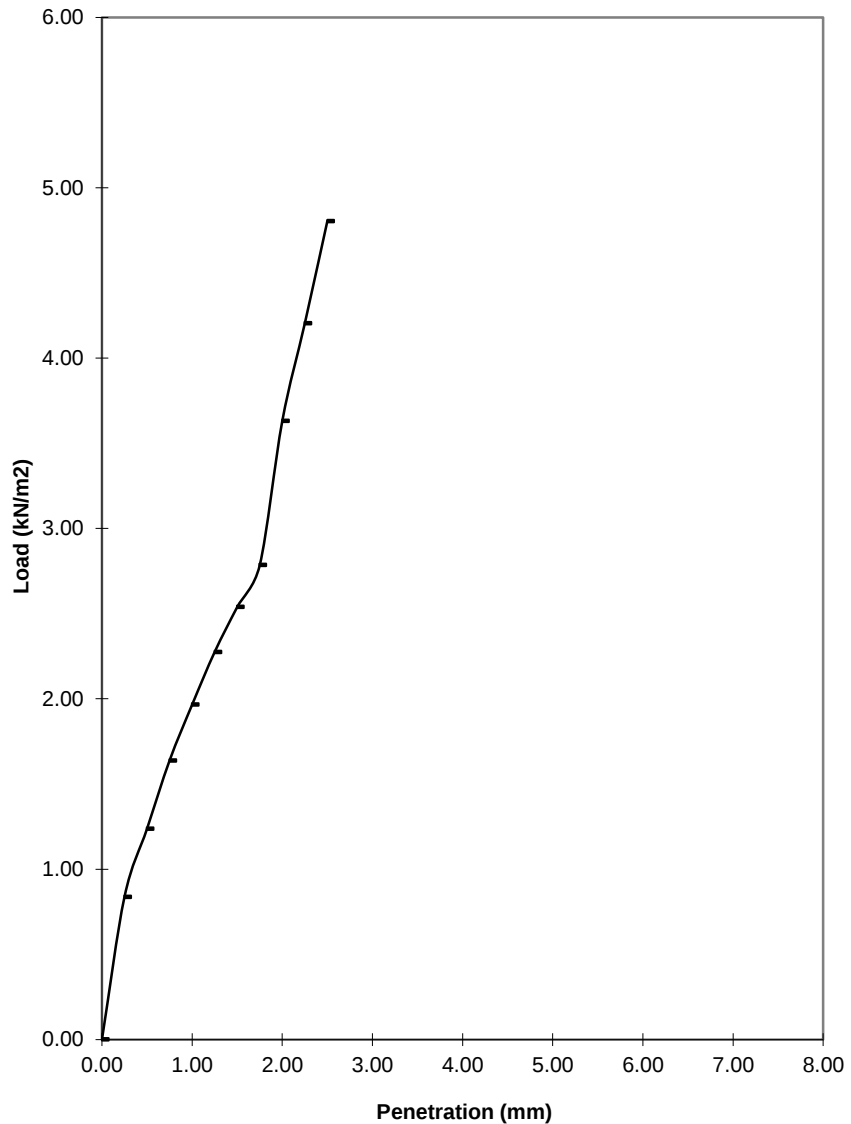
CONTRACT: Atlantic Waste, Cardiff.



# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

| PENETRATION<br>(mm) | PR READING<br>(divs) | LOAD<br>(KN) |
|---------------------|----------------------|--------------|
| 0.00                | 0                    | 0.00         |
| 0.25                | 92                   | 0.84         |
| 0.50                | 136                  | 1.24         |
| 0.75                | 180                  | 1.64         |
| 1.00                | 216                  | 1.97         |
| 1.25                | 250                  | 2.28         |
| 1.50                | 279                  | 2.54         |
| 1.75                | 306                  | 2.78         |
| 2.00                | 399                  | 3.63         |
| 2.25                | 462                  | 4.20         |
| 2.50                | 528                  | 4.80         |
| 2.75                |                      |              |
| 3.00                |                      |              |
| 3.25                |                      |              |
| 3.50                |                      |              |
| 3.75                |                      |              |
| 4.00                |                      |              |
| 4.25                |                      |              |
| 4.50                |                      |              |
| 4.75                |                      |              |
| 5.00                |                      |              |
| 5.25                |                      |              |
| 5.50                |                      |              |
| 5.75                |                      |              |
| 6.00                |                      |              |
| 6.25                |                      |              |
| 6.50                |                      |              |
| 6.75                |                      |              |
| 7.00                |                      |              |
| 7.25                |                      |              |
| 7.50                |                      |              |



Test Depth: Formation

Mass of Split Rings:

PR Factor: 9.1 N/Div

Carried out in accordance  
with BS1377: Part 9: 1990, Test 4.3

DATE: 28.10.15

TEST REFERENCE: CBR1

CONTRACT: Atlantic Watse

Soil Description: Demolition crush and fill

Remarks: Test stopped at 2.5mm due  
to excessive force on proving ring

CBR at 2.50mm 36.29 %

CBR at 5.00mm 0.00 %

**CBR Value: 36.3 %**

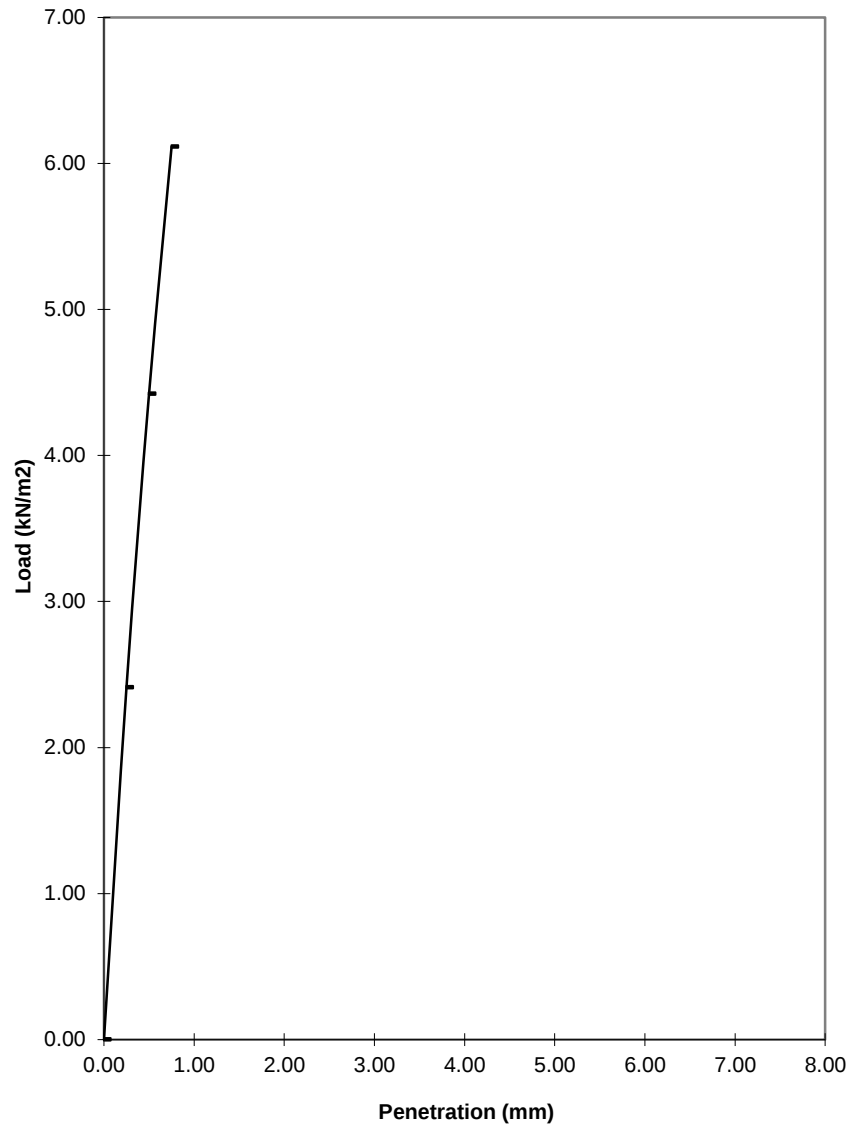
Checked By: J.P



# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

| PENETRATION<br>(mm) | PR READING<br>(divs) | LOAD<br>(KN) |
|---------------------|----------------------|--------------|
| 0.00                | 0                    | 0.00         |
| 0.25                | 265                  | 2.41         |
| 0.50                | 486                  | 4.42         |
| 0.75                | 672                  | 6.12         |
| 1.00                |                      |              |
| 1.25                |                      |              |
| 1.50                |                      |              |
| 1.75                |                      |              |
| 2.00                |                      |              |
| 2.25                |                      |              |
| 2.50                |                      |              |
| 2.75                |                      |              |
| 3.00                |                      |              |
| 3.25                |                      |              |
| 3.50                |                      |              |
| 3.75                |                      |              |
| 4.00                |                      |              |
| 4.25                |                      |              |
| 4.50                |                      |              |
| 4.75                |                      |              |
| 5.00                |                      |              |
| 5.25                |                      |              |
| 5.50                |                      |              |
| 5.75                |                      |              |
| 6.00                |                      |              |
| 6.25                |                      |              |
| 6.50                |                      |              |
| 6.75                |                      |              |
| 7.00                |                      |              |
| 7.25                |                      |              |
| 7.50                |                      |              |



Test Depth: Formation

Mass of Split Rings:

PR Factor: 9.1 N/Div

Carried out in accordance  
with BS1377: Part 9: 1990, Test 4.3

DATE: 28.10.15

TEST REFERENCE: CBR2

CONTRACT: Atlantic Watse

Soil Description: Demolition crush and fill

Remarks: Unable to obtain a CBR value  
due to the hardness of the ground. Could not  
achieve 2.5mm penetration with 3 attempts.

CBR at 2.50mm 0.00 %

CBR at 5.00mm 0.00 %

CBR Value: %

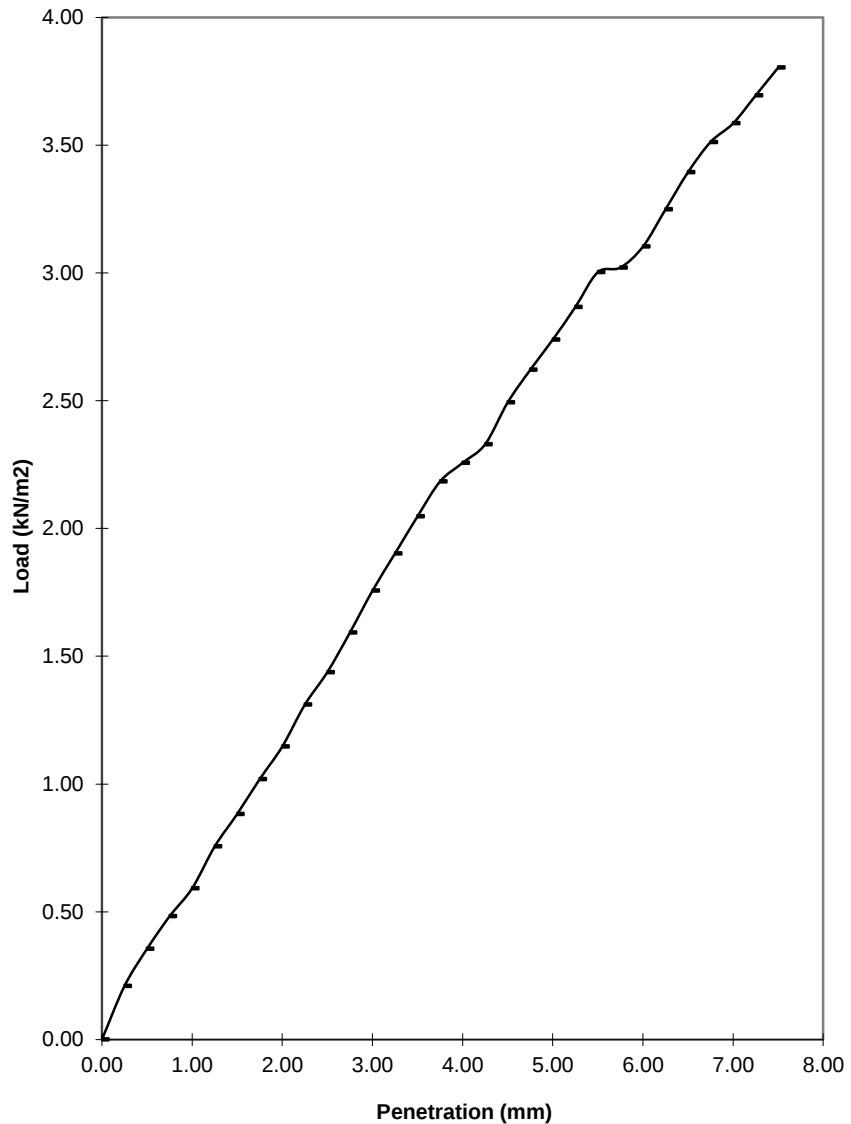
Checked By: J.P



# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

| PENETRATION<br>(mm) | PR READING<br>(divs) | LOAD<br>(KN) |
|---------------------|----------------------|--------------|
| 0.00                | 0                    | 0.00         |
| 0.25                | 23                   | 0.21         |
| 0.50                | 39                   | 0.35         |
| 0.75                | 53                   | 0.48         |
| 1.00                | 65                   | 0.59         |
| 1.25                | 83                   | 0.76         |
| 1.50                | 97                   | 0.88         |
| 1.75                | 112                  | 1.02         |
| 2.00                | 126                  | 1.15         |
| 2.25                | 144                  | 1.31         |
| 2.50                | 158                  | 1.44         |
| 2.75                | 175                  | 1.59         |
| 3.00                | 193                  | 1.76         |
| 3.25                | 209                  | 1.90         |
| 3.50                | 225                  | 2.05         |
| 3.75                | 240                  | 2.18         |
| 4.00                | 248                  | 2.26         |
| 4.25                | 256                  | 2.33         |
| 4.50                | 274                  | 2.49         |
| 4.75                | 288                  | 2.62         |
| 5.00                | 301                  | 2.74         |
| 5.25                | 315                  | 2.87         |
| 5.50                | 330                  | 3.00         |
| 5.75                | 332                  | 3.02         |
| 6.00                | 341                  | 3.10         |
| 6.25                | 357                  | 3.25         |
| 6.50                | 373                  | 3.39         |
| 6.75                | 386                  | 3.51         |
| 7.00                | 394                  | 3.59         |
| 7.25                | 406                  | 3.69         |
| 7.50                | 418                  | 3.80         |



Test Depth: Formation

Mass of Split Rings:

PR Factor: 9.1 N/Div

Carried out in accordance  
with BS1377: Part 9: 1990, Test 4.3

DATE: 28.10.15

TEST REFERENCE: CBR3

CONTRACT: Atlantic Watse

Soil Description: Demolition crush and fill

Remarks:

CBR at 2.50mm 10.86 %

CBR at 5.00mm 13.72 %

**CBR Value: 13.7 %**

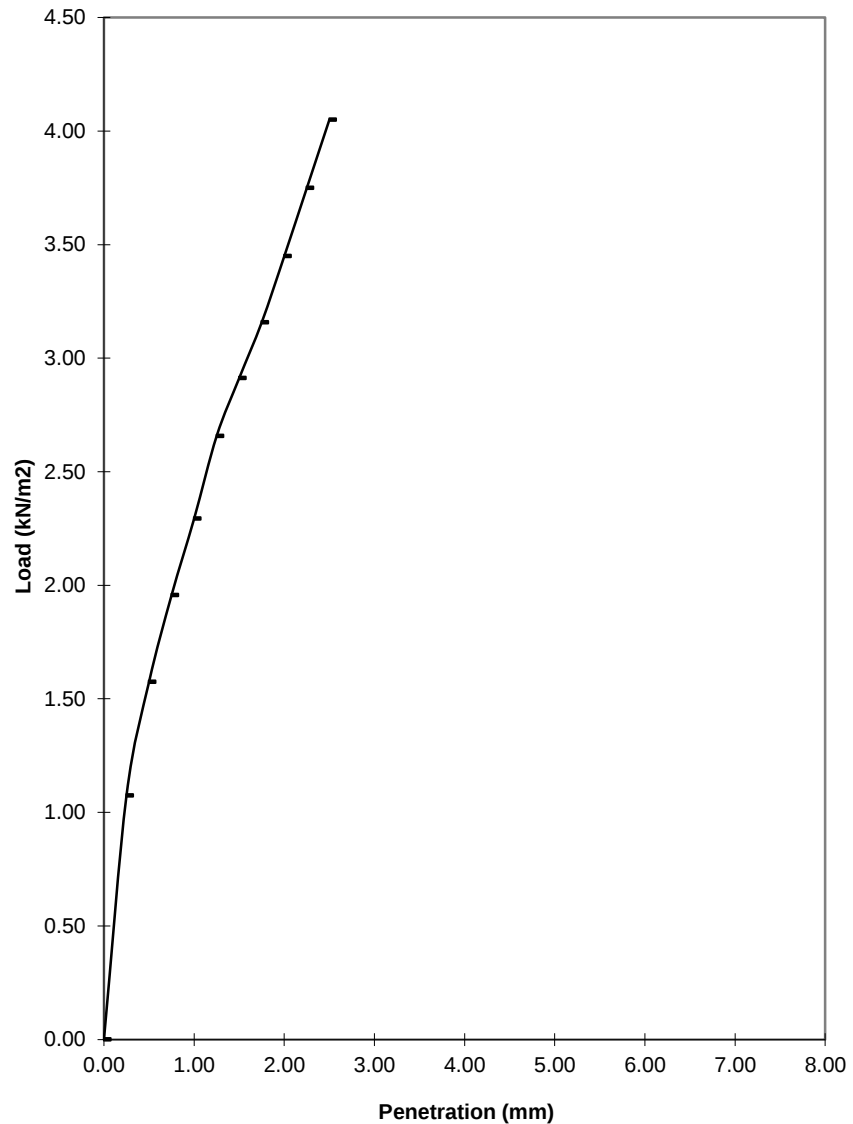
Checked By: J.P



# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

| PENETRATION<br>(mm) | PR READING<br>(divs) | LOAD<br>(KN) |
|---------------------|----------------------|--------------|
| 0.00                | 0                    | 0.00         |
| 0.25                | 118                  | 1.07         |
| 0.50                | 173                  | 1.57         |
| 0.75                | 215                  | 1.96         |
| 1.00                | 252                  | 2.29         |
| 1.25                | 292                  | 2.66         |
| 1.50                | 320                  | 2.91         |
| 1.75                | 347                  | 3.16         |
| 2.00                | 379                  | 3.45         |
| 2.25                | 412                  | 3.75         |
| 2.50                | 445                  | 4.05         |
| 2.75                |                      |              |
| 3.00                |                      |              |
| 3.25                |                      |              |
| 3.50                |                      |              |
| 3.75                |                      |              |
| 4.00                |                      |              |
| 4.25                |                      |              |
| 4.50                |                      |              |
| 4.75                |                      |              |
| 5.00                |                      |              |
| 5.25                |                      |              |
| 5.50                |                      |              |
| 5.75                |                      |              |
| 6.00                |                      |              |
| 6.25                |                      |              |
| 6.50                |                      |              |
| 6.75                |                      |              |
| 7.00                |                      |              |
| 7.25                |                      |              |
| 7.50                |                      |              |



Test Depth: Formation

Mass of Split Rings:

PR Factor: 9.1 N/Div

Carried out in accordance  
with BS1377: Part 9: 1990, Test 4.3

DATE: 28.10.15

TEST REFERENCE: CBR4

CONTRACT: Atlantic Watse

Soil Description: Demolition crush and fill

Remarks: Test stopped at 2.5mm due  
to excessive force on proving ring

CBR at 2.50mm 30.59 %

CBR at 5.00mm 0.00 %

**CBR Value: 30.6 %**

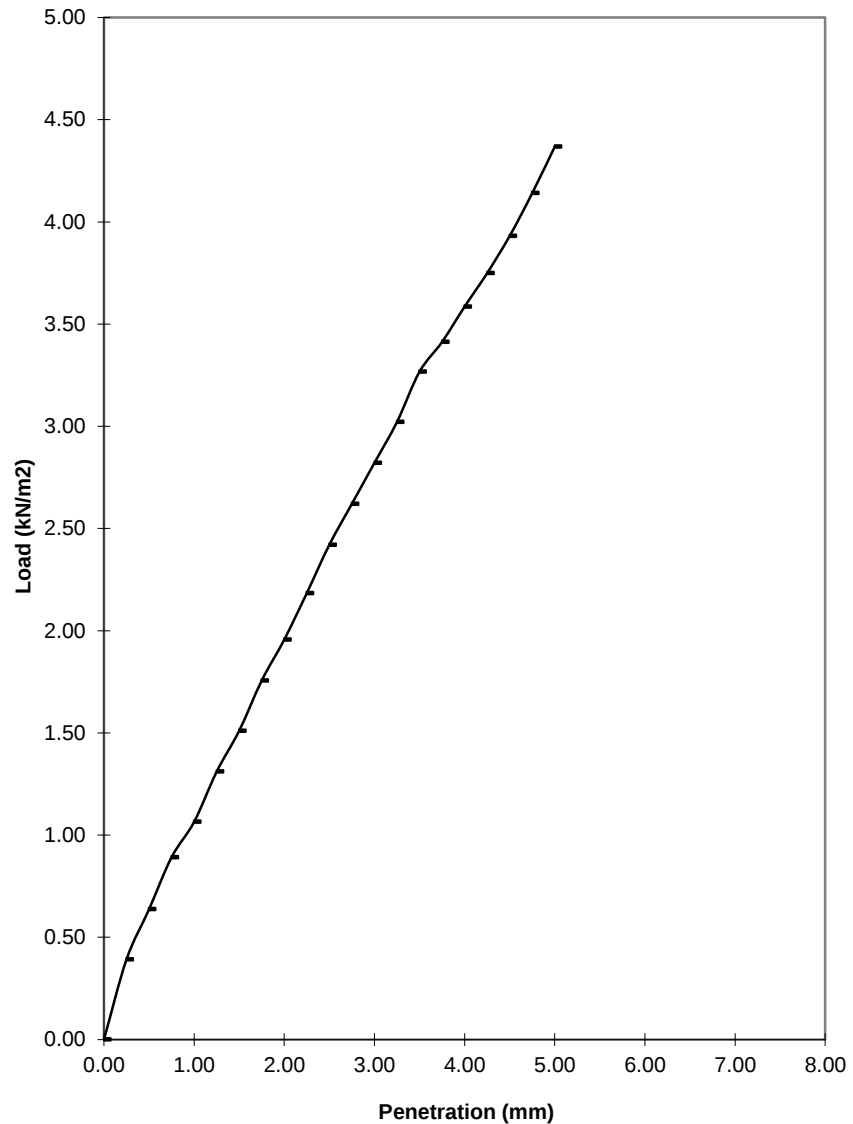
Checked By: J.P



# SOUTHERN GROUND TESTING

## IN SITU CBR TEST

| PENETRATION<br>(mm) | PR READING<br>(divs) | LOAD<br>(KN) |
|---------------------|----------------------|--------------|
| 0.00                | 0                    | 0.00         |
| 0.25                | 43                   | 0.39         |
| 0.50                | 70                   | 0.64         |
| 0.75                | 98                   | 0.89         |
| 1.00                | 117                  | 1.06         |
| 1.25                | 144                  | 1.31         |
| 1.50                | 166                  | 1.51         |
| 1.75                | 193                  | 1.76         |
| 2.00                | 215                  | 1.96         |
| 2.25                | 240                  | 2.18         |
| 2.50                | 266                  | 2.42         |
| 2.75                | 288                  | 2.62         |
| 3.00                | 310                  | 2.82         |
| 3.25                | 332                  | 3.02         |
| 3.50                | 359                  | 3.27         |
| 3.75                | 375                  | 3.41         |
| 4.00                | 394                  | 3.59         |
| 4.25                | 412                  | 3.75         |
| 4.50                | 432                  | 3.93         |
| 4.75                | 455                  | 4.14         |
| 5.00                | 480                  | 4.37         |
| 5.25                |                      |              |
| 5.50                |                      |              |
| 5.75                |                      |              |
| 6.00                |                      |              |
| 6.25                |                      |              |
| 6.50                |                      |              |
| 6.75                |                      |              |
| 7.00                |                      |              |
| 7.25                |                      |              |
| 7.50                |                      |              |



Test Depth: Formation

Mass of Split Rings:

PR Factor: 9.1 N/Div

Carried out in accordance  
with BS1377: Part 9: 1990, Test 4.3

DATE: 28.10.15

TEST REFERENCE: CBR5

CONTRACT: Atlantic Watse

Soil Description: Demolition crush and fill

Remarks: Test stopped at 5mm due to  
excessive force on the proving ring

CBR at 2.50mm 18.28 %

CBR at 5.00mm 21.88 %

**CBR Value: 21.9 %**

Checked By: J.P



**ATLANTIC WASTE  
ECOPARK PAVING  
PROJECT**

**PHASE 3 CQA  
VALIDATION REPORT**

**Appendix 2  
Particle Size Distribution  
Laboratory Test Certificates**  
*Report Number 1379r6v1d1215*

TEST CERTIFICATES TO FOLLOW

**ATLANTIC WASTE  
ECOPARK PAVING  
PROJECT**

**PHASE 3 CQA  
VALIDATION REPORT**

**Appendix 3  
Photographic Record**  
*Report Number 1379r6v1d1215*







**ATLANTIC WASTE  
ECOPARK PAVING  
PROJECT**

**PHASE 3 CQA  
VALIDATION REPORT**

**Appendix 4  
Slab Coring Laboratory  
Test Certificates**

*Report Number 1379r6v1d1215*

TEST CERTIFICATES TO FOLLOW