

Technical Note

Project: Swansea Bay University Campus

Subject: Imported Material Classification and Validation

Client:	St. Modwen Developments		
Project No:	05774	Version:	A
Document Ref:	05774-TN-PJA-005	Author:	L. Clark / B Irlam
Date:	17/09/2024	Approved:	M. Poland

I Introduction

I.1 Background

- 1.1.1 In May 2022 a Reserved Matters Application was submitted to the Neath Port Talbot County Borough Council to rise site levels in Phase 2 of the Swansea University Bay Campus off Fabian Way, SA18EN. The Reserved Matters Application was approved subject to conditions as detailed in the Reserved Matters Approval Notice: P2022/0450.
- 1.1.2 A Flood Consequence Assessment (FCA) (reference: 05774/FCA/0002 R0) was produced by PJA and submitted to NPTCBC as part of the Reserved Matters Application. The FCA concluded that the site required raising from current levels (between 6.7mAOD and 7.3mAOD) to proposed levels of 7.83m AOD to protect against flooding.
- 1.1.3 Earthworks Modelling carried out by PJA indicate that the proposed raising of levels requires approximately 23,000m³ of material.
- 1.1.4 A source of clean naturally occurring material, considered suitable for the upfill, was identified from a surplus of excavated material from a nearby residential development site at Hendrefoilan Park, Sketty. The excess material was generated at Hendrefoilan Park as a result of a cut/fill exercise. The material was generally described as a brown, clayey, sandy, gravel with frequent sub-angular to sub-rounded cobbles and boulders of sandstone.

1.1.5 PJA were instructed by St. Modwen Developments to provide geo-environmental support during the import of material from Hendrefoilan Park, Sketty, SA2 7RE to Swansea Bay University Campus, Swansea, SA1 8PX. Site plans are presented in Appendix A.

1.1.6 With regards to imported materials , Condition 4 of the Reserved Matters Approval P2022/0450 states:

“All the topsoil to be imported shall be assessed for chemical and other potential contaminants including invasive species plant seeds and fragments in advance of its importation. Only material approved by the Local Planning Authority pursuant to this permission shall be imported. Following importation, sampling of the material received at the development site to verify that the imported soil is free from contamination shall be undertaken in accordance with details to be submitted to and approved in writing by the Local Planning Authority within 3 months of the date of importation. Additional sampling and verification of the imported material shall be undertaken in accordance with a timetable to be submitted to and approved in writing by the Local Planning Authority as part of the first verification approval process. The development shall only proceed in accordance with the approved details.”

1.1.7 Movement of clean naturally occurring material from St. Modwen Hendrefoilan Park to Swansea Bay University Campus were covered by a direct transfer material management plan (MMP) submitted to CL:AIRE by the qualified person on the 23rd of May 2022. Import of material commenced on 22nd June 2023 and the final material import took place on 7th August 2024. Photographs of the stockpiled material are presented in Appendix B.

1.1.8 This Technical Note has been produced to present the verification testing of the imported material report, to discharge Planning Condition 4

I.2 Summary of Works

1.2.1 Geo-environmental services provided by PJA comprised environmental and geotechnical sampling and laboratory testing to validate the imported material, to confirm the material is free from contamination and suitable for use.

1.2.2 During the importation, regular inspections were carried out by PJA at the donor site, (Hendrefoilan Park) and at the receiver site (Swansea Bay University Campus) to safeguard against unauthorised materials being imported onto Swansea Bay University Campus. During

these inspections, soil sampling and testing was carried out by PJA to ensure the material was frequently tested through the importation and remained as suitable for use at the Swansea Bay site throughout the lifespan of the material movement.

2 Verification Criteria

- 2.1.1 The import verification testing is based on criteria agreed with NPTCBC as detailed in the PJA technical Note: TN 02742/TN/0002/V1: *Material Import Scheme for investigation* and is in general accordance with the WLGA, CLILC publication: *'Requirements for the Chemical Testing of Imported Materials for Various End Uses and Validation Cover Systems'* May 2013.
- 2.1.2 The testing requirements set out in the Material Import Scheme for Investigation were referred to in the MMP covering the direct transfer of materials from Hendrefoilan to Swansea Bay and state that:
- Chemical testing of imported bulk materials from green field sites will be tested at a frequency of 1 test per 1000m³ and Materials from a brownfield site will be subjected to a minimum testing frequency of 1 per 500m³.
 - As a minimum the sampling will be tested for the following:
 - pH, Arsenic, Cadmium, Chromium, Copper, Lead, Copper, Nickel, Zinc, Mercury (Inorganic), Selenium, TPH CWG, Speciated PAH, Asbestos.
- 2.1.3 Results of the chemical testing will be screened against site specific criteria derived by Atkins and set out in their report: 5077146-TRA-OUT-0020- July 2010.
- 2.1.4 With regards to Geotechnical characterisation of the material and to confirm its acceptability for use, material testing requirements are outlined in the PJA Swansea Bay Material Placement Scope of Works Document (05774_SOW_PJA_002_V4) July 2024. The scope of works document stipulates a geotechnical testing frequency of 1/500m³ to carry out the following testing:
- Particle Size Distribution (PSD)
 - Moisture Content
 - Compaction Testing (2.5kg)

- 2.1.5 The results of the geotechnical testing are used to characterise the material and determine the optimal method of compaction in line with the requirements of Series 600 of the Specification for Highway Works.

3 Material Volumes

- 3.1.1 On completion of the material movement, a survey of the imported stockpiles at Swansea Bay was carried out and recorded a total of approximately 24,500m³ of material has been imported to the Swansea Bay University Campus from the residential development at Hendrefoilan Park. Material movements.
- 3.1.2 Once placed in accordance with an engineered specification the material will take up less volume than it does currently in stockpile. Assuming a typical 30% reduction in volume once spread across the site, it is anticipated that a level of 7.64mAOD will be achieved. The material required to meet the 7.83mbgl planning levels will be imported from other sources and subject to the same regulatory process and verification as the material imported from the Hendrefoilan Development.

4 Geo -Environmental Analysis

- 4.1.1 During the period of import, 55 environmental samples were collected by PJA engineers from stockpiled material at Swansea Bay University Campus. All samples were packed in cool bags with ice packs and dispatched to ALS, a UKAS-accredited laboratory under full chain of custody and scheduled for the following analysis:
- Asbestos ID
 - Soil Organic Matter (SOM)
 - pH
 - Metals* (arsenic, cadmium, chromium, copper, hexavalent chromium, lead, mercury, nickel, selenium, vanadium, and zinc)
 - Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG)
 - Polycyclic Aromatic Hydrocarbons (PAHs)
 - Volatile Organic Compounds (VOCs)

*Samples collected on 4th and 31st July 2023 were not scheduled for hexavalent chromium and vanadium. Hexavalent chromium and vanadium were not agreed as part of the testing suite.

4.2 Environmental Sampling Frequency

- 4.2.1 Based on an approximate total import volume of 24,500m³, the 55 samples of material imported from Hendrefoilan Park scheduled for geo environmental analysis equates to an approximate testing frequency of 1 test per 445m³,

4.3 Discussion

- 4.3.1 Laboratory results from the 55 samples were screened against the site-specific values derived by Atkins for shallow soils at the University Campus as outlined in Atkins technical note 5077146-TRA-OUT-0020. No exceedances of these values were detected within any of the samples.
- 4.3.2 Asbestos, in the form of chrysotile as loose fibres, was detected in two samples. Asbestos quantification analysis was scheduled on both samples and the percentage of asbestos in both samples was recorded as <0.001%.
- 4.3.3 Based on the proposed end use of the site the imported materials are considered to pose a low risk to end users of the site.
- 4.3.4 Environmental laboratory data is presented in Appendix D.

5 Geotechnical Characterisation

- 5.1.1 Twenty-seven geotechnical samples were collected by PJA engineers and submitted to GSTL Ltd for analysis. All geotechnical samples were scheduled for the following analysis:
- Moisture content
 - 4-point liquid & plastic limit (where applicable)
 - Particle density
 - Particle size distribution
 - Dry density/moisture content

5.2 Geotechnical Sampling Frequency

- 5.2.1 Prior to import it was intended to collect geotechnical samples at a frequency of 1 test per 500m³ in accordance with PJA Swansea Bay Material Placement Scope of Works Document (05774_SOW_PJA_002_V4) July 2024. However, during the import the variability of the material was noted to be low and, given the uniformity of the material and the fact that it was all imported from the same source the testing frequency was revised to 1 test per 1,000m³.
- 5.2.2 In total 27 samples of material imported from Hendrefoilan Park were scheduled for geotechnical analysis, which equated to an approximate testing frequency of 1 test per 910m³, based on the approximate total import volume of 24,500m³.

5.3 Discussion

- 5.3.1 The material has been classified, based on the grading parameters presented in Table 6/2 in Volume 1 Specification for Highway Works Series 600 Earthworks.
- 5.3.2 Of the 27 samples taken, 85% have been classified as Class 1A or Class 1B material, a well/uniformly graded granular material. 11% were classed as a 2C, a stoney cohesive material and 4% were classed as a 1C, coarse granular material. The difference in the classification is due to the fines content (<0.063mm) which ranges from 0-25% with an average of 9.4%. All samples were described by the laboratory as 'Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)'.
- 5.3.3 The average maximum dry density across all samples was 1.94 with an upper value of 1.99 and a lower value of 1.87. There is no correlation between the different classifications and the maximum dry density value.
- 5.3.4 The average optimum moisture content was 11.4%, with a range between 14 and 10%. The average natural moisture content across all samples was found to be 18% with a range of between 23 and 11%.
- 5.3.5 Based on this data, it's noted that most samples analysed were found to have moisture content values that exceeded the optimum moisture content values. To achieve an optimum level of compaction the material should only be handled in dry weather and should be spread thinly during placement to aid compaction.
- 5.3.6 Placement and compaction of the material should be carried out in accordance with Table 6/4 in Volume 1 Specification for Highway Works Series 600 Earthworks. Validation testing should be carried out during placement to ensure good levels of compaction are achieved.

5.3.7 Geotechnical laboratory data is summarised below and presented in Appendix E.

Table 1: Geotechnical Properties Summary Table

Classification	No. of samples	Description	Maximum Dry Density		Optimum Moisture Content		Natural Moisture Content	
			Range	Avg	Range	Avg	Range	Avg
1A/1B	23 (85%)	Brown silty clayey fine to coarse sandy fine to coarse GRAVEL	1.87-1.99	1.94	10-14	11.5	11-21	15
1C	1 (4%)	Brown silty clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	1.99	1.99	11	11	20	20
2/2C	3 (11%)	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (with cobbles)	1.89-1.94	1.92	10-12	11	13-23	18.75
Overall	27	N/A	1.87-1.99	1.94	10-14	11.4	11-23	18.3

6 Ecological Considerations

6.1.1 An ecological survey of the stockpiled material and the wider site was undertaken by Celtic Wildflowers on behalf of SK Environmental in June 2024. This was carried out to confirm no invasive species had been inadvertently transferred with the material. No non-native invasive plants e.g., Japanese Knotweed or Himalayan Balsam were identified during the survey. A copy of the ecological survey report is presented in Appendix C.

7 Summary

7.1.1 Approximately 24,500m³ of clean naturally occurring material was imported to Swansea Bay University Campus from St. Modwen Hendrefoilan Park to be used to raise levels across the site to protect against flooding.

- 7.1.2 Environmental analysis did not highlight any chemical exceedances. However, asbestos was detected in two samples, but quantification analysis confirmed the samples contained <0.001% asbestos.
- 7.1.3 In accordance with Table 6/2 in Volume 1 Specification for Highway Works Series 600 Earthworks the material is generally classified as type 1A/1B '*well/uniformly graded granular material*'. With regards to compaction requirements the earthworks contractor should consult Table 6/4 of Volume 1 Specification for Highway Works Series 600 Earthworks.
- 7.1.4 Geotechnical data indicates the material is too wet in its current state to achieve optimum compaction. The material may need to dry further before compaction and compaction should take place during periods of dry weather.

Appendix A Drawings



These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

P1	19:04:22	Scale	BAI
REV	DATE	REVISION NOTE	BY



St Modwen

Swansea University
Material Import Levels

Site Location Plan

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
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05746 - SK - 9006 - P1

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction
BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@1:1250	BAI	CRS	13.04.2022



These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

Key

Site Boundary

REV	DATE	REVISION NOTE	BY
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CLIENT

St Modwen Developments

PROJECT

Swansea University
Material Import
Levels

DRAWING TITLE

Hendrefoilan Park
Site Location Plan

DRAWING ISSUE STATUS

INFORMATION

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
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5746 - SK - 002 -

5740 SR 002

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

viii En

SCALE	DRAWN	REVIEWED	DATE
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SCALE	DRAWN	REVIEWED	DATE
A3 @ 1:5000	IB	LC	31.01.23

A3@1.5000	JF	LC	31.01.22
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Appendix B Photographic Log



Photograph 1 – Stockpile A



Photograph 2 – Stockpile B



Photograph 3 – Stockpile C



Photograph 4 – Stockpile D



Photograph 5 – Stockpile E



Photograph 6 – Stockpile F



Photograph 7 – Stockpile G



Photograph 8 – Stockpile H

Appendix C Ecological Survey Report

CLIENT: ST MODWEN

SITE: SWANSEA BAY CAMPUS

DATE: JUNE 2024

DOCUMENT REF: SITE SURVEY REPORT – STOCKPILE ASSESSMENT

- 1.1 SK Environmental Solutions Limited was commissioned by St Modwen to undertake an assessment of several areas of historic stockpiled materials at the Swansea Bay Campus site to identify any ecological constraints that may be present prior to intrusive GI investigations into the materials.
- 1.2 The GI works are necessary to establish whether the stockpiled material is suitable for use in raising site levels in line with recent works associated with soils transfers from the nearby Hendrefoilan site.
- 1.3 The ecological walkover primarily focused upon the presence of breeding birds, invasive / non-native plant species and the presence of any notable ecological features that would need to be considered prior to the GI works occurring.

Breeding Birds

- 1.4 No schedule 1 species were identified during the walkover. Table 1 below, shows all species observed, which includes four species listed in the Welsh Governments Section 7 list of living organisms of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales, namely kestrel *Falco tinnunculus*, linnet *Linaria cannabina*, house sparrow *Passer domesticus* and song thrush *Turdus philomelos*.

TABLE 1. List of bird observations in and around stockpiles on 20th June 2024		
Species	Count	Highest breeding evidence
Blackbird (<i>Turdus merula</i>)	3	Recently fledged (FL)
Carrion Crow <i>Corvus corone</i>	3	Not breeding in study area
Feral Pigeon <i>Columba livia f. domestica</i>	2	Not breeding in study area
Goldcrest <i>Regulus regulus</i>	1	Singing male (S)

TABLE 1. List of bird observations in and around stockpiles on 20th June 2024		
Species	Count	Highest breeding evidence
Goldfinch <i>Carduelis carduelis</i>	7	Recently fledged (FL)
House Sparrow <i>Passer domesticus</i>	2	Not breeding in study area
Kestrel <i>Falco tinnunculus</i>	1	Not breeding in study area
Linnet <i>Linaria cannabina</i>	5	Recently fledged (FL)
Meadow Pipit <i>Anthus pratensis</i>	5	Recently fledged (FL)
Rock Pipit <i>Anthus petrosus</i>	1	Nesting habitat (H)
Song Thrush <i>Turdus philomelos</i>	1	Singing male (S)
Stonechat <i>Saxicola rubicola</i>	2	Not breeding in study area
Swallow <i>Hirundo rustica</i>	2	Pair in suitable habitat (P)
Whitethroat <i>Curruca communis</i>	2	Singing male (S)
Woodpigeon <i>Columba palumbus</i>	5	Not breeding in study area

- 1.5 Six of the species listed above nest in scrub, and the area identified on figure 1 must not be disturbed until end of August 2024 with first having been subjected to a detailed search for nests. All other areas in and around the stockpiles can be accessed for site investigation works.

Invasive / Non-Native Plants

- 1.6 No non-native invasive plants were recorded during targeted searches for species listed on Schedule 9 of the Wildlife and Countryside Act, 1981, such as Japanese knotweed *Fallopia japonica*, Himalayan balsam *Impatiens glandulifera*, Japanese rose *Rosa rugosa*, etc.
- 1.7 Two species, although not included on Schedule 9, are highlighted as they have the potential to have adverse impact on local ecology:
- Silver-flowered sedge *Carex buechananii* is a recently established non-native that has the potential to colonise nationally important nearby fenland sites at Crymlyn Bog and Pant-y-sais Fen if not controlled at an early stage.

- Sea-buckthorn *Hippophae rhamnoides*, although native in Britain, is non-native in the west and NRW have spent six-figure sums controlling its spread in South Wales in recent years. Established plants were recorded in the historic stockpiles enclosure as identified on photo 1.
- 1.8 The historic stockpiles were found to support a high level of botanical diversity (140 species), which included a high proportion of sand dune species. Some areas contain a root mass and seed bank that would be useful for inoculating any new areas created for biodiversity enrichment. Any donor material will need careful, ecologically guided use of these materials to ensure undesirable species are not moved around site.
- 1.9 Species of special note that were recorded included sharp rush *Juncus acutus*, small-flowered sedge *Carex oederi* and hawkweed oxtongue *Picris hieracioides*. The latter species is the host for the Red Data Book oxtongue broomrape *Orobanche picridis*, which occurs within the immediate vicinity.
- 1.10 Photo 5 shows the approximate location of the oxtongue broomrape. This area should be avoided with regards to the laying down of any materials and / or other disturbance.

Recommendations

- Do not carry out any works in the areas of scrub shown on Photo 1 until the bird nesting season has finished. If works are essential in this area before this date a detailed inspection for nests can be undertaken a week or two in advance of the works. If a nest is found, works will need to be deferred until after fledging;
- Implement a control programme to prevent the dispersal and/or movement of sea-buckthorn; and
- Use selected areas of vegetation to inoculate any receptor sites identified for ecological enhancement or mitigation.



Photo 1 - Historic stockpiles, showing areas of scrub and sea-buckthorn to be avoided until the end of August 2024



Photo 2. 2023 stockpile (top), with 2024 northern stockpile (middle) in car park.



Photo 3. 2024 western stockpiles.



Photo 4. 2024 eastern stockpiles.



Photo 5 Approximate location of nationally scare oxtongue broomrape to avoided.

APPENDIX 1

Appendix 1: List of species recorded on stock piles on 20th June 2024

Legend for first column

- * Bryophytes (mosses and liverworts)
- IN Invasive Native
- NS Nationally Scarce
- NSi Nationally Scarce, but has markedly increased in modern times

Abundance codes (dafor)

- d dominant
- a abundant
- f frequent
- o occasional
- r rare
- l locally (used as a prefix to d, a or f)
- p present (abundance not noted)

Taxon	Vernacular	Historical Stock Piles	2023 Stock Pile	2024 Stock Piles
<i>Acer pseudoplatanus</i>	Sycamore	r		
<i>Agrostis stolonifera</i>	Creeping Bent	lf	o	o
<i>Ammophila arenaria</i>	Marram	lf		
<i>Anagallis arvensis</i>	Scarlet Pimpernel	r	r	r
<i>Anthyllis vulneraria</i>	Kidney Vetch	lf		
<i>Arrhenatherum elatius</i>	False Oat-Grass	lf		
<i>Atriplex prostrata</i>	Spear-leaved Orache			r
<i>Bellis perennis</i>	Daisy	o	r	
<i>Blackstonia perfoliata</i>	Yellow-wort	o		
<i>Bolboschoenus maritimus</i>	Sea Club-rush	o		
<i>Buddleja davidii</i>	Butterfly-bush	lf		
* <i>Calliergonella cuspidata</i>	Pointed Sparmoss	lf		
<i>Cardamine hirsuta</i>	Hairy Bitter-cress			r
<i>Carex arenaria</i>	Sand Sedge	r		
<i>Carex buechananii</i>	Silver-spiked Sedge	o	o	
<i>Carex flacca</i>	Glaucous Sedge	r		
<i>Carex hirta</i>	Hairy Sedge	o		
<i>Carex leporina</i>	Oval Sedge	r		
<i>Carex oederi</i>	Small-fruited Yellow-sedge	r		
<i>Carex otrubae</i>	False Fox-sedge	o		

			Historical Stock Piles	2023 Stock Pile	2024 Stock Piles
Taxon	Vernacular				
<i>Carex pendula</i>	Pendulous Sedge		o		
<i>Carex remota</i>	Remote Sedge		r		
<i>Catapodium marinum</i>	Sea Fern-grass		r	r	
<i>Catapodium rigidum</i>	Fern-grass		r	r	
<i>Centaurea debeauxii</i>	Chalk Knapweed		r	r	r
<i>Cerastium diffusum</i>	Sea Mouse-ear			r	
<i>Cerastium glomeratum</i>	Sticky Mouse-ear				r
<i>Chenopodium album</i>	Fat-hen				r
<i>Cirsium arvense</i>	Creeping Thistle		o	r	r
<i>Cirsium palustre</i>	Marsh Thistle		o		
<i>Cirsium vulgare</i>	Spear Thistle			r	r
<i>Coincya monensis ssp. cheiranthos</i>	Wallflower Cabbage				r
<i>Conyza floribunda</i>	Bilbao's Fleabane		o	o	r
<i>Cortaderia selloana</i>	Pampas-grass		o		
* <i>Cratoneuron filicinum</i>	Fern-leaved Hookmoss		o		
<i>Cynosurus cristatus</i>	Crested Dog's-tail		o		
<i>Dactylis glomerata</i>	Cock's-foot			r	
<i>Dactylorhiza praetermissa</i>	Southern Marsh-orchid		r		
<i>Deschampsia cespitosa</i>	Tufted Hair-grass		r		
* <i>Dicranella varia</i>	Variable Forklet-moss		o		
<i>Dipsacus fullonum</i>	Wild Teasel		o		
* <i>Drepanocladus aduncus</i>	Kneiff's Hookmoss		o		
<i>Echium vulgare</i>	Viper's-bugloss		o		
<i>Epilobium ciliatum</i>	American Willowherb		o	o	r
<i>Epilobium hirsutum</i>	Great Willowherb				r
<i>Epilobium parviflorum</i>	Hoary Willowherb		o	r	
<i>Escallonia sp.</i>	Escallonia		r		
<i>Galium album</i>	Hedge Bedstraw		r		
<i>Galium palustre</i>	Marsh-bedstraw		r		
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill		r		
<i>Geranium robertianum</i>	Herb-Robert		r		
<i>Glaux maritima</i>	Sea-milkwort		o		
<i>Helminthotheca echioides</i>	Bristly Oxtongue		o	o	r
IN <i>Hippophae rhamnoides</i>	Sea-buckthorn		lf		
<i>Hirschfeldia incana</i>	Hoary Mustard		lf	o	r
<i>Holcus lanatus</i>	Yorkshire-fog				r
<i>Hypochaeris radicata</i>	Cat's-ear		o		

	Taxon	Vernacular	Historical Stock Piles	2023 Stock Pile	2024 Stock Piles
	<i>Isolepis setacea</i>	Bristle Club-rush	r		
NS	<i>Juncus acutus</i>	Sharp Rush	r		
	<i>Juncus articulatus</i>	Jointed Rush	lf		
	<i>Juncus bufonius</i>	Toad Rush	r	o	r
	<i>Juncus inflexus</i>	Hard Rush	lf		
	<i>Lathyrus pratensis</i>	Meadow Vetchling	r		
	<i>Leontodon hispidus</i>	Rough Hawkbit	r	r	
	<i>Leontodon saxatilis</i>	Lesser Hawkbit			r
	<i>Lepidium didymum</i>	Lesser Swine-cress			r
	<i>Leucanthemum vulgare</i>	Oxeye Daisy	la		
	<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil	o	r	
	<i>Lotus corniculatus</i> var. <i>sativus</i>	Common Bird's-foot-trefoil	o	r	
	<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil	o		
	<i>Lysimachia nemorum</i>	Yellow Pimpernel		r	
	<i>Lythrum salicaria</i>	Purple-loosestrife	r		r
*	<i>Marchantia polymorpha</i> ssp. <i>ruderalis</i>	Common Liverwort	r		
	<i>Matricaria discoidea</i>	Pineappleweed		r	
	<i>Medicago lupulina</i>	Black Medick	o	o	
	<i>Mentha aquatica</i>	Water Mint	o		
	<i>Myosotis arvensis</i>	Field Forget-me-not	o		
	<i>Myosotis laxa</i>	Tufted Forget-me-not	o		
	<i>Ononis repens</i>	Common Restharrow	o		
	<i>Ophrys apifera</i>	Bee Orchid	r		
	<i>Orobanche minor</i>	Common Broomrape	r		
	<i>Parapholis strigosa</i>	Hard-grass		r	
	<i>Pastinaca sativa</i> subsp. <i>sylvestris</i>	Wild Parsnip	r		
	<i>Persicaria lapathifolia</i>	Pale Persicaria			r
	<i>Persicaria maculosa</i>	Redshank			o
	<i>Phragmites australis</i>	Common Reed	r		
	<i>Picris hieracioides</i>	Hawkweed Oxtongue	o	r	
	<i>Plantago coronopus</i>	Buck's-horn Plantain			o
	<i>Plantago lanceolata</i>	Ribwort Plantain	o	o	r
	<i>Plantago major</i>	Greater Plantain	r	o	r
	<i>Poa annua</i>	Annual Meadow-grass	o	r	r
	<i>Poa trivialis</i>	Rough Meadow-grass	r	r	
	<i>Polygonum aviculare</i>	Knotgrass			o
NSi	<i>Polypogon monspeliensis</i>	Annual Beard-grass	o	r	r

		Historical Stock Piles	2023 Stock Pile	2024 Stock Piles
Taxon	Vernacular			
<i>Polypogon viridis</i>	Water Bent	r	r	r
<i>Potentilla anserina</i>	Silverweed	r	r	
<i>Potentilla reptans</i>	Creeping Cinquefoil	r		
<i>Prunella vulgaris</i>	Selfheal	o	o	r
<i>Pulicaria dysenterica</i>	Common Fleabane	lf		
<i>Ranunculus acris</i>	Meadow Buttercup	r		
<i>Ranunculus flammula</i>	Lesser Spearwort	r		
<i>Ranunculus repens</i>	Creeping Buttercup	o		r
<i>Reseda luteola</i>	Weld		r	
NSi <i>Rorippa islandica</i>	Northern Yellow-cress			r
<i>Rubus caesius</i>	Dewberry	o		
<i>Rubus fruticosus</i> agg.	Bramble	o		
<i>Rumex conglomeratus</i>	Clustered Dock	o	r	
<i>Rumex crispus</i>	Curled Dock			r
<i>Rumex obtusifolius</i>	Broad-leaved Dock			r
<i>Sagina filicaulis</i>	Upright Pearlwort		o	
<i>Sagina procumbens</i>	Procumbent Pearlwort			r
<i>Salix caprea</i>	Goat Willow	r		
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Rusty Willow	lf		
<i>Scorzonoides autumnalis</i>	Autumn Hawkbit		r	
<i>Scrophularia auriculata</i>	Water Figwort	o		
<i>Scrophularia nodosa</i>	Common Figwort	r	r	
<i>Senecio erucifolius</i>	Hoary Ragwort	r		
<i>Senecio jacobaea</i>	Common Ragwort	o		
<i>Sherardia arvensis</i>	Field Madder			r
<i>Silene flos-cuculi</i>	Ragged-Robin	lf		
<i>Sonchus asper</i>	Prickly Sow-thistle	r	r	r
<i>Sonchus oleraceus</i>	Smooth Sow-thistle	o	lf	
<i>Stachys sylvatica</i>	Hedge Woundwort	o		
* <i>Streblotrichum convolutum</i> var. <i>conv.</i>	Lesser Bird's-claw Beardmoss	lf		
<i>Taraxacum</i> agg.	Dandelion	r	r	
<i>Trifolium arvense</i>	Hare's-foot Clover	r	r	
<i>Trifolium campestre</i>	Hop Trefoil	o	o	
<i>Trifolium dubium</i>	Lesser Trefoil	o	o	r
<i>Trifolium hybridum</i>	Alsike Clover		r	
<i>Trifolium medium</i>	Zigzag Clover	r		
<i>Trifolium pratense</i>	Red Clover	o		

Taxon	Vernacular	Historical Stock Piles	2023 Stock Pile	2024 Stock Piles
<i>Trifolium repens</i>	White Clover	o	o	r
<i>Tripleurospermum maritimum</i>	Sea Mayweed			o
<i>Tussilago farfara</i>	Colt's-foot	lf		r
<i>Typha latifolia</i>	Bulrush	r		
<i>Ulex europaeus</i>	Gorse	o		
<i>Urtica dioica</i>	Common Nettle	r		
<i>Veronica serpyllifolia</i>	Thyme-leaved Speedwell	r	r	
<i>Vicia sativa subsp. segetalis</i>	Common Vetch	r	r	
<i>Vulpia myuros</i>	Rat's-tail Fescue	r	r	
Invertebrates (miscellaneous records)				
<i>Aphantopus hyperantus</i>	Ringlet	1		
<i>Aspitates ochrearia</i>	Yellow Belle	1		
<i>Bombus terrestris</i>	Buff-tailed Bumblebee	4	1	
<i>Coccinella septempunctata</i>	7-spot Ladybird		p	
<i>Coenagrion puella</i>	Azure Damselfly	3		
<i>Crambus lathoniellus</i>	a moth	1		
<i>Cucullia verbasci</i>	Mullein	1		
<i>Maniola jurtina</i>	Meadow Brown	1		
<i>Orthetrum cancellatum</i>	Black-tailed Skimmer		1	
<i>Polyommatus icarus</i>	Common Blue	2	1	
<i>Sympetrum striolatum</i>	Common Darter	20	2	

Appendix D Environmental Laboratory Data

Swansea Bay University
Campus - Stockpiles

[illegible]

Swansea Bay University Campus - Stockpiles		Stockpile F										Stockpile G										Stockpile H				Atmos - Shallow Soils
		Stockpile E - Sample 04	Stockpile F - Sample 01	Stockpile F - Sample 02	Stockpile F - Sample 03	Stockpile F - Sample 04	Stockpile F - Sample 05	Stockpile F - Sample 06	Stockpile F - Sample 07	Stockpile G - Sample 01	Stockpile G - Sample 02	Stockpile G - Sample 03	Stockpile G - Sample 04	Stockpile G - Sample 05	Stockpile G - Sample 06	Stockpile G - Sample 07	Stockpile H - Sample 01	Stockpile H - Sample 02	Stockpile H - Sample 03	Stockpile H - Sample 04						
SDQ(t):	240426-54	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID						
Customer:	PJA Civil Engineering Birmingham (11813)	07/08/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	24/04/2024	07/08/2024	24/04/2024	24/04/2024	07/08/2024	07/08/2024	07/08/2024	07/08/2024	07/08/2024	07/08/2024	07/08/2024	07/08/2024						
Client Reference / Location:	Swansea Bay University	09/08/2024	26/04/2024	26/04/2024	26/04/2024	26/04/2024	26/04/2024	26/04/2024	26/04/2024	09/08/2024	26/04/2024	26/04/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024						
Order no:	24126	09/08/2024	26/04/2024	26/04/2024	26/04/2024	26/04/2024	26/04/2024	26/04/2024	26/04/2024	09/08/2024	26/04/2024	26/04/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024	09/08/2024						
All results expressed on a dry weight basis																										
		16/08/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	08/05/2024	16/08/2024	08/05/2024	08/05/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024	16/08/2024						
		240809-96	240426-54	240426-54	240426-54	240426-54	240426-54	240426-54	240809-96	240426-54	240809-96	240426-54	240809-96	240809-96	240809-96	240809-96	240809-96	240809-96	240809-96	240809-96						
		30198459	29711382	29711389	29711395	29711400	29711405	29711411	30198425	29711355	29711360	30198464	30198470	30198475	30198481	30198486	30198492	30198433	30198441	30198447						
		13.6	7.2	7.2	7.2	7.2	7.2	7.2	13.6	7.2	7.2	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6						
Analysis	Test																									
Sample Description																										
	Colour	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Light Brown	Light Brown	Light Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown						
	Description	Loamy Sand	Silt Loam	Silt Loam	Sandy Loam	Loamy Sand	Sandy Clay Loam	Sandy Clay Loam	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Sandy Loam	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand						
	Inclusion 1)	Stones	Crushed Brick	Crushed Brick	Crushed Brick	Crushed Brick	Crushed Brick	Crushed Brick	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones						
	Inclusion 2)	Vegetation	Stones	Vegetation	Vegetation	Vegetation	Vegetation	Vegetation	Vegetation	Vegetation	Vegetation	None	Vegetation	Vegetation	Crushed Brick	Vegetation	None	Vegetation	None	Vegetation						
	Moisture Content Ratio (% of as received sample)	9	14	14	12	13	14	13	7.8	11	13	7.8	9.9	11	8.7	8.8	8.6	9.7	10	9.4						
Asbestos																										
	Asbestos Quantification - Gravimetric - %																									
	Date of Analysis	14/08/2024	30/04/2024	30/04/2024	30/04/2024	29/04/2024	30/04/2024	30/04/2024	14/08/2024	29/04/2024	29/04/2024	14/08/2024	14/08/2024	14/08/2024	14/08/2024	14/08/2024	14/08/2024	14/08/2024	14/08/2024	14/08/2024						
	Analysed By	Ashia Jackson	Danielle Duncan	Agnieszka Chelmonowska	Agnieszka Chelmonowska	Ashia Jackson	Danielle Duncan	Ashia Jackson	Agnieszka Chelmonowska	Agnieszka Chelmonowska	Ashia Jackson	Danielle Duncan	Danielle Duncan	Danielle Duncan	Ashia Jackson	Danielle Duncan	Ashia Jackson	Danielle Duncan	Ashia Jackson	Ashia Jackson						
	Asbestos Quantification - PCOM Evaluation - %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Additional Asbestos Components (Using TM048)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Analysts Comments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Asbestos Quantification - Total - %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	Chrysotile (White) Asbestos	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected						
	Amosite (Brown) Asbestos	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected						
	Crocidolite (Blue) Asbestos	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected						
	Asbestos Anthophyllite	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected						
	Asbestos Tremolite	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected						
	Asbestos Actinolite	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected						
	Non-Asbestos Fibre	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected						
	Comments	N/A	N/A	-	-	-	N/A	N/A	N/A	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Carbon																										
	Soil Organic Matter (SCM)	2.4	2.38	2.55	1.66	1.95	1.84	2.05	2.1	1.74	1.91	1.63	1.67	2.1	2.07	1.72	0.788	1.5	1.21	1.71						
Inorganics																										
	pH	8.37	8.08	8.06	8.07	8.37	8.41	8.31	8.53	8.41	8.46	8.52	8.69	8.38	8.43	8.42	6.53	8.45	9.11	8.43						
Metals - (Solids)																										
	Chromium, Hexavalent	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6						
	Arsenic	11	12.9	12.6	13.9	10.5	10.2	12.3	9.88	11.4	11.2	8.85	8	9.31	8.28	10.1	7.79	9.4	8.6	12.9	184					
	Cadmium	0.121	0.153	0.168	0.175	<0.02	0.18	0.186	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0693	<0.02	<0.02	82.2					
	Chromium	5.73	3.59	5.86	5.19	4.49	4.72	5.99	5.11	4.09	4.84	29.9	5.99	6.32	6.48	29.9	6.48	6.49	6.7	4.69	89.9					
	Copper	18.6	20.5	20.8	17.9	17.7	17.5	20.8	15.4	16.9	15.4	14	11.2	14.6	14	20.2	8.94	12.9	15.2	40.00						
	Lead	24.5	22.1	24.4	23.8	21.6	17.9	29.9	19.8	19.1	18	16.4	13	18.4	16.7	34.4	16.4	16.8	17.2	3280						
	Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1850					
	Nickel	21.3	15.1	15.3	14.2	15.4	14.1	17.6	16.2	17.7	15	13.5	12.1	16	13.2	17.2	17.8	16.3	15.6	17.8	473					
	Selenium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.18	<1	1.27	1.13	<1	<1	<1	<1	<1	8130					
	Vanadium	11.9	17.8	16.5	18.2	18.9	16.8	17.3	16.4	20.7	17.7	18.7	15	19	15.8	14.9	13.4	15.8	13	14.1	4270					
	Zinc	76.1	70.3	66.6	79.5	71.9	67.6	76.8	74.2	74.7	58.8	52.7	44.9	57.7	52	111	61.3	62.2	62.4	58	568000					
Gasoline Range Organics (GRO)																										
	Total Aliphatics >C5-C10	<0.05	<0.05	<0.05	<0.05	0.301	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05						
	Total Aromatics >EC5-EC10	<0.05	<0.05	<0.05	<0.05	0.127	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05						
	GRO >C5-C10	<0.02	<0.02	<0.02	<0.02	0.428	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02						
TPH Criteria Working Group (TPH CWG)																										
	GRO Surrogate % recovery**	87.7	94.9	99.3	95.1	129	85.8	95.2	92.4	98.1	90.8	94	103	116	98.7	101	98.1	92.5	93.4	91.2						
	Aliphatics >C5-C6	<0.01	<0.01	<0.01	<0.01	0.0331	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	160					
	Aliphatics >C6-C8	<0.01	<0.01	<0.01	<0.01	0.0787	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1740000					
	Aliphatics >C8-C10	<0.01	<0.01	<0.01	<0.01	0.189	<0.01	<0.01	<0.01																	

Appendix E Geotechnical Data



Laboratory Report



Contract Number: 69406

Client Ref: **05774/a**

Client PO:

Date Received: **01-11-2023**

Date Completed: **16-11-2023**

Report Date: **16-11-2023**

Client: **PJA Civil Engineering Limited**

Park Point

18 High Street, Longbridge,

Birmingham

B31 2UQ

This report has been checked and approved by:

Brendan Evans

Office Administrator

Contract Title: **Swansea Bay**

For the attention of: **Liam Clark**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	5
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	5
Particle Density (Gas Jar) BS 1377:1990 - Part 2 : 8.2 - * UKAS	5
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	5
Dry Den/MC (2.5kg Rammer Method 1 litre mould/CBR Mould) BS 1377:1990 - Part 4 : 3.4 - * UKAS	5
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 test report/certificate shall not be reproduced except in full, without the approval of GEO Site & Testing Services Ltd. Any opinions or interpretations stated - within this report/certificate are excluded from the laboratories UKAS accreditation.

Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

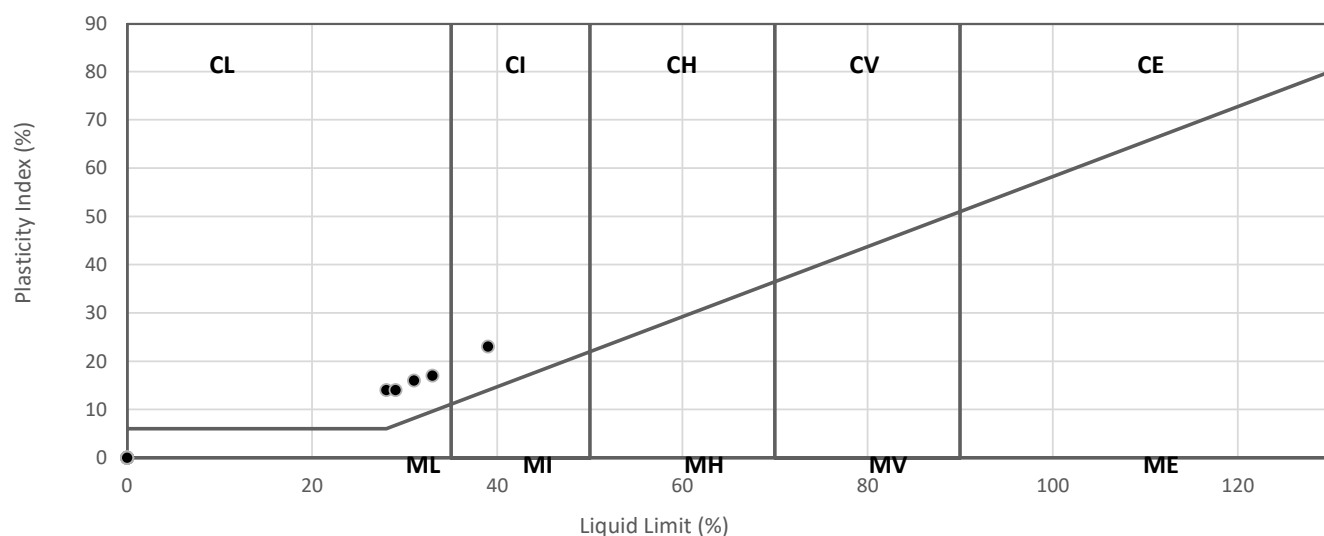
Wayne Honey (Human Resources/ Health and Safety Manager)

Contract Number	69406	
Project Name	Swansea Bay	
Date Tested	10/11/2023	

[illegible]

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION



Operator
Owain Davies

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69406
Borehole/Pit No.	Sample 01

Project Name	Swansea Bay
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Sample No.	
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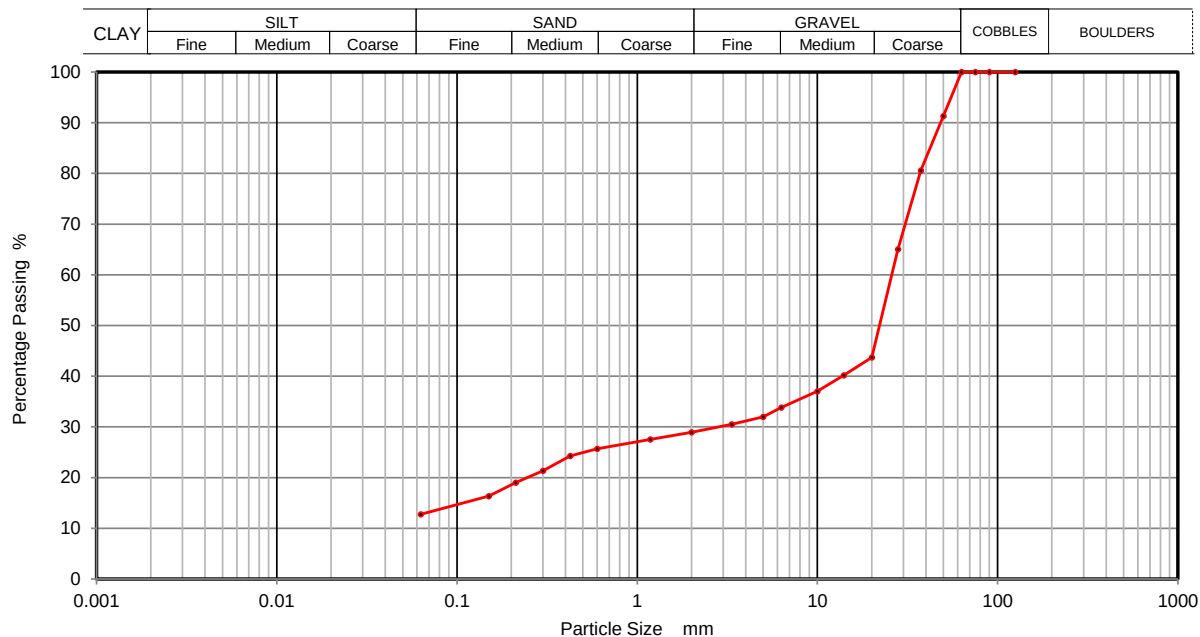
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL
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Depth Top	
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Depth Base	
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Date Tested	16/11/2023
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Sample Type	B
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Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	91		
37.5	81		
28	65		
20	44		
14	40		
10	37		
6.3	34		
5	32		
3.35	31		
2	29		
1.18	28		
0.6	26		
0.425	24		
0.3	21		
0.212	19		
0.15	16		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	16
Silt and Clay	13

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator

David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 69406

Borehole/Pit No. Sample 02

Project Name Swansea Bay

Sample No.

Soil Description Brown slightly silty/clayey slightly sandy fine to coarse GRAVEL (with cobbles)

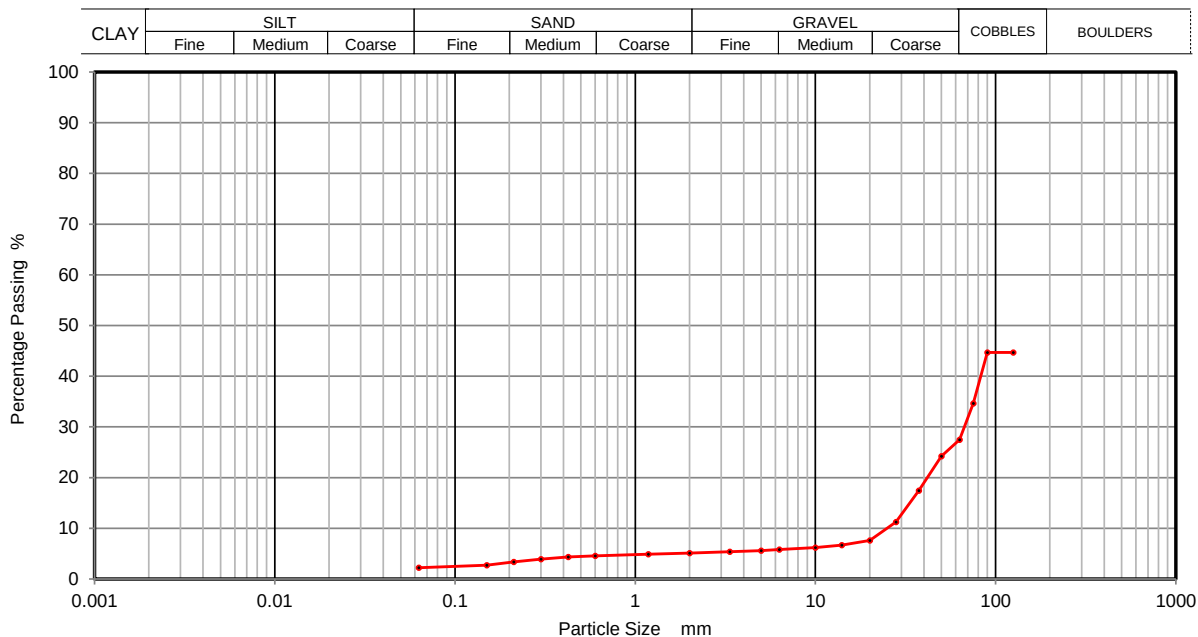
Depth Top

Depth Base

Date Tested 16/11/2023

Sample Type

B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	45		
90	45		
75	35		
63	27		
50	24		
37.5	17		
28	11		
20	8		
14	7		
10	6		
6.3	6		
5	6		
3.35	5		
2	5		
1.18	5		
0.6	5		
0.425	4		
0.3	4		
0.212	3		
0.15	3		
0.063	2		

Sample Proportions	% dry mass
Cobbles	73
Gravel	22
Sand	3
Silt and Clay	2

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator

David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69406
Borehole/Pit No.	Sample 03

Project Name	Swansea Bay
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Sample No.	
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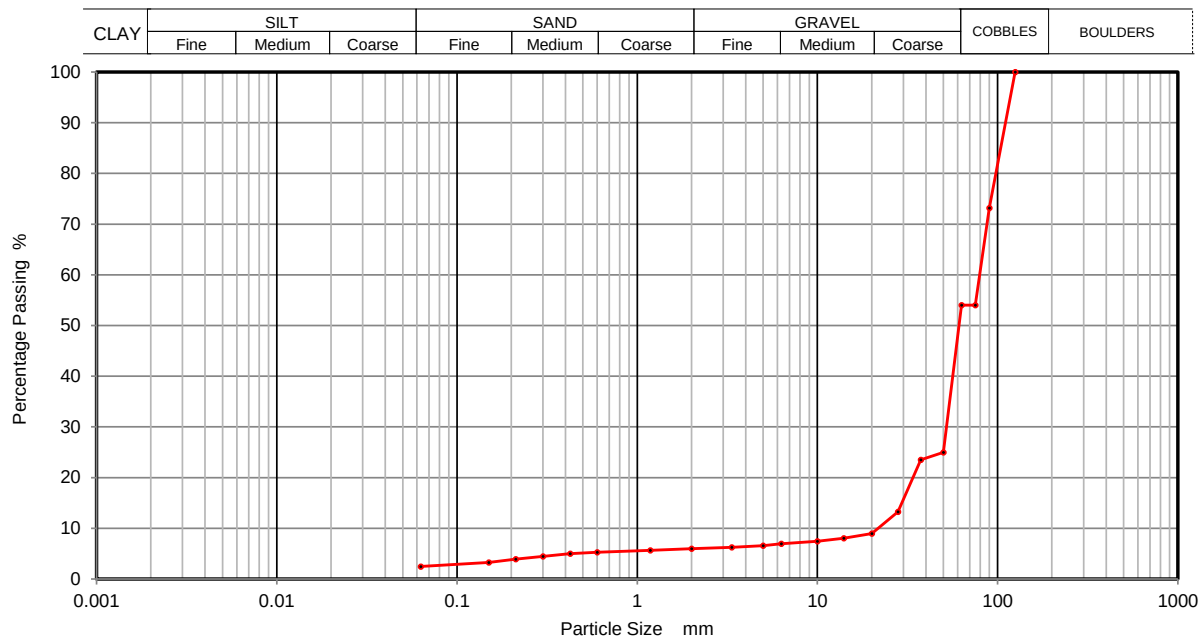
Soil Description	Brown slightly silty/clayey slightly sandy fine to coarse GRAVEL (with cobbles)
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Depth Top	
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Depth Base	
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Date Tested	16/11/2023
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Sample Type	B
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Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	73		
75	54		
63	54		
50	25		
37.5	24		
28	13		
20	9		
14	8		
10	7		
6.3	7		
5	7		
3.35	6		
2	6		
1.18	6		
0.6	5		
0.425	5		
0.3	4		
0.212	4		
0.15	3		
0.063	2		

Sample Proportions		% dry mass
Cobbles		46
Gravel		48
Sand		4
Silt and Clay		2

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator

David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 69406

Borehole/Pit No. Sample 04

Project Name Swansea Bay

Sample No.

Soil Description Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL

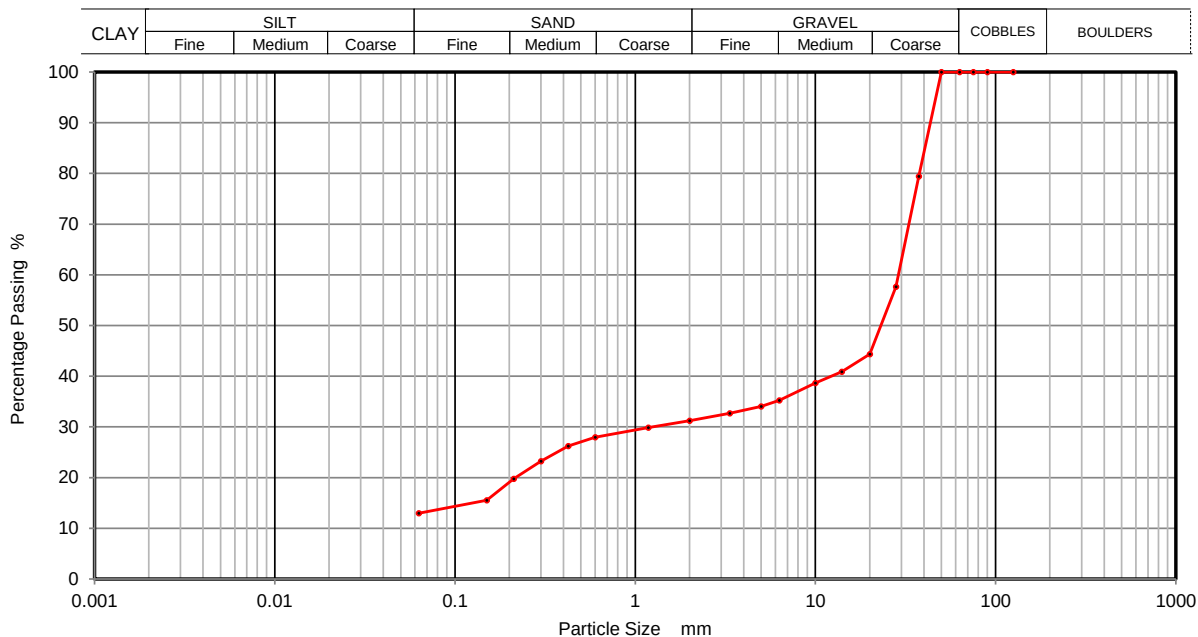
Depth Top

Depth Base

Date Tested 16/11/2023

Sample Type

B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	79		
28	58		
20	44		
14	41		
10	39		
6.3	35		
5	34		
3.35	33		
2	31		
1.18	30		
0.6	28		
0.425	26		
0.3	23		
0.212	20		
0.15	16		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	69
Sand	18
Silt and Clay	13

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator

David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 69406

Borehole/Pit No. Sample 05

Project Name Swansea Bay

Sample No.

Soil Description Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)

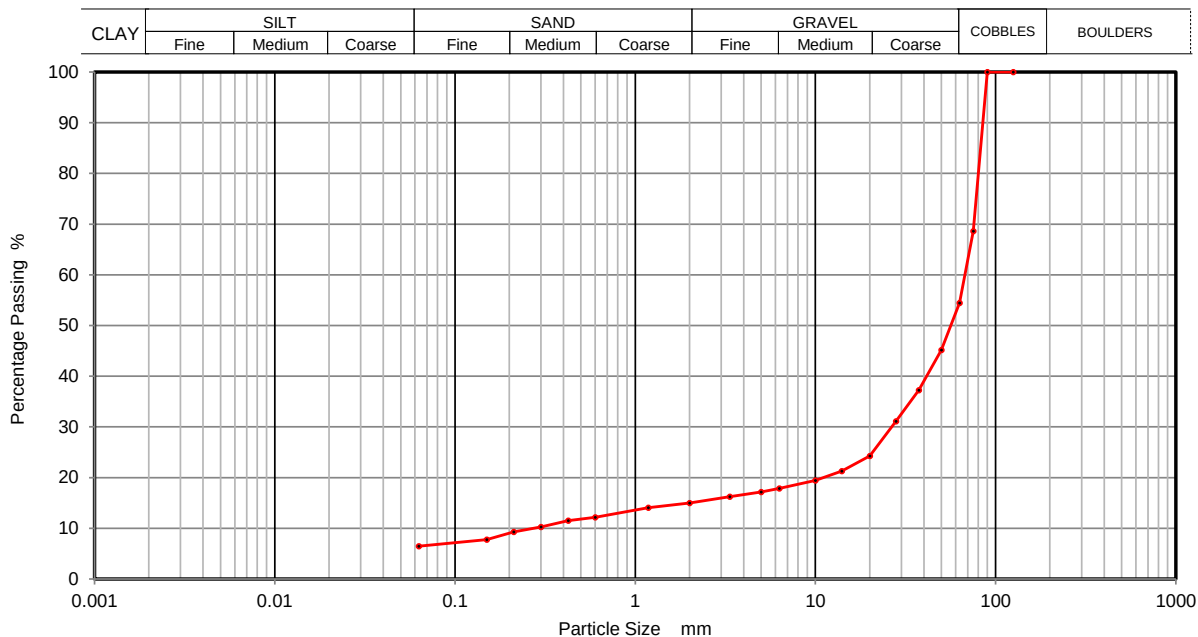
Depth Top

Depth Base

Date Tested 16/11/2023

Sample Type

B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	69		
63	54		
50	45		
37.5	37		
28	31		
20	24		
14	21		
10	19		
6.3	18		
5	17		
3.35	16		
2	15		
1.18	14		
0.6	12		
0.425	12		
0.3	10		
0.212	9		
0.15	8		
0.063	6		

Sample Proportions	% dry mass
Cobbles	46
Gravel	39
Sand	9
Silt and Clay	6

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator

David Edwards

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number 69406

Borehole / Pit No Sample 01

Project Name Swansea Bay

Sample No

Date Tested 13/11/2023

Depth Top

Compaction Method 2.5 Kg Rammer

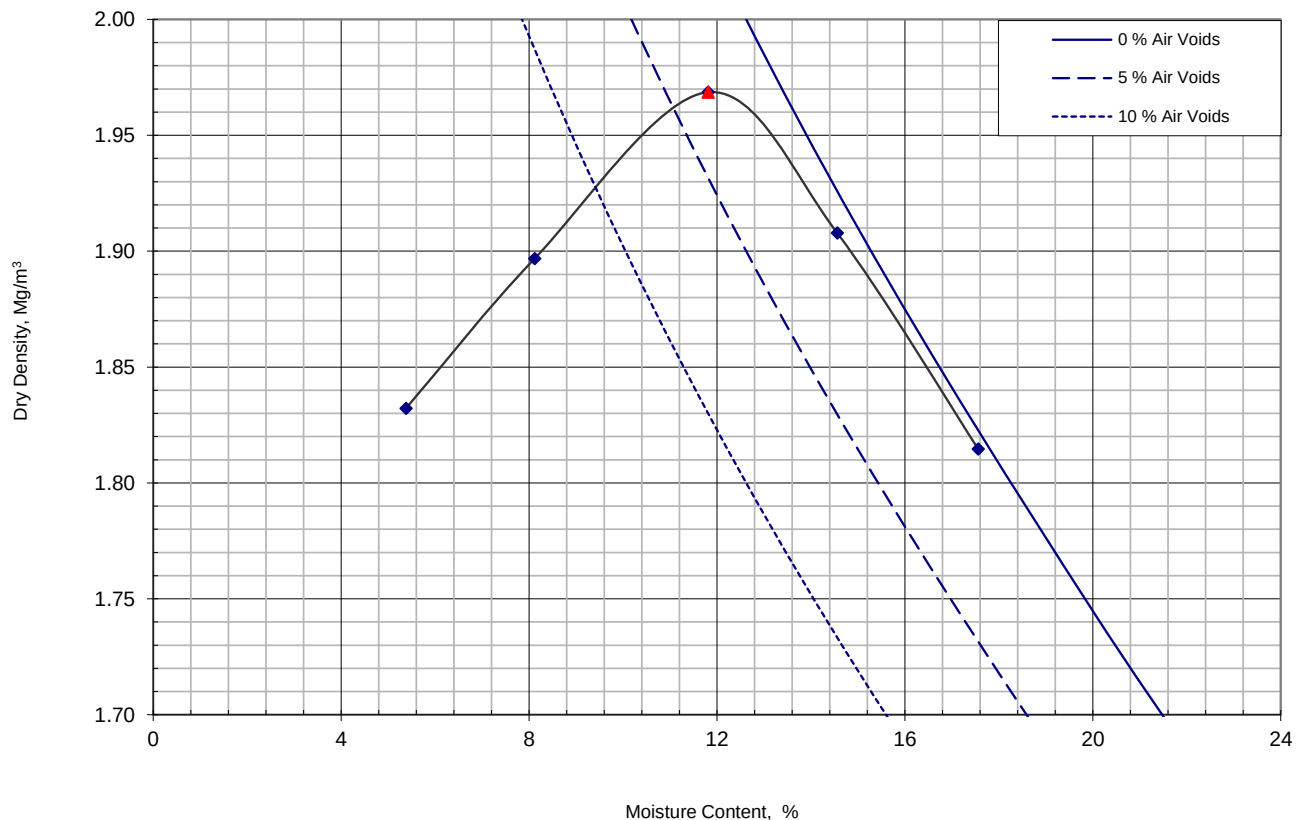
Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.3

Sample Type B

Sample Description Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL

Single or Separate Sample Used Single



Compaction Point	1	2	3	4	5							
Moisture Content	5.4	8.1	12	15	18							
Bulk Density	1.93	2.05	2.20	2.19	2.13							
Dry Density	1.83	1.90	1.97	1.91	1.81							

Initial Moisture Content	18	%
Maximum Dry Density	1.97	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.68 Measured	Mg/m3
Material Retained 37.5mm	19	%
Material Retained 20mm	35	%

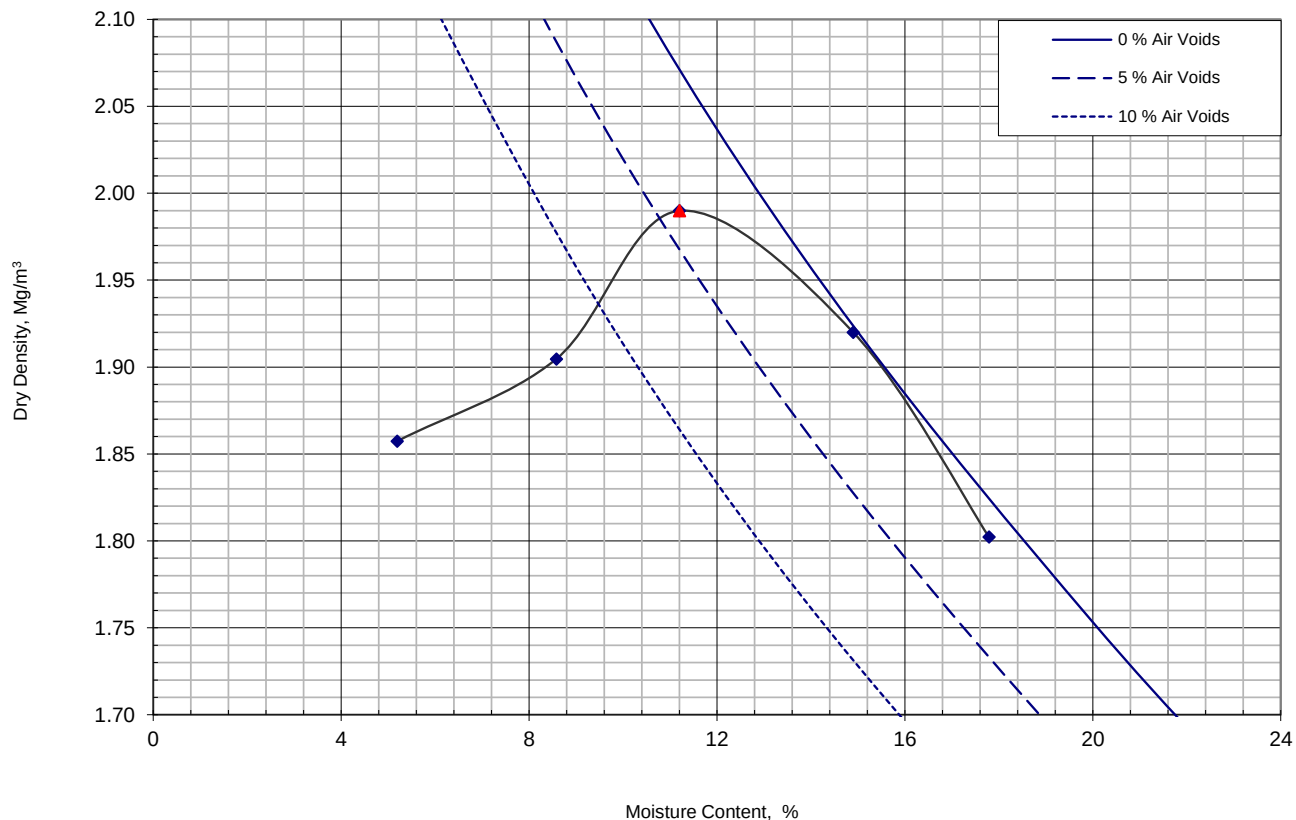
Operator

Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69406
Borehole / Pit No	Sample 02

Project Name	Swansea Bay	Sample No	
Date Tested	13/11/2023	Depth Top	
Compaction Method	2.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Brown slightly silty/clayey slightly sandy fine to coarse GRAVEL (with cobbles)	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5							
Moisture Content	5.2	8.6	11	15	18							
Bulk Density	1.95	2.07	2.21	2.21	2.12							
Dry Density	1.86	1.90	1.99	1.92	1.80							

Initial Moisture Content	18	%
Maximum Dry Density	1.99	Mg/m ³
Optimum Moisture Content	11	%
Particle Density	2.7 Measured	Mg/m ³
Material Retained 37.5mm	83	%
Material Retained 20mm	9	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number 69406

Borehole / Pit No Sample 03

Project Name Swansea Bay

Sample No

Date Tested 13/11/2023

Depth Top

Compaction Method 2.5 Kg Rammer

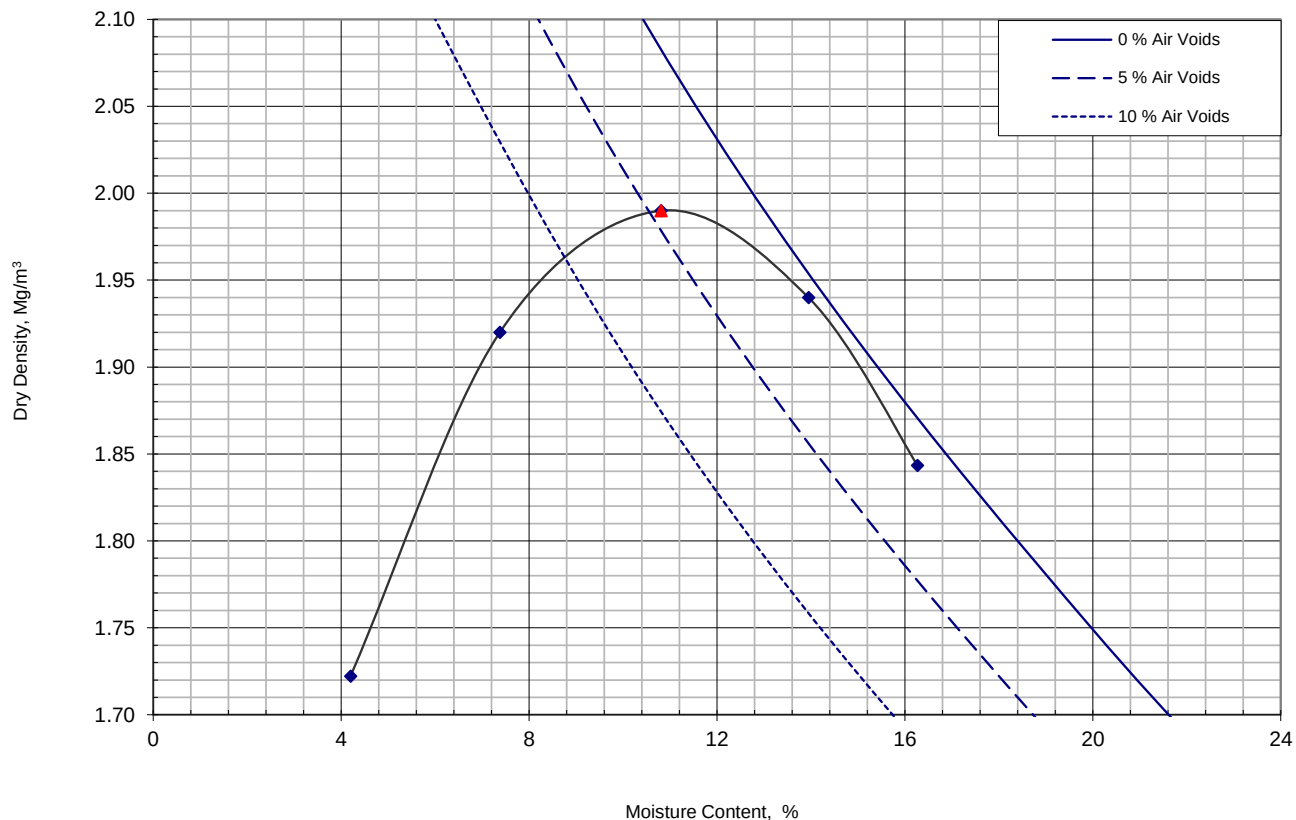
Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.3

Sample Type B

Sample Description Brown slightly silty/clayey slightly sandy fine to coarse GRAVEL (with cobbles)

Single or Separate Sample Used Single



Compaction Point	1	2	3	4	5							
Moisture Content	4.2	7.4	11	14	16							
Bulk Density	1.79	2.06	2.21	2.21	2.14							
Dry Density	1.72	1.92	1.99	1.94	1.84							

Initial Moisture Content	16	%
Maximum Dry Density	1.99	Mg/m3
Optimum Moisture Content	11	%
Particle Density	2.69 Measured	Mg/m3
Material Retained 37.5mm	76	%
Material Retained 20mm	15	%

Operator

Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number 69406

Borehole / Pit No Sample 04

Project Name Swansea Bay

Sample No

Date Tested 13/11/2023

Depth Top

Compaction Method 2.5 Kg Rammer

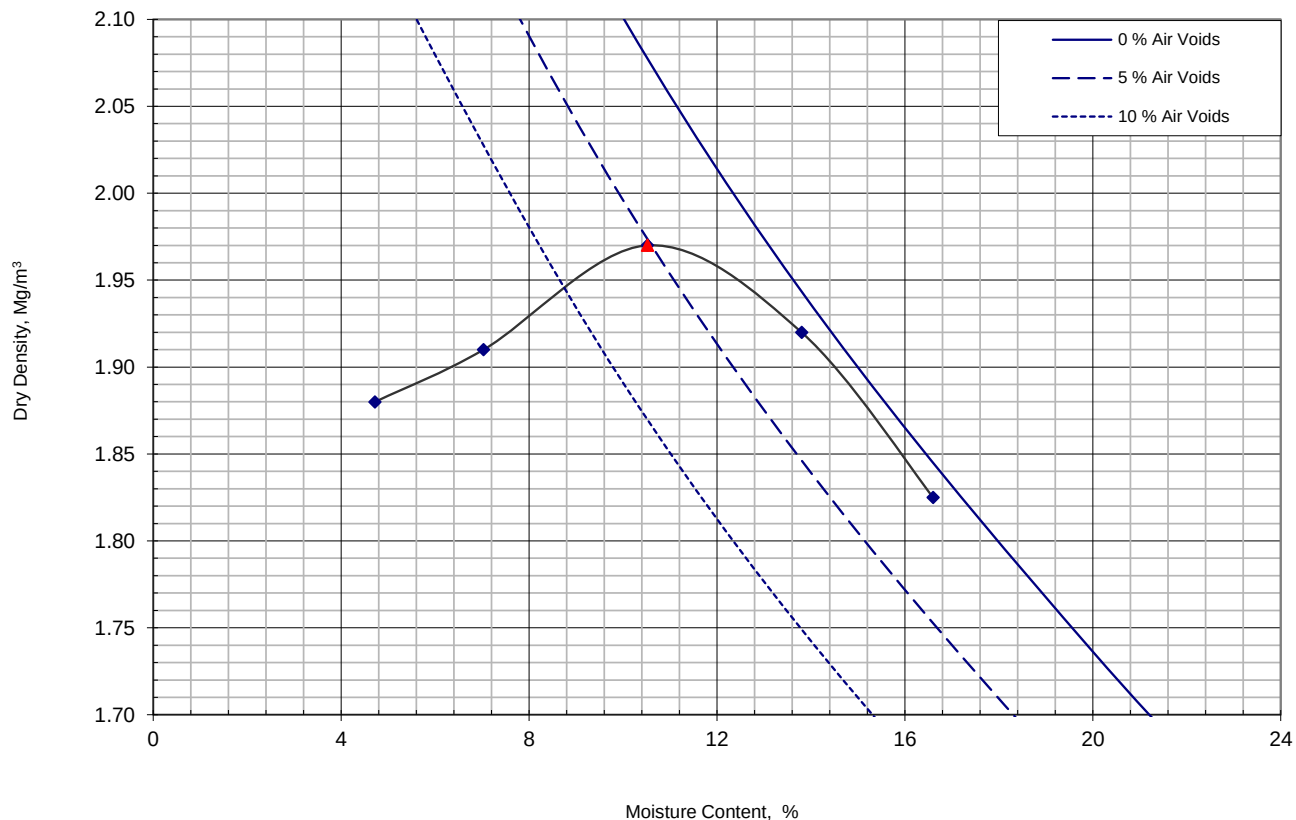
Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.3

Sample Type B

Sample Description Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL

Single or Separate Sample Used Single



Compaction Point	1	2	3	4	5							
Moisture Content	4.7	7.0	11	14	17							
Bulk Density	1.97	2.04	2.18	2.18	2.13							
Dry Density	1.88	1.91	1.97	1.92	1.83							

Initial Moisture Content	17	%
Maximum Dry Density	1.97	Mg/m ³
Optimum Moisture Content	11	%
Particle Density	2.66 Measured	Mg/m ³
Material Retained 37.5mm	21	%
Material Retained 20mm	35	%

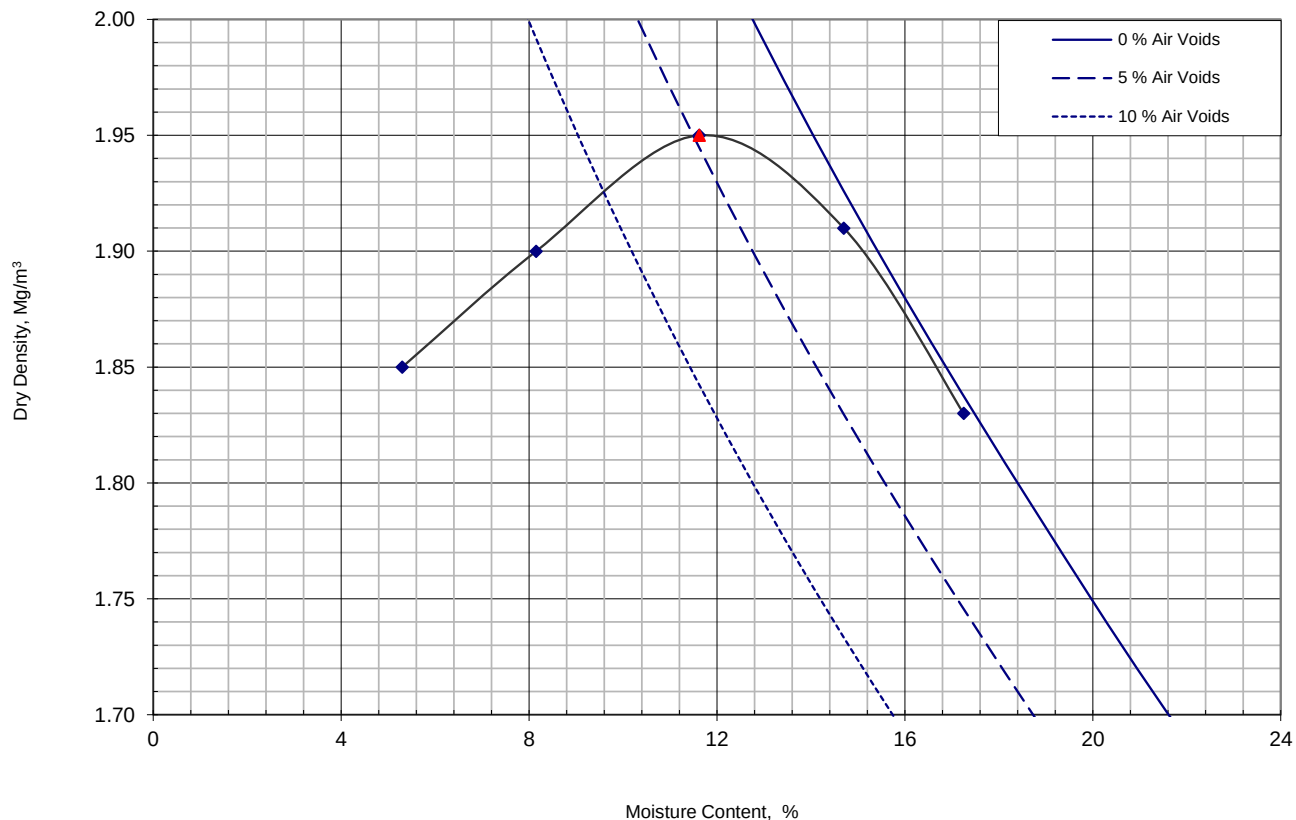
Operator

Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69406
Borehole / Pit No	Sample 05

Project Name	Swansea Bay	Sample No	
Date Tested	13/11/2023	Depth Top	
Compaction Method	2.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5							
Moisture Content	5.3	8.2	12	15	17							
Bulk Density	1.95	2.05	2.18	2.19	2.15							
Dry Density	1.85	1.90	1.95	1.91	1.83							

Initial Moisture Content	17	%
Maximum Dry Density	1.95	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.69 Measured	Mg/m3
Material Retained 37.5mm	63	%
Material Retained 20mm	13	%

Operator
Conor



Laboratory Report



Contract Number: 69677

Client Ref: **05774/A**

Client PO:

Date Received: **17-11-2023**

Date Completed: **05-12-2023**

Report Date: **05-12-2023**

Client: **PJA Civil Engineering Limited**

Park Point

18 High Street, Longbridge,

Birmingham

B31 2UQ

This report has been checked and approved by:

Brendan Evans

Office Administrator

Contract Title: **Swansea Bay**

For the attention of: **Liam Clark**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	10
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	10
Particle Density (Gas Jar) BS 1377:1990 - Part 2 : 8.2 - * UKAS	10
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	10
Dry Den/MC (2.5kg Rammer Method 1 litre mould/CBR Mould) BS 1377:1990 - Part 4 : 3.4 - * UKAS	10
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

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Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (Human Resources/ Health and Safety Manager)



**NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND
PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.3 & 5.3)**

Contract Number	69677	
Project Name	Swansea Bay	
Date Tested	29/11/2023	
	DESCRIPTIONS	

[illegible]

Operator

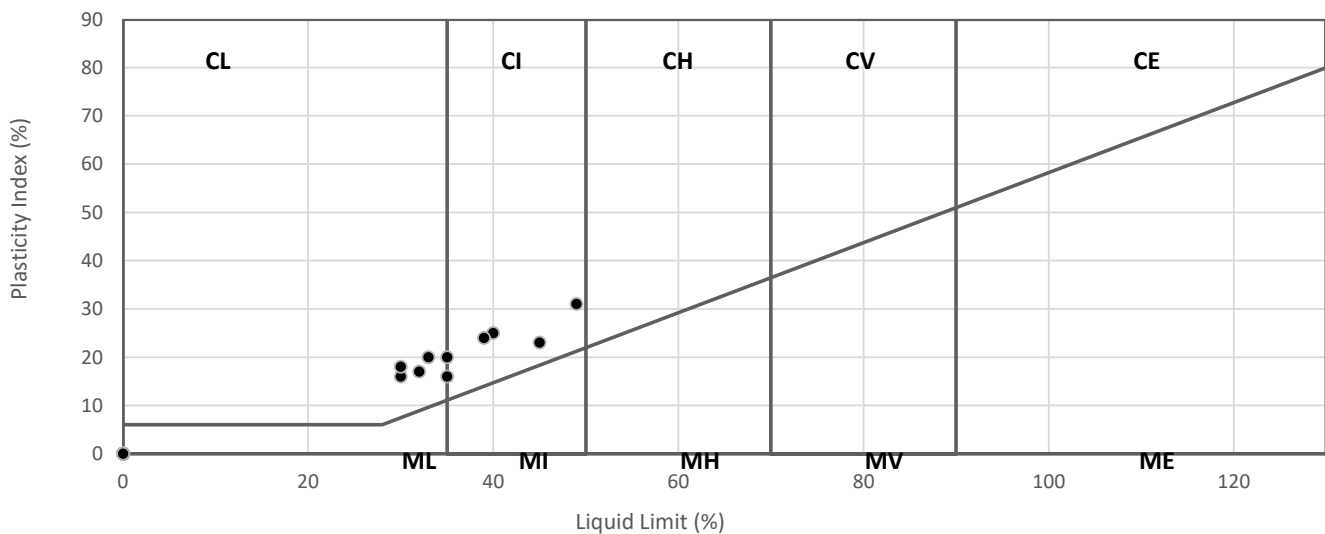
Aaron Hodge

Contract Number	69677	
Project Name	Swansea Bay	
Date Tested	29/11/2023	

[illegible]

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION BS 5930:2015+A1:2020

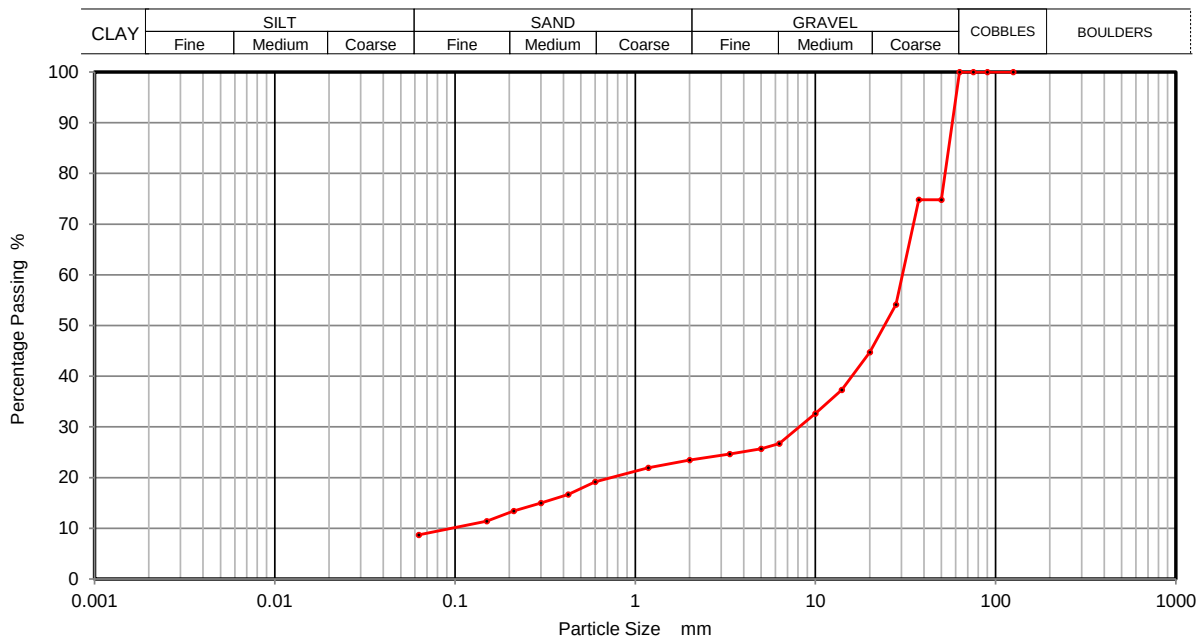


Operator
Aaron Hodge

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile A - Sample 01
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	75		
37.5	75		
28	54		
20	45		
14	37		
10	33		
6.3	27		
5	26		
3.35	25		
2	23		
1.18	22		
0.6	19		
0.425	17		
0.3	15		
0.212	13		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	77
Sand	14
Silt and Clay	9

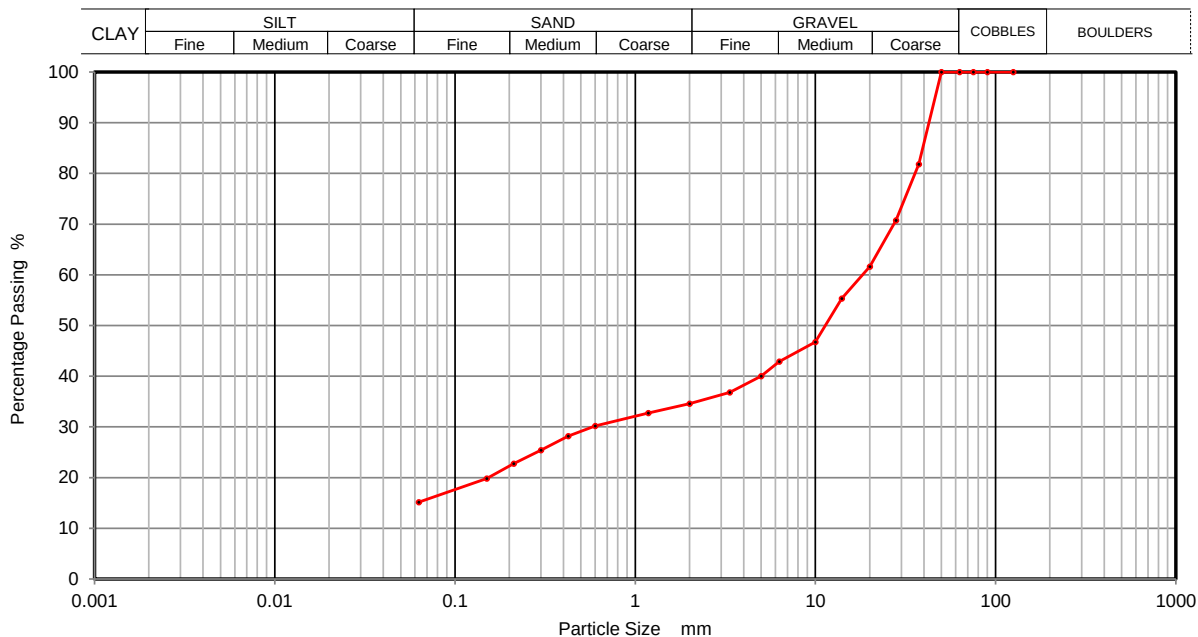
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile A - Sample 02
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	82		
28	71		
20	62		
14	55		
10	47		
6.3	43		
5	40		
3.35	37		
2	35		
1.18	33		
0.6	30		
0.425	28		
0.3	25		
0.212	23		
0.15	20		
0.063	15		

Sample Proportions	% dry mass
Cobbles	0
Gravel	65
Sand	20
Silt and Clay	15

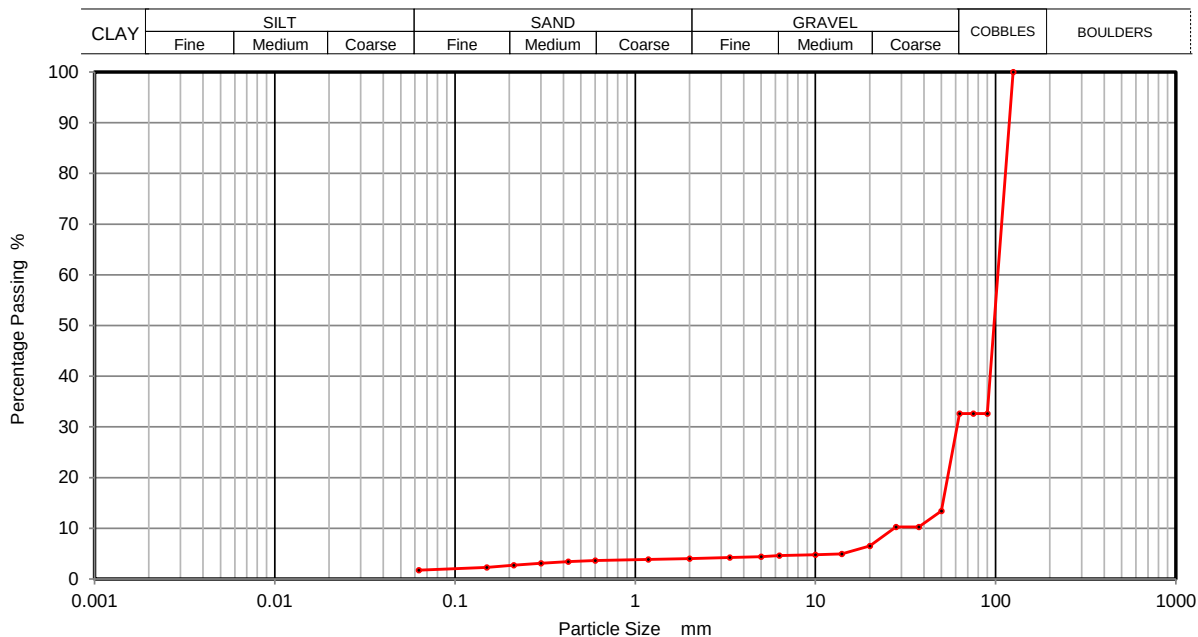
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile A - Sample 03
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown slightly silty/clayey slightly sandy fine to coarse GRAVEL (with cobbles)
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	33		
75	33		
63	33		
50	13		
37.5	10		
28	10		
20	7		
14	5		
10	5		
6.3	5		
5	4		
3.35	4		
2	4		
1.18	4		
0.6	4		
0.425	3		
0.3	3		
0.212	3		
0.15	2		
0.063	2		

Sample Proportions	% dry mass
Cobbles	67
Gravel	29
Sand	2
Silt and Clay	2

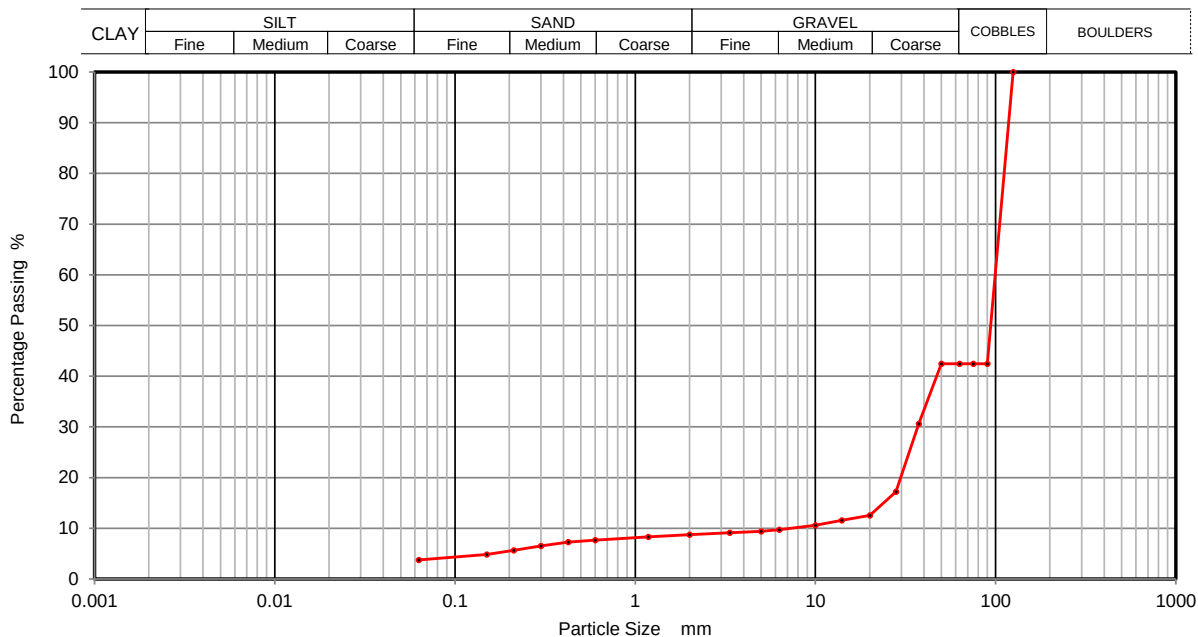
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile A - Sample 04
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	42		
75	42		
63	42		
50	42		
37.5	31		
28	17		
20	13		
14	12		
10	11		
6.3	10		
5	9		
3.35	9		
2	9		
1.18	8		
0.6	8		
0.425	7		
0.3	7		
0.212	6		
0.15	5		
0.063	4		

Sample Proportions	% dry mass
Cobbles	58
Gravel	33
Sand	5
Silt and Clay	4

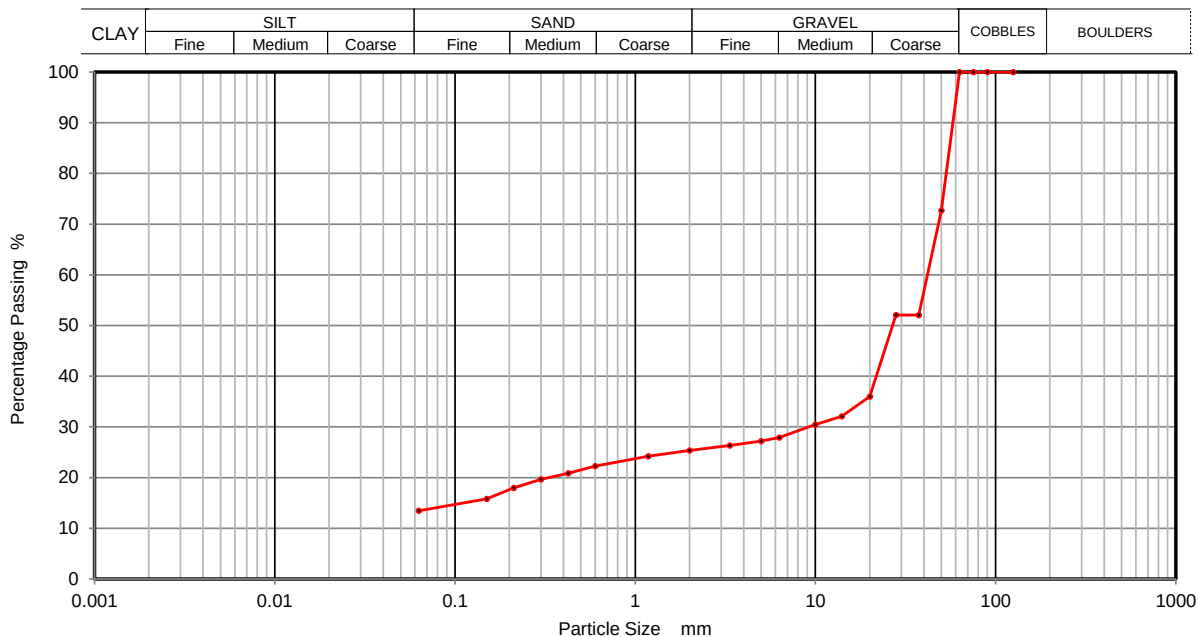
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile A - Sample 05
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	73		
37.5	52		
28	52		
20	36		
14	32		
10	30		
6.3	28		
5	27		
3.35	26		
2	25		
1.18	24		
0.6	22		
0.425	21		
0.3	20		
0.212	18		
0.15	16		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	75
Sand	12
Silt and Clay	13

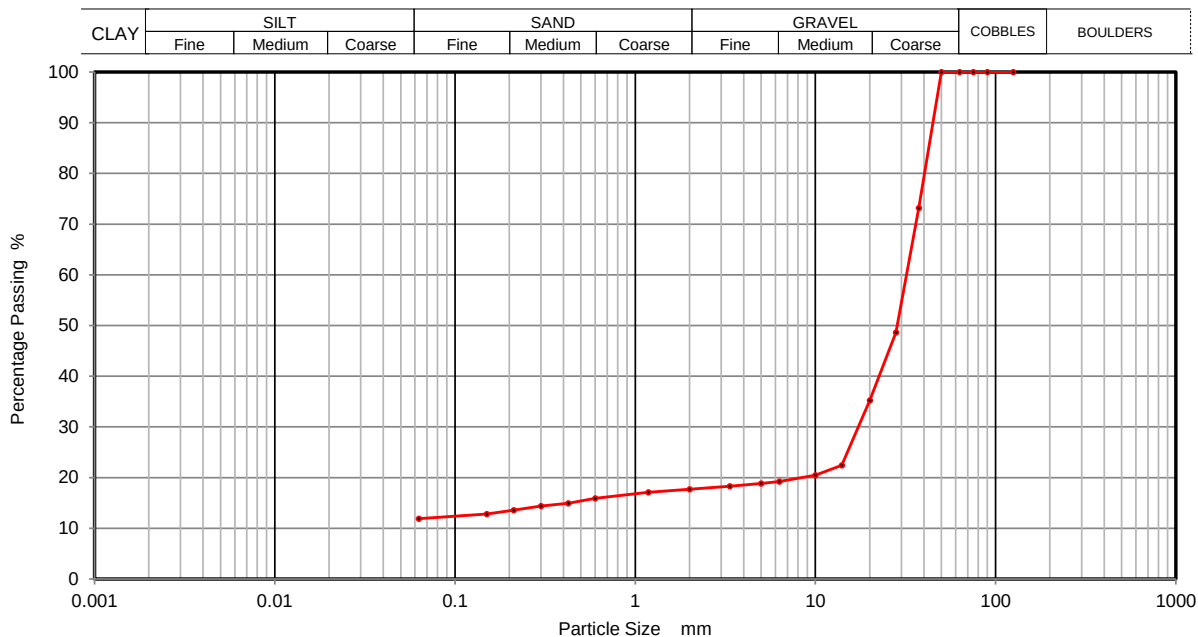
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile A - Sample 06
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	73		
28	49		
20	35		
14	22		
10	20		
6.3	19		
5	19		
3.35	18		
2	18		
1.18	17		
0.6	16		
0.425	15		
0.3	14		
0.212	14		
0.15	13		
0.063	12		

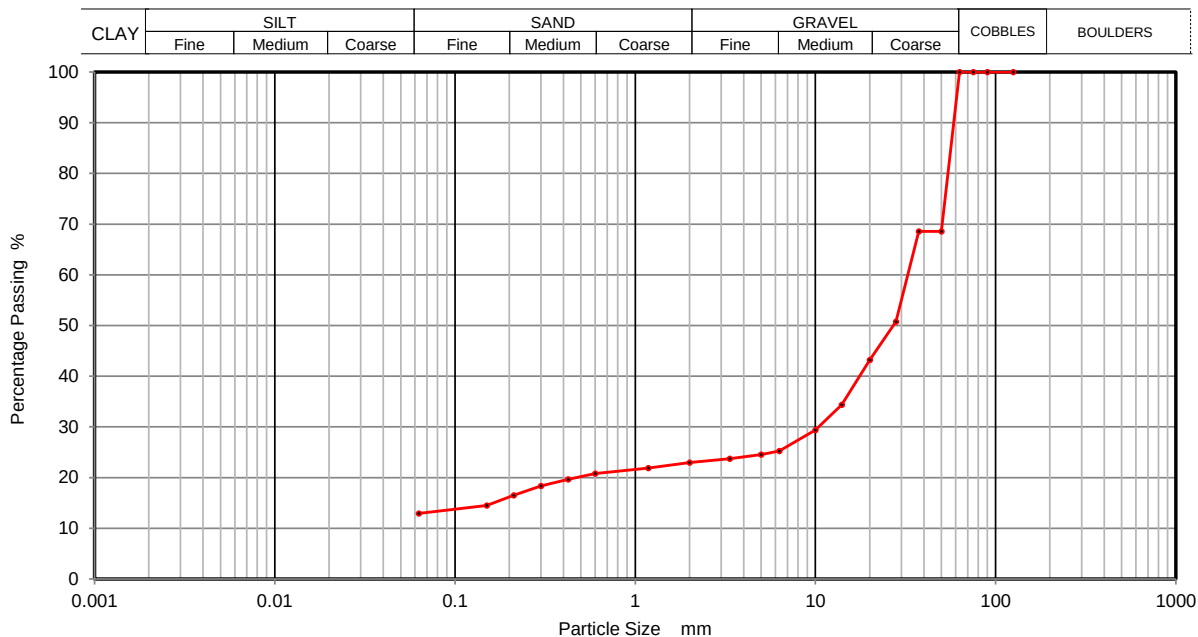
Sample Proportions	% dry mass
Cobbles	0
Gravel	82
Sand	6
Silt and Clay	12

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile B - Sample 01
Sample No.	
Depth Top	
Depth Base	
Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	69		
37.5	69		
28	51		
20	43		
14	34		
10	29		
6.3	25		
5	25		
3.35	24		
2	23		
1.18	22		
0.6	21		
0.425	20		
0.3	18		
0.212	17		
0.15	14		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	77
Sand	10
Silt and Clay	13

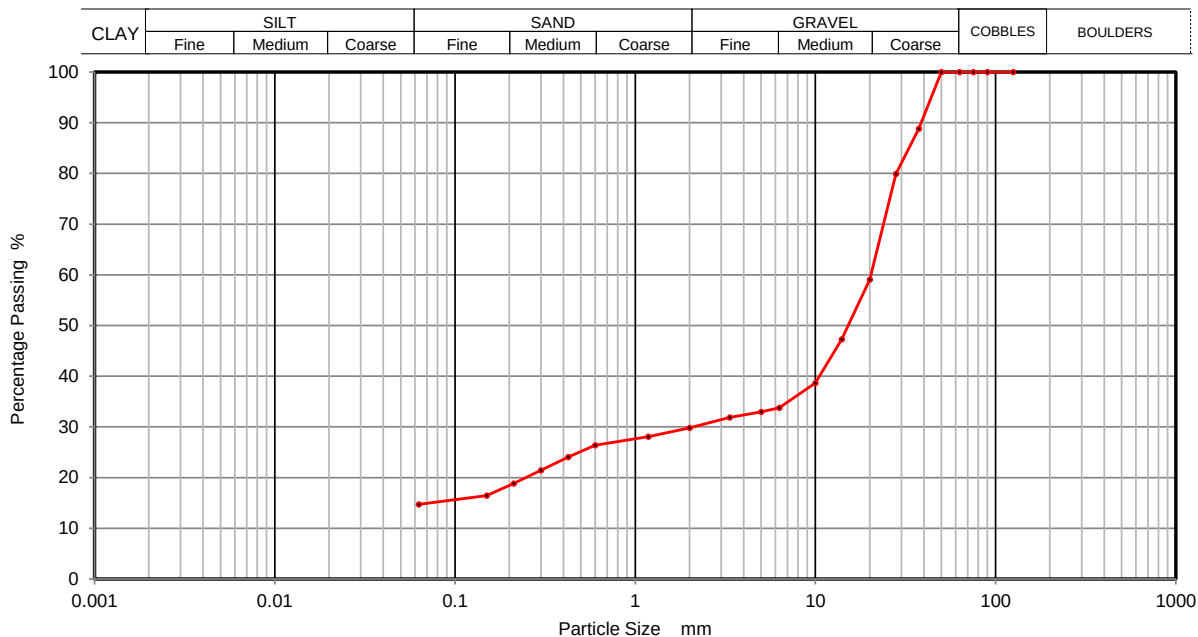
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile B - Sample 02
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	89		
28	80		
20	59		
14	47		
10	39		
6.3	34		
5	33		
3.35	32		
2	30		
1.18	28		
0.6	26		
0.425	24		
0.3	21		
0.212	19		
0.15	16		
0.063	15		

Sample Proportions	% dry mass
Cobbles	0
Gravel	70
Sand	15
Silt and Clay	15

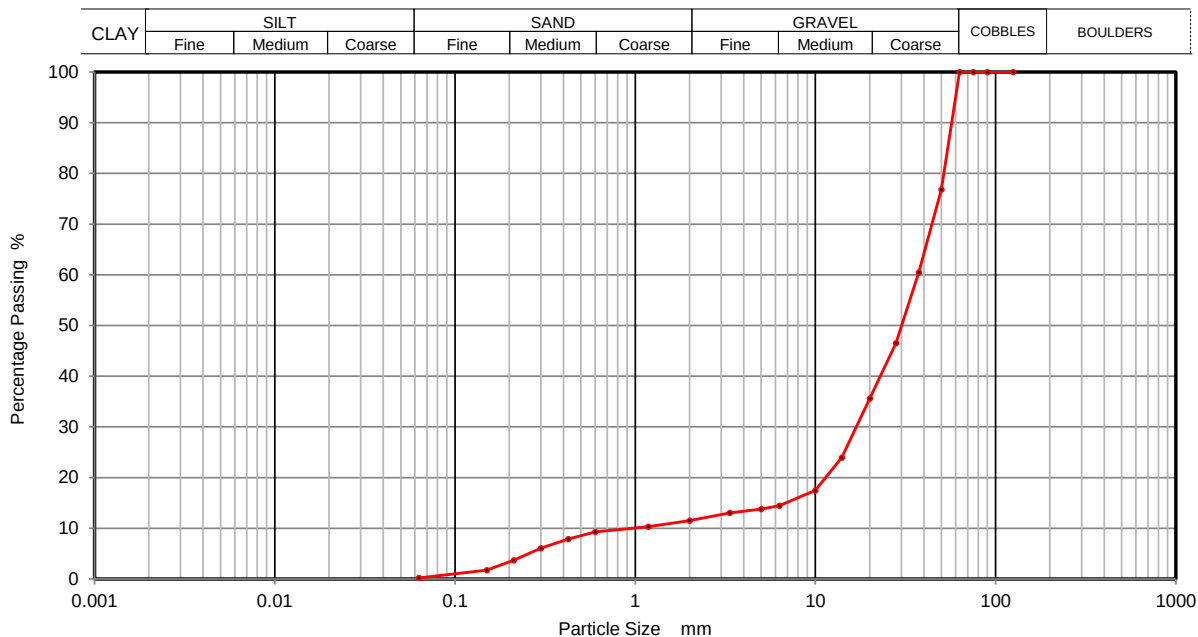
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile C - Sample 01
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	77		
37.5	60		
28	47		
20	36		
14	24		
10	17		
6.3	14		
5	14		
3.35	13		
2	11		
1.18	10		
0.6	9		
0.425	8		
0.3	6		
0.212	4		
0.15	2		
0.063	0		

Sample Proportions	% dry mass
Cobbles	0
Gravel	89
Sand	11
Silt and Clay	0

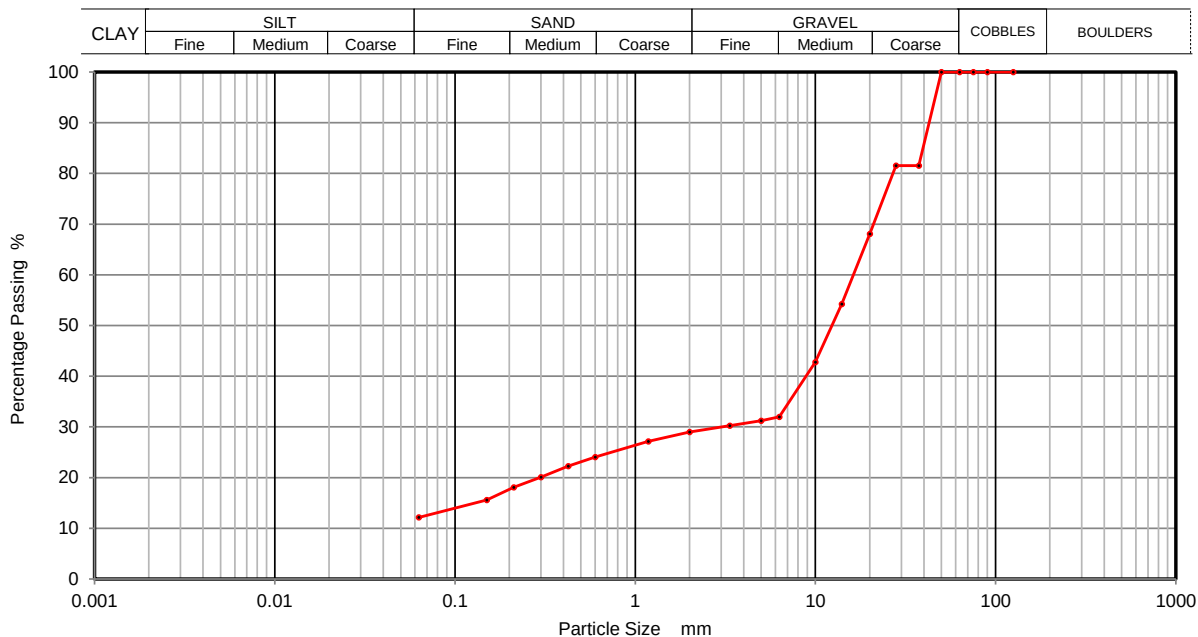
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	69677
Borehole/Pit No.	Stockpile C - Sample 02
Sample No.	
Depth Top	
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL
Date Tested	01/12/2023



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	82		
28	82		
20	68		
14	54		
10	43		
6.3	32		
5	31		
3.35	30		
2	29		
1.18	27		
0.6	24		
0.425	22		
0.3	20		
0.212	18		
0.15	16		
0.063	12		

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	17
Silt and Clay	12

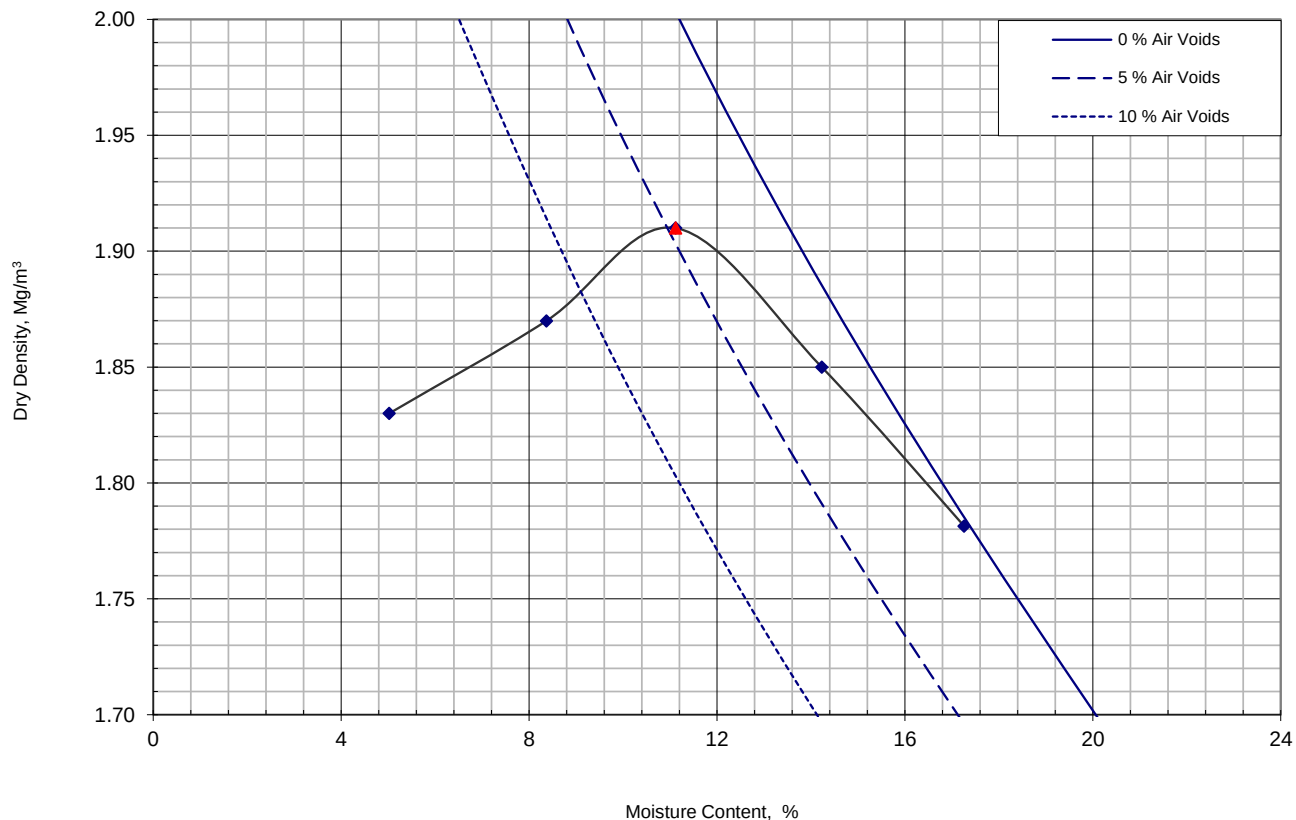
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile A - Sample 01
Sample No	
Depth Top	
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	02/12/2023
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL



Compaction Point	1	2	3	4	5							
Moisture Content	5.0	8.4	11	14	17							
Bulk Density	1.92	2.03	2.12	2.11	2.09							
Dry Density	1.83	1.87	1.91	1.85	1.78							

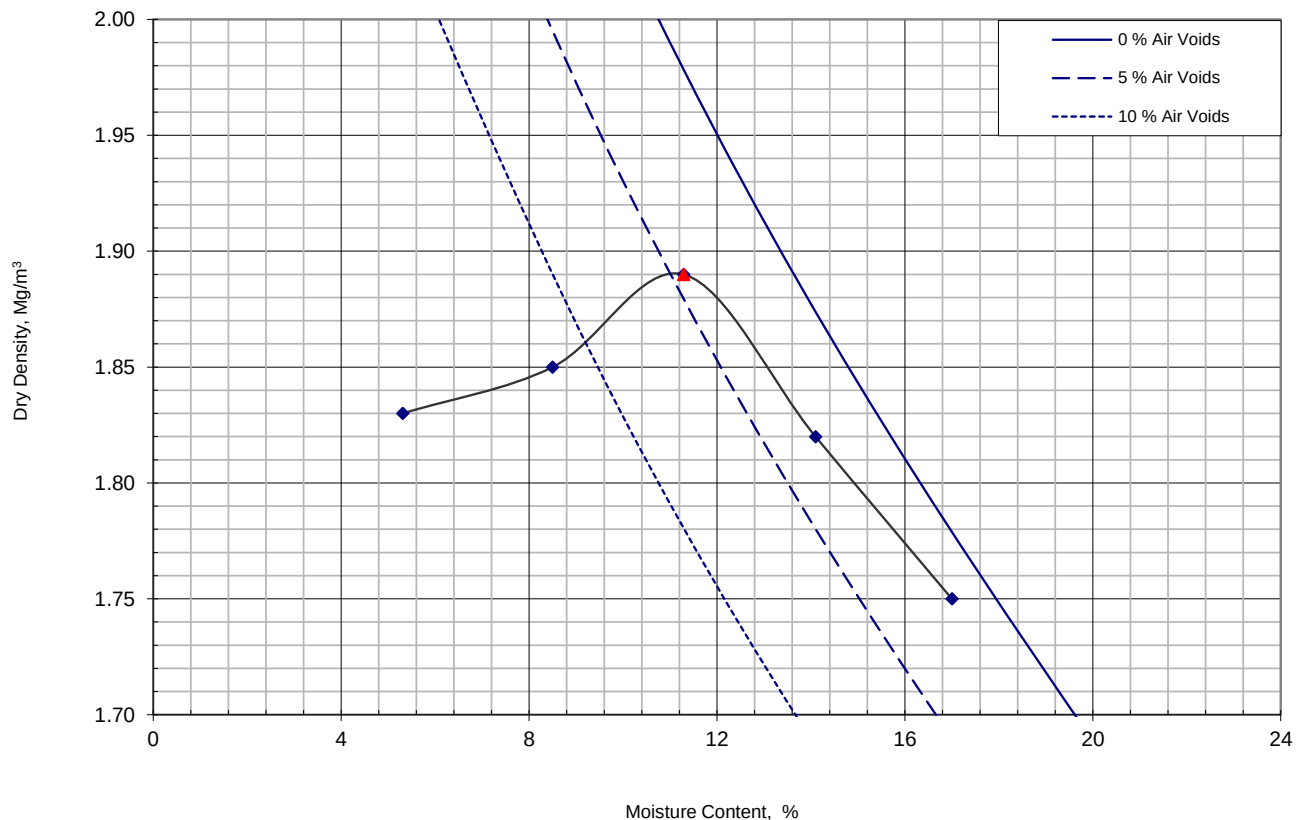
Initial Moisture Content	14	%
Maximum Dry Density	1.91	Mg/m3
Optimum Moisture Content	11	%
Particle Density	2.58 Measured	Mg/m3
Material Retained 37.5mm	25	%
Material Retained 20mm	30	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile A - Sample 02
Sample No	
Depth Top	
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	02/12/2023
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL



Compaction Point	1	2	3	4	5							
Moisture Content	5.3	8.5	11	14	17							
Bulk Density	1.93	2.01	2.10	2.08	2.05							
Dry Density	1.83	1.85	1.89	1.82	1.75							

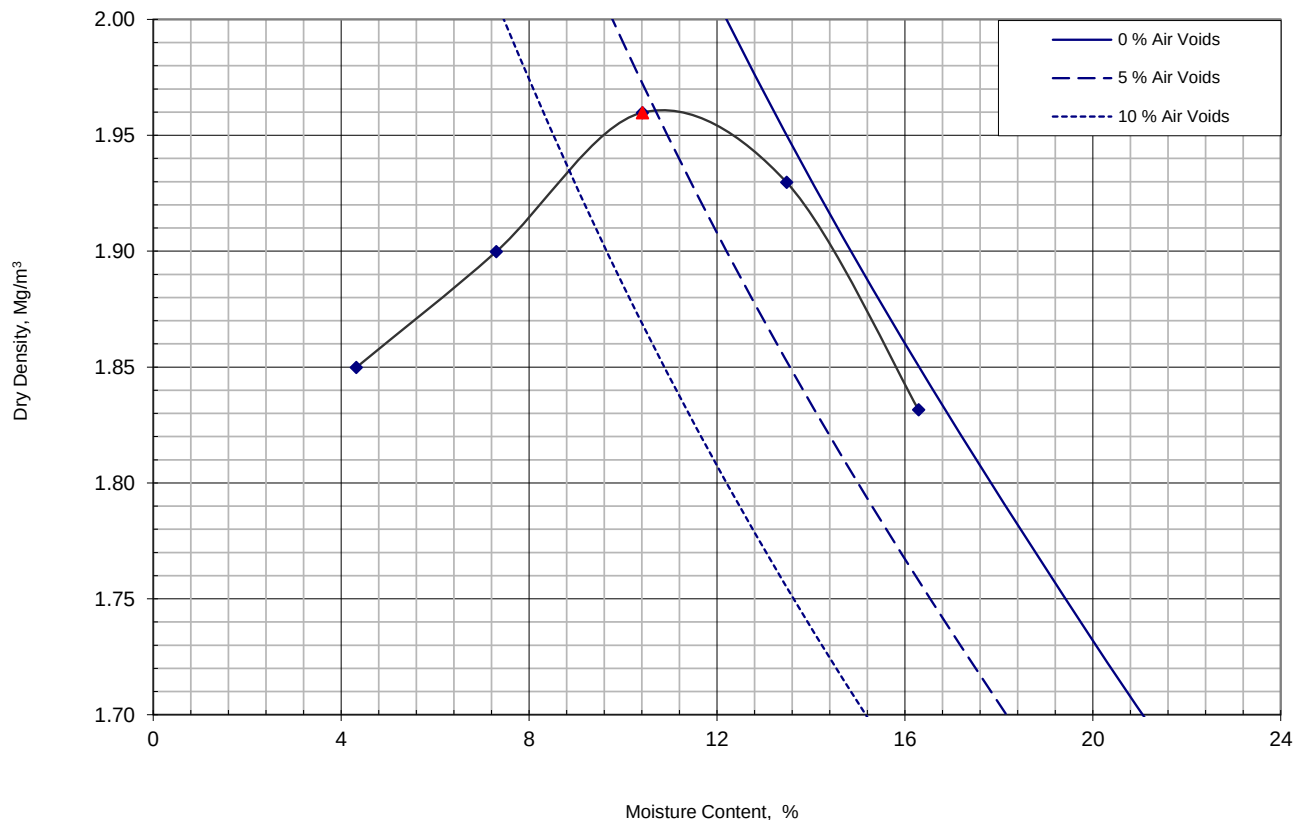
Initial Moisture Content	14	%
Maximum Dry Density	1.89	Mg/m ³
Optimum Moisture Content	11	%
Particle Density	2.55 Measured	Mg/m ³
Material Retained 37.5mm	18	%
Material Retained 20mm	20	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile A - Sample 03

Project Name	Swansea Bay	Sample No	
Date Tested	02/12/2023	Depth Top	
Compaction Method	2.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Brown slightly silty/clayey slightly sandy fine to coarse GRAVEL (with cobbles)	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5							
Moisture Content	4.3	7.3	10	13	16							
Bulk Density	1.93	2.04	2.16	2.19	2.13							
Dry Density	1.85	1.90	1.96	1.93	1.83							

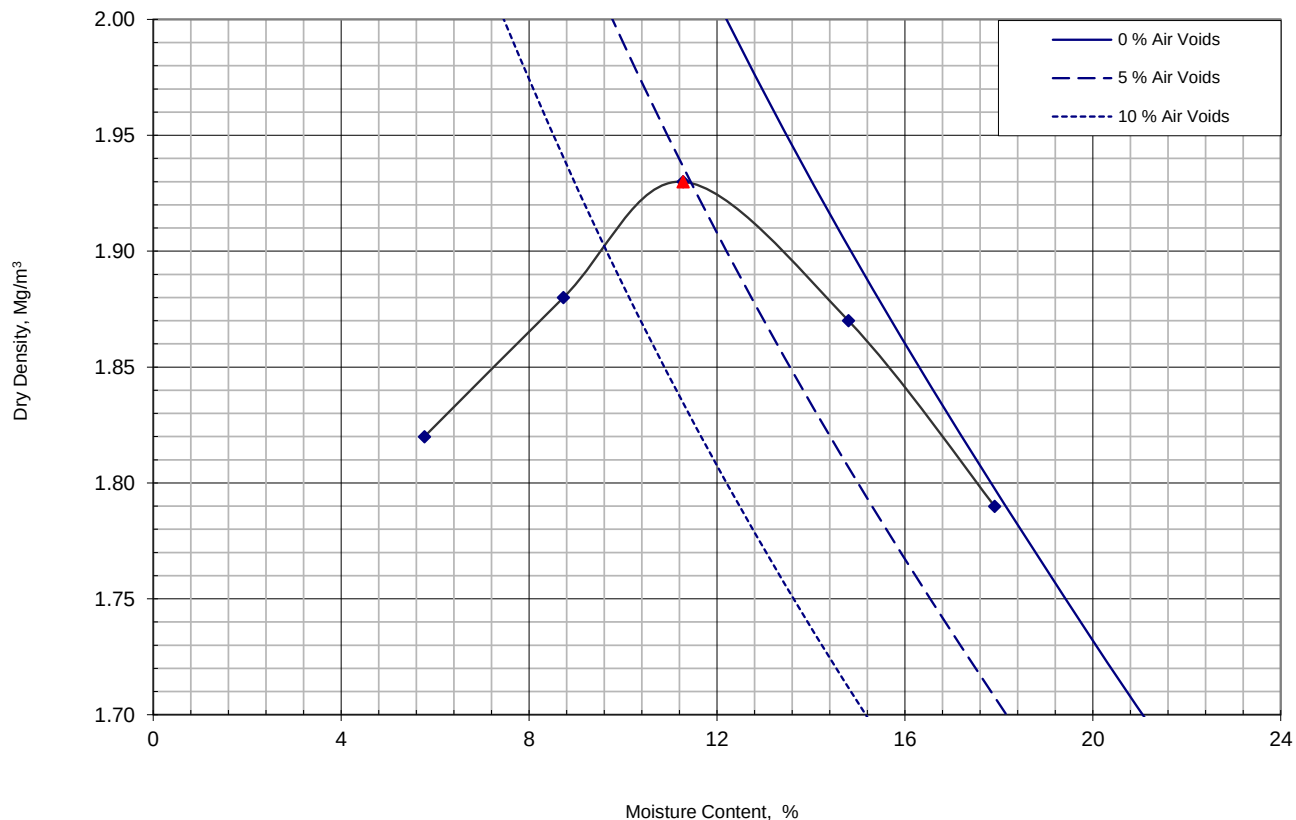
Initial Moisture Content	16	%
Maximum Dry Density	1.96	Mg/m ³
Optimum Moisture Content	10	%
Particle Density	2.65 Measured	Mg/m ³
Material Retained 37.5mm	90	%
Material Retained 20mm	3	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile A - Sample 04

Project Name	Swansea Bay	Sample No	
Date Tested	02/12/2023	Depth Top	
Compaction Method	2.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Brown slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5							
Moisture Content	5.8	8.7	11	15	18							
Bulk Density	1.92	2.04	2.15	2.15	2.11							
Dry Density	1.82	1.88	1.93	1.87	1.79							

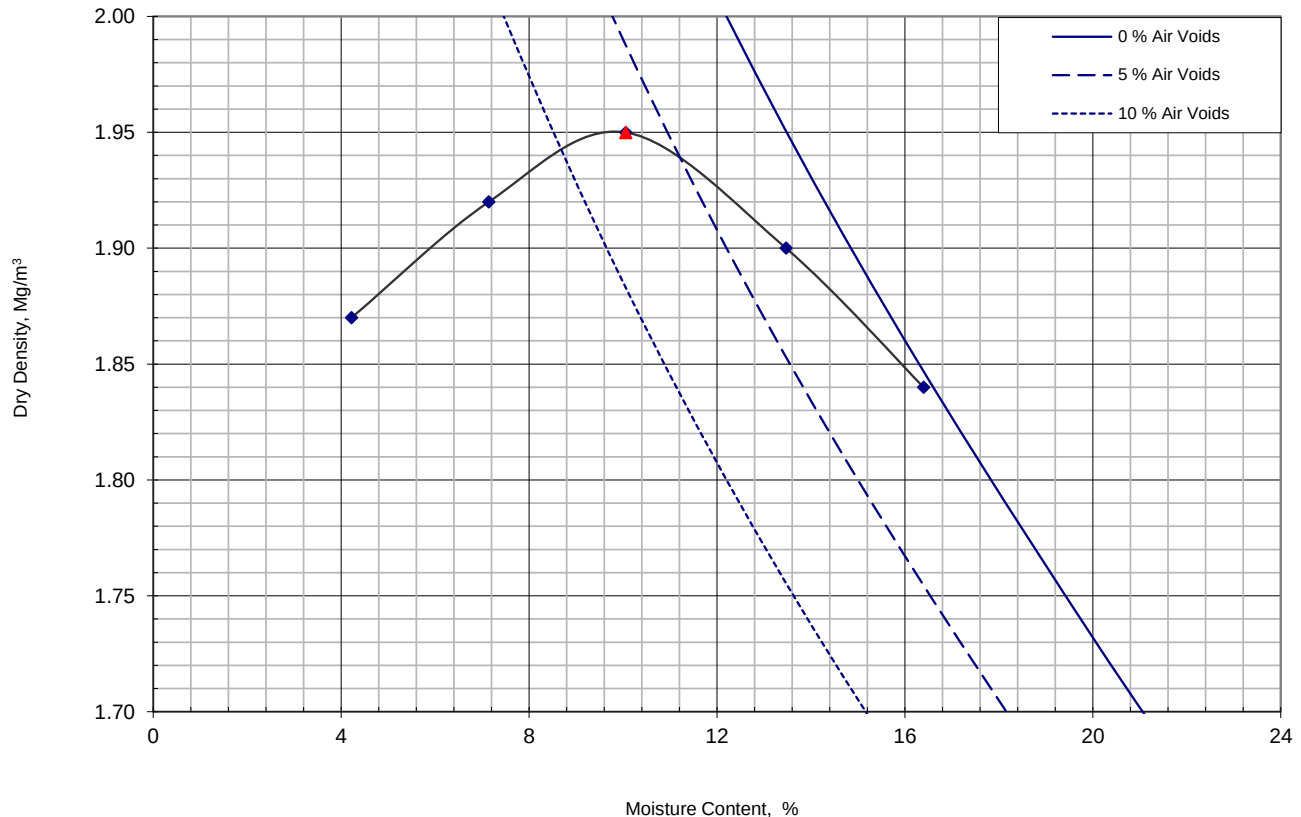
Initial Moisture Content	15	%
Maximum Dry Density	1.93	Mg/m ³
Optimum Moisture Content	11	%
Particle Density	2.65 Measured	Mg/m ³
Material Retained 37.5mm	69	%
Material Retained 20mm	18	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile A - Sample 05

Project Name	Swansea Bay	Sample No	
Date Tested	02/12/2023	Depth Top	
Compaction Method	2.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Brown slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5							
Moisture Content	4.2	7.1	10	13	16							
Bulk Density	1.95	2.06	2.15	2.16	2.14							
Dry Density	1.87	1.92	1.95	1.90	1.84							

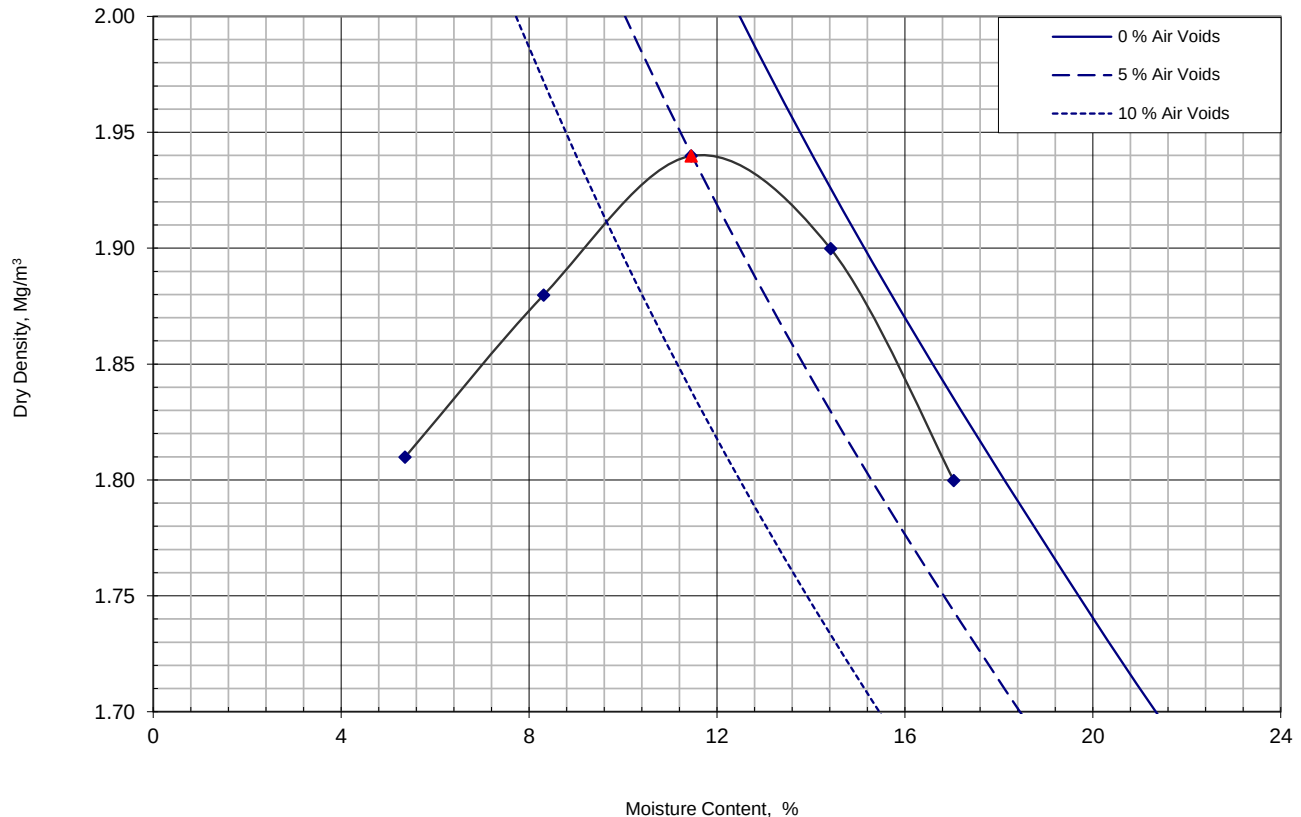
Initial Moisture Content	13	%
Maximum Dry Density	1.95	Mg/m ³
Optimum Moisture Content	10	%
Particle Density	2.65 Measured	Mg/m ³
Material Retained 37.5mm	48	%
Material Retained 20mm	16	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile A - Sample 06

Project Name	Swansea Bay	Sample No	
Date Tested	02/12/2023	Depth Top	
Compaction Method	2.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5							
Moisture Content	5.4	8.3	11	14	17							
Bulk Density	1.91	2.04	2.16	2.17	2.11							
Dry Density	1.81	1.88	1.94	1.90	1.80							

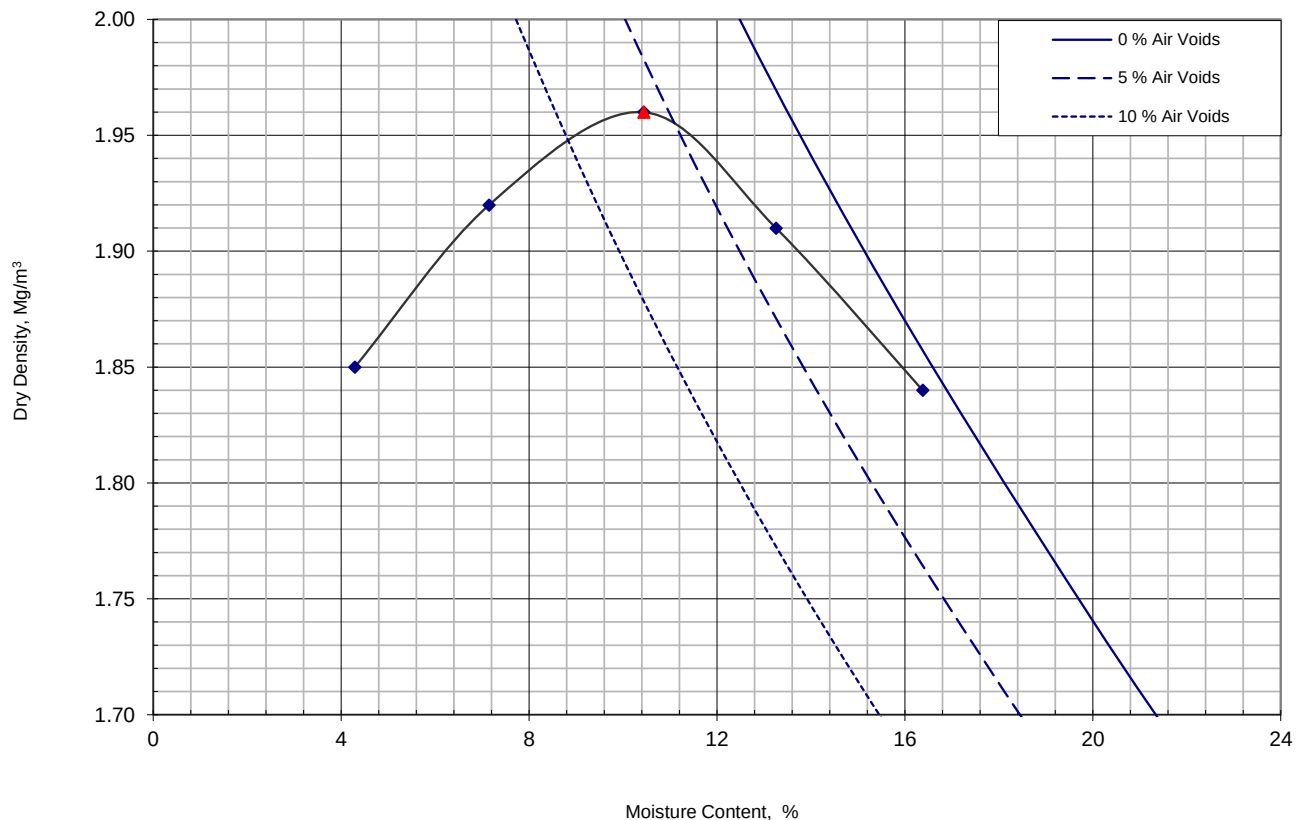
Initial Moisture Content	17	%
Maximum Dry Density	1.94	Mg/m ³
Optimum Moisture Content	11	%
Particle Density	2.67 Measured	Mg/m ³
Material Retained 37.5mm	27	%
Material Retained 20mm	38	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile B - Sample 01
Sample No	
Depth Top	
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	02/12/2023
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL



Compaction Point	1	2	3	4	5							
Moisture Content	4.3	7.2	10	13	16							
Bulk Density	1.93	2.06	2.16	2.16	2.14							
Dry Density	1.85	1.92	1.96	1.91	1.84							

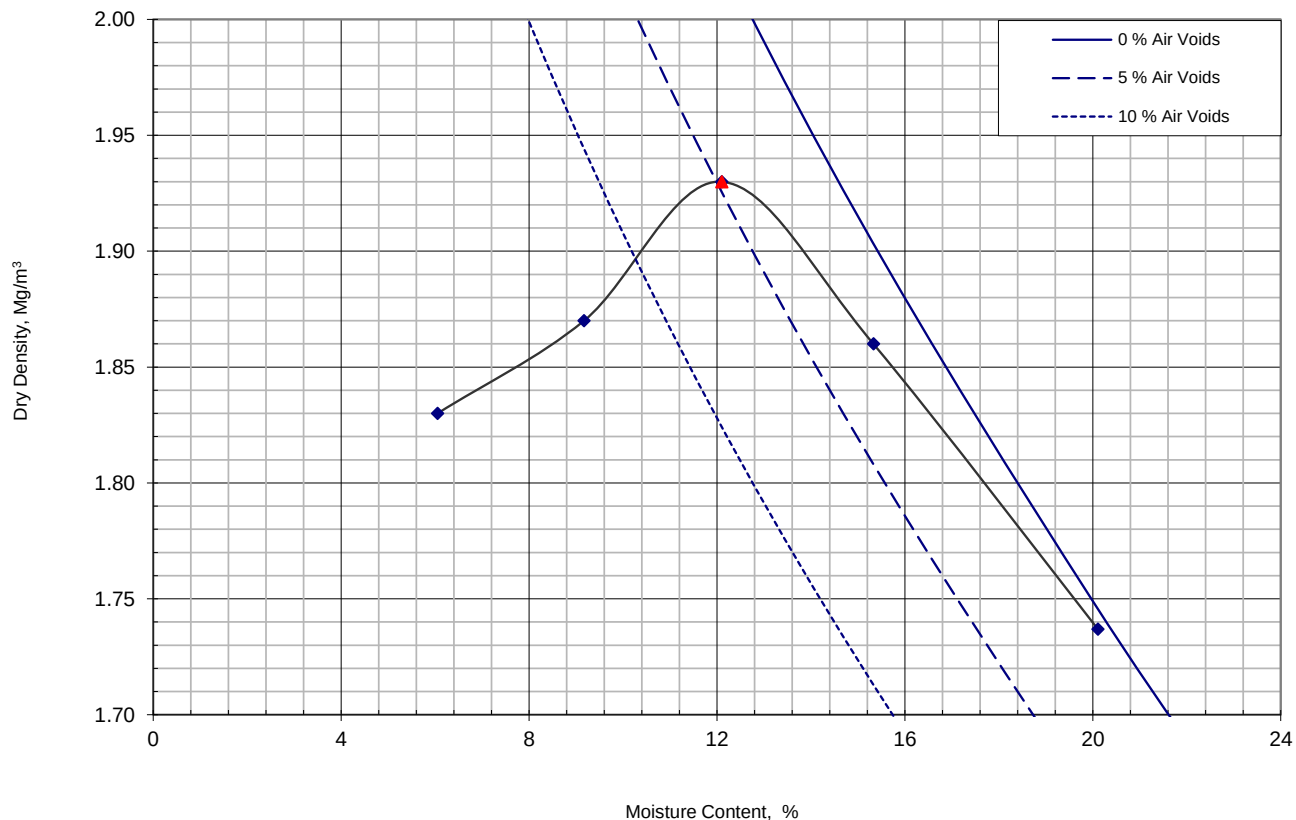
Initial Moisture Content	16	%
Maximum Dry Density	1.96	Mg/m ³
Optimum Moisture Content	10	%
Particle Density	2.67 Measured	Mg/m ³
Material Retained 37.5mm	31	%
Material Retained 20mm	26	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile B - Sample 02

Project Name	Swansea Bay	Sample No	
Date Tested	02/12/2023	Depth Top	
Compaction Method	2.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5							
Moisture Content	6.1	9.2	12	15	20							
Bulk Density	1.94	2.04	2.16	2.15	2.09							
Dry Density	1.83	1.87	1.93	1.86	1.74							

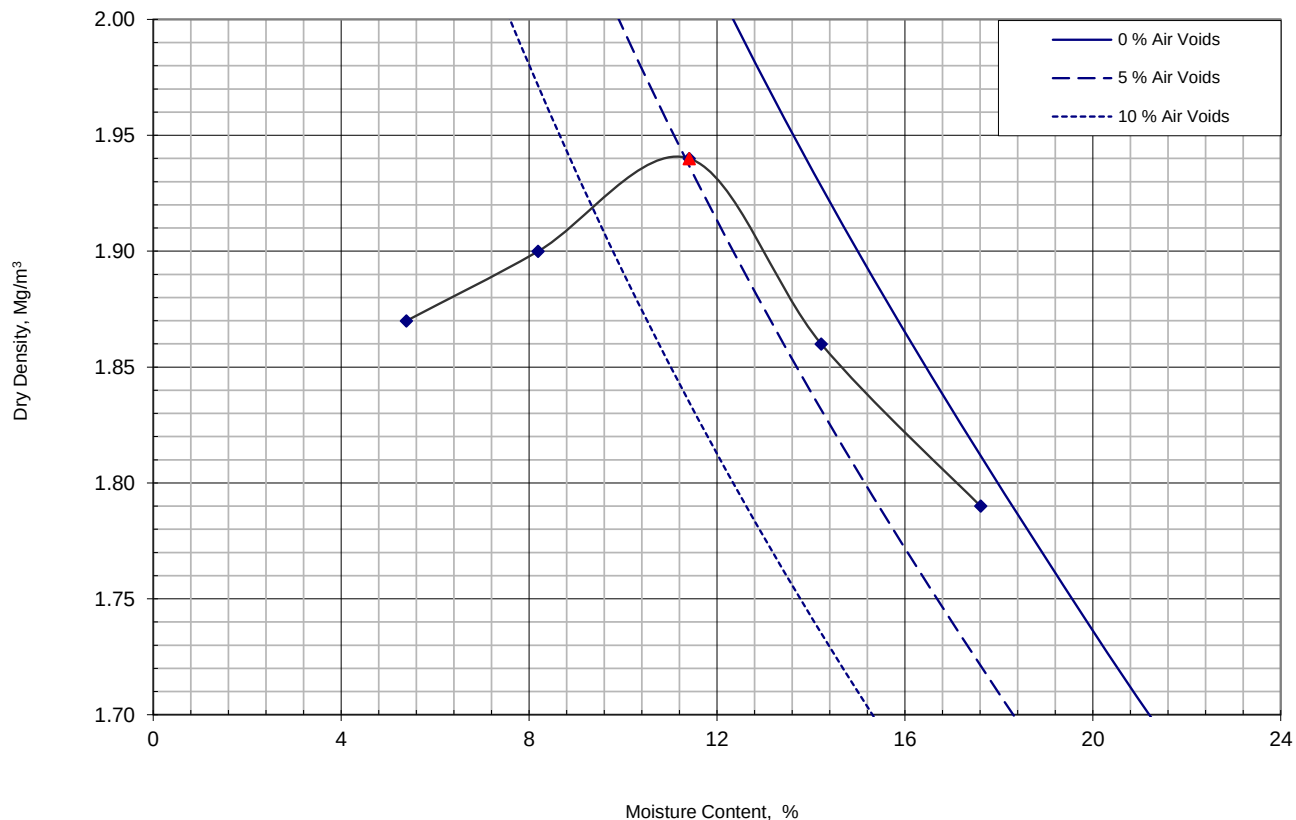
Initial Moisture Content	20	%
Maximum Dry Density	1.93	Mg/m ³
Optimum Moisture Content	12	%
Particle Density	2.69 Measured	Mg/m ³
Material Retained 37.5mm	11	%
Material Retained 20mm	30	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile C - Sample 01
Sample No	
Depth Top	
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	02/12/2023
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL



Compaction Point	1	2	3	4	5							
Moisture Content	5.4	8.2	11	14	18							
Bulk Density	1.97	2.06	2.16	2.12	2.11							
Dry Density	1.87	1.90	1.94	1.86	1.79							

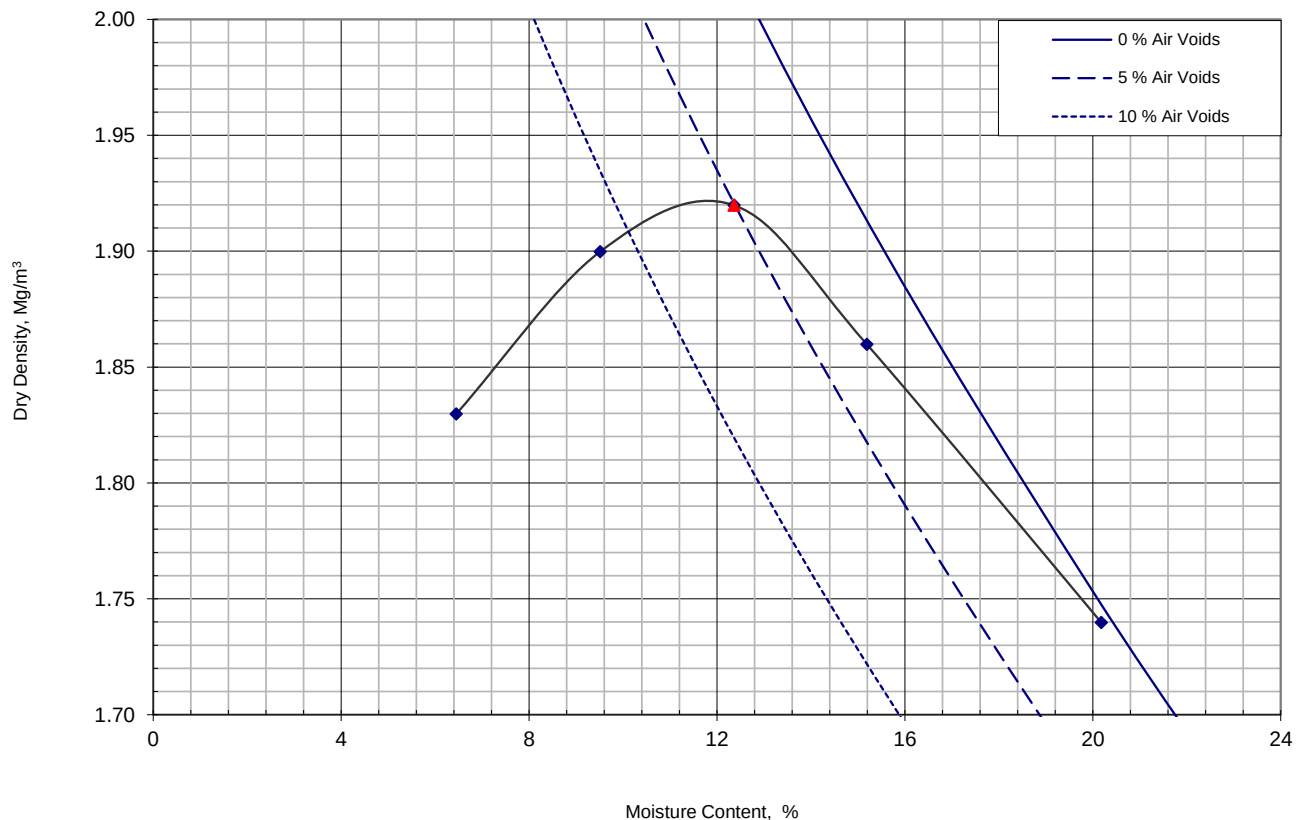
Initial Moisture Content	18	%
Maximum Dry Density	1.94	Mg/m3
Optimum Moisture Content	11	%
Particle Density	2.66 Measured	Mg/m3
Material Retained 37.5mm	40	%
Material Retained 20mm	24	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	69677
Borehole / Pit No	Stockpile C - Sample 02

Project Name	Swansea Bay	Sample No	
Date Tested	02/12/2023	Depth Top	
Compaction Method	2.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5							
Moisture Content	6.5	9.5	12	15	20							
Bulk Density	1.95	2.08	2.16	2.14	2.09							
Dry Density	1.83	1.90	1.92	1.86	1.74							

Initial Moisture Content	20	%
Maximum Dry Density	1.92	Mg/m ³
Optimum Moisture Content	12	%
Particle Density	2.7 Measured	Mg/m ³
Material Retained 37.5mm	18	%
Material Retained 20mm	14	%

Operator
Conor



Laboratory Report



Contract Number: 72545

Client Ref: **5151**

Client PO: **24127**

Date Received: **26-04-2024**

Date Completed: **18-05-2024**

Report Date: **18-05-2024**

Client: **PJA Civil Engineering Limited**

This report has been checked and approved by:

Contract Title: **Swansea Bay**

For the attention of: **Liam Clark**

Brendan Evans
Office Administrator

Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	9
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	9
Particle Density (Gas Jar) BS 1377:1990 - Part 2 : 8.2 - * UKAS	9
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	9
Dry Den/MC (2.5kg Rammer Method 1 litre mould/CBR Mould) BS 1377:1990 - Part 4 : 3.4 - * UKAS	9
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 test report/certificate shall not be reproduced except in full, without the approval of GEO Site & Testing Services Ltd. Any opinions or interpretations stated - within this report/certificate are excluded from the laboratories UKAS accreditation.

Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (HR & HSE Manager)

**NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND
PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.4 & 5.3)**

Contract Number	72545	
Project Name	Swansea Bay	
Date Tested	14/05/2024	
	DESCRIPTIONS	

[illegible]

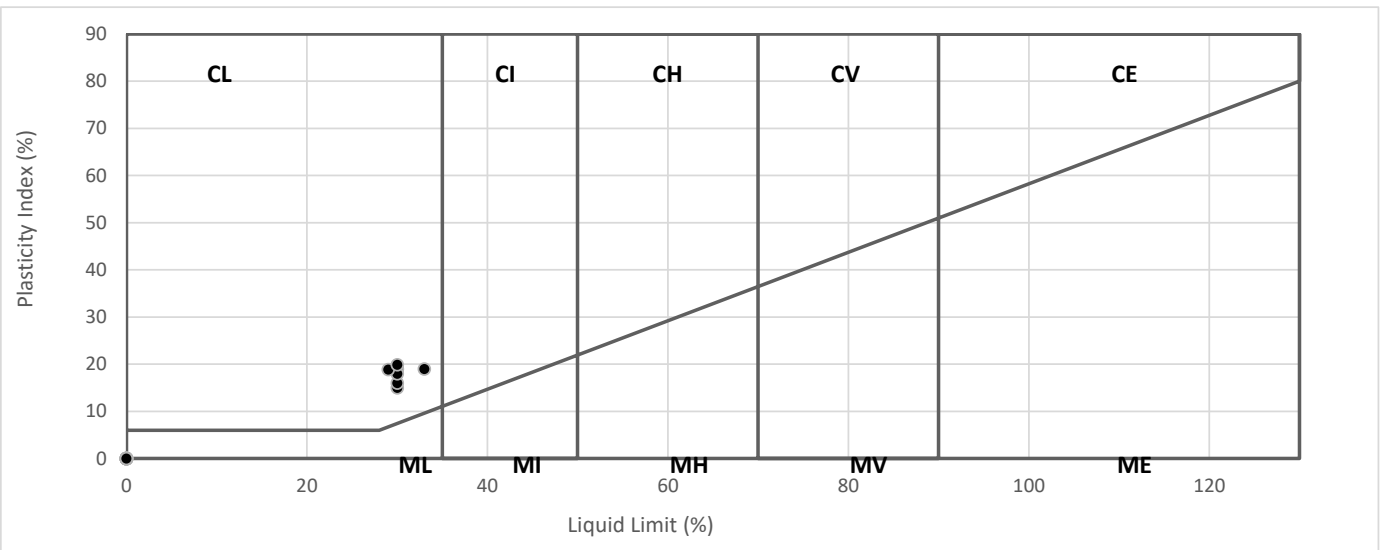
Operator
Aaron Hodge

Contract Number	72545	
Project Name	Swansea Bay	
Date Tested	14/05/2024	

[illegible]

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION BS 5930:2015+A1:2020



Operator
Aaron Hodge

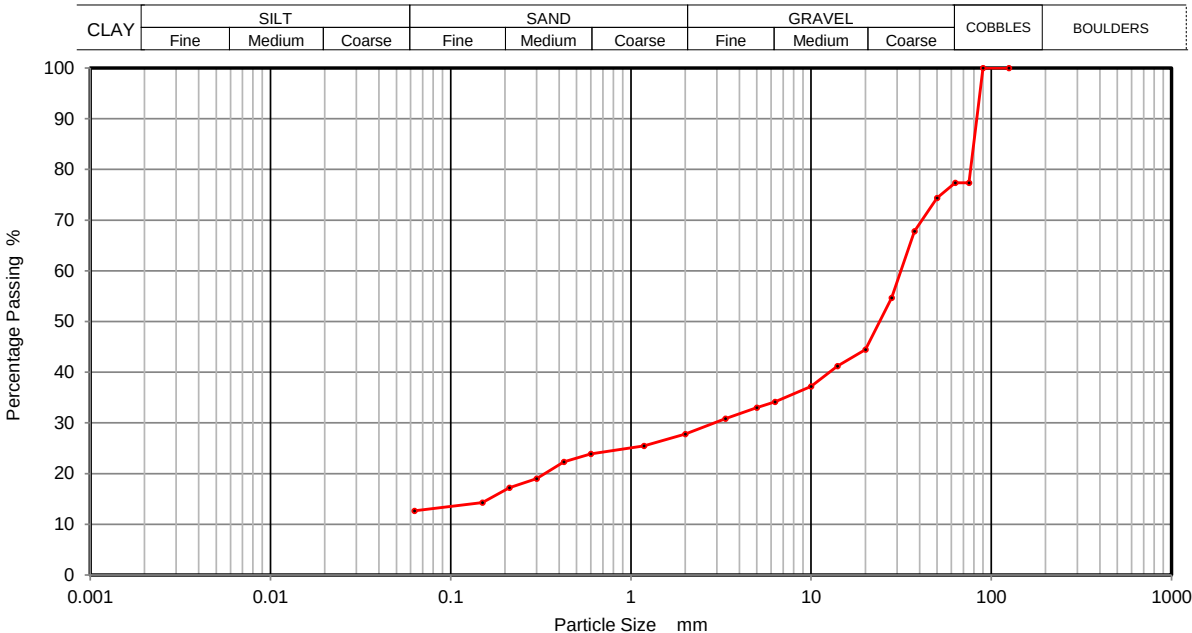




PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number	72545
Borehole/Pit No.	Stockpile D - Sample A
Sample No.	1
Depth Top	0.00
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)
Date Tested	15/05/2024



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	77		
63	77		
50	74		
37.5	68		
28	55		
20	44		
14	41		
10	37		
6.3	34		
5	33		
3.35	31		
2	28		
1.18	25		
0.6	24		
0.425	22		
0.3	19		
0.212	17		
0.15	14		
0.063	13		

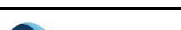
Sample Proportions	% dry mass
Cobbles	23
Gravel	49
Sand	15
Silt and Clay	13

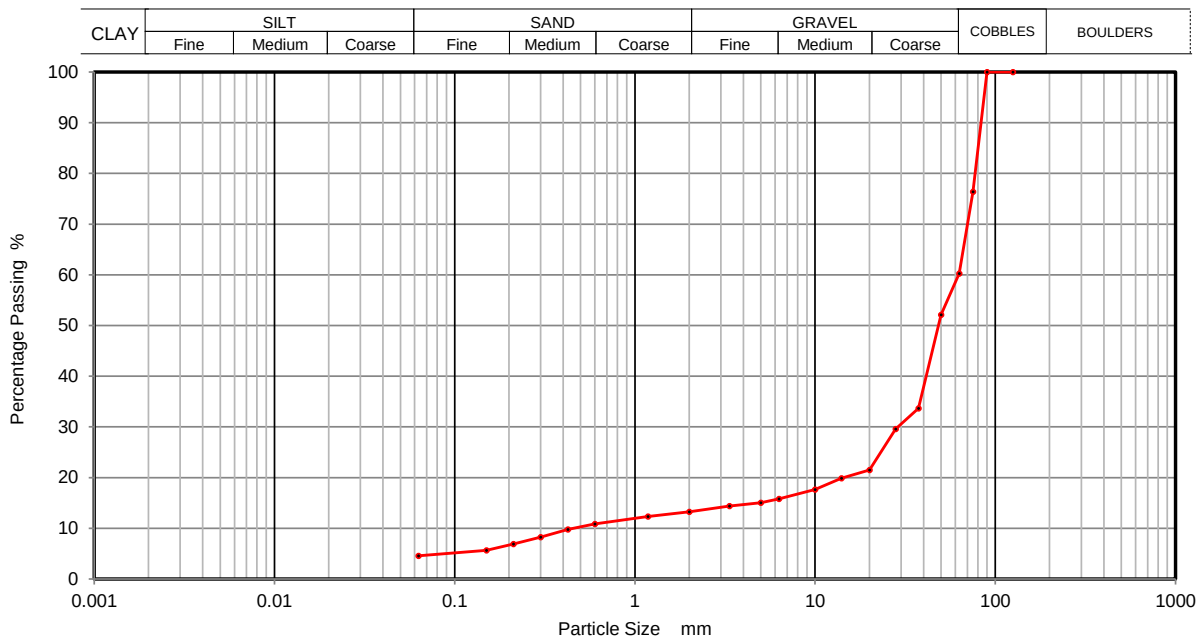
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas



**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

 GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	72545
		Borehole/Pit No.	Stockpile E - Sample A
Project Name	Swansea Bay	Sample No.	2
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	0.00
		Depth Base	
Date Tested	15/05/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	76		
63	60		
50	52		
37.5	34		
28	30		
20	22		
14	20		
10	18		
6.3	16		
5	15		
3.35	14		
2	13		
1.18	12		
0.6	11		
0.425	10		
0.3	8		
0.212	7		
0.15	6		
0.063	5		

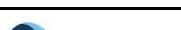
Sample Proportions	% dry mass
Cobbles	40
Gravel	47
Sand	8
Silt and Clay	5

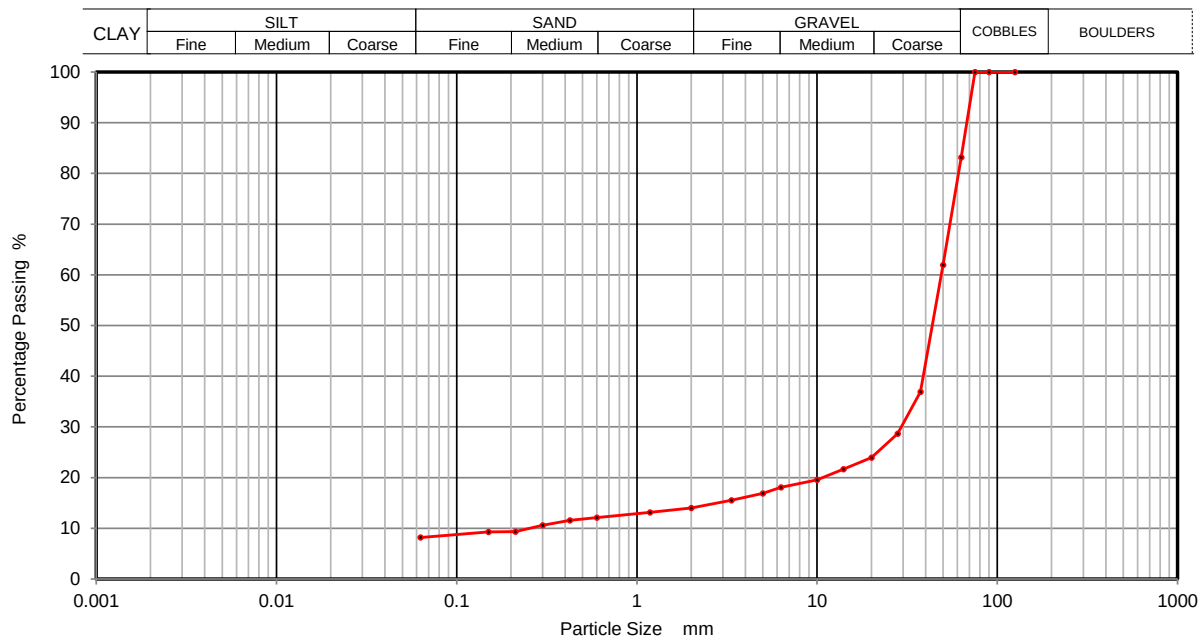
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	72545
		Borehole/Pit No.	Stockpile E - Sample B
Project Name	Swansea Bay	Sample No.	3
Soil Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (with cobbles)	Depth Top	0.00
		Depth Base	
Date Tested	15/05/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	83		
50	62		
37.5	37		
28	29		
20	24		
14	22		
10	20		
6.3	18		
5	17		
3.35	16		
2	14		
1.18	13		
0.6	12		
0.425	12		
0.3	11		
0.212	9		
0.15	9		
0.063	8		

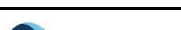
Sample Proportions	% dry mass
Cobbles	17
Gravel	69
Sand	6
Silt and Clay	8

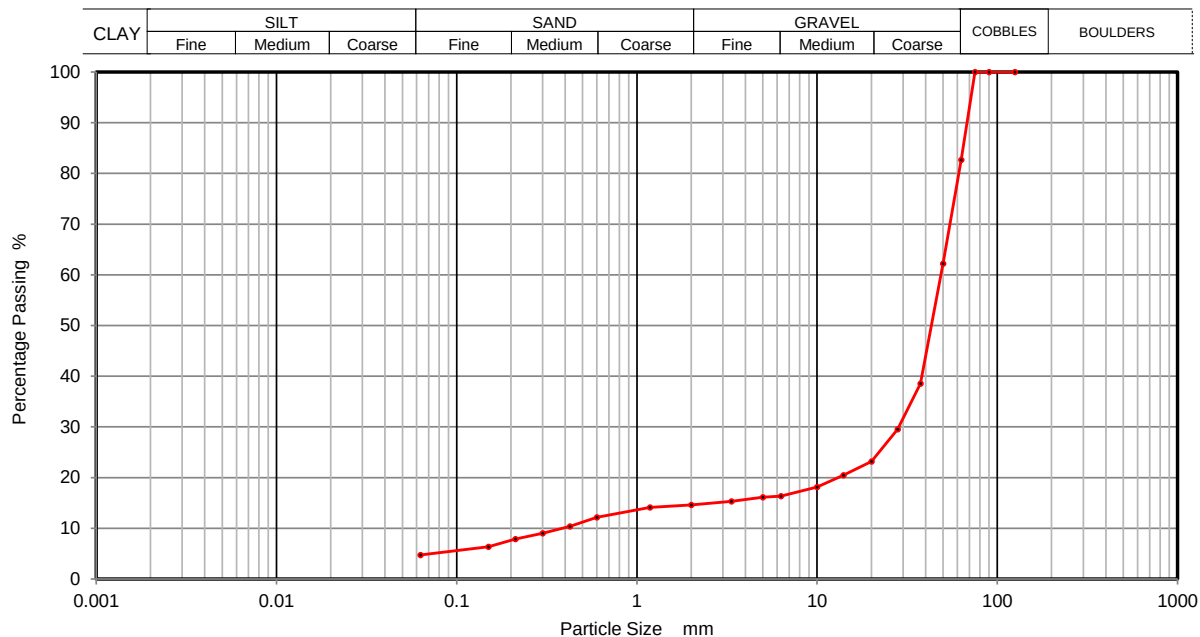
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	72545
		Borehole/Pit No.	Stockpile F - Sample A
Project Name	Swansea Bay	Sample No.	4
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	0.00
		Depth Base	
Date Tested	15/05/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	83		
50	62		
37.5	39		
28	30		
20	23		
14	20		
10	18		
6.3	16		
5	16		
3.35	15		
2	15		
1.18	14		
0.6	12		
0.425	10		
0.3	9		
0.212	8		
0.15	6		
0.063	5		

Sample Proportions	% dry mass
Cobbles	17
Gravel	68
Sand	10
Silt and Clay	5

Remarks
Preparation and testing in accordance with BS1377 unless noted below

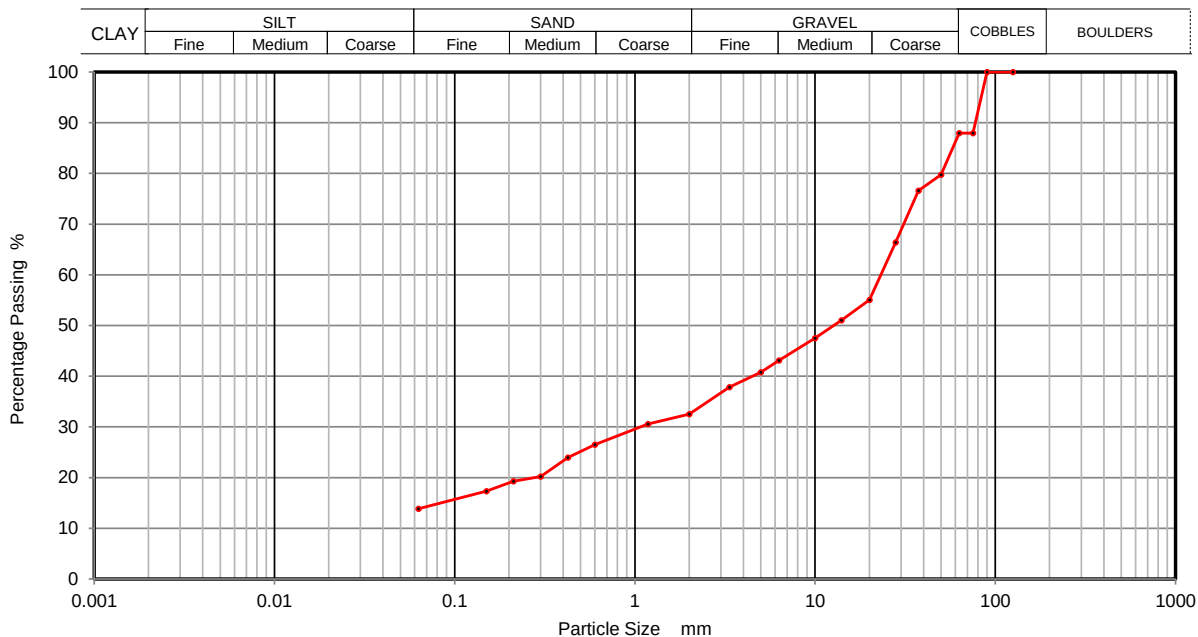
Operator
Cameron Thomas



PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number	72545
Borehole/Pit No.	Stockpile F - Sample B
Sample No.	5
Depth Top	0.00
Depth Base	
Sample Type	B

Project Name	Swansea Bay
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)
Date Tested	15/05/2024



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	88		
63	88		
50	80		
37.5	77		
28	66		
20	55		
14	51		
10	47		
6.3	43		
5	41		
3.35	38		
2	32		
1.18	31		
0.6	27		
0.425	24		
0.3	20		
0.212	19		
0.15	17		
0.063	14		

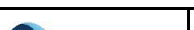
Sample Proportions	% dry mass
Cobbles	12
Gravel	56
Sand	18
Silt and Clay	14

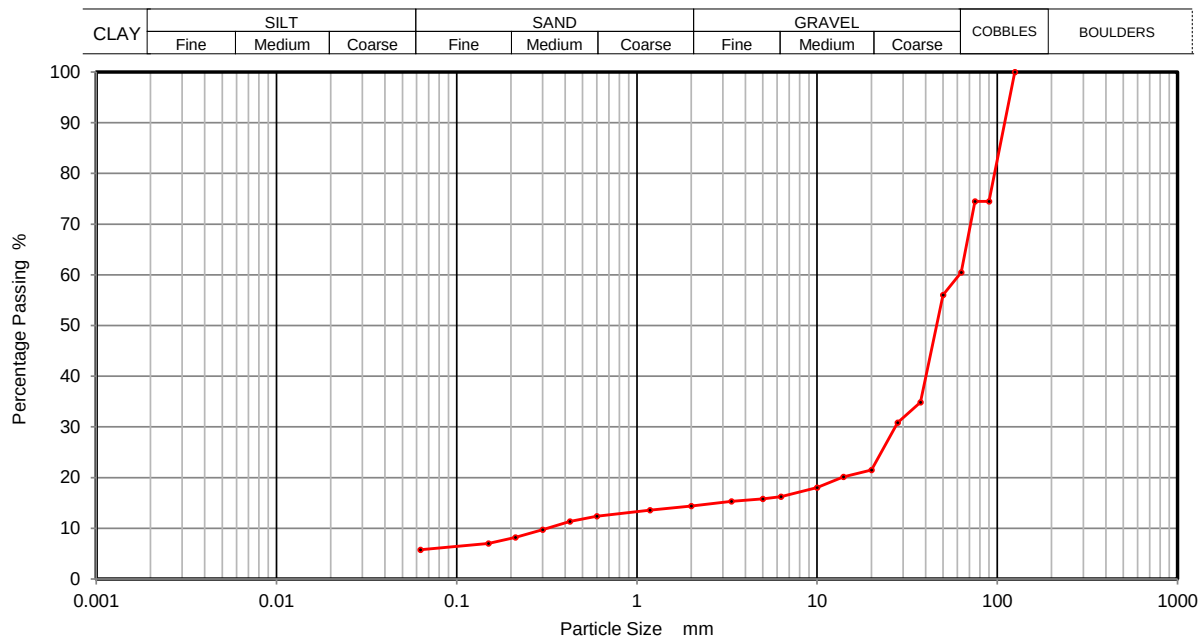
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas



**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	72545
		Borehole/Pit No.	Stockpile F - Sample C
Project Name	Swansea Bay	Sample No.	6
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	0.00
		Depth Base	
Date Tested	15/05/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	74		
75	74		
63	60		
50	56		
37.5	35		
28	31		
20	22		
14	20		
10	18		
6.3	16		
5	16		
3.35	15		
2	14		
1.18	14		
0.6	12		
0.425	11		
0.3	10		
0.212	8		
0.15	7		
0.063	6		

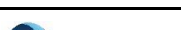
Sample Proportions	% dry mass
Cobbles	40
Gravel	46
Sand	8
Silt and Clay	6

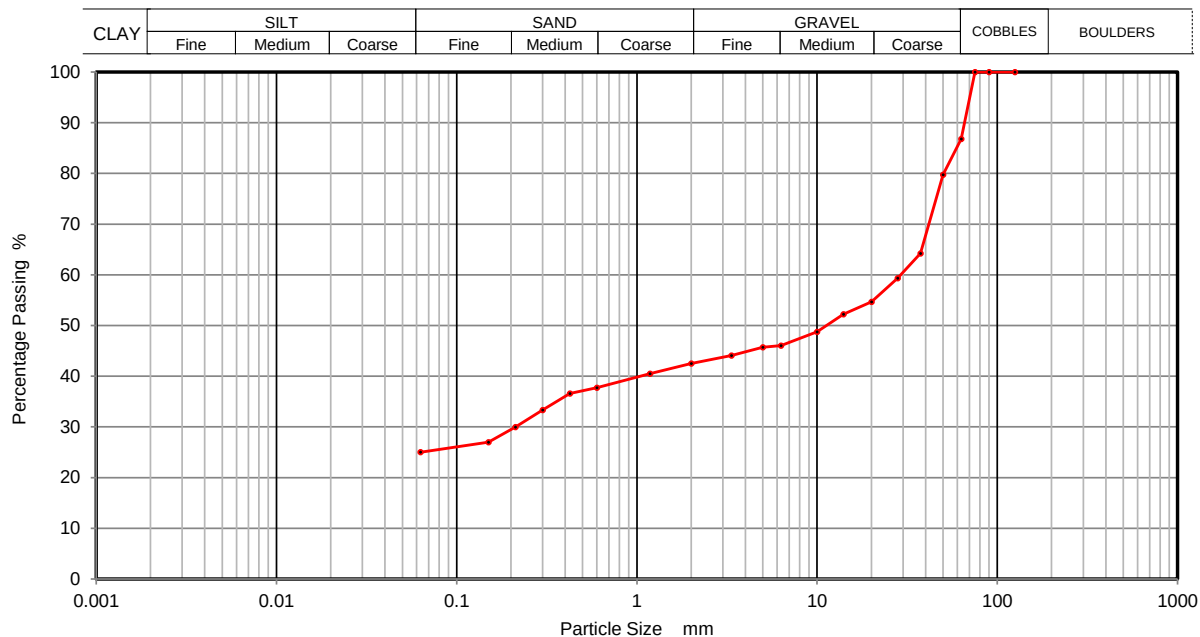
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	72545
		Borehole/Pit No.	Stockpile F - Sample D
Project Name	Swansea Bay	Sample No.	7
Soil Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (with cobbles)	Depth Top	0.00
		Depth Base	
Date Tested	15/05/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	87		
50	80		
37.5	64		
28	59		
20	55		
14	52		
10	49		
6.3	46		
5	46		
3.35	44		
2	42		
1.18	41		
0.6	38		
0.425	37		
0.3	33		
0.212	30		
0.15	27		
0.063	25		

Sample Proportions	% dry mass
Cobbles	13
Gravel	45
Sand	17
Silt and Clay	25

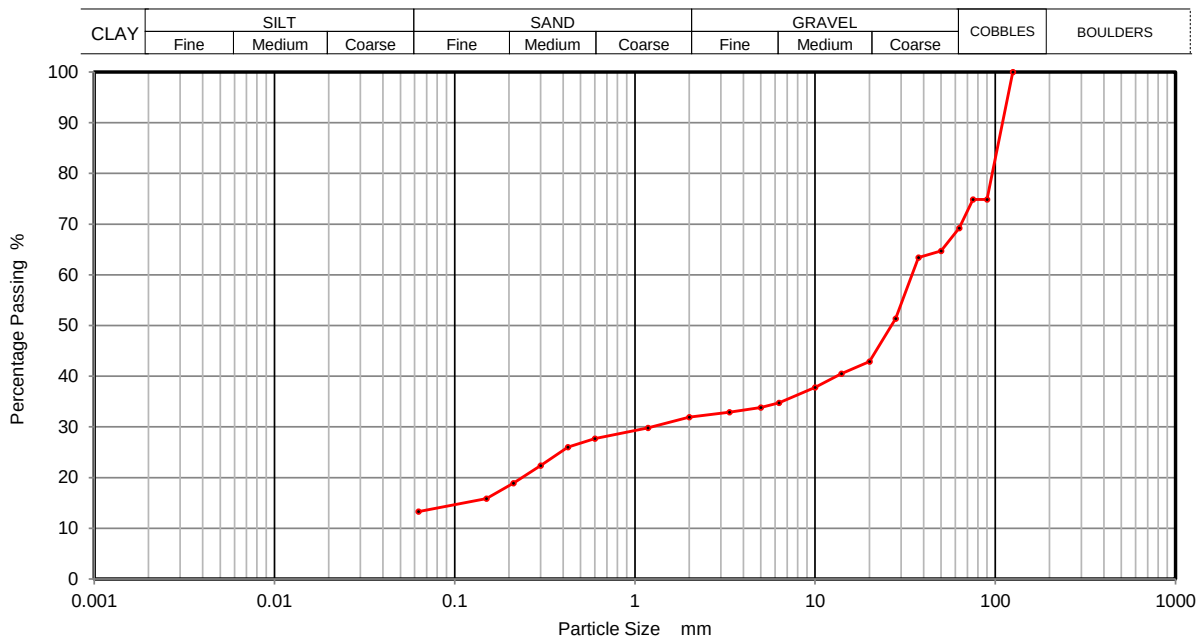
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	72545
		Borehole/Pit No.	Stockpile G - Sample A
Project Name	Swansea Bay	Sample No.	8
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	0.00
		Depth Base	
Date Tested	15/05/2024	Sample Type	B



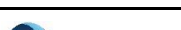
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	75		
75	75		
63	69		
50	65		
37.5	63		
28	51		
20	43		
14	41		
10	38		
6.3	35		
5	34		
3.35	33		
2	32		
1.18	30		
0.6	28		
0.425	26		
0.3	22		
0.212	19		
0.15	16		
0.063	13		

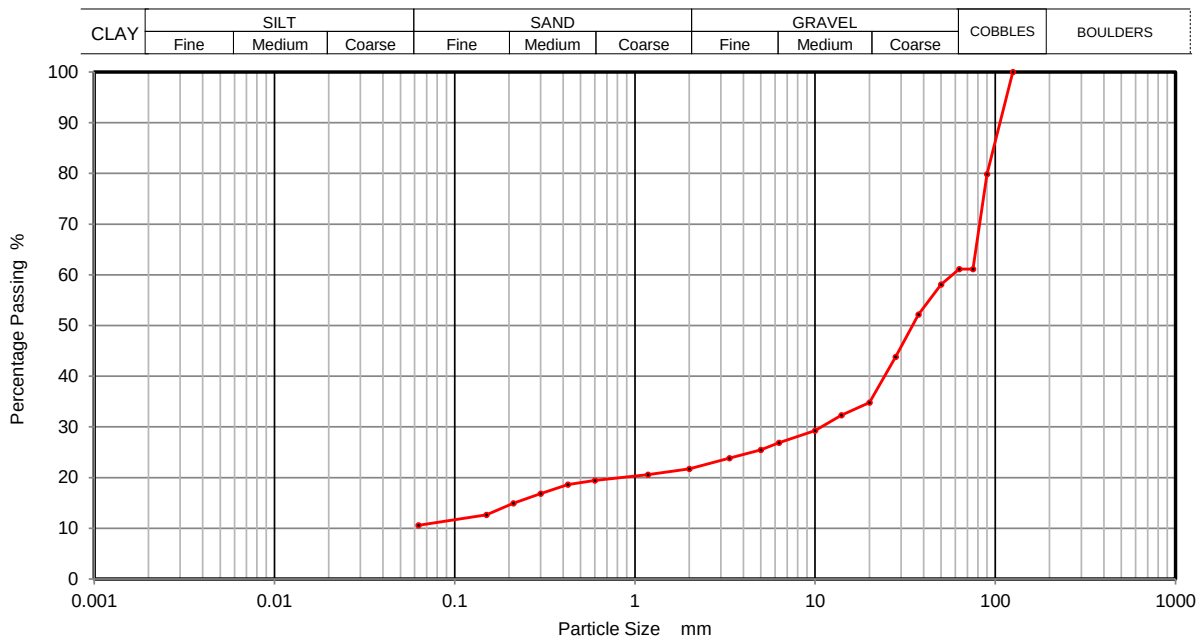
Sample Proportions	% dry mass
Cobbles	31
Gravel	37
Sand	19
Silt and Clay	13

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	72545
		Borehole/Pit No.	Stockpile G - Sample B
Project Name	Swansea Bay	Sample No.	9
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	0.00
		Depth Base	
Date Tested	15/05/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	80		
75	61		
63	61		
50	58		
37.5	52		
28	44		
20	35		
14	32		
10	29		
6.3	27		
5	25		
3.35	24		
2	22		
1.18	21		
0.6	19		
0.425	19		
0.3	17		
0.212	15		
0.15	13		
0.063	11		

Sample Proportions	% dry mass
Cobbles	39
Gravel	39
Sand	11
Silt and Clay	11

Remarks

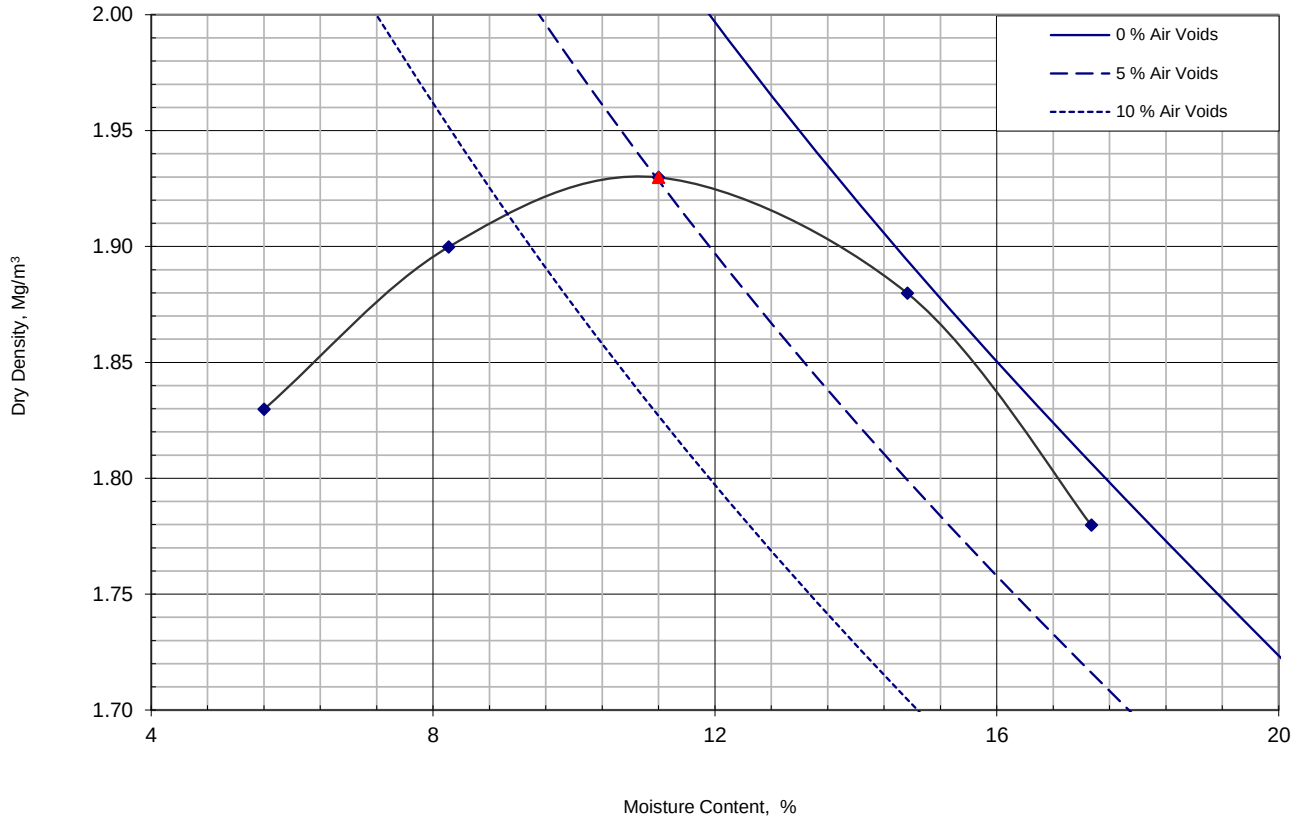
Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	72545
Borehole / Pit No	Stockpile D - Sample A
Sample No	1
Depth Top	0.00
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	15/05/2024
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)



Compaction Point	1	2	3	4	5							
Moisture Content	5.6	8.2	11	15	17							
Bulk Density	1.93	2.06	2.15	2.16	2.09							
Dry Density	1.83	1.90	1.93	1.88	1.78							

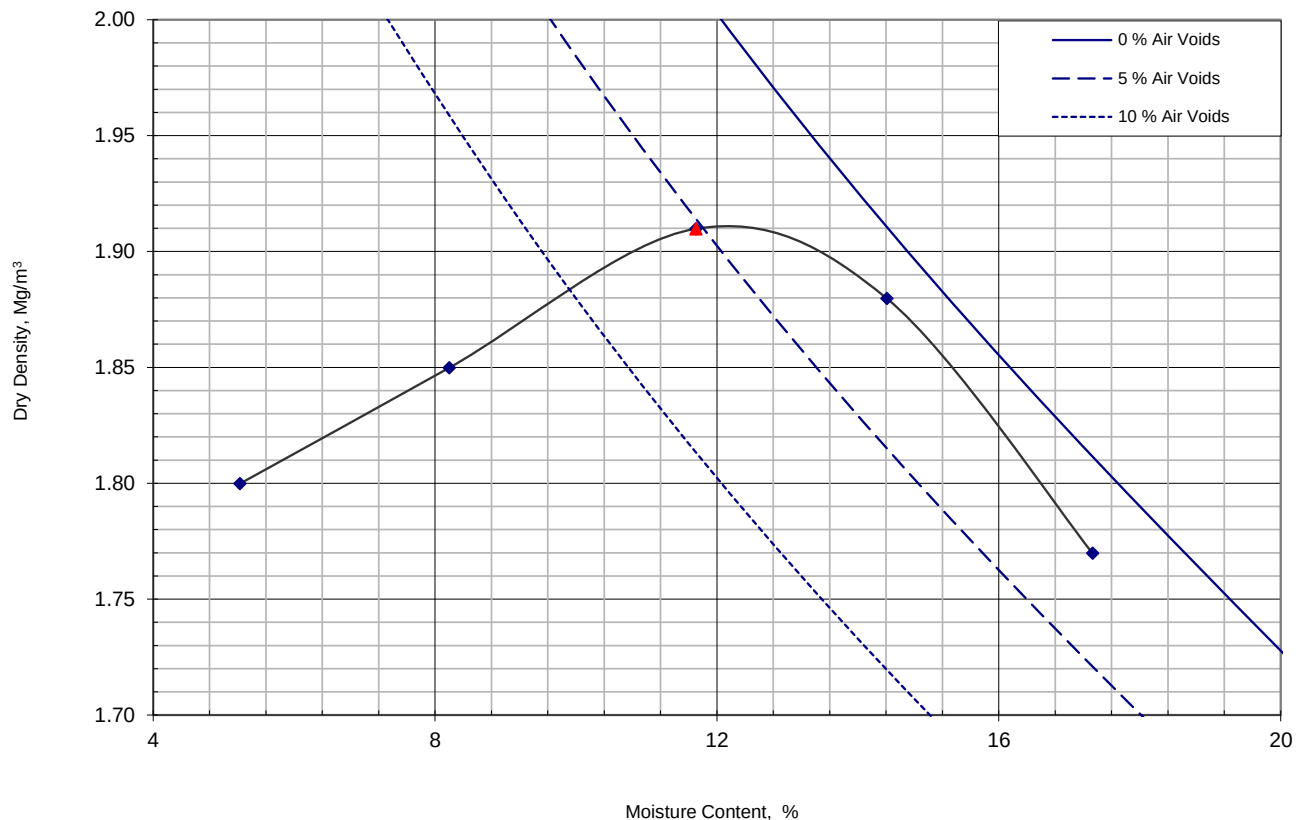
Initial Moisture Content	15	%
Maximum Dry Density	1.93	Mg/m3
Optimum Moisture Content	11	%
Particle Density	2.63 Measured	Mg/m3
Material Retained 37.5mm	32	%
Material Retained 20mm	24	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	72545
Borehole / Pit No	Stockpile E - Sample A
Sample No	2
Depth Top	0.00
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	15/05/2024
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)



Compaction Point	1	2	3	4	5							
Moisture Content	5.2	8.2	12	14	17							
Bulk Density	1.89	2.00	2.13	2.15	2.08							
Dry Density	1.80	1.85	1.91	1.88	1.77							

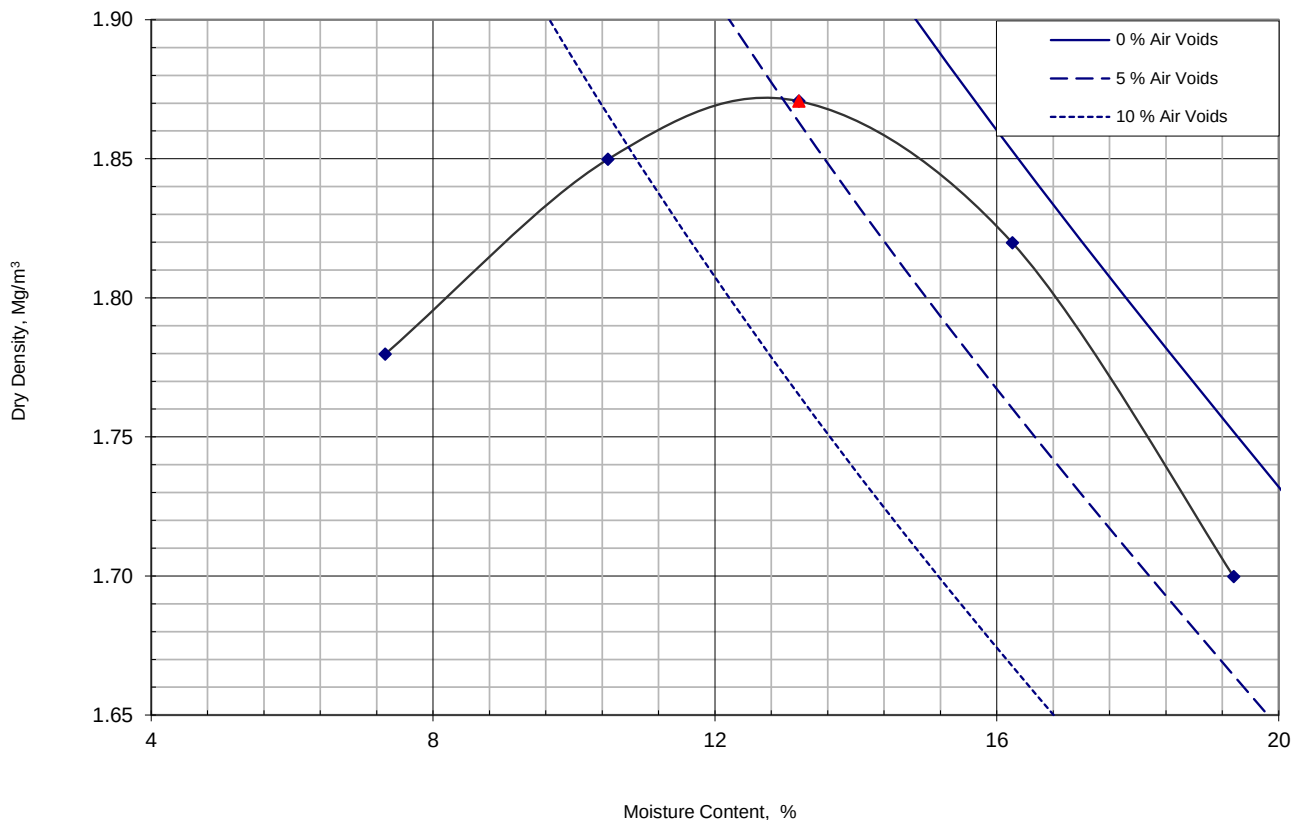
Initial Moisture Content	12	%
Maximum Dry Density	1.91	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.64 Measured	Mg/m3
Material Retained 37.5mm	66	%
Material Retained 20mm	12	%

Operator
Conor

Dry Density / Moisture Content Relationship BS 1377:Part 4:1990

Contract Number	72545
Borehole / Pit No	Stockpile E - Sample B
Sample No	3
Depth Top	0.00
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	15/05/2024
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (withcobbles)



Compaction Point	1	2	3	4	5							
Moisture Content	7.3	10	13	16	19							
Bulk Density	1.91	2.04	2.12	2.11	2.03							
Dry Density	1.78	1.85	1.87	1.82	1.70							

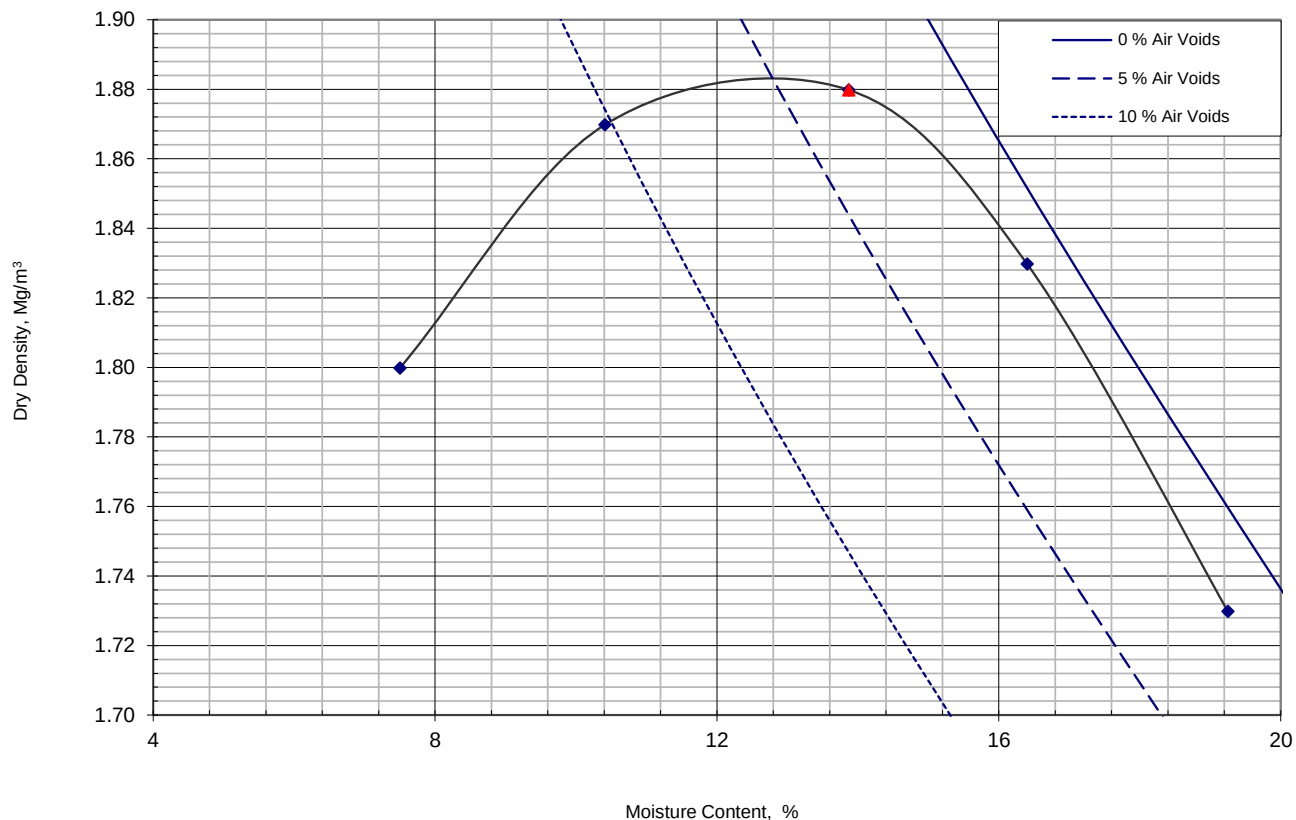
Initial Moisture Content	13	%
Maximum Dry Density	1.87	Mg/m3
Optimum Moisture Content	13	%
Particle Density	2.65 Measured	Mg/m3
Material Retained 37.5mm	63	%
Material Retained 20mm	13	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	72545
Borehole / Pit No	Stockpile F - Sample A
Sample No	4
Depth Top	0.00
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	15/05/2024
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (withcobbles)



Compaction Point	1	2	3	4	5							
Moisture Content	7.5	10	14	16	19							
Bulk Density	1.93	2.06	2.14	2.13	2.06							
Dry Density	1.80	1.87	1.88	1.83	1.73							

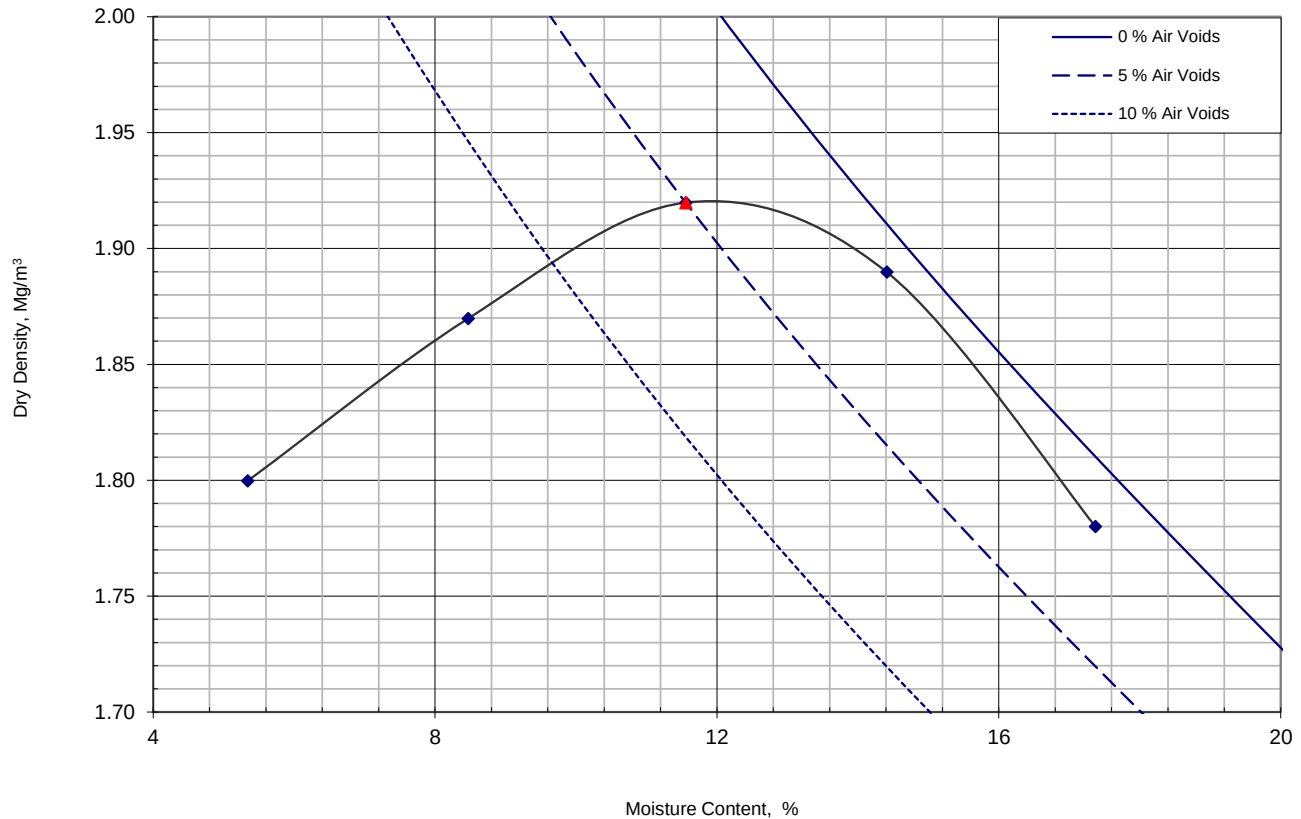
Initial Moisture Content	14	%
Maximum Dry Density	1.88	Mg/m ³
Optimum Moisture Content	14	%
Particle Density	2.66 Measured	Mg/m ³
Material Retained 37.5mm	61	%
Material Retained 20mm	16	%

Operator	
Conor	

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	72545
Borehole / Pit No	Stockpile F - Sample B
Sample No	5
Depth Top	0.00
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	15/05/2024
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)



Compaction Point	1	2	3	4	5							
Moisture Content	5.3	8.5	12	14	17							
Bulk Density	1.90	2.03	2.14	2.16	2.09							
Dry Density	1.80	1.87	1.92	1.89	1.78							

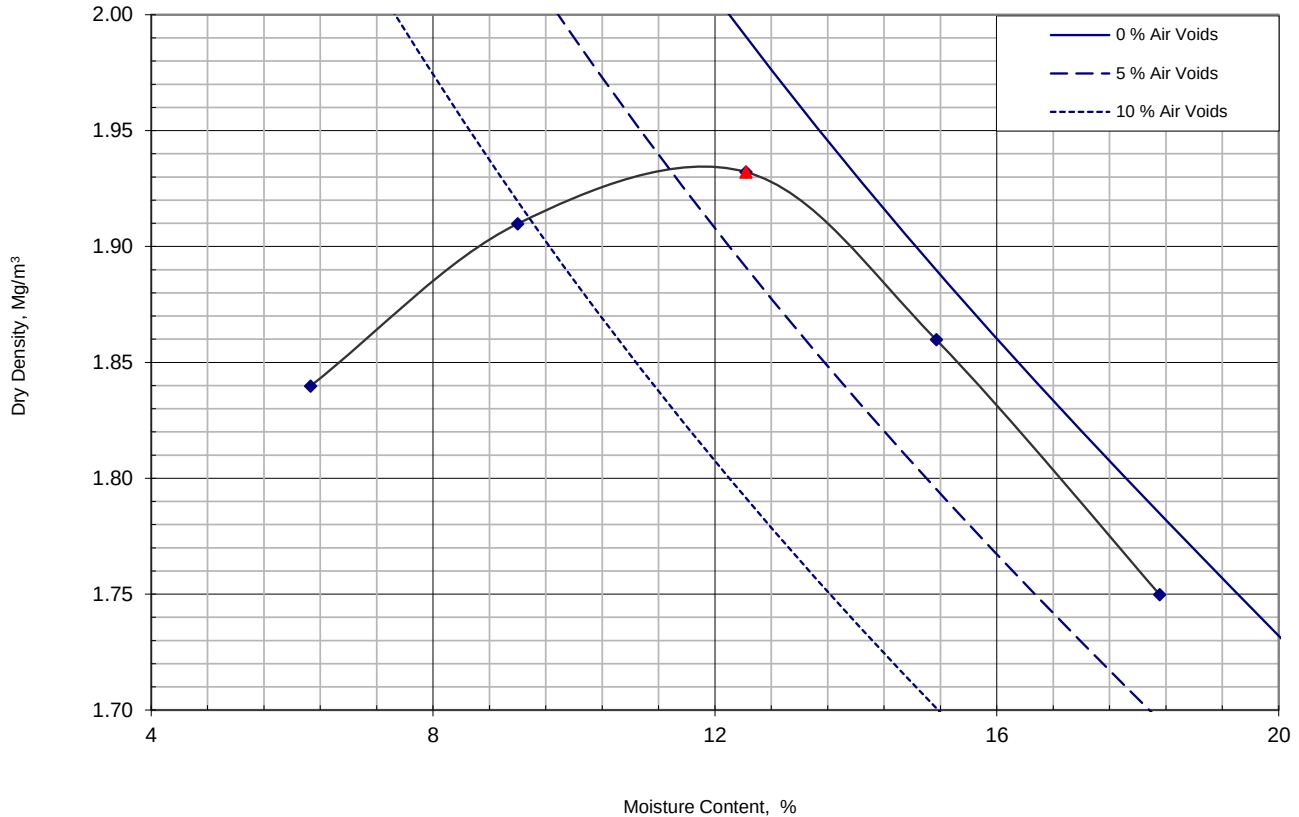
Initial Moisture Content	12	%
Maximum Dry Density	1.92	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.64 Measured	Mg/m3
Material Retained 37.5mm	23	%
Material Retained 20mm	22	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	72545
Borehole / Pit No	Stockpile F - Sample C
Sample No	6
Depth Top	0.00
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	15/05/2024
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)



Compaction Point	1	2	3	4	5							
Moisture Content	6.3	9.2	12	15	18							
Bulk Density	1.95	2.09	2.17	2.14	2.07							
Dry Density	1.84	1.91	1.93	1.86	1.75							

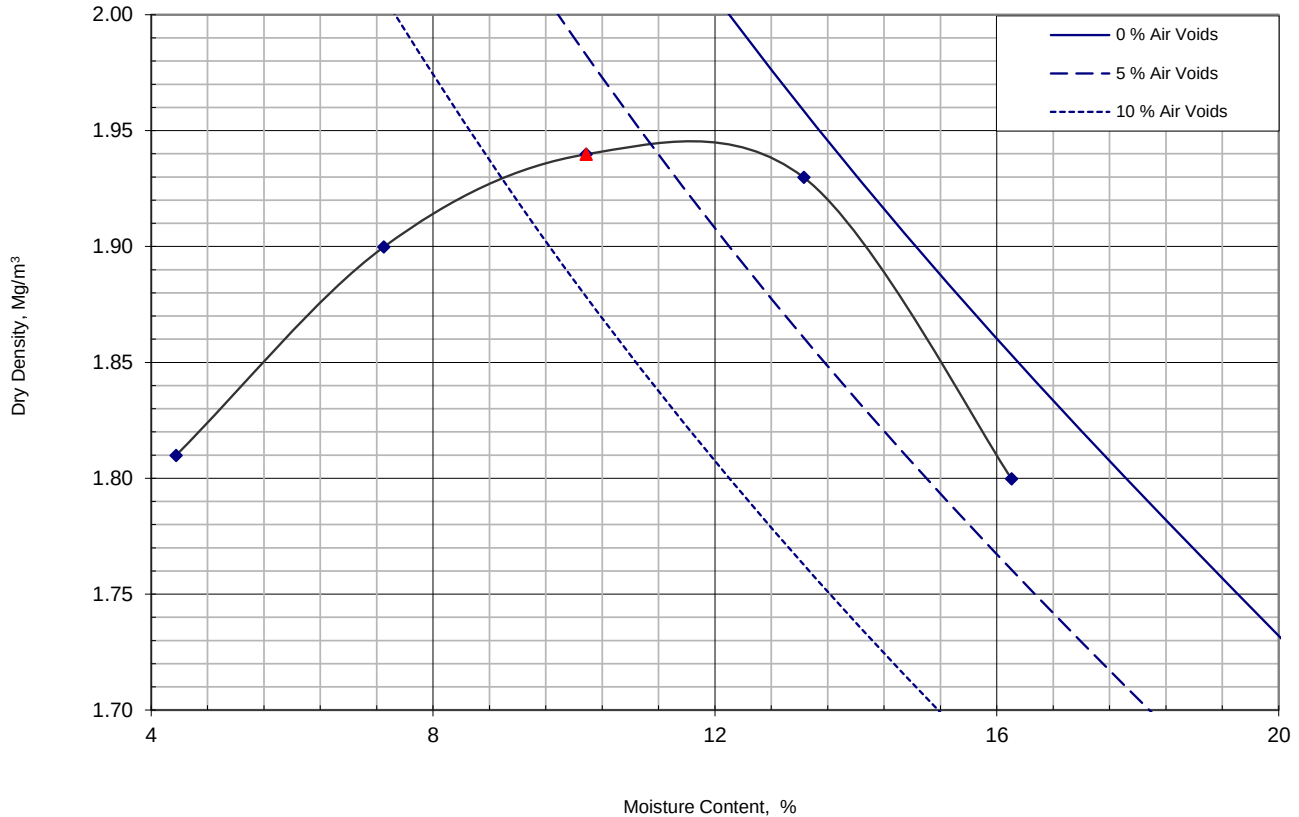
Initial Moisture Content	12	%
Maximum Dry Density	1.93	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.65 Measured	Mg/m3
Material Retained 37.5mm	65	%
Material Retained 20mm	13	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	72545
Borehole / Pit No	Stockpile F - Sample D
Sample No	7
Depth Top	0.00
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	15/05/2024
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (with cobbles)



Compaction Point	1	2	3	4	5							
Moisture Content	4.4	7.3	10	13	16							
Bulk Density	1.89	2.04	2.14	2.19	2.09							
Dry Density	1.81	1.90	1.94	1.93	1.80							

Initial Moisture Content	13	%
Maximum Dry Density	1.94	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Measured	Mg/m3
Material Retained 37.5mm	36	%
Material Retained 20mm	9	%

Operator
Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number 72545

Borehole / Pit No Stockpile G - Sample A

Project Name Swansea Bay

Sample No 8

Date Tested 15/05/2024

Depth Top 0.00

Compaction Method 2.5 Kg Rammer

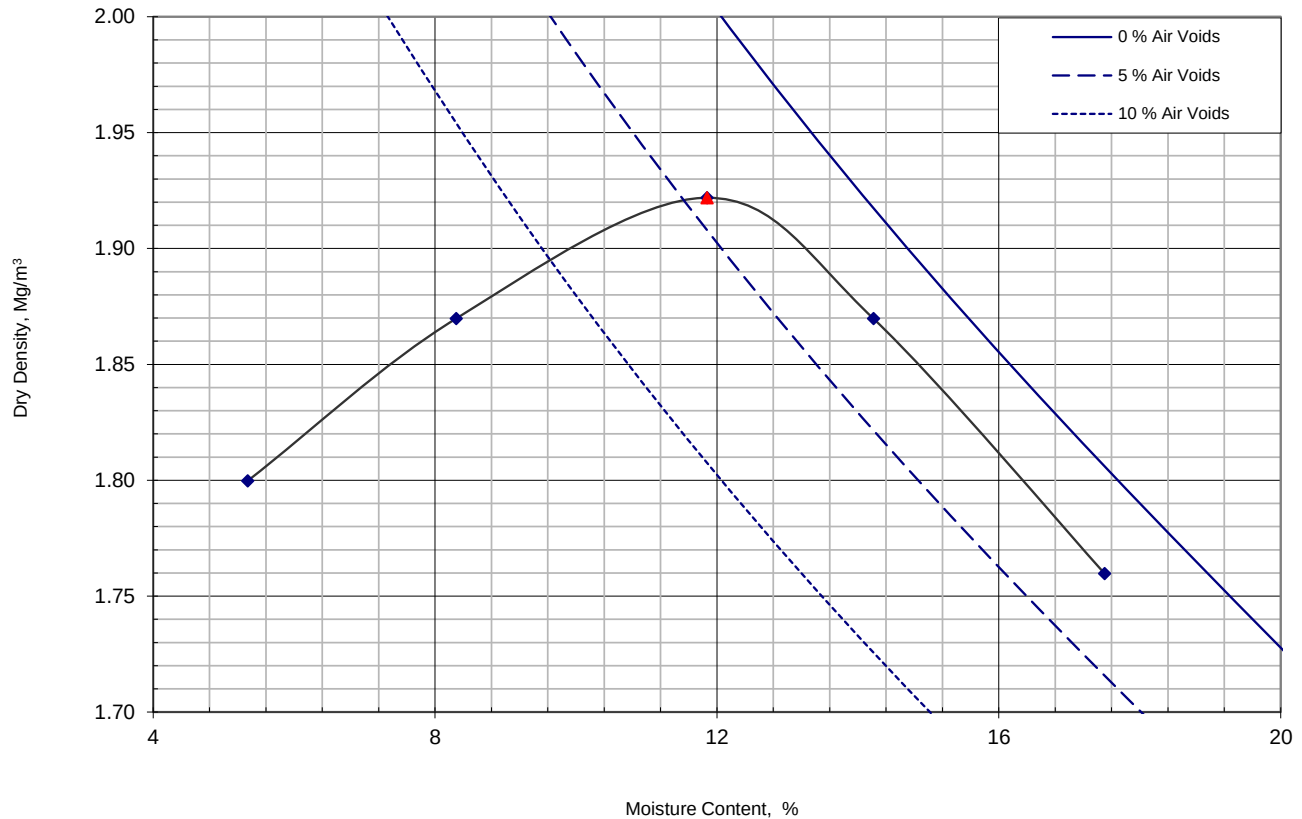
Depth Base

Compaction Clause BS1377:Part 4:1990, Clause 3.3

Sample Type B

Sample Description Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (withcobbles)

Single or Separate Sample Used Single



Compaction Point	1	2	3	4	5							
Moisture Content	5.3	8.3	12	14	18							
Bulk Density	1.90	2.02	2.15	2.14	2.07							
Dry Density	1.80	1.87	1.92	1.87	1.76							

Initial Moisture Content	12	%
Maximum Dry Density	1.92	Mg/m ³
Optimum Moisture Content	12	%
Particle Density	2.64 Measured	Mg/m ³
Material Retained 37.5mm	37	%
Material Retained 20mm	20	%

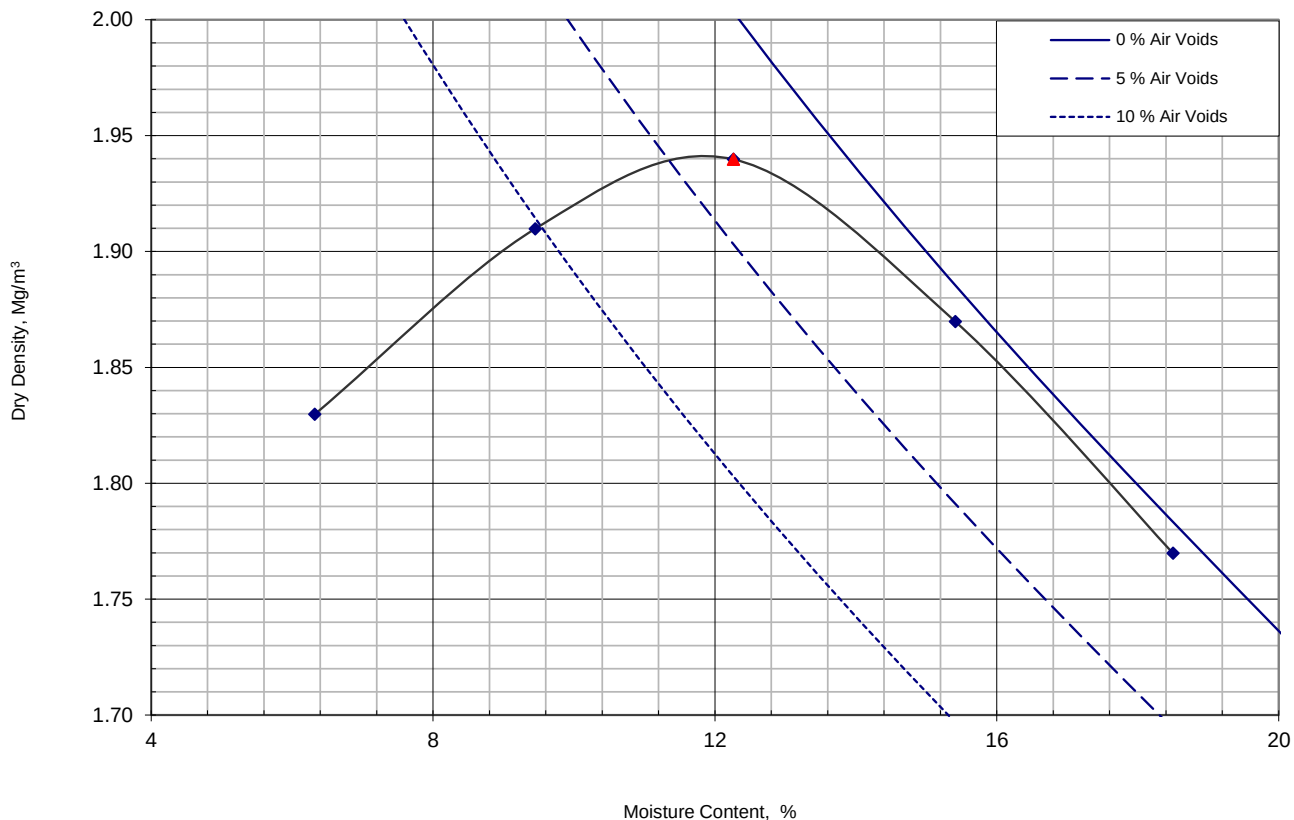
Operator

Conor

**Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990**

Contract Number	72545
Borehole / Pit No	Stockpile G - Sample B
Sample No	9
Depth Top	0.00
Depth Base	
Sample Type	B
Single or Separate Sample Used	Single

Project Name	Swansea Bay
Date Tested	15/05/2024
Compaction Method	2.5 Kg Rammer
Compaction Clause	BS1377:Part 4:1990, Clause 3.3
Sample Description	Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (withcobbles)



Compaction Point	1	2	3	4	5							
Moisture Content	6.3	9.5	12	15	19							
Bulk Density	1.95	2.09	2.18	2.16	2.10							
Dry Density	1.83	1.91	1.94	1.87	1.77							

Initial Moisture Content	12	%
Maximum Dry Density	1.94	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.66 Measured	Mg/m3
Material Retained 37.5mm	48	%
Material Retained 20mm	17	%

Operator
Conor



Laboratory Report



Contract Number: 74140

Client Ref:

Client PO:

Date Received: **09-08-2024**

Date Completed: **21-08-2024**

Report Date: **21-08-2024**

Client: **PJA Civil Engineering Limited**

This report has been checked and approved by:

Contract Title: **Hendrefoilan**

For the attention of: **Liam Clark**

Brendan Evans
Office Administrator

Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	3
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	3
Particle Density (Gas Jar) BS 1377-2:2022 Clause 9 - * UKAS	3
Particle Size Distribution BS EN ISO 17892-4 : 5.1 - * UKAS	3
Dry Den/MC (2.5kg Rammer Method 1 litre mould/CBR Mould) BS 1377-2:2022 Clause 11.3 & 11.4 - * 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

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Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (HR & HSE Manager)

GEO Site & Testing Services Ltd

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

Tel: 01554 784 040 Fax: 01554 784 040 info@gstl.co.uk https://gstl.co.uk

**PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2**

Contract Number **74140**

Borehole/Pit No. **SPH**

Project Name **Hendrefoilan**

Sample No. **1**

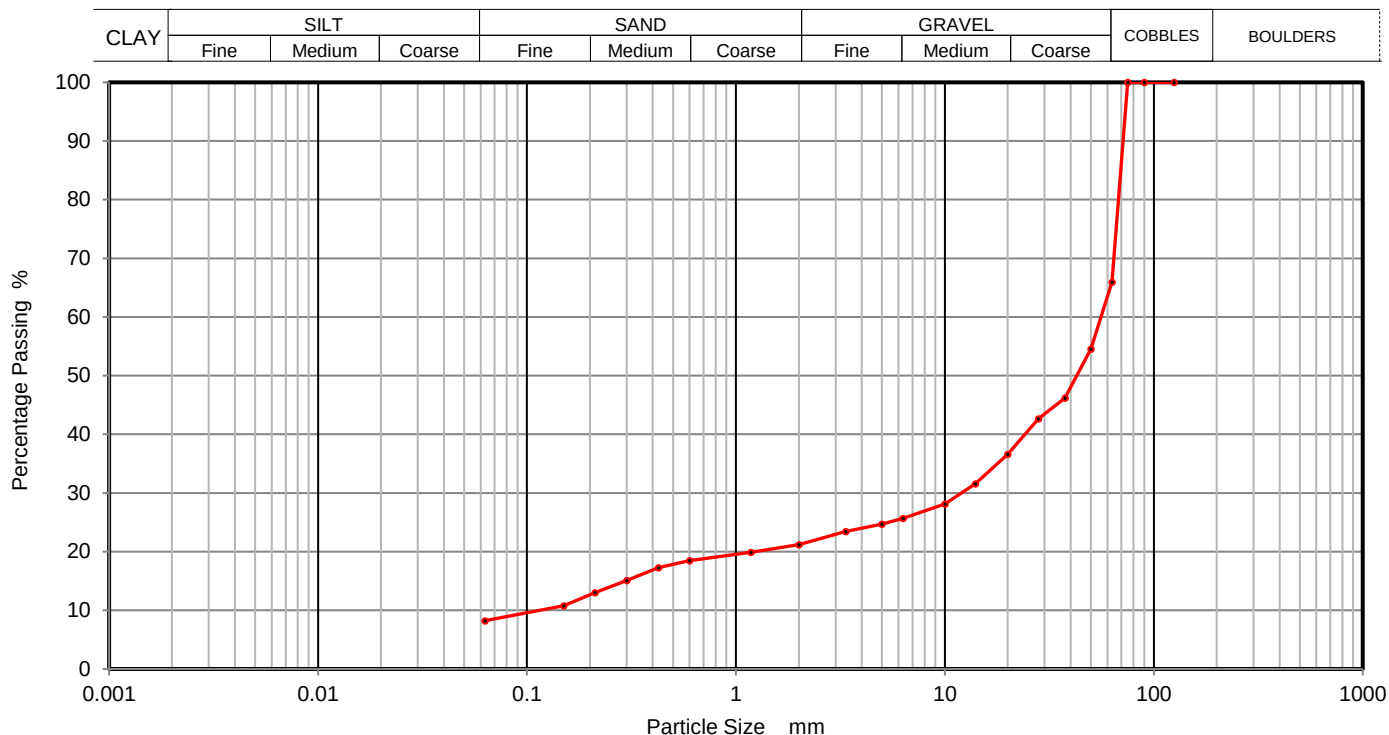
Sample Description **Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)**

Depth Top

Depth Base

Date Tested **17/08/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	66		
50	55		
37.5	46		
28	43		
20	37		
14	32		
10	28		
6.3	26		
5	25		
3.35	23		
2	21		
1.18	20		
0.63	18		
0.425	17		
0.30	15		
0.20	13		
0.15	11		
0.063	8		

Sample Proportions	% dry mass
Cobbles	34
Gravel	45
Sand	13
Silt and Clay	8

Remarks

Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

**PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2**

Contract Number **74140**

Borehole/Pit No. **SPH**

Project Name **Hendrefoilan**

Sample No. **2**

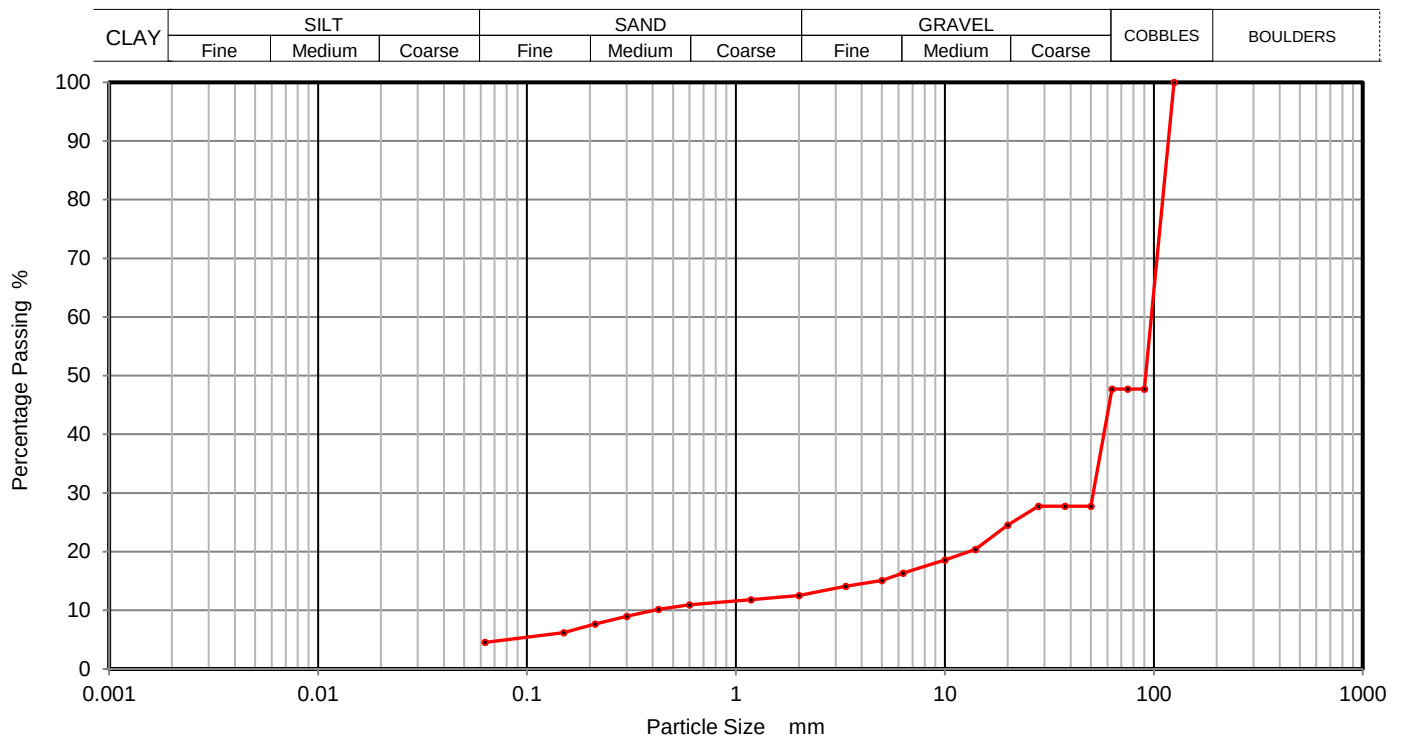
Sample Description **Brown slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL (mainly cobbles)**

Depth Top

Depth Base

Date Tested **17/08/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	48		
75	48		
63	48		
50	28		
37.5	28		
28	28		
20	25		
14	20		
10	19		
6.3	16		
5	15		
3.35	14		
2	13		
1.18	12		
0.63	11		
0.425	10		
0.30	9		
0.20	8		
0.15	6		
0.063	5		

Sample Proportions	% dry mass
Cobbles	52
Gravel	35
Sand	8
Silt and Clay	5

Remarks

Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

**PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2**

Contract Number **74140**

Borehole/Pit No. **SPG**

Project Name **Hendrefoilan**

Sample No. **3**

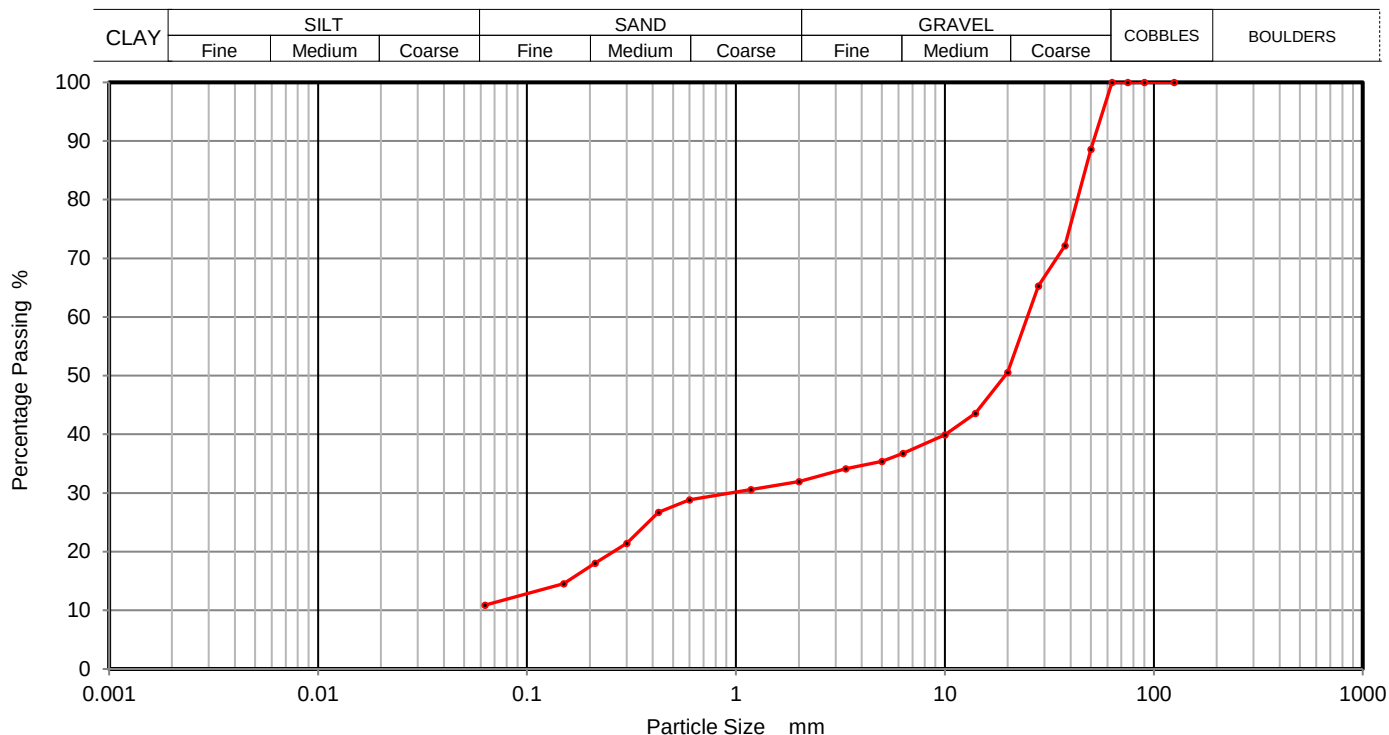
Sample Description **Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top

Depth Base

Date Tested **17/08/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	89		
37.5	72		
28	65		
20	51		
14	44		
10	40		
6.3	37		
5	35		
3.35	34		
2	32		
1.18	31		
0.63	29		
0.425	27		
0.30	21		
0.20	18		
0.15	15		
0.063	11		

Sample Proportions	% dry mass
Cobbles	0
Gravel	68
Sand	21
Silt and Clay	11

Remarks

Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

**Determination of The Dry Density / Water Content Relationship
BS 1377-2:2022**

Contract Number 74140

Borehole / Pit No SPH

Project Name Hendrefoilan

Sample No 1

Date Tested 19/08/2024

Depth Top

Compaction Method 2.5 Kg Rammer

Depth Base

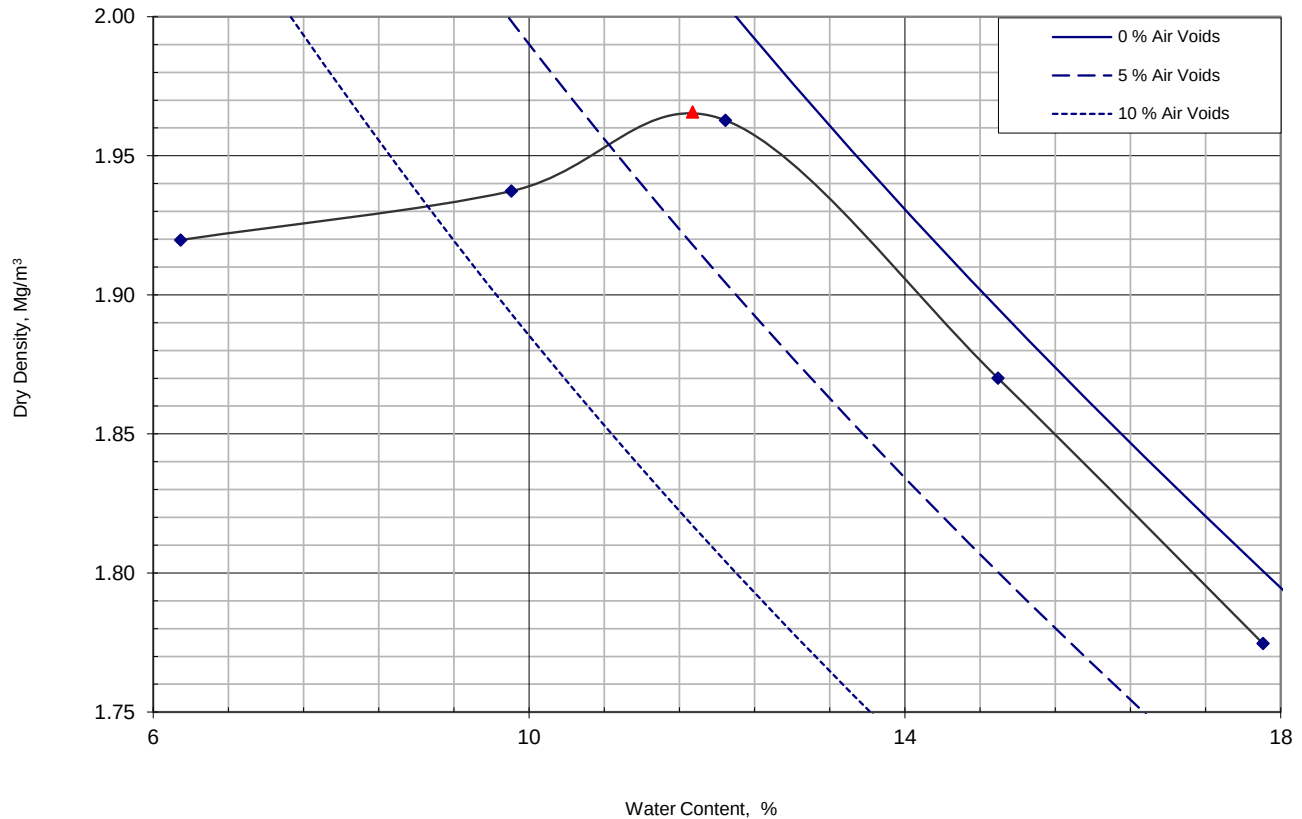
Compaction Clause BS1377-2:2022, Clause 11.3

Sample Type B

Sample Description Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)

Single or Separate Sample Used Single

Grading Zone Grading Zone X - Non-Standard



Compaction Point	1	2	3	4	5							
Water Content	6.3	9.8	12.1	15.0	17.8							
Bulk Density	2.04	2.13	2.20	2.15	2.09							
Dry Density	1.92	1.94	1.96	1.87	1.77							

Initial Water Content	9.8	%
Maximum Dry Density	1.97	Mg/m3
Optimum Water Content	11.7	%
Particle Density	2.65 Measured	Mg/m3
Material Retained 37.5mm	54	%
Material Retained 20mm	9	%

Operator

Stu

Determination of The Dry Density / Water Content Relationship BS 1377-2:2022

Contract Number 74140

Borehole / Pit No SPH

Project Name Hendrefoilan

Sample No 2

Date Tested 19/08/2024

Depth Top

Compaction Method 2.5 Kg Rammer

Depth Base

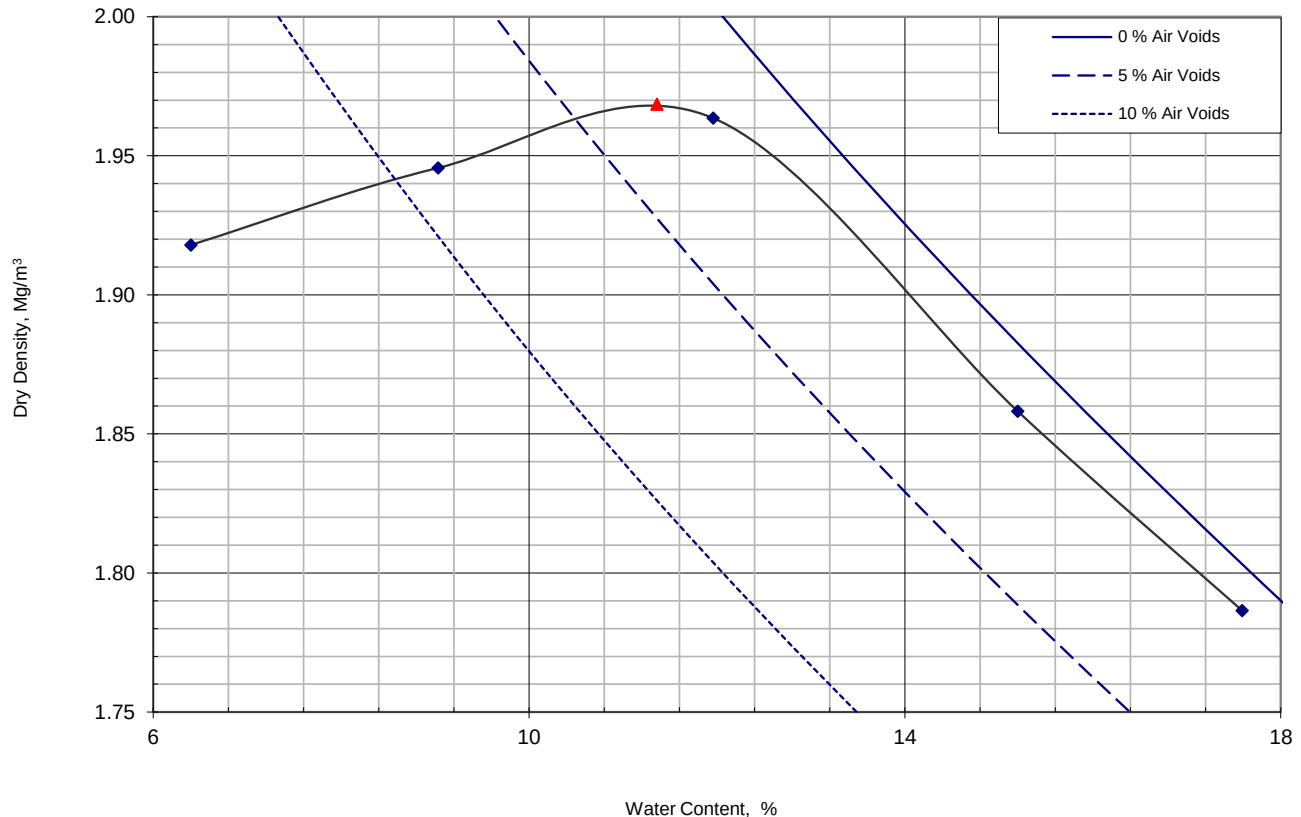
Compaction Clause BS1377-2:2022, Clause 11.3

Sample Type B

Sample Description Brown slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL (mainly cobbles)

Single or Separate Sample Used Single

Grading Zone Grading Zone X - Non-Standard



Compaction Point	1	2	3	4	5							
Water Content	6.4	9.0	12.0	15.2	17.6							
Bulk Density	2.04	2.12	2.20	2.14	2.10							
Dry Density	1.92	1.95	1.96	1.86	1.79							

Initial Water Content	9.0	%
Maximum Dry Density	1.97	Mg/m3
Optimum Water Content	11.4	%
Particle Density	2.64 Measured	Mg/m3
Material Retained 37.5mm	72	%
Material Retained 20mm	3	%

Operator

Stu

**Determination of The Dry Density / Water Content Relationship
BS 1377-2:2022**

Contract Number 74140

Borehole / Pit No SPG

Project Name Hendrefoilan

Sample No 3

Date Tested 19/08/2024

Depth Top

Compaction Method 2.5 Kg Rammer

Depth Base

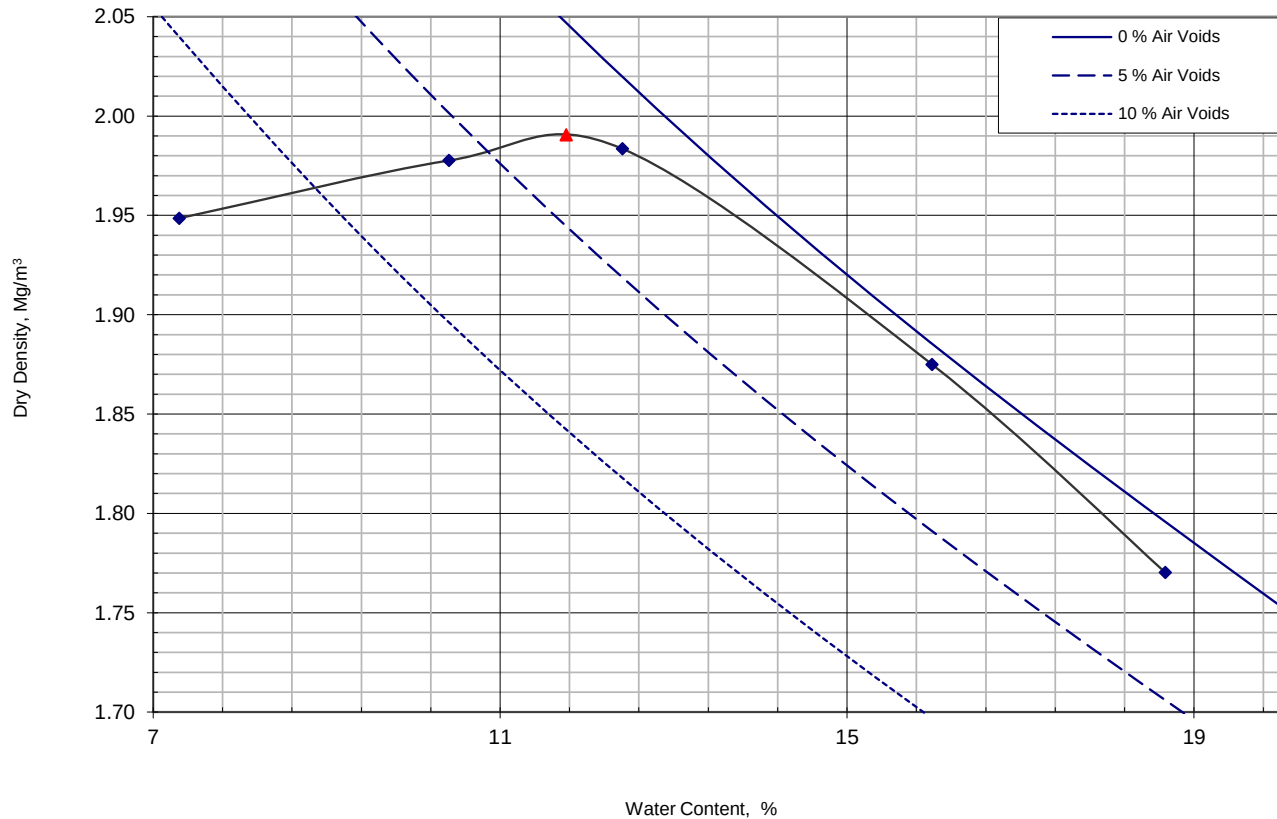
Compaction Clause BS1377-2:2022, Clause 11.3

Sample Type B

Sample Description Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL

Single or Separate Sample Used Single

Grading Zone Grading Zone X - Non-Standard



Compaction Point	1	2	3	4	5							
Water Content	7.3	10.4	12.4	16.0	18.7							
Bulk Density	2.09	2.18	2.23	2.17	2.10							
Dry Density	1.95	1.98	1.98	1.87	1.77							

Initial Water Content	12.4	%
Maximum Dry Density	1.99	Mg/m3
Optimum Water Content	11.8	%
Particle Density	2.7 Measured	Mg/m3
Material Retained 37.5mm	28	%
Material Retained 20mm	21	%

Operator

Stu