CHAPTER 13 – GEOTECHNICAL

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List of Acronyms

BRE	Building Research Establishment
C4SL	Category 4 Screening Level
CEMP	Construction Environmental Management Plan
CF	Cefn Formation
CIEH	Chartered Institute of Environmental Health
CL:AIRE	Contaminated Land: Applications in Real Environments
Development	All activities within the red line planning boundary (see Drawing ECL-BQ-001 in Technical Appendix TA1-1)
Development Area	As defined on Figure 13-1.
Development Site	The physical site on which the Development is to be located as defined by the red line planning boundary (see Drawing ECL-BQ-001 in Technical Appendix TA1-1)
DEMP	Decommissioning Environmental Management Plan
DEFRA	Department for Environment, Food and Rural Affairs
DSD	Dangerous Substance Directive
EPR	Environmental Permitting Regulations
EPA	Environmental Protection Agency
ERF	Energy Recovery Facility
LDP	Local Development Plan
LPP	Local Planning Policy
LQM	Land Quality Management
PAH	Polyaromatic Hydrocarbons
PH	Petroleum Hydrocarbons
PPC	Pollution Prevention and Control
PPW	Planning Policy Wales
S4UL	Suitable 4 Use Screening Level
SSSI	Site of Special Scientific Interest
TBMF	Trewern Brook Mudstone Formation
TMF	Tarannon Mudstone Formation
WFD	Water Framework Directive

List of Amendments

- Technical Appendix 13-3 has been added to address a number of comments made by the Geotechnical Consultant engaged by Powys County Council

13. Geotechnical and Materials Management

13.1. Introduction

13.1.1. This chapter reports on the existing soil, surface water and groundwater chemical conditions on site and the engineering properties of the ground in relation to development of Buttington Energy Recovery Facility ("ERF").

13.1.2. This chapter considers:

- the potential impact that the construction phase of the Development will have on existing soil, surface water and groundwater environmental quality and the health of construction workers
- the potential impact Buttington ERF will have on existing soil, surface water and groundwater environmental quality during operation.
- the potential impact that the development will have on the health of site users during operation of the Buttington ERF.
- how the integrity of the newly formed development area slopes will be maintained to ensure that there is no impact to the site during its operation phase.

13.1.3. A formal request for Scoping Direction was submitted to the Planning Inspectorate Wales in August 2018, with their response received October 2018. In their response, the Planning Inspectorate comments as follows:

'As mentioned in section 6 of this Direction under 'Baseline', the ES should include the impacts of preparatory works. As the SR identifies, the quarry floor requires stabilisation to create a level and stable plateau for construction. Although it may be the case that these work are permitted via extant planning permissions, they still constitute a part of this project, and as described above, the ES should capture the current baseline of on-site conditions and clearly describe the impacts involved in bringing the site to a level, fully prepared state, and then go on to assess the impacts from that point through construction, operation and decommissioning of this proposal. If the works have actually been carried out before the application is submitted, then the ES should confirm that and reflect that baseline.'

'Comments regarding geotechnical assessment, land contamination and materials management contained within the previous Scoping Opinion issued by PCC in 2017 should be considered by the Applicant in production of the ES. The Applicants should satisfy themselves that geological and material management issues have been adequately addressed as part of the ES, including the mitigation of any possible effects throughout the lifetime of the project.'

13.2. Relevant Legislation and Planning Policy

13.2.1. Within Powys there are three legislative documents available to address contaminated land:

- Planning Policy Wales (2018)[i]; and
- Local Planning Policy – Powys Local Development Plan (2018)[ii];
- Environmental Protection Act 1990: Part 2A (2012)[iii]

Planning Policy Wales

13.2.2. The Planning Policy Wales ("PPW") framework ensures that through the planning process and application of planning conditions a site is only developed once it has been proved that its intended use will be sustainable and not impose or cause any adverse environmental, social, economic or cultural affects. It aims to ensure balance between the needs of development and conservation and protection of natural resources and the historic environment

13.2.3. PPW provides guidance for the development of Local Planning Policy ("LPP"). In Powys local planning policy is presented in the Powys Local Development Plan ("LDP").

13.2.4. PPW enables contaminated land to be considered in relation to the planning system. Land intended for development may already be designated as contaminated under Part 2A of the Environmental Protection Act ("EPA"), or the development proposal may introduce changes to a site which may result in land potentially meeting the definition of contaminated under Part 2A.

13.2.5. Planning decisions need to consider the potential hazard that contamination presents to development itself, its occupants and the local environment

13.2.6. Specialist investigation and risk assessment will be required to determine the extent of any land contamination and to identify remedial measures that may be implemented to enable beneficial use of land.

13.2.7. Where acceptable remedial measures can overcome such contamination, planning permission may be granted subject to conditions specifying the necessary measures. If contamination cannot be overcome satisfactorily, the authority may refuse planning permission.

Powys Local Development Plan

13.2.8. The Powys Local Development Plan ("LDP") details the Council's development management policies for the sustainable development and use of land in Powys

13.2.9. The LDP has been prepared in accordance with PPW and considers the potential impact contamination and land instability may have on human health, property and the environment.

13.2.10. Development Management Policy 10 (DM10) Contaminated and Unstable Land specifies that 'development proposals on contaminated or unstable land will be permitted where they do not: 1. Result in any additional problems of ground instability of contamination either on or off site and shall remediate the contamination/instability; 2. Unacceptably adversely affect public health and safety, nature conservation, historic or archaeological interests.'

13.2.11. The LDP deems places the 'responsibility for determining the extent and effects of instability, contamination and other risk' with the developer, who must 'ensure that land is suitable for the development proposed.'

Part 2A of the Environmental Protection Act

13.2.12. PPW framework considers designation of contaminated land under Part 2A of the EPA.

13.2.13. Part 2A of EPA 1990 provides a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment.

13.2.14. Under Part 2A the statutory definition of 'contaminated land' is:

" any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that—(a)significant harm is being caused or there is a significant possibility of such harm being caused; or(b)pollution of controlled waters is being, or is likely to be, caused;"

13.2.15. Where land has been identified as meeting the statutory definition as being contaminated Part 2A considers that such land, where it is reasonable and practical to do so, should be remediated to ensure that is suitable for its current use and no longer represents an unacceptable risk.

13.2.16. The term 'Risk' is widely used in different contexts and situations, but a prescriptive definition is given by the Guidelines for Environmental Risk Assessment and Management: Green Leaves III (DEFRA et al, 2011)[iv] Risk is *'the potential consequence(s) of a hazard combined with their likelihoods/probabilities'*. A 'Hazard' is defined as *'a situation or biological, chemical or physical agent that may lead to harm or cause adverse affect'*.

13.2.17. For land to be classified as 'Contaminated Land' there must be a 'pollutant linkage'. A pollutant linkage requires three essential elements, a contaminant source, a potential receptor to contamination, and a pathway linking the source and receptor, as described in Table 13-1.

Table 13-1: Pollution Linkage Essential Elements

Essential Element	Description
Contaminant (Hazard)	• a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters
Receptor (Target)	• something which could be adversely affected by a contaminant
Pathway	• a route or means which either allows the contaminant to cause significant harm to that receptor, or that there is a significant possibility of such harm being caused to the receptor, or that pollution of controlled waters is being or likely to be caused

Other Technical Guidance

13.2.18. Other technical guidance considered in order to limit the potential for contamination of soils and waters are:

- Code of Practice for Site Investigations (BS5930:1990)[v] - this document outlines the procedures for ground investigation required in assessing the suitability of sites for potential development, detailing the correct methods of investigation, soil and rock sampling and testing, geotechnical testing and interpretation required for geotechnical and civil engineering design.
- Investigation of Potentially Contaminative Sites – Code of Practice (BS 10175:2001)[vi]; - BS10175 details the procedures required to appropriately design and implement intrusive ground investigation for the identification and characterisation of contaminated land. The publication informs the correct methodologies for collecting relevant soil, groundwater and ground gas data and how all site investigation data should be presented.
- Contaminated Land Report 11: Model Procedures for the Management of Land Contamination (Environment Agency, 2004)[vii] - this publication is a technical framework for identifying and managing unacceptable levels of contamination. The first stage of assessment determines the severity and risks from contamination through quantitative risk assessment. Stage two, options appraisal, seeks to identify the most suitable remedial option(s) that would enable the contamination to be treated or managed in a way that best protects human health and the environment conducive to the proposed development. Stage three is the development of a remediation strategy that details how the most suitable remedial option(s) to be implemented will put into practice.
- Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (CL:AIRE, December 2013)[viii] - with the objective of providing support DEFRA's Part 2A of the Environmental Protection Act CL:AIRE has developed a number of generic soil assessment criteria, category 4 screening levels ("C4SLs") for the classification of contaminated land with respect to human health and proposed land use. C4SLs are the levels of contaminant concentrations in soil that are considered an acceptable level of risk to human health, within the context of Part 2A, by combining information on human health toxicology, exposure assessment and normal ambient levels of contaminants in the environment.
- The LQM/CIEH S4ULs for Human Health Risk Assessment[ix] - Suitable 4 Use Levels ("S4Uls") have been derived for a range of generic land uses and soil organic matter contents in line with C4SL guidance. The S4ULs are based on health criteria that represent minimal or tolerable levels of risk to health.
- The Water Framework Directive (Standards and Classification) Directions (England and Wales) (2015)[x] - the Water Framework Directive ("WFD") seeks to achieve good qualitative and quantitative status of all water bodies (surface waters, transitional waters and coastal waters) in the EU. It sets a standard for chemical quality of water bodies, providing guidance thresholds for the acceptable concentrations of numerous potential pollutants. These thresholds can be compared directly with data from groundwater or surface water samples retrieved during site investigation works.
- Drinking Water Directive (Council Directive 98/83/EC, 1998)[xi] - The Drinking Water Directive ("DWD") provides legislation on the assessment of water intended for

human consumption and provides threshold levels that may be used for assessment of substances in groundwater where WFD thresholds are not available.

- Dangerous Substance Directive (Council Directive 74/464/EEC, 1974)[xii] - The Dangerous Substance Directive ("DSD") provides criteria for pollution caused by certain dangerous substances discharged into the aquatic environment. These criteria have been used for substances where no WFD threshold exists.
- CLAIRE: Petroleum Hydrocarbons in Groundwater (2017): Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies[xiii] - this publication provides guidance on assessing the risks to groundwater and surface water from petroleum hydrocarbon compounds. World Health Organisation criteria cited in this document may be applied to the assessment of petroleum hydrocarbons in groundwater, taken from World Health Organisation publication Petroleum products in drinking-water WHO/SDE/WSH/05.08.123.

13.3. The Existing Environment

Environmental Assessment Boundary

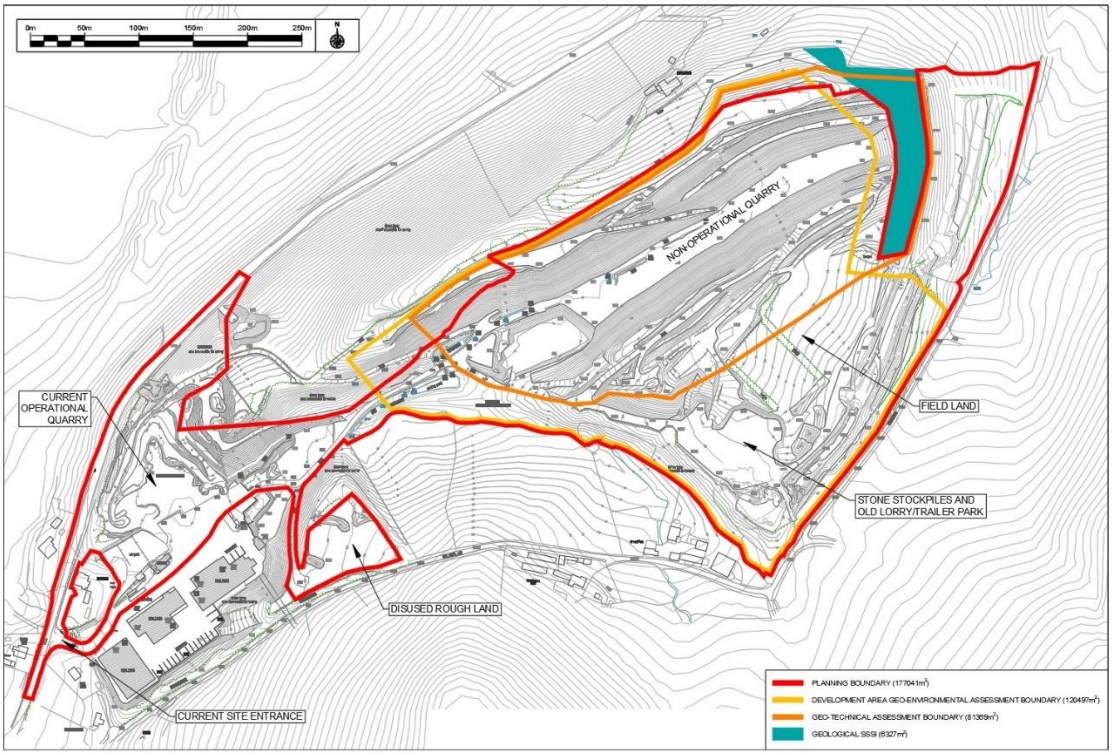
13.3.1. Reference to 'the Development area' in the following sections relates to the current non-operational quarry void where Buttington ERF will be constructed (e.g. the buildings and ancillary plant) and the area of land directly south of this existing quarry void, as illustrated in Figure 13-1.

13.3.2. Geo-environmental and geotechnical assessment has been undertaken and the assessment boundaries for each assessment vary slightly as follows:

- Geo-environmental assessment of the Development area has been performed using environmental data sourced from this area.
- The assessment also considers the impact of the current Development area on the wider surrounding area, which includes all land within the Development of National Significance ("DNS") planning boundary and other local sensitive receptors such as neighbouring residents within 250m of the Development area, surface waters down-gradient of the DNS planning boundary and groundwater below the DNS planning boundary.
- Geotechnical assessment is focused on the area of the proposed Buttington ERF only, that is, the quarry void and sides of the quarry void. Just outside the Development area is a designated geological Site of Special Scientific Interest ("SSSI"), which is identified as a sensitive receptor. The location of the SSSI is shown in Figure 13-1.

13.3.3. Figure 13-1 illustrates the Development Site (the DNS application boundary), the Development Area Geo-Environmental Assessment boundary and the Geo-Technical Assessment Boundaries.

Figure 13-1: Boundary Definitions



13.3.4. The assessment also considers the impact of the Development (construction, operation and decommissioning phases) upon the Development area itself and its future occupants, upon the remainder of the DNS planning application area including any future occupants, surface and groundwater within and beneath the DNS planning application area, and upon sensitive receptors in the local area: neighbouring residents within 250m of the Development area and surface waters down-gradient of the DNS planning boundary. This includes the preparatory works required to bring the site to a level, fully prepared site, in addition to the construction of the Development itself.

Base Line Conditions

13.3.5. The base line condition of the Development, in terms of Geotechnical and Materials Management is as follows:

- the Development will be placed within an area that is currently an operational quarry;
- there is an extant planning permission for an improved access approximately 155m north east of the existing quarry access - Planning Permission Ref. P/2015/0439). A Section 73 application (Planning Permission Reference 20/0575/REM) was submitted in April 2020 to request an extension of time which was approved in September 2020. Consequently, there is a new access proposed as part of this DNS application which is of the same design as the extant planning permission.

13.3.6. The base line conditions have been established for the Development Area as defined in Figure 13-1, that is the area where the Buttington ERF is to be constructed and land directly to the southeast.

13.3.7. In order to determine the base line conditions a geo-environmental and geotechnical site investigation was undertaken. The area covered by both assessments is illustrated in Figure 13-1.

13.3.8. The geo-environmental and geotechnical site investigation is performed in several stages. As the findings of each stage are understood these may be used to inform and plan the next stage. The stages include the following:

- preparation of a Desk Study;
- qualitative Geo-Environmental Risk Assessment;
- Site Investigation;
- Quantitative Geo-Environmental Human Health and Environmental Risk Assessment; and
- Geotechnical Assessment.

13.3.9. A copy of the Geo-environmental and Geotechnical Assessment Site Investigation Report Ref, dated March 2019) produced for the site, is reproduced in Technical Appendix 13-1.

13.3.10. The findings of the geo-environmental and geotechnical investigation have confirmed the baseline conditions set out in this section of the Chapter.

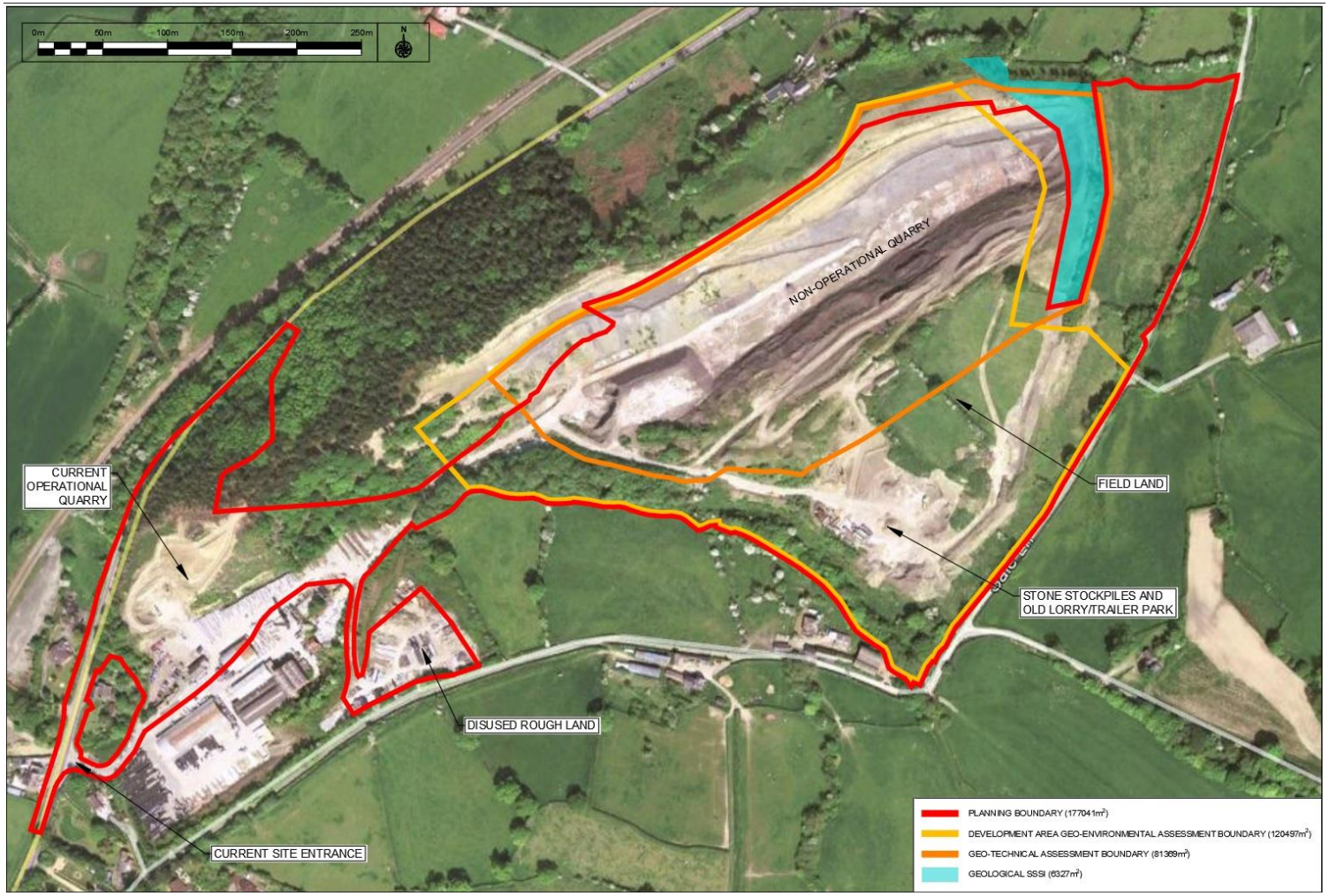
Current Land Use

13.3.11. The Development Area, as defined in Figure 13-1, comprises the operational quarry and an area to the south of the quarry above the quarry void, which is partially field land and partially rough ground where various stone stockpiles remain, as well as an old defunct lorry and several lorry trailers (see Chapter 1 – paragraph 1.4.7. for further details).

13.3.12. Land excluded from the Buttington ERF Development area, but within the DNS planning application boundary comprises active access roads between the current site entrance, current operation quarry and non-operational quarry. Also included is an area of disused rough land east of off-site warehouse buildings, which lies at a higher topographic level to the adjacent access road.

13.3.13. An aerial image of the Development Site and surrounding areas illustrating current land use is provided as Figure 13-2.

Figure 13-2: Current Development Area



13.3.14. Land outside the planning application boundary primarily comprises field land with intersecting roads. The area adjacent to and directly south of proposed access road and current operation quarry (see Figure 13-2) is occupied by two large warehouse type buildings and offices. One of the warehouses provides storage of classic cars and caravans, and Speed Welshpool Limited, a pallet and parcel delivery company, occupy the other large unit.

History

13.3.15. The Development Area historically remained as field land until the existing quarry was formed, first recorded as a quarry or clay pit on historical plans in 1954. The area south of the quarry void remains partly as field land, but in part is currently used for access.

13.3.16. The area adjacent to Development Site access road was historically primarily field land and woodland in 1885, but a small quarry and gravel pit were present at that time. The quarry and gravel pit closed but quarrying continued in this area. Small-scale quarrying is currently ongoing. A brick works was established between 1885 and 1902 and closed in 1990.

13.3.17. Beyond the Development Site boundary rural land use prevails to the present day, with neighbouring properties comprising houses or farms. A rail line that presently runs northeast-southwest on the opposing side of the A458, about 40m from the Development at its closest point, had already been constructed by 1885. A second rail line previously diverged from the main line towards the north, however, this was dismantled between 1954 and 1973.

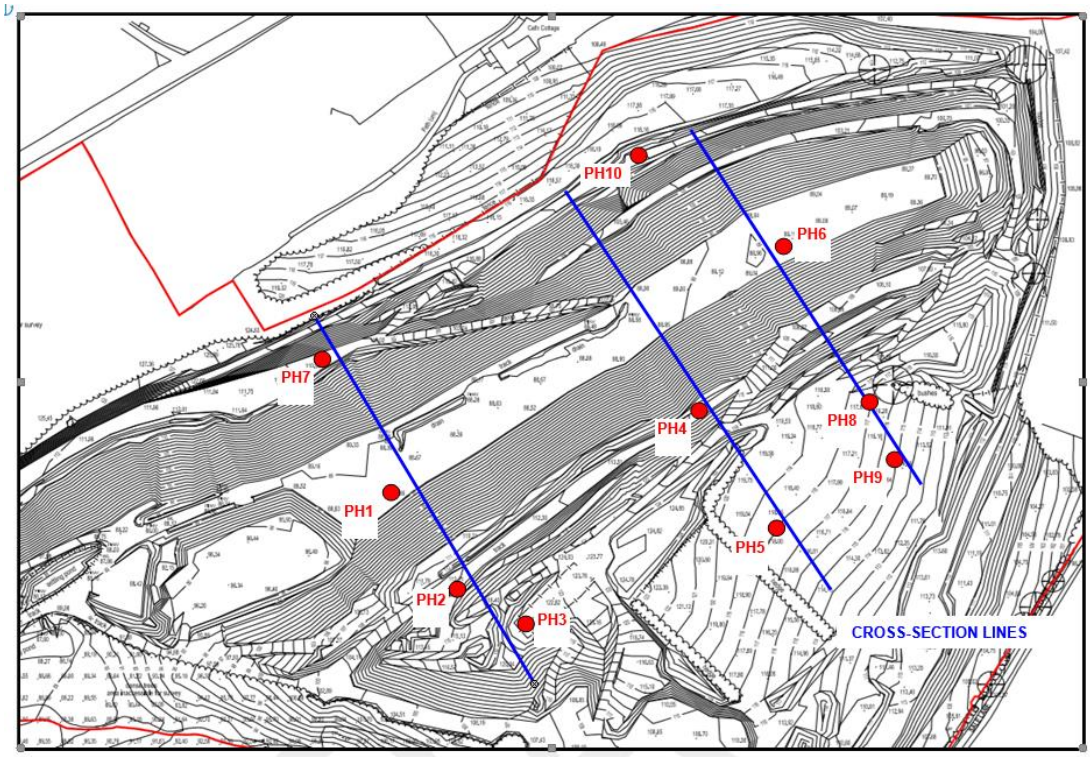
13.3.18. Historical plans may be found within Annex A of the Geo-environmental and Geotechnical Assessment Site Investigation Report, as found in Technical Appendix 13-1.

Geology and Ground Conditions

13.3.19. The geological and ground conditions across the Development Area were determined through study of available geological maps, a field survey of the exposed geology within the sides of the quarry void and through intrusive site investigation comprising ten rotary probeholes (PH1 – PH10) which retrieved cores of the various rock formations. The findings are described in detail in the Geo-environmental and Geotechnical Assessment Site Investigation Report, see Technical Appendix 13-1.

13.3.20. Probehole Locations are provided on Figure 13-3.

Figure 13-3: Investigative Probehole Locations



13.3.21. The Development Site is underlain by Silurian mudstones, which are bedded very steeply, typically between 75°–85° towards the southeast, and young towards the southeast. The three lithologies encountered are the Cefn Formation ("CF"), Tarannon Mudstone Formation ("TMF") and Trewern Brook Mudstone Formation ("TBMF").

13.3.22. The TMF was found as weak dark reddish brown locally light greenish grey mudstone with closely spaced fractures stained orangish brown. Bedding fractures were recorded as orientated 75°- 85° with primarily planar smooth to polished surfaces. Other fractures were found to be variable in orientation with no consistent fracture surface type, but fractures were clean and generally tight to open.

13.3.23. The CF was found to be completed weathered to soil to around 1m depth. This grades into extremely weak dark grey mudstone with bands of non-intact laminated mudstone and siltstone retrieved as angular gravel in places. Bedding fractures are identified by their 80°- 85° orientation, with variable surfaces but often striated. Other fracture planes are dominantly found to be 15°- 45° to around 11m depth before favouring a 35°- 60° orientation but 60°- 70° fracture planes were also found to regularly feature to the full depth of the probehole. Fractures were generally clean. Non-intact greenish grey mudstone retrieved as gravel extended to 3.0m depth in PH10 (as located on Figure 13-3), succeeded by very weak grey mudstone with very close to closely and occasionally medium spaced fractures dominantly orientated 5°- 35° and stained orangish brown or dark grey/black. Bedding fractures were consistently dipping 80°- 85°.

13.3.24. The TBMF was found weathered to very gravelly clay soil in some areas to 1.0m depth. In general, it is formed of weak grey to dark grey mudstone beds, initially non-intact or very weak in areas and becoming medium strong to strong at depth. Bedding fractures follow a 75°- 85° orientation. Other fractures and joints are prevalent but no relationship between spacing and orientation may be determined between different boreholes. Most fractures are clean but occasionally found to be infilled with soft to stiff grey clay to no more than a few centimetres in thickness. Mineralisation of some fractures was also noted, but these were typically no wider than 1mm. Graptolite fossils (monograptids) were observed in particular beds and often seen on bedding fracture surfaces.

13.3.25. The geological map of the area records superficial Devensian fluvioglacial fan deposits (sand and gravel) or Devensian till in the immediate areas surrounding the quarry top but cover was found to comprise weathered bedrock deposits.

13.3.26. Imported materials/made ground were noted to form part of the access track into the base of the quarry, and surface some of the area of rough ground south of the quarry. Rubble hardcore material was also noted on a section of track mid-way up the southeast quarry face.

13.3.27. A section of rock exposure just beyond the northeast end of the proposed Development area and non-operation quarry is classed as a geological SSSI. The location of the SSSI is illustrated on Figure 13-1. Geological SSSIs are designated for their geological national importance where they present an example of a specific geological feature that must be protected and preserved for future study.

13.3.28. The SSSI exposes a continuous sequence of Llandovery to Wenlock rocks encompassing the Buttington Shale Formation (TMF) from the upper Llandovery through to the TBMF. These rocks are hold significance for their particular fossil content, particularly of graptolites.

Hydrology and Hydrogeology

13.3.29. The bedrock underlying the Development Site has been defined as a Secondary B Aquifer as confirmed by a dataset created by collaboration of the Environment Agency, National Resources Wales and British Geological Survey. Groundwater flow within the underlying bedrock will be controlled by the strata dip and any fractures or bedding planes within the rock units.

13.3.30. Surface water features include the stream that flows along part of the Development Site's southern boundary and the two settlement lagoons at the entrance to the quarry. The stream route across the west of the Development Site is no longer recorded. This may have been culverted, or it may perhaps 'sink' within the Development Site following localised quarrying and alteration of the ground.

13.3.31. Beyond the Development Site there are numerous drains along field boundaries and two wells are also located within 20m of the northern site boundary.

13.3.32. The River Severn is located approximately 1.1km southwest of the Development Site.

13.3.33. The Development Site does not lie within a groundwater source protection zone, nor are there any groundwater abstraction points within 750m of the DNS application boundary.

Radon Gas

13.3.34. The underlying geology is deemed to be a source of radon gas and the Development Site lies within an intermediate probability radon area.

Environmental Information

13.3.35. Border Hardcore currently operates on the current operational quarry (see Figure 13-1) and within the Development Area (as defined on Figure 13-1) and maintains a permit relating to general mineral process. This was originally issued as a Local Authority Pollution Prevention and Control permit (permit reference PPC 47) on 11th September 2006 but Border Hardcore automatically continued operating under Environmental Permitting Regulations (England and Wales) when these permits replaced PPC permits in 2010.

13.3.36. No historic or active landfill sites, or licensed waste management facilities are present within 250m of the site.

13.3.37. Potentially infilled land is recorded in the west of the Development Site in relation to an historical small quarry and an area of former quarrying/clay pit.

13.3.38. No pollution incidents are detailed to have occurred within a 250m radial area around the Development Site since 1997.

13.3.39. The remaining woodland in the northwest of the Development Site is designated ancient woodland.

16.1.1. Border Hardcore is listed as a contemporary trade. The former brick works and clay pit are also listed. No contemporary trades are recorded in the Envirocheck Report at properties adjacent to the site. However, Speed Welshpool Limited, a pallet and parcel delivery company are known to occupy one of the large units directly adjacent to the Development Site.

13.3.40. No premises with consent to discharge waste waters are present within 150m of the Development Site.

Soil Chemistry

13.3.41. A series of 25 samples were taken from the surface or shallow trial holes excavated by hand or by using a tracked machine. 'Soil' samples comprised superficial soil cover, fill materials or weathered rock/scree.

13.3.42. Samples were retrieved from the quarry floor, quarry sides and from the area south of the quarry.

13.3.43. Samples were submitted for laboratory chemical analysis for a range of metals and organic and in-organic substances, as well as asbestos, to ascertain the baseline chemistry of site soils/rock.

13.3.44. As part of the geo-environmental assessment test results were compared with regulatory human health commercial threshold levels. These guidelines were used to determine whether site soils present a risk to the human health or the environment both during and beyond construction of Buttington ERF. Only the threshold for sulphate is not human health related, but this is important in relation to construction concrete only. Test results are summarised in Tables 13-2 and 13-3.

13.3.45. Full details of the sample locations, analysis results and assessment may be found in the Geo-environmental and Geotechnical Assessment Site Investigation Report provided in Technical Appendix 13-1.

Table 13-2: Soil Chemical Test Results – Metals and In-organics

Substance	Human Health Threshold Level (mg/kg)	Measured Concentrations (mg/kg)		Number of Exceedances
		Minimum	Maximum	
Aluminium	-	5900	22,000	-
Arsenic	640	1.8	47	0
Boron	240000	0.4	1.1	0
Cadmium	190	<0.1	13	0
Calcium	-	2000	100,000	-
Chromium III	8600	21	110	0
Chromium VI	33	<1.0	<1.0	0
Copper	68000	10	260	0
Iron	-	11000	43000	-
Lead	2330	5.4	37	0
Manganese	-	160	27000	-
Mercury	1100	<0.05	<0.05	0
Nickel	980	22	170	0
Selenium	12000	<0.5	9.7	0
Sodium	-	130	2300	-
Tin	-	<1.0	2.1	-
Zinc	730000	63	690	0
Cyanide	480	<0.1	0.3	0
Phenol	440	<0.3	<0.3	0
Sulphate	2400	<100	2700	1

Table13-2: Soil Chemical Test Results – Metals and In-organics (cont)

Substance	Human Health Threshold Level (mg/kg)	Measured Concentrations (mg/kg)		Number of Exceedances
		Minimum	Maximum	
Ammoniacal Nitrogen	-	<0.5	19	-
Chloride	-	<1.0	35.1	-
Nitrite	-	<1.0	9.2	-
Ortho Phosphate	-	<0.1	0.11	-
Organic Matter	-	0.1	3.2	-
pH	-	6.7	9.9	-
Asbestos	-	Not detected	Not detected	0

Table 13-3: Soil Chemical Test Results – Speciated Polyaromatic Hydrocarbons and Petroleum Hydrocarbons

Substance	Human Health Threshold Level (mg/kg)	Measured Concentrations (mg/kg)		Number of Exceedances
		Minimum	Maximum	
Naphthalene	190	<0.03	<0.03	0
Acenaphthylene	83000	<0.03	<0.03	0
Acenaphthene	84000	<0.03	<0.03	0
Fluorene	63000	<0.03	<0.03	0
Phenanthrene	22000	<0.03	<0.03	0
Anthracene	520000	<0.03	<0.03	0
Fluoranthene	23000	<0.03	<0.03	0
Pyrene	54000	<0.03	<0.03	0
Benzo(a)anthracene	170	<0.03	<0.03	0
Chrysene	350	<0.03	<0.03	0
Benzo(b)fluoranthene	44	<0.03	<0.03	0
Benzo(k)fluoranthene	1200	<0.03	<0.03	0
Benzo(a)pyrene	35	<0.03	<0.03	0
Indeo(123cd) pyrene	500	<0.03	<0.03	0
Dibenzo(ah)anthracene	3.5	<0.03	<0.03	0
Benzo(ghi)perylene	3900	<0.03	<0.03	0
PH C5 – C6 Ali	3200	<0.01	<0.01	0
PH C6 – C8 Ali	7800	<0.01	<0.01	0
PH C8 – C10 Ali	2000	<0.01	<0.01	0
PH C10 – C12 Ali	9700	<1.5	<1.5	0

Table13-3: Soil Chemical Test Results – Speciated Polyaromatic Hydrocarbons and Petroleum Hydrocarbons (cont)

Substance	Human Health Threshold Level (mg/kg)	Measured Concentrations (mg/kg)		Number of Exceedances
		Minimum	Maximum	
PH C12 – C16 Ali	59000	<1.2	2.8	0
PH C16 – C21 Ali*	1600000	<1.5	9.9	0
PH C21 – C35 Ali*	1600000	<3.4	<3.4	0
PH C5 – C7 Arom	26000	<0.01	<0.01	0
PH C7 – C8 Arom	56000	<0.01	<0.01	0
PH C8 – C10 Arom	3500	<0.01	<0.01	0
PH C10 – C12 Arom	16000	<0.9	<0.9	0
PH C12 – C16 Arom	36000	<0.5	13	0
PH C16 – C21 Arom	28000	<0.6	29	0
PH C21 – C35 Arom	28000	<1.4	6.9	0

Note to Table
PH = petroleum hydrocarbon
C = Carbon
Ali = aliphatic
Arom = aromatic

13.3.46. All substances tested for in soil were found to be present at level below their threshold level with the exception of sulphate in one sample. However, the threshold used in assessment of the results is relevant to construction concrete only. Sulphate does not present at risk to human health or the environment.

13.3.47. The soils may therefore be confirmed to be uncontaminated and do not present a risk to human or environmental receptors.

Groundwater Chemistry

13.3.48. Groundwater monitoring wells were installed in the probeholes drilled on Site as part of the geotechnical and geo-environmental site investigation. Groundwater samples were extracted from the boreholes on one occasion as part of the investigation.

13.3.49. Samples were submitted for laboratory chemical analysis for a range of metals and organic and in-organic substances to ascertain the baseline chemistry of groundwater beneath the site.

13.3.50. As part of the geo-environmental assessment test results were compared with regulatory threshold levels for freshwater. These guidelines were used to determine whether groundwater presents a risk to the aquatic environment both on and off Site.

13.3.51. Full details of the sample locations, analysis results and assessment may be found in the Geo-environmental and Geotechnical Assessment Site Investigation Report provided in Technical Appendix 13-1.

13.3.52. Test results are summarised in Tables 13-4 for metals and inorganic compounds, and Table 13-5 for speciated polyaromatic compounds ("PAH") and petroleum hydrocarbons ("PH").

Table 13-4: Groundwater Chemical Test Results – Metals and In-organics

Substance	Freshwater Threshold Level (µg/l)	Measured Concentrations (µg/l)		Number of Exceedances
		Minimum	Maximum	
Aluminium	-	58	790	-
Arsenic	50	0.73	45	0
Boron	-	<0.03	0.17	-
Cadmium	0.08 – 0.25*	<0.03	0.17	1*
Calcium	-	7700	240000	-
Chromium III	4.7	<1.0	75	1
Chromium VI	3.4	<7.0	<7.0	BLDL
Copper	1.0	<0.4	100	1
Iron	1000	5.5	1600	1
Lead	1.2	0.1	14	1
Manganese	123	3.9	270	1
Mercury	0.07	<0.01	<0.01	0
Nickel	4.0	<0.5	150	2
Selenium	10	0.83	7.4	0
Sodium	-	24000	200000	-
Tin	25	<0.4	2.5	0
Zinc	12.9	2.1	340	6
Phenol	7.7	<100	<100	BLDL
pH	-	6.6	8.3	-
Cyanide	1.0	<40	<40	BLDL
Hardness	-	23.3mg/l	898mg/l	-
Ammoniacal Nitrogen	-	79	8500	-
Chloride	250,000	1100	18,000	0
Nitrite	50,000	<35	79	0
Ortho Phosphate	-	<0.01	0.1	-
Sulphate	-	2100	330,000	-

Note to Table
BLDL – Below Laboratory Detection Limit
* Threshold range where sample specific dependant on groundwater hardness

Table 13-5: Groundwater Chemical Test Results – Speciated PAH and Petroleum Hydrocarbons

Substance	Freshwater Threshold Level (µg/l)	Measured Concentrations (µg/l)		Number of Exceedances
		Minimum	Maximum	
Naphthalene	2.0	<0.05	0.09	0
Acenaphthylene	-	<0.01	<0.01	BLDL
Acenaphthene	-	<0.01	<0.01	BLDL
Fluorene	-	<0.01	0.03	2 ALDL
Phenanthrene	-	<0.01	0.11	2 ALDL
Anthracene	0.1	<0.01	<0.01	0
Fluoranthene	0.0063	<0.01	0.01	1
Pyrene	-	<0.01	0.02	1 ALDL
Benzo(a)anthracene	-	<0.01	<0.01	BLDL
Chrysene	-	<0.01	<0.01	BLDL
Benzo(b)fluoranthene	0.017	<0.01	<0.01	0
Benzo(k)fluoranthene	0.017	<0.01	<0.01	0
Benzo(a)pyrene	0.00017	<0.01	<0.01	BLDL
Indeo(123cd)pyrene	-	<0.01	<0.01	BLDL
Dibenzo(ah)anthracene	-	<0.01	<0.01	BLDL
Benzo(ghi)perylene	0.0082	<0.01	<0.01	BLDL
PH C5 – C6 Ali	15000	<0.1	<0.1	0
PH C6 – C8 Ali	15000	<0.1	<0.1	0
PH C8 – C10 Ali	300	<0.1	<0.1	0
PH C10 – C12 Ali	300	<0.1	<0.1	0
PH C12 – C16 Ali	300	<0.1	<0.1	0
PH C16 – C21 Ali*	-	<0.1	<0.1	BLDL
PH C21 – C35 Ali*	-	<0.1	48	1 ALDL
PH C5 – C7 Arom	-	<0.1	<0.1	BLDL
PH C7 – C8 Arom	-	<0.1	<0.1	BLDL
PH C8 – C10 Arom	300	<0.1	<0.1	0
PH C10 – C12 Arom	90	<0.1	<0.1	0
PH C12 – C16 Arom	90	<0.1	<0.1	0
PH C16 – C21 Arom	90	<0.1	<0.1	0
PH C21 – C35 Arom	90	<0.1	<0.1	0

Note to Table

PH = petroleum hydrocarbon C = Carbon
Ali = aliphatic Arom = aromatic
BLDL – Below Laboratory Detection Limit
ALDL – Above Laboratory Detection Limit

13.3.53. Laboratory testing of groundwater identified numerous substances above their quoted threshold level in one or more locations.

13.3.54. There appears to be no correlation between these results and the results of soil samples analysed.

13.3.55. Given the lack of on-site and neighbouring site sources of contamination it is surmised that the substances of concern in groundwater are naturally occurring, groundwater chemistry being influenced by the chemistry of the underlying rocks or mineralised fractures.

13.3.56. In addition, it should be noted that the new Development will collect surface waters in new drains installed across the Development Area that will be covered with either new buildings or hardstanding.

13.3.57. Groundwater is not therefore considered to present a risk to the wider aquatic environment.

Geotechnical Parameters

13.3.58. Geotechnical properties of the existing rock types have been determined through laboratory testing.

13.3.59. Slake durability testing may be used to understand how susceptible rock may be to degradation when subject to weathering processes such as wetting and drying and freezing and thawing cycles. This is particularly important with respect to mudstones and shales. Slake durability test results are compared to Gamble's Slake Durability Classification.

13.3.60. The slake durability results are summarised in Table 13-6.

Table 13-6: Slake Durability Test Results

Sample	Strata	Percentage retained after one 10 min cycle	Durability Classification	Percentage retained after two 10 min cycles	Durability Classification
S1	TMF	88	Medium	76	Medium
S2	TMF	88	Medium	75	Medium
S3	CF	96	Medium High	93	Medium High
S4	TBMF	93	Medium	88	Medium High
S5	TBMF	94	Medium	89	Medium High
S6	TBMF	91	Medium	88	Medium High

Note to Table
TMF – Tarannon Mudstone Formation
CF – Cefn Formation

13.3.61. Samples were tested in the laboratory by dry and wet sieving analysis to determine their grading characteristics.

13.3.62. Based upon the soil property test results, and referring to Table 6/1: Acceptable Earthworks Materials: Classification and Compaction Requirements and Table 6/2: Grading Requirements for Acceptable Earthworks Materials, of the 'Series 600 Specification for Highway Works[xiv]', the samples can be classified shown in Table 13-7.

Table 13-7: Grading Analysis Results and Soil Classification

Sample	Strata	Type (Table 6/2)	Classification (Table 6/1)
S1	TMF	1A	Well graded granular material Compaction Method 2
S2	TMF		
S3	CF		
S4	TBMF		
S5	TBMF		
S6	TBMF		

Note to Table
TMF – Tarannon Mudstone Formation
CF – Cefn Formation
TBMF – Trewern Brook Mudstone Formation

13.3.63. Compaction should be undertaken in accordance with Table 6/4: Method Compaction for Earthworks Materials: Plant and Methods of the 'Series 600 Specification for Highway Works'. Table 13-8 details the geotechnical parameters of the strata considered in the sloe stability assessment.

Table 13-8: Geotechnical Soil and Rock Parameters for Slope Stability Assessment

Strata	Angle of Shearing Resistance ° (φ´)	Effective Cohesion kPa (c´)	Bulk Density kN/m³
CF	60°	20	26
TMF (quarried)	60°	20	26
CF (scree)	34°	0	16
TMF (quarried scree)	34°	0	20

Note to Table
TMF – Tarannon Mudstone Formation
CF – Cefn Formation

Slope Stability Analysis

13.3.64. Slope stability modelling on the existing scree slopes either side of the quarry void was performed using Geo5 software. This software program may be utilised to analyse a variety of slope stability scenarios based on a two-dimensional environment, where topographic and site derived geotechnical parameters may be inputted to model the real environment.

13.3.65. Analysis of slope stability was also performed using stereonets. A stereonet is a geological graphical method of assessment whereby the orientation and dip of 3D geological planes may be illustrated in 2D on a circular projection plane. Stereographic projection permits a 3D representation of the planes on a half-sphere pictorially. A stereonet may be used to

understand the relationship between different geological planes and whether the intersection between different geological planes may indicate a potential method of rock failure.

13.3.66. Slope stability analysis concluded that the degree of any slope stabilisation required is dependent on the angle of newly created slopes. Assessment has shown that a slope angle of 34° is deemed to be what the strata will naturally attain if left exposed. This is the steepest angle slope permitted to require the minimum protection measures. An angle of 60° is considered the steepest angle at which the slope may be safety stabilised for long term integrity. The Slope Stability Assessment undertaken may be found as Technical Appendix 13-2.

Likely Future Conditions

13.3.67. If the project is not approved and the site remains unchanged then long-term site conditions will not alter significantly. The site has already been confirmed to be uncontaminated. If the ground will not be disturbed there will be no adverse effects on the SSSI, or the current stability of the quarry faces that will continue to weather to its natural angle of repose of 34°.

13.3.68. If the project is not approved it is anticipated that quarry would continue to be worked at permitted levels until the quarried product is exhausted. Once this has been achieved the Development area would be ground engineered to form a level plateau upon which a new development comprising industrial units would be constructed. Continuation of quarrying would not be expected to have an adverse effect on the environment. Consideration would have to be given to construction works and future site use specific to any future development with regards to traffic, proposed industrial processes and emissions, etc. The SSSI may be protected by applying a surrounding development exclusion zone.

13.4. Environmental Effects Assessment

Construction Phase – Physical Effects

13.4.1. Construction works will be carried out in a series of stages (see Chapter 4 for a full description of the construction activities):

- widening of the quarry bottom and reprofiling of the existing south-eastern quarry face in order to bring the site to a level, fully prepared state;
- placement of excavated quarry materials in the area immediately south of the Buttington ERF as engineered fill (surplus material would be moved off-site); and
- erection of the Buttington ERF upon strip or pad foundations including roads and installation of services.

13.4.2. Soils excavated out during modification of the existing quarry will include movement and relocation of these materials to other areas of the site. This will include laying the excavated materials as engineer fill both in the current quarry bottom and on land southeast of the quarry.

13.4.3. Soils or aggregate could be imported for use in the new development.

Construction Phase – Construction Workers

13.4.4. There is potential human health risk to construction workers via exposure to imported soils/aggregate and any unexpected made ground discovered on site via dermal contact, ingestion and inhalation of dust if these are contaminated. Imported materials or unexpected site soils may also present a risk from inhalation of asbestos fibres or vapours.

Construction Phase – Local Residents

13.4.5. Local residents may be at risk through exposure to dust or asbestos fibres generated through from site activities with unexpected made ground or imported soils/aggregate.

Construction Phase – Site Soils

13.4.6. The introduction of imported materials could potentially have a negative impact on site soils or groundwater if contaminated.

Construction Phase – Surface Water and Groundwater

13.4.7. If any unexpected made ground is discovered on site or soils or aggregate is imported these may potentially have a negative impact on site soils or groundwater if contaminated.

Construction Phase – Building Materials

13.4.8. Concrete used in construction is potentially at risk from chemical attack from substances in site soils.

Construction Phase – Construction Chemicals, Fuels and Waste Products

13.4.9. There are potential environmental risks to the development site during the construction period in connection with construction activities, vehicles and construction materials such as fuels and concrete.

Construction Phase – Geological SSSI

13.4.10. Construction works have been designed so that the geological SSSI will remain unaffected.

Construction Phase - Mitigation

13.4.11. During the construction phase, risks to construction workers, local residents and the environment from any imported soils or aggregate will be mitigated by:

- review of chemical test certificates for intended imported materials to ensure only materials deemed uncontaminated when compared to regulatory soil thresholds are considered for import;
- independent sampling and testing of soils or aggregate once received on site and results compared to regulatory soil thresholds to confirm only intended soils have been imported and that these are acceptable;
- compilation of all testing and assessment data for imported soils and aggregate in the form of a soils validation report; and
- removal of any materials found to be unsuitable

13.4.12. If previously undetected made ground is identified on site during the construction period the following mitigation measures will be employed:

- inspection, sampling and testing of soils by a geo-environmental engineer;
- undertake a quantitative human health and environmental risk assessment and comparison to laboratory test results to regulatory soil thresholds to determine whether soils are contaminated; and
- removal of any materials found to be unsuitable for retention on site.

13.4.13. A Construction Environmental Management Plan ("CEMP") has been prepared for the Development and may be found in Technical Appendix 4-2. The construction contractors will be responsible for implementing measures to control or prevent run-off of construction materials or leaks and spills. This will include:

- prepare a drainage plan;
- store all oils, fuels and chemicals in a fully bunded area;
- carry out any activities (such as refuelling) that could cause pollution (leaks/spills) in a designated area, away from surface water or boreholes. Where possible it should drain to the foul sewer;
- use settlement ponds to remove silty water; and
- emergency procedure plan.

13.4.14. The appointed contractor will provide Method Statements and Risk Assessments to deal with these matters. During the ground works, the contractor will comply with all current Health and Safety regulations.

13.4.15. Discharge of waste materials/waters will be regulated in accordance with any relevant environmental permits.

13.4.16. Based on chemical test data from site soils an assessment has been made in accordance with publication BRE Special Digest 1:2005 Concrete in Aggressive Ground[xv] to the risk to concrete from the chemical agents in the ground. This confirms that all buried concrete should as a minimum conform to Class AC-1 to resist chemical attack.

Operational Phase – Effects

13.4.17. Buttington ERF will introduce and store specific non-hazardous and hazardous substances and chemicals on site. These will comprise waste to be processed and substances associated with plant activity: calcium hydroxide (hydrated lime); 24% aqueous ammonia; activated carbon; boiler treatment chemicals (trisodium phosphate); low sulphur gas oil.

13.4.18. Incinerator bottom ash and air pollution control residues will also be produced as waste through plant activity.

13.4.19. There is the potential for leaks or spills of chemicals and waste to occur, which would impact the underlying soils and groundwater.

13.4.20. Future site users will potentially be at risk through exposure to naturally occurring radon gas.

13.4.21. Concrete used in construction is potentially at risk from chemical attack from substances in site soils.

Operational Phase - Mitigation

13.4.22. A risk to human health from radon gas is identified. Basic radon protection measures will be incorporated into Buttington ERF.

13.4.23. The following pollution prevention measures will be implemented to minimise the potential contamination of the land as a result of the operation of the Installation:

- all chemical storage tanks, silos or sumps will be impermeable and resistant to the materials to be stored therein;
- all bunds, hard standing area and sumps will be subject to regular inspection and, in the case of bunds and sumps, the contents will be removed to allow for checking;
- all operation areas will have an impervious surface with sealed construction joints and spill containment kerbs;
- surfacing in all areas of the site will be fit for purpose, i.e. it will be chemically resistant to the materials that will be stored/treated in that area; and
- all storage tanks will be bunded, impermeable to the materials they contain, have all delivery and discharge pipe work and valves contained within the bund, are inspected on a regular basis (including emptying the contents) and will be subject to integrity testing as and when required.

13.4.24. Emergency procedures for any unexpected pollution incidents will be in place and will be detailed in the Installations Emergency Plan.

13.4.25. Discharge of waste materials/waters will be regulated in accordance with any relevant environmental permits.

13.4.26. Buttington ERF will operate under an NRW environmental permit. In order to comply with this permit periodic monitoring will be carried out at least once every five years for

groundwater and ten years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination.

13.4.27. The permit will specify that waste produced by Buttington ERF (bottom ash and APC residue) will be sampled and analysed in accordance with NRW protocol for total organic carbon, heavy metals, dioxins and furans, dioxin-like poly-chlorinated biphenyls quarterly and for soluble heavy metal content before use of a new disposal or recycling route.

13.4.28. The permit will also stipulate that 'all liquids in containers, whose emission to water or land could cause pollution, shall be provided with secondary containment, unless the operator has used other appropriate measures to prevent or where that is not practicable, to minimise, leakage and spillage from the primary container'.

Decommissioning Phase - Effects

13.4.29. Decommissioning of Buttington ERF would see the site return to its current form.

13.4.30. Removal of any remaining processing substances/chemicals and waste products and storage containers presents a risk from accidental spillage or leaks, which could impact site soils or groundwater.

13.4.31. There are potential environmental risks to the site during the decommission period in connection with demolition and clearance activities such as accidental spillage or leaks of vehicle fuel.

Decommissioning Phase - Mitigation

13.4.32. The Decommissioning will be undertaken in accordance with a Decommissioning Environmental Management Plan ("DEMP"). This will include emergency procedures for any unexpected pollution incidents to be put in place during removal of remnant plant chemicals, bottom ash and APC residue.

13.4.33. The demolition contractors will be responsible for implementing measures to control or prevent run-off of materials or leaks and spills. This will include:

- prepare a drainage plan;
- store all oils, fuels and chemicals in a fully bunded area;
- carry out any activities (such as refuelling) that could cause pollution (leaks/spills) in a designated area, away from surface water or boreholes. Where possible it should drain to the foul sewer;
- emergency procedure plan.

13.4.34. Following decommission samples of site soils and groundwater will be taken and analysed to confirm decommissioning works has had no adverse effects on the environment.

13.4.35. If decommissioning works have impacted site soils or groundwater, appropriate management or treatment of contamination will be undertaken.

The Development Overall

13.4.36. Provided that any soils, aggregates, fuels, oils and other substances brought on to site during construction phase and during operation of Buttington ERF are correctly regulated, used and stored to prevent potential spills and leaks then the Development should not have an impact on the Development area.

13.4.37. Provided that any remnant chemicals and waste products are removed appropriately prior to decommissioning, and any, fuels, oils and other substances brought on to site during demolition and clearance of Buttington ERF are correctly regulated, used and stored to prevent potential spills and leaks then the decommissioning should not have an adverse impacts upon the environment.

The Development in Combination with Other Developments

13.4.38. There will be no cumulative effects with other developments in the local area.

Interactive Effects

13.4.39. Interactions with other KEA's – to be provided in Table 13-9.

Table 13-9: Interactive Effects on KEA

KEA Interaction	Interactive Effects
Geotechnical and Materials Management and Air Quality	During the construction phase the site soils have the potential to become airborne and decrease air quality. The impact of dust from construction has been considered in Chapter 6 Air Quality.
Geotechnical and Materials Management and Transport	Removal/Import of material onsite in the construction phase has been addressed in Chapter 8 Highways and Transport.
Geotechnical and Materials Management and Water Environment	The geotechnical requirement for earthworks including slope stabilisation works during the site preparation phase has the potential to impact surface water quality due to the generation of suspended solids. Management of site runoff during the site preparation and construction phase has been incorporated into the SWMP in Technical Appendix 11-2.
Geotechnical and Materials Management and Ecology	During the construction phase modelling of the quarry faces and the excavation and deposition of site-won soils across the site could potentially impact site flora and fauna as this will involve the direct removal of trees and vegetation, and animal territories. The impact on local ecology has been considered in Chapter 10.

13.5. Environmental Effects Assessment Evaluation

13.5.1. Based on the Environmental Effect Assessment for all Development phases discussed in Section 13.4, a detailed environmental effects analysis is provided in Tables 13-11 and 13-13.

13.5.2. The evaluation criteria provided in Table 13-10 are considered relevant in respect of the geotechnical and geo-environmental impacts of the Development within the study area and have been used to describe the effects.

Table 13-10: Environmental Effects Assessment Evaluation Criteria

Criteria	Description
Magnitude of Impact (Mg) Effects on Human Health	• U - Unknown - there is insufficient evidence to indicate the magnitude of the effect. • N -Nil – Comparison of analysis data does not find any substance to be present at a concentration above its respective C4SL or S4UL soil guideline value. No risks to human health will be presented. • L - Low risk to human health. Substances present in soils at concentrations marginally above their respective C4SL or S4UL guidelines. • M -Medium risk to human health. Substances present in soils at concentrations above their respective C4SL or S4UL guidelines. • H - High Risk to human health. Substances present in soils at concentrations severely above their respective regulatory C4SL or S4UL guideline.
Magnitude of Impact (Mg) Risk from Radon Gas	• N - No risk from radon gas • L - Low risk from radon gas • H - High risk from radon gas
Magnitude of Impact (Mg) Effects on Soils and Groundwater	• U - Unknown - there is insufficient evidence to indicate the magnitude of the effect. • N - Nil – Comparison of soil analysis data does not find any substance to be present at a concentration above its respective C4SL or S4UL guideline. No contamination of the ground or groundwater will occur. • L - Low – Contamination of the ground and groundwater may occur. Substances present at concentrations marginally above their respective C4SL or S4UL soil guideline or groundwater WFD, DWD or DSD threshold. • M - Medium – Contamination of the ground and groundwater will occur. Substances present at concentrations above their respective C4SL or S4UL soil guideline or groundwater WFD, DWD or DSD threshold. • H - High – Contamination of the ground and groundwater will occur. Substances present at concentrations severely above respective C4SL or S4UL soil guideline or groundwater WFD, DWD or DSD threshold guideline.
Magnitude of Impact (Mg) Effect on concrete	• L - Low risk from aggressive ground. Site soils contain low levels of substances that may chemically attack concrete • H - High risk from aggressive ground. Site soils contain high levels of substances that may chemically attack concrete

Table13-10: Environmental Effects Assessment Evaluation Criteria (cont)

Criteria	Description
Geographic Extent of Impact (GE)	• DA - Within Development area Boundary • DNS - Within DNS planning application boundary <250m - Up to 250m from Development Area
Frequency of Impact (F)	• S - Single event • A - Annual activity • M - Monthly occurrence C - Continuous activity
Duration of Impact (D)	• D – 1 day • M - 1 month • Y - 1 year >2Y Greater than 2 years
Reversibility of Impact (R)	• U -Unknown - there is insufficient research/experience to indicate whether the environmental effect is reversible • N -Nil - previous research/ experience indicates that the environmental effect is irreversible • L - Low - previous research/ experience indicates that there is a small likelihood that the environmental effect is reversible • M - Medium - previous research/experience indicates the environmental effect may be reversible • H - High - previous research/experience indicates the environmental effect is reversible
Ecological, Cultural and Socio-economic Context of Impact (ESC)	• P - Relatively pristine area not adversely affected by human activity • E - Evidence of human activity • H - High level of human activity

Table 13-11: Environmental Effects Analysis - Geotechnical: Construction Phase

Activity	Potential Effect	Evaluation Criteria					
		Mg	GE	F	D	R	ESC
Import of soils and aggregate	Contamination of site soils, surface waters and groundwater. Risk to human health of construction workers & neighbouring site users	N	DA	S	D	H	P
	Conclusion: Contamination of site soils, surface waters and groundwater and the risk to human health from the import of soils and aggregate is considered not significant provided that the mitigation below is followed.						
	Mitigation: • Pre-import assessment of chemical test data for materials • Post-import sampling, testing and quantitative assessment of import materials to confirm suitable for use • Any materials found to be unsuitable to be removed from site						

Table 13-11: Environmental Effects Analysis - Geotechnical: Construction Phase (cont)

Activity	Potential Effect	Evaluation Criteria					
		Mg	GE	F	D	R	ESC
Accidental spillage of construction materials, fuels etc	Contamination of site soils, surface waters and groundwater and risks to human health of construction workers & neighbouring site users	H	<250m	S	M	H	P
	Conclusion: Contamination of site soils, surface waters and groundwater and risk to human health from accidental spillage of site construction materials and chemicals should not be significant provided that the mitigation below is followed.						
	Mitigation • Prepare a drainage plan. • Store all oils, fuels and chemicals in a fully bunded area. • Carry out any activities (such as refuelling) that could cause pollution (leaks/spills) in a designated area, away from surface water or boreholes. Where possible it should drain to the foul sewer. • Use settlement ponds to remove silty water. • Emergency procedure plan.						
Encountering unexpected potentially contaminated soils	Contamination of site soils, surface waters and groundwater and risk to human health of construction workers and neighbouring site users	L	DA	S	D	H	P
	Conclusion: Contamination of site soils, surface waters and groundwater and the risk to human health from is considered not significant provided that the mitigation below is followed.						
	Mitigation • Inspection, sampling and testing to determine whether unexpected soils are contaminated • If unacceptable contamination is identified affected soils can be treated or removed from site						
Chemical attack of construction concrete	Degradation of concrete	L	DA	C	>2Y	L	P
	Conclusion: Risk to buried concrete is considered not significant provided that the mitigation below is followed.						
	Mitigation • Use of correct class of concrete in construction						

Table 13-12: Environmental Effects Analysis - Geotechnical: Operational

Activity	Potential Effect	Evaluation Criteria					
		Mg	**GE**	**F**	**D**	**R**	**ESC**
Accidental spillage of stored fuels, chemical and waste products	Contamination of site soils, surface waters and groundwater and risk to human health of site occupiers and neighbouring site users	H	<250m	S	>2Y	H	P
	Conclusion: Contamination of site soils, surface waters and groundwater and risks to human health are considered not significant provided that the mitigation below is followed.						
	Mitigation • Storage containers/tanks will be suitably bunded • Operations will be undertaken on an impermeable surface to prevent downward migration of spilt/leaked contaminants into the ground • Spill response procedures will be detailed in the CEMP.						
Chemicals in site soils	Degradation of concrete	L	DA	C	>2Y	L	P
	Conclusion: Risk to buried concrete is considered not significant provided that the mitigation below is followed.						
	Mitigation: • Use of correct class of concrete in construction						
Radon Gas	Human exposure to Radon Gas	M	DA	C	>2yr	N	P
	Conclusion: Risk to human health is considered not significant provided that the mitigation below is followed.						
	Mitigation: • Installation of Radon Gas Protection						
Fire and fire suppression water may mobilise potentially polluting materials into the underlying soils /groundwater	Contamination of the Ground	U	<250m	S	D	U	P
	Conclusion: The risk is considered not significant provided that the mitigation below is followed.						
	Mitigation: • On site material storage will be kept to a minimum • Sensitive materials will be located securely above anticipated flood water levels • Fire water is contained within emergency tanks						

Table 13-13: Environmental Effects Analysis - Geotechnical: Decommissioning Phase

Activity	Potential Effect	Evaluation Criteria					
		Mg	GE	F	D	R	ESC
Accidental spillage of stored fuels, chemical and waste products during removal from site	Contamination of site soils, surface waters and groundwater and risk to human health of site occupiers and neighbouring site users	H	<250m	S	D	H	1
Accidental spillage of substance used during decommission including fuels	**Conclusion:** Contamination of site soils, surface waters and groundwater and risks to human health are considered not significant provided that the mitigation below is followed.						
	Mitigation: • Storage containers/tanks will be suitably bunded • Operations will be undertaken on an impermeable surface to prevent downward migration of spilt/leaked contaminants into the ground • A spill response procedure will be included in the Decommissioning Environmental Management Plan ("DEMP"). • Measures to avoid accidental spillage of materials • Measures to control surface run-off • prepare a drainage plan; • store all oils, fuels and chemicals in a fully bunded area; • carry out any activities (such as refuelling) that could cause pollution (leaks/spills) in a designated area, away from surface water or boreholes. Where possible it should drain to the foul sewer; • emergency procedure plan. • Sample, test and assess site soils and groundwater to confirm no contamination has occurred. • Treat/remove any contamination found to exist						

13.6. Residual Environmental Effects

13.6.1. This section considers the residual environmental effect of the Development, i.e. those effects which remain after the application of mitigation or engineering design.

13.6.2. In addition to the above significance rating the nature / type and duration of the impacts will be assessed using the following criteria:

- **Major (significant) residual environmental effect** = contamination of the ground will occur and will exceed soil guideline values for residential use and groundwater guidelines and there is a high risk from radon gas or degradation of concrete; or
- **Moderate (significant) residual environmental effect** = contamination of the ground will occur and will exceed soil guideline values for industrial use and groundwater guidelines and there is a medium risk from radon gas or degradation of concrete; or
- **Minor (not significant) residual environmental effect** = contamination of the ground may occur but will not exceed soil guideline values for industrial use or

groundwater guidelines and there is a low risk from radon gas or degradation of concrete; or

- **Negligible (not significant) residual environmental effect** = contamination of the ground will not occur and there is no risk from radon gas or degradation of concrete.
- **Beneficial** - An impact that is considered to represent an improvement on the baseline or introduces a positive change

13.6.3. The type of impact will also be defined according to the following criteria:

- **Direct Impact** – Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors.
- **Indirect Impact** - Impacts that result from other activities that are encouraged to happen as a consequence of the Project.

13.6.4. Residual adverse environmental effects for the Project are provided in Table 13-14.

Table 13-14: Summary of Residual Adverse Environmental Effects – Geo-environmental and Geotechnical

Development Phase	Residual Adverse Environmental Effect	Significance	Likely Effect on the Environment
Construction	Contamination of site soils, surface waters and groundwater. Risk to human health of construction workers & neighbouring site users	Negligible **Not Significant** Indirect	Incorporated mitigation and control procedures will ensure there is no effect on the environment or human health.
	Degradation of concrete	Negligible **Not Significant** Direct	No effect.
Operation	Contamination of site soils, surface waters and groundwater and risk to human health of site occupiers and neighbouring site users	Negligible **Not Significant** Indirect	Incorporated mitigation and control procedures will ensure there is no effect on the environment or human health.
	Degradation of concrete	Negligible **Not Significant** Direct	No effect.
	Human exposure to Radon Gas	Negligible **Not Significant** Direct	Incorporated mitigation and control procedures will ensure there is no effect on human health.
Decommissioning	Contamination of site soils, surface waters and groundwater and risk to human health of site occupiers and neighbouring site users	Negligible **Not Significant** Indirect	Incorporated mitigation and control procedures will ensure there is no effect on the environment or human health.

13.7. Summary

13.7.1. The Development area historically remained as field land until the existing quarry was formed, first recorded as a quarry or clay pit on historical plans in 1954. The area south of the existing quarry remains partly as field land, but in part is currently used for access. Other areas within the DNS planning boundary remain in use for access and small-scale quarrying.

13.7.2. Intrusive investigation of the Development area has confirmed the underlying ground conditions and characterised the chemistry of soils and groundwater.

13.7.3. The Development area is underlain by Silurian mudstones, which are bedded very steeply towards the southeast, and young towards the southeast. Slope stability analysis concluded that the slope stabilisation will be required for all newly created slopes angled between 34° and 60°. An angle of 60° is considered the steepest angle at which the slope may be safety stabilised for long term integrity.

13.7.4. A section of rock exposure just beyond the northeast end of the proposed Development area and non-operation quarry is classed as a geological SSSI. The new Development and associated earthworks and slope stabilisation have been designed to ensure long term preservation of the SSSI.

13.7.5. Soils were confirmed to be uncontaminated with regards to the human health of construction workers, future site occupiers and neighbouring site users. Groundwater is not considered to present a risk to the aquatic environment.

13.7.6. Best practice will be employed during the construction phase of development and therefore no adverse environmental effects on human health or the soil and water environment. Prior to construction a construction environmental management plan will be developed to ensure that are sufficient control measures in place to prevent or control any potential adverse effects on human health and the aquatic environment.

13.7.7. Buttington ERF has been designed to meet best available techniques as described in NRW guidance and associated Bref documents and as such it is not anticipated that the operational phase of the development will have any impact on human health or the aquatic environment.

13.7.8. During the decommissioning phase, as with the construction phase, best practice will be employed to ensure that there are no adverse environmental effects. Control measures as specified in a Decommissioning Environmental Management Plan will be followed.

13.7.9. It is considered that the implementation of the above construction phase and operation phase design and control features will ensure any potential detrimental effects to land and human health are minimised.

13.8. References

[i] Planning Policy Wales, 2010 (Edition 10)
[ii] Powys Local Development Plan, (2018
[iii] Department for Environment, Food and Rural Affairs, 2012. Environmental Protection Act 1990: Part 2A
[iv]Department for Environment, Food and Rural Affairs et al, 2011. Guidelines for Environmental Risk Assessment and Management: Green Leaves III
[v] British Standards Institution, 2015. Code of Practice for Site Investigations (BS5930)
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[vii] Environment Agency, 2004. Contaminated Land Report 11 (CLR11): Model Procedures for the Management of Land Contamination
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[ix] LQM/CIEH, 2015. Suitable 4 Use Levels for Human Health Risk Assessment
[x] European Commission, 2015. Water Framework Directive (Standards and Classification) Directions (England and Wales) (Council Directive 2000/60/EC)
[xi] European Commission, 1998. Drinking Water Directive (Council Directive 98/83/EC)
[xii] European Commission, 1975. Dangerous Substances Directive (Council Directive 74/464/EC)
[xiii] CL:AIRE, 2017. Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies
[xiv] Department of Transport, 2008. Specification for Highway Works: Series 600.
[xv] British Research Establishment, 2005. BRE Special Digest 1: Concrete in Aggressive Ground

Technical Appendix 13-1
Geotechnical and Geo-Environmental Site Investigation Report

Geotechnical & Geo-environmental Site Investigation Report:
Buttington Quarry
Buttington
Welshpool

Prepared For:
Broad Energy (Wales) Limited

March 2019

Report No. 14880/GGR

terrafirma

REPORT TITLE	**:**	**Geotechnical and Geo-environmental Site Investigation Report:** Buttington Quarry, Buttington, Welshpool
REPORT STATUS	**:**	**FINAL**
JOB NUMBER	**:**	**14880/GGR**
DATE	**:**	**March 2019**
PREPARED BY	**:**	…….. **Mrs Ruth Howells**
REVIEWED BY	**:**	…….. **Mr Mathew Lake**
APPROVED BY	**:**	…….. **Dr Gwyn C Lake**

Executive Summary

Proposed Development	*Broad Energy (Wales) Limited is proposing the development of an Energy Recovery Facility (ERF) at Buttington Quarry, near Welshpool, a renewable energy plant that will fuelled by non-recyclable waste.*
Site Location	*Buttington Quarry sits into a natural hillside just northeast of Buttington, adjacent to and east of the A458 between Welshpool and Shrewsbury. The surrounding area is entirely rural. The site is centred on a National Grid Reference of 326380 309950. It occupies a plan area of approximately 25 hectares.*
Site History	*Set in a rural area, small scale quarrying is recorded in the west of the site on the 1885 historical map and a brick works had opened in the west by 1902. Quarrying continued on site until 15-20 years ago, extending across the proposed development area. The brick works closed in 1990.*
Geology and Ground Conditions	*The site is underlain by three main geological units, the Cefn Formation, Tarannon Mudstone Formation and the Trewern Brook Mudstone Formation. All three lithologies are exposed within the exiting quarry and areas investigated adjacent to the quarry found very shallow soils grading in to weathered rock to be present. Localised small areas of made ground exist where hardcore materials have been imported to form access tracks.*
Radon	*Basic radon protection is required for new development.*
Ground Gas/Landfill Gas	*No sources of potential ground gas or landfill gas are identified upon or within influencing distance of the site.*
Laboratory Chemical Testing and Proposed Remediation	*Laboratory analysis of site soils has confirmed that site soils are uncontaminated and present no risk to human health of the environment.* *Laboratory testing of groundwater identified numerous substances above their quoted threshold level in one or more locations. There appears to be no correlation between these results and the results of soil samples analysed and given the lack of on-site and neighbouring site sources of contamination it is surmised that the substances of concern in groundwater are naturally occurring, groundwater chemistry being influenced by the chemistry of the underlying rocks or mineralised fractures. There are no recorded groundwater abstraction points within 750m of the site. The River Severn situates approximately 1.1km southwest of the site. Groundwater is not therefore considered to present a risk to the wider aquatic environment.*

Foundation Solution	*The new ERF plant may be constructed upon strip or pad foundations taken down in to the engineered fill or bedrock. Due to the new development spanning across both the fill and bedrock foundations should be designed as reinforced to prevent any differential settlement. Reinforcement will also provide added protection from the two faults known to cross the development area, although in the event of any earthquake activity in the area any movement of faults would not be expected to be significant.* *For design purposes an allowable bearing pressure of 150kN/m^2 may be used for foundations constructed within the engineered fill. Those foundations seated solely on bedrock may be designed to allowable bearing pressure of 300kN/m^2.* *Reinforced strip/pad foundations may also be used for construction of the new bunker as described above. However, it is recommended that appropriate waterproofing be incorporated into the bunker construction and allowances made for potential buoyancy effects.* *Floor slabs may be designed as ground bearing.*

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SECTION 1 Introduction and Proposed Development

1.1 Introduction

Broad Energy (Wales) Limited is proposing the development of an Energy Recovery Facility (ERF) at Buttington Quarry, near Welshpool, a renewable energy plant that will be fuelled by non-recyclable waste. The new ERF is to be constructed in the bottom of the former quarry. To accommodate this the quarry is to be widened. Some of the material removed during creation of the new development area will be deposited within the existing quarry bottom or on land directly southeast as engineered fill.

A new access road to the ERF will be formed from the main road and through the western side of the site and enter the development area approximately where the current access road enters the existing quarry.

Terra Firma (Wales) Limited has been commissioned to undertake a geo-environmental assessment and geotechnical investigation of the site.

The main objectives of the geoenvironmental assessment programme were to:

- Investigate the potential environmental liabilities at the site associated with any soil contamination
- Provide a summary of the environmental conditions at the site, together with any necessary further intrusive works and / or remediation works to render the site fit for its intended use

The main objectives of the geotechnical site investigation were to:

- Determine the type, strength and bearing characteristics of the shallow superficial and underlying solid geology
- Provide engineering foundation and floor slab recommendations for the development
- Provide recommendations with regard to any other geotechnical aspects pertaining to the development

In order to achieve the above objectives, Terra Firma (Wales) Limited carried out an assessment programme including a review of existing data, followed by a field investigation to collect geotechnical and environmental data from selected locations.

1.2 Limitations and Exceptions of Investigation

Broad Energy (Wales) Limited has requested that a Geo-environmental Site Assessment (GSA) and Geotechnical Investigation (GI) be performed in order to determine if contamination is present beneath the site and to determine an appropriate foundation and floor slab solution for the proposed development.

The GSA and GI were conducted, and this report has been prepared for the sole internal reliance of Broad Energy (Wales) Limited and its design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill. The report represents the findings and opinions of experienced geo-environmental and geotechnical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may be required.

1.2 Limitations and Exceptions of Investigation (Continued)

The subsurface geological profiles, any contamination and other plots are generalised by necessity and have been based on the information found at the locations of the exploratory holes and depths sampled and tested.

SECTION 2 Review of Existing Data

2.1 Physical Setting and Current Site Use

Buttington Quarry sits into a natural hillside just northeast of Buttington, adjacent to and east of the A458 between Welshpool and Shrewsbury. The surrounding area is entirely rural.

The site is centred on a National Grid Reference of 326380 309950. It occupies a plan area of approximately 25 hectares.

The location of the quarry is illustrated in **Figure 2.1** below.

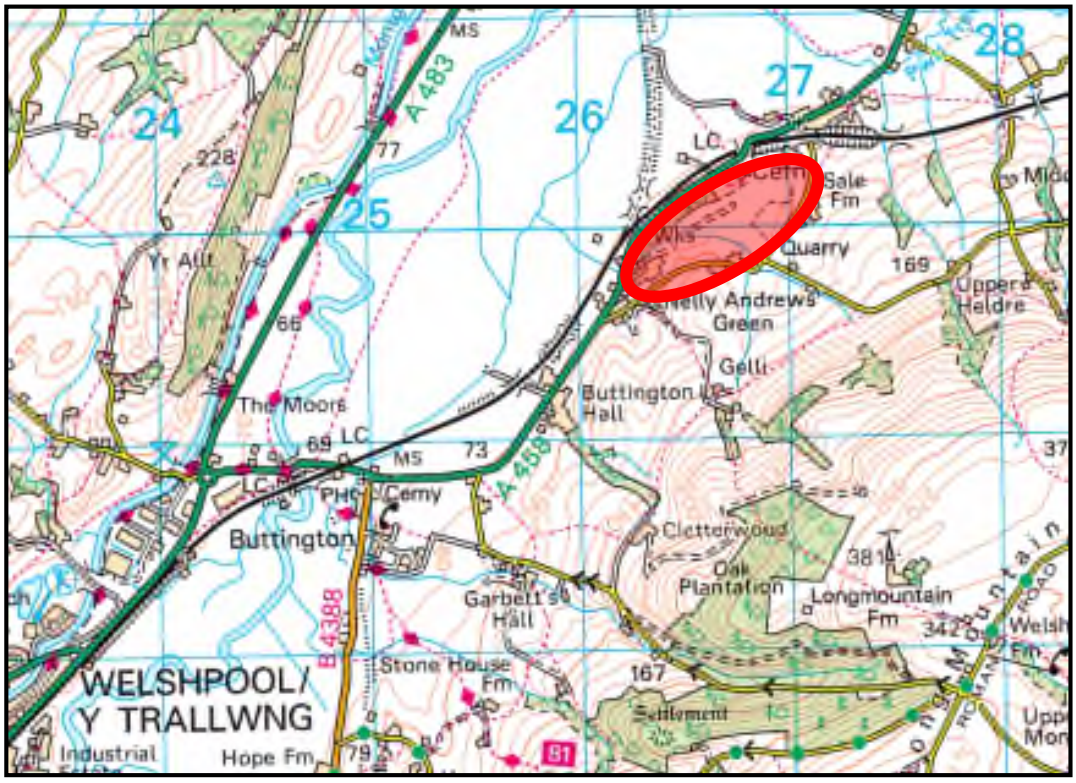

Figure 2.1: Site Location – OS Map 216 Welshpool & Montgomery

The site area may be split into several areas.

The far south-western portion of the site lies outside the main development area. This is currently occupied by several buildings, including two large warehouse type buildings and offices, and a small quarry. There is also a weighbridge. Most of this area is surfaced with hardstanding, but the staff car park is gravelled. Border Hardcore operate the quarry and also provide storage of classic cars and caravans in one of the large units. Speed Welshpool Limited, a pallet and parcel delivery company, occupy the other large unit. In this western region of the site there is also an area of rough land east of the warehouse buildings, which lies at a higher topographic level and is accessed via a rough track.

A track leads from the western section of the site to the main quarry, now disused. The base of the quarry aligns northeast-southwest and lies at 88m - 89m AOD. The quarry sides extend up to approximately 118.5m - 127m AOD to the northwest and a maximum of 119.5m AOD to the southeast.

2.1 Physical Setting and Current Site Use (Continued)

The quarry sides remain exposed and unvegetated, and weathering of these surfaces has led to ravelling where the rock has deteriorated to form fine gravel. Where rock faces are exposed this gravel debris has accumulated at the base of the face. Exposed rock faces are primarily present towards the top of the quarry sides, particularly on its north-western side.

An area south and south-east of the quarry, which is included in the development area, slopes downhill towards the southeast. It may be accessed via an inclined track that cuts from the main entrance track into the bottom of the quarry. The hillside remains unaltered towards the northeast and comprises two grassy fields declining from around 119.5m to 111.5m AOD. The smaller of these fields is heavily overgrown and largely enclosed by hedgerows. The hillside has also been quarried south of the fields and numerous stockpiles of stone material remain in this disused area or rough ground, which sits at around 108m – 109.5m AOD.

A newly formed earth bund defines the south-eastern boundary of the development area.

Two settlement ponds are present at the entrance to the quarry, either side of the access track. During wet weather surface waters were also noted to collect in areas of the quarry floor.

An area between the northwest side of the quarry spanning west towards the currently operating small quarry is wooded.

A site layout plan is found in **Drawing 01**.

2.2 Site History

The history of the site has been traced using historical Ordnance Survey maps from an Envirocheck Report obtained from Landmark Information Group. The Envirocheck Report is presented in **Annex A.**

1885
The site at this time is seen to be situated across field land, and woodland towards the northwest. Within the woodland a small quarry is denoted, adjacent to a road that runs along the north-western site boundary. An old quarry is also recorded in this area and a small gravel pit lies further southwest (at or close to the current site entrance). A line of the Cambrian Railway is seen to traverse north to southwest to the west, where Buttington Junction locates 40m to the west on the opposing side of the road. A second rail line diverges from the junction, initially following the northwest site boundary before continuing further northeast. A stream flows west initially along the southern site boundary and continuing through the southwest of the site. The surrounding area comprises field land with isolated houses and farms, including Brookside, which nestles between the southwest portion of the site and the road.

1902
The majority of the site remains unchanged and the above-mentioned quarry and gravel pit are no longer shown to be in use. However, a brick works has been established in the southwest of the site comprising several buildings and a tramway leading from the brick works towards the northwest on the edge of the wood. Although not labelled, it appears that the tramway accesses a small quarry.

1954
No maps are available within the period 1902-1954. The 1954 edition map shows continued quarrying in the west of the site, where the quarry has migrated further towards the east.

1972/1973
The brick works is shown to have expanded with the demolition of some buildings and erection of several larger units. The tramway has been dismantled. A trackway leads from the brick works towards a clay pit that occupies the central portion of the site. The section of rail line leading north of Butting Junction has been dismantled.

1993
Filling of land adjacent to and east and south of the brick works is apparent. It is likely that fill materials were site-won, perhaps those extracted but unsuitable for brick formation. It is understood from an online source that the brick works closed in 1990.

2000
Aerial photographs from this period record significant extension of the clay pit into the eastern half of the site, but it is now recorded to be disused. A trackway also leads to an area in the far south of the site that appears to be a rough area used for access and possibly storage. The brick works buildings remain.

2019
The quarry area remains the same as 2000, but some localised small-scale quarrying beyond 2000 appears to have deepened the quarry to today's level. All but one of the former brick works buildings currently remains. The stream still follows the southern edge of the site, but where it previously continued through the site towards its western boundary it is no longer recorded.

2.3 Geological Setting

2.3.1 Geology

The solid geology at the quarry is illustrated in **Figure 3.1** below. Please note that this plan is not to scale and actual boundaries between each strata will vary.

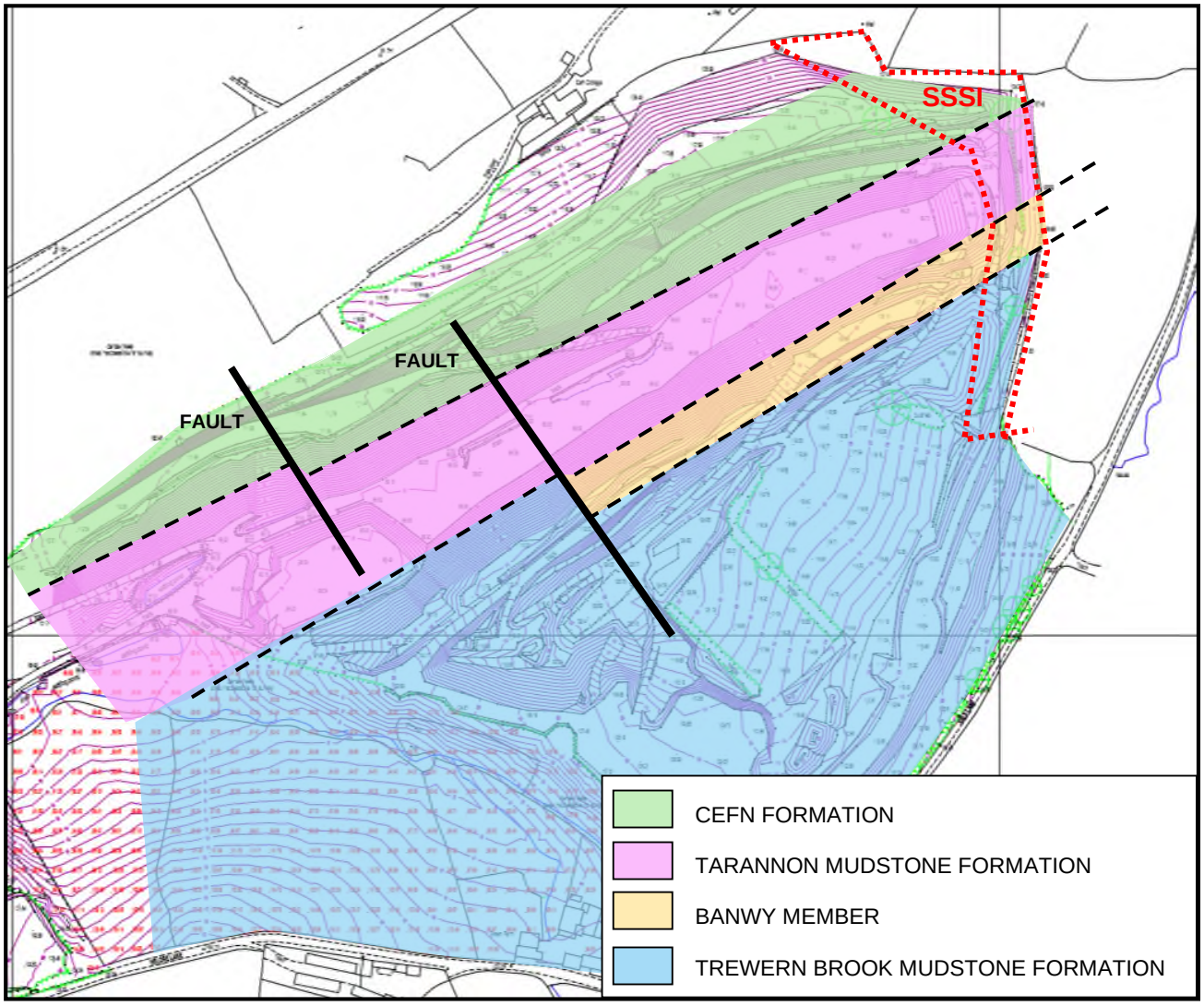

Figure 2.2: Site Geology

Figure 3.1 shows four different strata to be present at Buttington Quarry, younging towards the southeast. **Table 3.1** summarises the stratigraphic sequence.

Table 2.1 Stratigraphic Sequence

Silurian	Wenlock	Sheinwoodian	Trewern Brook Mudstone Formation
			Banwy River Member
	Llandovery	Telychian	Tarannon Mudstone Formation
			Cefn Formation

2.3.1 Geology (Continued)

Cefn Formation (CF)
This is comprised of primarily of grey to dark grey mudstones, with thin sandstone beds. Concretions and nodules recorded.

Tarannon Mudstone Formation (TMF)
The Tarannon Mudstone Formation is comprised of purple/red brown mudstone/shale, also fossiliferous, with graptolites. It is this strata that has been extracted for brick making.

Banwy Member (BM)
A section of mudstone upon the quarry face that is defined by its specific graptolite fossil biostratigraphy that spans the lower Wenlock and upper Llandovery boundary.

Trewern Brook Mudstone Formation (TBMF)
Comprised of blue-grey mudstone beds, also host to graptolite fossils. At the base of the TBMF the Butterley Member is recorded, comprising an approximate 9m thick horizon of bio-turbated silty mudstone with shelly, trilobite and graptolite fossils (Lydell *et al*).

Two faults have been found to cross roughly perpendicular to the length of the quarry, as illustrated in **Figure 3.1**. These down-throw strata towards the southwest.

A continuous sequence of Llandovery to Wenlock rocks is designated as a geological SSSI (Site of Special Scientific Interest). This encompasses the Buttington Shale Formation (TMF) from the upper Llandovery through to the TBMF. The approximate area of the SSSI is illustrated on **Figure 3.1.**

Superficial Devensian fluvioglacial fan deposits (sand and gravel) or Devensian till is recorded in the immediate areas surrounding the quarry top but cover is anticipated to be very shallow, with bedrock at or near the surface.

2.3.2 Radon

The Envirocheck Report (**Annex A**) details that the site lies within an intermediate probability radon area.

Basic radon protection is required for new buildings.

2.4 Environmental Setting

The following sections have been compiled using the Envirocheck datasheet and maps which can be found in **Annex A**.

2.4.1 Hydrogeology and Hydrology

The bedrock underlying the site has been classed by the Environment Agency as a Secondary B Aquifer. Superficial cover, where present, is classified as a Secondary Undifferentiated Aquifer.

Surface water features include the stream that flows along part of the site's southern boundary and the two settlement lagoons at the entrance to the quarry. The stream route across the west of the site is no longer recorded. This may have been culverted, or it may perhaps 'sink' on site following localised quarrying and alteration of the ground.

Beyond the site there are numerous drains along field boundaries and two wells are also denoted within 20m of the northern site boundary.

The River Severn situates approximately 1.1km southwest of the site.

Deeper groundwater flow within the underlying bedrock will be controlled by the strata dip and any fractures or bedding planes within the rock units.

2.4.2 Groundwater

The Envirocheck Report confirms that the site does not situate within a groundwater source protection zone.

There are no groundwater abstraction points within 750m of the site.

No premises with consent to discharge waste waters are present within 150m of the site.

2.4.3 Flooding

There is considered to be localised risk from flooding of surface water features on site, which includes the settlement lagoons and the stream.

2.4.4 Waste

Border hardcore, which currently operates on site, maintains a permit as a local authority pollution prevention and control site relating to general mineral process.

No historic or active landfill sites, or licensed waste management facilities are present within 250m of the site.

Potentially infilled land is recorded on site in relation to an historical small quarry in the west of the site and an area of former quarrying/clay pit.

2.4.5 Pollution

No pollution incidents are detailed to have occurred within a 250m radial area around the site since 1997.

2.4.6 Sensitive Land Use

The geological SSSI at the north-eastern end of the site is recorded.

The remaining woodland in the northwest of the site is designated ancient woodland.

2.4.7 Contemporary Trades

Border Hardcore are listed as a contemporary trade. The former brick works and clay pit are also listed.

No contemporary trades are recorded on properties adjacent to the site.

2.4.8 Recorded Mineral Sites

The main site quarry/former clay pit is listed as a dormant recorded mineral site. The small quarry still operated by Border Hardcore is also recorded by the Envirocheck Report.

2.4.9 Natural Cavities

The bedrock beneath the site is not susceptible to the formation of dissolution features such as underground cavities and sink holes.

The site is therefore not deemed to be at risk from natural cavities.

SECTION 3 Preliminary Human Health and Environmental Risk Assessment

3.1 General

The contaminated land regime is set out in Part IIA of the Environmental Protection Act (EPA) 1990 and was introduced on the 1st April 2000 in England and 1st July 2001 in Wales. A similar regime was introduced in Scotland on 14th July 2000. Part IIA was introduced to achieve two aims:

(1) The identification of contaminated land
(2) The remediation of contaminated land that poses an unacceptable risk to human health and/or the environment

Under Part IIA the statutory definition of 'contaminated land' is: any land which appears to the local authority in whose area it is situated, to be in such a condition, by reason of substances in, on, or under the land, that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) Pollution of controlled waters is being, or is likely to be, caused."

For land to be classified as 'Contaminated Land' there must be a 'pollutant linkage'.

For our definitions of pollution linkage and how we define risk please refer to **Annex B** which includes our classifications of consequence and probability and risk assessment matrix.

3.2 Preliminary Site Conceptual Model

Assessment of the development area only is considered.

The development area is confined to and south of the existing quarry. The development area will be formed by widening the quarry and excavated materials will be laid within the existing quarry bottom or on land directly to the southeast of the newly formed development area.

A new access road to the ERF will be formed from the main road and through the western side of the site and enter the development area approximately where the current access road enters the existing quarry.

The risks to human health and the environmental for the development area has been considered.

The preceding sections enable a preliminary conceptual model of the development area to be drawn up, to illustrate the likely geological and hydrological ground conditions beneath the site and to identify any potential sources of contamination.

3.3 Potential Sources of Contamination and Gas

The potential contamination beneath the site, whether in the matrix of soil or any groundwater will be related to the sites past use and the history of the surrounding area.

Historical records have shown that the development area remained as undeveloped field land until quarrying took place. Quarrying ceased approximately 15-20 years ago.

Part of the area south of the existing quarry is currently used for access and here an old disused lorry and several lorry trailers remain. Here the ground is surfaced with imported hardcore type material. Imported materials are also noted to form part of the access track into the base of the quarry.

Other tracks on site appear to either cut straight in to the in-situ weathered rock or are formed of site won stone.

No potential sources of contamination are identified in connection with site quarrying.

Any imported fill or hardcore is from unknown origin and therefore must be considered as a potential source of contamination.

The old lorry parked may have presented a risk from a fuel/oil leak.

There are no recorded landfills or significant areas infilled land within influencing distance of the site and there is not deemed to be any a gas risk on site. However, basic radon protection is required for the new development.

3.4 Potential Receptors and Pollution Pathways

There are both human and hydrological receptors to be considered should any contamination be detected on site.

Construction workers will be excavating the in-situ rock and shallow surface soils/imported fill where present, and will be exposed via dermal contact with soil/rock and dust, ingestion of dust and inhalation of dust.

Future site users are taken to be workers at the new ERF plant. These receptors will potentially be at risk from any contamination from the same pathways as well as through intake of potable water.

The risk from dermal contact from a leak/spill from the parked lorry to construction workers. However, it is anticipated that the fuel tank would have been emptied prior to disuse. This area will not be accessible to the future ERF plant workers.

If any contamination is identified this may be leachable, enabling it to mobilise through perched groundwater and impact surface waters or deeper groundwater.

A qualitative preliminary Human Health and Environmental Risk Assessment summarises the above and is detailed in the **Tables 3.1 and 3.2** on the following pages.

Table 3.1 - Qualitative Preliminary Human Health Risk Assessment					
Potential Source	**Pathway**	**Receptor During Construction**	**Level of Risk**	**Receptor Post Construction**	**Level of Risk**
In-situ Soil/Rock	**Ingestion, inhalation and dermal contact with soil/rock and dust.**	Construction Workers	No Risk *No potential source of contamination*	Future site users	No Risk *No potential source of contamination*
Leaked fuel/oil	**Ingestion, inhalation and dermal contact with soil/rock and dust.** **Inhalation of vapours**	Construction Workers	Negligible Risk *Any such leaks would have been isolated and very small*	N/A	N/A
Imported Fill	**Ingestion, inhalation and dermal contact with soil/rock and dust.**	Construction Workers	Low Risk	Future site users	Negligible Risk *The materials to be removed or covered by the new buildings or hardstanding upon development*
Radon Gas	**Inhalation** *Accumulation of gas indoors in confined spaces- asphyxiation and explosion*	N/A	N/A	Future site users	Unacceptable Risk *BGS confirm BASIC Radon Protection required for new buildings*
Landfill Gas	**Inhalation** *Accumulation of gas indoors in confined spaces- asphyxiation and explosion*	N/A	N/A	Future site users	No Risk *No landfills within influencing distance of the site*
Ground Gas	**Inhalation** *Accumulation of gas indoors in confined spaces- asphyxiation and explosion*	N/A	N/A	Future site users	No Risk No on-site source of ground gas identified
Made Ground *Anticipated made ground at location of infilled pond*	**Ingestion of potable water** *Absorption of contamination from made ground into potable water pipes*	N/A	N/A	Future site users	Negligible Risk

Table 3.2 – Qualitative Preliminary Environmental Risk Assessment					
Potential Source	**Pathway**	**Receptor During Construction**	**Level of Risk**	**Receptor Post Construction**	**Level of Risk**
Surface Water	**Run-off**	Site and Adjacent Sites Shallow/Perched Groundwater	Low	Site and Adjacent Sites Shallow/Perched Groundwater	Low
Accidental spillage	**Run-off, digging foundations, moving contaminated soil, drainage misconnections, discharges to local surface waters or the ground, construction materials and/or exposed ground, wheel washings, oil or chemical spills**	Site and Adjacent Sites	Low *On site procedures will ensure that all efforts are made to prevent accidental spillage*	N/A	N/A
In-situ Soil/Rock	**Leaching of contamination**	Site and Adjacent Sites	No Risk *No potential source of contamination*	Site and Adjacent Sites	No Risk *No potential source of contamination*
Imported Fill	**Leaching of contamination**	Shallow/Perched Groundwater	Low Risk	Shallow/Perched Groundwater	Low Risk
Contaminated Groundwater	**Direct migration and Perched Groundwater migration**	Secondary B Aquifer	Negligible Risk	Secondary B Aquifer	Negligible Risk
Contaminated Groundwater	**Groundwater Migration**	Stream and drains	Negligible Risk	Stream and drains	Negligible Risk

SECTION 4 Field Investigation

4.1 General

A geo-technical and geo-environmental site investigation was performed during October and November 2018.

The purpose of this investigation was to:

1. Confirm the existing sub-surface geology in the development area, and its strength and structure to inform on the stability of newly formed slopes and foundation recommendations for the new ERF plant
2. Provide recommendations for earthworks
3. Determine the chemistry of soils/rock in the development area and assess whether any contamination exists that presents a risk to human health or the environment are present.
4. Determine the chemistry of groundwater and surface water and assess whether groundwater presents a risk to the environment.

The investigation comprised:

1. Ten rotary probeholes (PH1–PH10) within and outside the quarry. The purpose of the drilling works was to obtain information on the rock units across the site, required to perform a slope stability assessment
2. Sampling of groundwater and settlement lagoon waters
3. Sampling of surface/shallow soil/weathered rock samples for laboratory chemical testing and human health and environmental risk assessment.
4. Bulk sampling and geotechnical testing of the three main lithologies

4.2 Probeholes

PH1 and PH6 were situated with the quarry bottom, targeting the TMF. PH7 and PH10 were drilled into the CMF. The remaining probeholes extended in to the TBMF. The probeholes were sunk using a Beretta T44 drilling rig.

The probehole locations are illustrated on **Figure 4.1** on the following page.

4.2 **Probeholes** (Continued)

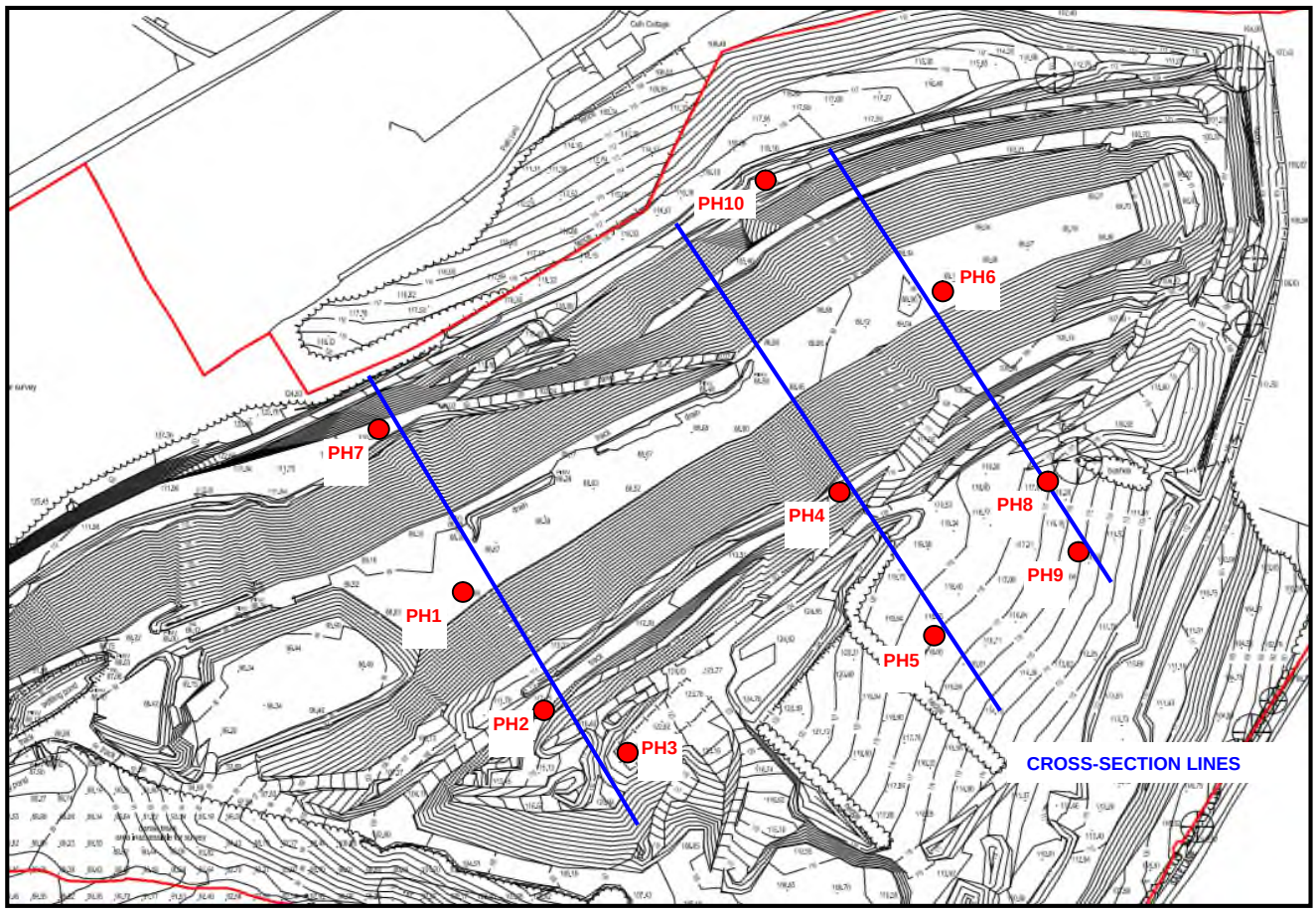

Figure 4.1: Probehole Locations

The exact borehole co-ordinates and levels are detailed on the probehole logs, see **Annex C**.

The probeholes were almost entirely drilled via core sampling and only limited open hole drilling was carried out. Open hole drilling was carried out using compressed air as the flushing medium.

The fieldworks were supervised by Terra Firma (Wales) Limited. The probehole cores were logged to the requirements of BS5930: 1999.

4.2 **Probeholes** (Continued)

A summary of the probehole depths and the geology they intercepted is detailed in **Table 4.1**.

Table 4.1 Probehole Depths and Geology Encountered

Location	Probehole Level at Surface (m AOD)	Depth of Probehole (mbgl)	Base of Probehole (m AOD)	Geology Encountered
PH1	88.71	13.85	74.86	TMF
PH2	111.92	43.45	68.47	TMF
PH3	112.23	18.10	94.13	TBMF
PH4	114.35	39.45	74.90	TBMF
PH5	118.22	17.80	100.42	TBMF
PH6	89.17	14.0	75.17	TBMF
PH7	110.52	24.25	86.27	CF
PH8	117.23	46.45	70.78	TBMF
PH9	115.26	14.0	101.26	TBMF
PH10	114.16	11.5	102.66	CF

Photographs of the extracted rock cores may be found in **Annex D**.

Selected samples of rock cores were retrieved for laboratory geotechnical testing. Test results are provided in **Annex E**.

The Tarannon Mudstone (PH1 and PH6) was found as weak dark reddish brown locally light greenish grey mudstone with closely spaced fractures stained orangish brown. Bedding fractures were recorded as orientated 75°- 85° with primarily planar smooth to polished surfaces. Other fractures were found to be variable in orientation with no consistent fracture surface type, but fractures were clean and generally tight to open.

The Cefn Mudstone (PH7 and PH10) was found to be completed weathered to soil to around 1m depth. In PH7 this grades in to extremely weak dark grey mudstone with bands of non-intact laminated mudstone and siltstone retrieved as angular gravel between 3.85–5.05m, 6.45–7.15m and 9.65m–10.75m depth. Bedding fractures are identified by their 80°- 85° orientation, with variable surfaces but often striated. Other fracture planes are dominantly found to be 15°- 45° to around 11m depth before favouring a 35°- 60° orientation but 60°- 70° fracture planes were also found to regularly feature to the full depth of the probehole. Fractures were generally clean. Non-intact greenish grey mudstone retrieved as gravel extended to 3.0m depth in

PH10, succeeded by very weak grey mudstone with very close to closely and occasionally medium spaced fractures dominantly orientated 5°- 35° and stained orangish brown or dark grey/black. Bedding fractures were consistently dipping 80°- 85°.

4.2 Probeholes (Continued)

The Trewern Brook Mudstone Formation (PH2 – PH6) was found weathered to very gravelly clay soil in some areas to 1.0m depth, and made ground was noted in PH2 to 1.0m depth comprised of rubble hardcore material. In general, the strata is formed of weak grey to dark grey mudstone beds, initially non-intact or very weak in areas and becoming medium strong to strong at depth (PH2 & PH8). Bedding fractures follow a 75°- 85° orientation. Other fractures and joints are prevalent but no relationship between spacing and orientation may be determined between different boreholes. Most fractures are clean but occasionally found to be infilled with soft to stiff grey clay to no more than a few centimetres in thickness. Mineralisation of some fractures was also noted, but these were typically no wider than 1mm. Graptolite fossils (monograptids) were observed in particular beds and often seen on bedding fracture surfaces.

4.3 Groundwater Sampling and Testing

Groundwater monitoring wells were installed in seven of the ten probeholes. The well installations are detailed in the following table.

Table 4.2 Groundwater Well Installations

Location	Full Installation Depth (m)	Installation Details
PH1	13.85	Each installation comprises plain pipe with bentonite seal to 1.0m depth, with slotted pipe, geotextile sock and gravel surround to the full probehole depth
PH2	43.45	
PH4	39.45	
PH6	14.0	
PH7	24.25	
PH8	46.45	
PH9	14.0	

Table 4.3 records groundwater encountered during the drilling works and during a monitoring/sampling round completed on the 21.11.2018.

Table 4.3 Groundwater Levels

Borehole	Groundwater level (mbgl) noted during drilling	Groundwater level 21.11.2018 (mbgl)	Groundwater level AOD 21.11.2018
PH1	0.6	0.3	88.408
PH2	-	18.35	93.569
PH3	-	-	
PH4	-	12.69	101.649
PH5	-	-	
PH6		0.27	89.499
PH7	-	11.8	98.719
PH8	-	11.3	105.934
PH9	6.7m borehole wet	10.2	105.064
PH10	-	-	-

4.3 Groundwater Sampling and Testing (Continued)

During the monitoring round on the 21.11.2018 water samples were taken from the seven wells.

The following method was employed in the taking the water samples:

1. Measurement of groundwater levels was taken with a dip meter.

2. Each borehole was purged prior to sampling. This was undertaken using a battery operated pump. The volume of perched groundwater purged was calculated by:

   Volume purged = (3 x cross sectional area of borehole, including gravel) x depth of groundwater within borehole.

3. The groundwater samples were stored within the appropriate sample jar within a cool box. The samples were taken to the laboratory on the day of their collection.

A water sample was also retrieved from the settlement lagoon north of the quarry entrance track. The lagoon is set within the TMF below the groundwater table and is therefore effectively holding groundwater.

Water samples were submitted for laboratory analysis for the substances listed in **Table 4.4**.

The following chemical tests were undertaken on groundwater samples:

Table 4.4 Groundwater Testing Suite

Metals and Metalloids		Organics	In-organics
Aluminium Arsenic Boron Cadmium Calcium Chromium III Chromium VI Copper Iron	Lead Magnesium Manganese Mercury Nickel Selenium Sodium Tin Zinc	Phenol PAHs) TPHCWG	Conductivity pH BOD COD Cyanide Hardness Ammoniacal Nitrogen Chloride Nitrite Ortho Phosphate Sulphate

The laboratory groundwater chemical test results are presented in **Annex F**.

Refer to **Section 5** for groundwater assessment.

4.4 Soil Sampling and Testing

A series of samples (S1 – S25) were taken from the surface or shallow trial holes excavated by hand or by using a tracked machine. Samples comprised superficial soil cover, fill materials or weathered rock/scree.

The sample locations are illustrated on **Figure 4.2** below.

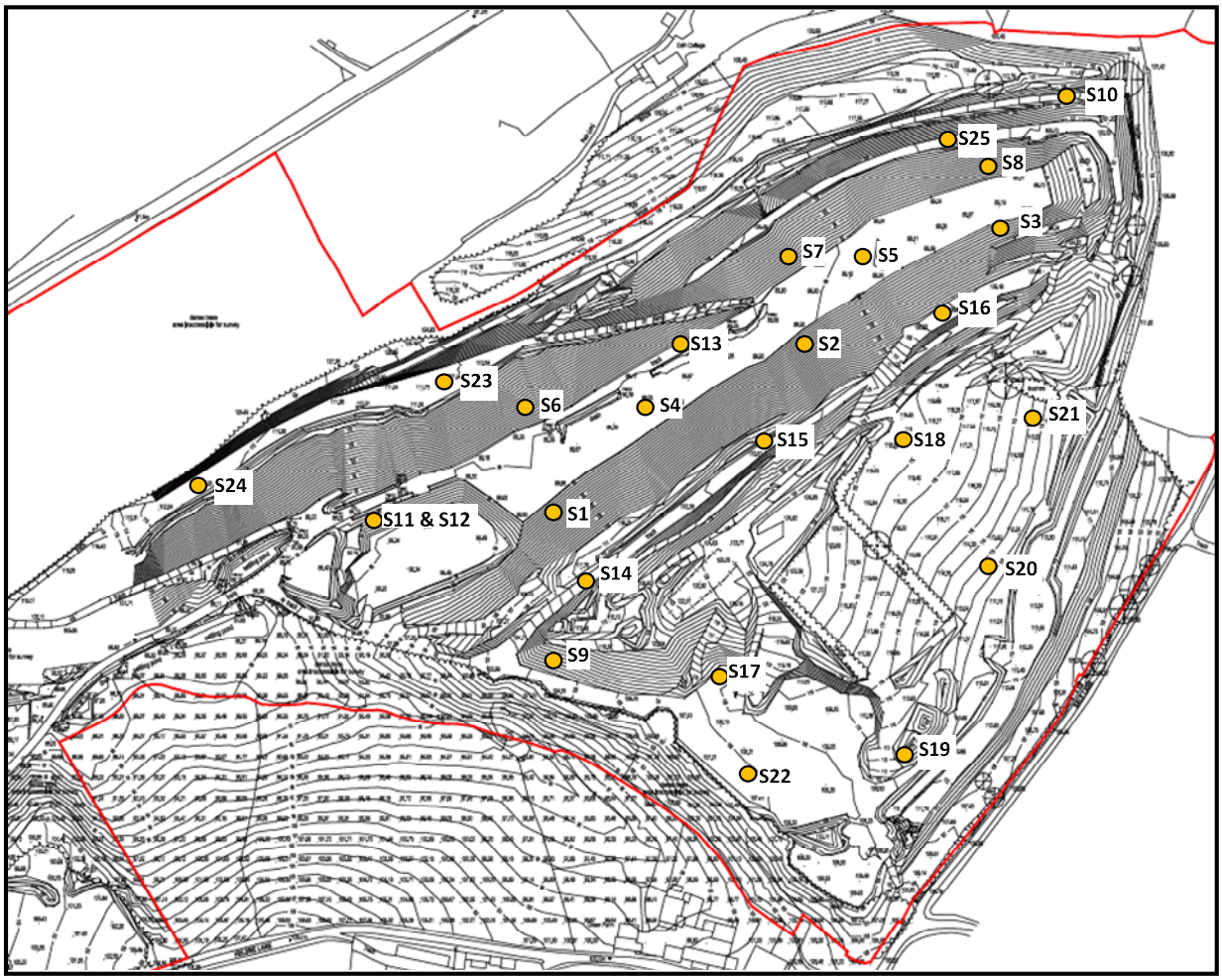

Figure 4.2: Soil Sample Locations

The sampling regime was conducted in accordance with BS5930: 2015 in order to satisfy the following criteria:

- Identify and confirm suspected sources of contamination
- Determine type and concentration of contamination
- Determine lateral and vertical spread of contaminants
- Ensure representation of the entire site
- Provide sufficient data to determine suitable remedial measures if necessary

S22 targeted the area adjacent to the old lorry.

4.4 Soil Sampling and Testing (Continued)

Sample descriptions are detailed in **Table 4.5**.

Table 4.5 Soil Sample Descriptions

Sample	Description
S1	Very fine gravel of mudstone (scree)
S2	
S3	
S4	
S5	
S6	
S7	
S8	
S9	Grey very clayey gravel of mudstone
S10	Very gravelly CLAY
S11	Slight clayey GRAVEL (grey mudstone)
S12	Slight clayey GRAVEL (purple mudstone)
S13	Imported track fill – sand and gravel of granite
S14 (0.2m)	Made ground: Brown sand and gravel with fine to coarse angular to rounded gravel with bricks, plastic, metal. Rebar, nail, can to 0.3m underlain by Made ground: grey very clayey fine to coarse angular gravel of mudstone with brick. Weathered mudstone at 0.7m.
S15	Very fine gravel of mudstone (scree)
S16	Very fine gravel of mudstone (scree)
S17	Made Ground: Clayey gravel
S18	(Topsoil over) Very gravelly clay
S19	
S20	
S21	
S22	Made ground: Clayey sand and gravel.
S23	Very fine gravel of mudstone (scree)
S24	
S25	

The soil samples were submitted for laboratory analysis for the substances listed in **Table 4.6.**

Table 4.6 Soil Testing Suite

Metals and Metalloids		Organics	In-organics
Aluminium Arsenic Boron Cadmium Calcium Chromium III Chromium VI Copper Iron	Lead Magnesium Manganese Mercury Nickel Selenium Sodium Tin Zinc	Phenol PAHs) TPHCWG	Conductivity pH Cyanide Ammoniacal Nitrogen Chloride Nitrite Ortho Phosphate Sulphate Asbestos

The laboratory soil chemical test results are presented in **Annex G.** Please refer to **Section 6** for the soil assessment.

4.5 Bulk Sampling

A number of bulk samples (B1 – B6) were retrieved for geotechnical property testing from shallow depth, with representative samples from each of the three main strata.

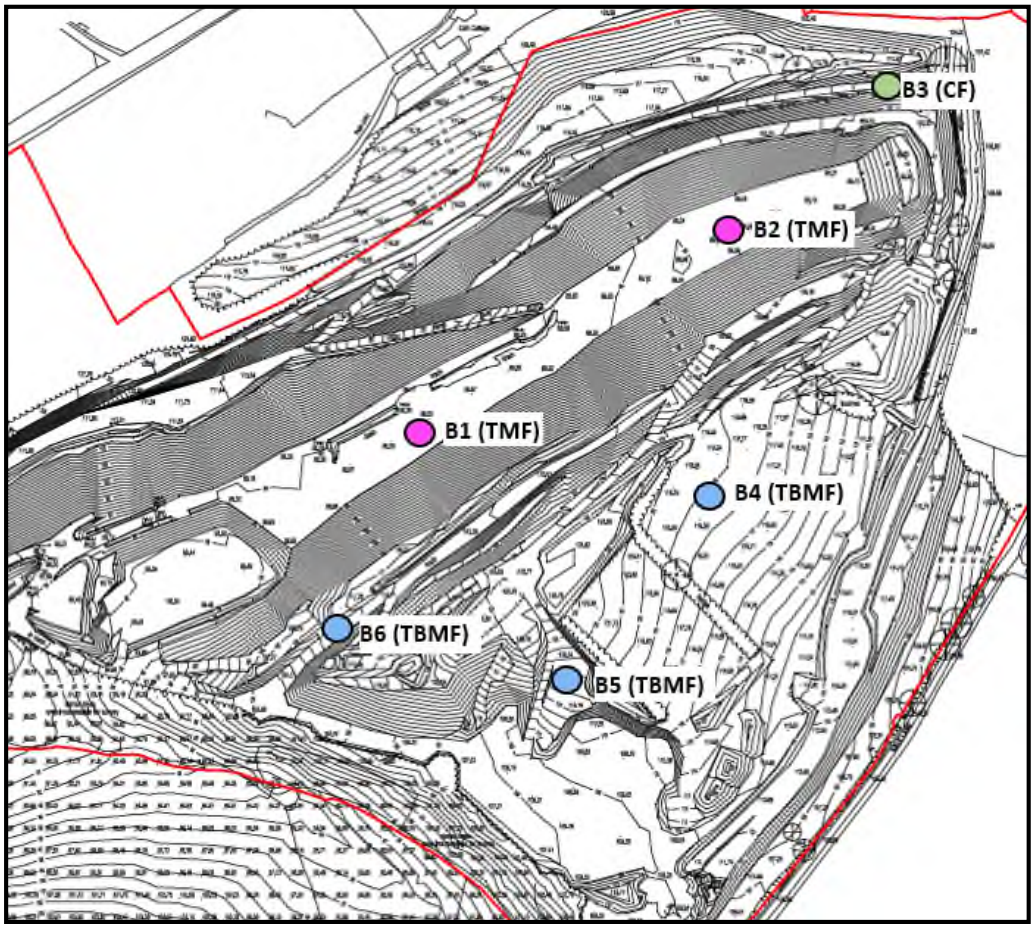

Figure 4.3: Bulk Sample Locations

Samples were submitted for slake durability tests and grading analysis

Test certificates may be found in **Annex H.**

Please refer to **Section 9** for interpretation of the test results.

SECTION 5 Groundwater Assessment

5.1 Groundwater Assessment Methodology

Groundwater results have been compared to thresholds for inland freshwater environments (annual average or maximum allowable concentration where annual average not available) provided by the 2015 UK Water Framework Directive (WFD). No WFD thresholds are available for reference has therefore been made to Dangerous Substance Directive (DSD) or Drinking Water Directive (DWD) criteria in their absence. For TPHCWG WHO thresholds as quoted by 'CLAIRE: Petroleum Hydrocarbons in Groundwater (2017)' have been utilised where available.

5.2 Groundwater Test Results

Groundwater results are summarised in the following tables.

Table 5.1 Summary of Groundwater Chemical Test Results Metals and In-organics

Substance	Threshold (ug/l)	Source	Measured Concentrations of Tested Substances (ug/l)		Number of Exceedances
			Minimum	Maximum	
Aluminium	-	-	58	790	-
Arsenic	50	WFD	0.73	45	0
Boron	-	-	<0.03	0.17	-
Cadmium	0.08 – 0.25*	WFD	<0.03	0.17	**1**
Calcium	-	-	7700	240000	-
Chromium III	4.7	WFD	<1.0	75	**1**
Chromium VI	3.4	WFD	<7.0	<7.0	BLDL
Copper	1.0	WFD	<0.4	100	**1**
Iron	1000	WFD	5.5	1600	**1**
Lead	1.2	WFD	0.1	14	**1**
Manganese	123	WFD	3.9	270	**1**
Mercury	0.07	WFD	<0.01	<0.01	0
Nickel	4.0	WFD	<0.5	150	**2**
Selenium	10	DWD	0.83	7.4	0
Sodium	-	-	24000	200000	-
Tin	25	DSD	<0.4	2.5	0
Zinc	12.9**	WFD	2.1	340	**6**
Phenol	7.7	WFD	<100	<100	BLDL
Ph	-	-	6.6	8.3	-
Cyanide	1.0	WFD	<40	<40	BLDL
Hardness	-	-	23.3mg/l	898mg/l	-
Ammoniacal Nitrogen	-	-	79	8500	-
Chloride	250,000	DWD	1100	18,000	0
Nitrite	50,000	DWD	<35	79	0
Ortho Phosphate	-	-	<0.01	0.1	-
Sulphate	-	-	2100	330,000	-

Notes:

- *Cadmium threshold dependant on hardness
- ** Takes into account ambient background concentration of the River Wye (closest to site with available ambient data (WFD publication 2015)
- BLDL – Below Laboratory Detection Limit

5.2 Groundwater Test Results (Continued)

All samples were tested for speciated PAH and petroleum hydrocarbons.

Table 5.2 Summary of Groundwater Chemical Test Results Speciated Polyaromatic Hydrocarbons and Petroleum Hydrocarbons

Substance	Threshold (ug/l)	Source	Measured Concentrations of Tested Substances (ug/l)		Number of Exceedances
			Minimum	Maximum	
SPECIATED PAH					
Naphthalene	2.0	WFD	<0.05	0.09	0
Acenaphthylene	-	-	<0.01	<0.01	BLDL
Acenaphthene	-	-	<0.01	<0.01	BLDL
Fluorene	-	-	<0.01	0.03	2 ALDL
Phenanthrene	-	-	<0.01	0.11	2 ALDL
Anthracene	0.1	WFD	<0.01	<0.01	0
Fluoranthene	0.0063	WFD	<0.01	0.01	**1**
Pyrene	-	-	<0.01	0.02	1 ALDL
Benzo(a)anthracene	-	-	<0.01	<0.01	BLDL
Chrysene	-	-	<0.01	<0.01	BLDL
Benzo(b)fluoranthene	0.017	WFD	<0.01	<0.01	0
Benzo(k)fluoranthene	0.017	WFD	<0.01	<0.01	0
Benzo(a)pyrene	0.00017	WFD	<0.01	<0.01	BLDL
Indeno(123cd)pyrene	-	-	<0.01	<0.01	BLDL
Dibenzo(ah)anthracene	-	-	<0.01	<0.01	BLDL
Benzo(ghi)perylene	0.0082	WFD	<0.01	<0.01	BLDL
PETROLEUM HYDROCARBONS					
Aliphatic					
PH C5 – C6 Ali	15000	WHO	<0.1	<0.1	0
PH C6 – C8 Ali	15000	WHO	<0.1	<0.1	0
PH C8 – C10 Ali	300	WHO	<0.1	<0.1	0
PH C10 – C12 Ali	300	WHO	<0.1	<0.1	0
PH C12 – C16 Ali	300	WHO	<0.1	<0.1	0
PH C16 – C21 Ali	-	-	<0.1	<0.1	BLDL
PH C21 – C35 Ali	-	-	<0.1	48	1 ALDL
Aromatic					
PH C5 – C7 Arom	-	-	<0.1	<0.1	BLDL
PH C7 – C8 Arom	-	-	<0.1	<0.1	BLDL
PH C8 – C10 Arom	300*	WHO	<0.1	<0.1	0
PH C10 – C12 Arom	90	WHO	<0.1	<0.1	0
PH C12 – C16 Arom	90	WHO	<0.1	<0.1	0
PH C16 – C21 Arom	90	WHO	<0.1	<0.1	0
PH C21 – C35 Arom	90	WHO	<0.1	<0.1	0

Notes:

- - No guideline available
- ALDL – Above Laboratory Detection Limit
- BLDL – Below Laboratory Detection Limit
- * Threshold for ethylbenzene

5.2 Groundwater Test Results (Continued)

Those substances found to be in exceedance of their threshold level or above the limit of detection are detailed in **Table 5.3**.

Table 5.3 Contaminants of Concern in Groundwater

Substance	Threshold (ug/l)	Recorded Concentration (ug/l)	Location
Cadmium	0.08	0.17	PH6
Chromium III	4.7	75	PH6
Copper	1.0	100	PH6
Iron	1000	1600	PH6
lead	1.1	14	PH7
Manganese	123	270	PH4
Nickel	4.0	12 150	PH4 PH6
Zinc	12.9	61 22 110 60 37 340	PH2 PH4 PH7 LAGOON PH1 PH6
Fluorene	-	0.02 0.03	PH7 LAGOON
Phenanthrene	-	0.06 0.11	PH7 LAGOON
Fluoranthene	0.0063	0.01	LAGOON
Pyrene	-	0.02	LAGOON
PH C21 – C35 Ali	-	48ug/l	PH7

SECTION 6 Soil Analytical Results

6.1 Soil Assessment Methodology

Comparison of the analytical results has been made with commercial Suitable 4 Use Levels (S4ULs) provided by Land Quality Management Limited and the Chartered Institute of Environmental Health (CIEH). Where CIEH thresholds are not available reference has been made to Category 4 Screening Levels (C4SLs).

Sulphate results have been compared to British Research Establishment (BRE) guidelines as sulphate levels need only be considered for buried concrete risk assessment only, not human health related.

6.2 Soil Test Results

A summary of the chemical test results is given in **Tables 6.1** and **6.2**.

Table 6.1 Summary of Soil Chemical Test Results Metals and In-Organics

Substance	SGV/GAC (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of Exceedences
			Minimum	Maximum	
Aluminium	-	-	5900	22,000	-
Arsenic	640	CIEH	1.8	47	0
Boron	240000	CIEH	0.4	1.1	0
Cadmium	190	CIEH	<0.1	13	0
Calcium	-	-	2000	100,000	-
Chromium III	8600	CIEH	21	110	0
Chromium VI	33	CIEH	<1.0	<1.0	0
Copper	68000	CIEH	10	260	0
Iron	-	-	11000	43000	-
Lead	2330	C4SL	5.4	37	0
Manganese	-	-	160	27000	-
Mercury	1100	CIEH	<0.05	<0.05	0
Nickel	980	CIEH	22	170	0
Selenium	12000	CIEH	<0.5	9.7	0
Sodium	-	-	130	2300	-
Tin	-	-	<1.0	2.1	-
Zinc	730000	CIEH	63	690	0
Cyanide	-	-	<0.1	0.3	-
Phenol	440	CIEH	<0.3	<0.3	0
Sulphate	2400	BRE	<100	2700	**1**
Ammoniacal Nitrogen	-	-	<0.5	19	-
Chloride	-	-	<1.0	35.1	-
Nitrite	-	-	<1.0	9.2	-
Ortho Phosphate	-	-	<0.1	0.11	-
Organic Matter	-	-	0.1	3.2	-
pH	-	-	6.7	9.9	-

Notes:

- - no available guideline

6.2 Soil Test Results (Continued)

Table 6.2 Summary of Soil Chemical Test Results
Speciated Polyaromatic Hydrocarbons and Petroleum Hydrocarbons

Substance	GAC (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of Exceedences
			Minimum	Maximum	
SPECIATED PAH					
Naphthalene	190	CIEH	<0.03	<0.03	0
Acenaphthylene	83000	CIEH	<0.03	<0.03	0
Acenaphthene	84000	CIEH	<0.03	<0.03	0
Fluorene	63000	CIEH	<0.03	<0.03	0
Phenanthrene	22000	CIEH	<0.03	<0.03	0
Anthracene	520000	CIEH	<0.03	<0.03	0
Fluoranthene	23000	CIEH	<0.03	<0.03	0
Pyrene	54000	CIEH	<0.03	<0.03	0
Benzo(a)anthracene	170	CIEH	<0.03	<0.03	0
Chrysene	350	CIEH	<0.03	<0.03	0
Benzo(b)fluoranthene	44	CIEH	<0.03	<0.03	0
Benzo(k)fluoranthene	1200	CIEH	<0.03	<0.03	0
Benzo(a)pyrene	35	CIEH	<0.03	<0.03	0
Indeno(123cd)pyrene	500	CIEH	<0.03	<0.03	0
Dibenzo(ah)anthracene	3.5	CIEH	<0.03	<0.03	0
Benzo(ghi)perylene	3900	CIEH	<0.03	<0.03	0
PETROLEUM HYDROCARBONS					
Aliphatic					
PH C5 – C6 Ali	3200	CIEH	<0.01	<0.01	0
PH C6 – C8 Ali	7800	CIEH	<0.01	<0.01	0
PH C8 – C10 Ali	2000	CIEH	<0.01	<0.01	0
PH C10 – C12 Ali	9700	CIEH	<1.5	<1.5	0
PH C12 – C16 Ali	59000	CIEH	<1.2	2.8	0
PH C16 – C21 Ali*	1600000	CIEH	<1.5	9.9	0
PH C21 – C35 Ali*	1600000	CIEH	<3.4	<3.4	0
Aromatic					
PH C5 – C7 Arom	26000	CIEH	<0.01	<0.01	0
PH C7 – C8 Arom	56000	CIEH	<0.01	<0.01	0
PH C8 – C10 Arom	3500	CIEH	<0.01	<0.01	0
PH C10 – C12 Arom	16000	CIEH	<0.9	<0.9	0
PH C12 – C16 Arom	36000	CIEH	<0.5	13	0
PH C16 – C21 Arom	28000	CIEH	<0.6	29	0
PH C21 – C35 Arom	28000	CIEH	<1.4	6.9	0

Notes:

- Thresholds based on 1.0% SOM
- CIEH for Ali C16 - 21 and C21 - C35 based on CIEH for EC >16 – 35

All samples were screened for asbestos. No asbestos was detected.

SECTION 7 Quantitative Risk Assessment

7.1 Soils

All substances tested for in soil were found to be present at level below their threshold level with the exception of sulphate in one sample.

In sample S10 sulphate was recorded at 2700mg/kg, above its threshold of 2400mg.kg. However, the threshold is a BRE threshold relevant to construction concrete (see **Section 8.4**). Sulphate does not present at risk to human health or the environment.

Soils may therefore be confirmed to be uncontaminated and do not present a risk to human or environmental receptors.

If during site excavation materials are encountered that are significantly different to those encountered in the investigation the occurrence should be reported to a geo-environmental engineer and appropriate action taken prior to continuing with the works.

As good practice, construction workers should adhere to good site management, COSHH, good standards of hygiene and appropriate health & safety on site, with personal protection equipment (PPE).

Any imported soils or aggregate should be validated as clean and suitable for use in accordance with 'Requirements for the Chemical testing of Imported Soils for Various End Uses and Validation Cover Systems'.

For proposed new supply water pipes, the UK Water Industry Research publication 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (Report 10/WM/03/21)' should be consulted.

In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM3 any soils destined for off-site disposal should be classified on the basis of their hazard phrases prior to disposal. Soils are classified as a mirror entry waste and should be classified on the basis of their specific chemical properties. Terra Firma (Wales) Ltd offer this service if required.

7.2 Groundwater

Laboratory testing of groundwater identified numerous substances above their quoted threshold level in one or more locations.

There appears to be no correlation between these results and the results of soil samples analysed.

Given the lack of on-site and neighbouring site sources of contamination it is surmised that the substances of concern in groundwater are naturally occurring, groundwater chemistry being influenced by the chemistry of the underlying rocks or mineralised fractures.

In addition, it should be noted that the new development will collect surface waters in new drains installed across the development area that will be covered with either new buildings or hardstanding.

7.2 **Groundwater** (Continued)

There are no recorded groundwater abstraction points within 750m of the site. The River Severn situates approximately 1.1km southwest of the site.

Groundwater is not therefore considered to present a risk to the wider aquatic environment.

During the construction period, there is a risk to the environment/adjacent sites from de-watering, digging foundations, moving contaminated soil, drainage misconnections, discharges to local surface waters or the ground, runoff from construction materials and/or exposed ground, wheel washings and oil or chemical spills.

The risk is considered to be negligible as any adverse effects will be easily preventable by due diligence to good construction practise and housekeeping in preventing surface runoff and the spillage of materials.

The basic measures that should be taken are as follows:

- Prepare a drainage plan and mark the manholes to prevent pollutants accidently reaching the surface water sewers;
- Carry out any activities that could cause pollution in a designated, bunded area, away from rivers or boreholes. Where possible it should drain to the foul sewer;
- Use settlement ponds to remove silty water;
- Store all oils and chemicals in a fully bunded area to prevent leaks or spills;
- Get advice on whether you need an environmental permit and apply in good time

SECTION 8 Engineering Recommendations for the New ERF Plant

8.1 Preparation of Site

Any vegetation in the development area, including all roots, should be stripped and removed prior to site works.

Prior to introduction of engineered fill in to the quarry all soft surface material should be stripped and the underlying weathered bedrock exposed.

Contingencies should be made for the protection/diversion any underground services present beneath the site brought about as a result of the proposed works.

Allowances should be made for the excavation of any soft spots/areas. Any reduced levels may be brought up to the required levels with site won granular materials and compacted in layers to the requirements of the Specification for Highway works.

8.2 Foundation and Floor Slab Solution

The development area will be created by extensive cut into the existing southeast quarry face and the creation of a new slope.

The existing quarry floor will be raised to 90AOD, rising to 95AOD towards the northeast using site-won engineered fill. The corresponding cut in to the current southeast quarry face will at its lowest point be to 90AOD and 95AOD.

The new ERF plant may be constructed upon strip or pad foundations taken down in to the engineered fill or bedrock.

Due to the new development spanning across both the fill and bedrock foundations should be designed as reinforced to prevent any differential settlement. Reinforcement will also provide added protection from the two faults known to cross the development area, although in the event of any earthquake activity in the area any movement of faults would not be expected to be significant.

For design purposes an allowable bearing pressure of 150kN/m^2 may be used for foundations constructed within the engineered fill. Those foundations seated solely on bedrock may be designed to allowable bearing pressure of 300kN/m^2. For the given foundation solution and bearing pressure, maximum total settlements of 25mm should result with differential movements of the superstructure not exceeding 1:750.

Reinforced strip/pad foundations may also be used for construction of the new bunker as described above. However, it is recommended that appropriate waterproofing be incorporated into the bunker construction and allowances made for potential buoyancy effects.

Allowances should be made for the removal of any ‘soft spots’ and their replacement with well-compacted site-won granular materials compacted in layers to the specification for Highway Works.

Floor slabs may be designed as reinforced ground bearing.

All foundation formations should be inspected by a suitably qualified Engineer before being concreted.

8.3 Excavations and Formations

Excavations will require specialist equipment for excavating and breaking bedrock,

Shallow perched water flows are not expected. Any water inflows together with rainwater infiltration should be dealt with by conventional pumping techniques.

The sides of any excavations deeper than 1.0m, or shallower if unstable, should be supported by planking and strutting or other proprietary means.

The sub-formations/formations may be susceptible to loosening, softening and deterioration by exposure to weather (rain, frost and drying conditions), the action of water (flood water or removal of groundwater) and site traffic.

Formations should never be left unprotected and continuously exposed to rain causing degradation, or left exposed/uncovered overnight, unless permitted by a qualified engineer.

Construction plant and other vehicular traffic should not be operated on unprotected formations.

As a minimum the formation/excavation surfaces must be protected by blinding concrete immediately after exposure.

Allowances should be made for the removal of soft spots/areas and their replacement with well compacted granular materials.

Allowances should also be made for special precautions to prevent formation deterioration in addition to the above.

8.4 Protection of Buried Concrete

Levels of total sulphate recorded within the in-situ materials in the development area measured between <100mg/kg to 1000mg/kg and the pH varied between 6.7 and 8.7.

When these results are compared with Tables C1 of BRE Digest 1:2005, they indicate that all buried concrete should most likely as a minimum conform to Class AC-1.

8.6 Slopes

The development will include extensive reprofiling of the north and south-eastern existing quarry faces.

Please refer to Terra Firma (Wales) Limited Slope Stability Report (Report No. 14880/ss, dated March 2019)

SECTION 9 Earthworks

9.1 General

Upon development the excavated rock material is to be retained on site where possible. This will include filling the current quarry bottom from approximately 88 - 89AOD to 95AOD.

Some filling on land southeast of the quarry is also intended.

During site works representative bulk samples of each of the three main strata were taken for laboratory geotechnical property testing.

Samples 1 and 2 were taken from the Tarannon Mudstone. Sample 3 was taken from the Cefn Formation. Samples 4, 5 and 6 represent the Trewern Mudstone Formation.

It should be noted that the samples tested represent weathered materials that could be retrieved at or close to the surface.

Test certificates may be found in **Annex G**.

9.2 Slake Durability Testing

Slake durability testing may be used to understand how susceptible rock may be to degradation when subject to weathering processes such as wetting and drying and freezing and thawing cycles. This is particularly important with respect to mudstones and shales.

Slake durability test results are compared to Gamble's Slake Durability Classification

Table 9.1 Slake Durability Test Results

Sample	Strata	% retained after one 10 min cycle	Durability Classification	% retained after two 10 min cycles	Durability Classification
S1	TMF	88	Medium	76	Medium
S2	TMF	88	Medium	75	Medium
S3	CF	96	Medium High	93	Medium High
S4	TBMF	93	Medium	88	Medium High
S5	TBMF	94	Medium	89	Medium High
S6	TBMF	91	Medium	88	Medium High

The samples used for testing comprised weathered rock (although not as weathered as the exposed scree materials) and results for more competent undisturbed rock may be expected to show the rock to be more durable.

9.3 Grading Analysis

All our samples were tested in the laboratory by dry and wet sieving analysis to determine their grading characteristics. These tests were conducted in accordance with BS1377: Part 2, Clause 9.2: 1990.

Based upon the soil property test results, and referring to Table 6/1: Acceptable Earthworks Materials: Classification and Compaction Requirements and Table 6/2: Grading Requirements for Acceptable Earthworks Materials, of the 'Series 600 Specification for Highway Works', the samples can be classified as:

Table 9.2 Grading Analysis Results and Soil Classification

Sample	Strata	Type (Table 6/2)	Classification (Table 6/1)
S1	TMF	1A	Well graded granular material Compaction Method 2
S2	TMF		
S3	CF		
S4	TBMF		
S5	TBMF		
S6	TBMF		

A 1A classification assumes a maximum particle size of 300mm. Please note that on removal, how the rock will fragment will be governed largely by the bedding and fracture planes and the way it is extracted.

Segments larger than 300mm are likely to be retrieved, particularly with depth where the competency of the rock increases.

Where this occurs, the rock should be crushed to conform with a 1A particle size classification or re-classified and the appropriate compaction method determined.

9.4 Compaction Specification

Compaction should be undertaken in accordance with Table 6/4: Method Compaction for Earthworks Materials: Plant and Methods of the 'Series 600 Specification for Highway Works', as summarised in **Table 9.3**

The minimum number of passes, 'N', is the minimum number of times that each point on the surface of the layer being compacted should be traversed by the compaction plant, in its operating mode 'D' is the maximum depth of the compacted layer.

Table 9.3 Compaction Method

Plant Type		Plant Type	
Smooth Wheeled Roller	D = 125mm 2100-2700kg N = 8 2700-5400kg N = 6 D = 150mm >5400kg N = 4	**Grid Roller**	D = 125mm 5400-8000kg N = 12 D = 150mm >8000kg N = 12
Dead Weight Tamping Roller	D = 150mm 4000-6000kg N = 12 D = 200mm >6000kg N = 12	**Pneumatic Tyred Roller**	D = 125mm 2000-2500kg N = 12 2500-4000kg N = 10 4000-6000kg N = 10 D = 150mm 6000-8000kg N = 8 8000-12000kg N = 8 D = 175mm >12000kg N = 6

Please refer to Series 600 Specification for Highway Works for specifications for alternative plant.

Compaction should be undertaken in accordance with Table 6/1 and 6/4, as soon as practicable after deposition.

Where combinations of different types or categories of plant are used, the depth of the layer should be for the type of plant requiring the least depth of layer, and the number of passes should be that for the type of plant requiring the greatest number of passes.

Earthmoving plants are not recommended for use as compaction plant, nor are lighter categories of plants used to provide preliminary compaction to assist the use of heavier plant.

The maximum particle size of any fill material should not exceed more than two thirds of the compacted layer thickness. Any larger fragments should be crushed or removed prior to use.

The stability of excavations or fills should not be compromised by the location of stockpiled materials or use of plant or location of temporary buildings/structures.

All earthworks must be kept free of water including arranging for the rapid removal of water, water shed onto the earthworks and water entering the earthworks from any source.

9.4 Compaction Specification (Continued)

All exposed fill surfaces must be adequately weather proofed during inclement weather or at the end of the working day/compaction process.

Any exposed cohesive fill that becomes wet and slurrified due to water ingress or weather erosion must be stripped off, spread into thin layers and aerated. The fill should then be re-compacted.

Plant movement across compaction layers should be restricted to that plant necessary for its deposition, spreading and compaction.

Fill areas should be constructed evenly over their full width and their fullest possible extent and the contractor should control and direct constructional plant and other traffic uniformly over them. Damage by construction plant should be made good with material having the same characteristics and strength as the material had before it was damaged.

Where fill is to be placed against an existing slope, the existing slope should be cut and benched before placing the fill. This will include the transition from the existing quarry floor to the new base of the development are.

It is recommended that a number of in-situ plate load tests be performed throughout the earthworks and at the final finished level, particularly beneath any proposed buildings or the access road. This is to confirm the compaction works have been carried out satisfactorily.

The earthworks should be supervised by a suitably qualified engineer.

The tests should be conducted in accordance with BS 1377: Part 9: 1990 under the supervision of a qualified geotechnical engineer.

Allowances should also be made for the removal of soft spots and their replacement with imported suitable selected inert granular materials or suitable inert site won materials.

ANNEX A
Envirocheck Report

terrafirma

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
196125587_1_1

Customer Reference:
14880

National Grid Reference:
327660, 310170

Slice:
B

Site Area (Ha):
25.12

Search Buffer (m):
1000

Site Details:

Quarry
Buttington
Welshpool
SY21 8SZ

Client Details:

Ms R Liley
Terra Firma (Wales) Ltd
5 Deryn Court
Wharfdale Road
Pentwyn
Cardiff
CF23 7HB

terrafirma

Contents

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.
In this datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

Report Version v53.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 2			5	4
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls					
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 4		Yes		
Pollution Incidents to Controlled Waters	pg 4			2	
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances					
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register					
Water Abstractions					
Water Industry Act Referrals					
Groundwater Vulnerability	pg 5	Yes	n/a	n/a	n/a
Drift Deposits			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 5	Yes	n/a	n/a	n/a
Superficial Aquifer Designations	pg 5	Yes	n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences	pg 5		Yes	n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 5		3	8	25

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites					
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Landfill Coverage	pg 10	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)					
Potentially Infilled Land (Water)					
Registered Landfill Sites					
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 11	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 11	Yes		Yes	Yes
BGS Recorded Mineral Sites					
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 12	Yes		n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 12	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 12		Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 12	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 12		Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 12	Yes	Yes	n/a	n/a
Radon Potential - Radon Affected Areas	pg 13	Yes	n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 14				1
Fuel Station Entries					
Points of Interest - Commercial Services					
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 14				3
Points of Interest - Public Infrastructure					
Points of Interest - Recreational and Environmental	pg 14			1	
Gas Pipelines					
Underground Electrical Cables					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland	pg 15			1	8
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
Ramsar Sites					
Sites of Special Scientific Interest	pg 15	1			
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(W)	0	1	327100 310200
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	0	1	327100 309950
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(W)	0	1	326750 310050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	0	1	327050 310050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	0	1	326850 309950
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(W)	0	1	326800 310200
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	0	1	327100 310173
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	(W)	0	1	326700 310050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	(SW)	0	1	327300 309750
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(W)	0	1	327050 310100
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(W)	0	1	327100 310300
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	0	1	326700 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	0	1	326750 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(W)	0	1	327000 310100
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(W)	0	1	326800 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	0	1	327000 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	(W)	0	1	327100 310100
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	(W)	0	1	327100 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	B13SW (NW)	0	1	327400 310750
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	71	1	326850 310350
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(SW)	80	1	326750 309600
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	89	1	326700 309850

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	93	1	326750 309800
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(W)	109	1	326700 309800
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	111	1	327050 310400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(W)	111	1	327100 310400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(SW)	151	1	326800 309700
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(NW)	163	1	327050 310450
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	B9NW (NW)	336	1	327500 310350
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	(SW)	354	1	326750 309500
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(SW)	365	1	327250 309650
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	B9NW (N)	488	1	327650 310650
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	(SW)	498	1	326750 309350
1	**Discharge Consents** Operator: Powys County Council Property Type: Not Given Location: Trewern School Authority: Environment Agency, Midlands Region Catchment Area: Not Given Reference: S175/1 /1 Permit Version: Not Supplied Effective Date: Not Supplied Issued Date: 23rd September 1955 Revocation Date: Not Supplied Discharge Type: Sewage Treatment Works - Final Effluent Discharge Environment: Into And/Or Watercourse Receiving Water: Pwll Trewern **Status: Not Supplied** Positional Accuracy: Located by supplier to within 100m	B13SW (NW)	492	2	327400 310695
1	**Discharge Consents** Operator: Powys County Council Property Type: Sewage Disposal Works - Other Location: Buttington Trewern County School, Welshpool, Powys Authority: Natural Resources Wales Catchment Area: Severn Upper Reference: S/01/55057/S Permit Version: 1 Effective Date: 27th January 1997 Issued Date: 27th January 1997 Revocation Date: 27th April 2006 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Pwll Trewern **Status: Revoked (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 100m	B13SW (NW)	496	3	327400 310700

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Discharge Consents** Operator: Powys County Council Property Type: Sewage Disposal Works - Other Location: Buttington Trewern County School Buttington, Welshp Authority: Environment Agency, Midlands Region Catchment Area: Upper Severn Catchment (Above Montford) Reference: S/01/55057/S Permit Version: 1 Effective Date: 27th January 1997 Issued Date: 27th January 1997 Revocation Date: 27th April 2006 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Pwll Trewern **Status: Revoked (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 100m	B13SW (NW)	496	2	327400 310700
1	**Discharge Consents** Operator: Powys County Council Property Type: Not Given Location: Trewern School Authority: Environment Agency, Midlands Region Catchment Area: Not Given Reference: S/01/04175/S /1 Permit Version: Not Supplied Effective Date: Not Supplied Issued Date: 17th March 1992 Revocation Date: Not Supplied Discharge Type: Sewage Treatment Works - Final Effluent Discharge Environment: Into And/Or Watercourse Receiving Water: Pwll Trewern **Status: Not Supplied** Positional Accuracy: Located by supplier to within 100m	B13SW (NW)	496	2	327400 310700
1	**Discharge Consents** Operator: Powys County Council Property Type: Sewage Disposal Works Location: Buttington Trewern County, Primary School, Buttington, Welshpool, Powys Authority: Environment Agency, Midlands Region Catchment Area: Upper Severn Catchment (Above Montford) Reference: CS/01/55057/S/1 Permit Version: Not Supplied Effective Date: Not Supplied Issued Date: 27th January 1997 Revocation Date: Not Supplied Discharge Type: Sewage Treatment Works - Final Effluent Discharge Environment: Unknown Receiving Water: Pwll Trewern **Status: Not Supplied** Positional Accuracy: Located by supplier to within 100m	B13SW (NW)	499	2	327405 310700
2	**Discharge Consents** Operator: Mr Keith Mallows Property Type: Domestic Property (Single) Location: Stp @ Ty Ger Y Nant, Heldre Lane, Trewern, Welshpool, Powys, Sy21 8du Authority: Natural Resources Wales Catchment Area: Not Supplied Reference: Eprpb3993hk Permit Version: 1 Effective Date: 23rd January 2014 Issued Date: 23rd January 2014 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Pwll Trewern **Status: New issued under EPR 2010** Positional Accuracy: Located by supplier to within 10m	B13SW (N)	742	3	327631 310828

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
2	**Discharge Consents** Operator: Keith Mallows Property Type: Domestic Property (Single) Location: Stp @ Ty Ger Y Nant, Heldre Lane, Trewern, Welshpool, Powys, Sy21 8du Authority: Natural Resources Wales Catchment Area: PWLL TREWERN - SOURCE TO CONF R SEVERN Reference: Pb3993hk Permit Version: 1 Effective Date: 23rd January 2014 Issued Date: 23rd January 2014 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Pwll Trewern **Status: Effective** Positional Accuracy: Located by supplier to within 10m	B13SW (N)	742	3	327631 310828
2	**Discharge Consents** Operator: Min-Y-Nant Property Type: Sewage Disposal Works - Other Location: Min-Y-Nant, Trewern, Welshpool, Powys Authority: Natural Resources Wales Catchment Area: Severn Upper Reference: S/01/10959/S Permit Version: 1 Effective Date: 7th January 1988 Issued Date: 7th January 1988 Revocation Date: 19th September 1991 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Pwll Trewern **Status: Revoked (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	B13SW (N)	771	3	327650 310850
2	**Discharge Consents** Operator: Min-Y-Nant Property Type: Sewage Disposal Works - Other Location: Min-Y-Nant, Trewern, Welshpool, Powys Authority: Environment Agency, Midlands Region Catchment Area: Upper Severn Catchment (Above Montford) Reference: S/01/10959/S Permit Version: 1 Effective Date: 7th January 1988 Issued Date: 7th January 1988 Revocation Date: 19th September 1991 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Pwll Trewern **Status: Revoked (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	B13SW (N)	771	2	327650 310850
	Nearest Surface Water Feature	(SW)	70	-	327329 309891
3	**Pollution Incidents to Controlled Waters** Property Type: Water Company Sewage: Pumping Station Location: Location Description Not Available Authority: Environment Agency, Midlands Region Pollutant: Crude Sewage Note: Amenity Affected Incident Date: 12th February 1996 Incident Reference: 2500271 Catchment Area: Severn Catchment : Upper Severn (Above Montford) Receiving Water: Watercourse Cause of Incident: Mechanical Failure Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	B9NW (NW)	397	2	327420 310550

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
3	**Pollution Incidents to Controlled Waters** Property Type: Private Sewage (Non-PLC): Pumping Station Location: Location Description Not Available Authority: Environment Agency, Midlands Region Pollutant: Crude Sewage Note: Amenity Affected Incident Date: 19th December 1995 Incident Reference: 2500219 Catchment Area: Severn Catchment : Upper Severn (Above Montford) Receiving Water: Watercourse Cause of Incident: Mechanical Failure Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	B9NW (NW)	431	2	327420 310600
	Groundwater Vulnerability Soil Classification: Not classified Map Sheet: Sheet 21 West Shropshire Scale: 1:100,000	B9SW (NW)	0	2	327656 310173
	Drift Deposits None				
	Bedrock Aquifer Designations Aquifer Designation: Secondary Aquifer - B	B9SW (S)	0	3	327656 310000
	Bedrock Aquifer Designations Aquifer Designation: Secondary Aquifer - B	B9SW (NW)	0	3	327656 310173
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - Undifferentiated	(W)	0	3	326986 310000
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - A	(W)	0	3	327104 310000
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - Undifferentiated	(W)	0	3	326793 309927
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - Undifferentiated	(W)	0	3	327106 310273
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - A	(SW)	0	3	327125 309950
	Extreme Flooding from Rivers or Sea without Defences None				
	Flooding from Rivers or Sea without Defences Type: Extent of Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	B9NW (N)	113	3	327600 310645
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				
4	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 323.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	(SW)	70	5	327329 309891
5	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 375.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B5NW (SW)	113	5	327339 309744

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
6	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 282.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9SW (SW)	231	5	327547 310040
7	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 438.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	B9SW (SW)	329	5	327521 310088
8	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 10.2 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	B9NW (NW)	341	5	327437 310416
9	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 327.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	B9NW (NW)	348	5	327440 310426
10	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 160.0 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B5NW (SW)	422	5	327339 309744
11	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 7.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B5NW (SW)	422	5	327346 309746
12	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 224.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9SW (SW)	477	5	327547 310040
13	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 18.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9SW (SW)	477	5	327565 310035
14	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 371.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9SW (SW)	495	5	327572 310031

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
15	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 187.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Pwll Trewern Catchment Name: Severn Primacy: 1	B13SW (N)	504	5	327452 310731
16	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 416.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	(SW)	521	5	327307 309533
17	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 235.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Pwll Trewern Catchment Name: Severn Primacy: 1	B13SW (N)	550	5	327486 310714
18	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 162.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B5SW (SW)	564	5	327415 309603
19	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 375.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9NW (N)	573	5	327671 310449
20	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 13.7 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9NE (N)	574	5	327676 310437
21	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 107.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9NE (N)	575	5	327697 310332
22	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 3.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9NE (N)	579	5	327697 310329
23	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 276.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9SE (NE)	579	5	327723 310218

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
24	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 176.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Pwll Trewern Catchment Name: Severn Primacy: 1	B13SW (N)	727	5	327622 310816
25	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 9.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B5NE (S)	790	5	327768 309756
26	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 925.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B5NE (S)	796	5	327771 309747
27	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 223.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9SE (E)	852	5	327991 310290
28	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 392.8 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B9NE (NE)	852	5	327945 310499
29	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 199.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Nant y Neuadd Dingle Catchment Name: Severn Primacy: 1	B13SE (N)	869	5	327727 310913
30	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 106.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Pwll Trewern Catchment Name: Severn Primacy: 1	B13SE (N)	869	5	327727 310913
31	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 151.2 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B10SW (E)	926	5	328045 310201
32	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 136.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B10SW (E)	936	5	328055 310295

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
33	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 535.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Pwll Trewern Catchment Name: Severn Primacy: 1	B13SE (N)	936	5	327757 310979
34	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 398.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B10SW (E)	938	5	328043 310129
35	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 137.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B13SE (N)	938	5	327760 310978
36	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 106.8 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B10NW (NE)	960	5	328070 310422
37	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 11.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B10NW (NE)	973	5	328063 310529
38	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 245.3 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	B10NW (NE)	974	5	328061 310540
39	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 188.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Nant y Neuadd Dingle Catchment Name: Severn Primacy: 1	B14SW (NE)	998	5	328066 310785

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Local Authority Landfill Coverage Name: Powys County Council - Has supplied landfill data		0	6	327656 310173

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Llandovery Rocks (Undifferentiated)	B9SW (NW)	0	1	327587 310286
	BGS 1:625,000 Solid Geology Description: Caradoc Rocks (Undifferentiated)	B9NW (NW)	0	1	327484 310457
	BGS 1:625,000 Solid Geology Description: Wenlock Rocks (Undifferentiated)	B9SW (NW)	0	1	327656 310173
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <100 mg/kg Nickel Concentration: 15 - 30 mg/kg	B9SW (NW)	0	1	327656 310173
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <100 mg/kg Nickel Concentration: 15 - 30 mg/kg	B5NE (SE)	388	1	327763 309950
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <100 mg/kg Nickel Concentration: 30 - 45 mg/kg	B9NW (N)	401	1	327558 310628
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <100 mg/kg Nickel Concentration: 30 - 45 mg/kg	B9NW (N)	522	1	327592 310513
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <100 mg/kg Nickel Concentration: 30 - 45 mg/kg	B9NE (N)	785	1	327832 310620
	BGS Measured Urban Soil Chemistry No data available				
	BGS Urban Soil Chemistry Averages No data available				

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Coal Mining Affected Areas In an area that might not be affected by coal mining				
	Non Coal Mining Areas of Great Britain Risk: Highly Unlikely Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310000
	Non Coal Mining Areas of Great Britain Risk: Highly Unlikely Source: British Geological Survey, National Geoscience Information Service	B9SW (NW)	0	1	327656 310173
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310000
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	B9SW (NW)	0	1	327656 310173
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	B9NW (N)	134	1	327558 310628
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	B9SW (NW)	0	1	327656 310173
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310000
	Potential for Compressible Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	B9NW (NW)	19	1	327526 310467
	Potential for Compressible Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	B9NW (N)	134	1	327558 310628
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	B9SW (NW)	0	1	327656 310173
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310000
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310000
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	B9SW (NW)	0	1	327656 310173
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	B5SE (S)	0	1	327718 309602
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	B9SW (NW)	19	1	327468 310320
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	B9SW (NW)	0	1	327656 310173
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310000
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	B9NW (N)	134	1	327558 310628
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	B9SW (NW)	0	1	327656 310173
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	B9NW (NW)	19	1	327526 310467
	Radon Potential - Radon Affected Areas Affected Area: The property is in an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310001
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	B9SW (S)	0	1	327656 310001

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
40	**Contemporary Trade Directory Entries** Name: Powys Transport Ltd Location: Trewern, Welshpool, Powys, SY21 8DU Classification: Road Haulage Services **Status: Active** Positional Accuracy: Manually positioned within the geographical locality	B13SW (N)	600	-	327456 310787
41	**Points of Interest - Manufacturing and Production** Name: Poultry Houses Location: SY21 Category: Farming Class Code: Poultry Farming, Equipment and Supplies Positional Accuracy: Positioned to an adjacent address or location	B13NW (N)	910	7	327518 311109
41	**Points of Interest - Manufacturing and Production** Name: Tank Location: SY21 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to an adjacent address or location	B13NW (N)	987	7	327589 311159
42	**Points of Interest - Manufacturing and Production** Name: Fred Mountford Location: Middle Heldre, Buttington, Welshpool, SY21 8TE Category: Farming Class Code: Livestock Farming Positional Accuracy: Positioned to address or location	B10SW (E)	919	7	328031 310182
43	**Points of Interest - Recreational and Environmental** Name: Playground Location: Hazel Close, SY21 Category: Recreational Class Code: Playgrounds Positional Accuracy: Positioned to address or location	B9NW (NW)	426	7	327361 310642

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
44	**Ancient Woodland** Name: Not Supplied Reference: 44244 Area(m²): 10612.88 Type: Plantation on Ancient Woodland	B9SW (SW)	346	3	327555 310070
45	**Ancient Woodland** Name: Not Supplied Reference: 27143 Area(m²): 7025.73 Type: Ancient and Semi-Natural Woodland	B9SE (NE)	560	3	327707 310212
46	**Ancient Woodland** Name: Not Supplied Reference: 29223 Area(m²): 30108.06 Type: Restored Ancient Woodland Site	(SW)	663	3	327096 309152
47	**Ancient Woodland** Name: Not Supplied Reference: 26855 Area(m²): 1471.76 Type: Ancient and Semi-Natural Woodland	B5SW (S)	685	3	327348 309330
48	**Ancient Woodland** Name: Not Supplied Reference: 28059 Area(m²): 16908.93 Type: Ancient and Semi-Natural Woodland	B5SW (S)	686	3	327439 309398
49	**Ancient Woodland** Name: Not Supplied Reference: 28058 Area(m²): 4896.52 Type: Ancient and Semi-Natural Woodland	(SW)	701	3	326845 309111
50	**Ancient Woodland** Name: Not Supplied Reference: 33924 Area(m²): 5632.36 Type: Ancient and Semi-Natural Woodland	(SW)	709	3	326725 309112
51	**Ancient Woodland** Name: Not Supplied Reference: 27140 Area(m²): 13843.73 Type: Ancient and Semi-Natural Woodland	B5NE (S)	810	3	327773 309705
52	**Ancient Woodland** Name: Not Supplied Reference: 28060 Area(m²): 9010.02 Type: Ancient and Semi-Natural Woodland	B5SE (S)	938	3	327818 309540
53	**Sites of Special Scientific Interest** Name: Gwaith Brics Buttington / Buttington Brickworks Multiple Areas: N Total Area (m2): 6545.96 Source: Natural Resources Wales Reference: 279733wpy Designation Details: Geological Designation Date: 16th July 2004 Date Type: Notified	(W)	0	3	327014 310205

Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices		
Shrewsbury and Atcham Borough Council (now part of Shropshire Council) - Environmental Health Department	August 2008	Not Applicable
Powys County Council - Public Protection Department	February 2015	Annual Rolling Update
Shropshire Council - Environmental Health Department	March 2015	Annually
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	May 2009	Not Applicable
Discharge Consents		
Environment Agency - Midlands Region	January 2019	Quarterly
Natural Resources Wales	January 2019	Quarterly
Enforcement and Prohibition Notices		
Environment Agency - Midlands Region	March 2013	Annual Rolling Update
Environment Agency - Welsh Region	March 2013	Annual Rolling Update
Integrated Pollution Controls		
Environment Agency - Midlands Region	October 2008	Variable
Environment Agency - Welsh Region	October 2008	Variable
Integrated Pollution Prevention And Control		
Environment Agency - Midlands Region	January 2019	Quarterly
Environment Agency - Welsh Region	January 2019	Quarterly
Natural Resources Wales	January 2019	Quarterly
Local Authority Integrated Pollution Prevention And Control		
Shrewsbury and Atcham Borough Council (now part of Shropshire Council) - Environmental Health Department	February 2007	Not Applicable
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	June 2008	Not Applicable
Powys County Council - Public Protection Department	May 2014	Variable
Shropshire Council - Environmental Health Department	October 2014	Variable
Local Authority Pollution Prevention and Controls		
Shrewsbury and Atcham Borough Council (now part of Shropshire Council) - Environmental Health Department	February 2007	Not Applicable
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	June 2008	Not Applicable
Powys County Council - Public Protection Department	May 2014	Annual Rolling Update
Shropshire Council - Environmental Health Department	October 2014	Annually
Local Authority Pollution Prevention and Control Enforcements		
Shrewsbury and Atcham Borough Council (now part of Shropshire Council) - Environmental Health Department	February 2007	Not Applicable
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	June 2008	Not Applicable
Powys County Council - Public Protection Department	May 2014	Variable
Shropshire Council - Environmental Health Department	October 2014	Variable
Nearest Surface Water Feature		
Ordnance Survey	January 2019	
Pollution Incidents to Controlled Waters		
Environment Agency - Midlands Region	December 1999	Not Applicable
Prosecutions Relating to Authorised Processes		
Environment Agency - Midlands Region	July 2015	Annual Rolling Update
Environment Agency - Welsh Region	March 2013	Annual Rolling Update
Natural Resources Wales	March 2013	Annual Rolling Update
Prosecutions Relating to Controlled Waters		
Environment Agency - Midlands Region	March 2013	Annual Rolling Update
Environment Agency - Welsh Region	March 2013	Annual Rolling Update
Natural Resources Wales	March 2013	Annual Rolling Update

Agency & Hydrological	Version	Update Cycle
Registered Radioactive Substances		
Natural Resources Wales	January 2015	Annually
Environment Agency - Midlands Region	June 2016	
Environment Agency - Welsh Region	June 2016	
Substantiated Pollution Incident Register		
Environment Agency - Midlands Region - Upper Severn Area	January 2019	Quarterly
Environment Agency - Midlands Region - West Area	January 2019	Quarterly
Environment Agency Wales - North Area	January 2019	Quarterly
Natural Resources Wales	October 2018	Quarterly
Water Abstractions		
Natural Resources Wales	February 2019	Quarterly
Environment Agency - Midlands Region	January 2019	Quarterly
Water Industry Act Referrals		
Natural Resources Wales	January 2019	Quarterly
Environment Agency - Midlands Region	October 2017	Quarterly
Environment Agency - Welsh Region	October 2017	Quarterly
Groundwater Vulnerability		
Environment Agency - Head Office	April 2015	Not Applicable
Bedrock Aquifer Designations		
Environment Agency - Head Office	January 2018	Annually
Natural Resources Wales	January 2018	Annually
Superficial Aquifer Designations		
Environment Agency - Head Office	January 2018	Annually
Natural Resources Wales	January 2018	Annually
Source Protection Zones		
Natural Resources Wales	November 2016	Annual Rolling Update
Extreme Flooding from Rivers or Sea without Defences		
Natural Resources Wales	February 2019	Quarterly
Flooding from Rivers or Sea without Defences		
Natural Resources Wales	February 2019	Quarterly
Areas Benefiting from Flood Defences		
Natural Resources Wales	February 2019	Quarterly
Flood Water Storage Areas		
Natural Resources Wales	February 2019	Quarterly
Flood Defences		
Natural Resources Wales	February 2019	Quarterly
OS Water Network Lines		
Ordnance Survey	October 2018	Quarterly
Surface Water 1 in 30 year Flood Extent		
Natural Resources Wales	October 2013	Annually
Surface Water 1 in 100 year Flood Extent		
Natural Resources Wales	October 2013	Annually
Surface Water 1 in 1000 year Flood Extent		
Natural Resources Wales	October 2013	Annually
Surface Water Suitability		
Natural Resources Wales	October 2013	Annually
BGS Groundwater Flooding Susceptibility		
British Geological Survey - National Geoscience Information Service	May 2013	Annually

Waste	Version	Update Cycle
BGS Recorded Landfill Sites		
British Geological Survey - National Geoscience Information Service	June 1996	Not Applicable
Historical Landfill Sites		
Natural Resources Wales	July 2017	Quarterly
Integrated Pollution Control Registered Waste Sites		
Environment Agency - Midlands Region	October 2008	Not Applicable
Environment Agency - Welsh Region	October 2008	Not Applicable
Licensed Waste Management Facilities (Landfill Boundaries)		
Environment Agency - Midlands Region - Upper Severn Area	July 2018	Quarterly
Environment Agency - Midlands Region - West Area	July 2018	Quarterly
Environment Agency Wales - North Area	July 2018	Quarterly
Natural Resources Wales	July 2018	Quarterly
Licensed Waste Management Facilities (Locations)		
Environment Agency - Midlands Region - Upper Severn Area	January 2019	Quarterly
Environment Agency - Midlands Region - West Area	January 2019	Quarterly
Environment Agency Wales - North Area	January 2019	Quarterly
Natural Resources Wales	January 2019	Quarterly
Local Authority Landfill Coverage		
Powys County Council	May 2000	Not Applicable
Shrewsbury and Atcham Borough Council (now part of Shropshire Council) - Environmental Health Department	May 2000	Not Applicable
Shropshire County Council (now part of Shropshire Council) - Shropshire Records And Research Centre	May 2000	Not Applicable
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	May 2000	Not Applicable
Local Authority Recorded Landfill Sites		
Shrewsbury and Atcham Borough Council (now part of Shropshire Council) - Environmental Health Department	December 2002	Not Applicable
Powys County Council	May 2000	Not Applicable
Shropshire County Council (now part of Shropshire Council) - Shropshire Records And Research Centre	May 2000	Not Applicable
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	May 2003	Not Applicable
Potentially Infilled Land (Non-Water)		
Landmark Information Group Limited	December 1999	Not Applicable
Potentially Infilled Land (Water)		
Landmark Information Group Limited	December 1999	Not Applicable
Registered Landfill Sites		
Environment Agency - Midlands Region - Upper Severn Area	March 2003	Not Applicable
Environment Agency - Midlands Region - West Area	March 2003	Not Applicable
Environment Agency Wales - North Area	March 2003	Not Applicable
Registered Waste Transfer Sites		
Environment Agency - Midlands Region - Upper Severn Area	March 2003	Not Applicable
Environment Agency - Midlands Region - West Area	March 2003	Not Applicable
Environment Agency Wales - North Area	March 2003	Not Applicable
Registered Waste Treatment or Disposal Sites		
Environment Agency - Midlands Region - Upper Severn Area	March 2003	Not Applicable
Environment Agency - Midlands Region - West Area	March 2003	Not Applicable
Environment Agency Wales - North Area	March 2003	Not Applicable

Hazardous Substances	Version	Update Cycle
Control of Major Accident Hazards Sites (COMAH)		
Health and Safety Executive	April 2018	Bi-Annually
Explosive Sites		
Health and Safety Executive	March 2017	Variable
Notification of Installations Handling Hazardous Substances (NIHHS)		
Health and Safety Executive	November 2000	Not Applicable
Planning Hazardous Substance Enforcements		
Shrewsbury and Atcham Borough Council (now part of Shropshire Council)	December 2008	Not Applicable
Powys County Council - Planning Department	February 2016	Variable
Shropshire Council - Planning Department	February 2016	Variable
South Shropshire District Council (now part of Shropshire Council) - Planning Department	January 2008	Not Applicable
Shropshire County Council (now part of Shropshire Council)	March 2009	Annual Rolling Update
Planning Hazardous Substance Consents		
Shrewsbury and Atcham Borough Council (now part of Shropshire Council)	December 2008	Not Applicable
Powys County Council - Planning Department	February 2016	Variable
Shropshire Council - Planning Department	February 2016	Variable
South Shropshire District Council (now part of Shropshire Council) - Planning Department	January 2008	Not Applicable
Shropshire County Council (now part of Shropshire Council)	March 2009	Annual Rolling Update

Geological	Version	Update Cycle
BGS 1:625,000 Solid Geology		
British Geological Survey - National Geoscience Information Service	January 2009	Not Applicable
BGS Estimated Soil Chemistry		
British Geological Survey - National Geoscience Information Service	October 2015	Annually
BGS Recorded Mineral Sites		
British Geological Survey - National Geoscience Information Service	November 2018	Bi-Annually
CBSCB Compensation District		
Cheshire Brine Subsidence Compensation Board (CBSCB)	August 2011	Not Applicable
Coal Mining Affected Areas		
The Coal Authority - Property Searches	March 2014	Annual Rolling Update
Mining Instability		
Ove Arup & Partners	October 2000	Not Applicable
Non Coal Mining Areas of Great Britain		
British Geological Survey - National Geoscience Information Service	May 2015	Not Applicable
Potential for Collapsible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Compressible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Ground Dissolution Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Landslide Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Running Sand Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Shrinking or Swelling Clay Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Radon Potential - Radon Affected Areas		
British Geological Survey - National Geoscience Information Service	July 2011	Annually
Radon Potential - Radon Protection Measures		
British Geological Survey - National Geoscience Information Service	July 2011	Annually

Industrial Land Use	Version	Update Cycle
Contemporary Trade Directory Entries Thomson Directories	January 2019	Quarterly
Fuel Station Entries Catalist Ltd - Experian	November 2018	Quarterly
Gas Pipelines National Grid	July 2014	
Points of Interest - Commercial Services PointX	November 2018	Quarterly
Points of Interest - Education and Health PointX	November 2018	Quarterly
Points of Interest - Manufacturing and Production PointX	November 2018	Quarterly
Points of Interest - Public Infrastructure PointX	November 2018	Quarterly
Points of Interest - Recreational and Environmental PointX	November 2018	Quarterly
Underground Electrical Cables National Grid	December 2015	

Sensitive Land Use	Version	Update Cycle
Ancient Woodland		
Natural England	August 2018	Bi-Annually
Natural Resources Wales	August 2018	Bi-Annually
Areas of Adopted Green Belt		
Shropshire Council - Planning Department	August 2018	As notified
Areas of Unadopted Green Belt		
Shropshire Council - Planning Department	August 2018	As notified
Areas of Outstanding Natural Beauty		
Natural England	August 2018	Bi-Annually
Natural Resources Wales	August 2018	Bi-Annually
Environmentally Sensitive Areas		
Natural England	January 2017	
The National Assembly for Wales - GI Services (Department of Planning & Countryside)	January 2017	
Forest Parks		
Forestry Commission	April 1997	Not Applicable
Local Nature Reserves		
Natural England	August 2018	Bi-Annually
Powys County Council	August 2018	Bi-Annually
Marine Nature Reserves		
Natural Resources Wales	August 2018	Bi-Annually
National Nature Reserves		
Natural Resources Wales	August 2018	Bi-Annually
National Parks		
Natural England	April 2017	Bi-Annually
Natural Resources Wales	August 2018	Annually
Nitrate Vulnerable Zones		
Natural Resources Wales	July 2017	Bi-Annually
The National Assembly for Wales - GI Services (Department of Planning & Countryside)	October 2005	
Ramsar Sites		
Natural Resources Wales	February 2019	Bi-Annually
Sites of Special Scientific Interest		
Natural Resources Wales	February 2018	Bi-Annually
Natural England	October 2018	Bi-Annually
Special Areas of Conservation		
Natural Resources Wales	August 2018	Bi-Annually
Special Protection Areas		
Natural Resources Wales	August 2018	Bi-Annually

Data Suppliers

A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	Map data
Environment Agency	Environment Agency
Scottish Environment Protection Agency	SEPA Scottish Environment Protection Agency
The Coal Authority	The Coal Authority
British Geological Survey	British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL
Centre for Ecology and Hydrology	Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL
Natural Resources Wales	Cyfoeth Naturiol Cymru Natural Resources Wales
Scottish Natural Heritage	SCOTTISH NATURAL HERITAGE
Natural England	NATURAL ENGLAND
Public Health England	Public Health England
Ove Arup	ARUP
Peter Brett Associates	pba peterbrett

Useful Contacts

Contact	Name and Address	Contact Details
1	**British Geological Survey - Enquiry Service** British Geological Survey, Environmental Science Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
2	**Environment Agency - National Customer Contact Centre (NCCC)** PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 03708 506 506 Email: enquiries@environment-agency.gov.uk
3	**Natural Resources Wales** Ty Cambria, 29 Newport Road, Cardiff, CF24 0TP	Telephone: 0300 065 3000 Email: enquiries@naturalresourceswales.gov.uk
4	**Environment Agency - Head Office** Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol, Avon, BS32 4UD	Telephone: 01454 624400 Fax: 01454 624409
5	**Ordnance Survey** Adanac Drive, Southampton, Hampshire, SO16 0AS	Telephone: 03456 05 05 05 Email: customerservices@ordnancesurvey.co.uk Website: www.ordnancesurvey.gov.uk
6	**Powys County Council** County Hall, Llandrindod Wells, Powys, LD1 5LG	Telephone: 01597 826000 Fax: 01597 826230 Website: www.powys.gov.uk
7	**PointX** 7 Abbey Court, Eagle Way, Sowton, Exeter, Devon, EX2 7HY	Website: www.pointx.co.uk
8	**Natural England** County Hall, Spetchley Road, Worcester, WR5 2NP	Telephone: 0300 060 3900 Email: enquiries@naturalengland.org.uk Website: www.naturalengland.org.uk
-	**Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards** Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	**Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Please note that the Environment Agency / Natural Resources Wales / SEPA have a charging policy in place for enquiries.

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Envirocheck® Report:

Datasheet

Order Details:

Order Number:
196125587_1_1

Customer Reference:
14880

National Grid Reference:
326380, 309950

Slice:
A

Site Area (Ha):
25.12

Search Buffer (m):
1000

Site Details:

Quarry
Buttington
Welshpool
SY21 8SZ

Client Details:

Ms R Liley
Terra Firma (Wales) Ltd
5 Deryn Court
Wharfdale Road
Pentwyn
Cardiff
CF23 7HB

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Contents

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.
In this datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

Report Version v53.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 3		5	2	
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 4	1			
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature		Yes			
Pollution Incidents to Controlled Waters	pg 4		2		
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances					
River Quality	pg 5				1
River Quality Biology Sampling Points					
Substantiated Pollution Incident Register					
River Quality Chemistry Sampling Points					
Water Abstractions	pg 5				2 (*24)
Water Industry Act Referrals					
Groundwater Vulnerability	pg 11	Yes	n/a	n/a	n/a
Drift Deposits			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 11	Yes	n/a	n/a	n/a
Superficial Aquifer Designations	pg 11	Yes	n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences	pg 12		Yes	n/a	n/a
Flooding from Rivers or Sea without Defences	pg 13		Yes	n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 13	7	58	31	92

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites					
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Landfill Coverage	pg 35	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 35	2			1
Potentially Infilled Land (Water)	pg 35			2	2
Registered Landfill Sites					
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 36	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 36	Yes		Yes	
BGS Recorded Mineral Sites	pg 36	3	1		2
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 37	Yes		n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 37	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 38	Yes	Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 38	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 39	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 40	Yes	Yes	n/a	n/a
Radon Potential - Radon Affected Areas	pg 40	Yes	n/a	n/a	n/a
Radon Potential - Radon Protection Measures	pg 40	Yes	n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 41	1		1	
Fuel Station Entries					
Points of Interest - Commercial Services	pg 41			1	
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 41	6			3
Points of Interest - Public Infrastructure	pg 42				1
Points of Interest - Recreational and Environmental					
Gas Pipelines					
Underground Electrical Cables					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland	pg 43	6	2	1	11
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
Ramsar Sites					
Sites of Special Scientific Interest	pg 44	1			
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (S)	0	1	326350 309700
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12SE (E)	0	1	327050 310200
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (SE)	0	1	326450 309900
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (E)	0	1	326850 309900
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A11SE (E)	0	1	326500 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12SW (E)	0	1	326700 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12SE (E)	0	1	327000 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (S)	0	1	326400 309800
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A7NE (E)	0	1	326400 309950
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (E)	0	1	326800 309950
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A11SE (NE)	0	1	326650 310150
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12SE (E)	0	1	327050 310150
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A11SE (E)	0	1	326550 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A7NE (E)	0	1	326500 309954
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (S)	0	1	326382 309750
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12SE (E)	0	1	327000 310050
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12SW (NE)	0	1	326800 310250
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A7NE (E)	0	1	326450 309954
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (E)	0	1	326650 309954
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (E)	0	1	326700 309954
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12SW (E)	0	1	326750 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A8NW (E)	0	1	326750 309954

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (E)	0	1	326950 309954
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A12SE (E)	0	1	327050 310000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A8NE (E)	0	1	327000 309954
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (SE)	0	1	326450 309850
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A7NW (W)	0	1	326200 309954
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A11SW (NW)	0	1	326300 310050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A7NE (S)	0	1	326382 309800
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12NW (NE)	71	1	326800 310350
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A7NE (SE)	80	1	326550 309750
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (E)	89	1	326650 309850
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (SE)	93	1	326700 309800
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A7NE (SE)	109	1	326650 309800
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12NW (NE)	111	1	326950 310400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12NE (NE)	111	1	327050 310400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (SE)	151	1	326750 309700
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12NE (NE)	163	1	327000 310450
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	(E)	336	1	327450 310350
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A8SW (SE)	354	1	326700 309500
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NE (E)	365	1	327200 309650
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	(NE)	488	1	327400 310700
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8SW (SE)	498	1	326700 309350

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Discharge Consents** Operator: Nigel G Pryce Property Type: Not Given Location: The Developmentoff Sale Lane, Trewern, WELSHPOOL, Powys Authority: Environment Agency, Midlands Region Catchment Area: Not Given Reference: WQ/72/919 /1 Permit Version: Not Supplied Effective Date: Not Supplied Issued Date: 23rd December 1976 Revocation Date: Not Supplied Discharge Type: Sewage Effluent Discharge Environment: Groundwater Receiving Water: Not Supplied **Status: Not Supplied** Positional Accuracy: Located by supplier to within 100m	A12SE (E)	172	2	327201 310001
2	**Discharge Consents** Operator: Forte (Uk) Limited Property Type: Snack Bars,Cafes Etc. Location: Little Chef Restaurant - A458 A458 Trewern, Trewern, Nr Welshpool, Powys Authority: Environment Agency, Midlands Region Catchment Area: Upper Severn Catchment (Above Montford) Reference: S/01/14372/Sg Permit Version: 2 Effective Date: 2nd April 2012 Issued Date: 2nd April 2012 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Land/Soakaway Receiving Water: Underground Strata **Status: Varied under EPR 2010** Positional Accuracy: Located by supplier to within 10m	A12NE (NE)	237	2	327180 310520
2	**Discharge Consents** Operator: Forte (Uk) Limited Property Type: Snack Bars,Cafes Etc. Location: Little Chef Restaurant - A458, A458 Trewern, Nr Welshpool, Powys Authority: Natural Resources Wales Catchment Area: PWLL TREWERN - SOURCE TO CONF R SEVERN Reference: S/01/14372/Sg Permit Version: 2 Effective Date: 2nd April 2012 Issued Date: 2nd April 2012 Revocation Date: 27th March 2018 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Land/Soakaway Receiving Water: Underground Strata **Status: Revoked** Positional Accuracy: Located by supplier to within 10m	A12NE (NE)	237	3	327180 310520
2	**Discharge Consents** Operator: Forte (Uk) Limited Property Type: Snack Bars,Cafes Etc. Location: Little Chef Restaurant - A458, A458 Trewern, Nr Welshpool, Powys Authority: Natural Resources Wales Catchment Area: Severn Upper Reference: S/01/14372/Sg Permit Version: 1 Effective Date: 30th January 1986 Issued Date: 30th January 1986 Revocation Date: 1st April 2012 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Land/Soakaway Receiving Water: Underground Strata **Status: Lapsed (under Environment Act 1995, Schedule 23)** Positional Accuracy: Located by supplier to within 10m	A12NE (NE)	237	3	327180 310520

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
2	**Discharge Consents** Operator: Forte (Uk) Limited Property Type: Snack Bars,Cafes Etc. Location: Little Chef Restaurant - A458 A458 Trewern, Trewern Authority: Environment Agency, Midlands Region Catchment Area: Upper Severn Catchment (Above Montford) Reference: S/01/14372/Sg Permit Version: 1 Effective Date: 30th January 1986 Issued Date: 30th January 1986 Revocation Date: 1st April 2012 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Land/Soakaway Receiving Water: Underground Strata **Status: Lapsed (under Environment Act 1995, Schedule 23)** Positional Accuracy: Located by supplier to within 100m	A12NE (NE)	237	2	327180 310520
3	**Discharge Consents** Operator: Laurie Ritchie Property Type: Domestic Property (Single) Location: Plas-Y-Don, Trewern, Welshpool, Powys, Wales, Sy21 8sz Authority: Natural Resources Wales Catchment Area: Not Supplied Reference: Rb3793hx Permit Version: Not Supplied Effective Date: 4th May 2017 Issued Date: 6th April 2017 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Not Supplied **Status: Effective** Positional Accuracy: Located by supplier to within 10m	A12NE (NE)	289	3	327093 310579
3	**Discharge Consents** Operator: Laurie Ritchie Property Type: Domestic Property (Single) Location: Plas-Y-Don, Trewern, Welshpool, Powys, Wales, Sy21 8sz Authority: Natural Resources Wales Catchment Area: Not Supplied Reference: Rb3793hx Permit Version: 2 Effective Date: 4th May 2017 Issued Date: 6th April 2017 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Unnamed Trib Of Pwll Trewern **Status: Effective** Positional Accuracy: Located by supplier to within 10m	A12NE (NE)	289	3	327093 310579
4	**Local Authority Pollution Prevention and Controls** Name: Border Hardcore Location: Trewern, Welshpool Authority: Powys County Council, Public Protection Department Permit Reference: PPC 47 Dated: 11th September 2006 Process Type: Local Authority Pollution Prevention and Control Description: Part B - General Mineral Process (No Specific Reference) **Status: Permitted** Positional Accuracy: Manually positioned to the address or location	A7NW (SW)	0	4	326311 309827
	Nearest Surface Water Feature	A7NE (E)	0	-	326474 309953
5	**Pollution Incidents to Controlled Waters** Property Type: Construction Location: Location Description Not Available Authority: Environment Agency, Midlands Region Pollutant: Oils - Diesel (Including Agricultural) Note: No Adverse Effects Incident Date: 12th April 1997 Incident Reference: 2501683 Catchment Area: Severn Catchment : Upper Severn (Above Montford) Receiving Water: Watercourse Cause of Incident: Accidental Spillage/Leakage Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A7NW (SW)	29	2	326200 309800

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
6	**Pollution Incidents to Controlled Waters** Property Type: Beef Cattle Location: Location Description Not Available Authority: Environment Agency, Midlands Region Pollutant: Organic Wastes: Cattle Manure (solid) Note: No Adverse Effects Incident Date: 15th June 1997 Incident Reference: 2501876 Catchment Area: Severn Catchment : Upper Severn (Above Montford) Receiving Water: Watercourse Cause of Incident: Land Runoff Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A8NE (E)	137	2	327100 309900
	River Quality Name: Severn R GQA Grade: River Quality A Reach: Welshpool Stw To Conf. A. Vyrnwy Estimated Distance (km): 25 Flow Rate: Flow less than 40 cumecs Flow Type: River Year: 2000	A14SE (NW)	969	2	325744 310844
7	**Water Abstractions** Operator: Mr&Mrs R & J Tutton Licence Number: 18/54/01/0421 Permit Version: 100 Location: Buttington New Hall - Surface Spring Authority: Environment Agency, Midlands Region Abstraction: Private Water Undertaking: General Farming And Domestic Abstraction Type: Water may be abstracted from a single point Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Buttington New Hall - Surface Spring Authorised Start: 01 April Authorised End: 31 March Permit Start Date: 1st March 2005 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 100m	A3SW (S)	786	2	326200 308900
7	**Water Abstractions** Operator: Mr&Mrs R & J Tutton Licence Number: 18/54/01/0421 Permit Version: 100 Location: Buttington New Hall - Surface Spring Authority: Natural Resources Wales Abstraction: Private Water Undertaking: General Farming And Domestic Abstraction Type: Water may be abstracted from a single point Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Buttington New Hall - Surface Spring Authorised Start: 01 April Authorised End: 31 March Permit Start Date: 1st March 2005 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 100m	A3SW (S)	786	3	326200 308900
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 4 Location: The Moors Farm Buttington - River Severn-E Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 29th June 2005 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A10NW (NW)	1026	2	325430 310550

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 3 Location: The Moors Farm Buttington - River Severn-E Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 7th May 2002 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A10NW (NW)	1026	2	325430 310550
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 2 Location: The Moors Farm Buttington - River Severn-E Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 28th June 2000 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A10NW (NW)	1026	2	325430 310550
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 1 Location: The Moors Farm Buttington - River Severn-E Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 30th November 1999 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A10NW (NW)	1026	2	325430 310550
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 4 Location: The Moors Farm Buttington - River Severn-D Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 29th June 2005 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A9NE (W)	1096	2	325260 310380

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 3 Location: The Moors Farm Buttington - River Severn-D Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 7th May 2002 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A9NE (W)	1096	2	325260 310380
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 2 Location: The Moors Farm Buttington - River Severn-D Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 28th June 2000 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A9NE (W)	1096	2	325260 310380
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 1 Location: The Moors Farm Buttington - River Severn-D Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 30th November 1999 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A9NE (W)	1096	2	325260 310380
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 4 Location: The Moors Farm Buttington- River Severn-B Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 29th June 2005 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A1SW (SW)	1734	2	324670 308930

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 3 Location: The Moors Farm Buttington- River Severn-B Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 7th May 2002 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A1SW (SW)	1734	2	324670 308930
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 2 Location: The Moors Farm Buttington- River Severn-B Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 28th June 2000 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A1SW (SW)	1734	2	324670 308930
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 1 Location: The Moors Farm Buttington- River Severn-B Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Not Supplied Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 30th November 1999 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	A1SW (SW)	1734	2	324670 308930
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 4 Location: The Moors Farm Buttington - River Severn-C Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 29th June 2005 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1783	2	324560 309050

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 3 Location: The Moors Farm Buttington - River Severn-C Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 7th May 2002 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1783	2	324560 309050
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 2 Location: The Moors Farm Buttington - River Severn-C Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 28th June 2000 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1783	2	324560 309050
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 1 Location: The Moors Farm Buttington - River Severn-C Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 30th November 1999 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1783	2	324560 309050
	Water Abstractions Operator: Eric Ivor Lloyd Licence Number: 18/54/01/05741 Permit Version: Not Supplied Location: Tributary Of River Severn, WELSHPOOL Authority: Environment Agency, Midlands Region Abstraction: Impounding Abstraction Type: Not Supplied Source: Surface Daily Rate (m3): 0 Yearly Rate (m3): 0 Details: Upper Severn Catchment (Above Montford) Authorised Start: Not Supplied Authorised End: Not Supplied Permit Start Date: Not Supplied Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 100m	(N)	1900	2	325800 311955

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 4 Location: The Moors Farm Buttington- River Severn -A Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 29th June 2005 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1951	2	324540 308720
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 3 Location: The Moors Farm Buttington- River Severn -A Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 7th May 2002 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1951	2	324540 308720
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 2 Location: The Moors Farm Buttington- River Severn -A Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 28th June 2000 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1951	2	324540 308720
	Water Abstractions Operator: J & M Suckley Licence Number: 18/54/01/0636 Permit Version: 1 Location: The Moors Farm Buttington- River Severn -A Authority: Environment Agency, Midlands Region Abstraction: General Agriculture: Spray Irrigation - Direct Abstraction Type: Water may be abstracted from a river or stream reach, or a row of wellpoints Source: Surface Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: The Moors Farm Buttington Authorised Start: 01 April Authorised End: 31 October Permit Start Date: 30th November 1999 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1951	2	324540 308720

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Water Abstractions Operator: Welshpool Livestock Sales Limited Licence Number: Md/054/0001/011 Permit Version: 2 Location: Borehole Adj Buttington Cross Authority: Natural Resources Wales Abstraction: Other Industrial/Commercial/Public Services: General Washing/Process Washing Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Welshpool Livestock Market, Welshpool Authorised Start: 01 April Authorised End: 31 March Permit Start Date: 24th June 2011 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1969	3	324450 308844
	Water Abstractions Operator: Welshpool Livestock Sales Limited Licence Number: Md/054/0001/011 Permit Version: 2 Location: Borehole Adj Buttington Cross Authority: Environment Agency, Midlands Region Abstraction: Other Industrial/Commercial/Public Services: General Washing/Process Washing Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Welshpool Livestock Market, Welshpool Authorised Start: 01 April Authorised End: 31 March Permit Start Date: 24th June 2011 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1969	2	324450 308844
	Water Abstractions Operator: Welshpool Livestock Sales Limited Licence Number: Md/054/0001/011 Permit Version: 1 Location: Borehole Adj Buttington Cross Authority: Environment Agency, Midlands Region Abstraction: Other Industrial/Commercial/Public Services: General Washing/Process Washing Abstraction Type: Water may be abstracted from a single point Source: Groundwater Daily Rate (m3): Not Supplied Yearly Rate (m3): Not Supplied Details: Welshpool Livestock Market, Welshpool Authorised Start: 01 April Authorised End: 31 March Permit Start Date: 10th February 2010 Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 10m	(SW)	1969	2	324450 308844
	Groundwater Vulnerability Soil Classification: Not classified Map Sheet: Sheet 21 West Shropshire Scale: 1:100,000	A7NE (W)	0	2	326382 309954
	Drift Deposits None				
	Bedrock Aquifer Designations Aquifer Designation: Secondary Aquifer - B	A7NE (W)	0	3	326382 309954
	Bedrock Aquifer Designations Aquifer Designation: Secondary Aquifer - B	A11SE (N)	0	3	326382 310000
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - Undifferentiated	A12SW (E)	0	3	326936 309987
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - A	A12SW (E)	0	3	326986 310000
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - Undifferentiated	A7NE (E)	0	3	326595 309966

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - Undifferentiated	A11SW (W)	0	3	326238 310000
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - Undifferentiated	A12SW (E)	0	3	326952 310000
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - A	A8NW (E)	0	3	326771 309845
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Events Boundary Accuracy: As Supplied	A11SW (NW)	63	3	326291 310096
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models and Fluvial Events Boundary Accuracy: As Supplied	A11SW (NW)	104	3	326244 310094
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11SE (N)	106	3	326444 310269
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11SE (N)	109	3	326435 310264
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11SW (NW)	113	3	326199 310059
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Events Boundary Accuracy: As Supplied	A11SE (N)	115	3	326439 310270
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Events Boundary Accuracy: As Supplied	A11SW (NW)	120	3	326194 310062
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11SW (NW)	123	3	326184 310054
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Events Boundary Accuracy: As Supplied	A11SW (NW)	138	3	326169 310058
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11SW (NW)	143	3	326159 310054
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11NE (N)	164	3	326535 310384
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Events Boundary Accuracy: As Supplied	A11NE (N)	166	3	326534 310384
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11NE (N)	202	3	326566 310429
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Events Boundary Accuracy: As Supplied	A11NE (N)	202	3	326564 310427

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Events Boundary Accuracy: As Supplied	A11NE (N)	205	3	326569 310431
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11NE (N)	207	3	326571 310434
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models and Fluvial Events Boundary Accuracy: As Supplied	A11NE (N)	248	3	326399 310514
	Flooding from Rivers or Sea without Defences Type: Extent of Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11SW (NW)	113	3	326234 310099
	Flooding from Rivers or Sea without Defences Type: Extent of Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A11SW (W)	230	3	326039 309994
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				
8	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 267.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NE (E)	0	5	326480 309945
9	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 118.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (E)	0	5	326723 309938
10	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 194.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (E)	0	5	326723 309938
11	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 53.4 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	0	5	326277 309807
12	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 43.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	0	5	326303 309840

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
13	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 125.0 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NE (SE)	0	5	326404 309914
14	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 96.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NE (SE)	0	5	326412 309930
15	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 103.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	8	5	327074 310098
16	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 14.1 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	8	5	326222 309780
17	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 19.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	10	5	327058 310086
18	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 15.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	10	5	326230 309778
19	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 28.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	11	5	326208 309784
20	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 81.9 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (E)	12	5	326867 309817
21	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 145.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	13	5	327106 310184

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
22	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 78.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	13	5	327106 310184
23	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 23.2 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (E)	17	5	326867 309817
24	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 67.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	18	5	326182 309795
25	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 103.0 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	20	5	326187 309727
26	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 81.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	20	5	326187 309727
27	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 9.8 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	21	5	327075 310092
28	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 45.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	28	5	327078 310083
29	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 42.0 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	28	5	327078 310083
30	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 118.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7SW (S)	34	5	326289 309643

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
31	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 80.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (E)	36	5	326875 309795
32	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 34.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	38	5	326182 309795
33	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 22.7 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (E)	49	5	326772 309846
34	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 485.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (E)	53	5	326947 309834
35	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 93.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NE (E)	57	5	327097 309975
36	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 122.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (E)	61	5	326773 309823
37	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 323.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	70	5	327113 310053
38	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 208.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	70	5	327113 310053
39	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 4.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (NE)	72	5	327192 310295

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
40	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 42.7 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	72	5	326155 309816
41	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 13.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (NE)	76	5	327195 310297
42	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 144.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (NE)	89	5	327207 310303
43	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 68.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (NE)	89	5	327207 310303
44	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 110.7 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	98	5	326156 309653
45	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 229.6 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7SE (S)	109	5	326370 309615
46	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NE (E)	110	5	327100 309953
47	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.7 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (SE)	112	5	326909 309723
48	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 396.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7NW (SW)	112	5	326118 309837

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
49	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 375.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NE (E)	113	5	327101 309948
50	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 80.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7SW (S)	116	5	326234 309574
51	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 308.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (SE)	117	5	326913 309719
52	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 89.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12NW (NE)	129	5	326736 310367
53	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.1 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (SE)	136	5	326789 309714
54	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 543.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8NW (SE)	141	5	326789 309714
55	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 32.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A11NE (N)	142	5	326488 310331
56	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 95.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12NW (NE)	143	5	326678 310339
57	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 13.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12NE (NE)	156	5	327101 310445

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
58	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 2.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	161	5	326497 310361
59	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 41.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	162	5	326494 310361
60	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 7.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12NE (NE)	169	5	327098 310458
61	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 4.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12NE (NE)	176	5	327095 310465
62	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 198.0 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12NE (NE)	178	5	327242 310420
63	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 323.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7SW (S)	180	5	326263 309502
64	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 230.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7SE (S)	180	5	326349 309495
65	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.6 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (NE)	185	5	326615 310410
66	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 79.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	186	5	326514 310396

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
67	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 75.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (NE)	188	5	326611 310414
68	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 177.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	202	5	326466 310388
69	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 179.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	224	5	326555 310465
70	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.3 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	225	5	327307 310113
71	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 282.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12SE (E)	231	5	327313 310115
72	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 267.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11SW (NW)	248	5	326127 310229
73	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 9.2 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	252	5	326329 310363
74	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 250.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	259	5	326330 310372
75	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 262.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12NW (NE)	274	5	326795 310552

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
76	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 159.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	285	5	326452 310478
77	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 275.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16SW (NE)	290	5	326914 310701
78	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 60.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7SE (S)	301	5	326479 309456
79	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 40.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7SE (S)	301	5	326502 309469
80	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	310	5	326564 310536
81	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 30.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	314	5	326567 310541
82	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 254.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A7SE (S)	318	5	326564 309493
83	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 169.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A12NE (NE)	344	5	327229 310617
84	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 533.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	352	5	326565 310606

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
85	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 28.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	362	5	326563 310589
86	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 2.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	383	5	326543 310607
87	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 4.8 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	385	5	326541 310609
88	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 192.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NE (N)	388	5	326538 310612
89	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 206.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6SE (SW)	398	5	325901 309481
90	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.3 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16SW (NE)	409	5	326910 310698
91	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 3.6 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8SE (SE)	414	5	327124 309498
92	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8SE (SE)	418	5	327127 309495
93	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 151.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A10SE (NW)	424	5	325979 310278

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
94	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.6 Watercourse Level: Underground Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A10SE (NW)	427	5	325986 310291
95	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 89.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A11SW (NW)	428	5	325990 310296
96	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 171.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A11NW (NW)	442	5	326042 310368
97	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 94.0 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NW (NW)	442	5	326042 310368
98	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A10SE (W)	476	5	325804 310064
99	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 162.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A10SE (W)	479	5	325834 310154
100	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 448.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A10SE (W)	482	5	325800 310069
101	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 314.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A10SE (W)	482	5	325800 310069
102	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 4.9 Watercourse Level: Underground Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A10SE (NW)	486	5	325858 310217

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
103	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 144.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A11NW (NW)	494	5	326123 310512
104	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 187.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Pwll Trewern Catchment Name: Severn Primacy: 1	A16SE (NE)	504	5	327314 310756
105	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 767.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Pwll Trewern Catchment Name: Severn Primacy: 1	A16SE (NE)	504	5	327079 310841
106	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 110.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A10NE (NW)	516	5	325948 310380
107	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.4 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8SE (SE)	517	5	327307 309540
108	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 416.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A8SE (SE)	521	5	327307 309533
109	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 333.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SE (N)	523	5	326439 310728
110	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 51.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SE (N)	523	5	326439 310728
111	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 122.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A3NW (S)	524	5	326091 309191

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
112	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 70.8 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6SE (SW)	525	5	325710 309560
113	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 91.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A6NE (W)	539	5	325670 309664
114	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 270.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A6NE (W)	539	5	325670 309664
115	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 140.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NW (NW)	579	5	326049 310586
116	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 277.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A11NW (N)	579	5	326165 310646
117	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 253.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A6SW (SW)	582	5	325643 309583
118	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 42.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NW (NW)	589	5	326008 310538
119	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 64.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A11NW (NW)	589	5	326008 310538
120	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 163.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NE (SW)	599	5	325983 309158

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
121	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 162.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NE (SW)	599	5	325983 309158
122	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 43.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	610	5	326147 310672
123	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 11.6 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NE (SW)	620	5	325852 309228
124	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 208.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NE (SW)	621	5	325842 309234
125	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 283.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A4NW (SE)	634	5	326746 309211
126	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 79.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A4NW (SE)	634	5	326746 309211
127	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 93.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	635	5	326164 310711
128	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 149.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	635	5	326164 310711
129	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 328.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6NW (W)	676	5	325525 309854

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
130	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 66.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NE (SW)	681	5	325699 309282
131	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 11.0 Watercourse Level: Underground Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A15SW (N)	689	5	326321 310862
132	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 28.6 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6NW (W)	690	5	325525 309854
133	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 153.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A15SE (N)	690	5	326330 310868
134	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.8 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A4NW (S)	690	5	326718 309147
135	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 90.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	691	5	326200 310798
136	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 130.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	691	5	326200 310798
137	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 20.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6NW (W)	692	5	325531 309896
138	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 398.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6NW (W)	692	5	325530 309934

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
139	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 31.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (NW)	692	5	326016 310679
140	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 262.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A4NW (S)	695	5	326716 309141
141	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 311.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6NW (W)	703	5	325516 309881
142	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.7 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16SW (N)	717	5	326668 310971
143	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 2.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16SW (N)	720	5	326671 310975
144	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.1 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	720	5	326297 310885
145	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 85.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16SW (N)	722	5	326673 310977
146	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 276.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A16SW (N)	722	5	326673 310977
147	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 86.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	722	5	326302 310889

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
148	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 42.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16SW (N)	723	5	326752 310997
149	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 112.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A3NW (S)	729	5	326020 308999
150	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6SW (SW)	736	5	325582 309346
151	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 4.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6SW (SW)	741	5	325578 309341
152	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 7.8 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NW (SW)	745	5	325631 309262
153	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 95.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A6SW (SW)	745	5	325575 309338
154	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 13.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NW (SW)	746	5	325636 309256
155	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 371.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A6SW (SW)	746	5	325575 309338
156	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 7.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NW (SW)	747	5	325643 309245

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
157	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 9.0 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NW (SW)	748	5	325647 309239
158	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 241.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NE (SW)	750	5	325656 309227
159	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NE (SW)	750	5	325652 309231
160	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 269.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A3SW (S)	762	5	326177 308926
161	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 1.5 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16NW (N)	765	5	326750 311038
162	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 104.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16NW (N)	765	5	326750 311038
163	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 18.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16NW (N)	766	5	326734 311036
164	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 28.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A15SE (N)	767	5	326393 310974
165	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 65.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A15SE (N)	767	5	326421 310975

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
166	**OS Water Network Lines** Watercourse Form: Marsh Watercourse Length: 72.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A15SW (N)	772	5	326321 310967
167	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 6.4 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A10SW (W)	777	5	325559 310270
168	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 20.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A10SW (W)	783	5	325554 310274
169	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 31.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A3SW (S)	785	5	326096 308918
170	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 21.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A15SW (N)	787	5	326312 310966
171	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 19.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	793	5	326300 310965
172	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 94.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	796	5	326132 310880
173	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.4 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A10SW (W)	803	5	325538 310287
174	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 472.0 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A3SW (S)	804	5	326067 308906

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
175	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 2	A10SW (W)	808	5	325534 310290
176	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 3.3 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	813	5	326292 310983
177	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 20.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A10SW (W)	814	5	325530 310294
178	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 71.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	816	5	326290 310986
179	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 302.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Main Ditch Catchment Name: Severn Primacy: 1	A15NE (N)	825	5	326441 311038
180	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 270.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A10SW (NW)	825	5	325527 310314
181	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 345.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A10SW (NW)	825	5	325527 310314
182	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 4.3 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	829	5	326191 310954
183	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 68.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15SW (N)	830	5	326194 310957

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
184	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 178.2 Watercourse Level: Not Supplied Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A2NE (SW)	832	5	325738 309046
185	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 385.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Pwll Trewern Catchment Name: Severn Primacy: 1	A16NW (N)	866	5	326749 311141
186	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 113.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15NW (N)	869	5	326228 311017
187	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 126.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15NW (N)	869	5	326228 311017
188	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 282.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16NE (NE)	879	5	327202 311167
189	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.8 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16NE (NE)	880	5	327204 311167
190	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 267.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A16NE (NE)	883	5	327210 311170
191	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 5.7 Watercourse Level: Underground Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A5NE (W)	909	5	325299 309658
192	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 101.1 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A5NE (W)	913	5	325295 309653

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
193	**OS Water Network Lines** Watercourse Form: Inland river Watercourse Length: 181.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15NW (N)	934	5	326103 311025
194	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 71.2 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A15NW (N)	965	5	326307 311151
195	**OS Water Network Lines** Watercourse Form: Lake Watercourse Length: 64.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Severn Primacy: 1	A5SE (W)	979	5	325240 309569

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Local Authority Landfill Coverage Name: Powys County Council - Has supplied landfill data		0	6	326382 309954
196	**Potentially Infilled Land (Non-Water)** Bearing Ref: NW Use: Unknown Filled Ground (Pit, quarry etc) Date of Mapping: 1976	A11SW (NW)	0	-	326298 309990
197	**Potentially Infilled Land (Non-Water)** Bearing Ref: E Use: Unknown Filled Ground (Pit, quarry etc) Date of Mapping: 1976	A7NE (E)	0	-	326431 309947
198	**Potentially Infilled Land (Non-Water)** Bearing Ref: S Use: Unknown Filled Ground (Pit, quarry etc) Date of Mapping: 1976	A4SW (S)	938	-	326790 308897
199	**Potentially Infilled Land (Water)** Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1888	A12NE (NE)	330	-	327207 310609
200	**Potentially Infilled Land (Water)** Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1888	A12NE (NE)	337	-	327231 310608
201	**Potentially Infilled Land (Water)** Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1954	A2NE (SW)	666	-	325977 309087
202	**Potentially Infilled Land (Water)** Use: Unknown Filled Ground (Pond, marsh, river, stream, dock etc) Date of Mapping: 1954	A15NW (N)	1000	-	326033 311059

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Llandovery Rocks (Undifferentiated)	A7NE (SE)	0	1	326398 309920
	BGS 1:625,000 Solid Geology Description: Caradoc Rocks (Undifferentiated)	A7NE (W)	0	1	326382 309954
	BGS 1:625,000 Solid Geology Description: Wenlock Rocks (Undifferentiated)	A7NE (SE)	0	1	326478 309736
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <100 mg/kg Nickel Concentration: 15 - 30 mg/kg	A7NE (W)	0	1	326382 309954
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <100 mg/kg Nickel Concentration: 15 - 30 mg/kg	A8SE (SE)	388	1	327000 309391
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <100 mg/kg Nickel Concentration: 30 - 45 mg/kg	A16SE (NE)	401	1	327000 310687
203	**BGS Recorded Mineral Sites** Site Name: Buttington Quarry Location: Buttington, Welshpool, Powys Source: British Geological Survey, National Geoscience Information Service Reference: 190918 Type: Opencast **Status: Active** Operator: Border Hardcore & Rockery Stone Co., Ltd. Operator Location: Not Supplied Periodic Type: Silurian Geology: Tarannon Mudstone Formation Commodity: Common Clay and Shale Positional Accuracy: Located by supplier to within 10m	A12SW (E)	0	1	326795 310120
204	**BGS Recorded Mineral Sites** Site Name: Buttington Quarry Location: Buttington, Welshpool, Powys Source: British Geological Survey, National Geoscience Information Service Reference: 3780 Type: Opencast **Status: Dormant** Operator: Border Hardcore & Rockery Stone Co., Ltd. Operator Location: Not Supplied Periodic Type: Silurian Geology: Tarannon Mudstone Formation Commodity: Common Clay and Shale Positional Accuracy: Located by supplier to within 10m	A8NW (E)	0	1	326855 309940

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
205	**BGS Recorded Mineral Sites** Site Name: Buttington Station Location: Buttington, Welshpool, Powys Source: British Geological Survey, National Geoscience Information Service Reference: 113107 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Ordovician Geology: Stone House Shale Formation Commodity: Common Clay and Shale Positional Accuracy: Located by supplier to within 10m	A11SE (N)	0	1	326388 310062
206	**BGS Recorded Mineral Sites** Site Name: Buttington Junction Location: Buttington, Welshpool, Powys Source: British Geological Survey, National Geoscience Information Service Reference: 113108 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Ordovician Geology: Stone House Shale Formation Commodity: Common Clay and Shale Positional Accuracy: Located by supplier to within 10m	A11SW (NW)	2	1	326297 310000
207	**BGS Recorded Mineral Sites** Site Name: Gelli Location: Buttington, Welshpool, Powys Source: British Geological Survey, National Geoscience Information Service Reference: 113109 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Silurian Geology: Knucklas Castle Formation Commodity: Sandstone Positional Accuracy: Located by supplier to within 10m	A4NW (SE)	801	1	326946 309033
208	**BGS Recorded Mineral Sites** Site Name: Gelli Location: Buttington, Welshpool, Powys Source: British Geological Survey, National Geoscience Information Service Reference: 113110 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Silurian Geology: Cwm-Yr-Hob Member Commodity: Sandstone Positional Accuracy: Located by supplier to within 10m	A4SW (S)	917	1	326777 308915
	BGS Measured Urban Soil Chemistry No data available				
	BGS Urban Soil Chemistry Averages No data available				
	Coal Mining Affected Areas In an area that might not be affected by coal mining				
	Non Coal Mining Areas of Great Britain Risk: Highly Unlikely Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954
	Non Coal Mining Areas of Great Britain Risk: Highly Unlikely Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310000
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310000
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A11SW (W)	121	1	326140 310000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A11SW (NW)	134	1	326177 310067
	Potential for Compressible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SE (NE)	0	1	326482 310000
	Potential for Compressible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A7NE (SE)	0	1	326407 309940
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310000
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954
	Potential for Compressible Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A12NW (NE)	19	1	326823 310505
	Potential for Compressible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SW (NW)	39	1	326268 310023
	Potential for Compressible Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A11SW (W)	121	1	326140 310000
	Potential for Compressible Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A11SW (NW)	134	1	326177 310067
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310000
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A8NW (E)	0	1	326781 309981
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A7NE (E)	0	1	326647 309962
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310000
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A8NW (E)	0	1	326697 309958
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A7NE (S)	0	1	326432 309803
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A12SE (E)	0	1	327013 310087
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SE (NE)	0	1	326482 310000
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A12SW (E)	0	1	326986 310000
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A7NE (SE)	0	1	326407 309940

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SW (W)	0	1	326203 310000
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A11SE (NE)	19	1	326490 310199
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SW (NW)	19	1	326268 310023
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A11SW (NW)	51	1	326318 310090
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A12SW (NE)	92	1	326721 310322
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A7NE (SE)	103	1	326558 309728
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A7NE (SE)	149	1	326589 309688
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A8NW (SE)	193	1	326663 309679
	Potential for Landslide Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A7SE (S)	202	1	326525 309608
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SW (W)	0	1	326238 310000
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SE (NE)	0	1	326482 310000
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A7NE (SE)	0	1	326407 309940
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310000
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A7NE (E)	0	1	326496 309942
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A12SE (E)	0	1	327047 310198
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A8NW (E)	0	1	326781 309981
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SW (NW)	19	1	326268 310023
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A7NE (SE)	103	1	326558 309728
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A11SW (W)	121	1	326140 310000
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A11SW (NW)	134	1	326177 310067

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310000
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A12NW (NE)	19	1	326823 310505
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A7NE (SE)	110	1	326546 309717
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A7NE (SE)	128	1	326611 309723
	Radon Potential - Radon Affected Areas Affected Area: The property is in an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A11SE (NE)	0	1	326425 310001
	Radon Potential - Radon Affected Areas Affected Area: The property is an Intermediate probability radon area (3 to 5% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A12SW (NE)	0	1	326875 310276
	Radon Potential - Radon Affected Areas Affected Area: The property is in an Intermediate probability radon area (5 to 10% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A12SW (E)	0	1	326925 310051
	Radon Potential - Radon Affected Areas Affected Area: The property is in an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A7NE (E)	0	1	326425 309954
	Radon Potential - Radon Affected Areas Affected Area: The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310001
	Radon Potential - Radon Affected Areas Affected Area: The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A11SE (NE)	0	1	326425 310001
	Radon Potential - Radon Protection Measures Protection Measure: Basic radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A12SW (NE)	0	1	326875 310276
	Radon Potential - Radon Protection Measures Protection Measure: Basic radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A12SW (E)	0	1	326925 310051
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A7NE (E)	0	1	326425 309954
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A11SE (N)	0	1	326382 310001
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A7NE (W)	0	1	326382 309954

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
209	**Contemporary Trade Directory Entries** Name: Border Hardcore Co Ltd Location: Buttington Quarry, Cefn, Buttington, Welshpool, Powys, SY21 8SZ Classification: Quarries **Status: Active** Positional Accuracy: Automatically positioned to the address	A7NW (SW)	0	-	326310 309827
210	**Contemporary Trade Directory Entries** Name: D Marston Location: 99, Parc Caradog, Trewern, Welshpool, Powys, SY21 8DS Classification: Road Haulage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A12NE (NE)	345	-	327294 310588
211	**Points of Interest - Commercial Services** Name: D Marston Location: 99 Parc Caradog, Trewern, Welshpool, SY21 8DS Category: Transport, Storage and Delivery Class Code: Distribution and Haulage Positional Accuracy: Positioned to address or location	A12NE (NE)	345	7	327294 310588
212	**Points of Interest - Manufacturing and Production** Name: Border Stone Location: Buttington Quarry, Cefn, Buttington, Welshpool, SY21 8SZ Category: Extractive Industries Class Code: Stone Quarrying and Preparation Positional Accuracy: Positioned to address or location	A7NW (SW)	0	7	326310 309827
212	**Points of Interest - Manufacturing and Production** Name: Border Hardcore Location: Buttington Quarry, Cefn, Buttington, Welshpool, SY21 8SZ Category: Extractive Industries Class Code: Unspecified Quarries Or Mines Positional Accuracy: Positioned to address or location	A7NW (SW)	0	7	326310 309827
212	**Points of Interest - Manufacturing and Production** Name: Brick Works Location: Not Supplied Category: Industrial Features Class Code: Unspecified Works Or Factories Positional Accuracy: Positioned to an adjacent address or location	A7NW (S)	0	7	326324 309758
212	**Points of Interest - Manufacturing and Production** Name: Border Hardcore Co Ltd Location: Buttington Quarry, Buttington, Welshpool, SY21 8SZ Category: Extractive Industries Class Code: Unspecified Quarries Or Mines Positional Accuracy: Positioned to address or location	A7NW (SW)	0	7	326309 309827
213	**Points of Interest - Manufacturing and Production** Name: Clay Pit Location: SY21 Category: Extractive Industries Class Code: Sand, Gravel and Clay Extraction and Merchants Positional Accuracy: Positioned to an adjacent address or location	A11SE (E)	0	7	326514 309993
214	**Points of Interest - Manufacturing and Production** Name: Clay Pit (Disused) Location: SY21 Category: Extractive Industries Class Code: Sand, Gravel and Clay Extraction and Merchants Positional Accuracy: Positioned to an adjacent address or location	A12SW (E)	0	7	326743 310066
215	**Points of Interest - Manufacturing and Production** Name: Tank Location: SY21 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to an adjacent address or location	A6SE (SW)	518	7	325886 309329
216	**Points of Interest - Manufacturing and Production** Name: Tank Location: SY21 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to an adjacent address or location	A3NW (SW)	630	7	326028 309103
216	**Points of Interest - Manufacturing and Production** Name: Tank Location: SY21 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to an adjacent address or location	A2NE (SW)	705	7	325979 309042

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
217	**Points of Interest - Public Infrastructure** Name: Weir Location: SY21 Category: Water Class Code: Weirs, Sluices and Dams Positional Accuracy: Positioned to an adjacent address or location	A16SW (NE)	656	7	326971 310944

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
218	**Ancient Woodland** Name: Not Supplied Reference: 46822 Area(m²): 9428.31 Type: Plantation on Ancient Woodland	A7NE (NW)	0	3	326381 309957
219	**Ancient Woodland** Name: Not Supplied Reference: 36224 Area(m²): 11601.71 Type: Restored Ancient Woodland Site	A7NE (N)	0	3	326374 309986
220	**Ancient Woodland** Name: Not Supplied Reference: 44245 Area(m²): 2955.45 Type: Plantation on Ancient Woodland	A11SE (NE)	0	3	326561 310121
221	**Ancient Woodland** Name: Not Supplied Reference: 50864 Area(m²): 8920.64 Type: Ancient Woodland Site of Unknown Category	A7NE (W)	0	3	326374 309953
222	**Ancient Woodland** Name: Not Supplied Reference: 36224 Area(m²): 9999.27 Type: Restored Ancient Woodland Site	A7NE (W)	0	3	326382 309954
223	**Ancient Woodland** Name: Not Supplied Reference: 46822 Area(m²): 423.51 Type: Plantation on Ancient Woodland	A11SE (NE)	0	3	326457 310095
224	**Ancient Woodland** Name: Not Supplied Reference: 33925 Area(m²): 14487.02 Type: Ancient and Semi-Natural Woodland	A11SW (NW)	55	3	326289 310068
225	**Ancient Woodland** Name: Not Supplied Reference: 33926 Area(m²): 18498.29 Type: Ancient and Semi-Natural Woodland	A11SW (NW)	91	3	326270 310101
226	**Ancient Woodland** Name: Not Supplied Reference: 44244 Area(m²): 10612.88 Type: Plantation on Ancient Woodland	(E)	346	3	327439 310141
227	**Ancient Woodland** Name: Not Supplied Reference: 27143 Area(m²): 7025.73 Type: Ancient and Semi-Natural Woodland	(E)	560	3	327679 310281
228	**Ancient Woodland** Name: Not Supplied Reference: 29223 Area(m²): 30108.06 Type: Restored Ancient Woodland Site	A4NE (SE)	663	3	327002 309180
229	**Ancient Woodland** Name: Not Supplied Reference: 26855 Area(m²): 1471.76 Type: Ancient and Semi-Natural Woodland	A8SE (SE)	685	3	327328 309313
230	**Ancient Woodland** Name: Not Supplied Reference: 28059 Area(m²): 16908.93 Type: Ancient and Semi-Natural Woodland	(SE)	686	3	327348 309330
231	**Ancient Woodland** Name: Not Supplied Reference: 33927 Area(m²): 23211.48 Type: Ancient and Semi-Natural Woodland	A15SE (N)	696	3	326331 310875

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
232	**Ancient Woodland** Name: Not Supplied Reference: 28058 Area(m²): 4896.52 Type: Ancient and Semi-Natural Woodland	A4NW (SE)	701	3	326782 309137
233	**Ancient Woodland** Name: Not Supplied Reference: 33924 Area(m²): 5632.36 Type: Ancient and Semi-Natural Woodland	A4NW (S)	709	3	326690 309107
234	**Ancient Woodland** Name: Not Supplied Reference: 27140 Area(m²): 13843.73 Type: Ancient and Semi-Natural Woodland	(E)	810	3	327752 309662
235	**Ancient Woodland** Name: Not Supplied Reference: 27473 Area(m²): 6160.29 Type: Ancient and Semi-Natural Woodland	A3SW (S)	826	3	326121 308871
236	**Ancient Woodland** Name: Not Supplied Reference: 32035 Area(m²): 3827.74 Type: Ancient and Semi-Natural Woodland	A3SW (S)	846	3	326112 308852
237	**Ancient Woodland** Name: Not Supplied Reference: 28060 Area(m²): 9010.02 Type: Ancient and Semi-Natural Woodland	(E)	938	3	327813 309530
238	**Sites of Special Scientific Interest** Name: Gwaith Brics Buttington / Buttington Brickworks Multiple Areas: N Total Area (m2): 6545.96 Source: Natural Resources Wales Reference: 279733wpy Designation Details: Geological Designation Date: 16th July 2004 Date Type: Notified	A12SW (E)	0	3	326968 310110

Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices		
Powys County Council - Public Protection Department	February 2015	Annual Rolling Update
Shropshire Council - Environmental Health Department	March 2015	Annually
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	May 2009	Not Applicable
Discharge Consents		
Environment Agency - Midlands Region	January 2019	Quarterly
Natural Resources Wales	January 2019	Quarterly
Enforcement and Prohibition Notices		
Environment Agency - Midlands Region	March 2013	Annual Rolling Update
Environment Agency - Welsh Region	March 2013	Annual Rolling Update
Integrated Pollution Controls		
Environment Agency - Midlands Region	October 2008	Variable
Environment Agency - Welsh Region	October 2008	Variable
Integrated Pollution Prevention And Control		
Environment Agency - Midlands Region	January 2019	Quarterly
Environment Agency - Welsh Region	January 2019	Quarterly
Natural Resources Wales	January 2019	Quarterly
Local Authority Integrated Pollution Prevention And Control		
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	June 2008	Not Applicable
Powys County Council - Public Protection Department	May 2014	Variable
Shropshire Council - Environmental Health Department	October 2014	Variable
Local Authority Pollution Prevention and Controls		
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	June 2008	Not Applicable
Powys County Council - Public Protection Department	May 2014	Annual Rolling Update
Shropshire Council - Environmental Health Department	October 2014	Annually
Local Authority Pollution Prevention and Control Enforcements		
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	June 2008	Not Applicable
Powys County Council - Public Protection Department	May 2014	Variable
Shropshire Council - Environmental Health Department	October 2014	Variable
Nearest Surface Water Feature		
Ordnance Survey	January 2019	
Pollution Incidents to Controlled Waters		
Environment Agency - Midlands Region	December 1999	Not Applicable
Prosecutions Relating to Authorised Processes		
Environment Agency - Midlands Region	July 2015	Annual Rolling Update
Environment Agency - Welsh Region	March 2013	Annual Rolling Update
Natural Resources Wales	March 2013	Annual Rolling Update
Prosecutions Relating to Controlled Waters		
Environment Agency - Midlands Region	March 2013	Annual Rolling Update
Environment Agency - Welsh Region	March 2013	Annual Rolling Update
Natural Resources Wales	March 2013	Annual Rolling Update
Registered Radioactive Substances		
Natural Resources Wales	January 2015	Annually
Environment Agency - Midlands Region	June 2016	
Environment Agency - Welsh Region	June 2016	
River Quality		
Environment Agency - Head Office	November 2001	Not Applicable

Agency & Hydrological	Version	Update Cycle
Substantiated Pollution Incident Register		
Environment Agency - Midlands Region - Upper Severn Area	January 2019	Quarterly
Environment Agency - Midlands Region - West Area	January 2019	Quarterly
Environment Agency Wales - North Area	January 2019	Quarterly
Natural Resources Wales	October 2018	Quarterly
Water Abstractions		
Natural Resources Wales	February 2019	Quarterly
Environment Agency - Midlands Region	January 2019	Quarterly
Water Industry Act Referrals		
Natural Resources Wales	January 2019	Quarterly
Environment Agency - Midlands Region	October 2017	Quarterly
Environment Agency - Welsh Region	October 2017	Quarterly
Groundwater Vulnerability		
Environment Agency - Head Office	April 2015	Not Applicable
Drift Deposits		
Environment Agency - Head Office	January 1999	Not Applicable
Bedrock Aquifer Designations		
Natural Resources Wales	January 2018	Annually
Superficial Aquifer Designations		
Natural Resources Wales	January 2018	Annually
Source Protection Zones		
Natural Resources Wales	November 2016	Annual Rolling Update
Extreme Flooding from Rivers or Sea without Defences		
Natural Resources Wales	February 2019	Quarterly
Flooding from Rivers or Sea without Defences		
Natural Resources Wales	February 2019	Quarterly
Areas Benefiting from Flood Defences		
Natural Resources Wales	February 2019	Quarterly
Flood Water Storage Areas		
Natural Resources Wales	February 2019	Quarterly
Flood Defences		
Natural Resources Wales	February 2019	Quarterly
OS Water Network Lines		
Ordnance Survey	October 2018	Quarterly
Surface Water 1 in 30 year Flood Extent		
Natural Resources Wales	October 2013	Annually
Surface Water 1 in 100 year Flood Extent		
Natural Resources Wales	October 2013	Annually
Surface Water 1 in 1000 year Flood Extent		
Natural Resources Wales	October 2013	Annually
Surface Water Suitability		
Natural Resources Wales	October 2013	Annually
BGS Groundwater Flooding Susceptibility		
British Geological Survey - National Geoscience Information Service	May 2013	Annually

Waste	Version	Update Cycle
BGS Recorded Landfill Sites		
British Geological Survey - National Geoscience Information Service	June 1996	Not Applicable
Historical Landfill Sites		
Natural Resources Wales	July 2017	Quarterly
Integrated Pollution Control Registered Waste Sites		
Environment Agency - Midlands Region	October 2008	Not Applicable
Environment Agency - Welsh Region	October 2008	Not Applicable
Licensed Waste Management Facilities (Landfill Boundaries)		
Environment Agency - Midlands Region - Upper Severn Area	July 2018	Quarterly
Environment Agency - Midlands Region - West Area	July 2018	Quarterly
Environment Agency Wales - North Area	July 2018	Quarterly
Natural Resources Wales	July 2018	Quarterly
Licensed Waste Management Facilities (Locations)		
Environment Agency - Midlands Region - Upper Severn Area	January 2019	Quarterly
Environment Agency - Midlands Region - West Area	January 2019	Quarterly
Environment Agency Wales - North Area	January 2019	Quarterly
Natural Resources Wales	January 2019	Quarterly
Local Authority Landfill Coverage		
Powys County Council	May 2000	Not Applicable
Shropshire County Council (now part of Shropshire Council) - Shropshire Records And Research Centre	May 2000	Not Applicable
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	May 2000	Not Applicable
Local Authority Recorded Landfill Sites		
Powys County Council	May 2000	Not Applicable
Shropshire County Council (now part of Shropshire Council) - Shropshire Records And Research Centre	May 2000	Not Applicable
South Shropshire District Council (now part of Shropshire Council) - Environmental Health Department	May 2003	Not Applicable
Potentially Infilled Land (Non-Water)		
Landmark Information Group Limited	December 1999	Not Applicable
Potentially Infilled Land (Water)		
Landmark Information Group Limited	December 1999	Not Applicable
Registered Landfill Sites		
Environment Agency - Midlands Region - Upper Severn Area	March 2003	Not Applicable
Environment Agency - Midlands Region - West Area	March 2003	Not Applicable
Environment Agency Wales - North Area	March 2003	Not Applicable
Registered Waste Transfer Sites		
Environment Agency - Midlands Region - Upper Severn Area	March 2003	Not Applicable
Environment Agency - Midlands Region - West Area	March 2003	Not Applicable
Environment Agency Wales - North Area	March 2003	Not Applicable
Registered Waste Treatment or Disposal Sites		
Environment Agency - Midlands Region - Upper Severn Area	March 2003	Not Applicable
Environment Agency - Midlands Region - West Area	March 2003	Not Applicable
Environment Agency Wales - North Area	March 2003	Not Applicable

Hazardous Substances	Version	Update Cycle
Control of Major Accident Hazards Sites (COMAH)		
Health and Safety Executive	April 2018	Bi-Annually
Explosive Sites		
Health and Safety Executive	March 2017	Variable
Notification of Installations Handling Hazardous Substances (NIHHS)		
Health and Safety Executive	November 2000	Not Applicable
Planning Hazardous Substance Enforcements		
Powys County Council - Planning Department	February 2016	Variable
Shropshire Council - Planning Department	February 2016	Variable
South Shropshire District Council (now part of Shropshire Council) - Planning Department	January 2008	Not Applicable
Shropshire County Council (now part of Shropshire Council)	March 2009	Annual Rolling Update
Planning Hazardous Substance Consents		
Powys County Council - Planning Department	February 2016	Variable
Shropshire Council - Planning Department	February 2016	Variable
South Shropshire District Council (now part of Shropshire Council) - Planning Department	January 2008	Not Applicable
Shropshire County Council (now part of Shropshire Council)	March 2009	Annual Rolling Update

Geological	Version	Update Cycle
BGS 1:625,000 Solid Geology		
British Geological Survey - National Geoscience Information Service	January 2009	Not Applicable
BGS Estimated Soil Chemistry		
British Geological Survey - National Geoscience Information Service	October 2015	Annually
BGS Recorded Mineral Sites		
British Geological Survey - National Geoscience Information Service	November 2018	Bi-Annually
CBSCB Compensation District		
Cheshire Brine Subsidence Compensation Board (CBSCB)	August 2011	Not Applicable
Coal Mining Affected Areas		
The Coal Authority - Property Searches	March 2014	Annual Rolling Update
Mining Instability		
Ove Arup & Partners	October 2000	Not Applicable
Non Coal Mining Areas of Great Britain		
British Geological Survey - National Geoscience Information Service	May 2015	Not Applicable
Potential for Collapsible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Compressible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Ground Dissolution Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Landslide Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Running Sand Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Shrinking or Swelling Clay Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Radon Potential - Radon Affected Areas		
British Geological Survey - National Geoscience Information Service	July 2011	Annually
Radon Potential - Radon Protection Measures		
British Geological Survey - National Geoscience Information Service	July 2011	Annually

Industrial Land Use	Version	Update Cycle
Contemporary Trade Directory Entries Thomson Directories	January 2019	Quarterly
Fuel Station Entries Catalist Ltd - Experian	November 2018	Quarterly
Gas Pipelines National Grid	July 2014	
Points of Interest - Commercial Services PointX	November 2018	Quarterly
Points of Interest - Education and Health PointX	November 2018	Quarterly
Points of Interest - Manufacturing and Production PointX	November 2018	Quarterly
Points of Interest - Public Infrastructure PointX	November 2018	Quarterly
Points of Interest - Recreational and Environmental PointX	November 2018	Quarterly
Underground Electrical Cables National Grid	December 2015	

Sensitive Land Use	Version	Update Cycle
Ancient Woodland		
Natural Resources Wales	August 2018	Bi-Annually
Areas of Adopted Green Belt		
Shropshire Council - Planning Department	August 2018	As notified
Areas of Unadopted Green Belt		
Shropshire Council - Planning Department	August 2018	As notified
Areas of Outstanding Natural Beauty		
Natural England	August 2018	Bi-Annually
Natural Resources Wales	August 2018	Bi-Annually
Environmentally Sensitive Areas		
Natural England	January 2017	
The National Assembly for Wales - GI Services (Department of Planning & Countryside)	January 2017	
Forest Parks		
Forestry Commission	April 1997	Not Applicable
Local Nature Reserves		
Natural England	August 2018	Bi-Annually
Powys County Council	August 2018	Bi-Annually
Marine Nature Reserves		
Natural Resources Wales	August 2018	Bi-Annually
National Nature Reserves		
Natural Resources Wales	August 2018	Bi-Annually
National Parks		
Natural England	April 2017	Bi-Annually
Natural Resources Wales	August 2018	Annually
Nitrate Vulnerable Zones		
Natural Resources Wales	July 2017	Bi-Annually
The National Assembly for Wales - GI Services (Department of Planning & Countryside)	October 2005	
Ramsar Sites		
Natural Resources Wales	February 2019	Bi-Annually
Sites of Special Scientific Interest		
Natural Resources Wales	February 2018	Bi-Annually
Special Areas of Conservation		
Natural Resources Wales	August 2018	Bi-Annually
Special Protection Areas		
Natural Resources Wales	August 2018	Bi-Annually

Data Suppliers

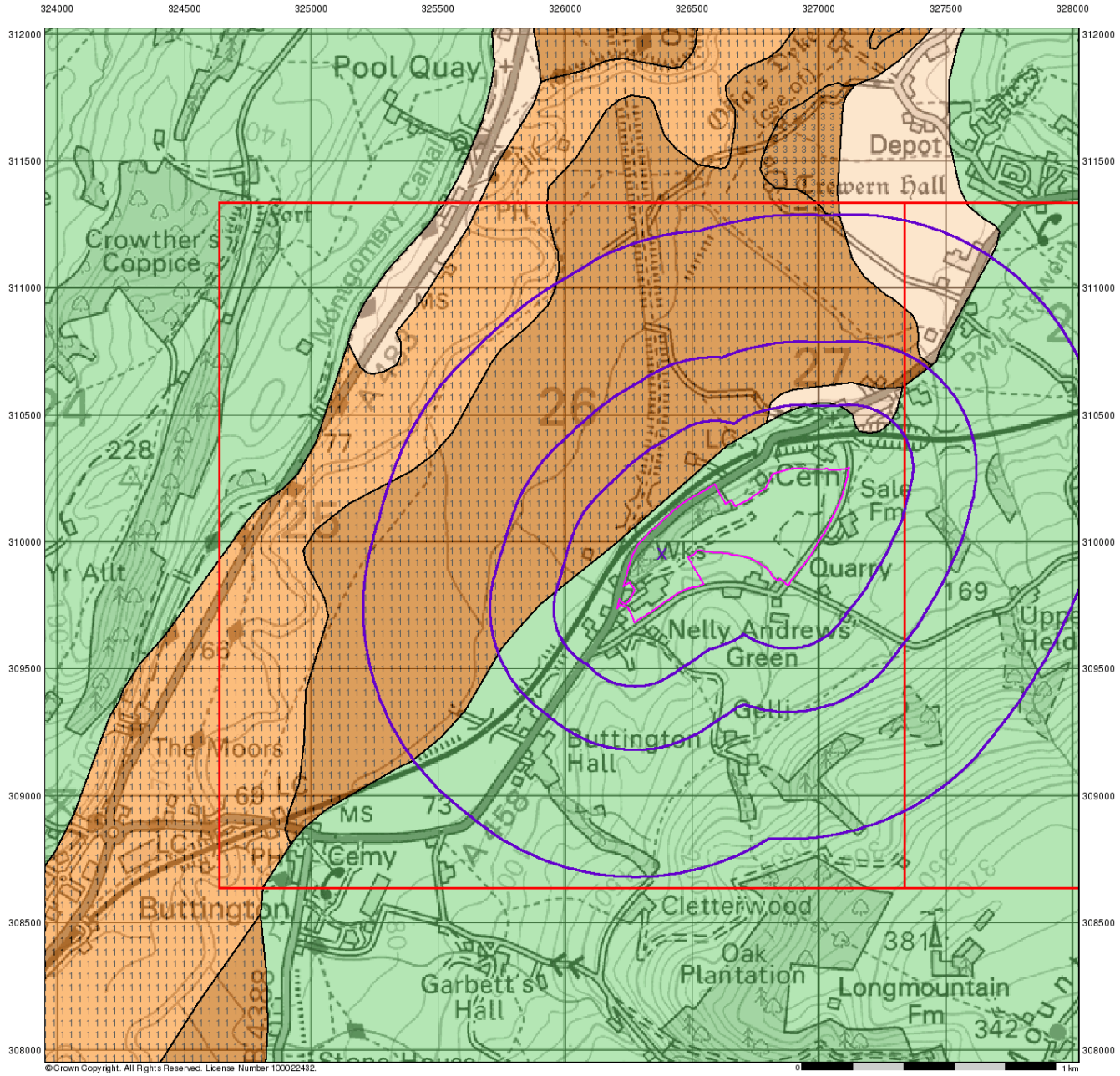
A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	Map data
Environment Agency	Environment Agency
Scottish Environment Protection Agency	SEPA Scottish Environment Protection Agency
The Coal Authority	The Coal Authority
British Geological Survey	British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL
Centre for Ecology and Hydrology	Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL
Natural Resources Wales	Cyfoeth Naturiol Cymru Natural Resources Wales
Scottish Natural Heritage	SCOTTISH NATURAL HERITAGE
Natural England	NATURAL ENGLAND
Public Health England	Public Health England
Ove Arup	ARUP
Peter Brett Associates	pba peterbrett

Useful Contacts

Contact	Name and Address	Contact Details
1	**British Geological Survey - Enquiry Service** British Geological Survey, Environmental Science Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
2	**Environment Agency - National Customer Contact Centre (NCCC)** PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 03708 506 506 Email: enquiries@environment-agency.gov.uk
3	**Natural Resources Wales** Ty Cambria, 29 Newport Road, Cardiff, CF24 0TP	Telephone: 0300 065 3000 Email: enquiries@naturalresourceswales.gov.uk
4	**Powys County Council - Public Protection Department** Neuadd Maldwyn, Severn Road, Welshpool, Powys, SY21 7AS	Telephone: 01597 826662 Fax: 01597 826669 Website: www.powys.gov.uk
5	**Ordnance Survey** Adanac Drive, Southampton, Hampshire, SO16 0AS	Telephone: 03456 05 05 05 Email: customerservices@ordnancesurvey.co.uk Website: www.ordnancesurvey.gov.uk
6	**Powys County Council** County Hall, Llandrindod Wells, Powys, LD1 5LG	Telephone: 01597 826000 Fax: 01597 826230 Website: www.powys.gov.uk
7	**PointX** 7 Abbey Court, Eagle Way, Sowton, Exeter, Devon, EX2 7HY	Website: www.pointx.co.uk
-	**Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards** Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	**Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Please note that the Environment Agency / Natural Resources Wales / SEPA have a charging policy in place for enquiries.



terrafirma

Groundwater Vulnerability

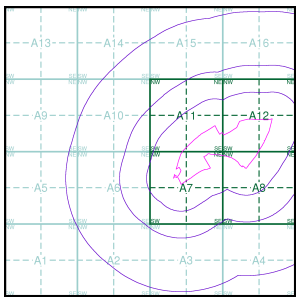
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes	Soil Classes
Major Aquifer (Highly Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Minor Aquifer (Variably Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Non Aquifer (Negligibly Permeable)	
Water or Sea	
Drift Deposit	

Site Sensitivity Context Map - Slice A

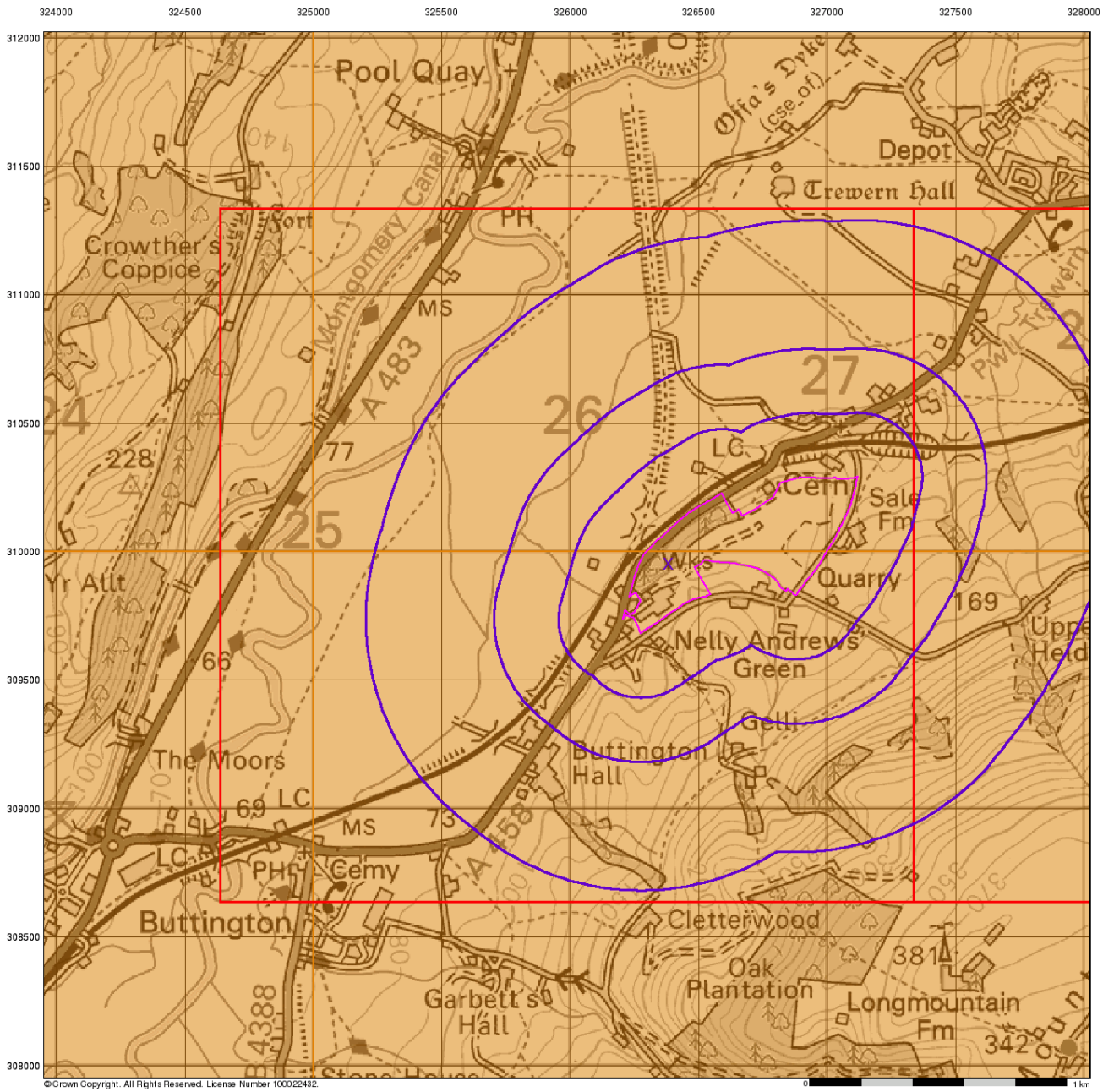


Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ



terrafirma

Bedrock Aquifer Designation

General

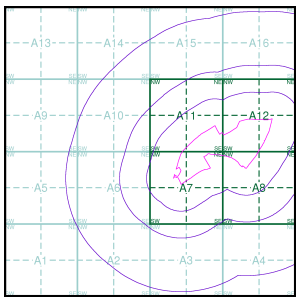
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



Order Details

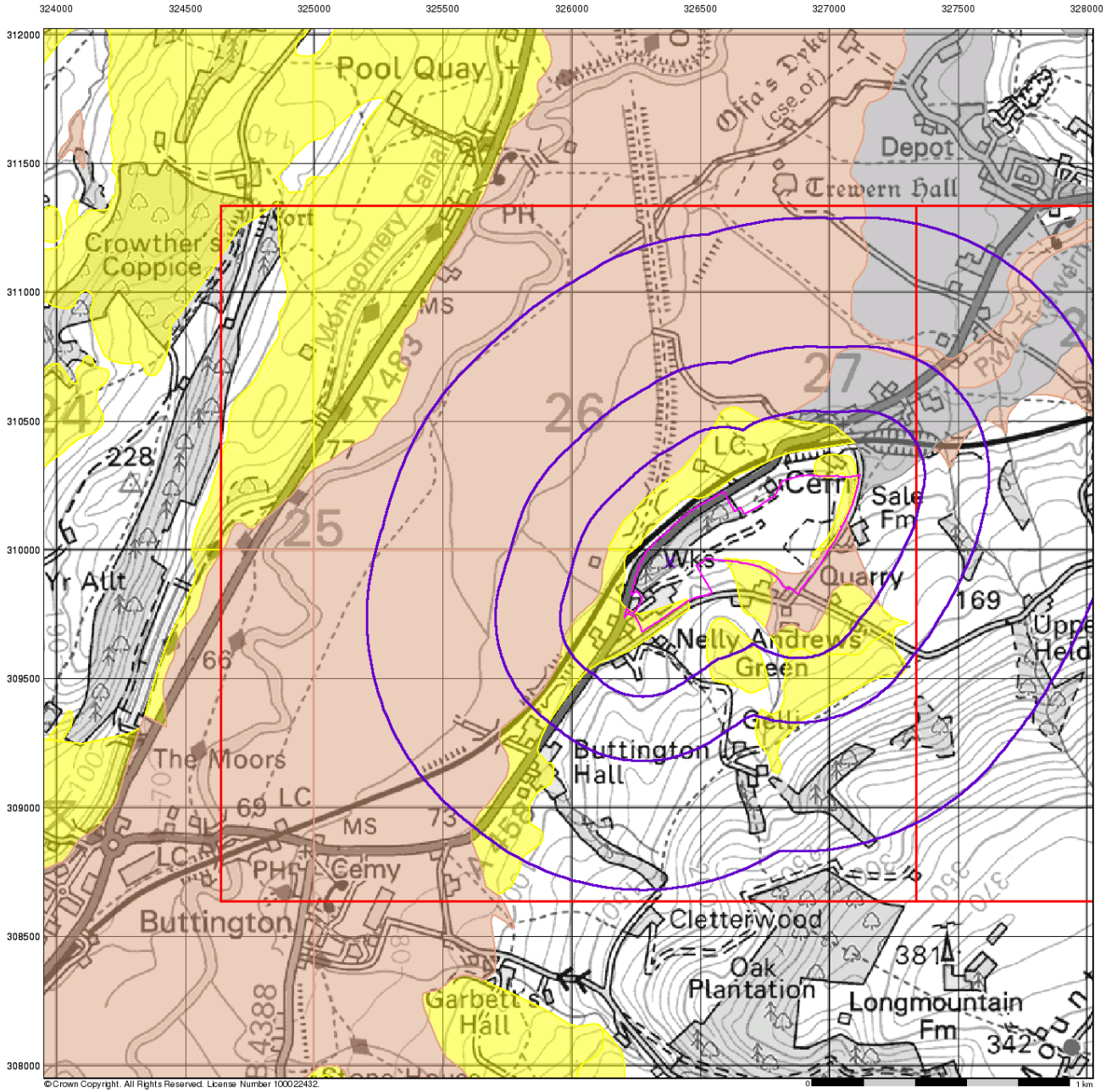
Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



terrafirma

Superficial Aquifer Designation

General

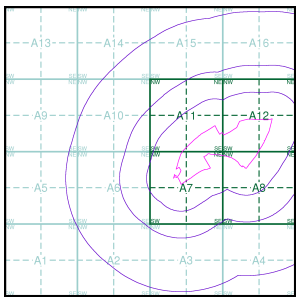
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A

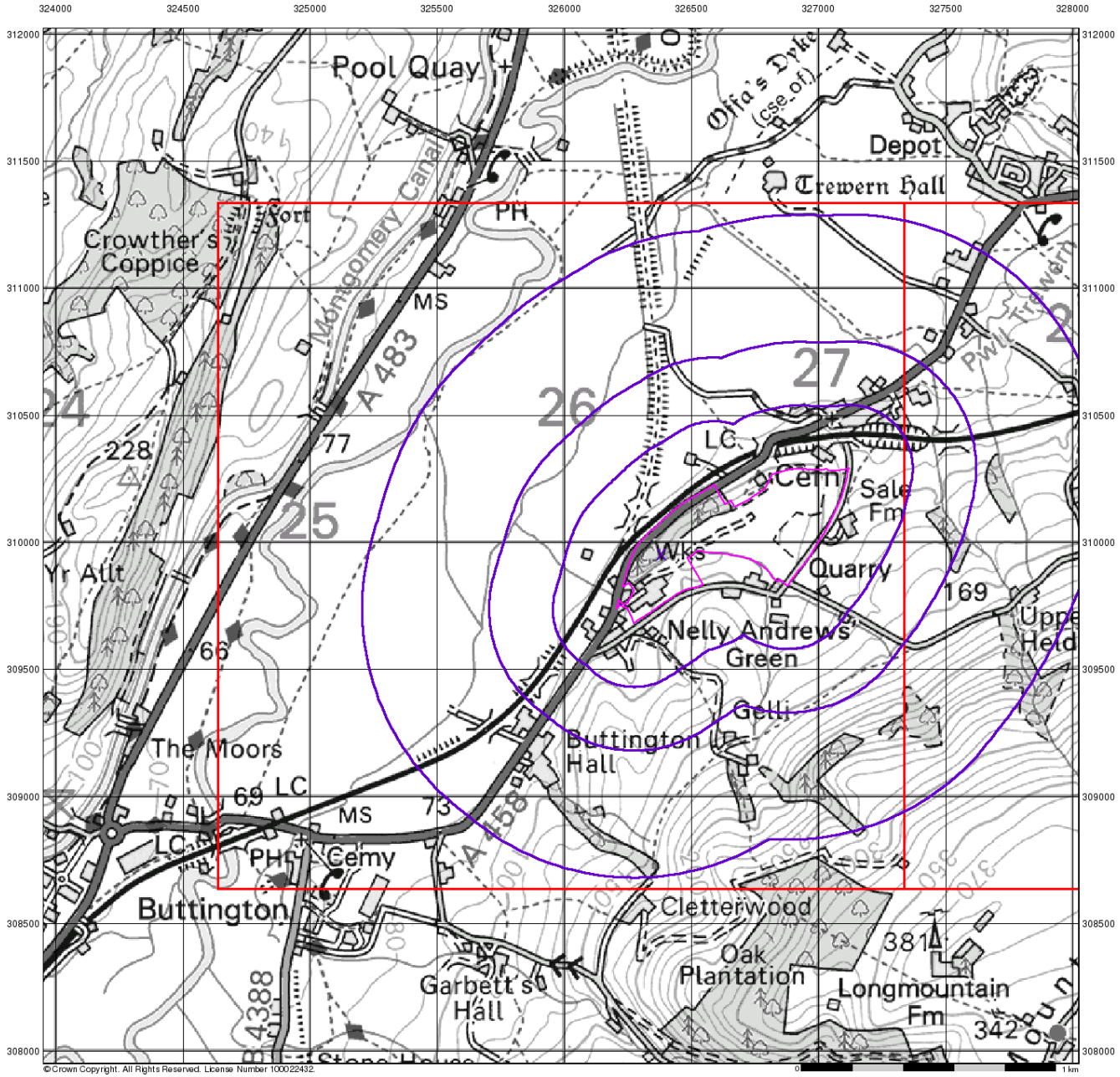


Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ



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Source Protection Zones

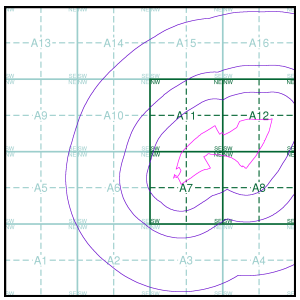
General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



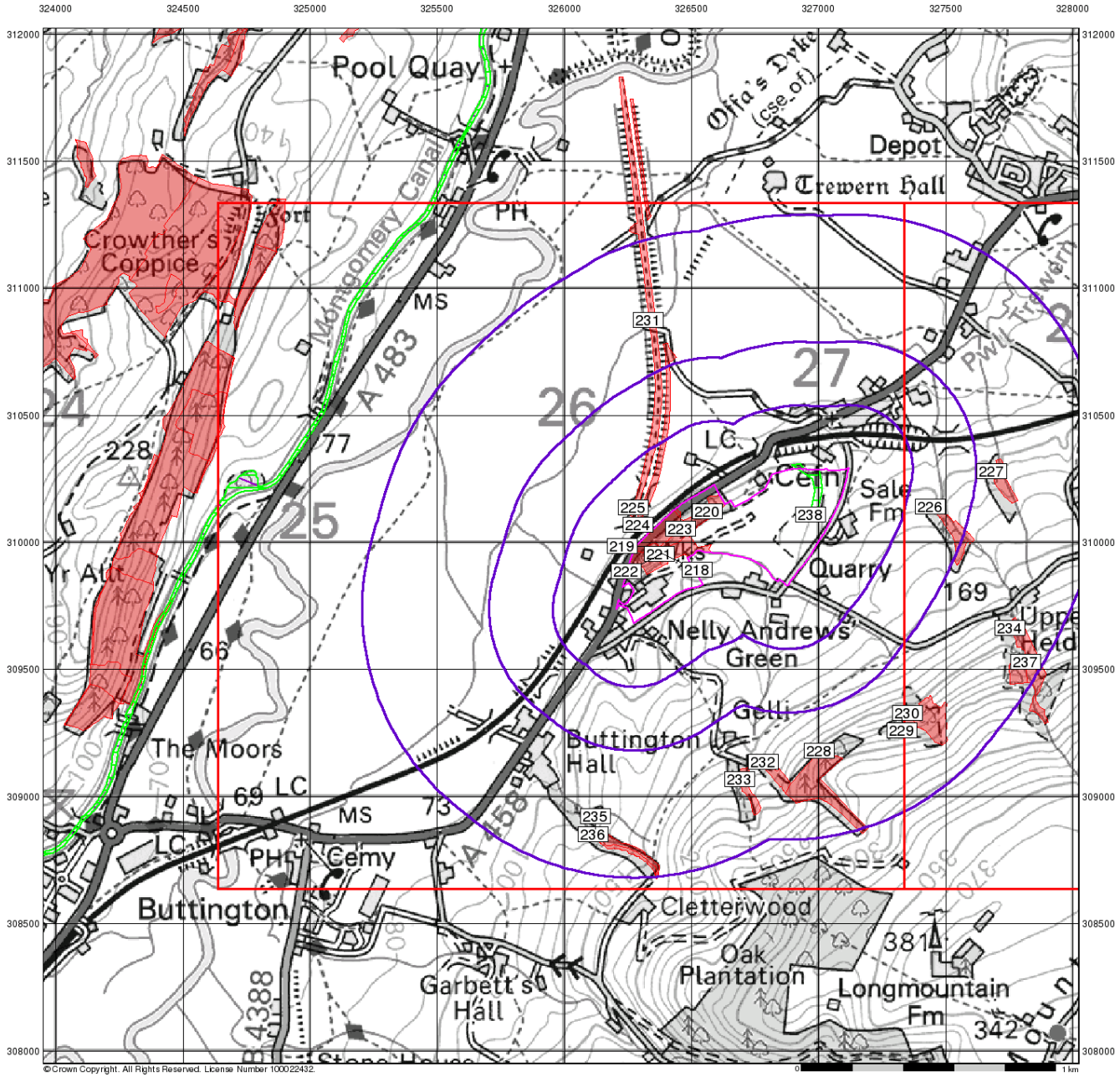
Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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Sensitive Land Uses

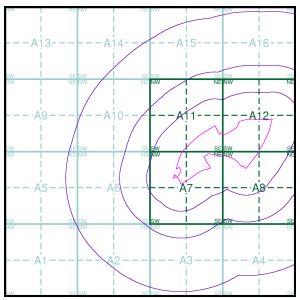
General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

Sensitive Land Uses

- Ancient Woodland
- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area
- World Heritage Sites

Site Sensitivity Context Map - Slice A



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

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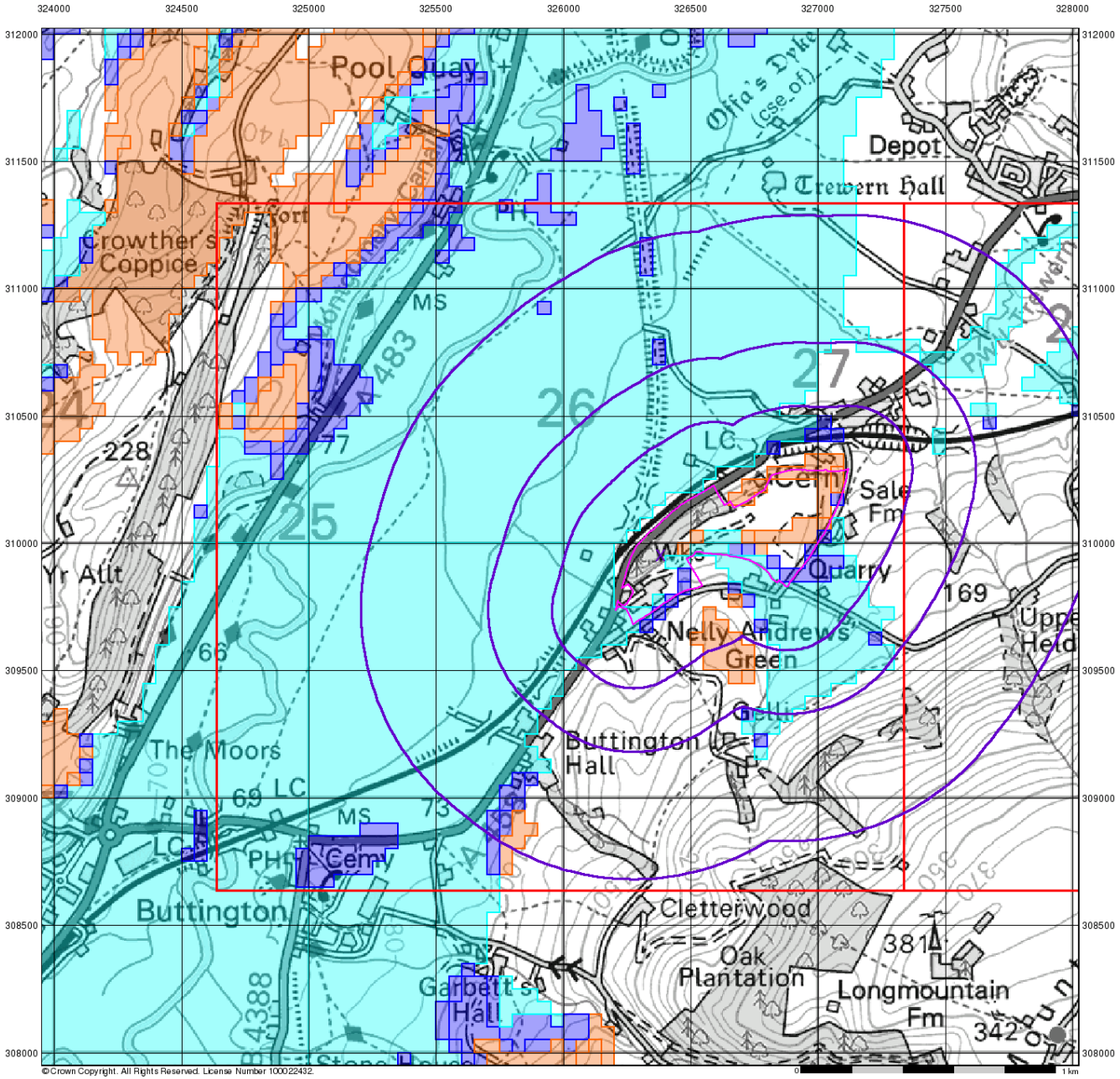

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BGS Flood GFS Data

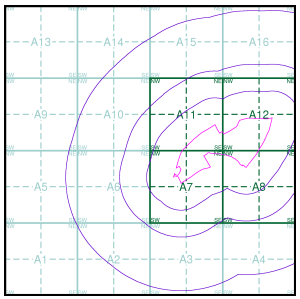
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A

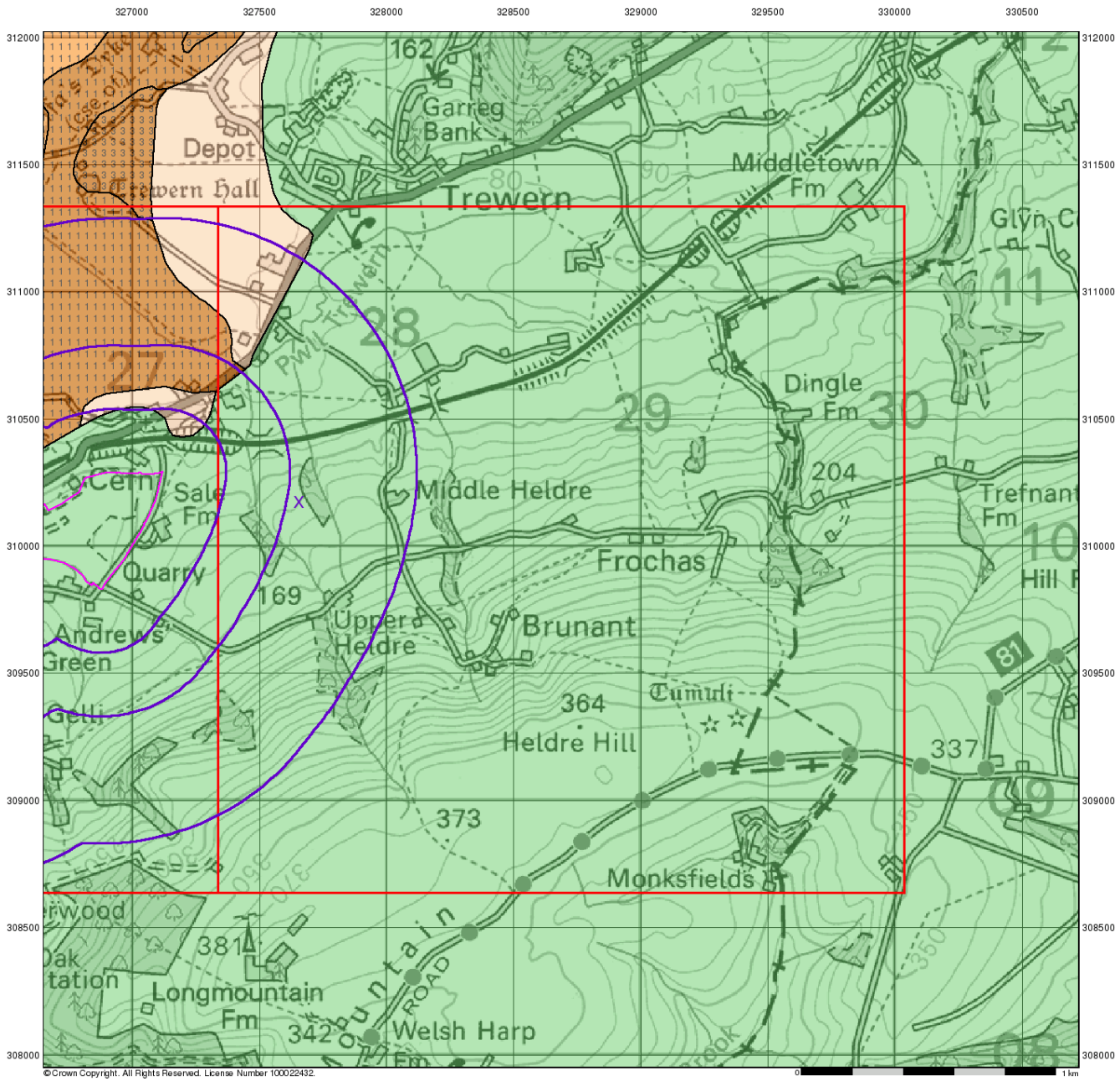


Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ



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Groundwater Vulnerability

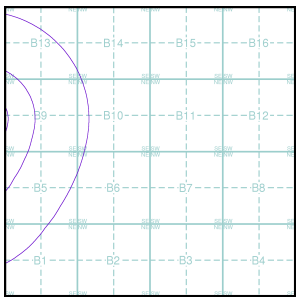
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes	Soil Classes
Major Aquifer (Highly Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Minor Aquifer (Variably Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Non Aquifer (Negligibly Permeable)	
Water or Sea	
Drift Deposit	

Site Sensitivity Context Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

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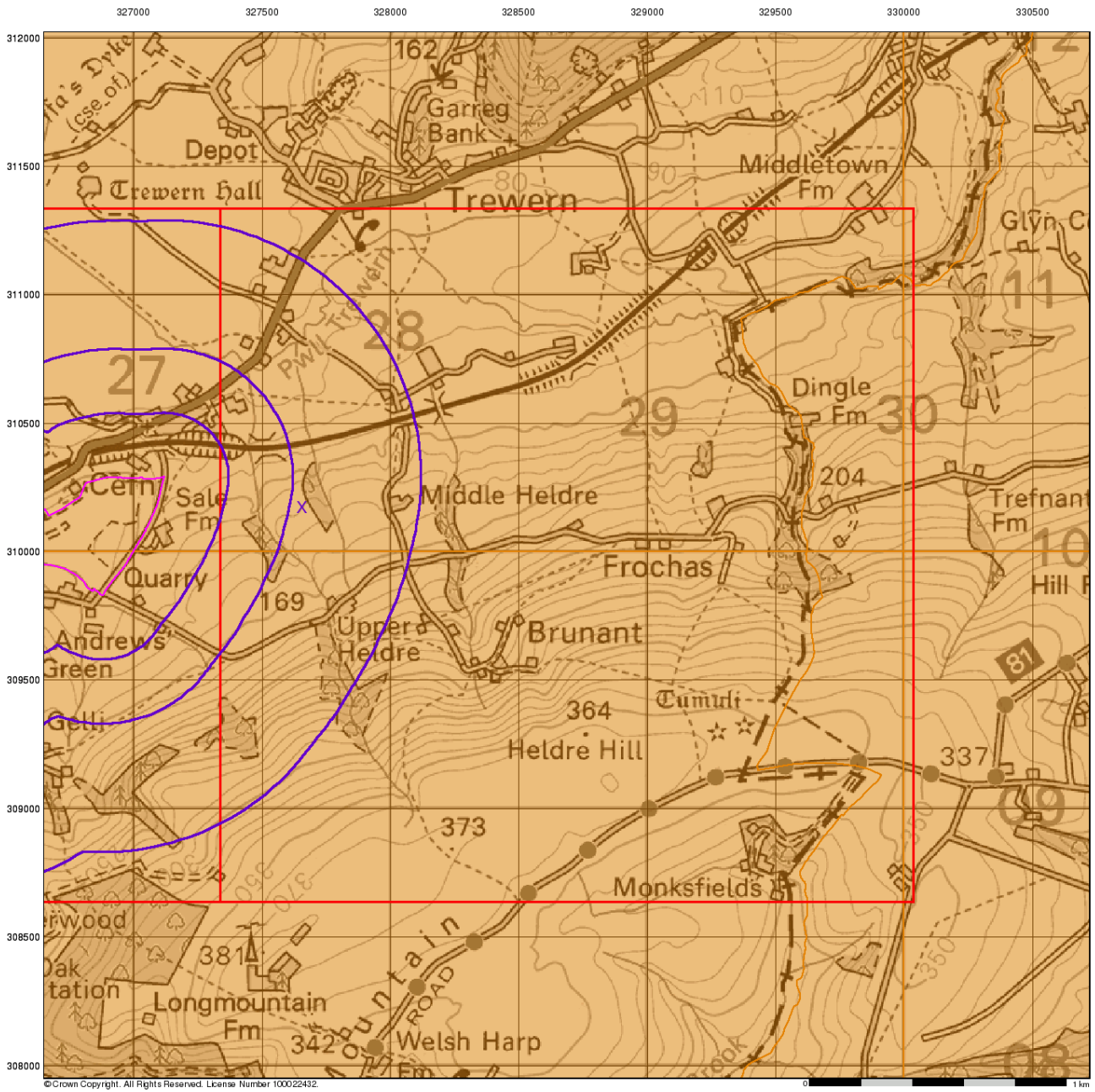

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Bedrock Aquifer Designation

General

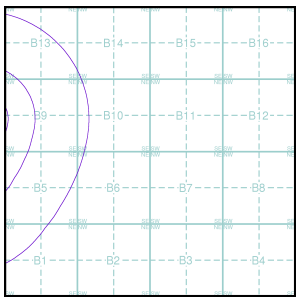
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice B

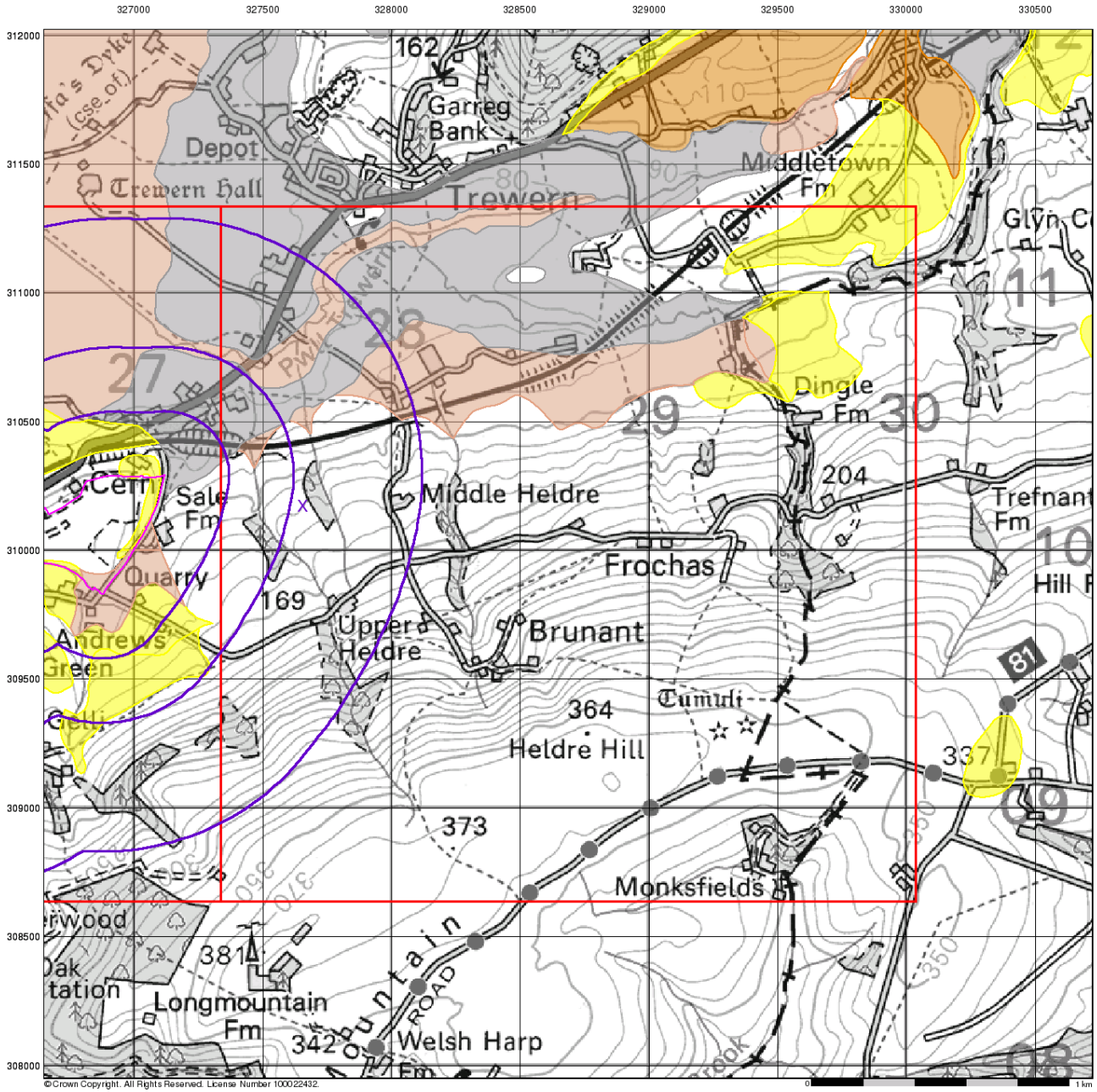


Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ



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Superficial Aquifer Designation

General

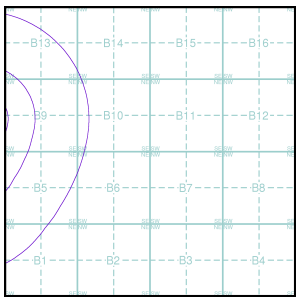
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice B

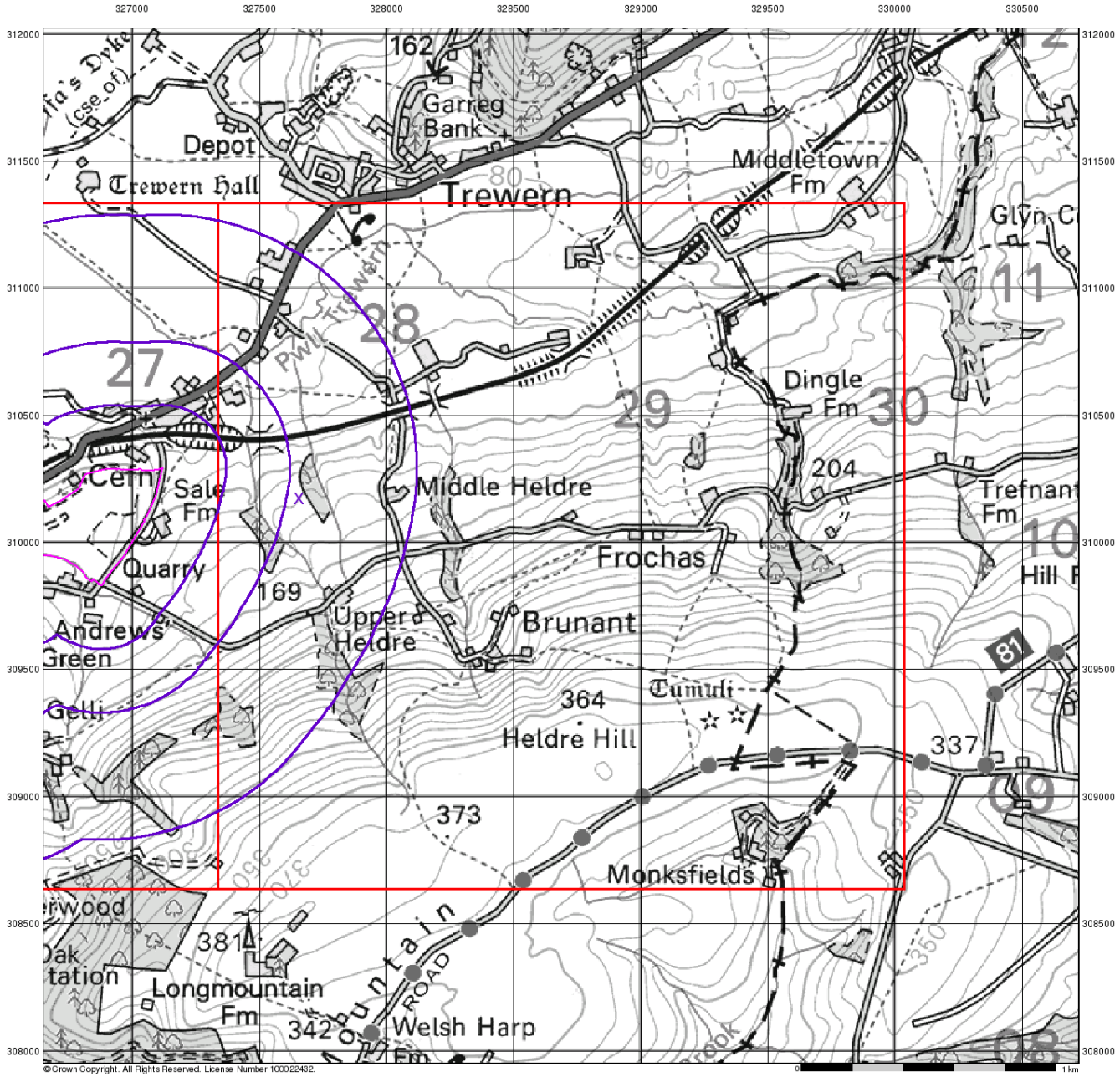


Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ



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Source Protection Zones

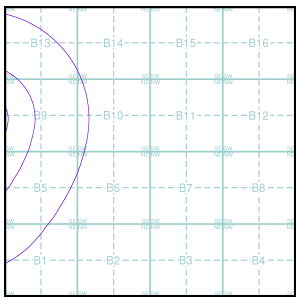
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

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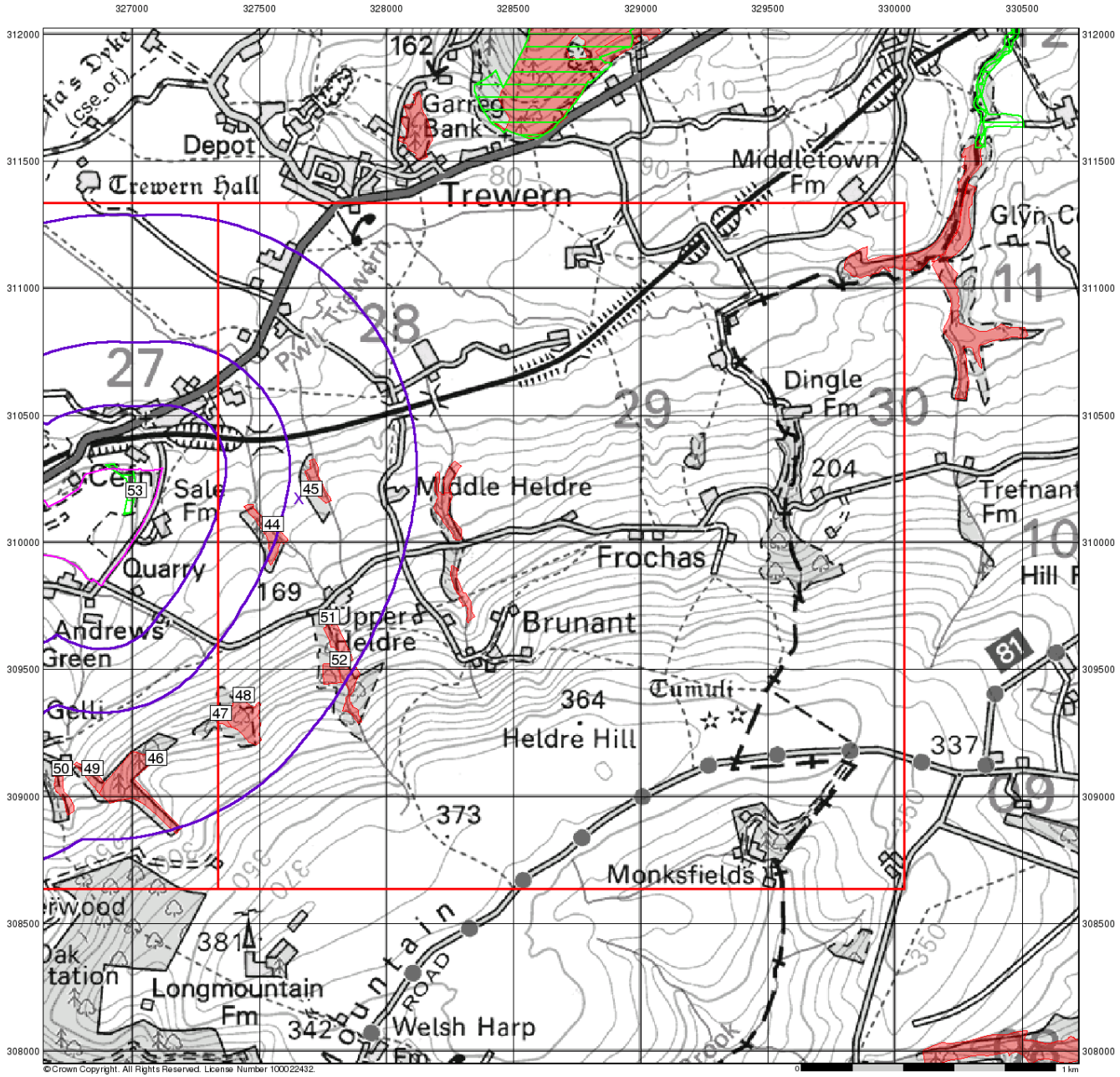

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Sensitive Land Uses

General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Sensitive Land Uses

- Ancient Woodland
- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
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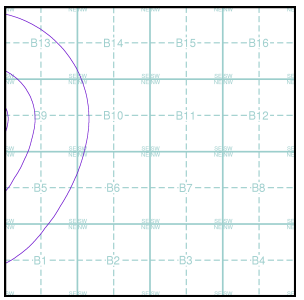
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area
- World Heritage Sites

Site Sensitivity Context Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

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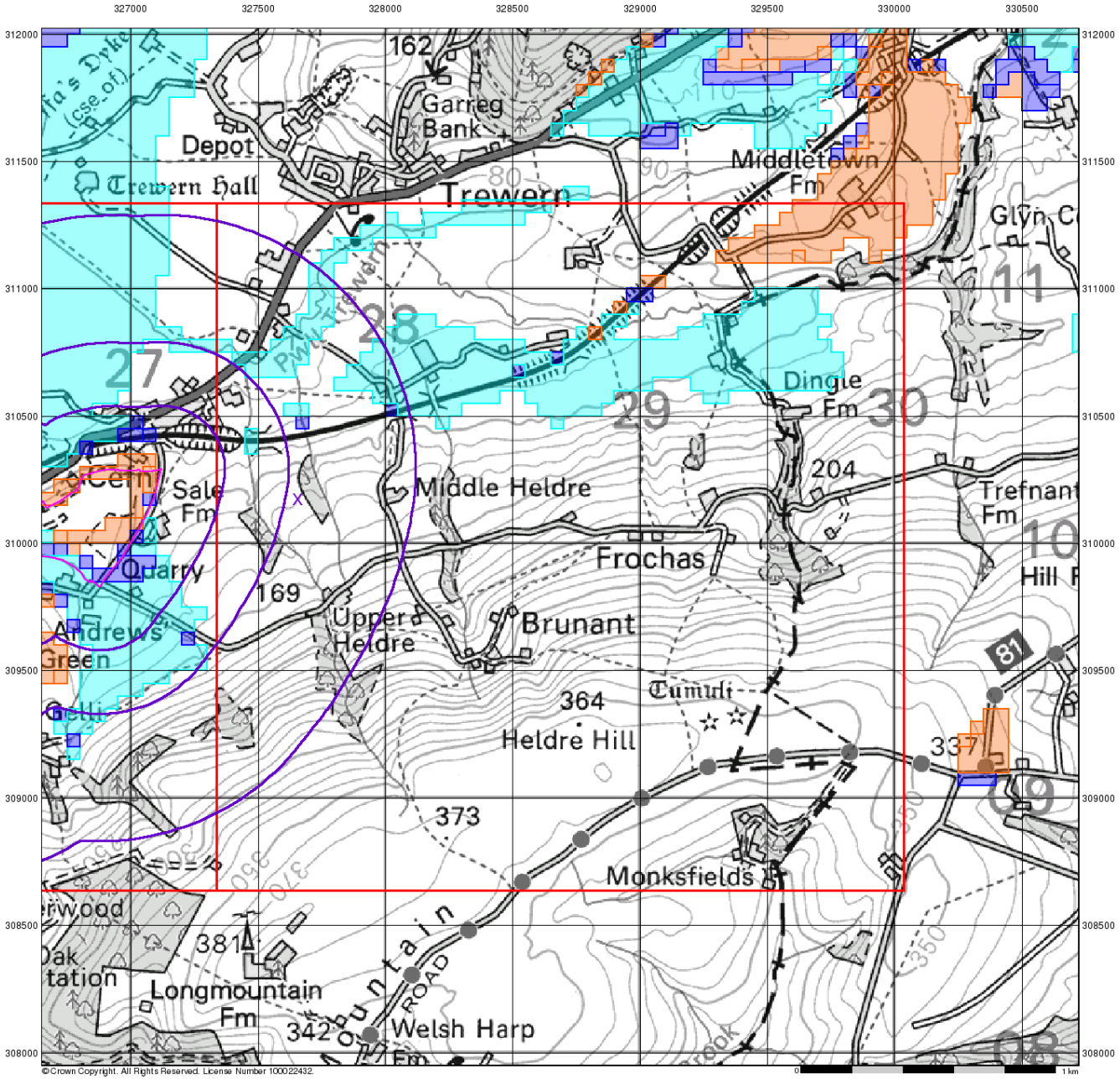

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BGS Flood GFS Data

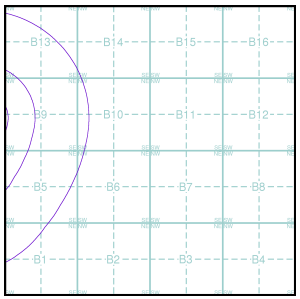
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

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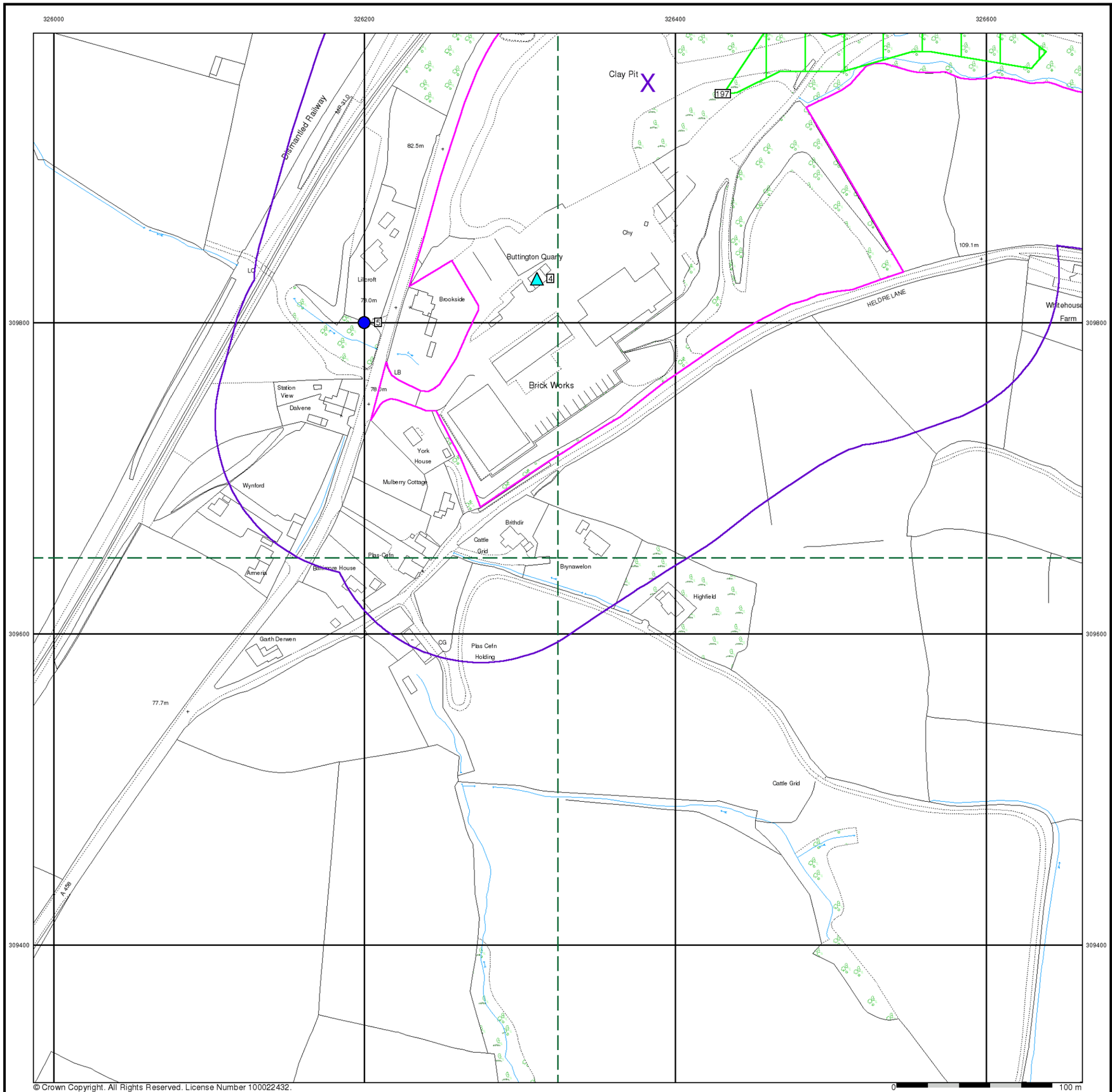

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General

Specified Site · Specified Buffer(s) · Bearing Reference Point · Map ID
Several of Type at Location · Pylon · Overhead Transmission Line

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

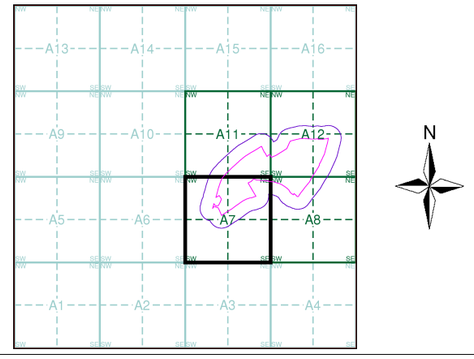
Geological

- BGS Recorded Mineral Site

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Segment A7



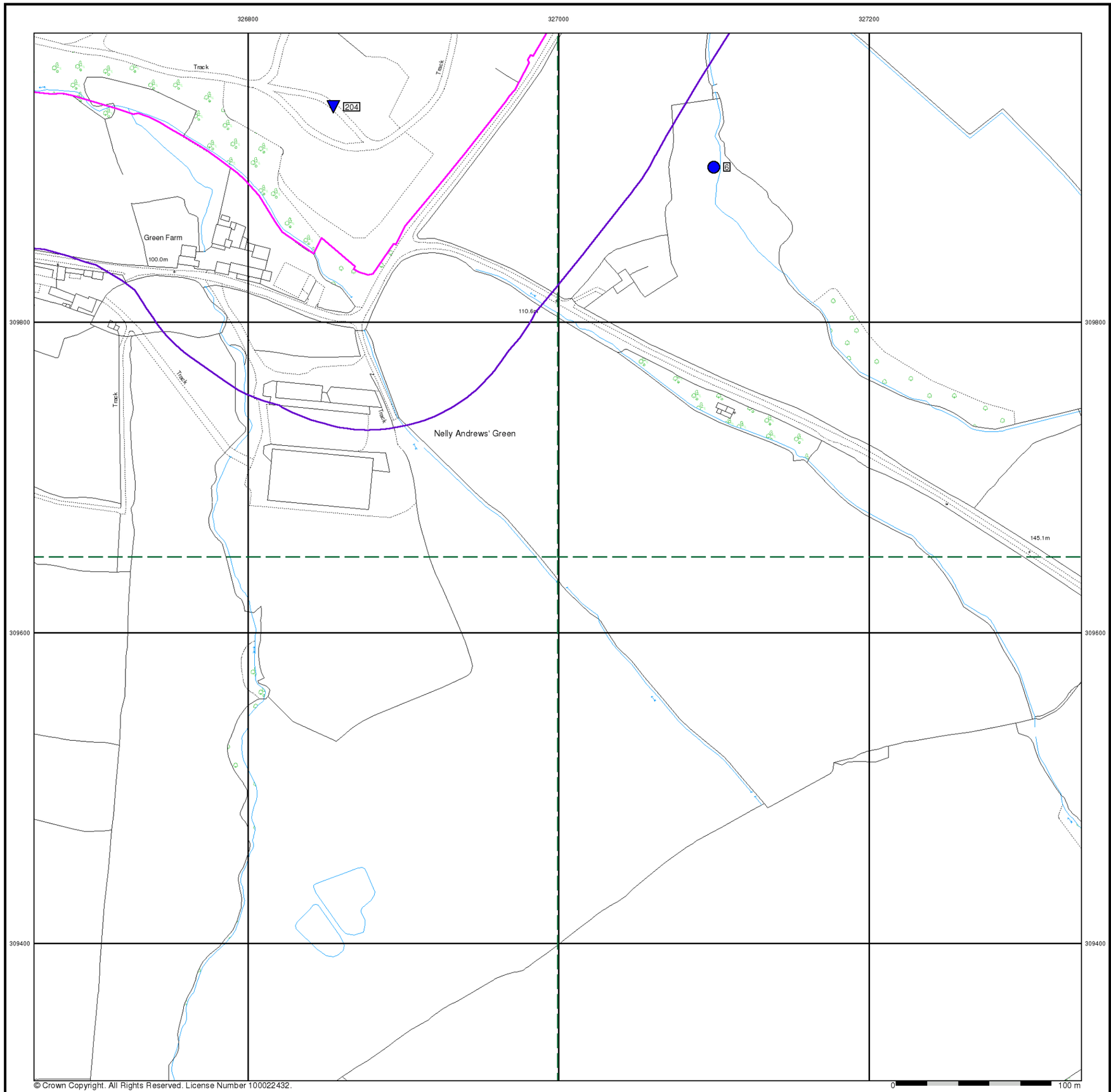
Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Plot Buffer (m):	100

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Map ID
Several of Type at Location | Pylon | Overhead Transmission Line

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Hazardous Substances

COMAH Site | Explosive Site
NIHHS Site
Planning Hazardous Substance Consent
Planning Hazardous Substance Enforcement

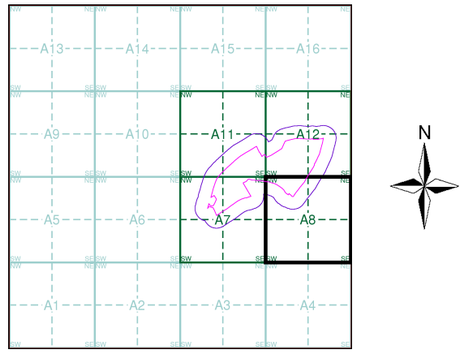
Geological

- BGS Recorded Mineral Site

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Segment A8



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Plot Buffer (m):	100

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP
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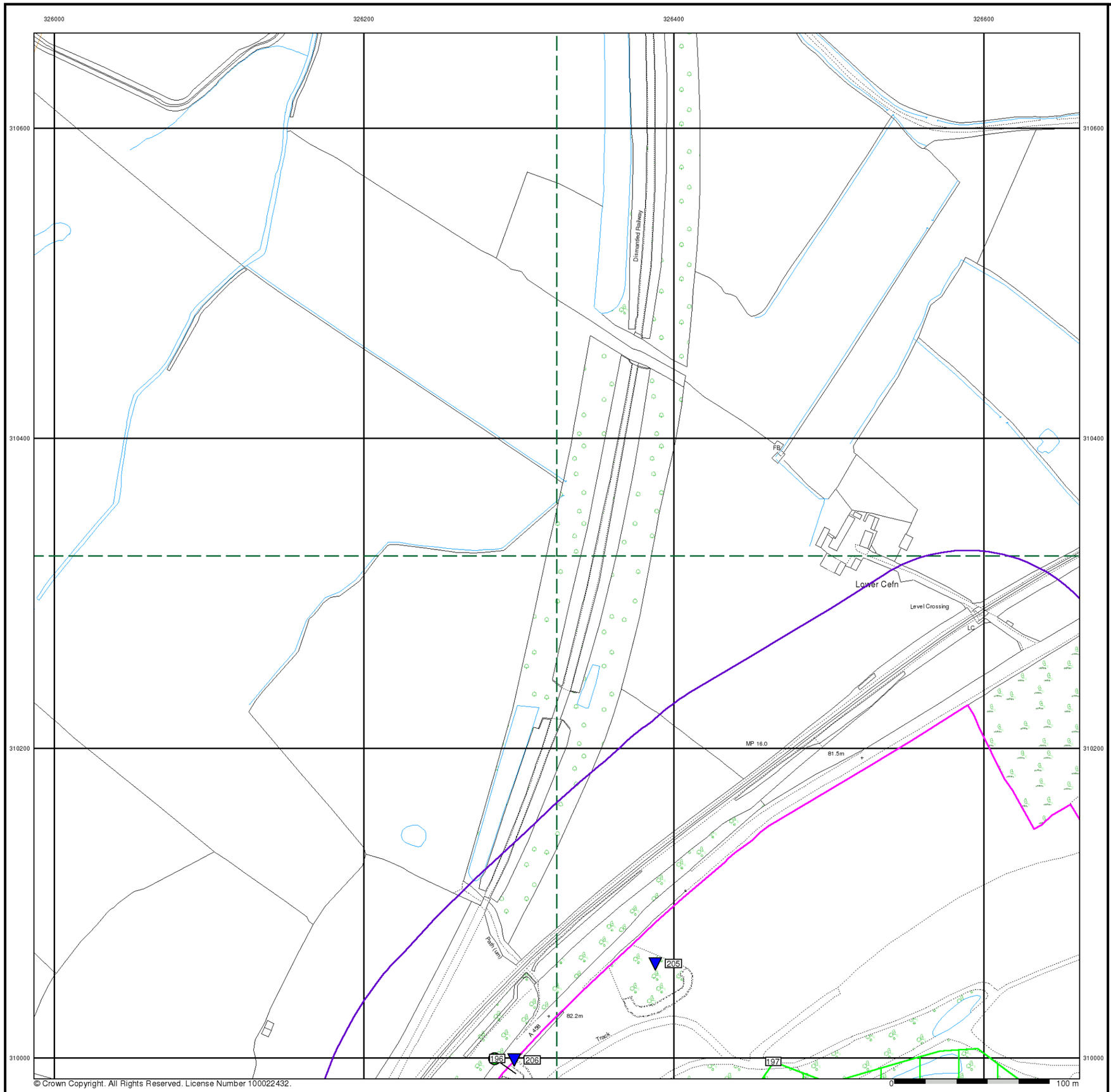

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General

Specified Site
Specified Buffer(s)
Bearing Reference Point
Map ID
Several of Type at Location
Pylon
Overhead Transmission Line

Agency and Hydrological

Contaminated Land Register Entry or Notice (Location)
Contaminated Land Register Entry or Notice
Discharge Consent
Enforcement or Prohibition Notice
Integrated Pollution Control
Integrated Pollution Prevention Control
Local Authority Integrated Pollution Prevention and Control
Local Authority Pollution Prevention and Control
Local Authority Pollution Prevention and Control Enforcement
Pollution Incident to Controlled Waters
Prosecution Relating to Authorised Processes
Prosecution Relating to Controlled Waters
Registered Radioactive Substance
River Network or Water Feature
River Quality Sampling Point
Substantiated Pollution Incident Register
Water Abstraction
Water Industry Act Referral

Hazardous Substances

COMAH Site
Explosive Site
NIHHS Site
Planning Hazardous Substance Consent
Planning Hazardous Substance Enforcement

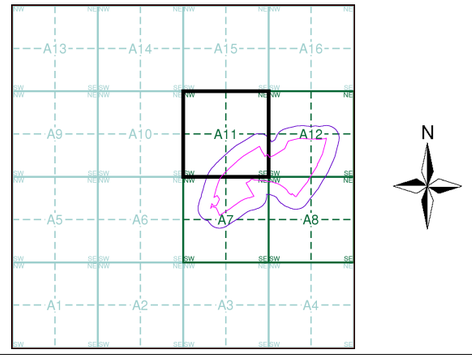
Geological

BGS Recorded Mineral Site

Waste

BGS Recorded Landfill Site (Location)
BGS Recorded Landfill Site
EA Historic Landfill (Buffered Point)
EA Historic Landfill (Polygon)
Integrated Pollution Control Registered Waste Site
Licensed Waste Management Facility (Landfill Boundary)
Licensed Waste Management Facility (Location)
Local Authority Recorded Landfill Site (Location)
Local Authority Recorded Landfill Site
Potentially Infilled Land (Non-water)
Potentially Infilled Land (Non-water)
Potentially Infilled Land (Non-water)
Potentially Infilled Land (Water)
Potentially Infilled Land (Water)
Potentially Infilled Land (Water)
Registered Landfill Site
Registered Landfill Site (Location)
Registered Landfill Site (Point Buffered to 100m)
Registered Landfill Site (Point Buffered to 250m)
Registered Waste Transfer Site (Location)
Registered Waste Transfer Site
Registered Waste Treatment or Disposal Site (Location)
Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Segment A11



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Plot Buffer (m):	100

Site Details

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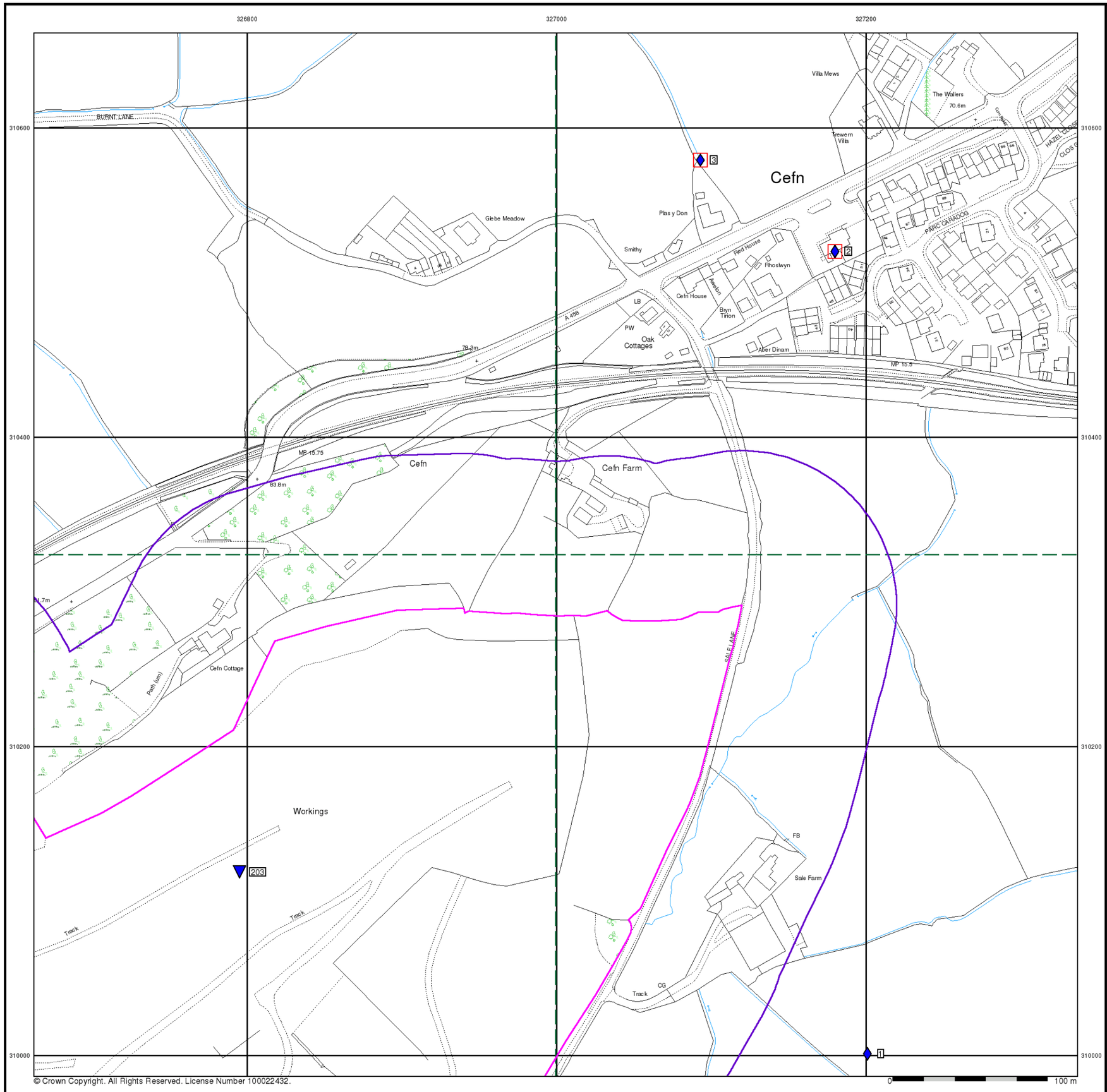

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General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Map ID
Several of Type at Location | Pylon | Overhead Transmission Line

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
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- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Hazardous Substances

COMAH Site | Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

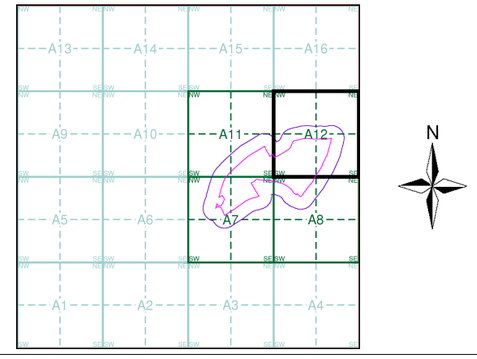
Geological

- BGS Recorded Mineral Site

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Segment A12



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Plot Buffer (m):	100

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

terrafirma

General

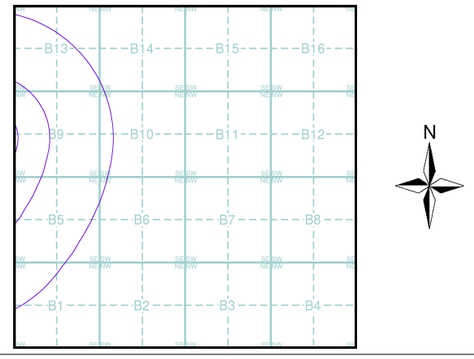
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Arsenic

Arsenic Concentrations mg/kg

- < 15
- 15 - 25
- 25 - 35
- 35 - 45
- 45 - 60
- 60 - 120
- > 120

Estimated Soil Chemistry Arsenic - Slice B



Order Details

Order Details:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

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General

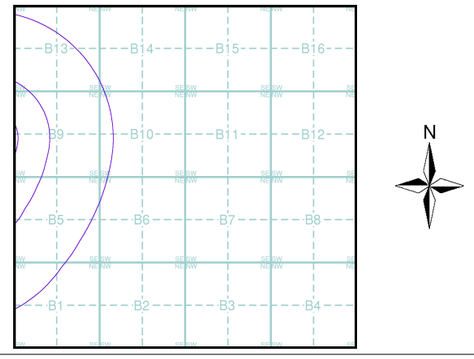
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Cadmium

Cadmium Concentrations mg/kg

- < 1.8
- 1.8 - 2.2
- 2.2 - 3.0
- > 3.0

Estimated Soil Chemistry Cadmium - Slice B



Order Details

Order Details:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

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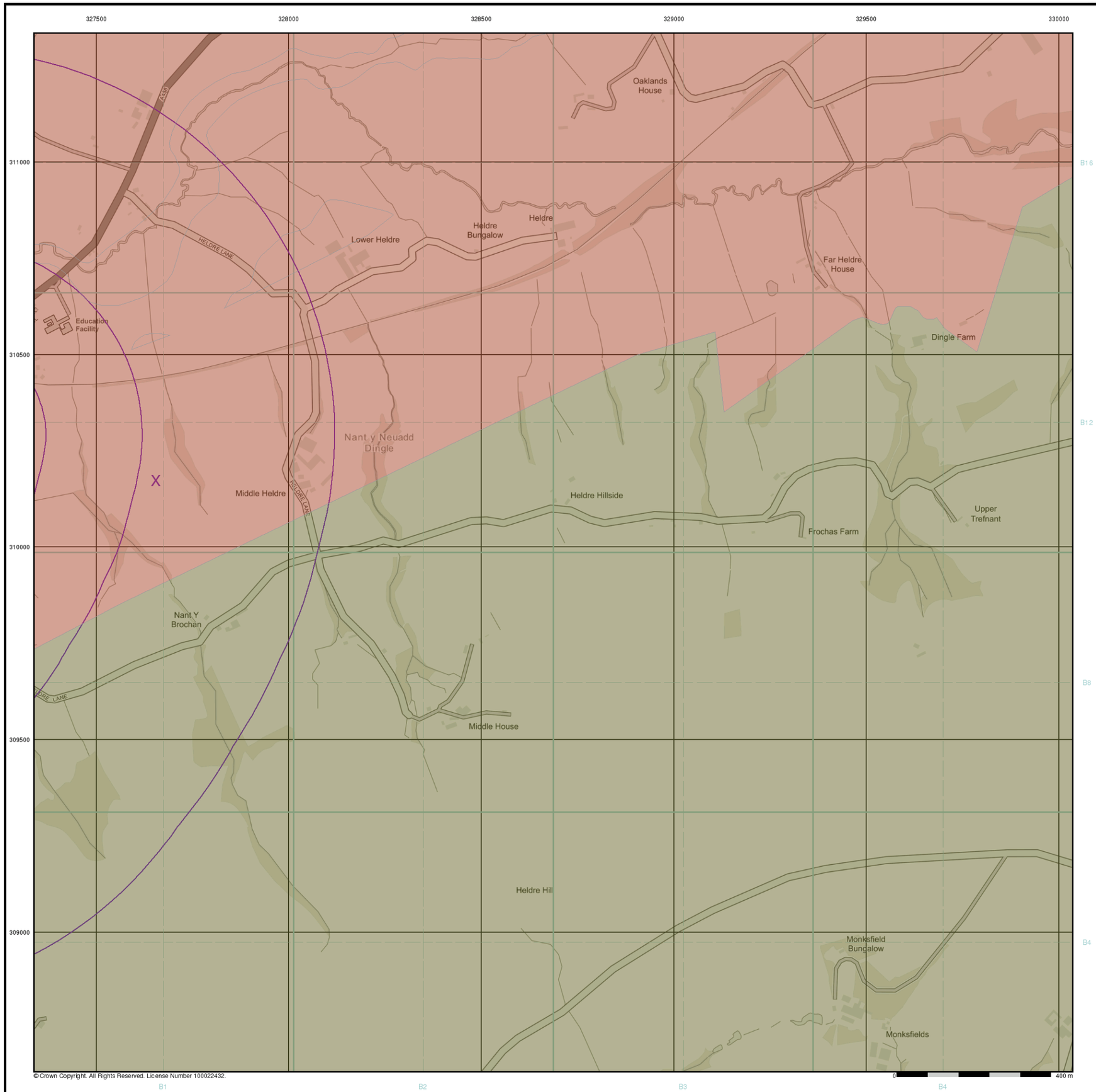

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General

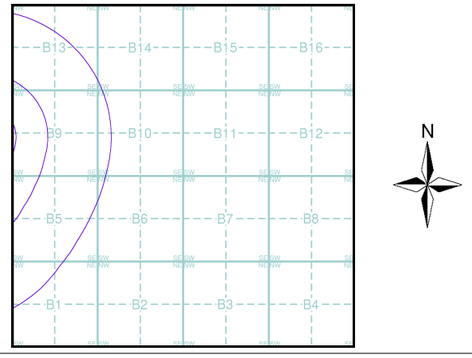
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Chromium

Chromium Concentrations mg/kg

- < 20
- 20 - 40
- 40 - 60
- 60 - 90
- 90 - 120
- 120 - 180
- > 180

Estimated Soil Chemistry Chromium - Slice B



Order Details

Order Details:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

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General

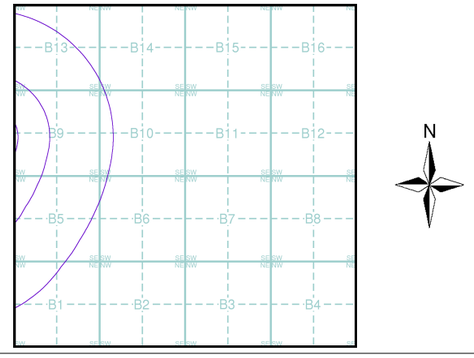
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Lead

Lead Concentrations mg/kg

- <100 mg/kg
- 100 - 200
- 200 - 300
- 300 - 600
- 600 - 1200
- >1200

Estimated Soil Chemistry Lead - Slice B



Order Details

Order Details:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

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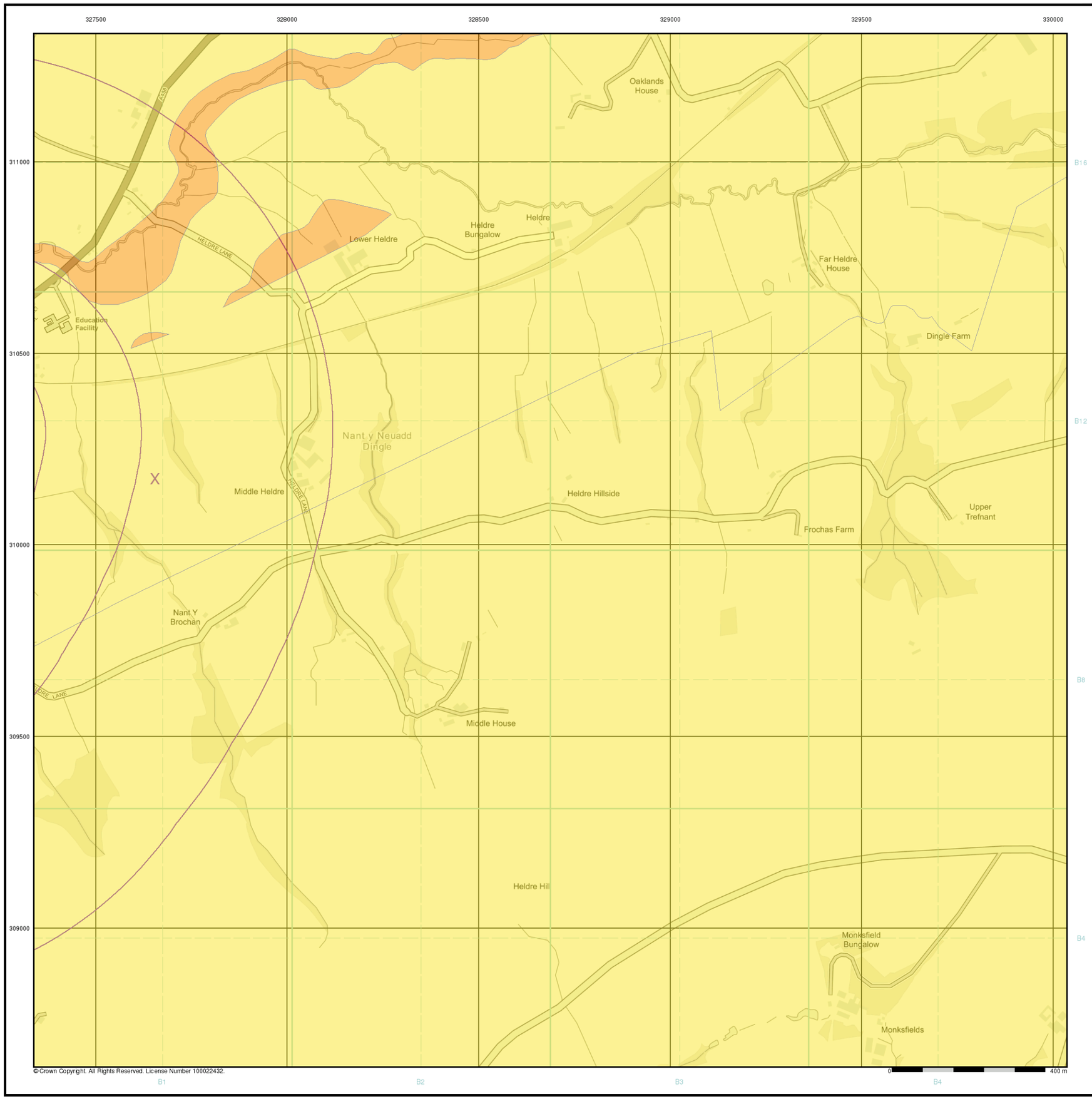


terrafirma

General

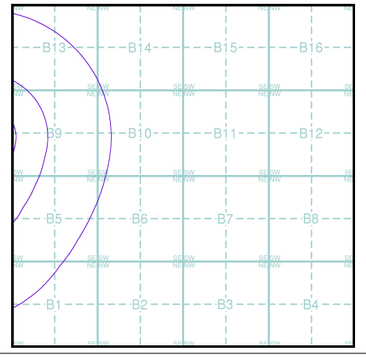
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Nickel

Nickel Concentrations mg/kg

- < 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 80
- 80 - 100
- > 100

Estimated Soil Chemistry Nickel - Slice B



Order Details

Order Details:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

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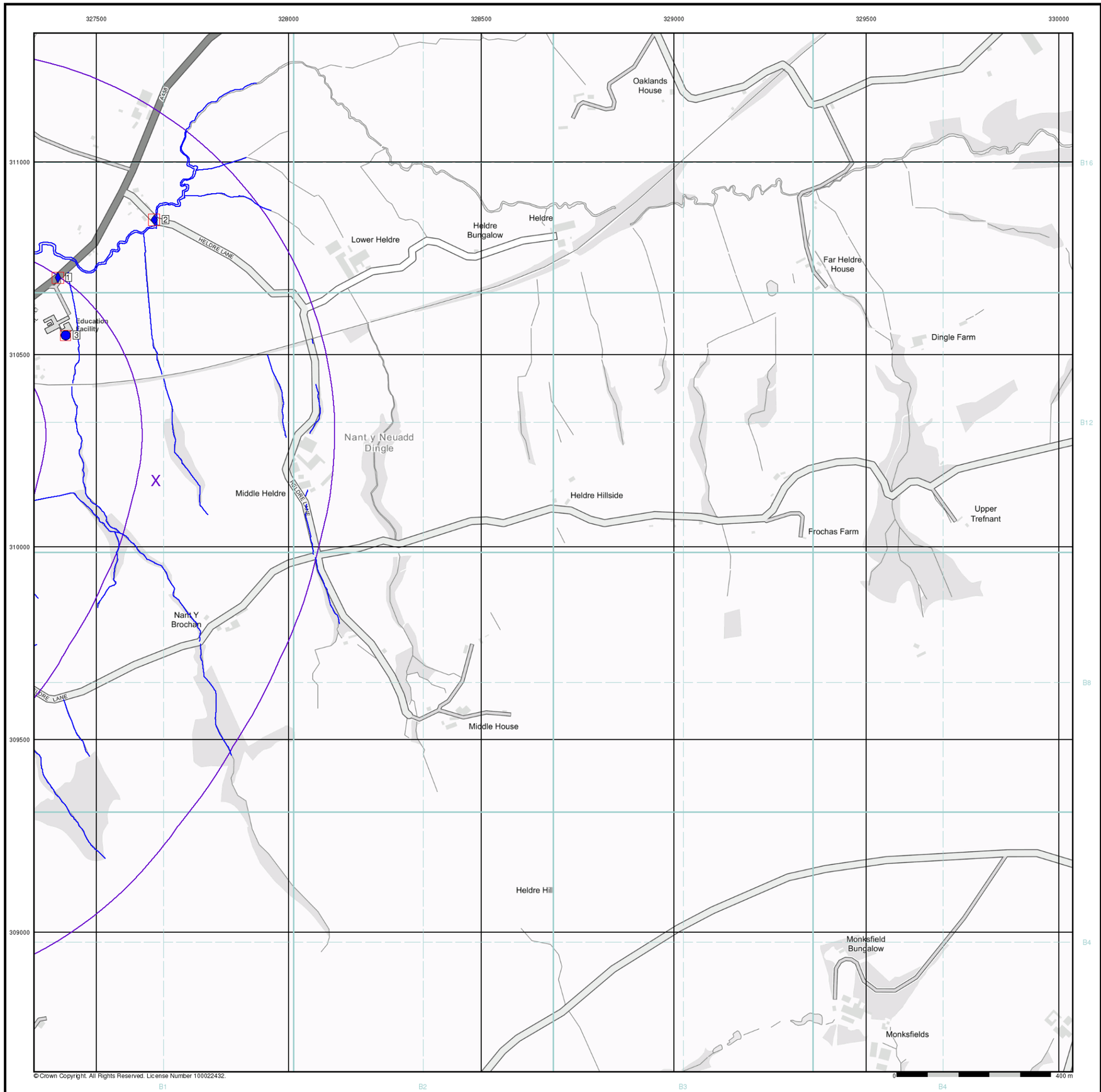

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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Geological

- BGS Recorded Mineral Site

Waste

- BGS Recorded Landfill Site (Location)
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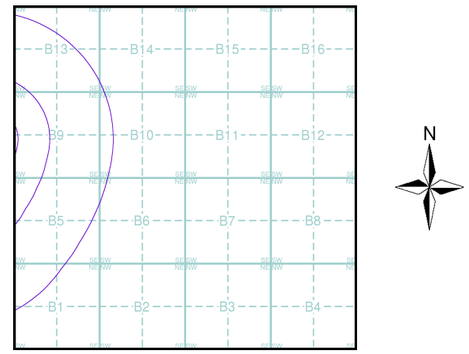
- Potentially Infilled Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

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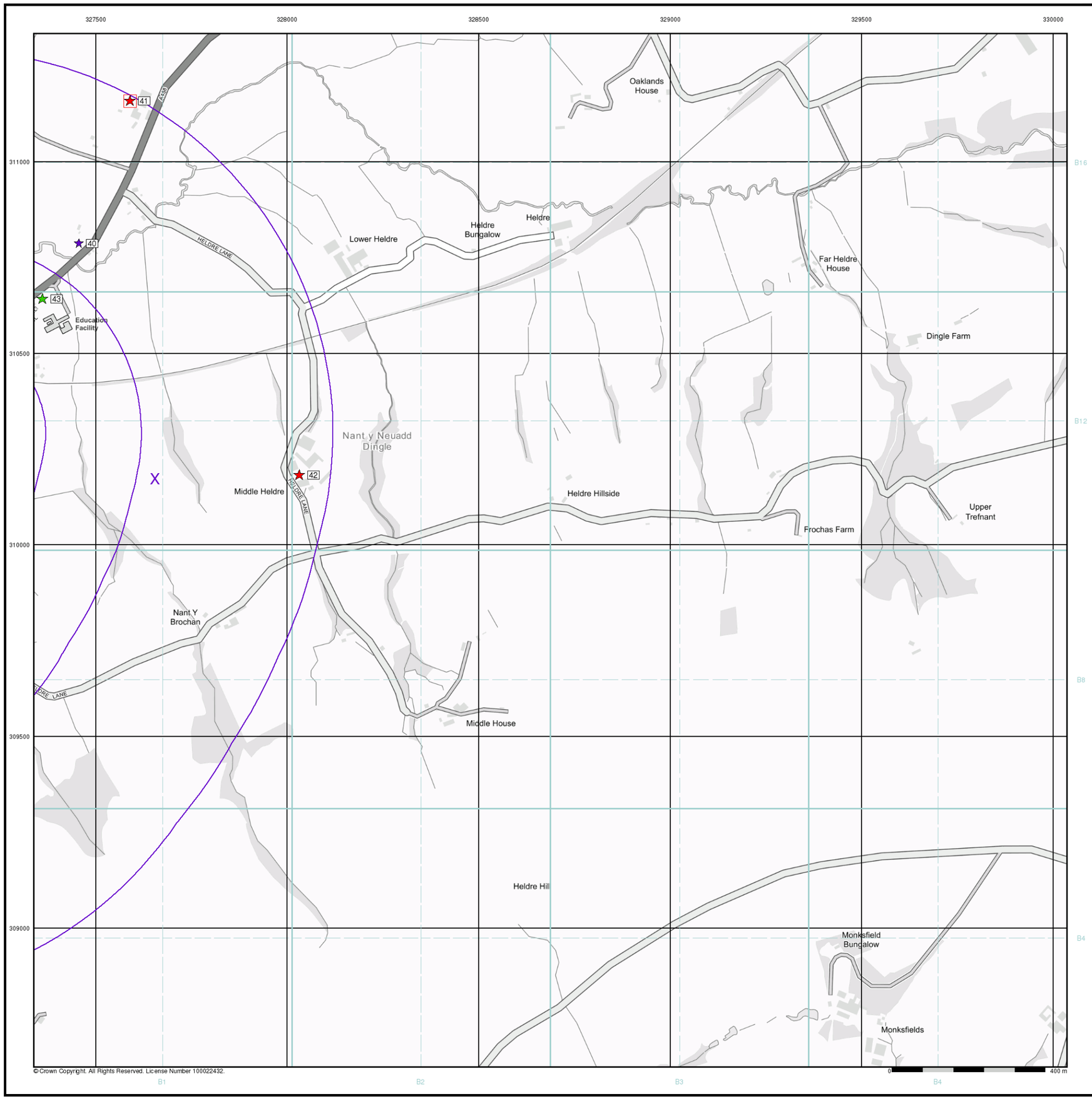
Web: www.envirocheck.co.uk



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Industrial Land Use Map

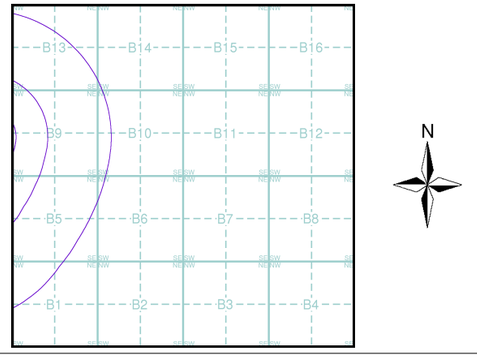
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry
- Gas Pipeline
- Points of Interest - Commercial Services
- Points of Interest - Education and Health
- Points of Interest - Manufacturing and Production
- Points of Interest - Public Infrastructure
- Points of Interest - Recreational and Environmental
- Underground Electrical Cables

Industrial Land Use Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

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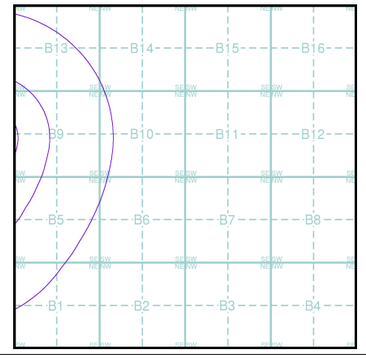
General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

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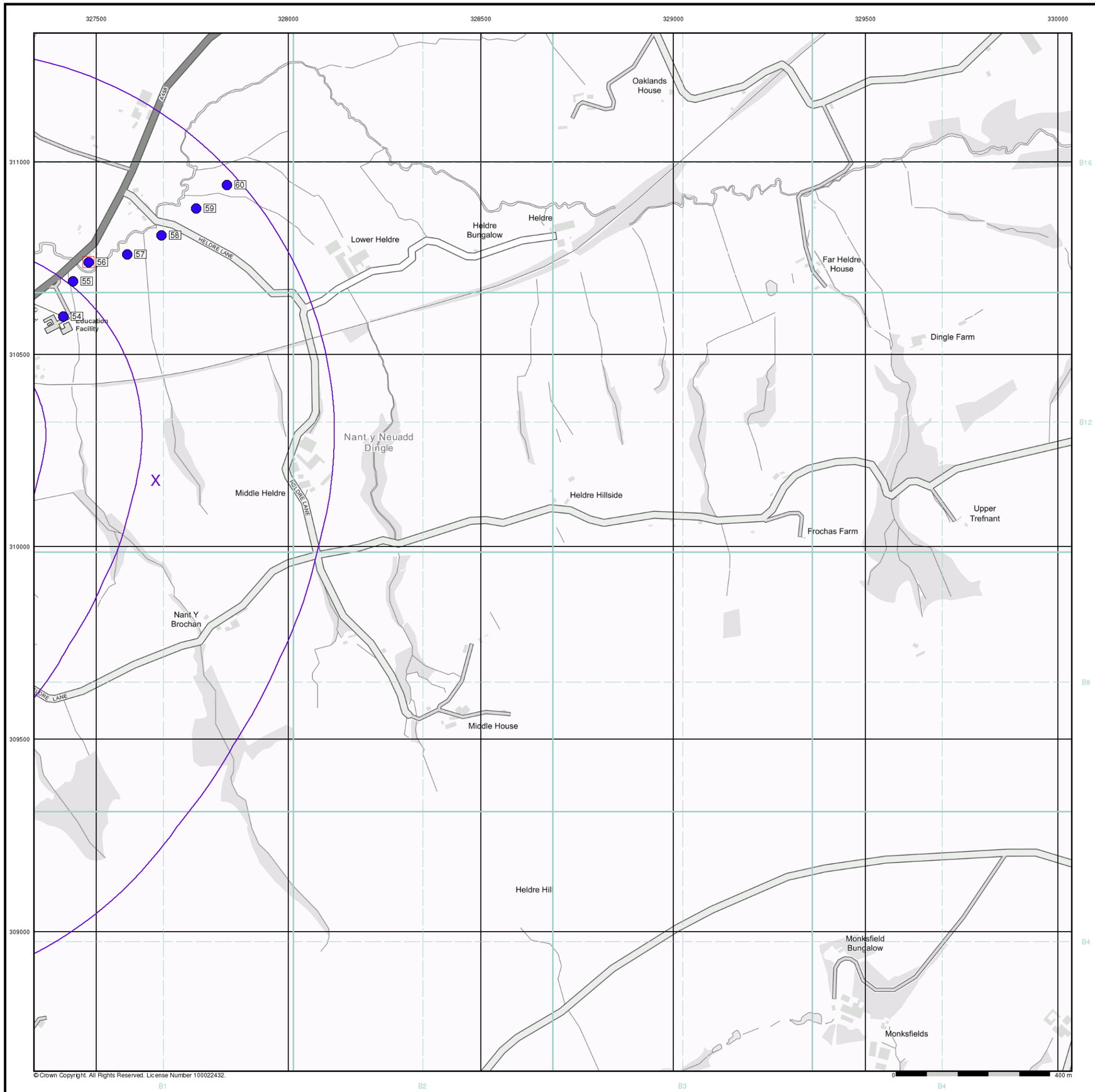

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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

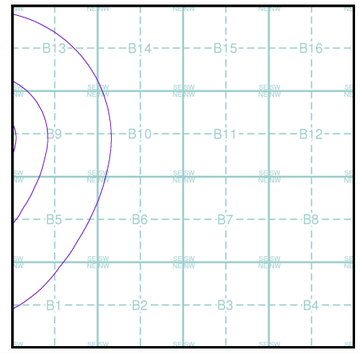
Agency and Hydrological (Boreholes)

- BGS Borehole Depth 0 - 10m
- BGS Borehole Depth 10 - 30m
- BGS Borehole Depth 30m +
- Confidential
- Other

For Borehole information please refer to the Borehole .csv file which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.

Borehole Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

Tel: 0844 844 9952
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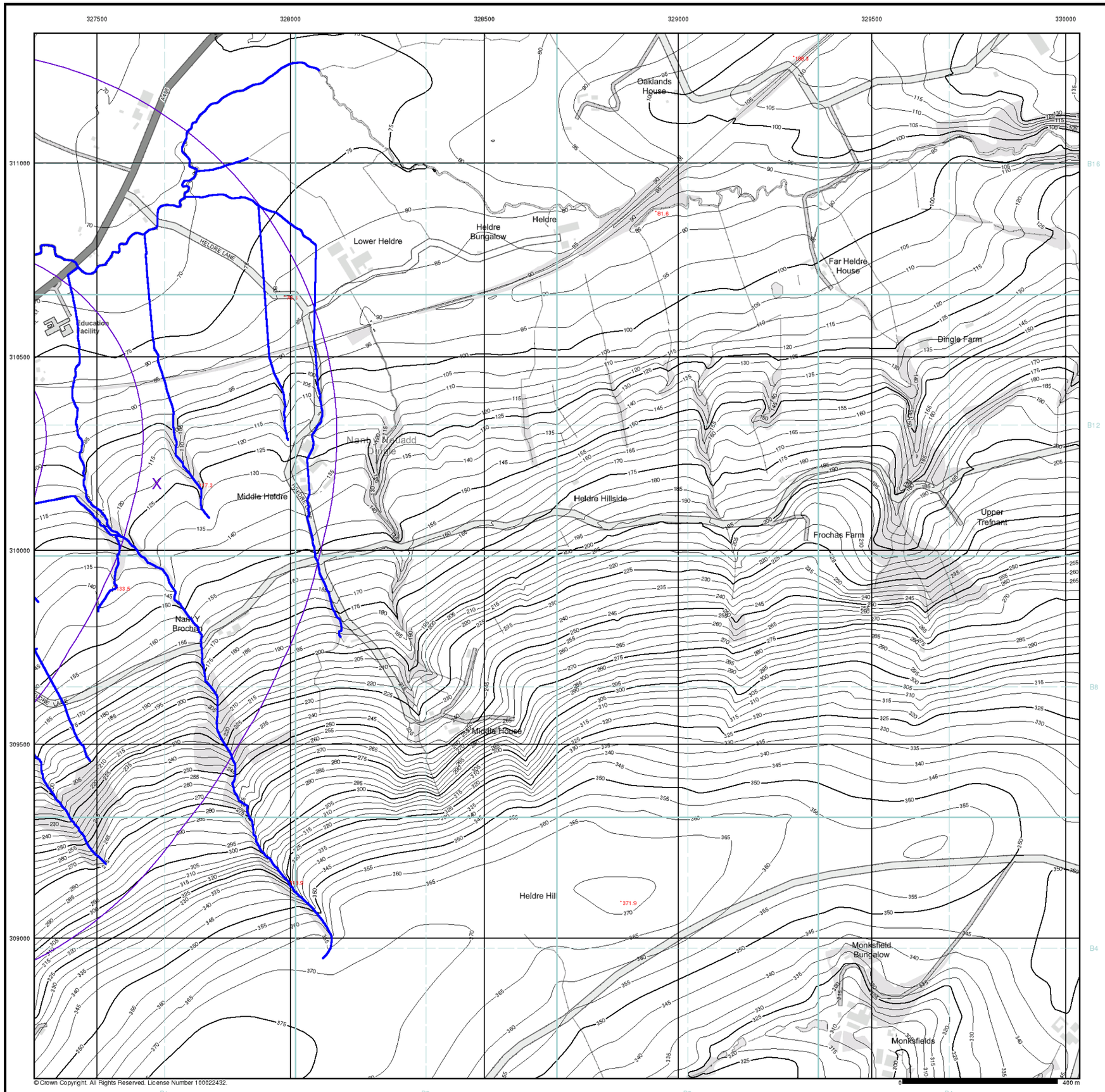
Web: www.envirocheck.co.uk



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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

OS Water Network Data

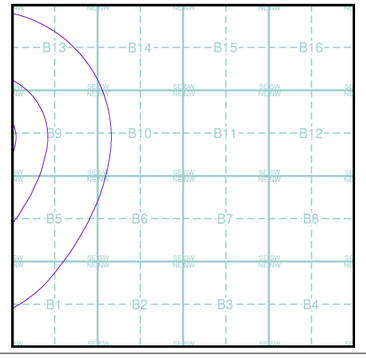
- Canal
- Reservoir
- Foreshore
- Marsh
- Tidal River
- Inland River
- Drain
- Other
- Lake
- Transfer
- Lock Or Flight Of Locks
- Sea

Contours (height in meters)

Standard Contour 105
Master Contour 100 95
Spot Height 167.3

MLW Mean Low Water
MHW Mean High Water

OS Water Network Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

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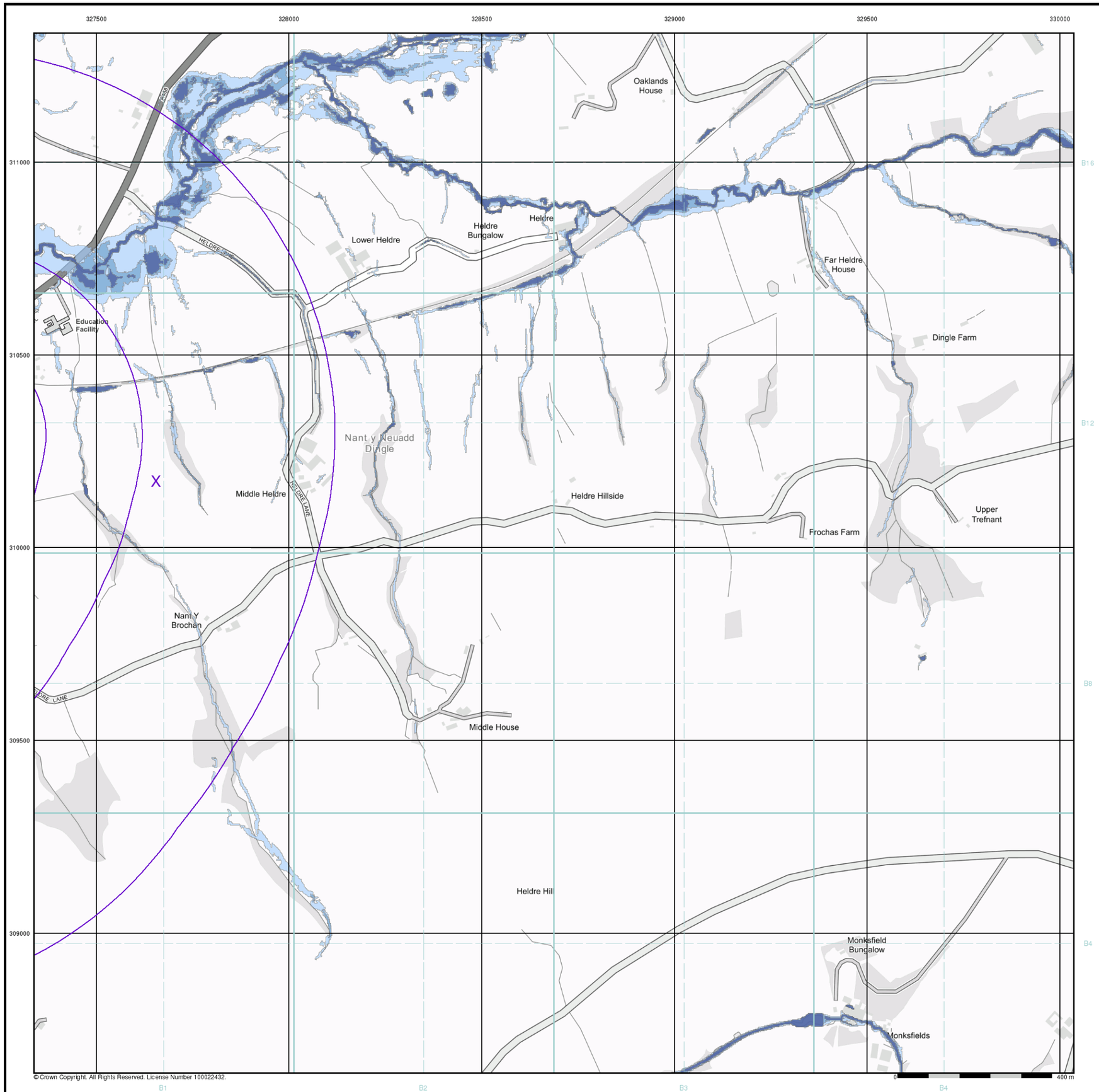

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General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Risk of Flooding from Surface Water

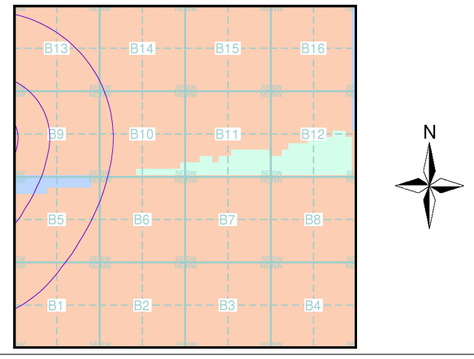
- High - 30 Year Return
- Medium - 100 Year Return
- Low - 1000 Year Return

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice B



Order Details

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National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
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Site Details

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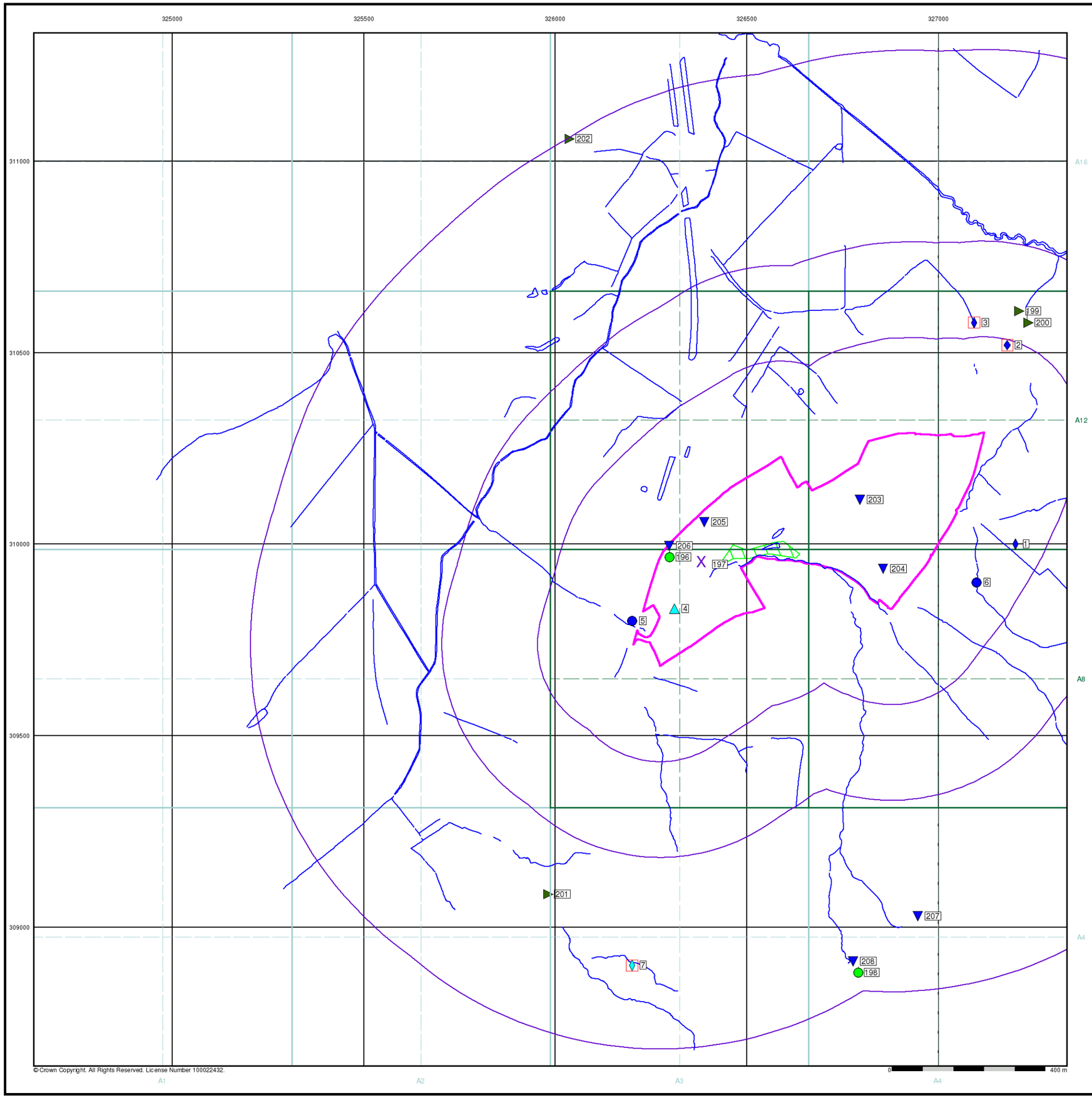

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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Geological

- BGS Recorded Mineral Site

Waste

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- BGS Recorded Landfill Site
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- Potentially Infilled Land (Non-water)
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- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
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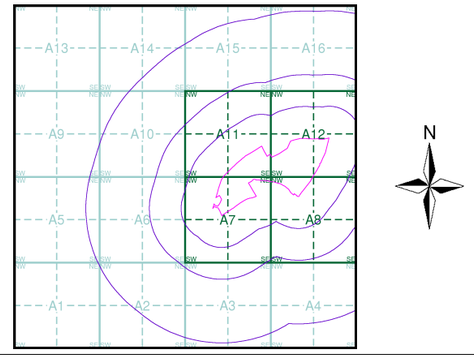
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Slice A



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

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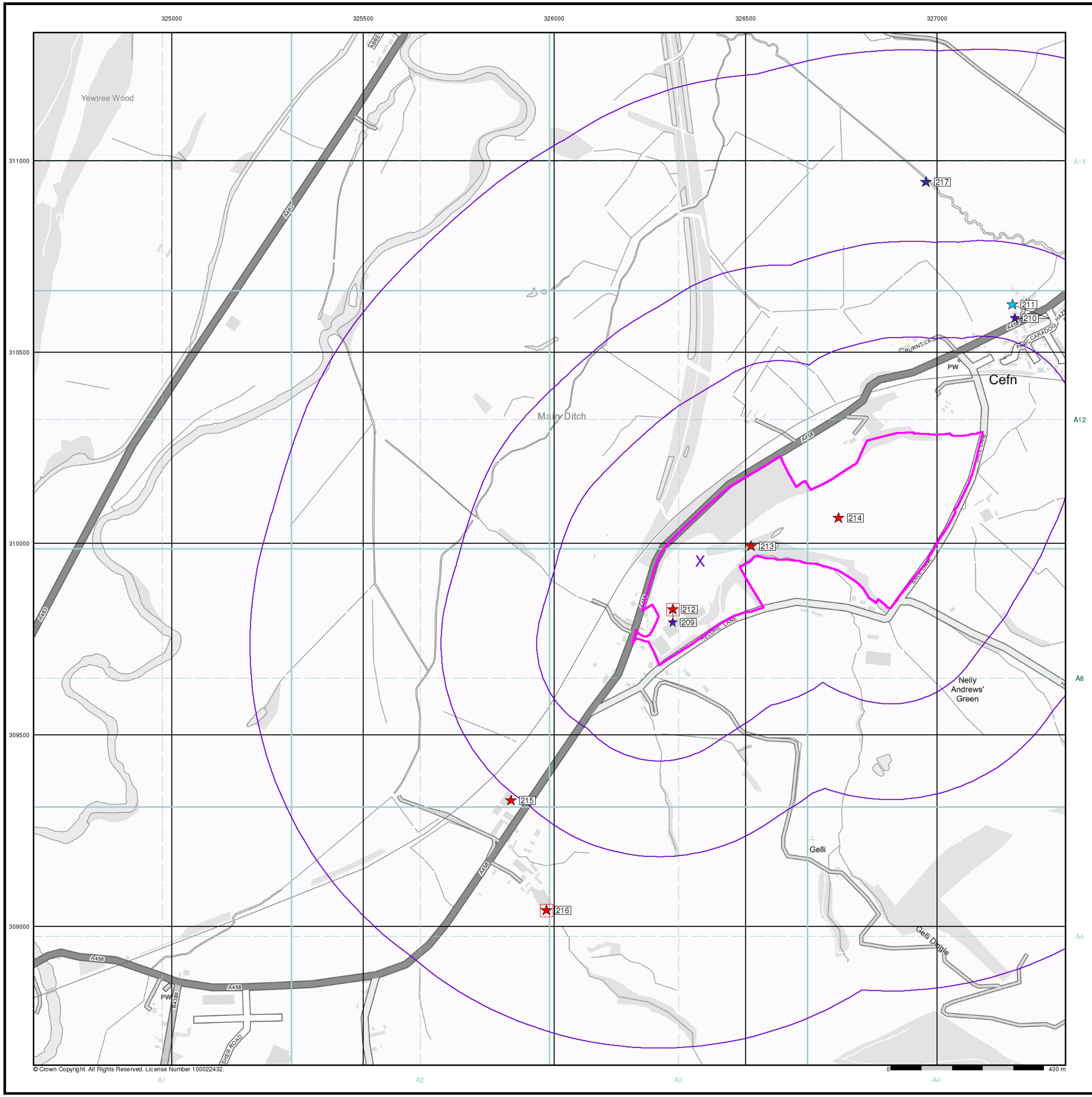


terrafirma

Industrial Land Use Map

General

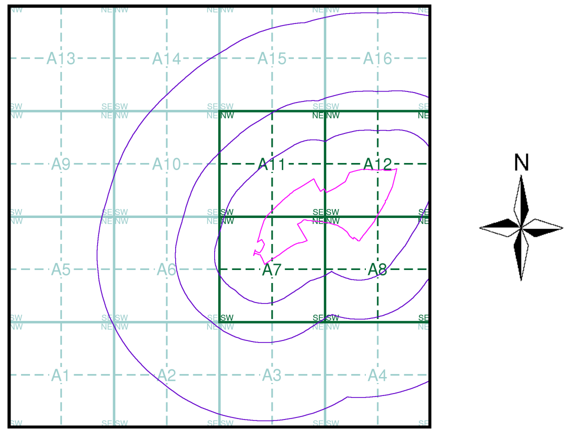
Specified Site | Specified Buffer(s) | Bearing Reference Point

Slice | Map ID

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry
- Gas Pipeline
- Points of Interest - Commercial Services
- Points of Interest - Education and Health
- Points of Interest - Manufacturing and Production
- Points of Interest - Public Infrastructure
- Points of Interest - Recreational and Environmental
- Underground Electrical Cables

Industrial Land Use Map - Slice A



Order Details

Order Number:	196125587_1_1
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National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
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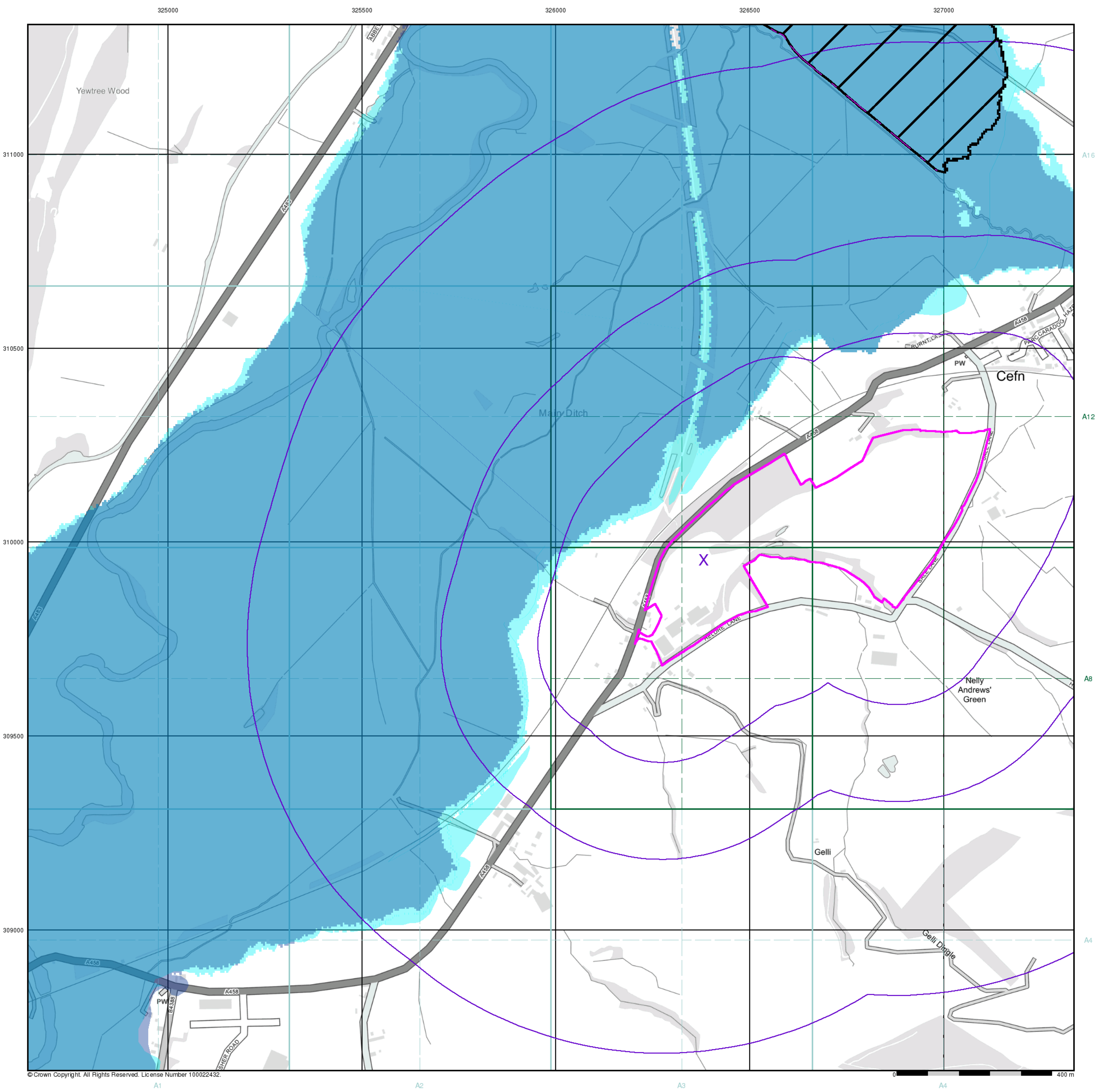


terrafirma

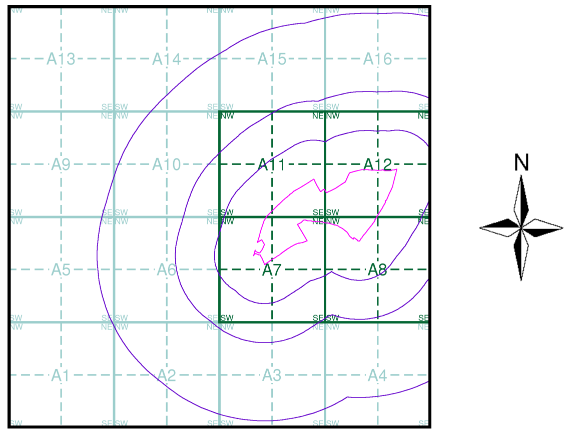
General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



Order Details

Order Number: 196125587_1_1
Customer Ref: 14880
National Grid Reference: 326380, 309950
Slice: A
Site Area (Ha): 25.12
Search Buffer (m): 1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

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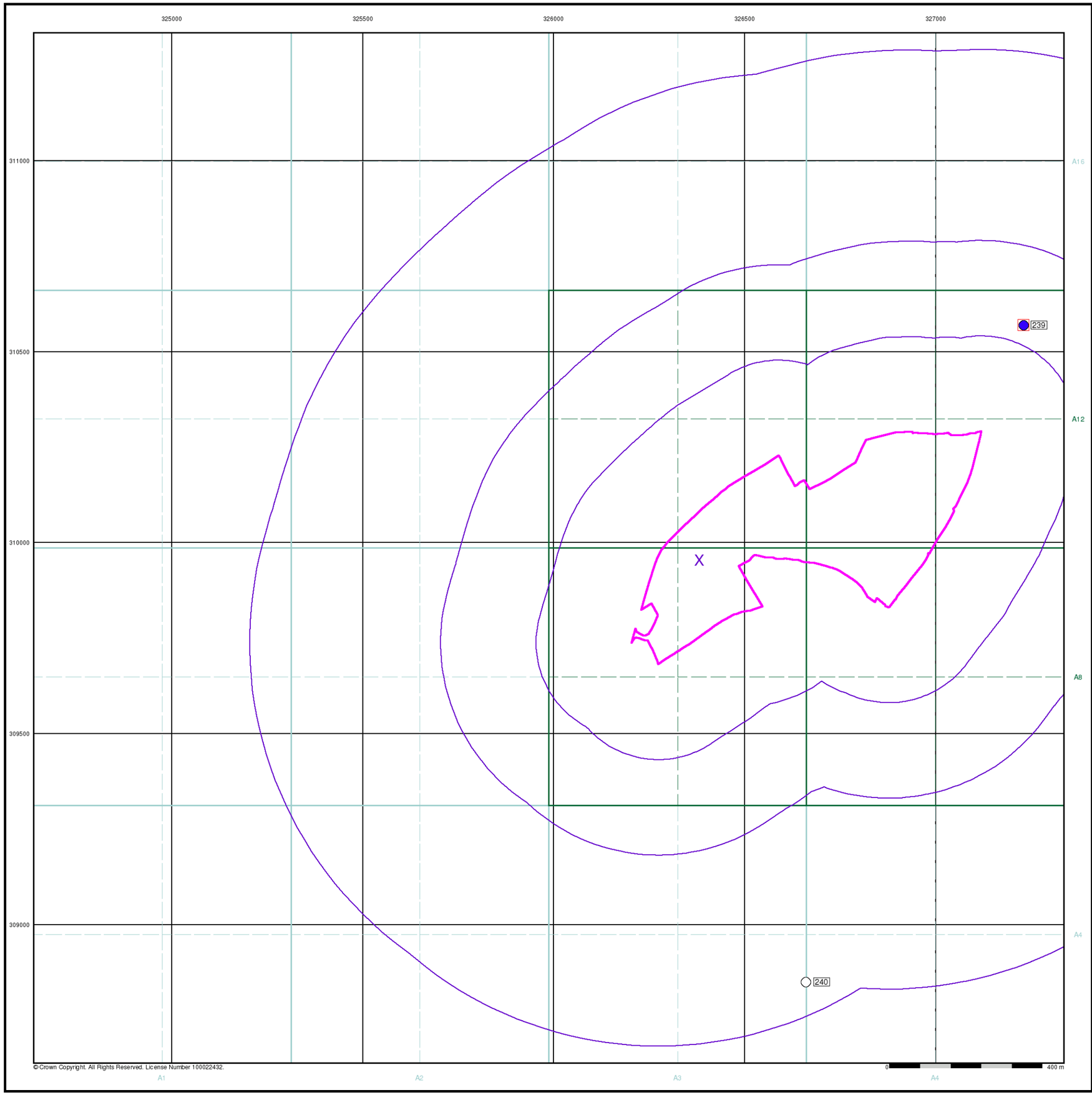
Web: www.envirocheck.co.uk



terrafirma

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

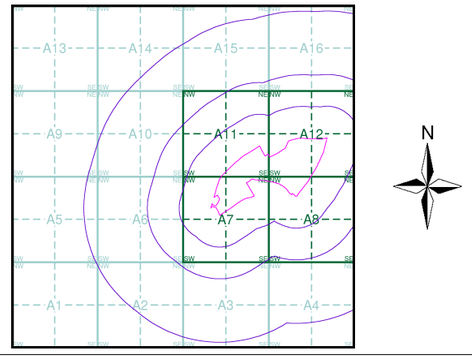
Agency and Hydrological (Boreholes)

- BGS Borehole Depth 0 - 10m
- BGS Borehole Depth 10 - 30m
- BGS Borehole Depth 30m +
- Confidential
- Other

For Borehole information please refer to the Borehole .csv file which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.

Borehole Map - Slice A



Order Details

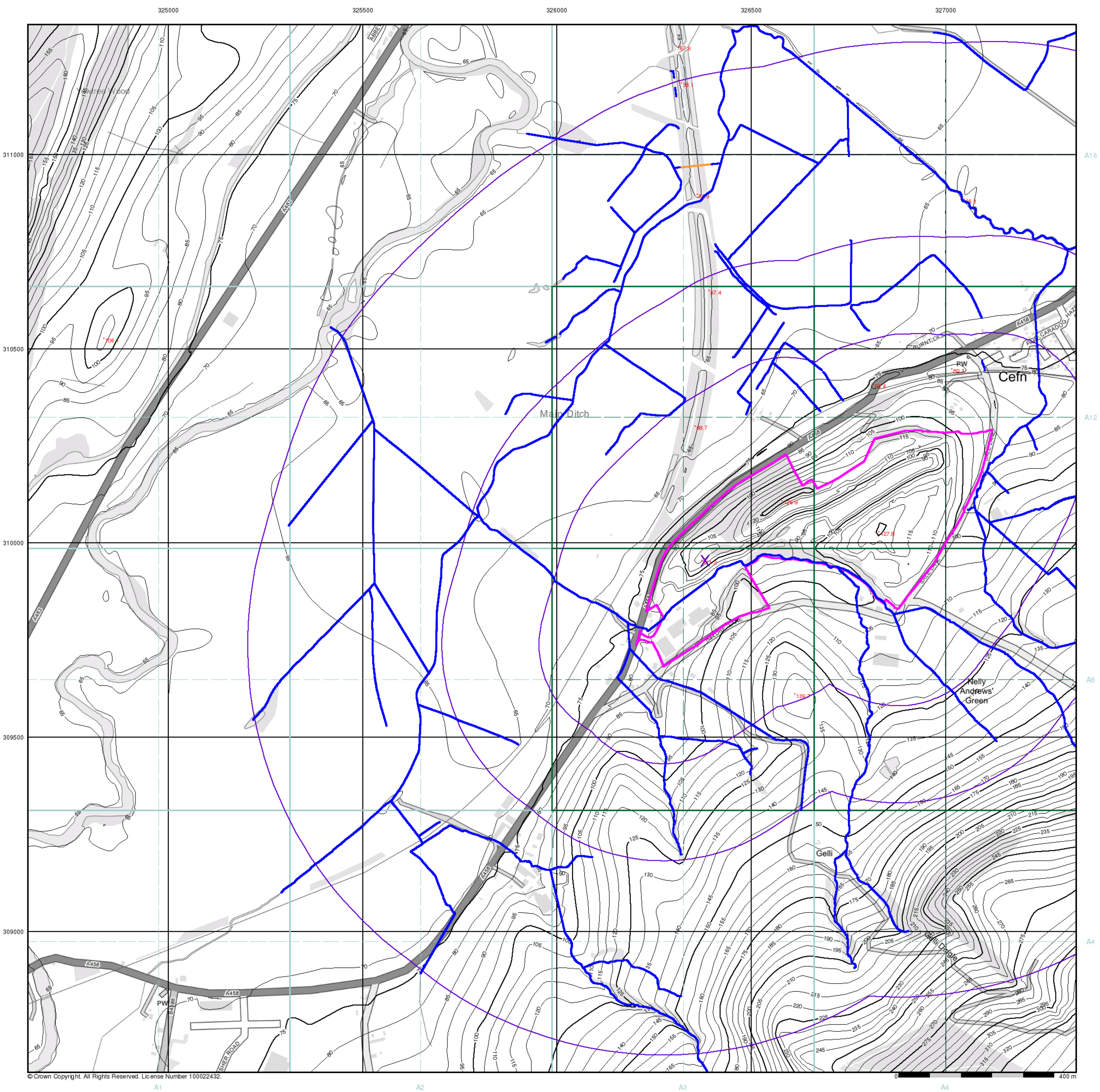
Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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General

Specified Site

Specified Buffer(s)

X Bearing Reference Point

OS Water Network Data

Canal		Drain	
Reservoir		Other	
Foreshore		Lake	
Marsh		Transfer	
Tidal River		Lock Or Flight Of Locks	
Inland River		Sea	

Contours (height in meters)

Standard Contour 105

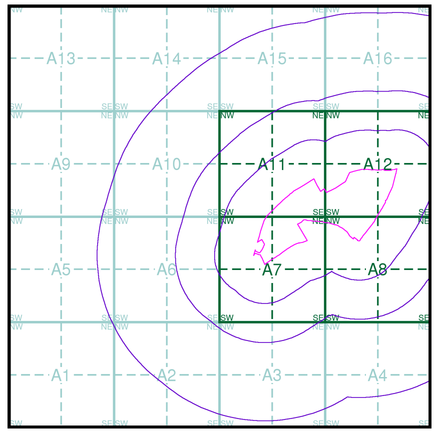
Master Contour 100 95

Spot Height 167.3

MLW Mean Low Water

MHW Mean High Water

OS Water Network Map - Slice A



Order Details

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Customer Ref: 14880
National Grid Reference: 326380, 309950
Slice: A
Site Area (Ha): 25.12
Search Buffer (m): 1000

Site Details

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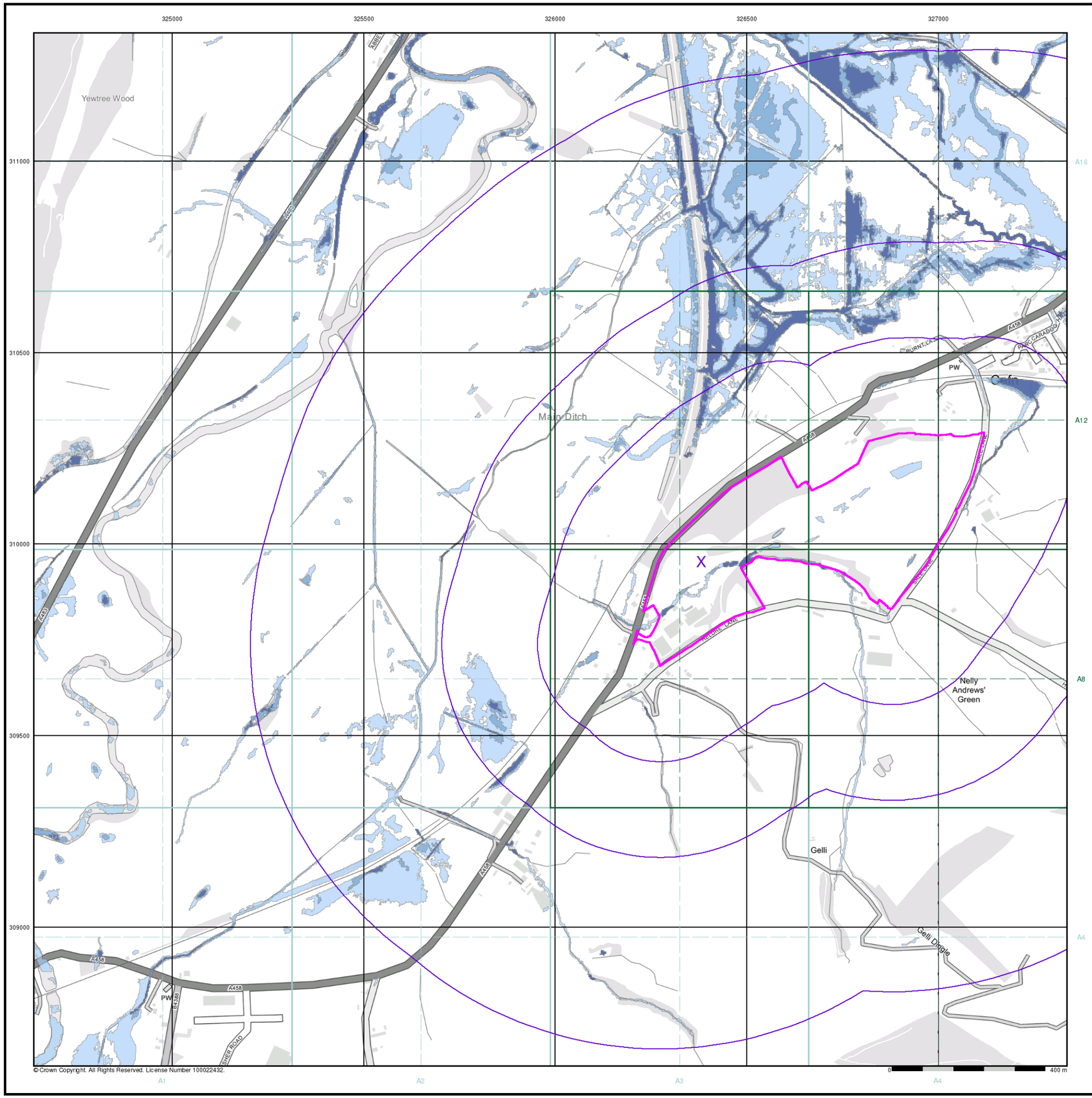

0 400 m

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General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Risk of Flooding from Surface Water

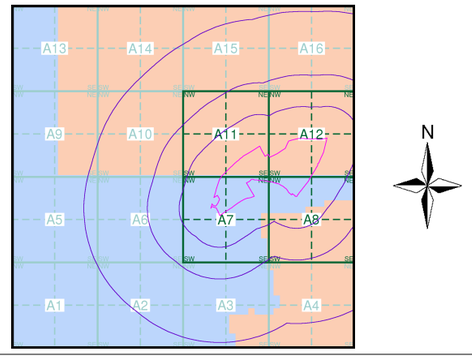
- High - 30 Year Return
- Medium - 100 Year Return
- Low - 1000 Year Return

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



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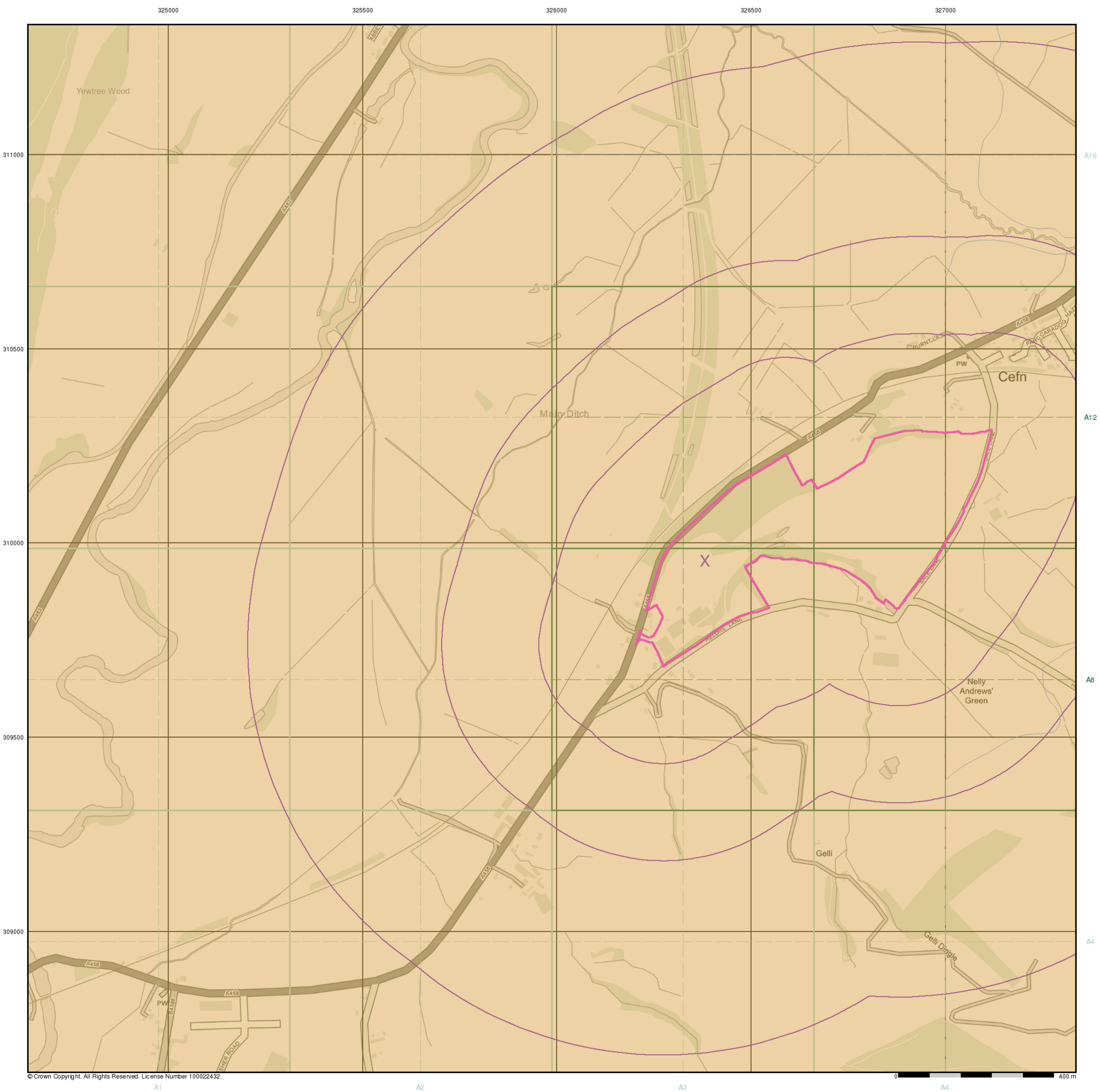

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General

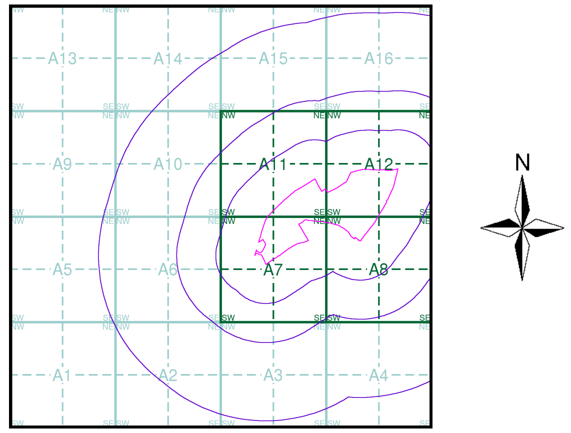
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Arsenic

Arsenic Concentrations mg/kg

- < 15
- 15 - 25
- 25 - 35
- 35 - 45
- 45 - 60
- 60 - 120
- > 120

Estimated Soil Chemistry Arsenic - Slice A



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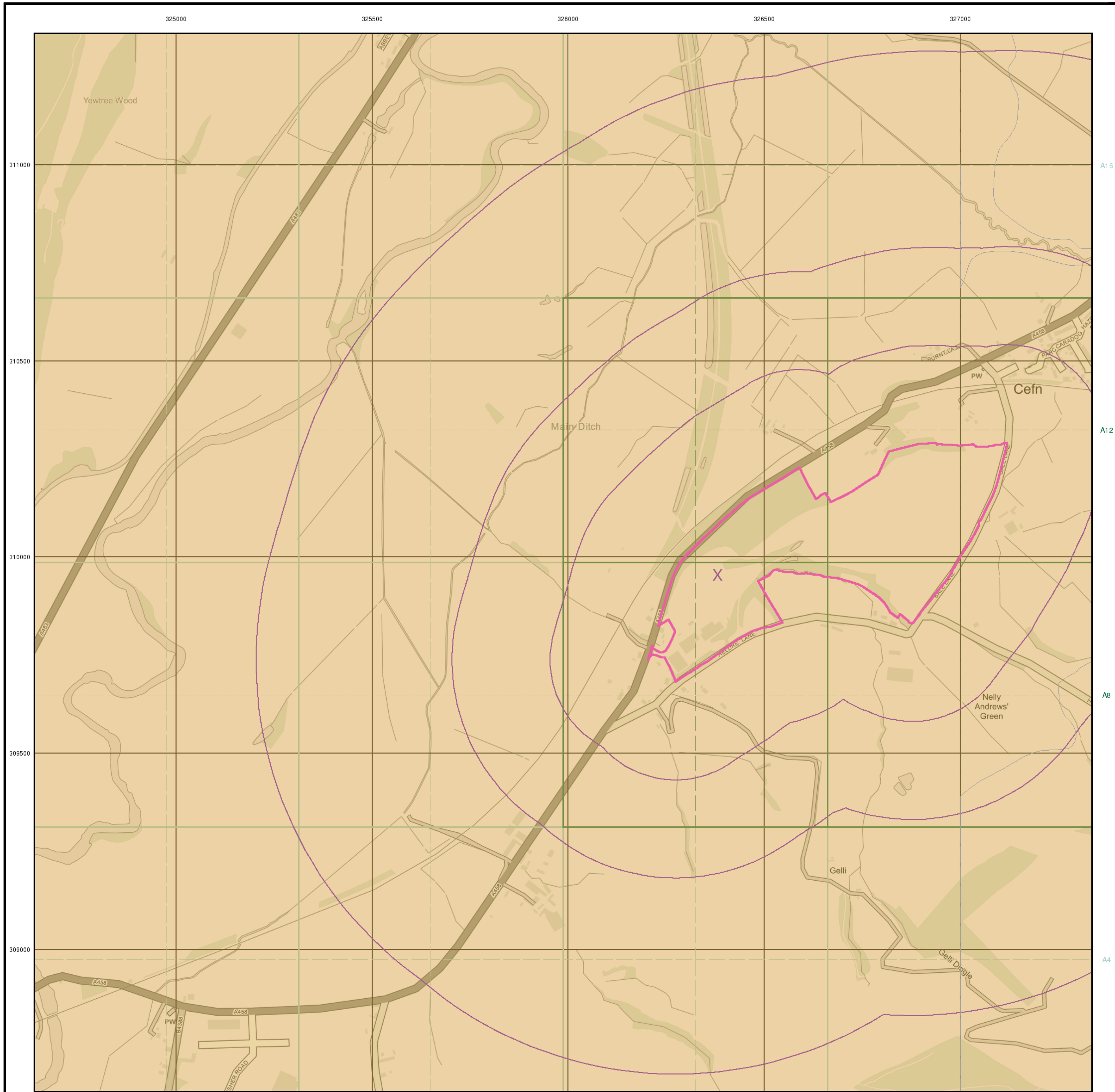

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General

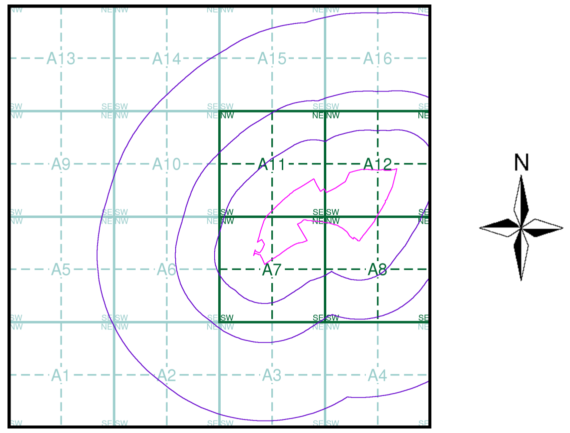
Specified Site　Specified Buffer(s)　X Bearing Reference Point

Estimated Soil Chemistry Cadmium

Cadmium Concentrations mg/kg

- < 1.8
- 1.8 - 2.2
- 2.2 - 3.0
- > 3.0

Estimated Soil Chemistry Cadmium - Slice A



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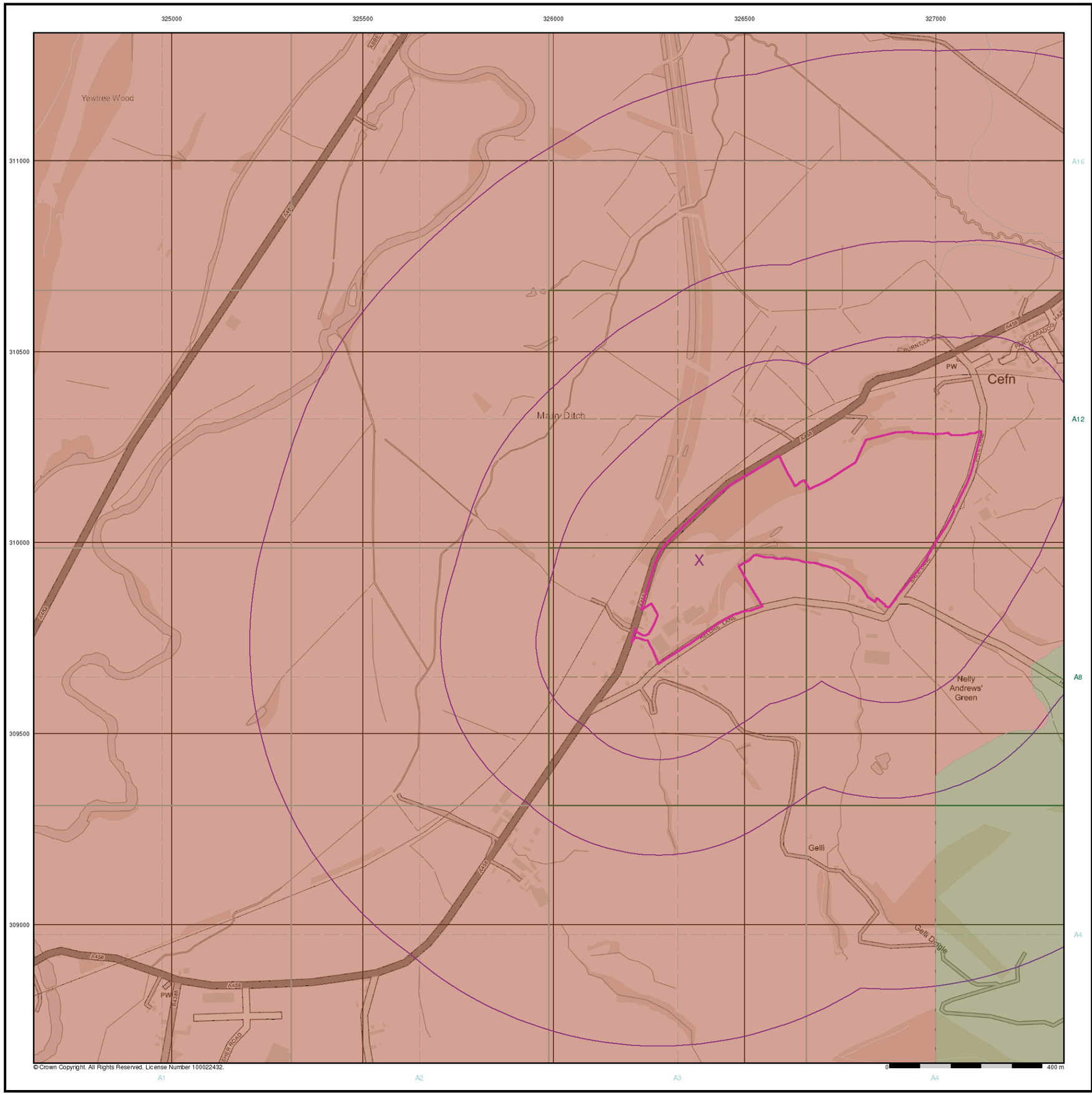

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General

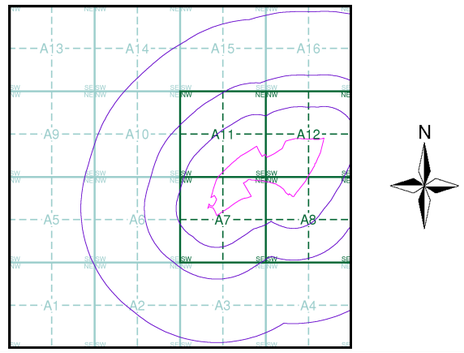
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Chromium

Chromium Concentrations mg/kg

- < 20
- 20 - 40
- 40 - 60
- 60 - 90
- 90 - 120
- 120 - 180
- > 180

Estimated Soil Chemistry Chromium - Slice A



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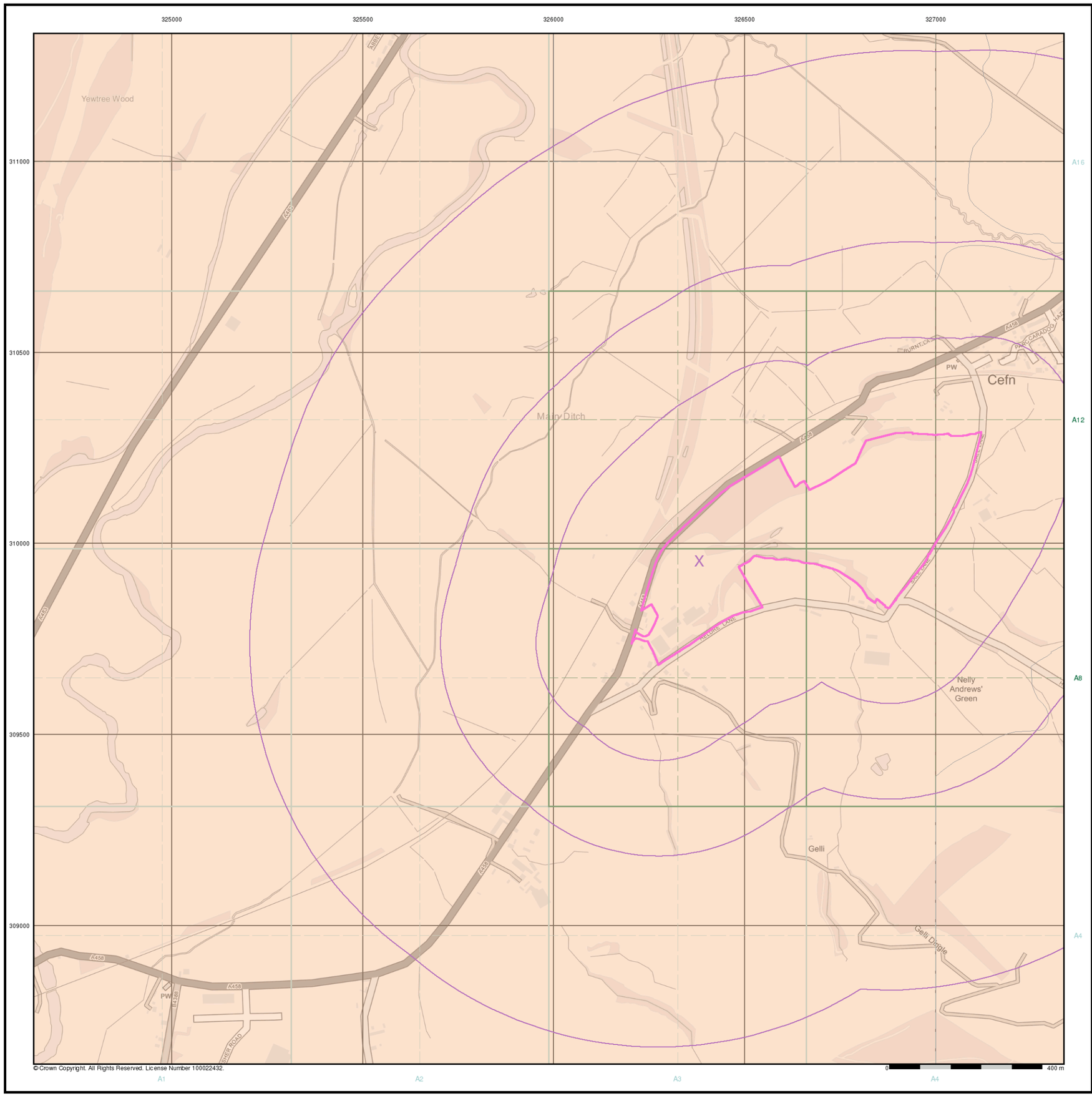

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General

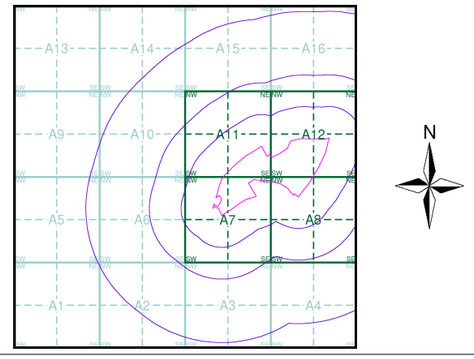
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Lead

Lead Concentrations mg/kg

- <100 mg/kg
- 100 - 200
- 200 - 300
- 300 - 600
- 600 - 1200
- >1200

Estimated Soil Chemistry Lead - Slice A



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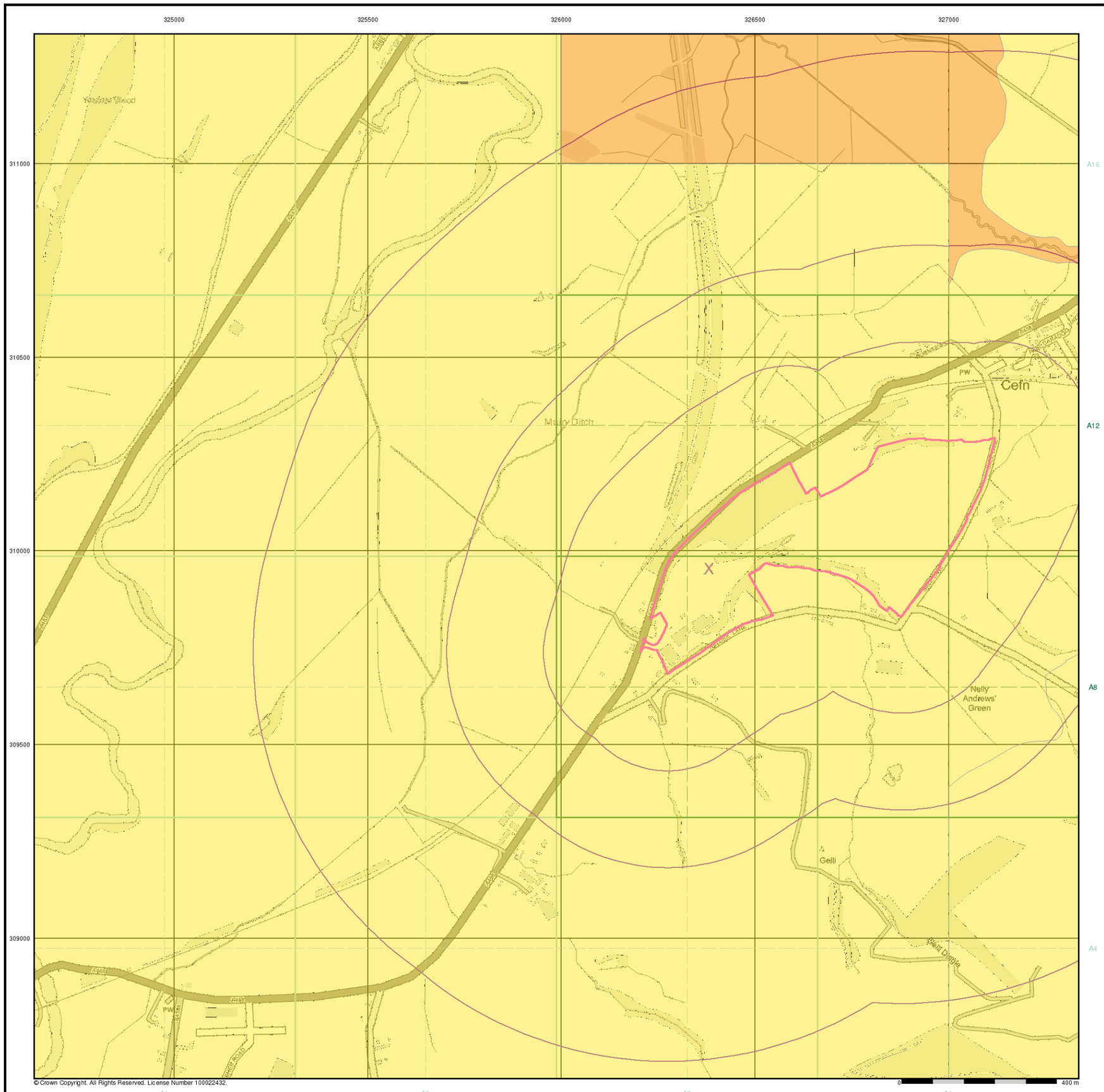

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General

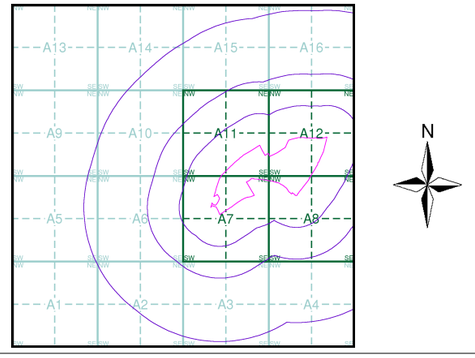
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Nickel

Nickel Concentrations mg/kg

- < 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 80
- 80 - 100
- > 100

Estimated Soil Chemistry Nickel - Slice A



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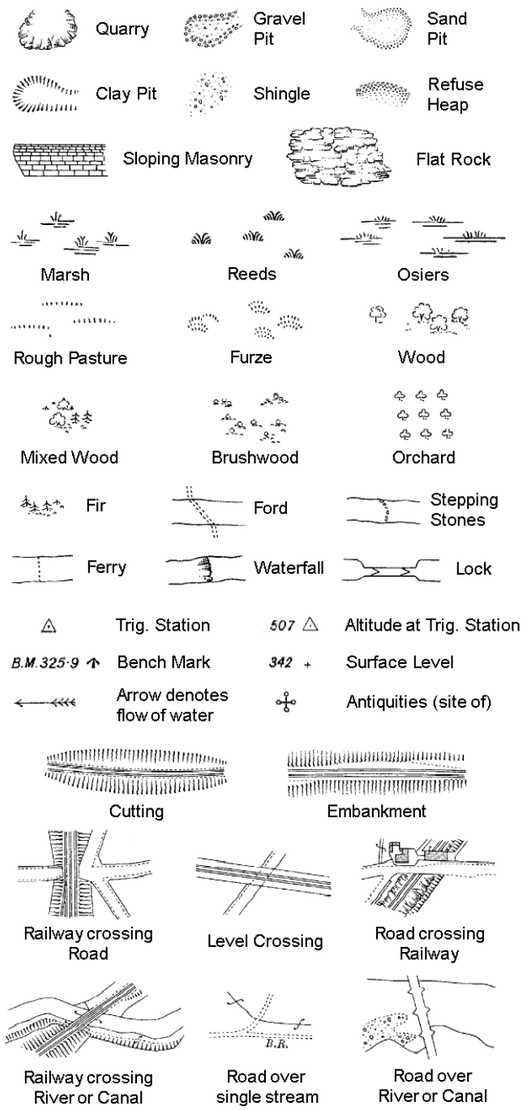
Historical Mapping Legends

Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



County Boundary (Geographical)

County & Civil Parish Boundary

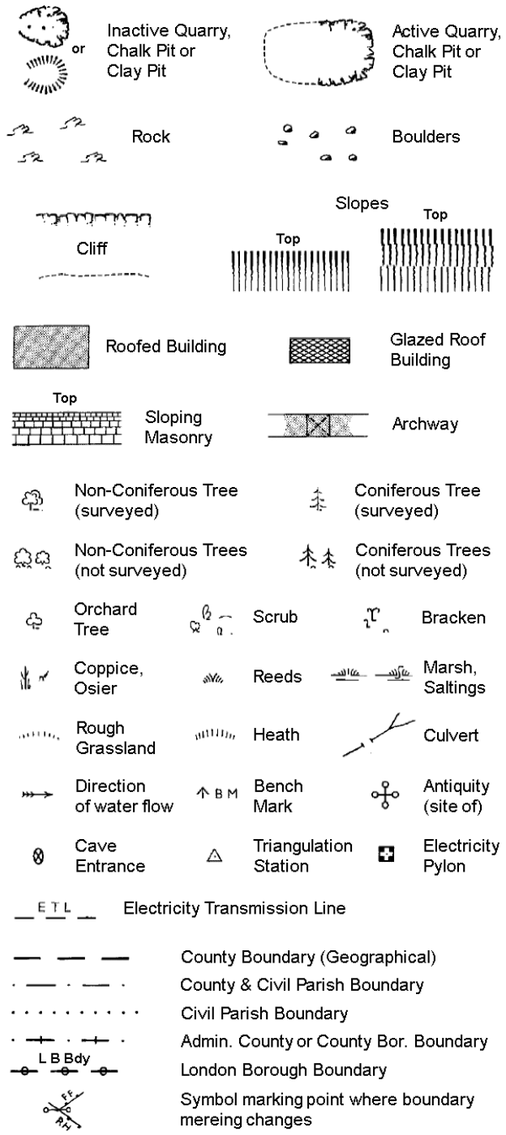
Administrative County & Civil Parish Boundary

Co. Boro. Bdy. County Borough Boundary (England)

Co. Burgh Bdy. County Burgh Boundary (Scotland)

B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



County Boundary (Geographical)

County & Civil Parish Boundary

Civil Parish Boundary

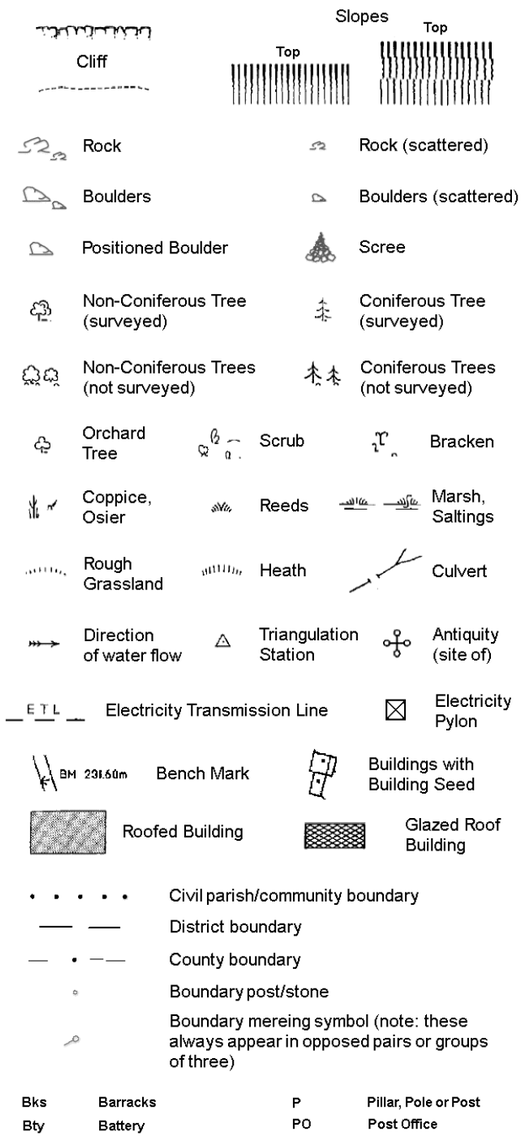
Admin. County or County Bor. Boundary

L B Bdy London Borough Boundary

Symbol marking point where boundary mereing changes

BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

Large-Scale National Grid Data 1:2,500 and 1:1,250



Civil parish/community boundary

District boundary

County boundary

Boundary post/stone

Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

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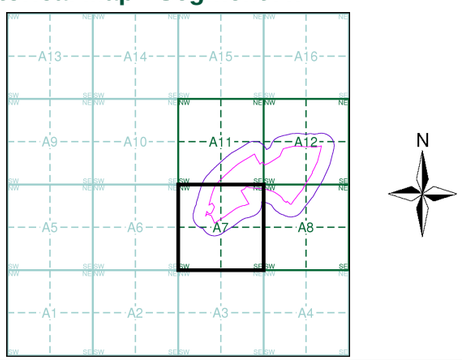
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Montgomeryshire	1:2,500	1886	2
Montgomeryshire	1:2,500	1902	3
Ordnance Survey Plan	1:2,500	1972	4
Additional SIMs	1:2,500	1988 - 1993	5
Large-Scale National Grid Data	1:2,500	1994	6
Historical Aerial Photography	1:2,500	2000	7

Historical Map - Segment A7



Order Details

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Slice:	A
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Site Details

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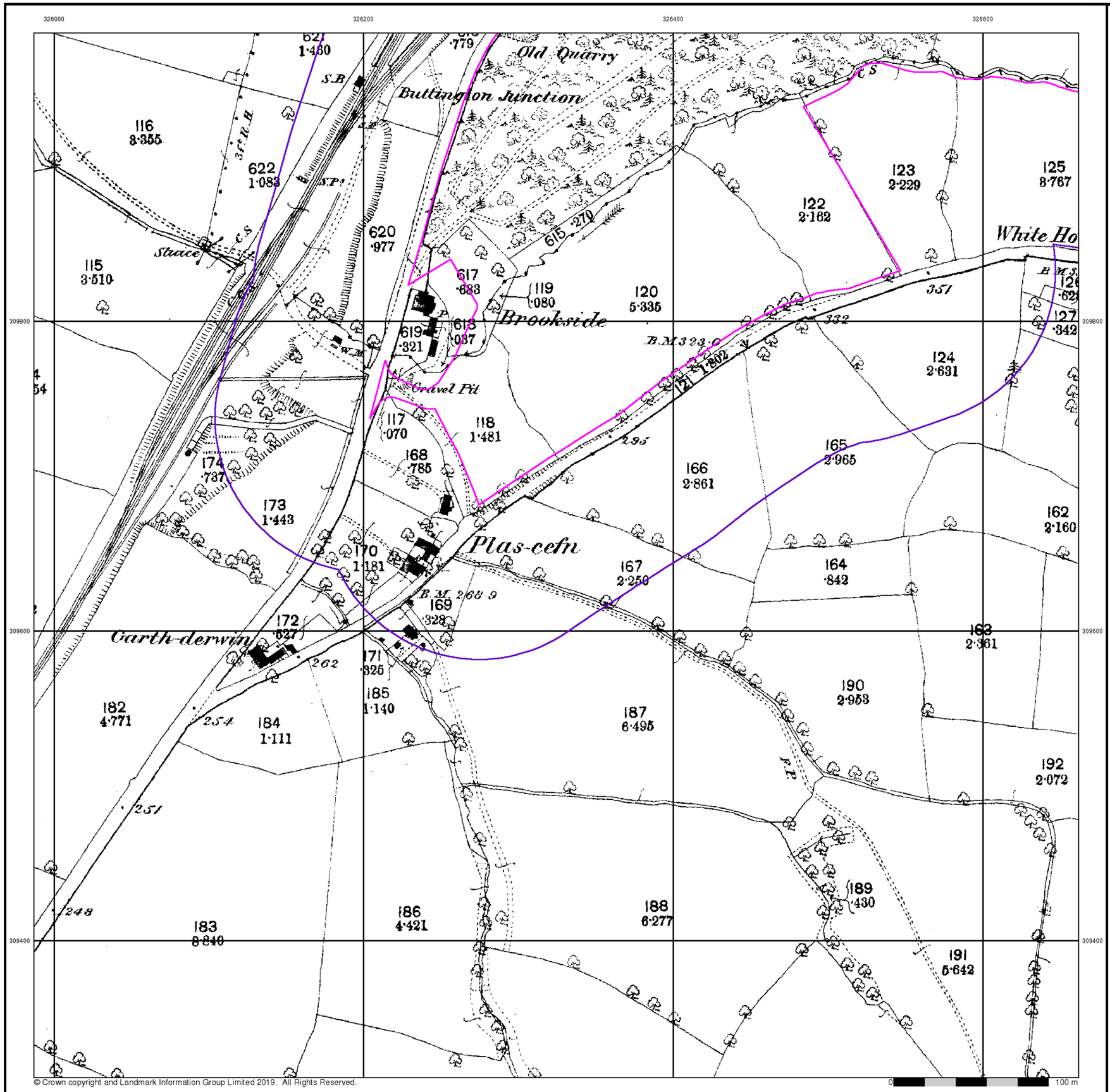

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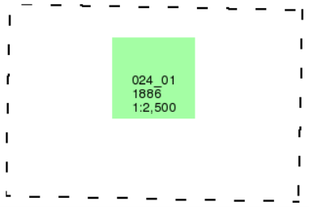
Montgomeryshire

Published 1886

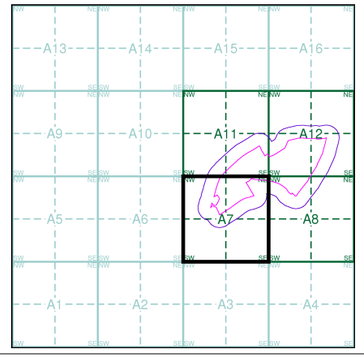
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A7



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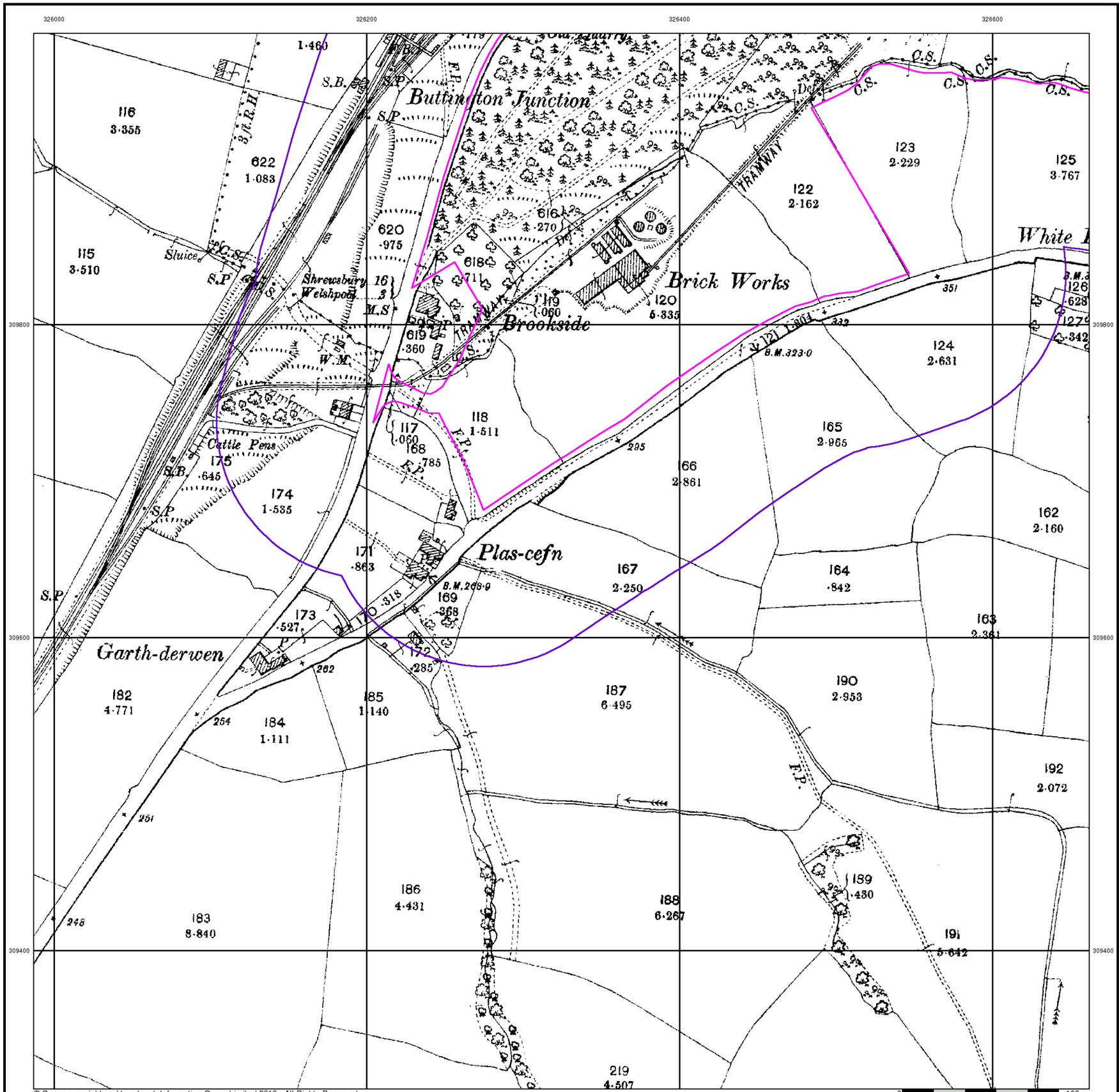

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Montgomeryshire

Published 1902

Source map scale - 1:2,500

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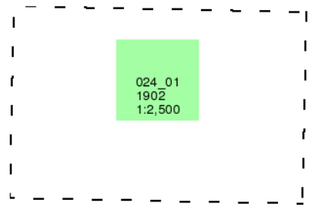
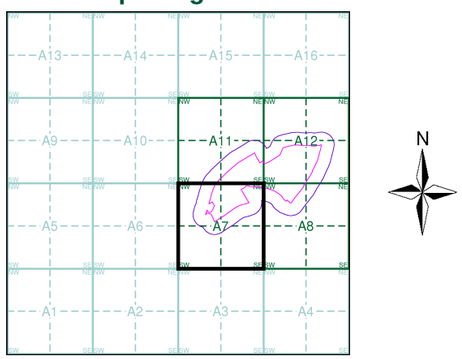


Historical Map - Segment A7



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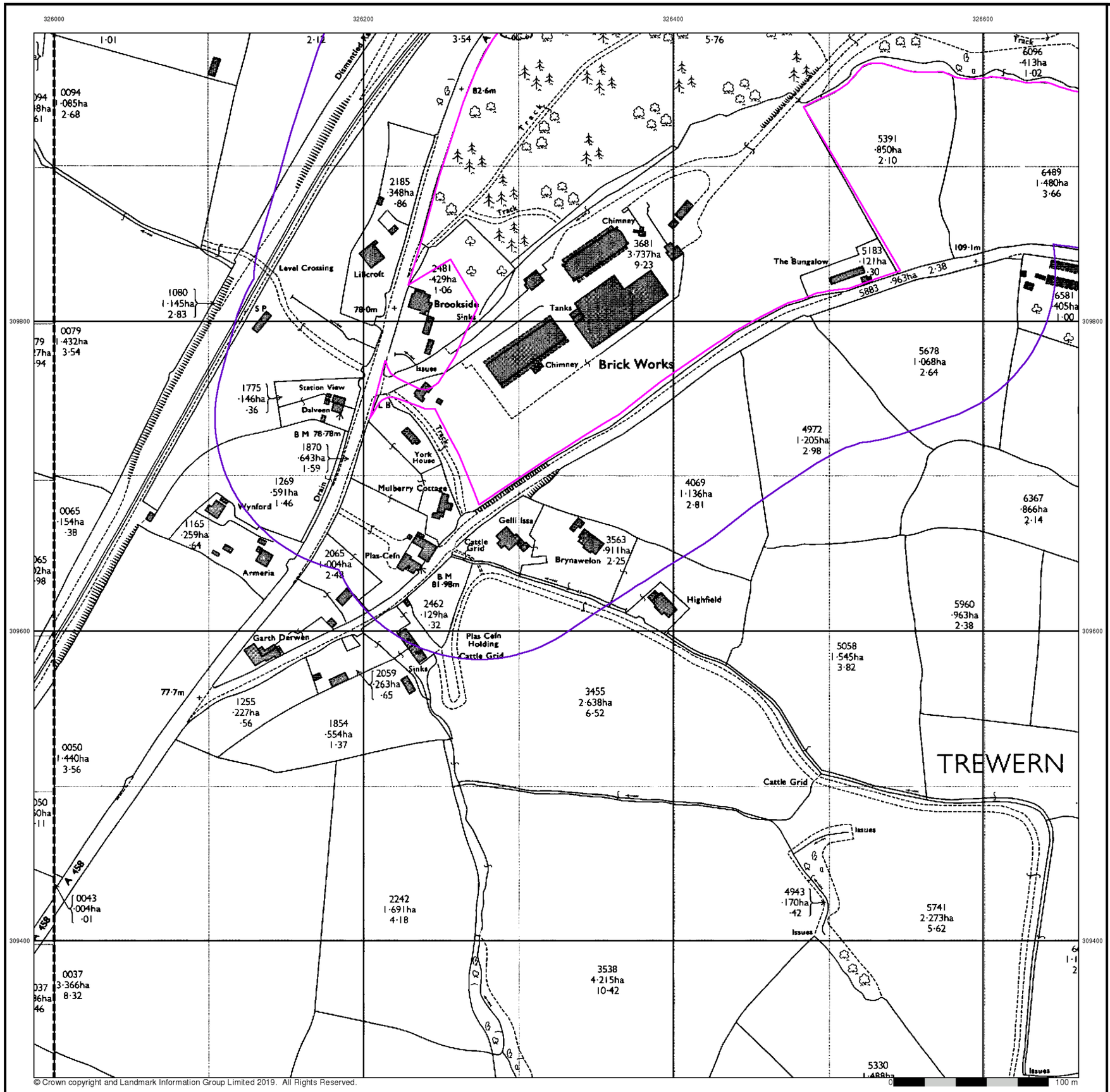

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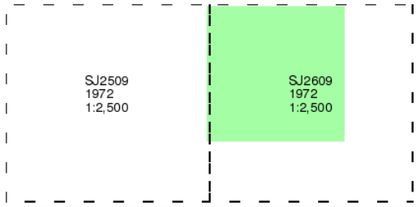
Ordnance Survey Plan

Published 1972

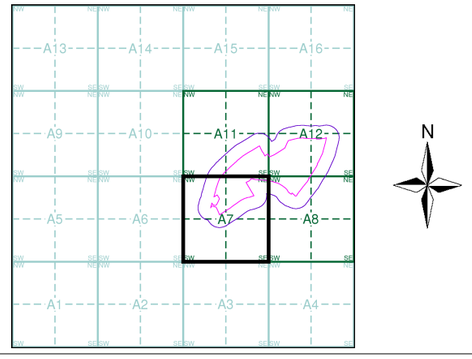
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A7



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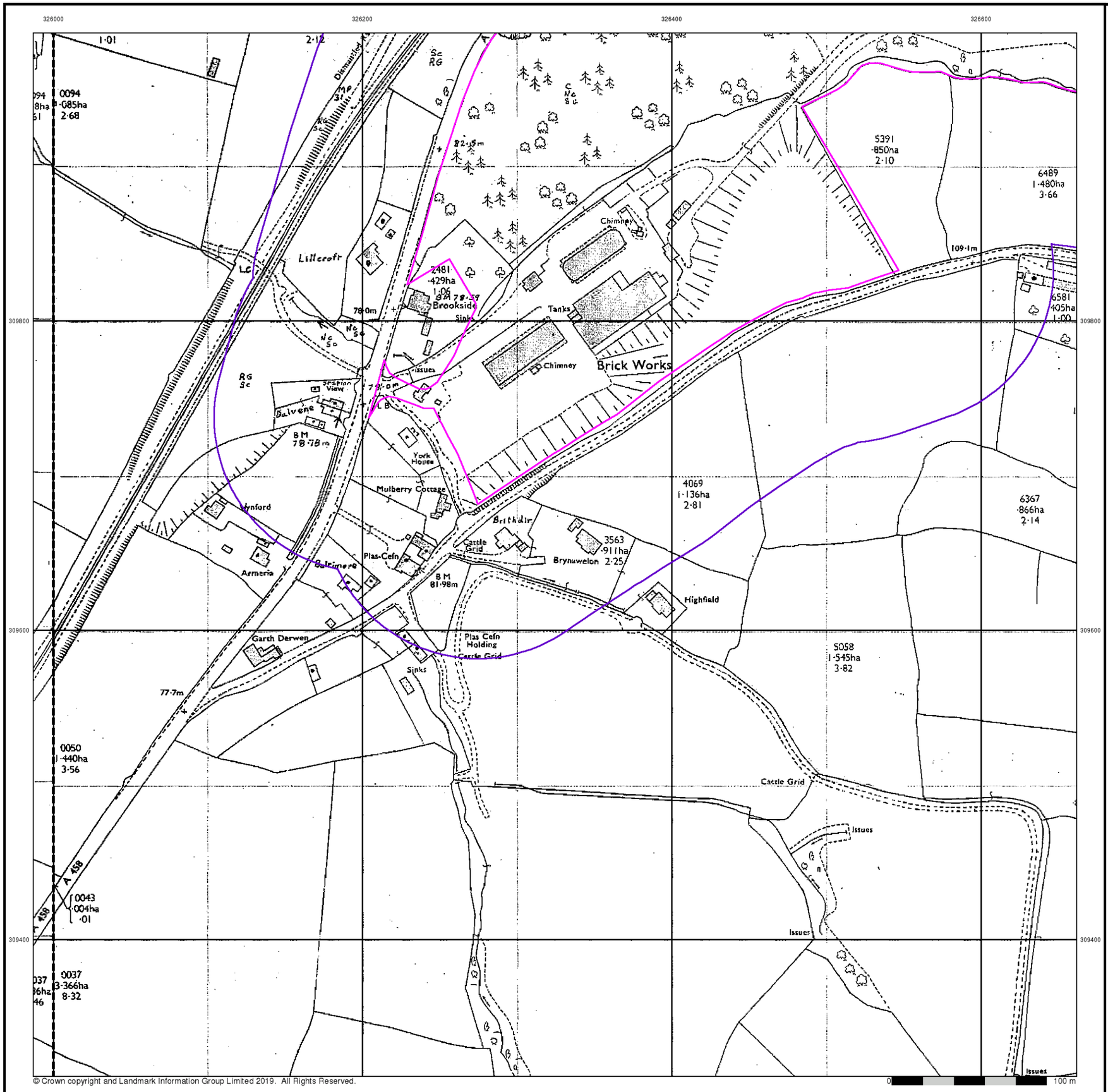

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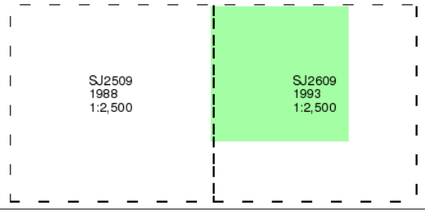
Additional SIMs

Published 1988 - 1993

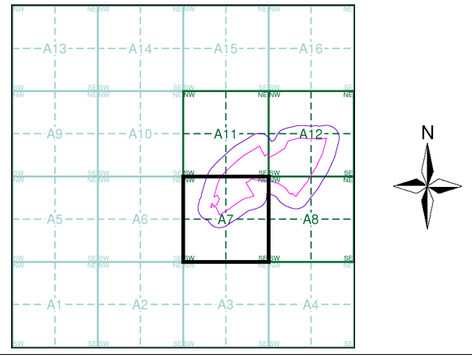
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A7



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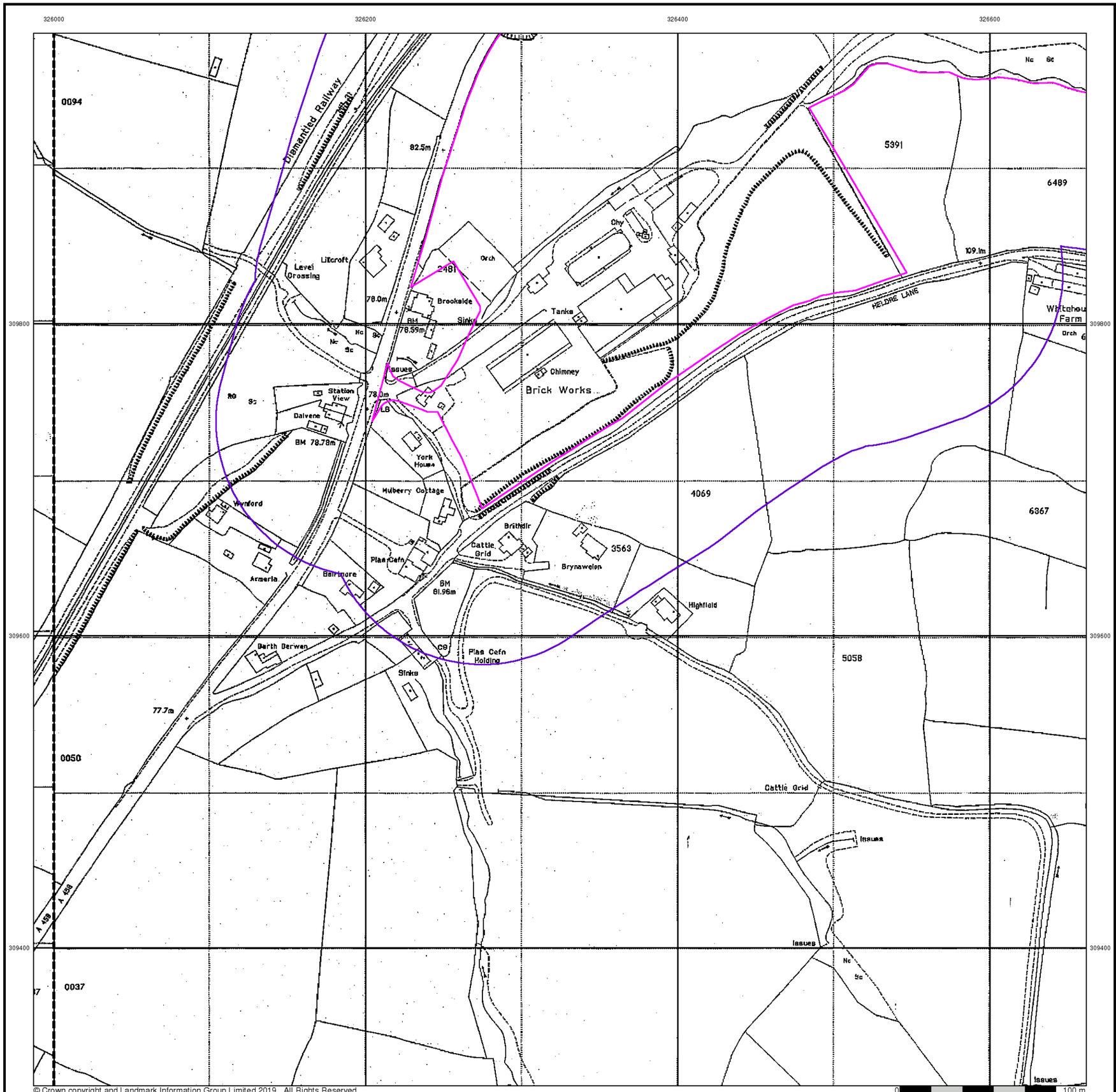

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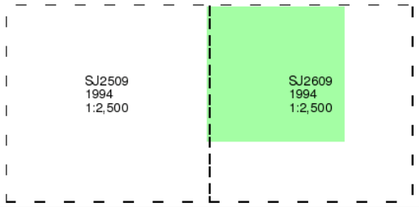
Large-Scale National Grid Data

Published 1994

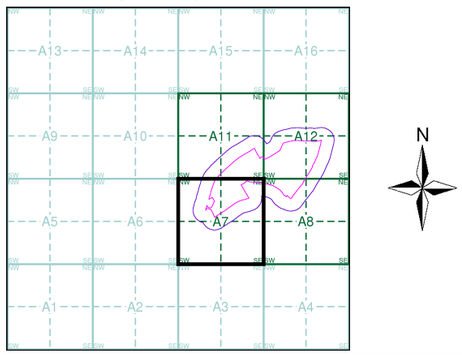
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A7



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	100

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

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Web: www.envirocheck.co.uk

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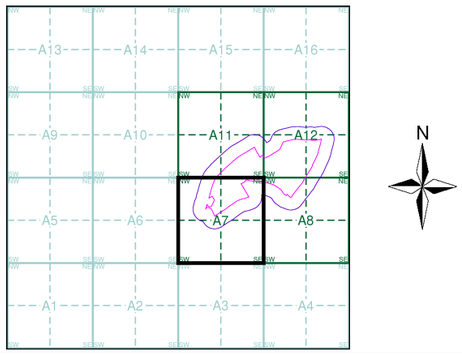
Historical Aerial Photography

Published 2000

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A7



Order Details

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National Grid Reference:	326380, 309950
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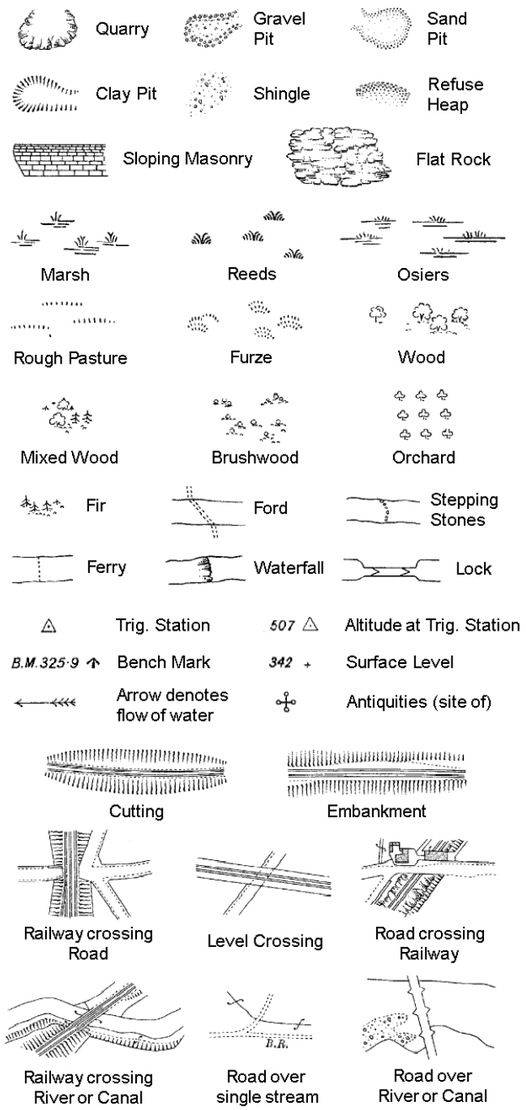
Historical Mapping Legends

Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



County Boundary (Geographical)

County & Civil Parish Boundary

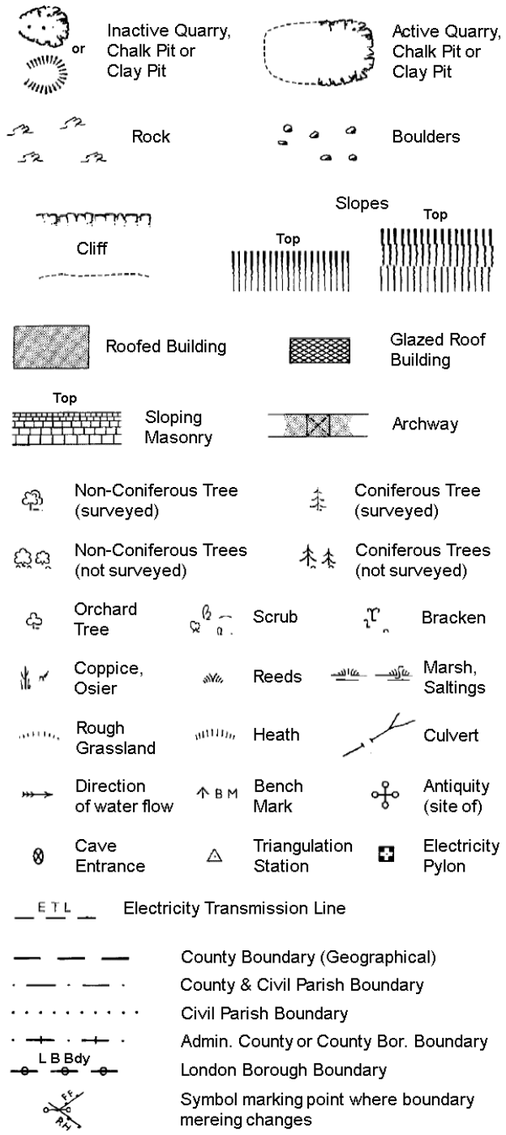
Administrative County & Civil Parish Boundary

Co. Boro. Bdy. County Borough Boundary (England)

Co. Burgh Bdy. County Burgh Boundary (Scotland)

B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	Sl.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



County Boundary (Geographical)

County & Civil Parish Boundary

Civil Parish Boundary

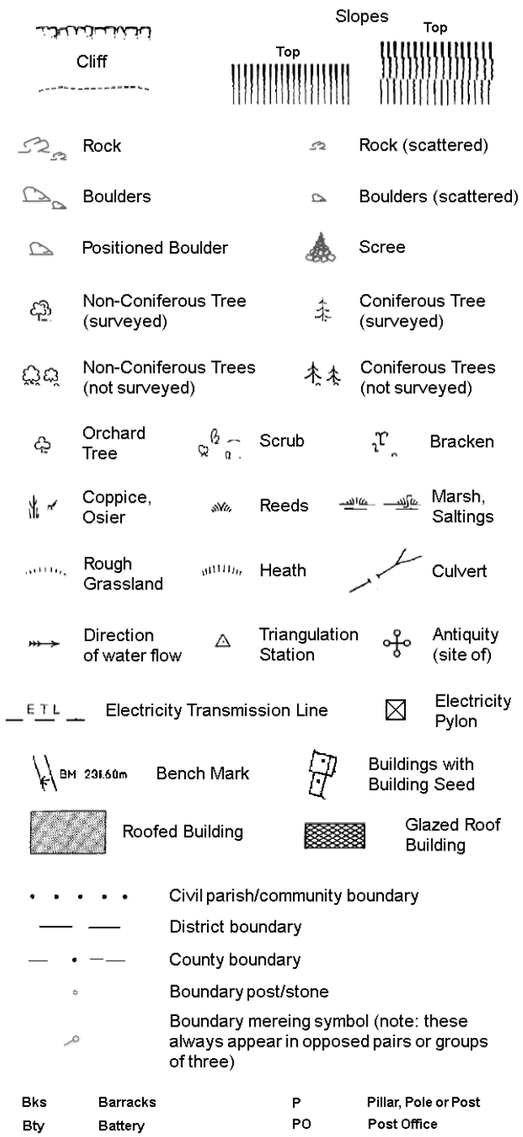
Admin. County or County Bor. Boundary

L B Bdy London Borough Boundary

Symbol marking point where boundary mereing changes

BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

Large-Scale National Grid Data 1:2,500 and 1:1,250



Civil parish/community boundary

District boundary

County boundary

Boundary post/stone

Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

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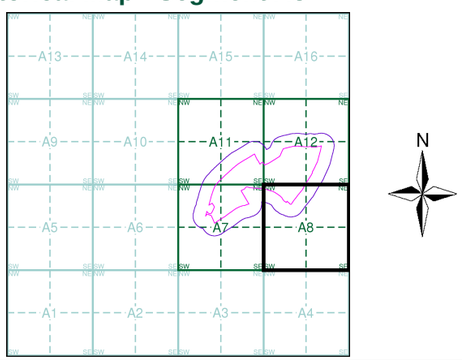
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Montgomeryshire	1:2,500	1886	2
Montgomeryshire	1:2,500	1902	3
Ordnance Survey Plan	1:2,500	1972	4
Additional SIMs	1:2,500	1993	5
Large-Scale National Grid Data	1:2,500	1994	6
Historical Aerial Photography	1:2,500	2000	7

Historical Map - Segment A8



Order Details

Order Number:	196125587_1_1
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Site Area (Ha):	25.12
Search Buffer (m):	100

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

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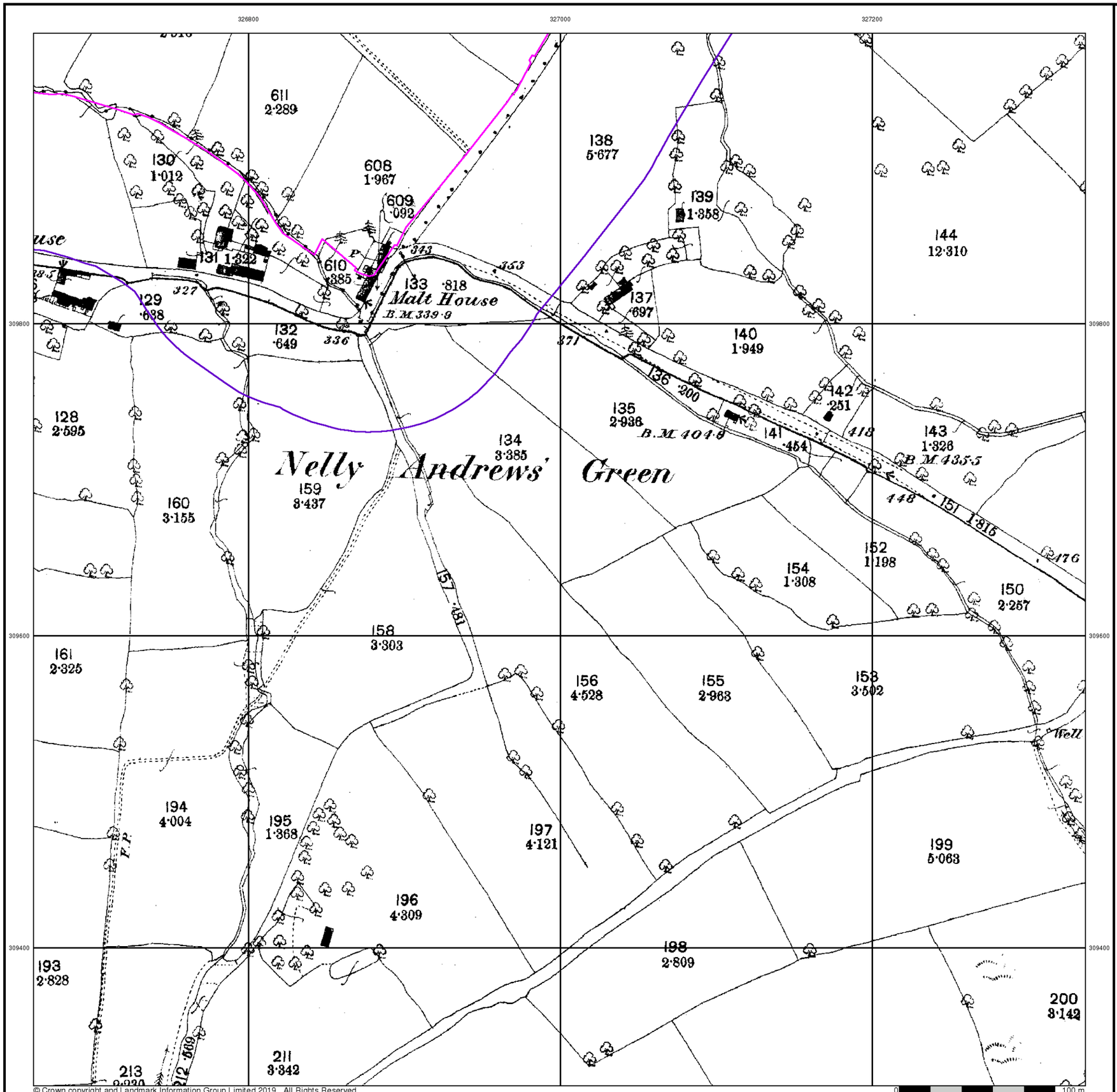

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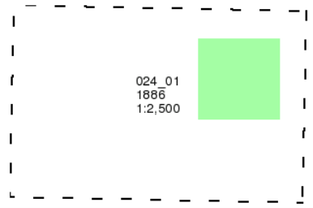
Montgomeryshire

Published 1886

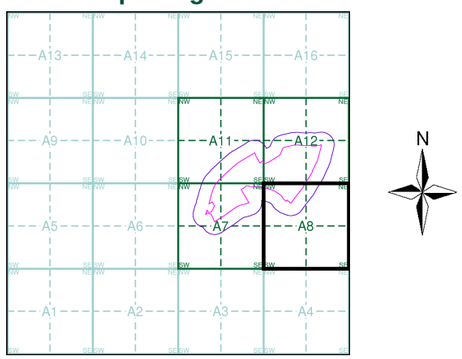
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A8



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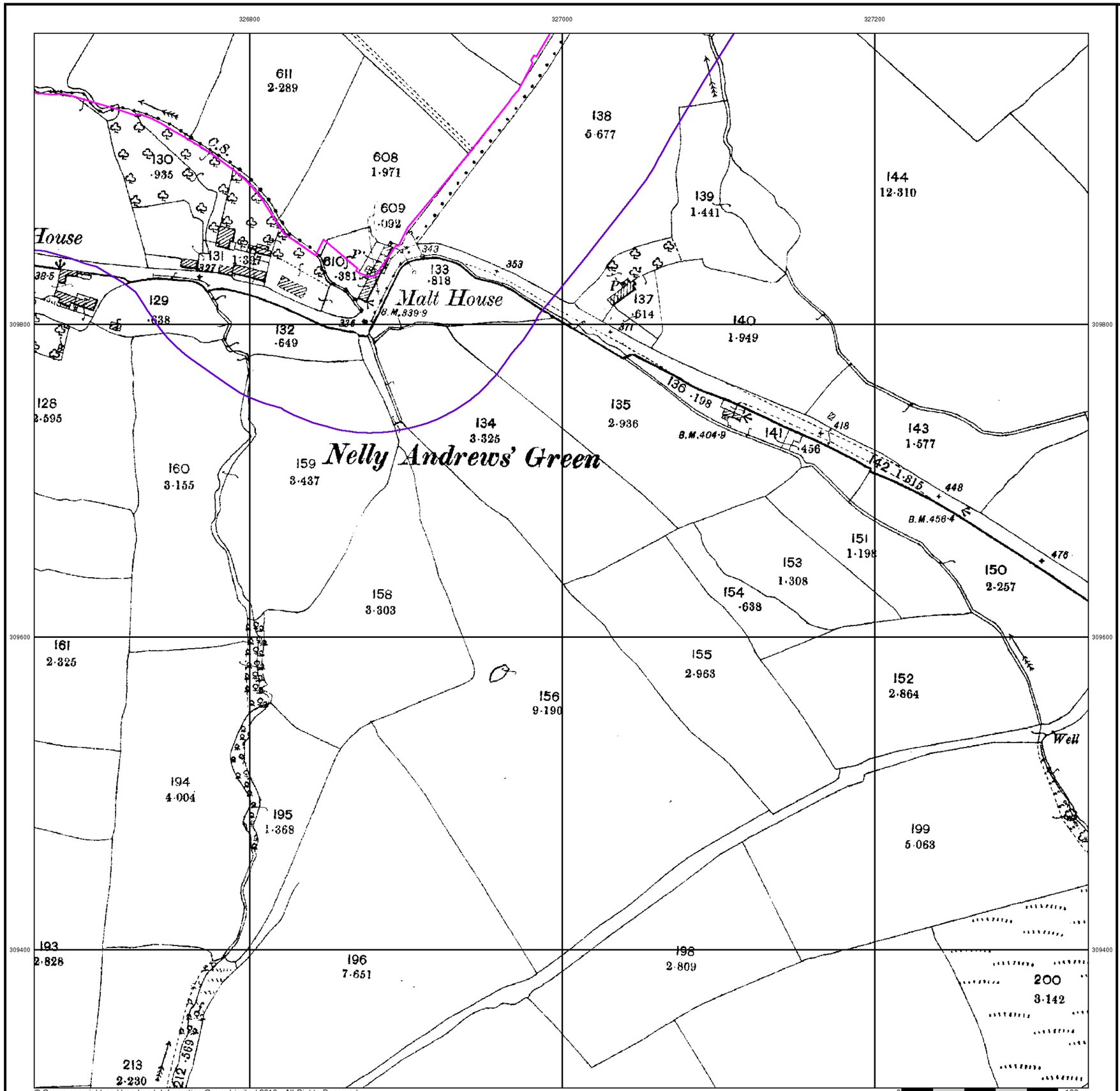

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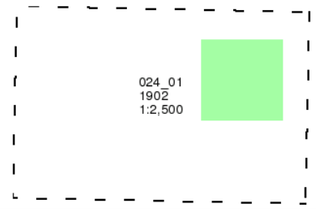
Montgomeryshire

Published 1902

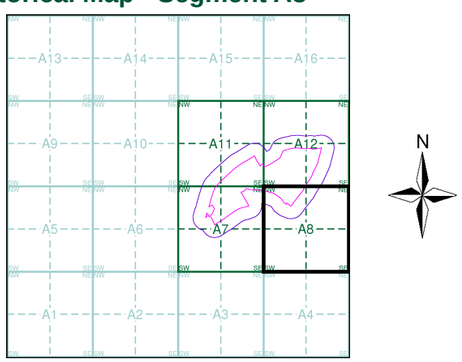
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A8



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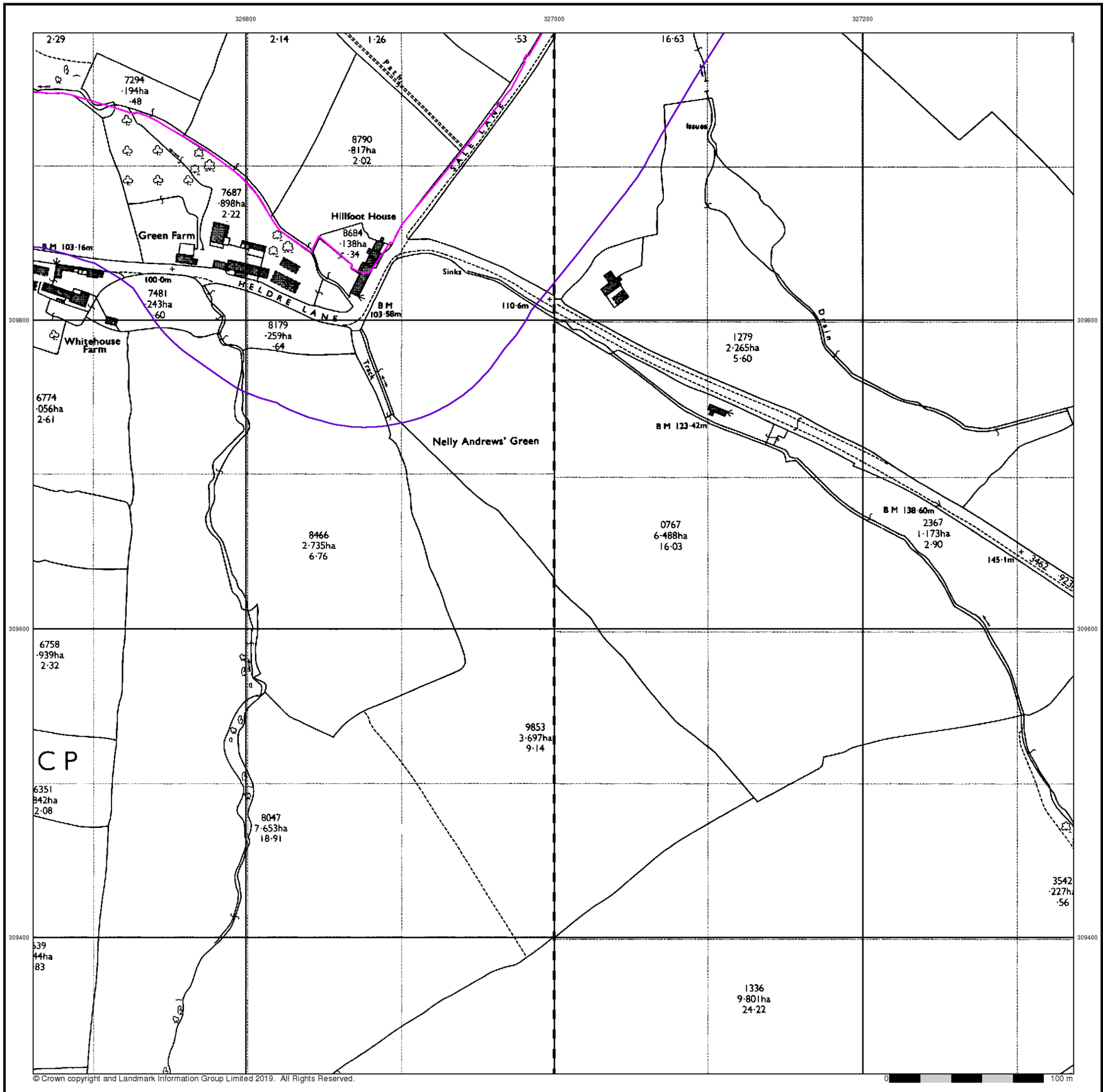

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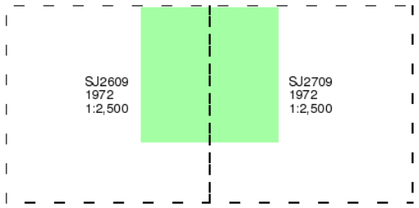
Ordnance Survey Plan

Published 1972

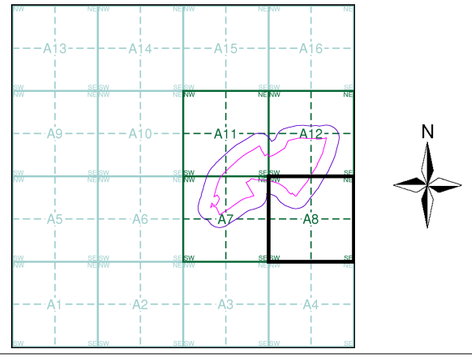
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A8



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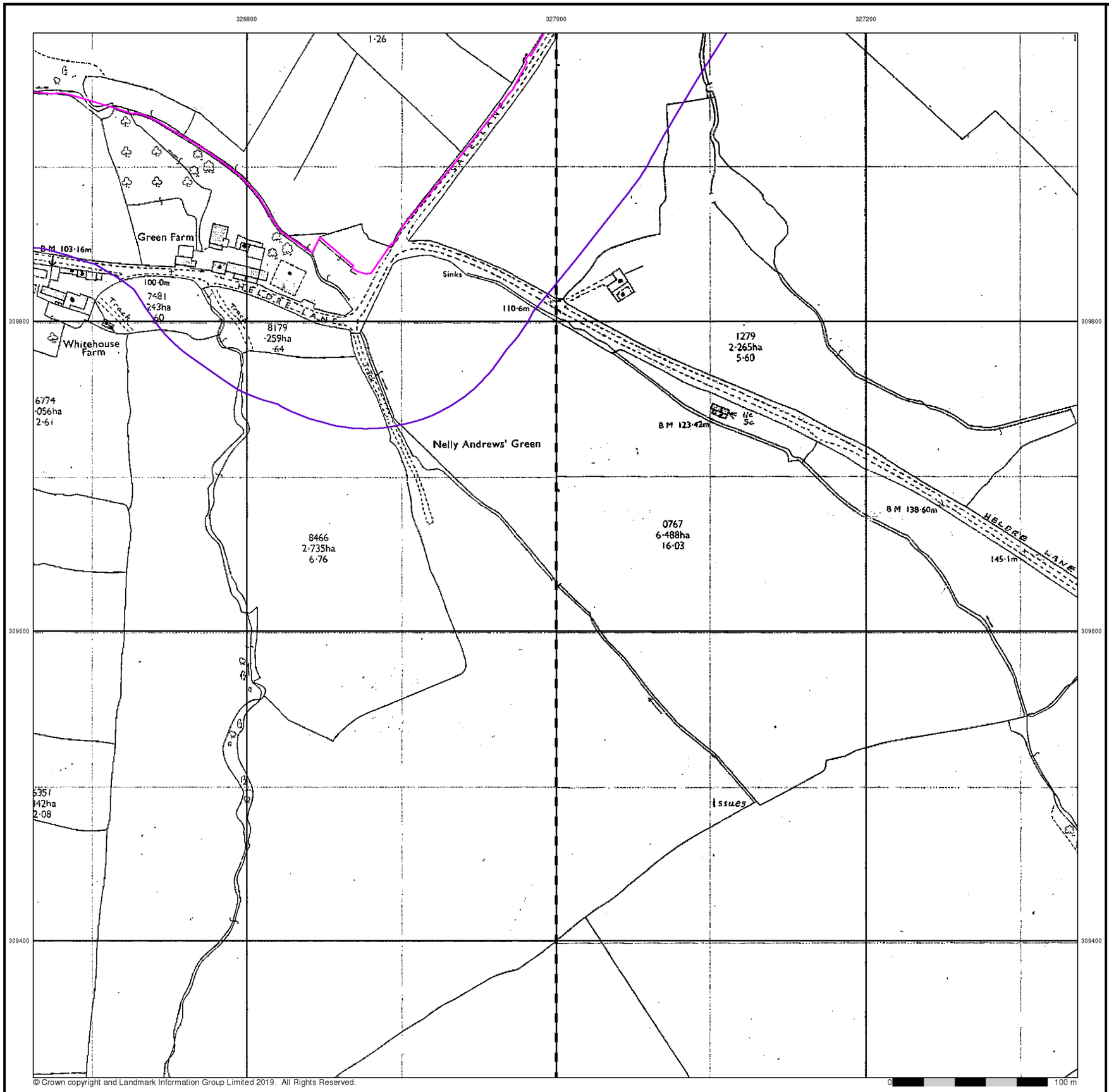

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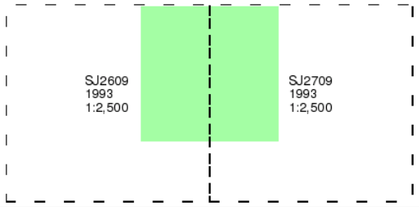
Additional SIMs

Published 1993

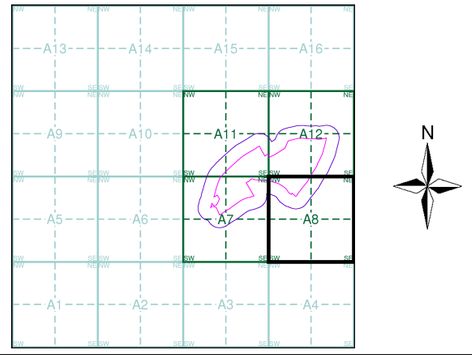
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A8



Order Details

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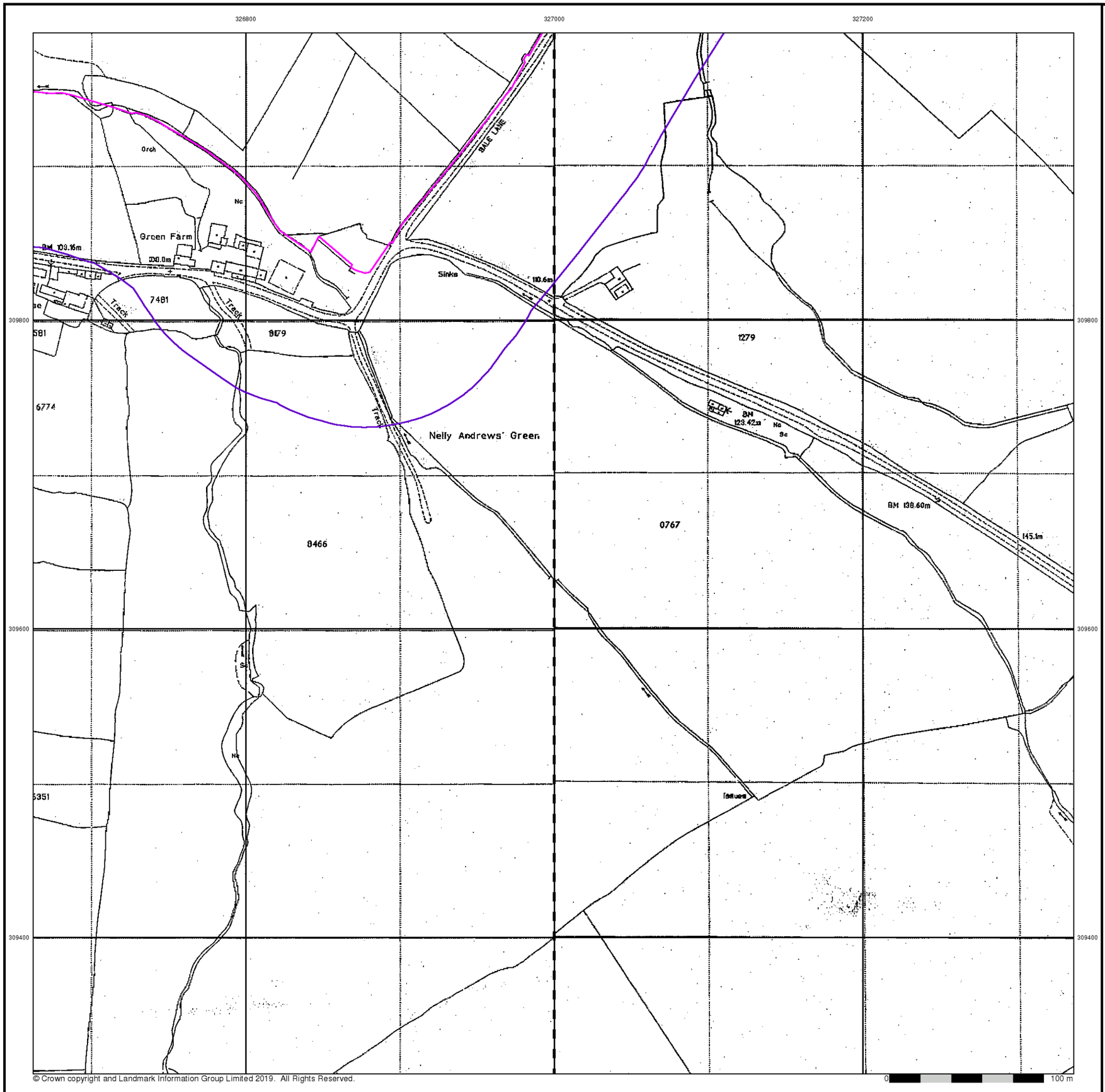

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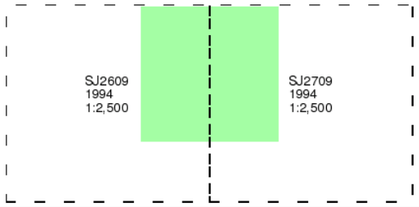
Large-Scale National Grid Data

Published 1994

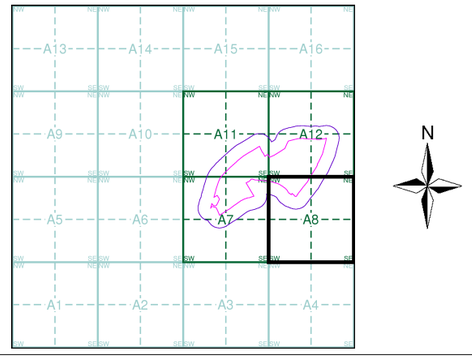
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A8



Order Details

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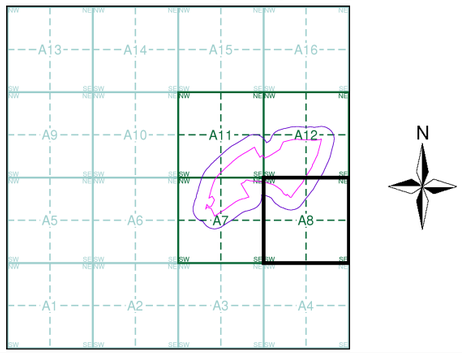
Historical Aerial Photography

Published 2000

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A8



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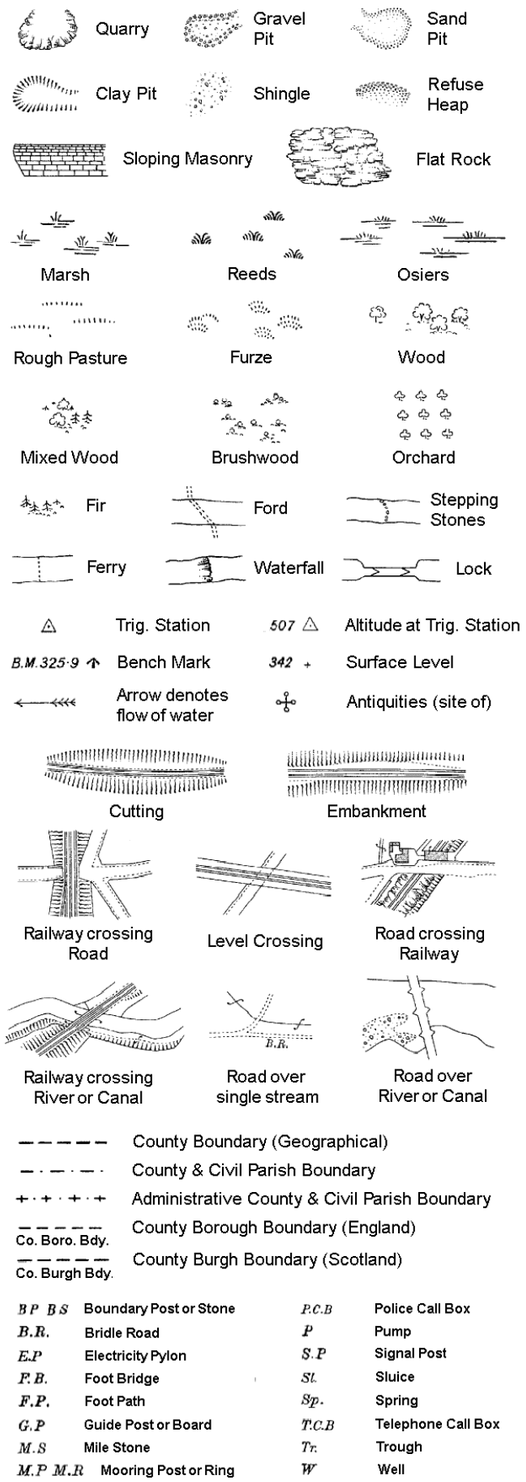
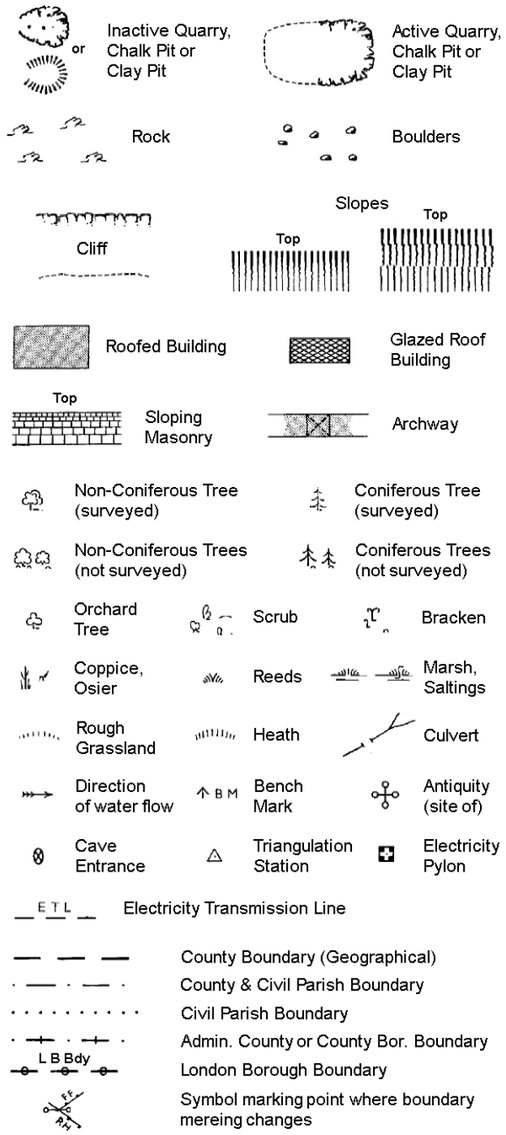
Historical Mapping Legends

Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
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El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
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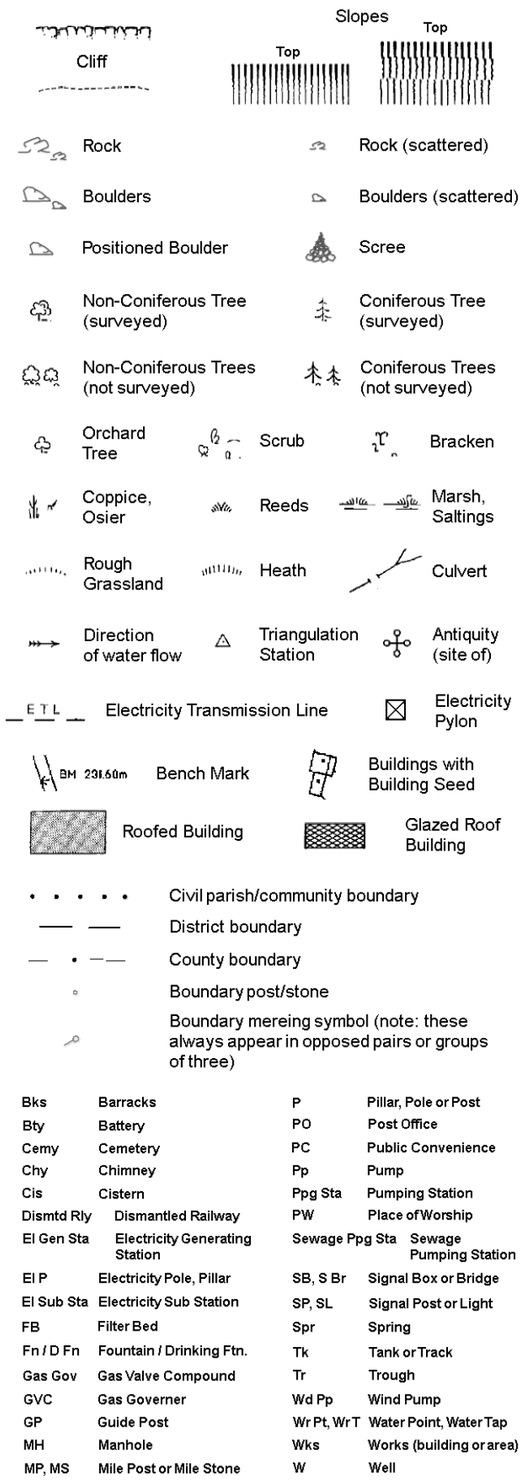
Large-Scale National Grid Data 1:2,500 and 1:1,250



Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
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Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
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MP, MS	Mile Post or Mile Stone	W	Well

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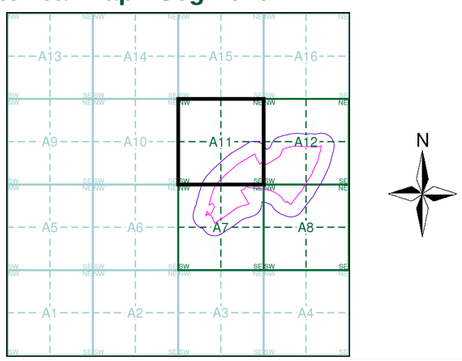
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Montgomeryshire	1:2,500	1886	2
Montgomeryshire	1:2,500	1902	3
Ordnance Survey Plan	1:2,500	1972 - 1973	4
Additional SIMs	1:2,500	1988 - 1993	5
Large-Scale National Grid Data	1:2,500	1994 - 1995	6
Historical Aerial Photography	1:2,500	2000	7

Historical Map - Segment A11



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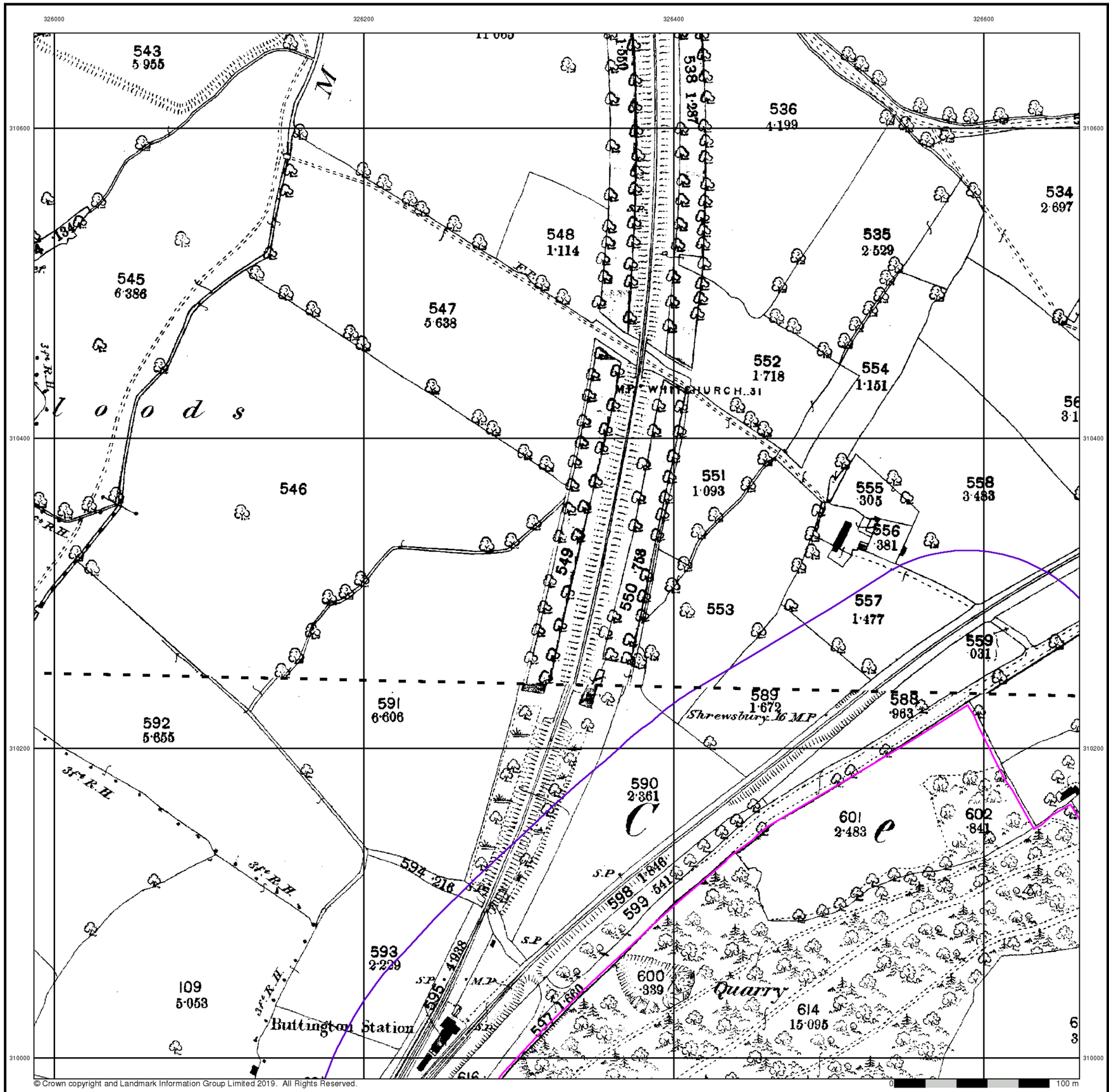


terrafirma

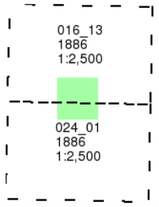
Montgomeryshire

Published 1886

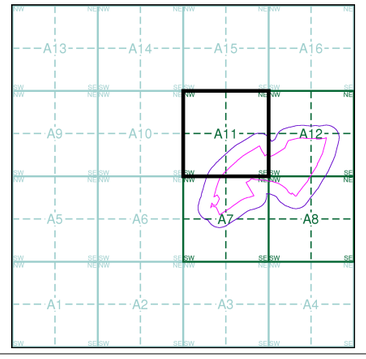
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A11



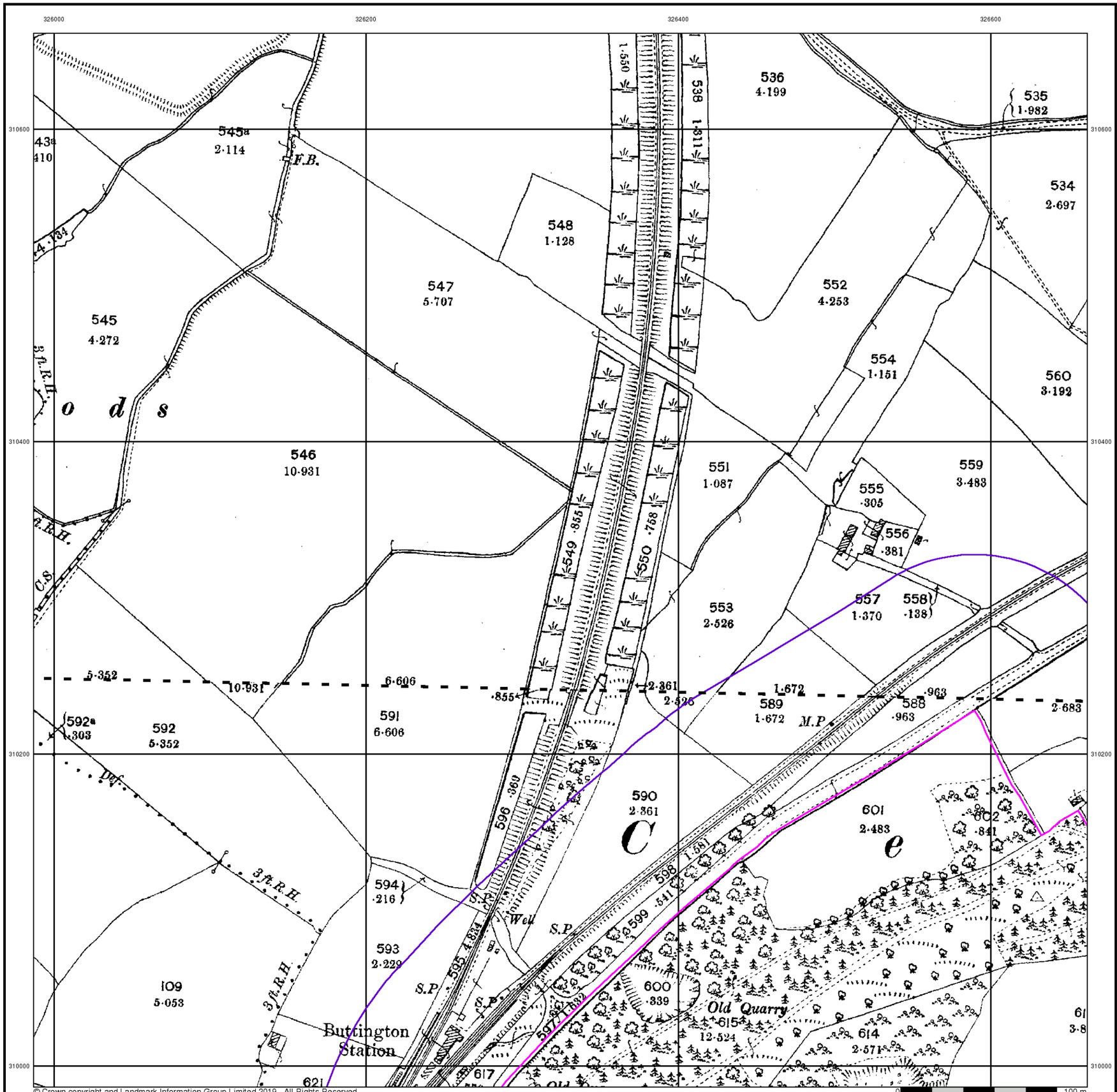
Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	100

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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Montgomeryshire

Published 1902

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

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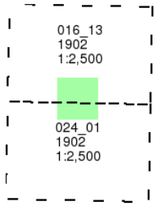
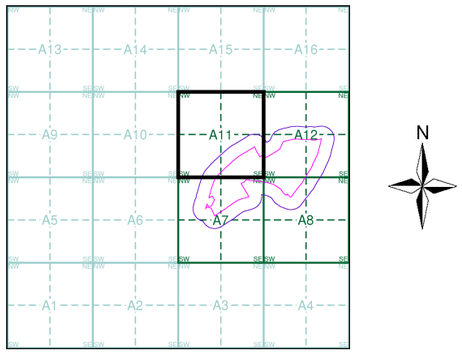


Historical Map - Segment A11



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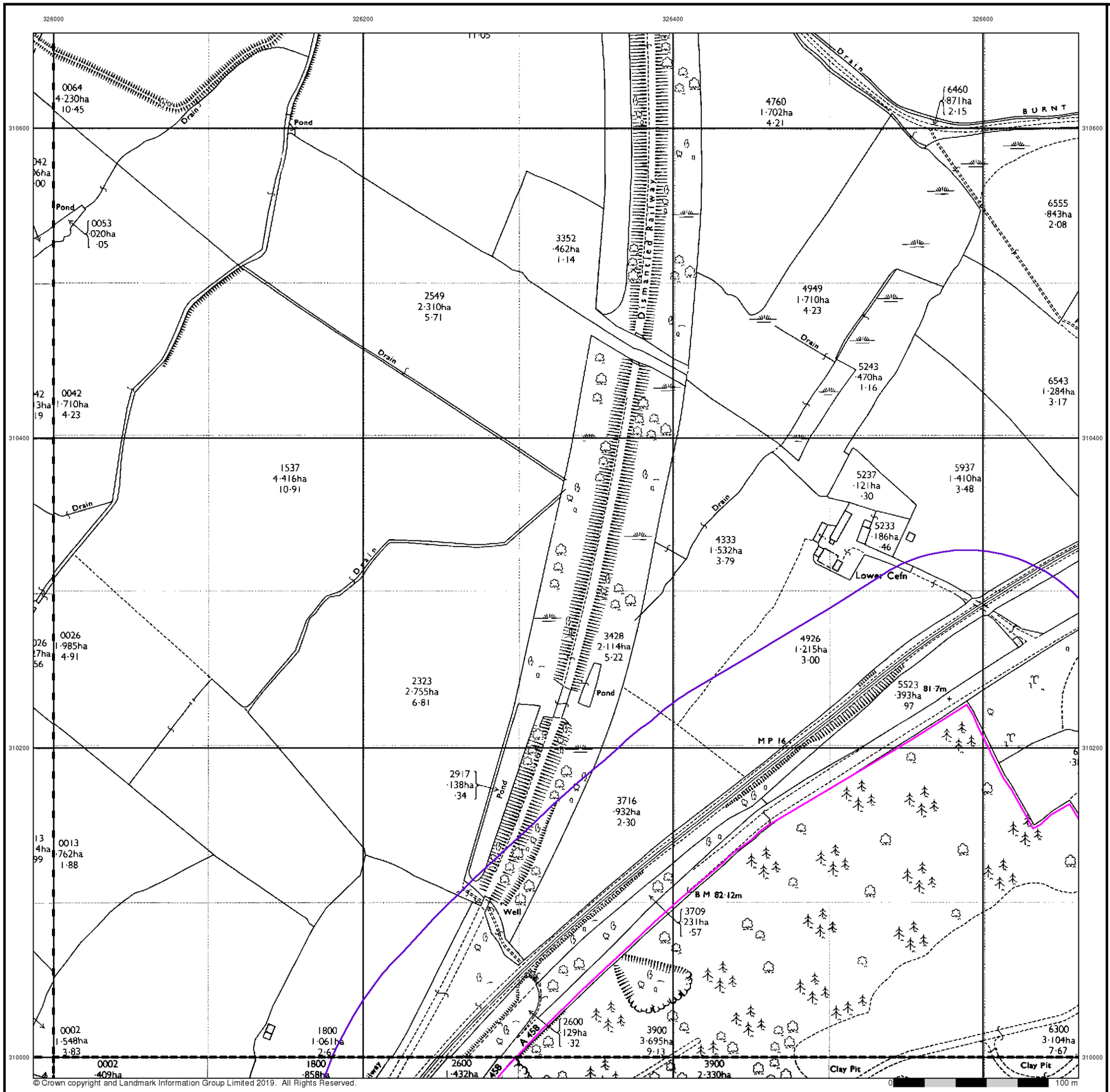

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Ordnance Survey Plan

Published 1972 - 1973

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

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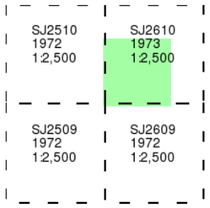
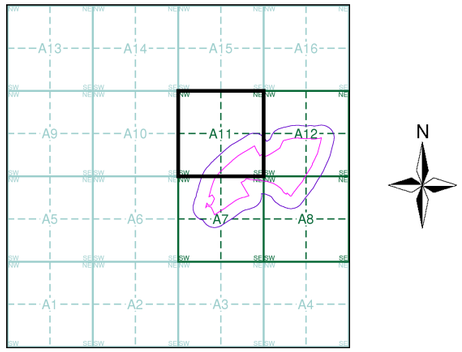


Historical Map - Segment A11



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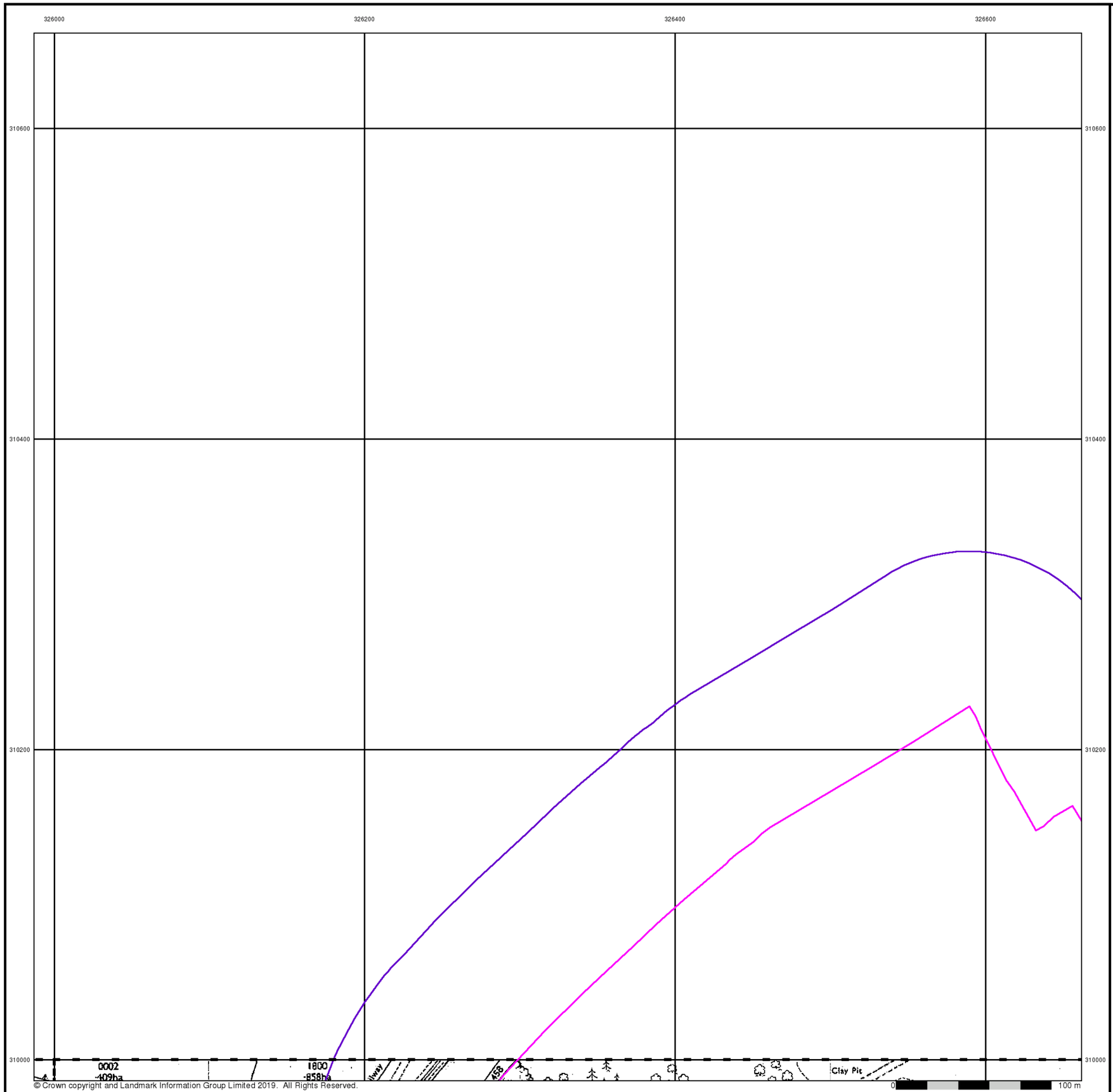

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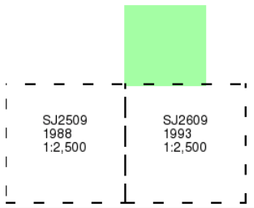
Additional SIMs

Published 1988 - 1993

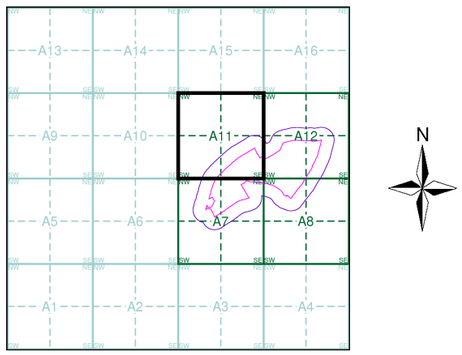
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A11



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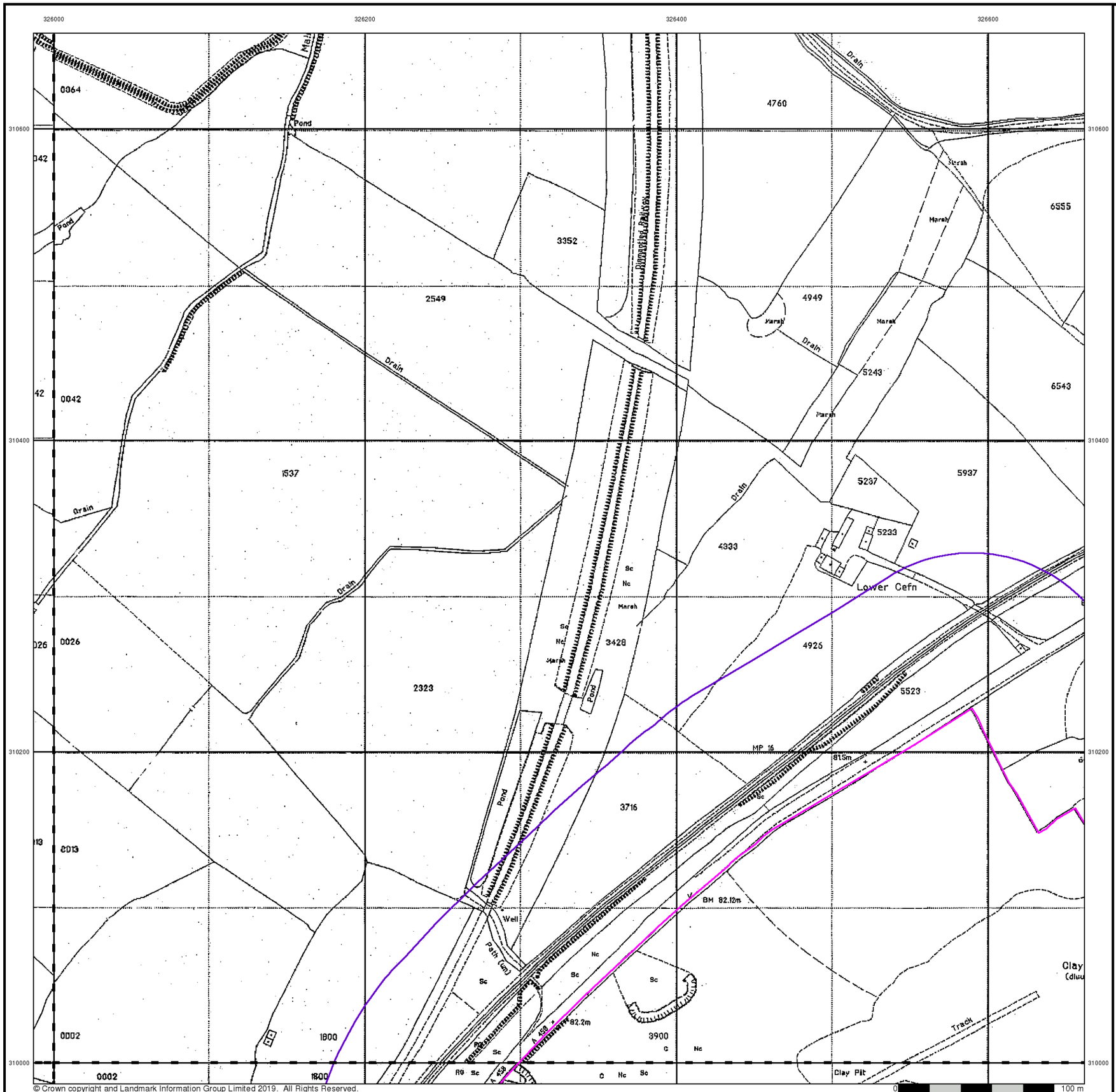

0 100 m

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Large-Scale National Grid Data

Published 1994 - 1995

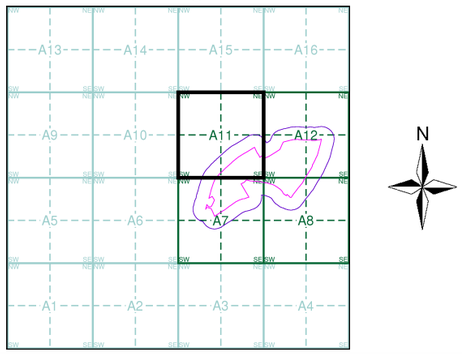
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SJ2510 1995 1:2,500	SJ2610 1995 1:2,500
SJ2509 1994 1:2,500	SJ2609 1994 1:2,500

Historical Map - Segment A11



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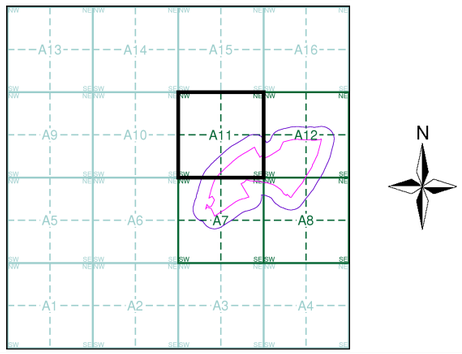
Historical Aerial Photography

Published 2000

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A11



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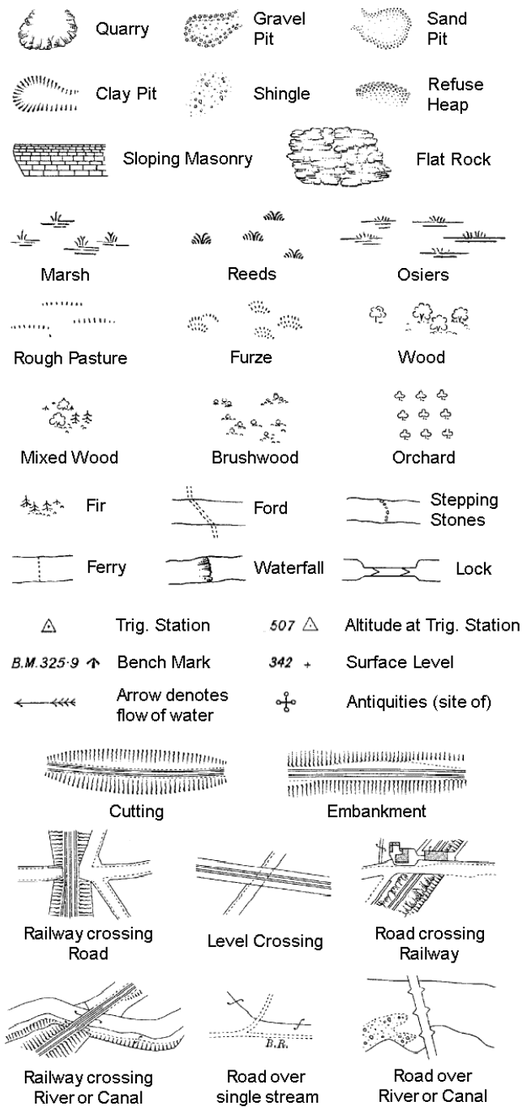
Historical Mapping Legends

Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



County Boundary (Geographical)

County & Civil Parish Boundary

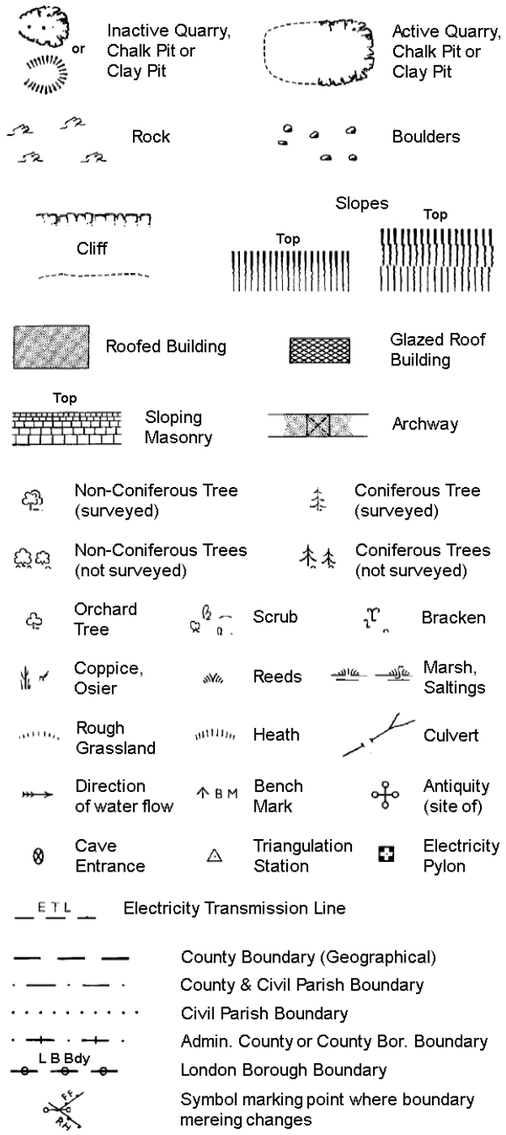
Administrative County & Civil Parish Boundary

Co. Boro. Bdy. County Borough Boundary (England)

Co. Burgh Bdy. County Burgh Boundary (Scotland)

BP BS	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



County Boundary (Geographical)

County & Civil Parish Boundary

Civil Parish Boundary

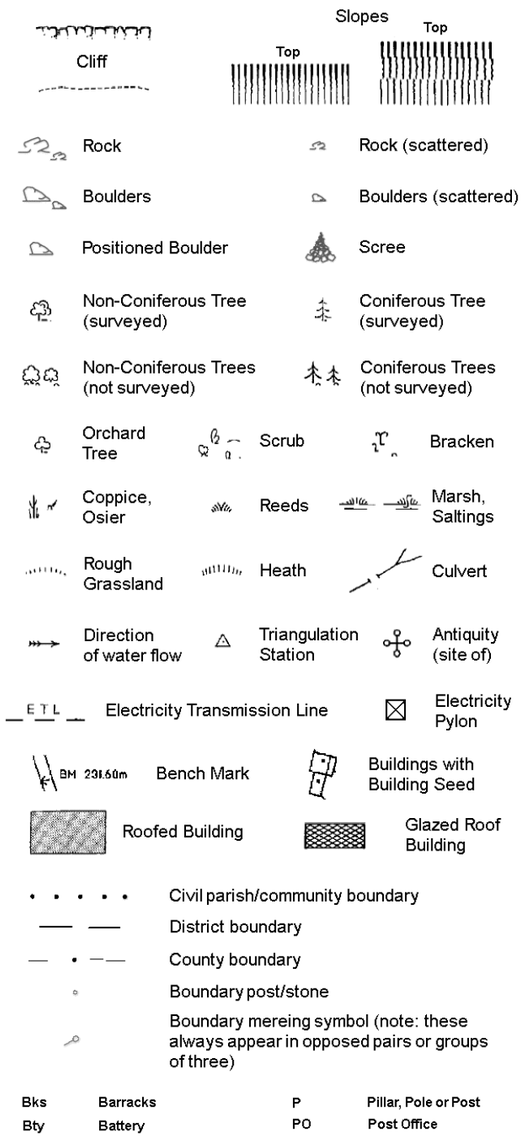
Admin. County or County Bor. Boundary

L B Bdy London Borough Boundary

Symbol marking point where boundary mereing changes

BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

Large-Scale National Grid Data 1:2,500 and 1:1,250



Civil parish/community boundary

District boundary

County boundary

Boundary post/stone

Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

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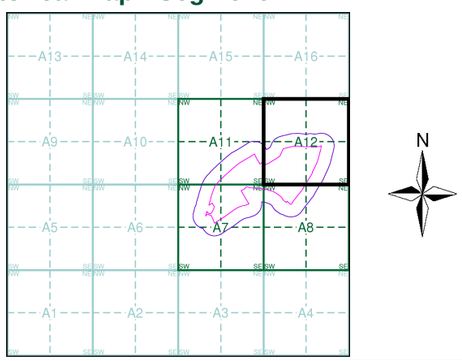
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Montgomeryshire	1:2,500	1886	2
Montgomeryshire	1:2,500	1902	3
Ordnance Survey Plan	1:2,500	1972 - 1973	4
Additional SIMs	1:2,500	1993	5
Large-Scale National Grid Data	1:2,500	1994 - 1995	6
Historical Aerial Photography	1:2,500	2000	7

Historical Map - Segment A12



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	100

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

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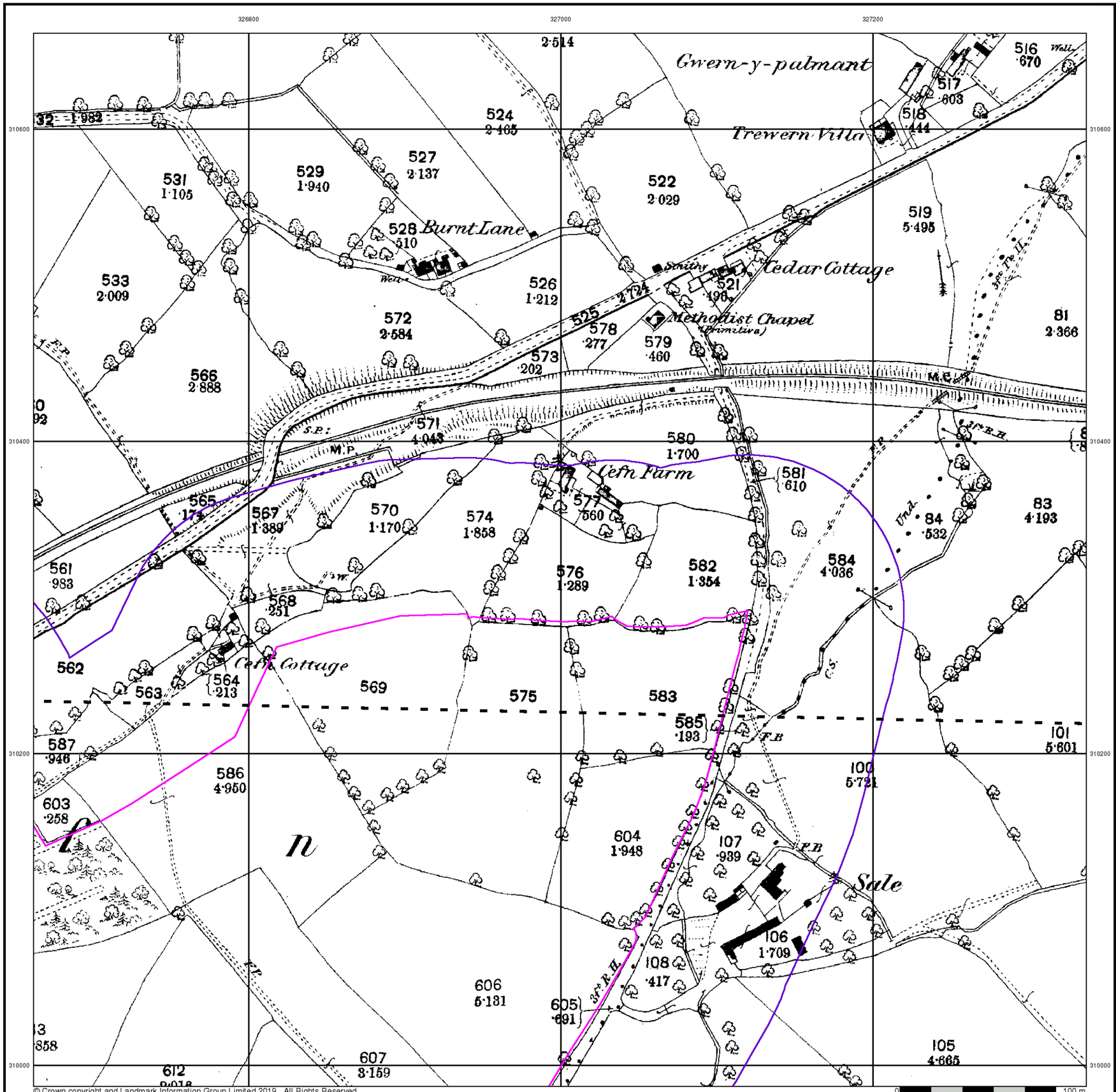

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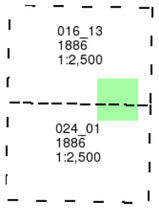
Montgomeryshire

Published 1886

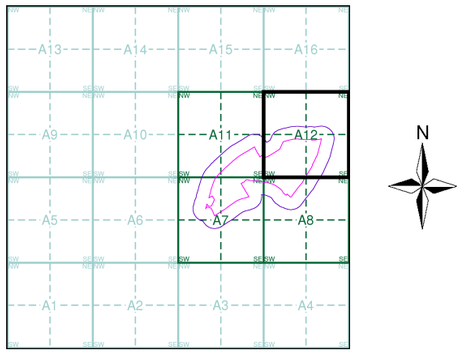
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A12



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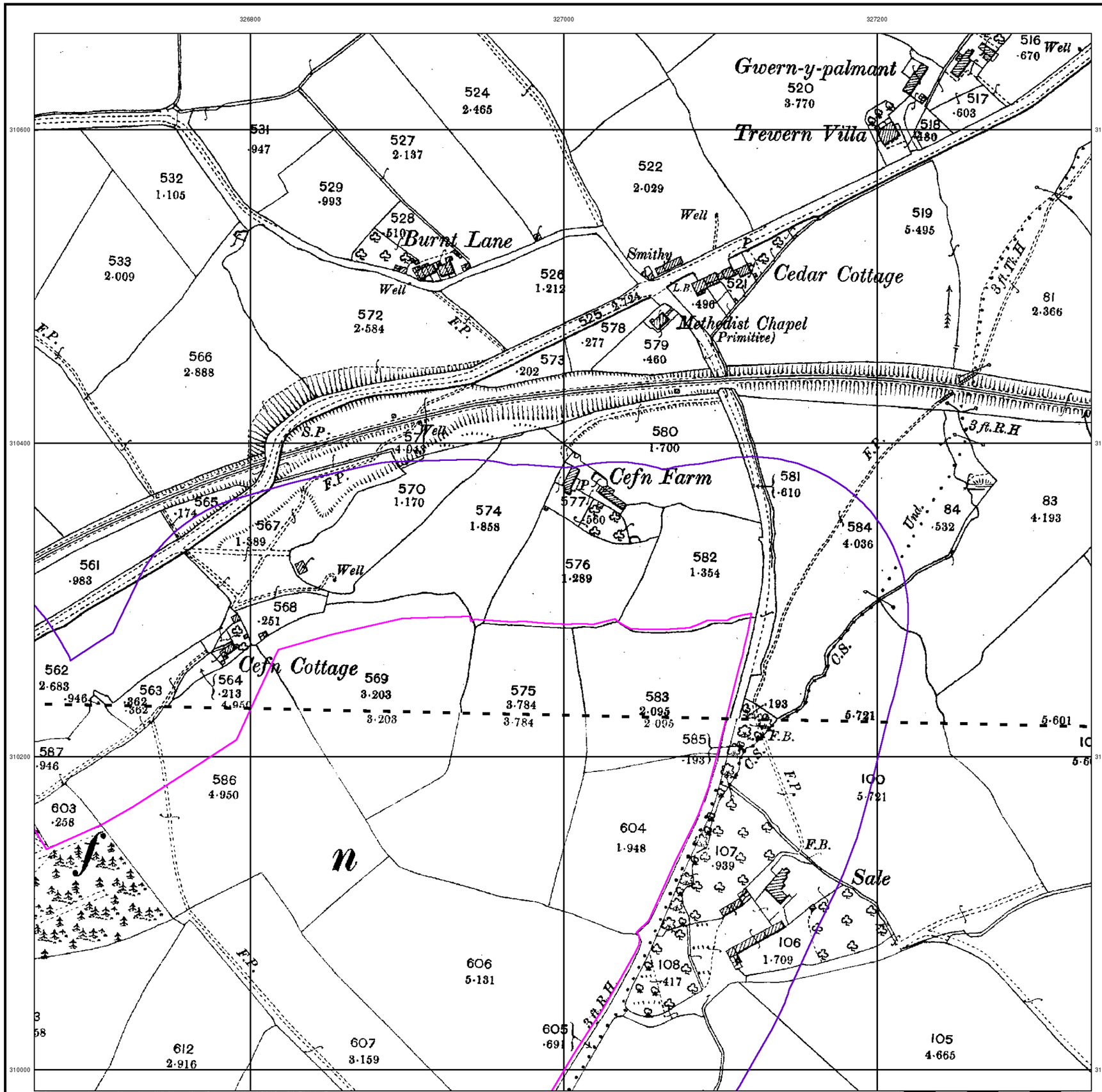

0 100 m

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Montgomeryshire

Published 1902

Source map scale - 1:2,500

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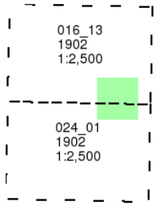
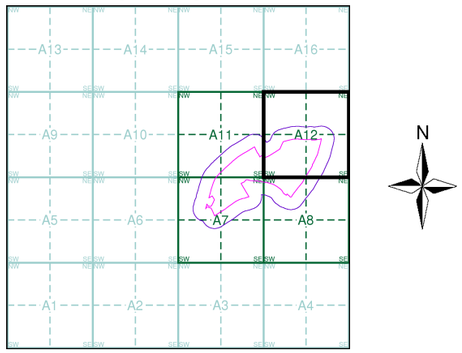


Historical Map - Segment A12



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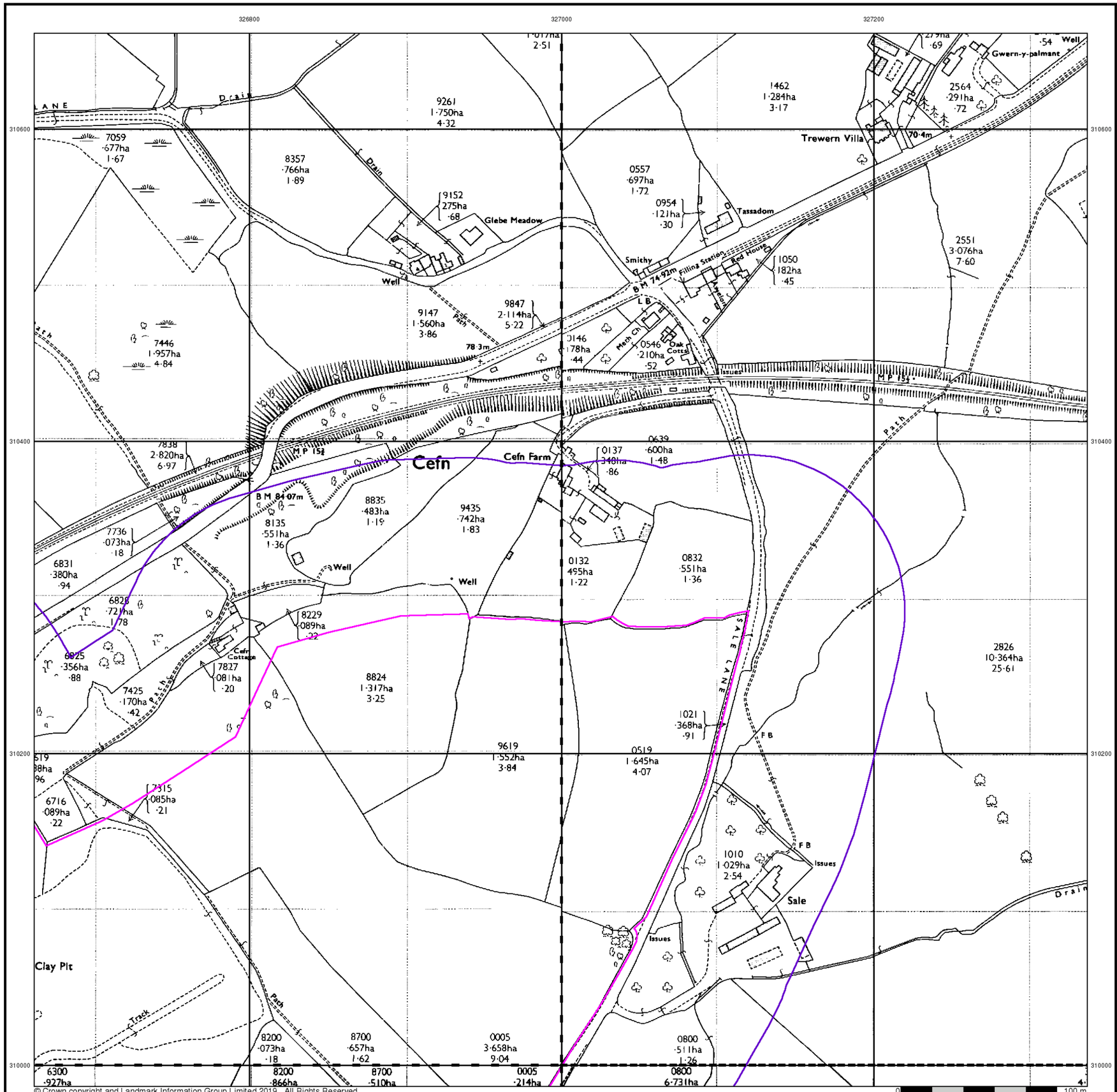

0 100 m

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Ordnance Survey Plan

Published 1972 - 1973

Source map scale - 1:2,500

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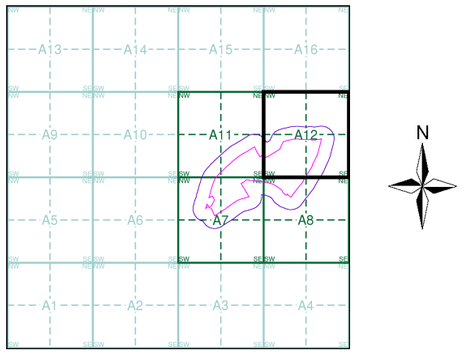
Map Name(s) and Date(s)

SJ2610 1973 1:2,500	SJ2710 1973 1:2,500
SJ2609 1972 1:2,500	SJ2709 1972 1:2,500

Historical Map - Segment A12



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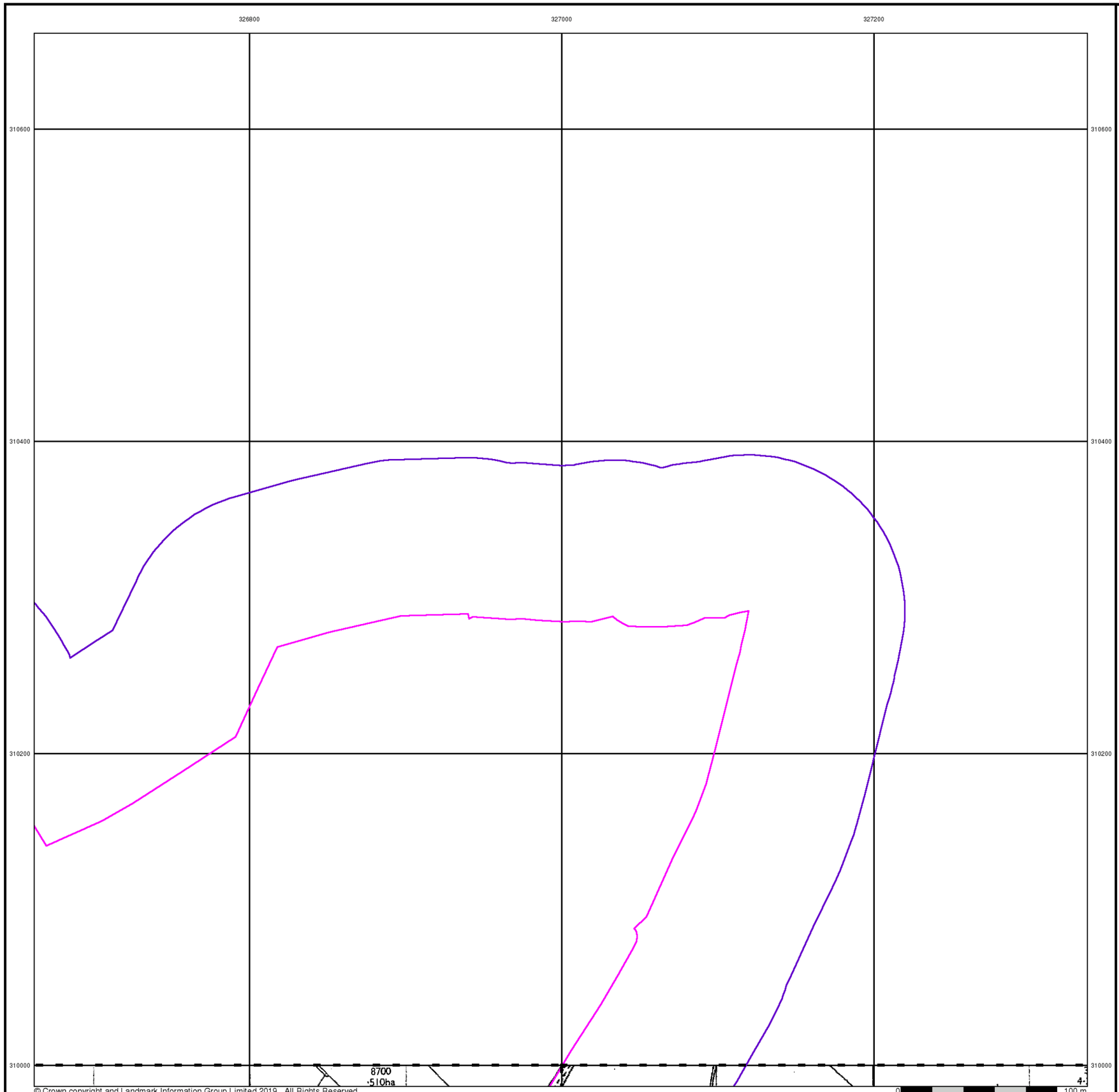

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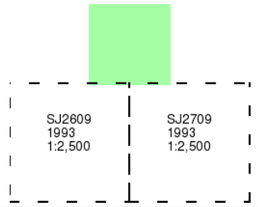
Additional SIMs

Published 1993

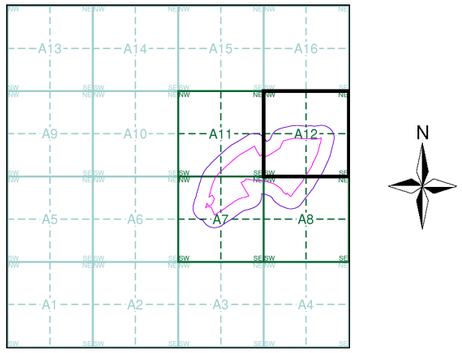
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A12



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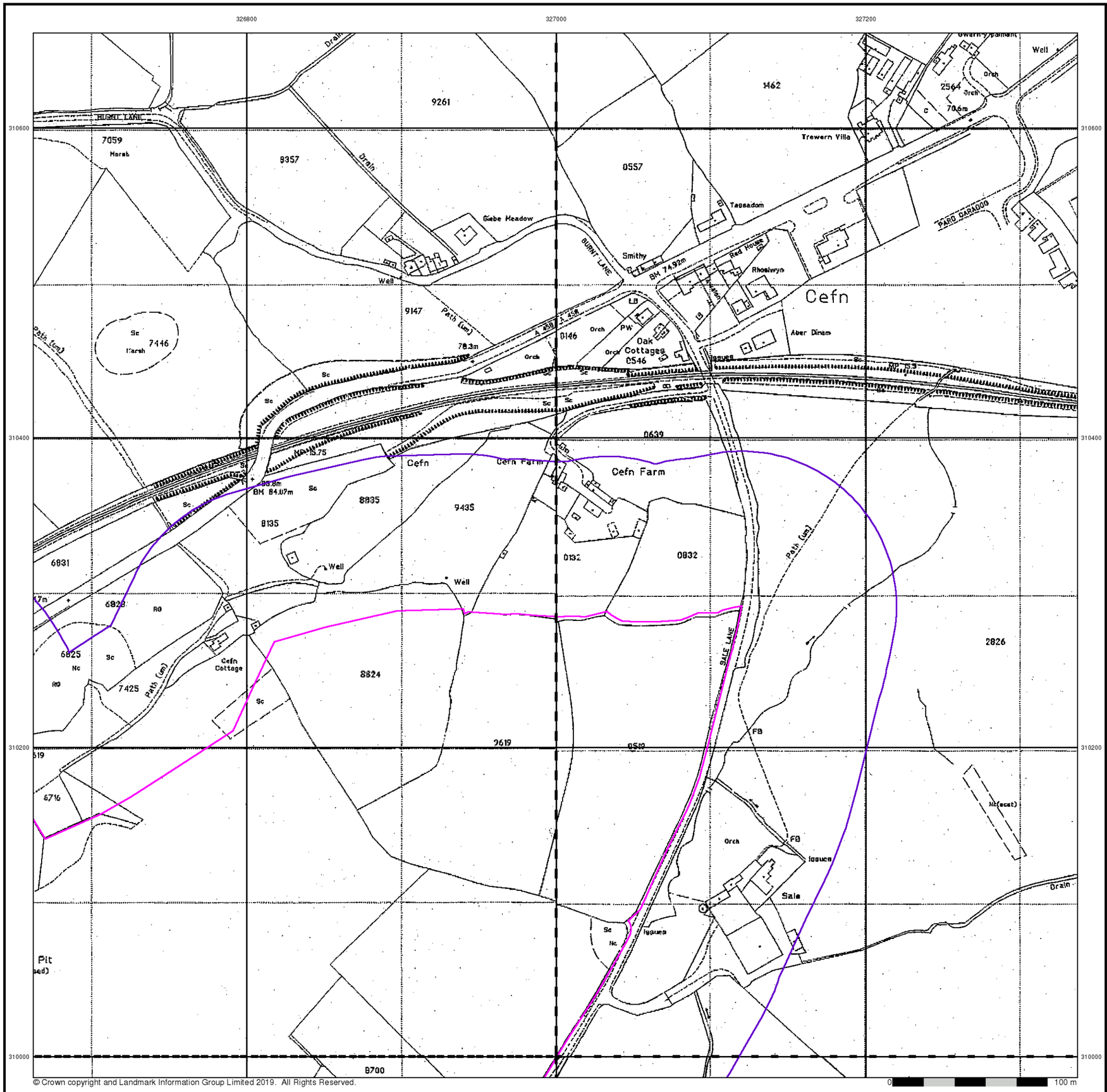


terrafirma

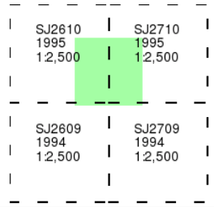
Large-Scale National Grid Data

Published 1994 - 1995

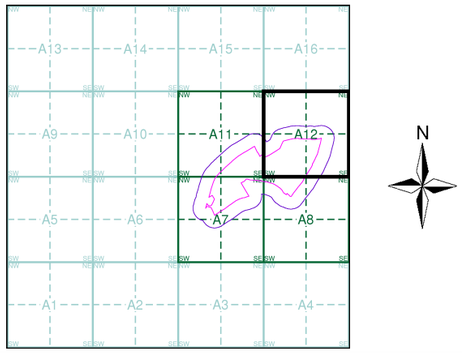
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A12



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	100

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

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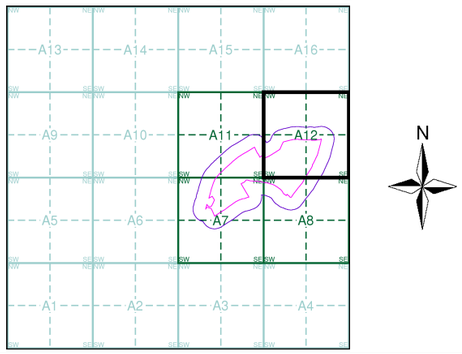
Historical Aerial Photography

Published 2000

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A12



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Historical Mapping Legends

Ordnance Survey County Series 1:10,560

Gravel Pit
Sand Pit
Other Pits
Quarry
Shingle
Orchard
Osiers
Reeds
Marsh
Mixed Wood
Deciduous
Brushwood
Fir
Furze
Rough Pasture
Arrow denotes flow of water
Trigonometrical Station
Site of Antiquities
Bench Mark
Pump, Guide Post, Signal Post
Well, Spring, Boundary Post
·285 Surface Level
Sketched Contour
Instrumental Contour
Main Roads
Fenced
Un-Fenced
Minor Roads
Fenced
Un-Fenced
Sunken Road
Raised Road
Road over Railway
Railway over River
Railway over Road
Level Crossing
Road over River or Canal
Road over Stream
Road over Stream
County Boundary (Geographical)
County & Civil Parish Boundary
Administrative County & Civil Parish Boundary
Co. Boro. Bdy. County Borough Boundary (England)
Co. Burgh Bdy. County Burgh Boundary (Scotland)
R.D. Bdy. Rural District Boundary
Civil Parish Boundary

Ordnance Survey Plan 1:10,000

Chalk Pit, Clay Pit or Quarry
Gravel Pit
Sand Pit
Disused Pit or Quarry
Refuse or Slag Heap
Lake, Loch or Pond
Dunes
Boulders
Coniferous Trees
Non-Coniferous Trees
Orchard
Scrub
Coppice
Bracken
Heath
Rough Grassland
Marsh
Reeds
Saltings
Building
Direction of Flow of Water
Shingle
Sand
Glasshouse
Pylon
Pylon
Electricity Transmission Line
Sloping Masonry
Cutting
Embankment
Standard Gauge Multiple Track
Road Under
Road Over
Level Crossing
Foot Bridge
Standard Gauge Single Track
Siding, Tramway or Mineral Line
Narrow Gauge
Geographical County
Administrative County, County Borough or County of City
Municipal Borough, Urban or Rural District, Burgh or District Council
Borough, Burgh or County Constituency
Shown only when not coincident with other boundaries
Civil Parish
Shown alternately when coincidence of boundaries occurs

BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Convenience
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Call Box
MP	Mile Post	TCP	Telephone Call Post
MS	Mile Stone	W	Well

1:10,000 Raster Mapping

Gravel Pit
Refuse tip or slag heap
Rock
Rock (scattered)
Boulders
Boulders (scattered)
Shingle
Mud
Sand
Sand Pit
Slopes
Top of cliff
General detail
Underground detail
Overhead detail
Narrow gauge railway
Multi-track railway
Single track railway
County boundary (England only)
Civil, parish or community boundary
District, Unitary, Metropolitan, London Borough boundary
Constituency boundary
Area of wooded vegetation
Non-coniferous trees
Non-coniferous trees (scattered)
Coniferous trees
Coniferous trees (scattered)
Positioned tree
Orchard
Coppice or Osiers
Rough Grassland
Heath
Scrub
Marsh, Salt Marsh or Reeds
Water feature
Flow arrows
MHW(S) Mean high water (springs)
MLW(S) Mean low water (springs)
Telephone line (where shown)
Electricity transmission line (with poles)
BM 123.45 m Bench mark (where shown)
Triangulation station
Point feature (e.g. Guide Post or Mile Stone)
Pylon, flare stack or lighting tower
Site of (antiquity)
Glasshouse
General Building
Important Building

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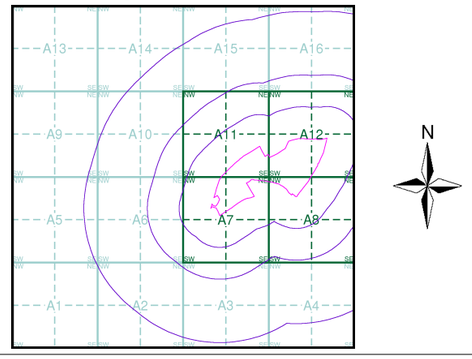
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Montgomeryshire	1:10,560	1884 - 1886	2
Montgomeryshire	1:10,560	1902 - 1903	3
Shropshire	1:10,560	1903	4
Montgomeryshire	1:10,560	1938 - 1953	5
Montgomeryshire	1:10,560	1953	6
Ordnance Survey Plan	1:10,000	1954	7
Ordnance Survey Plan	1:10,000	1963 - 1969	8
Ordnance Survey Plan	1:10,000	1976 - 1978	9
Ordnance Survey Plan	1:10,000	1980	10
10K Raster Mapping	1:10,000	2000	11
10K Raster Mapping	1:10,000	2006	12
VectorMap Local	1:10,000	2019	13

Historical Map - Slice A



Order Details

Order Number: 196125587_1_1
Customer Ref: 14880
National Grid Reference: 326380, 309950
Slice: A
Site Area (Ha): 25.12
Search Buffer (m): 1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

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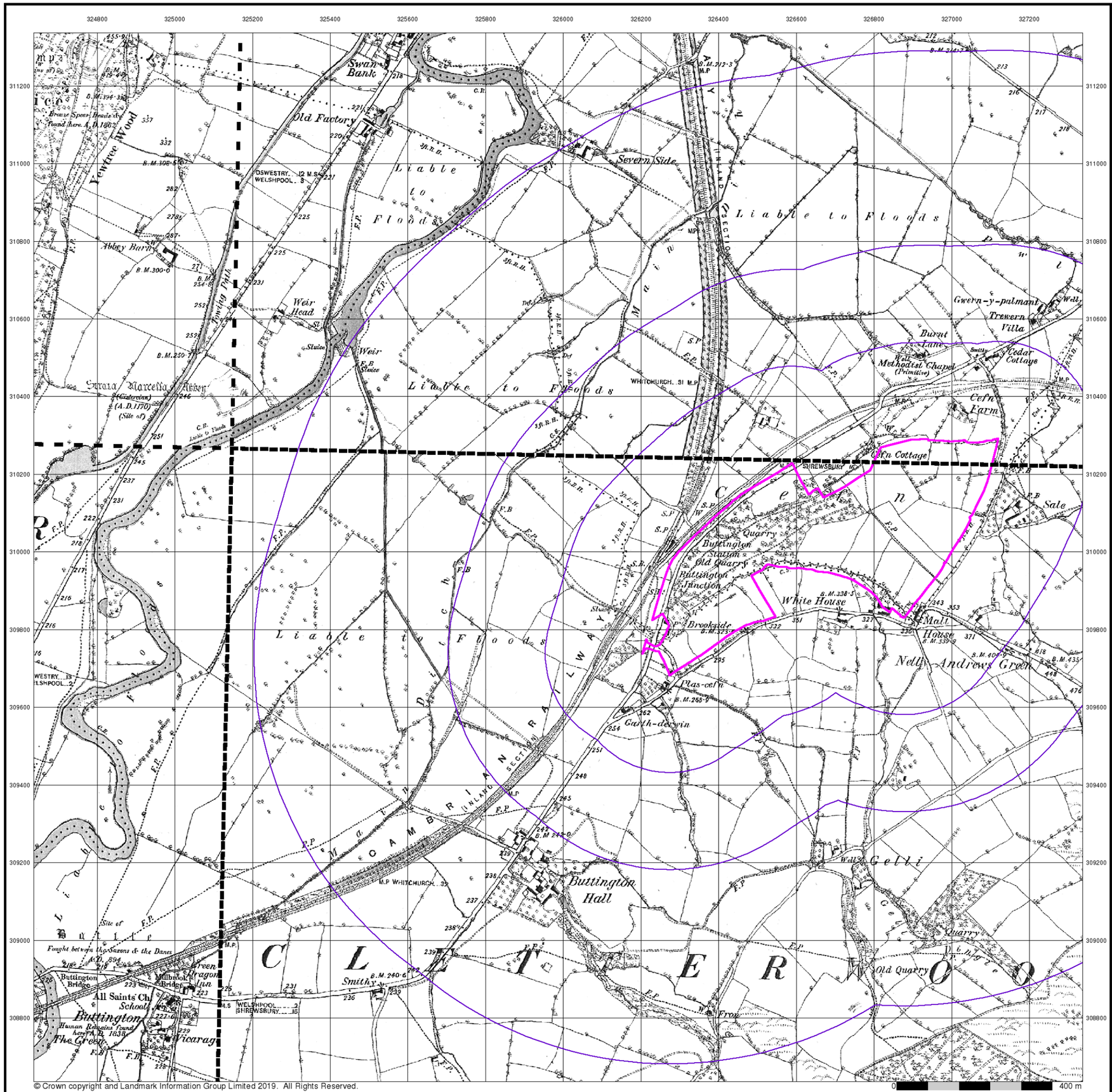

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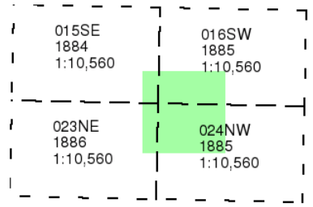
Montgomeryshire

Published 1884 - 1886

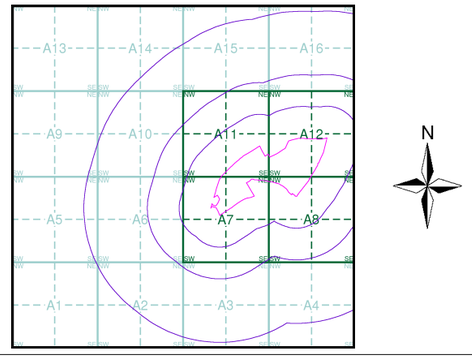
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
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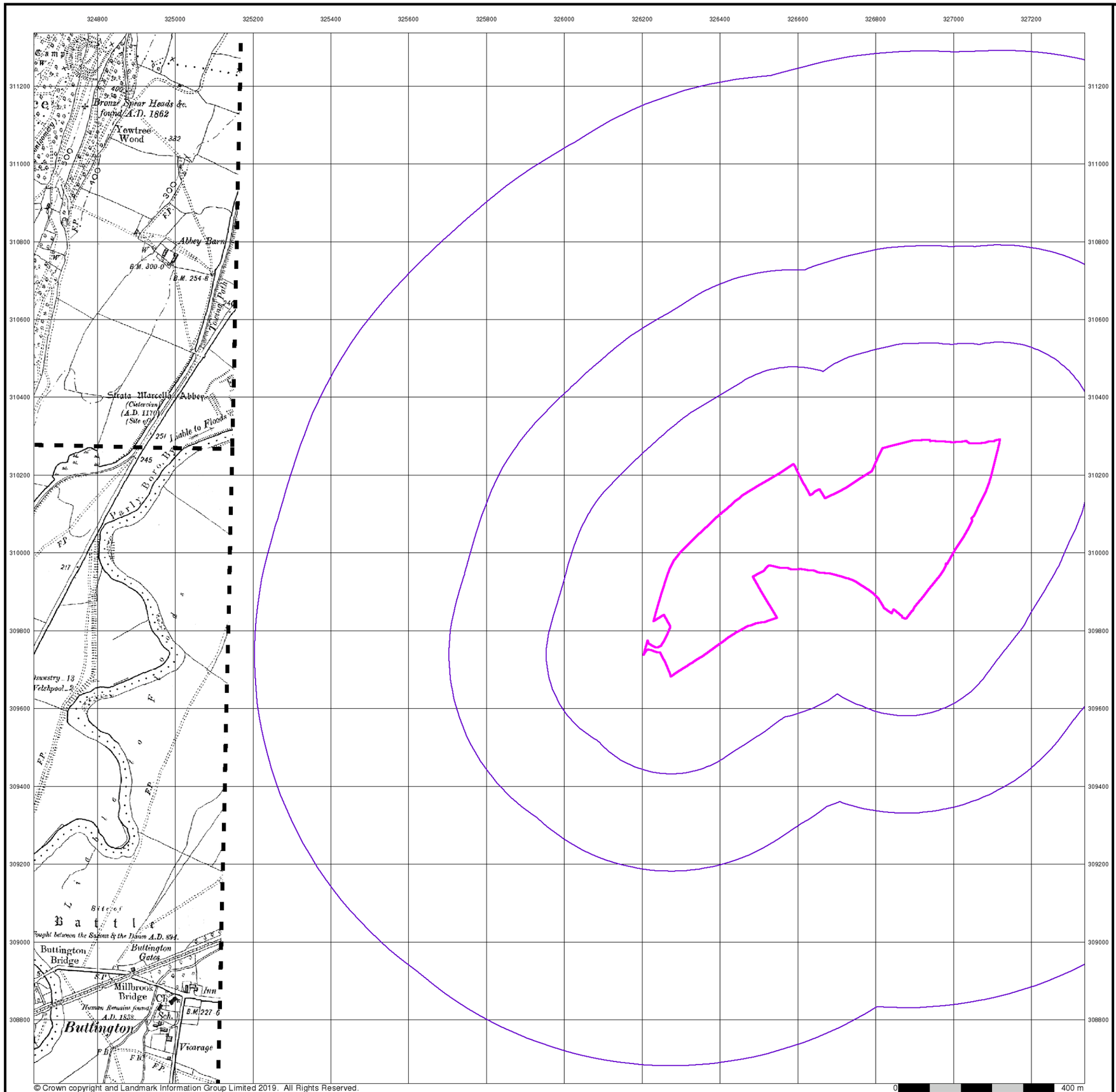


terrafirma

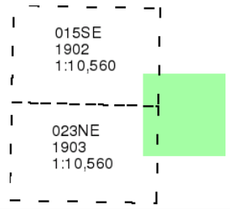
Montgomeryshire

Published 1902 - 1903

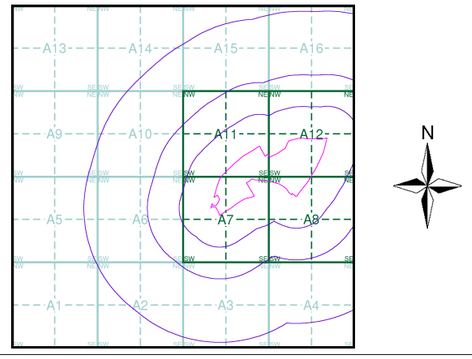
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

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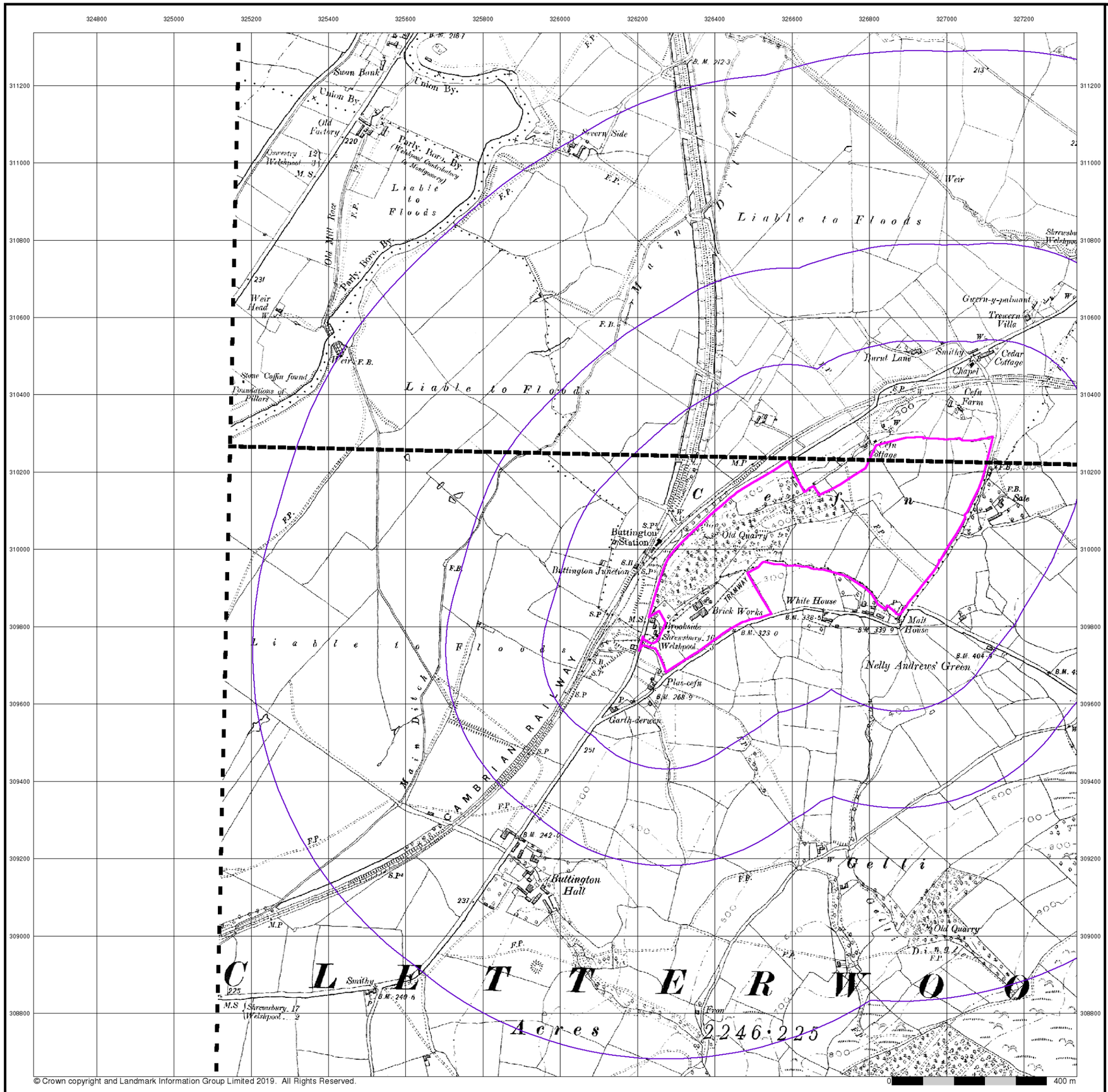

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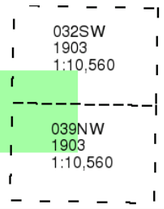
Shropshire

Published 1903

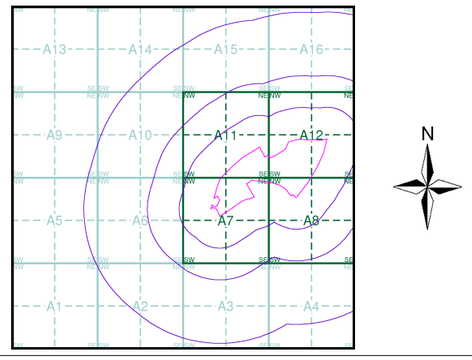
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

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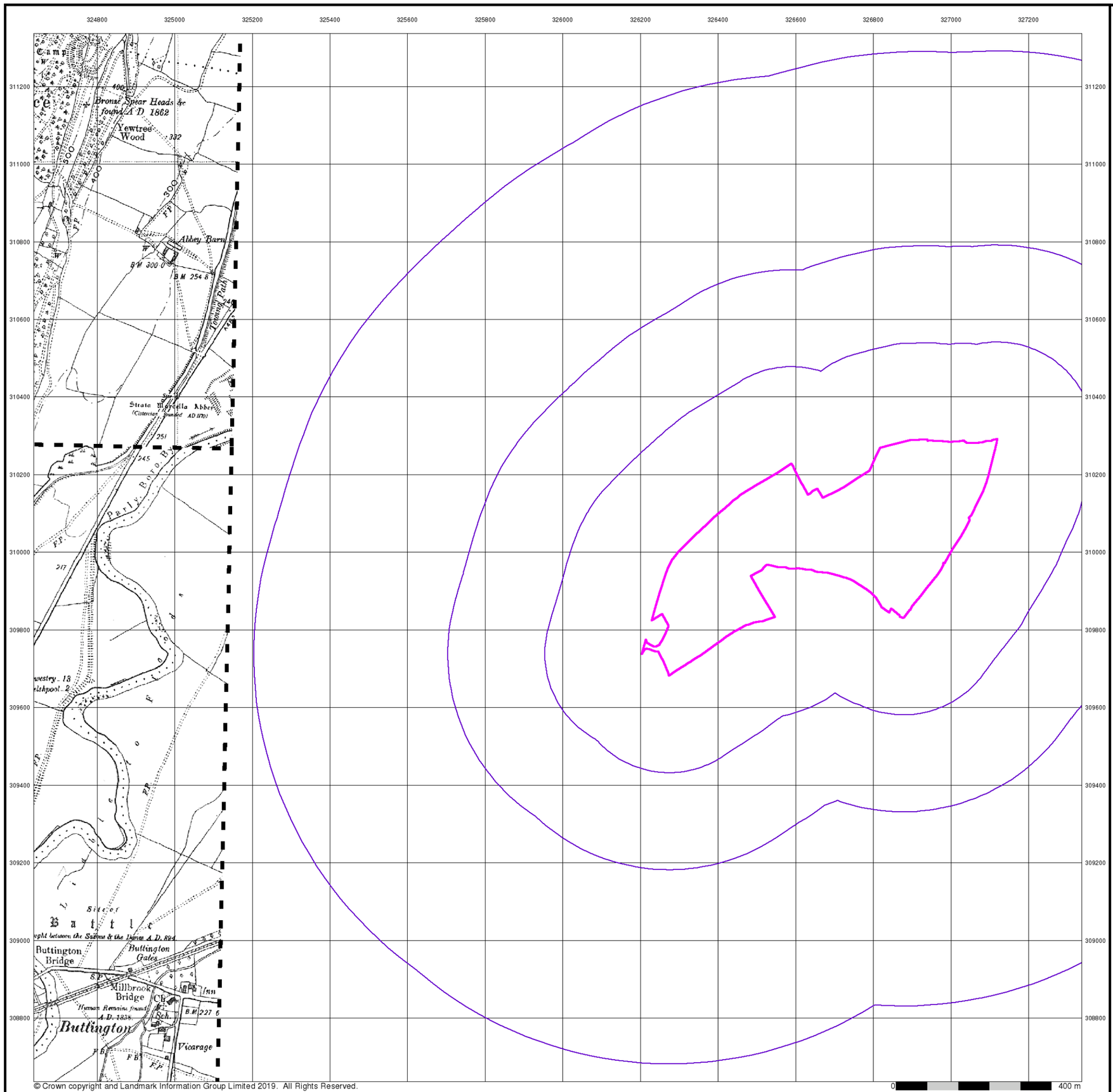

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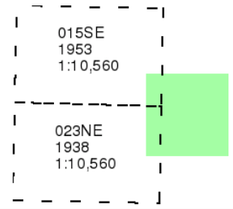
Montgomeryshire

Published 1938 - 1953

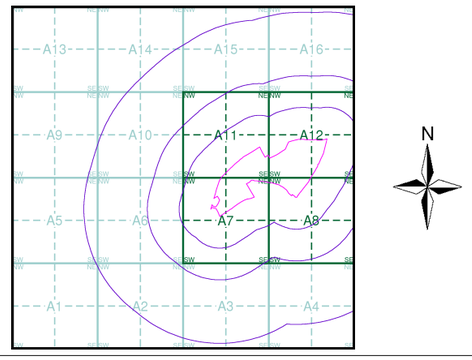
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	196125587_1_1
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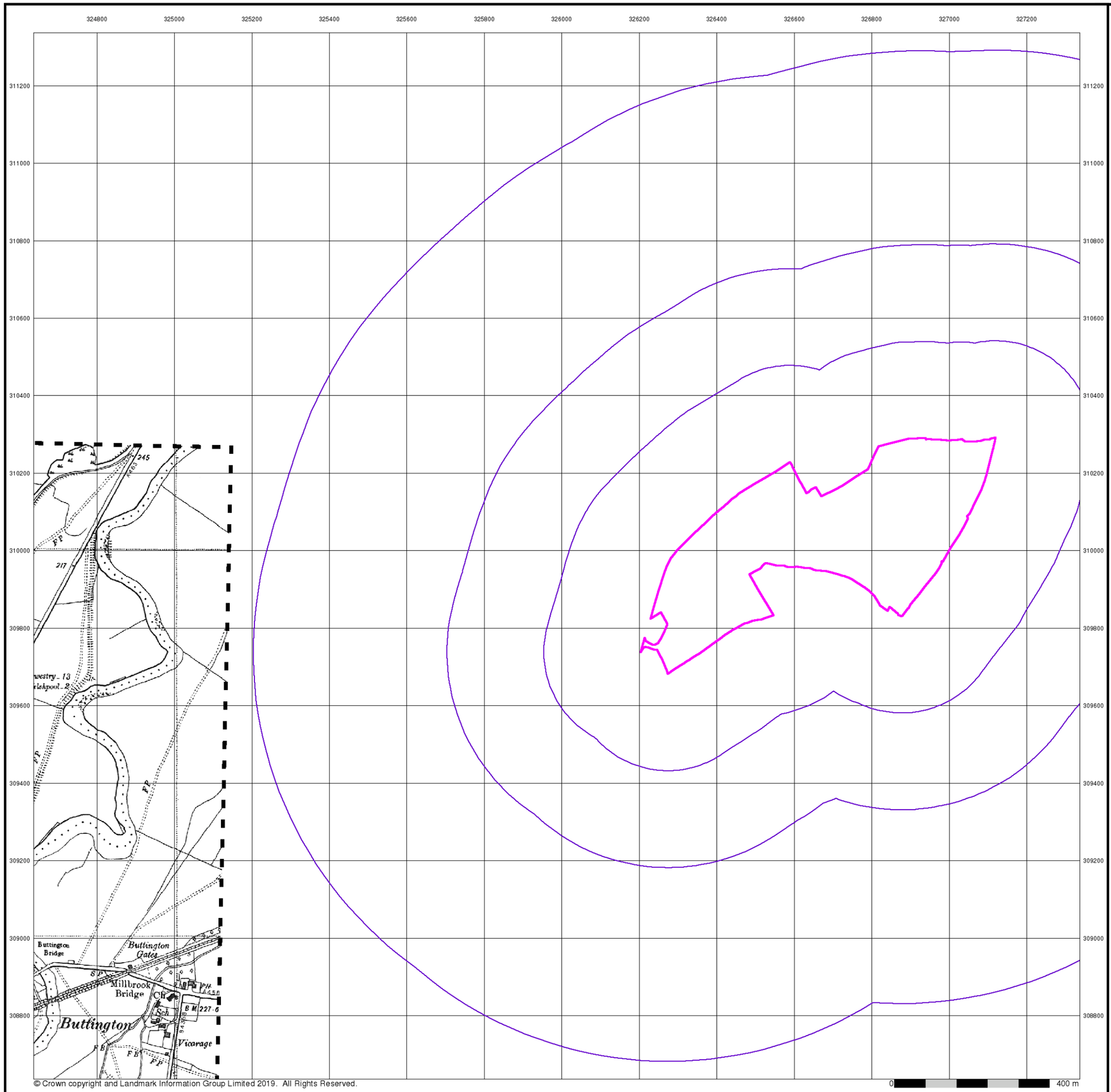


terrafirma

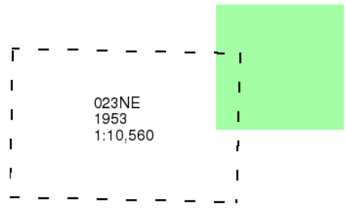
Montgomeryshire

Published 1953

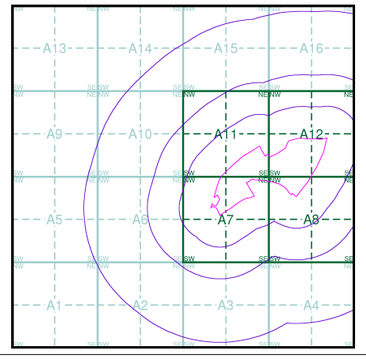
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



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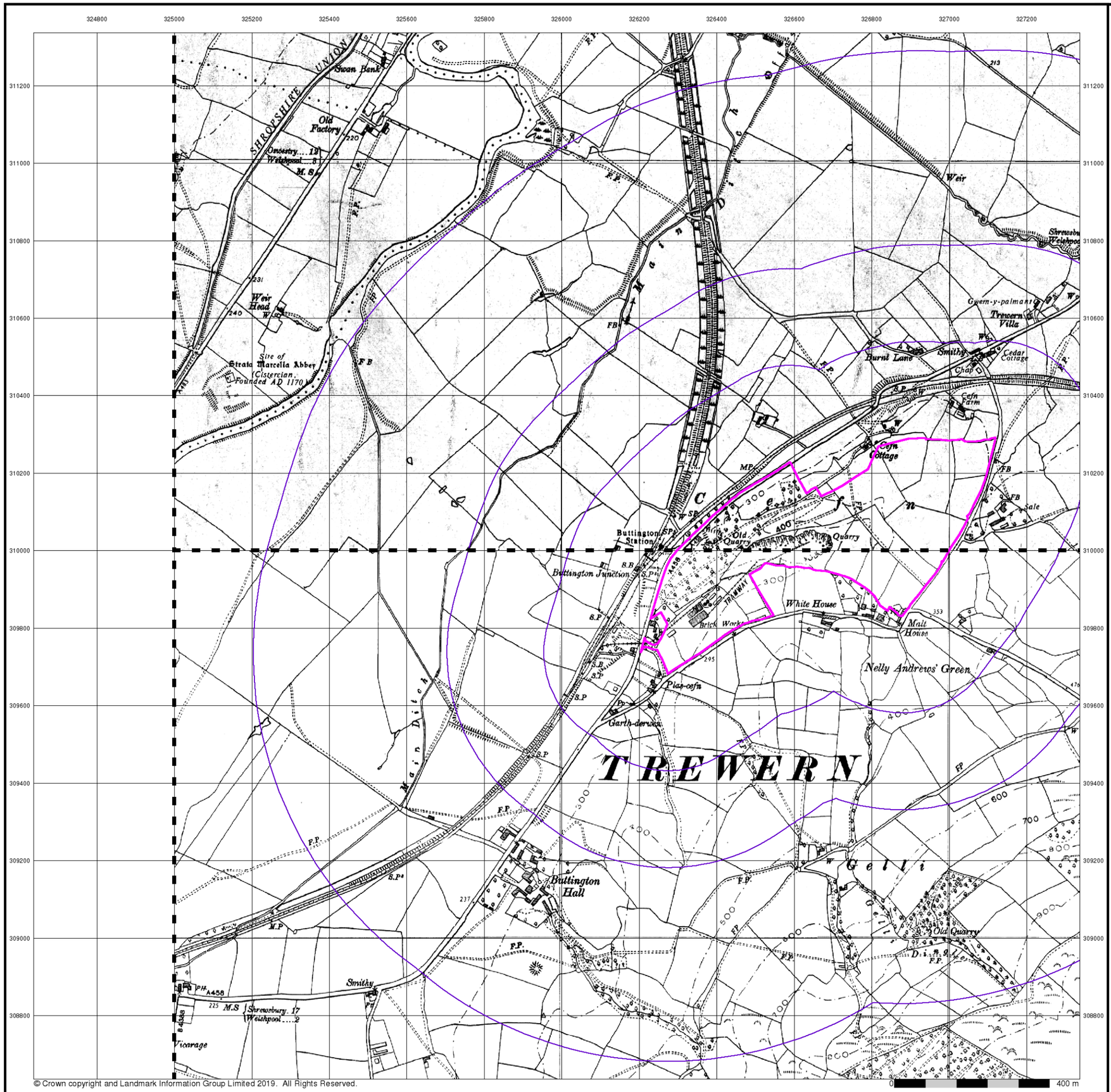

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Ordnance Survey Plan

Published 1954

Source map scale - 1:10,000

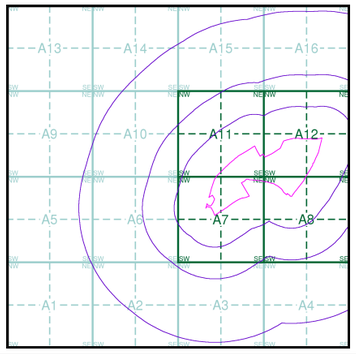
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)

SJ21SE
1954
1:10,560

SJ20NE
1954
1:10,560

Historical Map - Slice A



Order Details

Order Number:	196125587_1_1
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Site Area (Ha):	25.12
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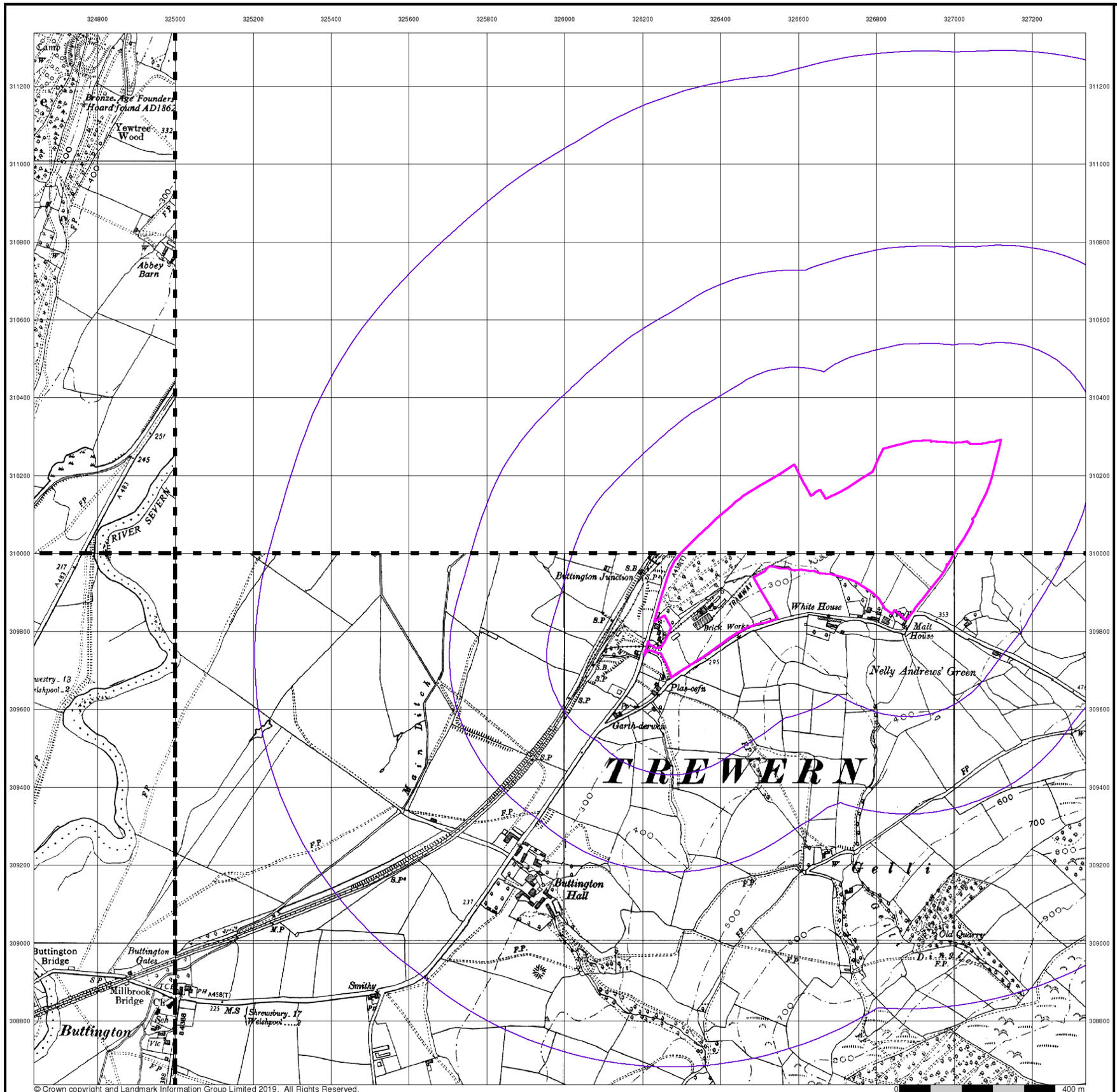

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Ordnance Survey Plan

Published 1963 - 1969

Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

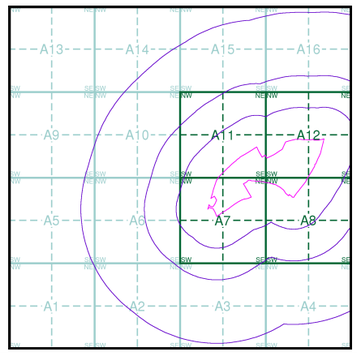
Map Name(s) and Date(s)

SJ21SW
1963
1:10,560

SJ20NW
1964
1:10,560

SJ20NE
1969
1:10,560

Historical Map - Slice A



Order Details

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Site Area (Ha):	25.12
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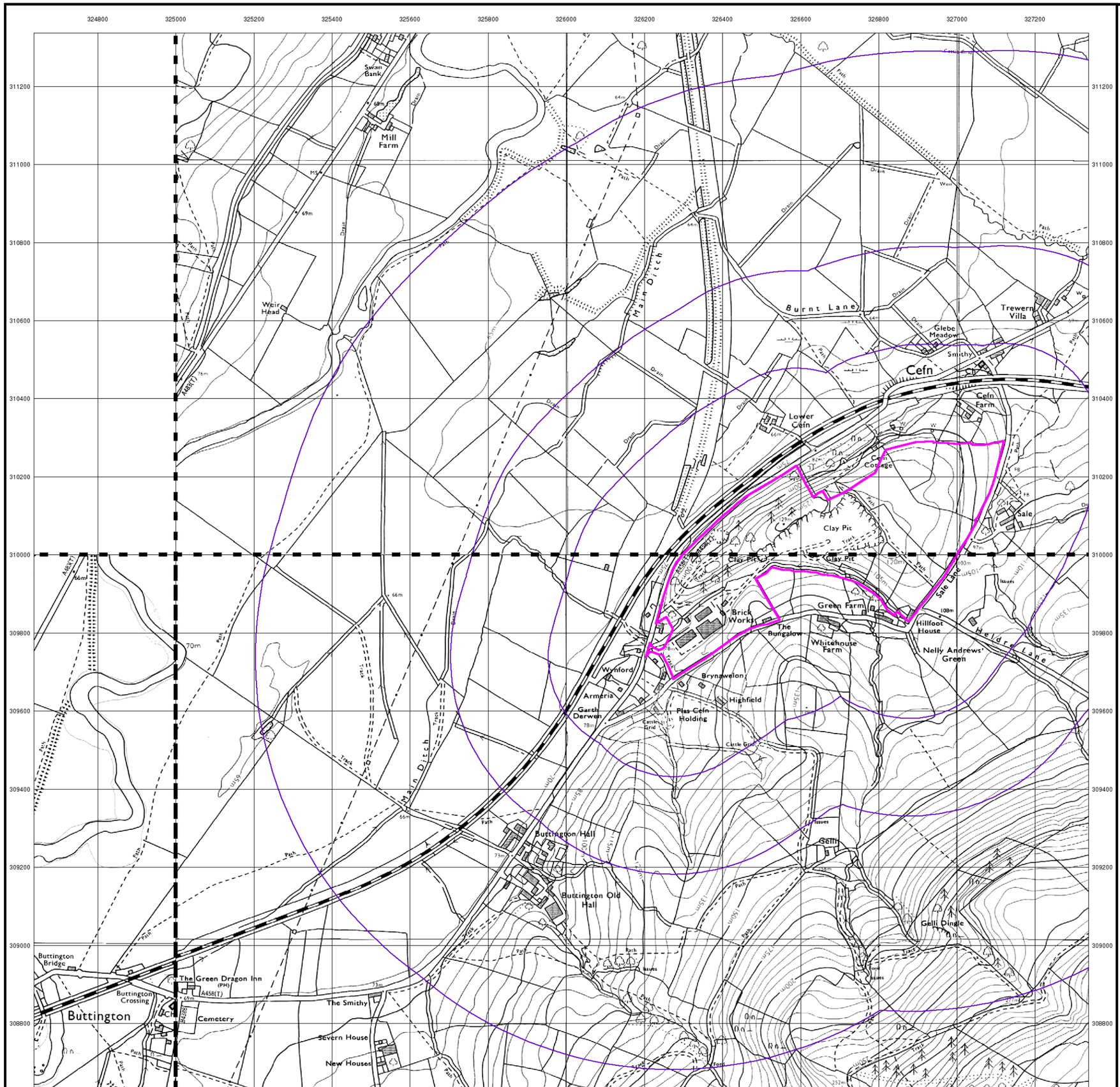

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Ordnance Survey Plan

Published 1976 - 1978

Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

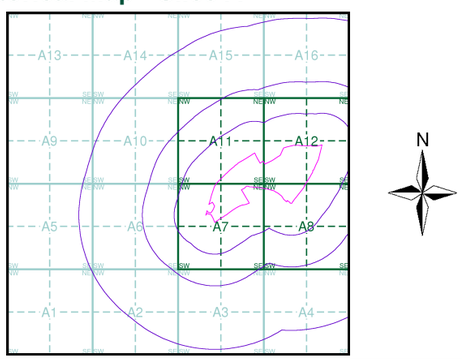
Map Name(s) and Date(s)

SJ21SE
1976
1:10,000

SJ20NW
1978
1:10,000

SJ20NE
1976
1:10,000

Historical Map - Slice A



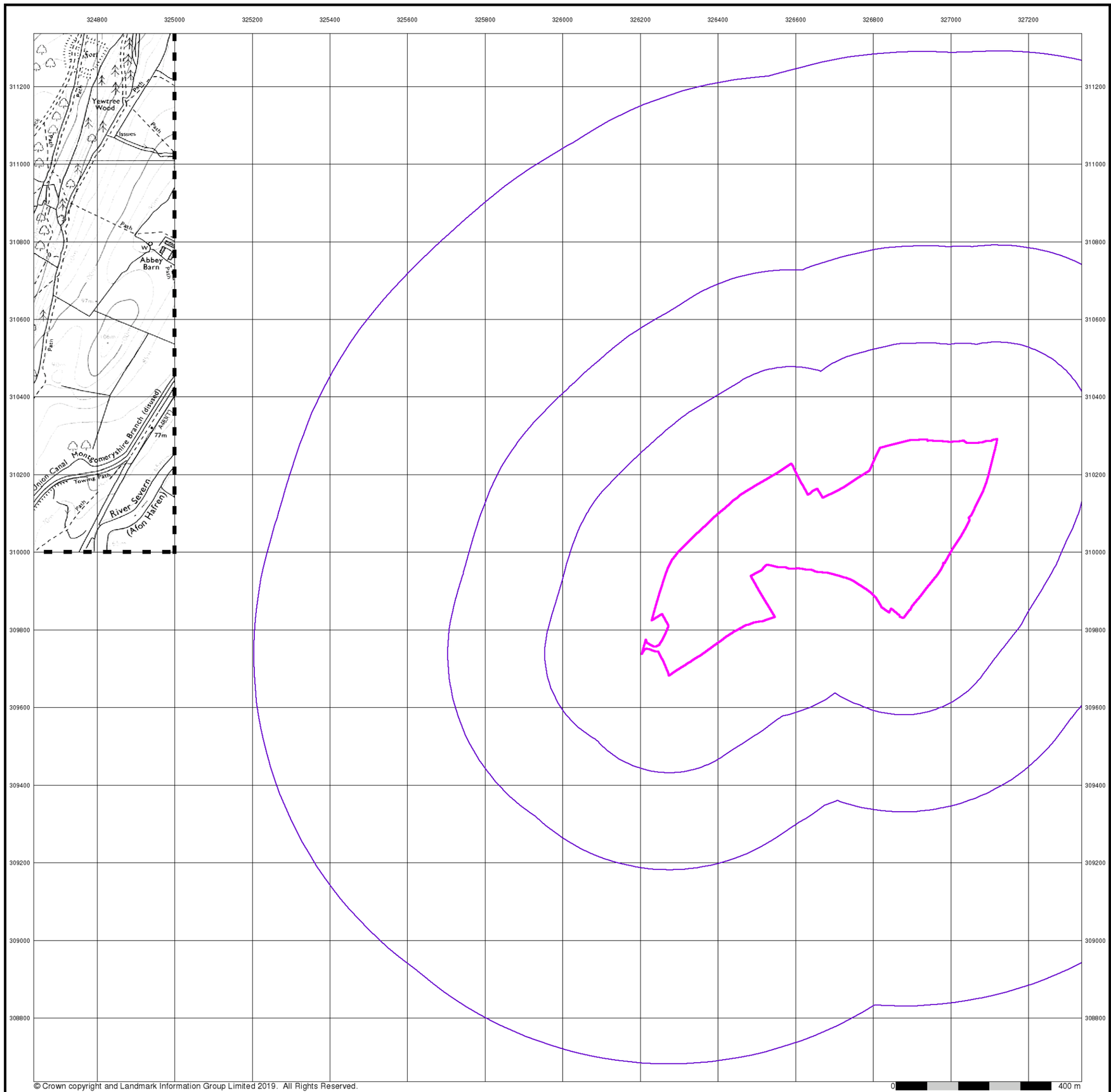
Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	326380, 309950
Slice:	A
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



0 400 m

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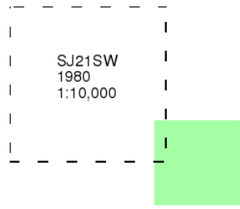
Ordnance Survey Plan

Published 1980

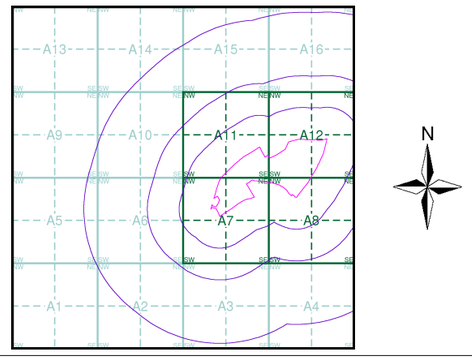
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



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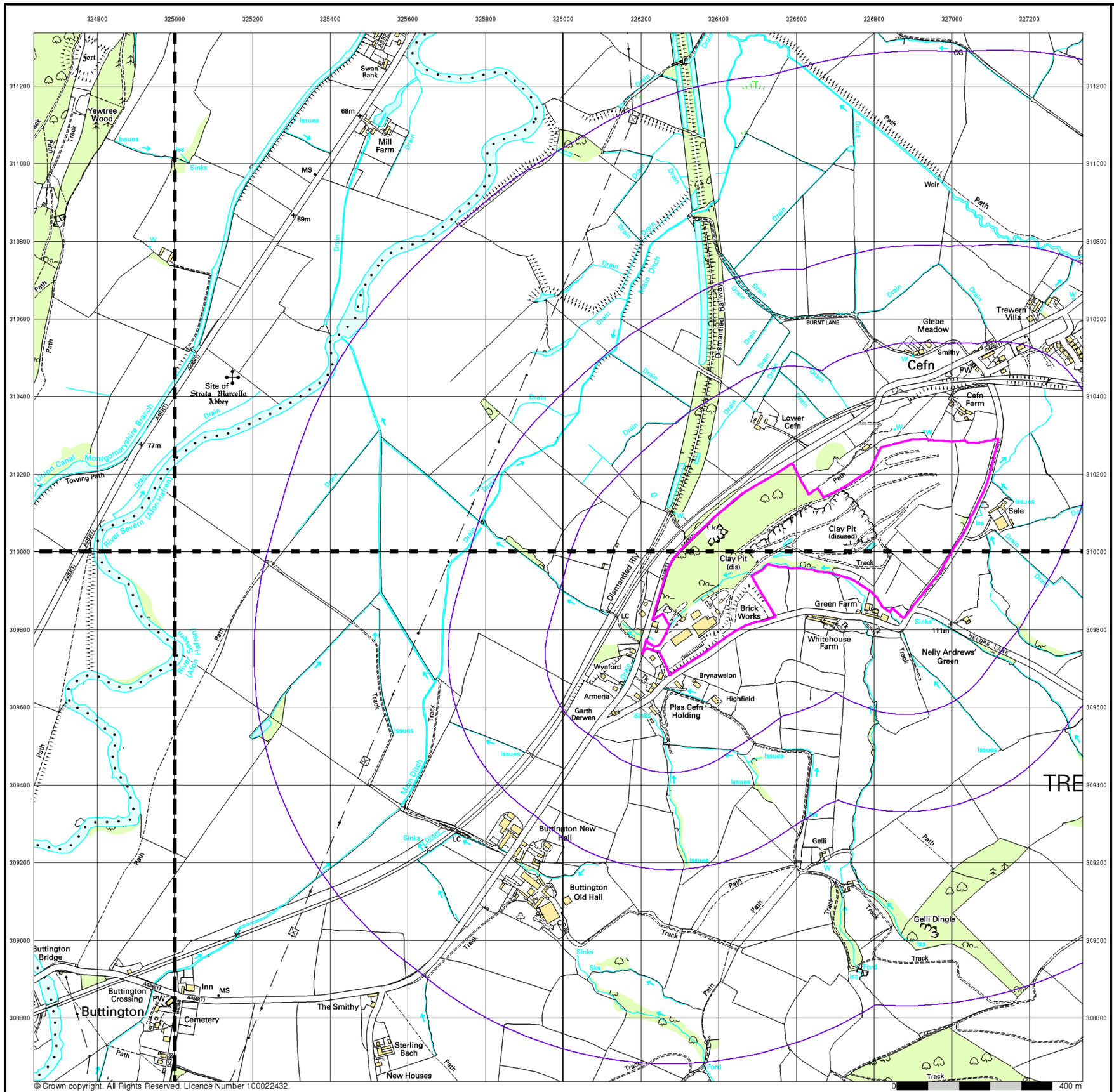


terrafirma

10k Raster Mapping

Published 2000

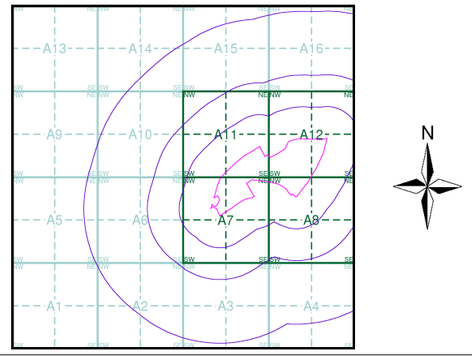
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

SJ21SW 2000 1:10,000	SJ21SE 2000 1:10,000
SJ20NW 2000 1:10,000	SJ20NE 2000 1:10,000

Historical Map - Slice A



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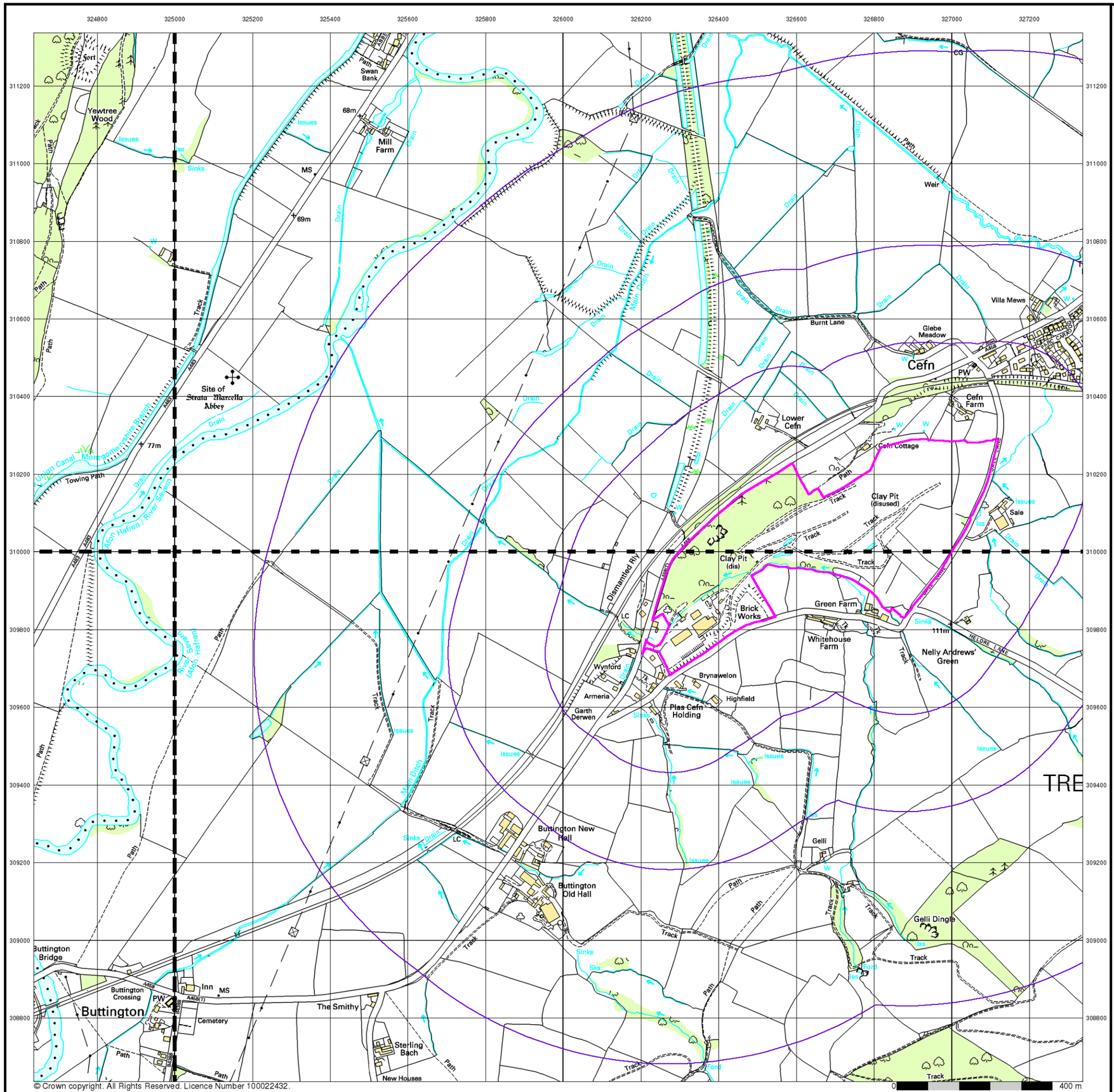


0 400 m

terrafirma

10k Raster Mapping

Published 2006

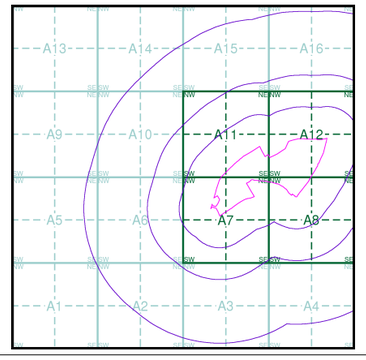
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

SJ21SW 2006 1:10,000	SJ21SE 2006 1:10,000
SJ20NW 2006 1:10,000	SJ20NE 2006 1:10,000

Historical Map - Slice A



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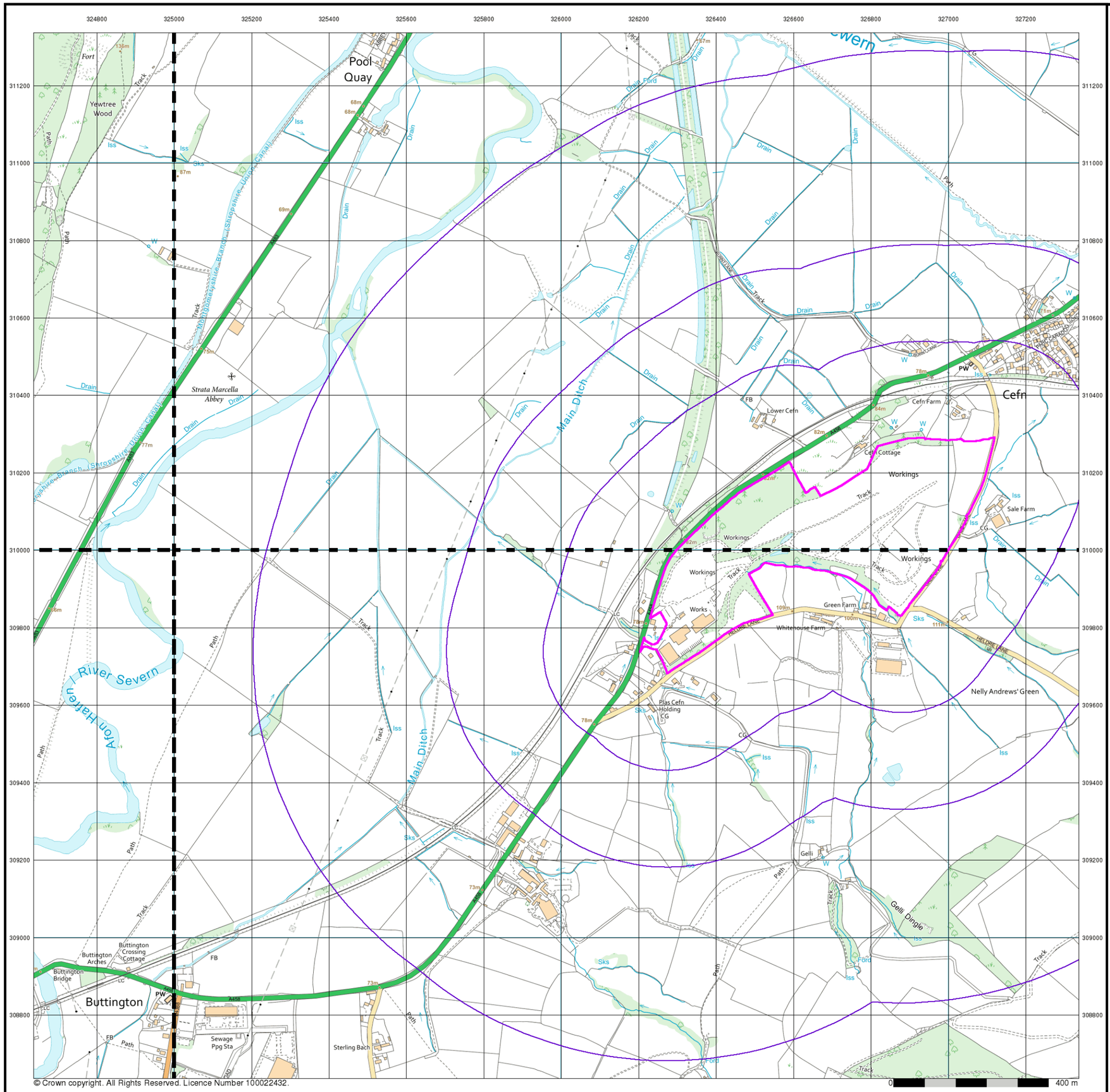

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VectorMap Local

Published 2019

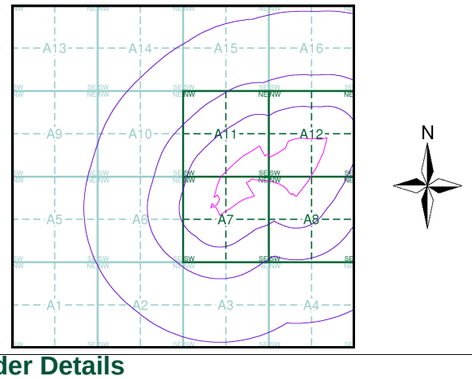
Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)

SJ21SW 2019 Variable	SJ21SE 2019 Variable
SJ20NW 2019 Variable	SJ20NE 2019 Variable

Historical Map - Slice A



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Historical Mapping Legends

Ordnance Survey County Series 1:10,560

Gravel Pit
Sand Pit
Other Pits
Quarry
Shingle
Orchard
Osiers
Reeds
Marsh
Mixed Wood
Deciduous
Brushwood
Fir
Furze
Rough Pasture
Arrow denotes flow of water
Trigonometrical Station
Site of Antiquities
Bench Mark
Pump, Guide Post, Signal Post
Well, Spring, Boundary Post
·285 Surface Level
Sketched Contour
Instrumental Contour
Main Roads
Fenced
Un-Fenced
Minor Roads
Fenced
Un-Fenced
Sunken Road
Raised Road
Road over Railway
Railway over River
Railway over Road
Level Crossing
Road over River or Canal
Road over Stream
Road over Stream
County Boundary (Geographical)
County & Civil Parish Boundary
Administrative County & Civil Parish Boundary
Co. Boro. Bdy. County Borough Boundary (England)
Co. Burgh Bdy. County Burgh Boundary (Scotland)
R.D. Bdy. Rural District Boundary
Civil Parish Boundary

Ordnance Survey Plan 1:10,000

Chalk Pit, Clay Pit or Quarry
Gravel Pit
Sand Pit
Disused Pit or Quarry
Refuse or Slag Heap
Lake, Loch or Pond
Dunes
Boulders
Coniferous Trees
Non-Coniferous Trees
Orchard
Scrub
Coppice
Bracken
Heath
Rough Grassland
Marsh
Reeds
Saltings
Building
Direction of Flow of Water
Shingle
Sand
Glasshouse
Pylon
Pylon
Electricity Transmission Line
Sloping Masonry
Cutting
Embankment
Standard Gauge Multiple Track
Road Under
Road Over
Level Crossing
Foot Bridge
Standard Gauge Single Track
Siding, Tramway or Mineral Line
Narrow Gauge
Geographical County
Administrative County, County Borough or County of City
Municipal Borough, Urban or Rural District, Burgh or District Council
Borough, Burgh or County Constituency
Shown only when not coincident with other boundaries
Civil Parish
Shown alternately when coincidence of boundaries occurs

BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Convenience
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Call Box
MP	Mile Post	TCP	Telephone Call Post
MS	Mile Stone	W	Well

1:10,000 Raster Mapping

Gravel Pit
Refuse tip or slag heap
Rock
Rock (scattered)
Boulders
Boulders (scattered)
Shingle
Mud
Sand
Sand Pit
Slopes
Top of cliff
General detail
Underground detail
Overhead detail
Narrow gauge railway
Multi-track railway
Single track railway
County boundary (England only)
Civil, parish or community boundary
District, Unitary, Metropolitan, London Borough boundary
Constituency boundary
Area of wooded vegetation
Non-coniferous trees
Non-coniferous trees (scattered)
Coniferous trees
Coniferous trees (scattered)
Positioned tree
Orchard
Coppice or Osiers
Rough Grassland
Heath
Scrub
Marsh, Salt Marsh or Reeds
Water feature
Flow arrows
MHW(S) Mean high water (springs)
MLW(S) Mean low water (springs)
Telephone line (where shown)
Electricity transmission line (with poles)
BM 123.45 m Bench mark (where shown)
Triangulation station
Point feature (e.g. Guide Post or Mile Stone)
Pylon, flare stack or lighting tower
Site of (antiquity)
Glasshouse
General Building
Important Building

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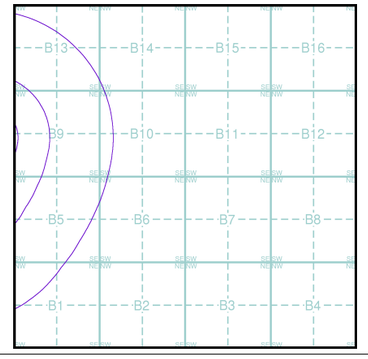
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Shropshire	1:10,560	1883 - 1886	2
Montgomeryshire	1:10,560	1885	3
Shropshire	1:10,560	1902 - 1903	4
Ordnance Survey Plan	1:10,000	1954	5
Ordnance Survey Plan	1:10,000	1969	6
Ordnance Survey Plan	1:10,000	1970 - 1976	7
Ordnance Survey Plan	1:10,000	1978	8
10K Raster Mapping	1:10,000	2000	9
10K Raster Mapping	1:10,000	2006	10
VectorMap Local	1:10,000	2019	11

Historical Map - Slice B



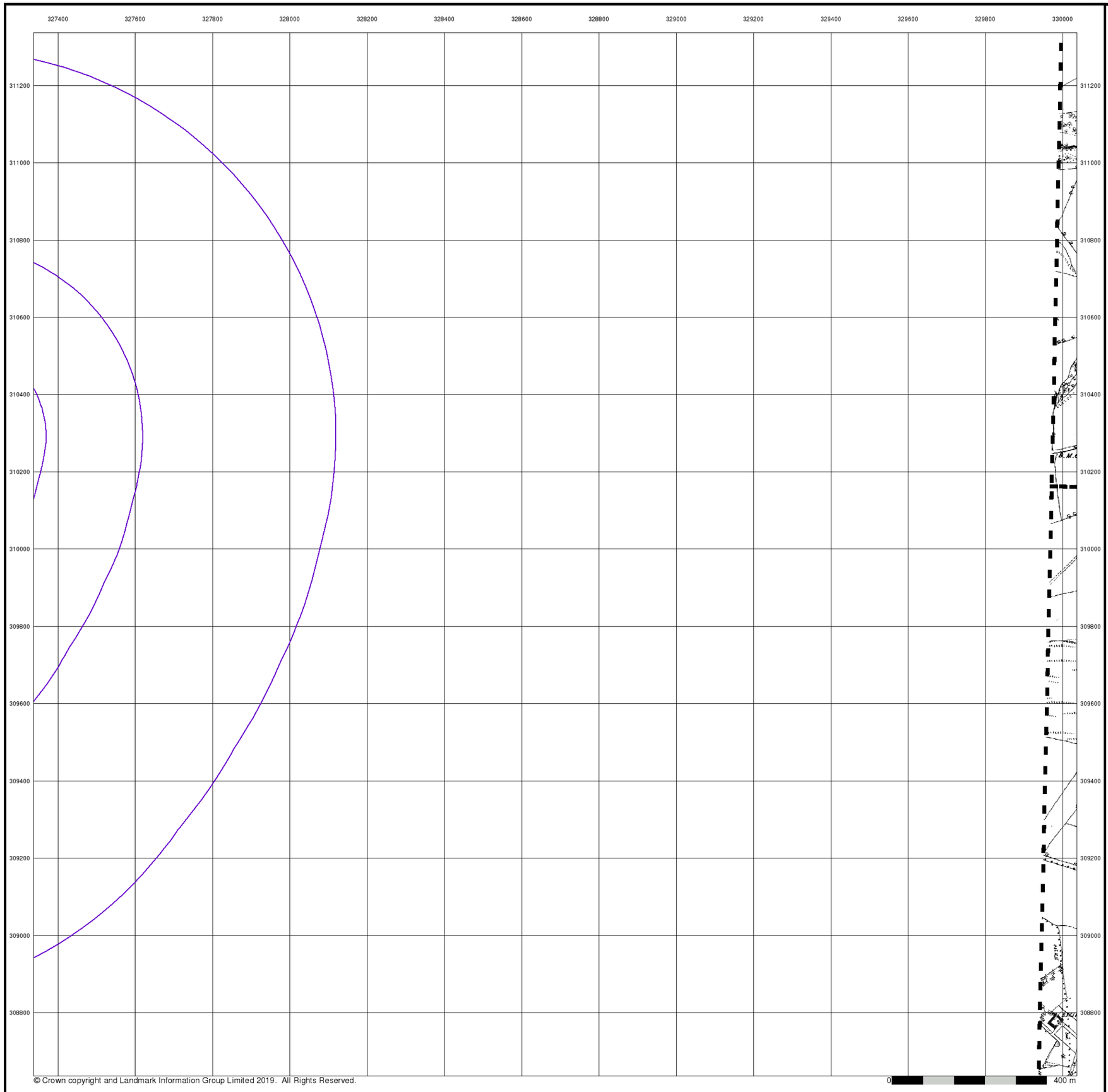
Order Details

Order Number: 196125587_1_1
Customer Ref: 14880
National Grid Reference: 327660, 310170
Slice: B
Site Area (Ha): 25.12
Search Buffer (m): 1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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Shropshire

Published 1883 - 1886

Source map scale - 1:10,560

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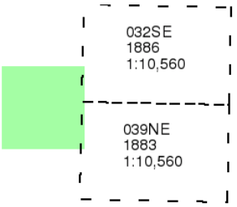
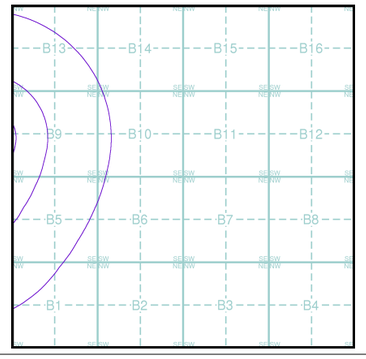
Map Name(s) and Date(s)



Historical Map - Slice B



Order Details

Order Number:	196125587_1_1
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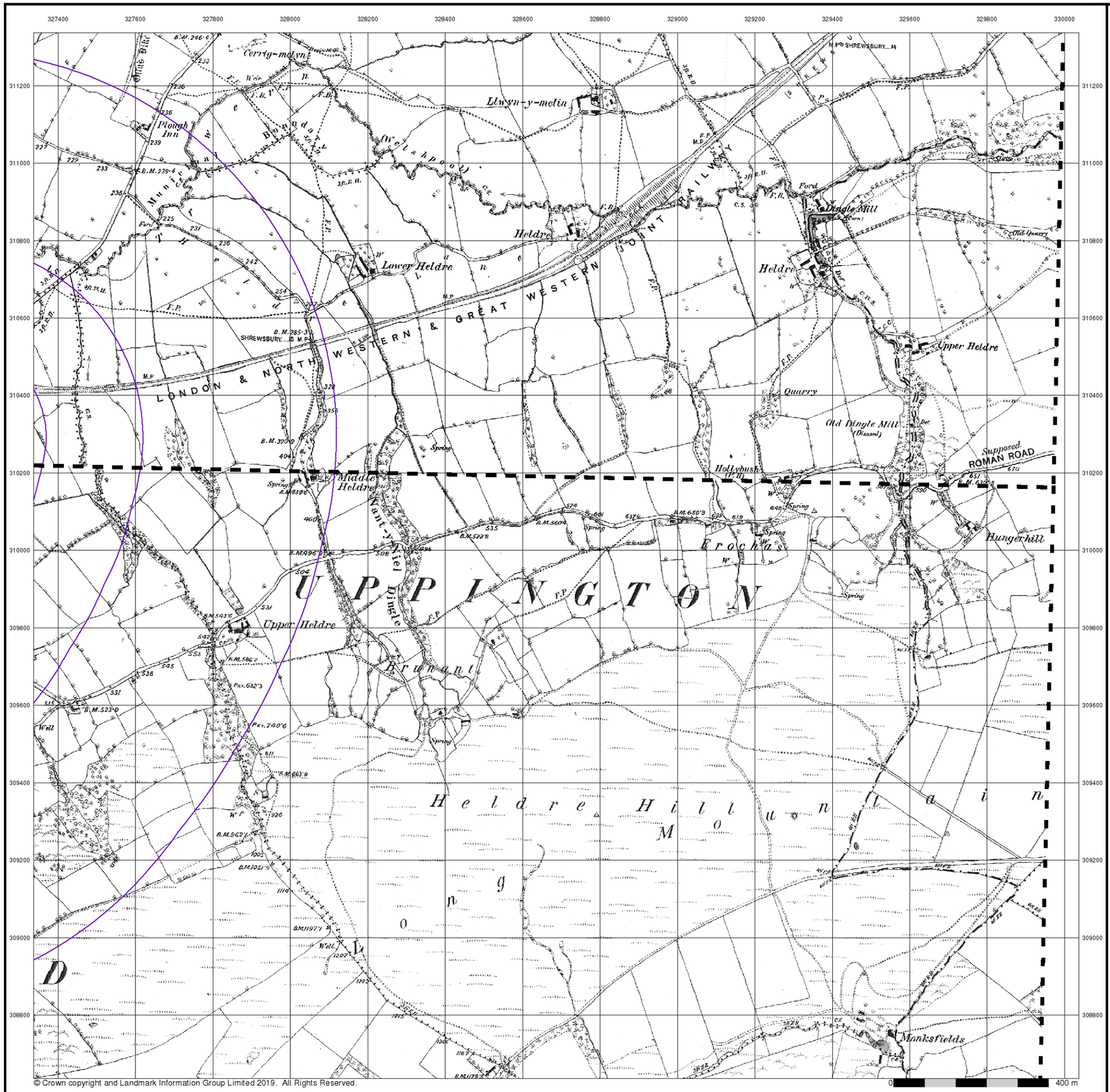

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Montgomeryshire

Published 1885

Source map scale - 1:10,560

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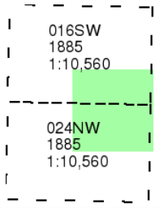
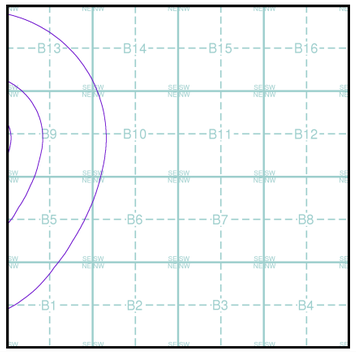


Historical Map - Slice B



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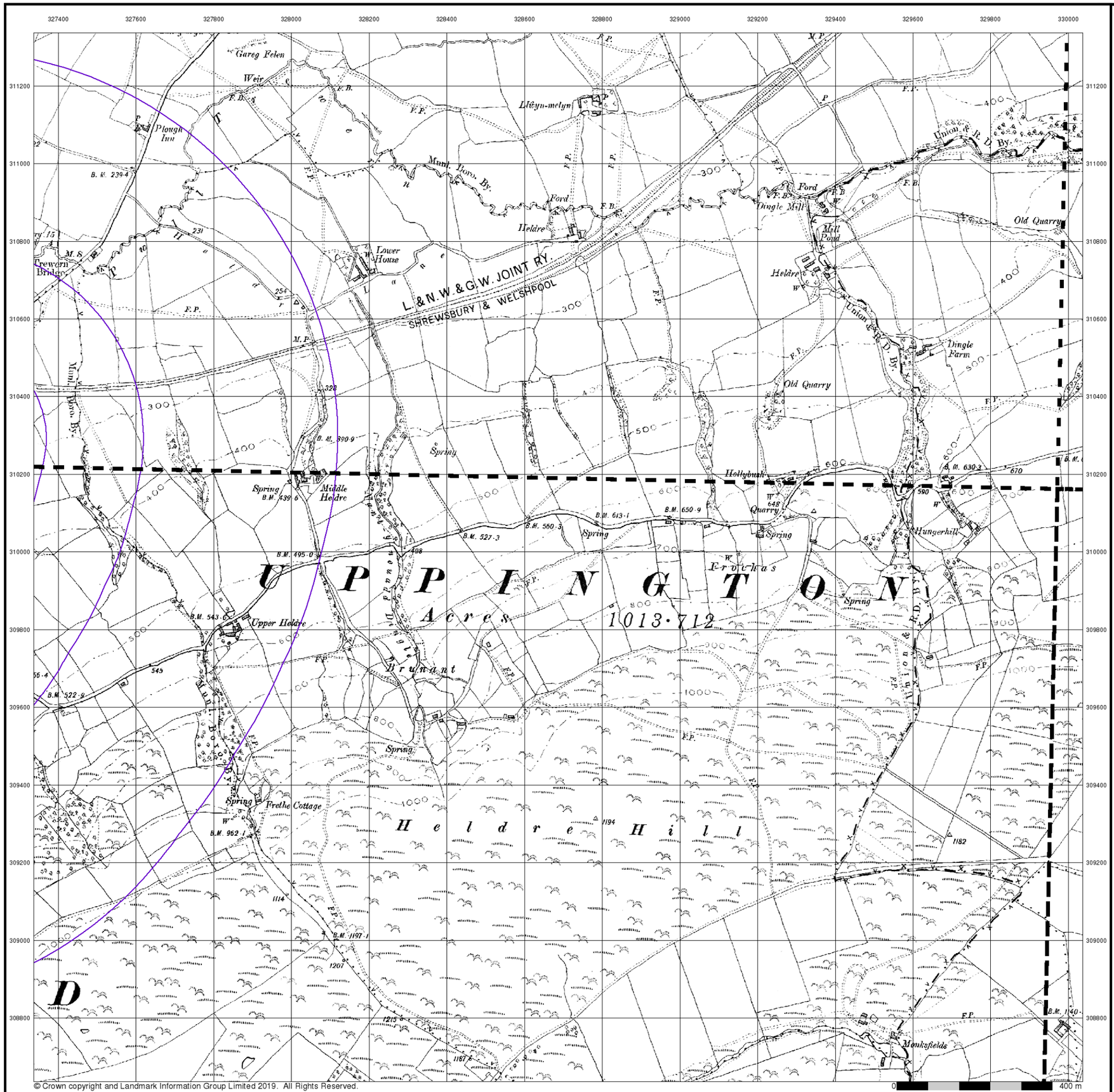

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Shropshire

Published 1902 - 1903

Source map scale - 1:10,560

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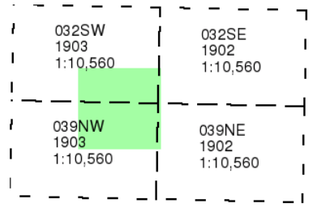
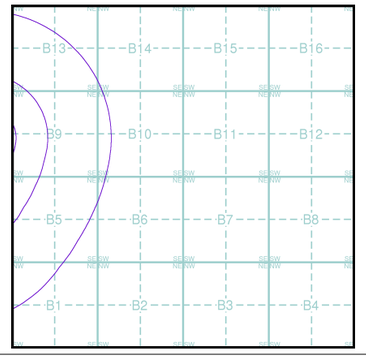
Map Name(s) and Date(s)



Historical Map - Slice B



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Ordnance Survey Plan

Published 1954

Source map scale - 1:10,000

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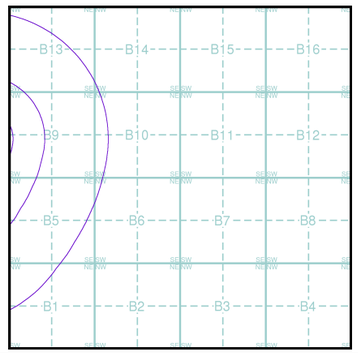
Map Name(s) and Date(s)

SJ21SE 1954 1:10,560	SJ31SW 1954 1:10,560
SJ20NE 1954 1:10,560	SJ30NW 1954 1:10,560

Historical Map - Slice B



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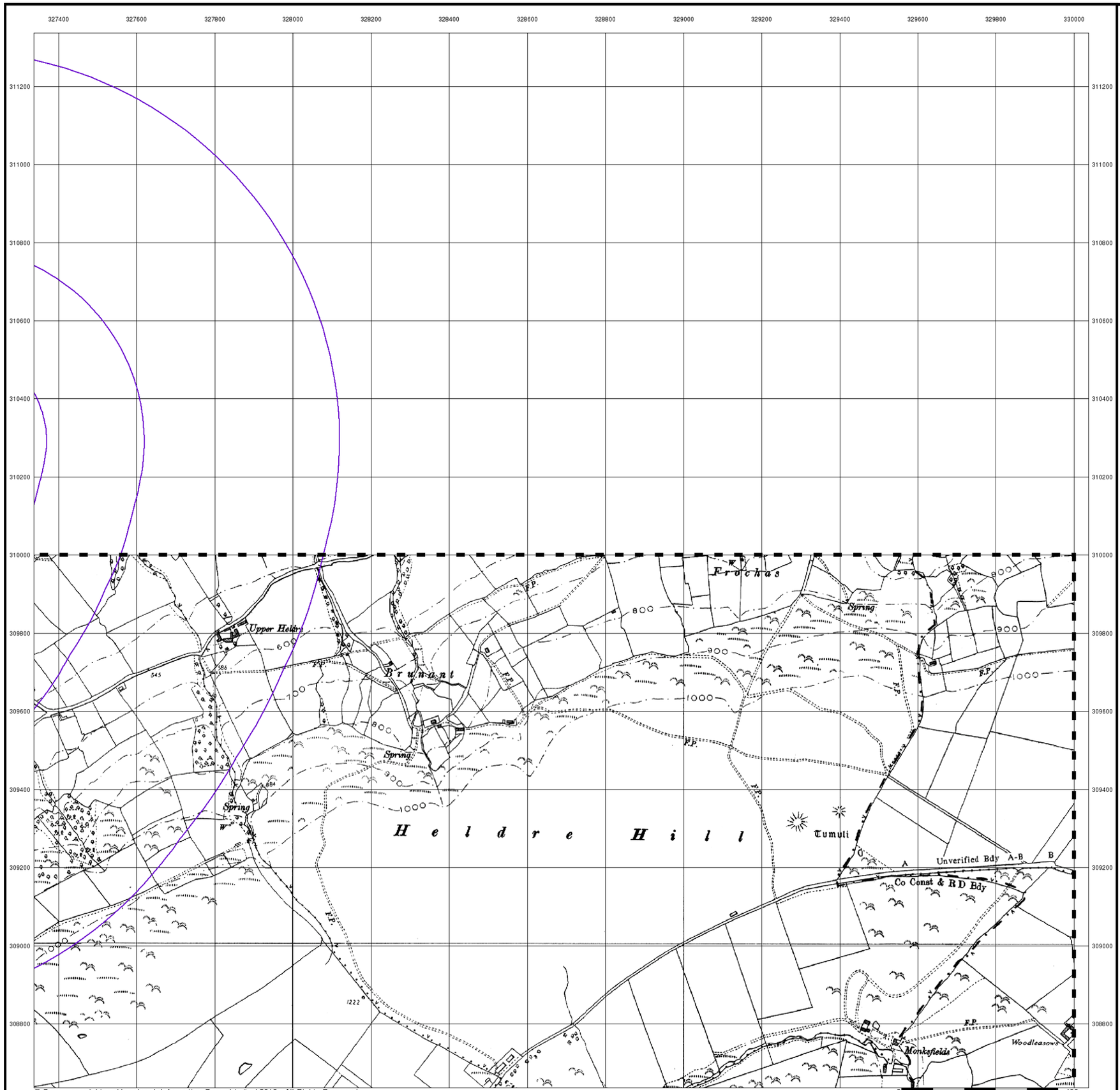

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Ordnance Survey Plan

Published 1969

Source map scale - 1:10,000

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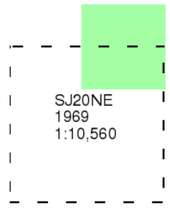

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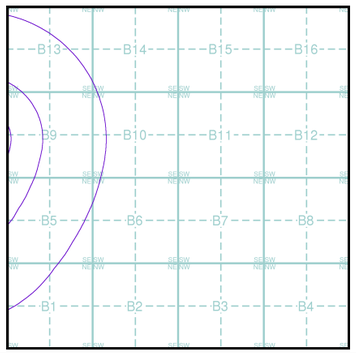

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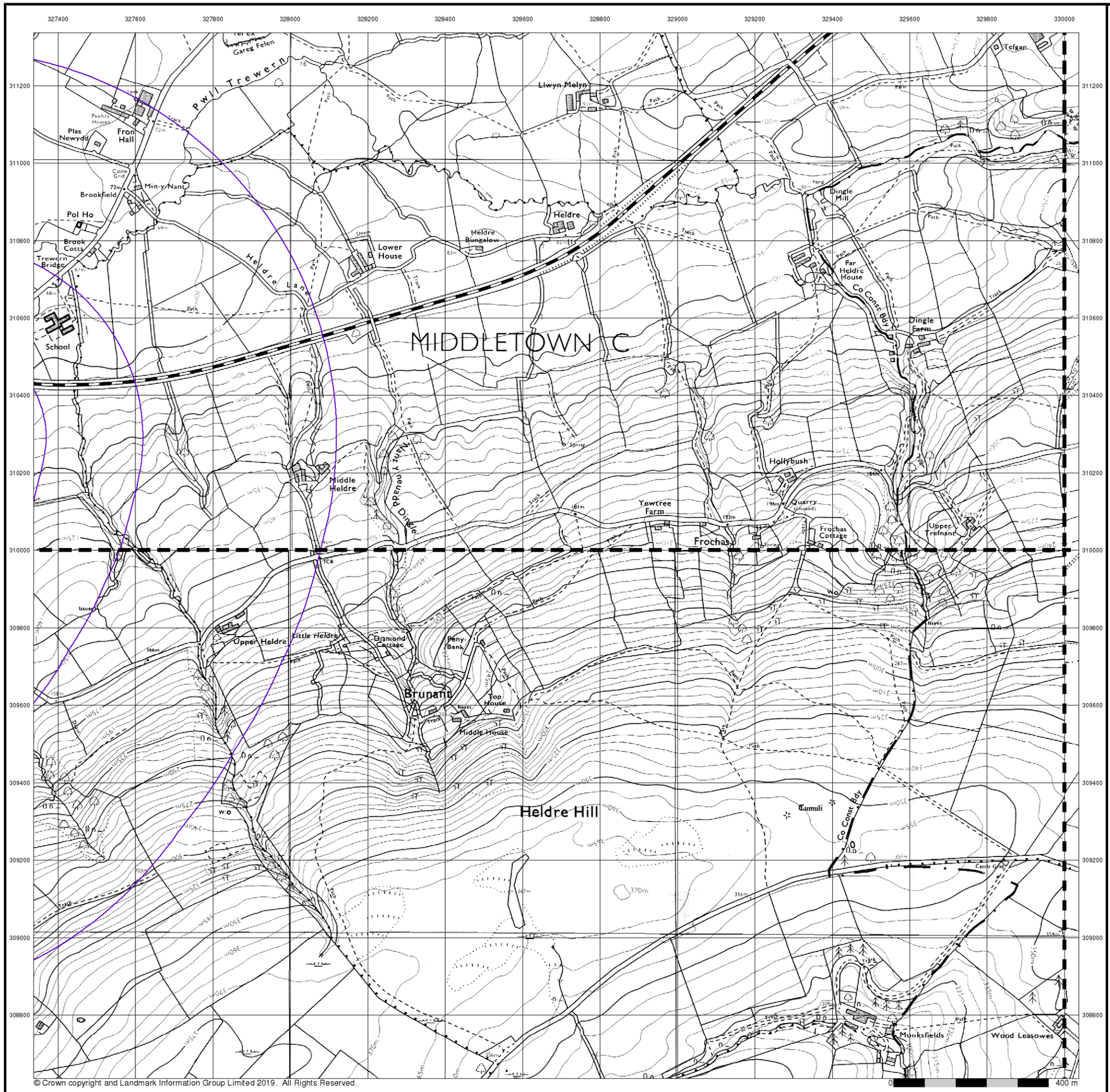

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Ordnance Survey Plan

Published 1970 - 1976

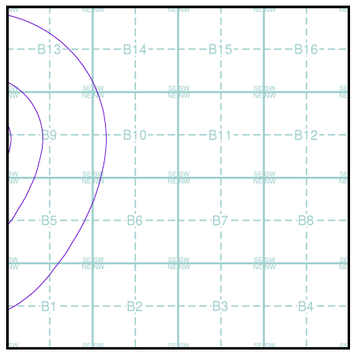
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)

SJ21SE 1976 1:10,000	SJ31SW 1970 1:10,560
SJ20NE 1976 1:10,000	SJ30NW 1971 1:10,560

Historical Map - Slice B



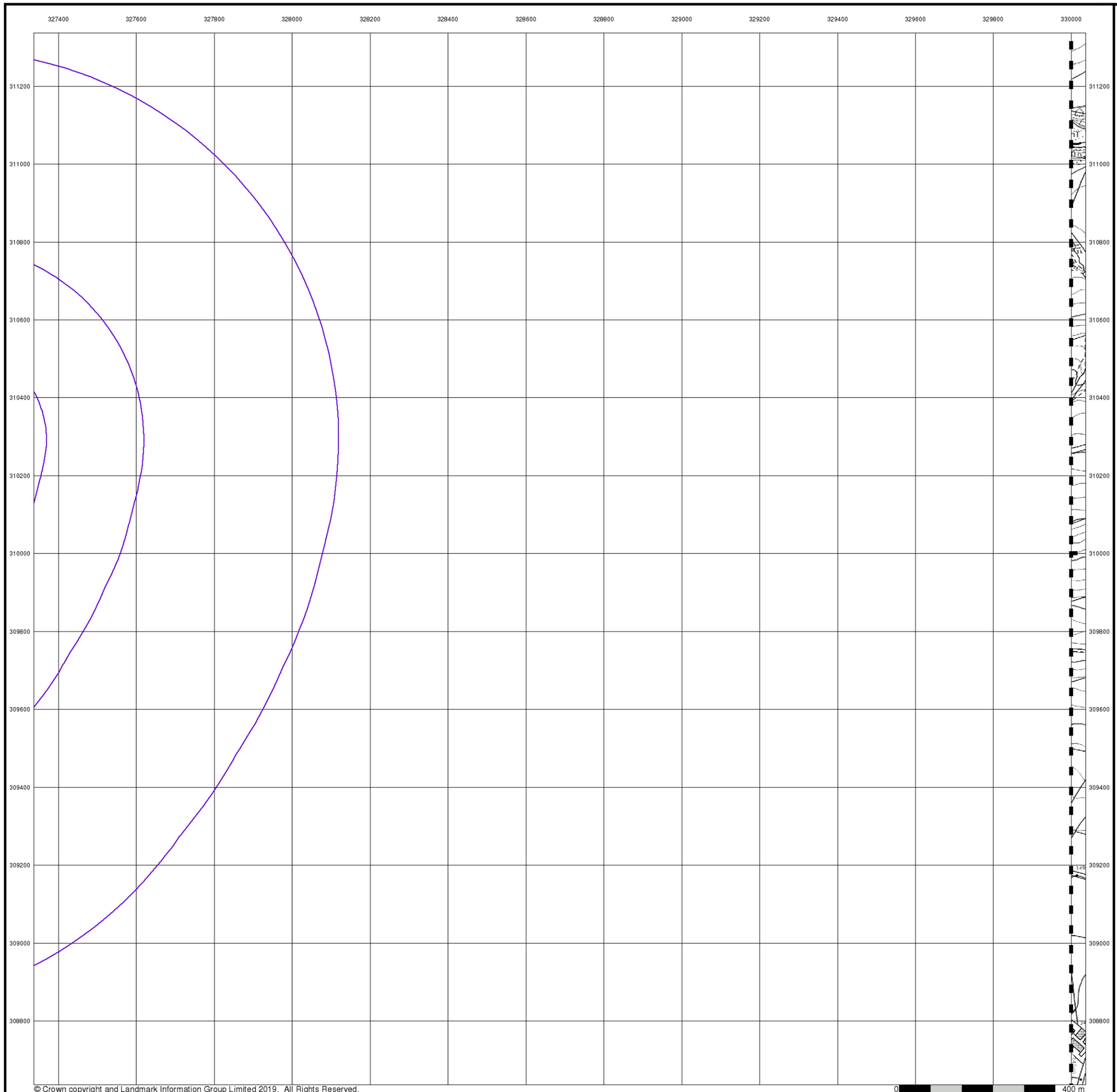
Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
Search Buffer (m):	1000

Site Details

Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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Ordnance Survey Plan

Published 1978

Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

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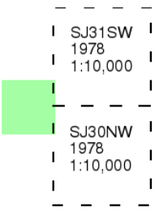
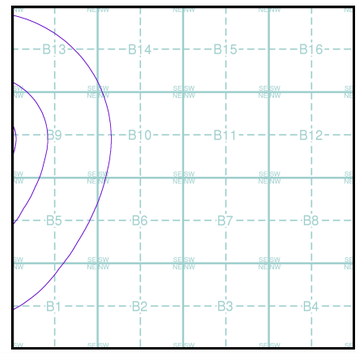


Historical Map - Slice B



Order Details

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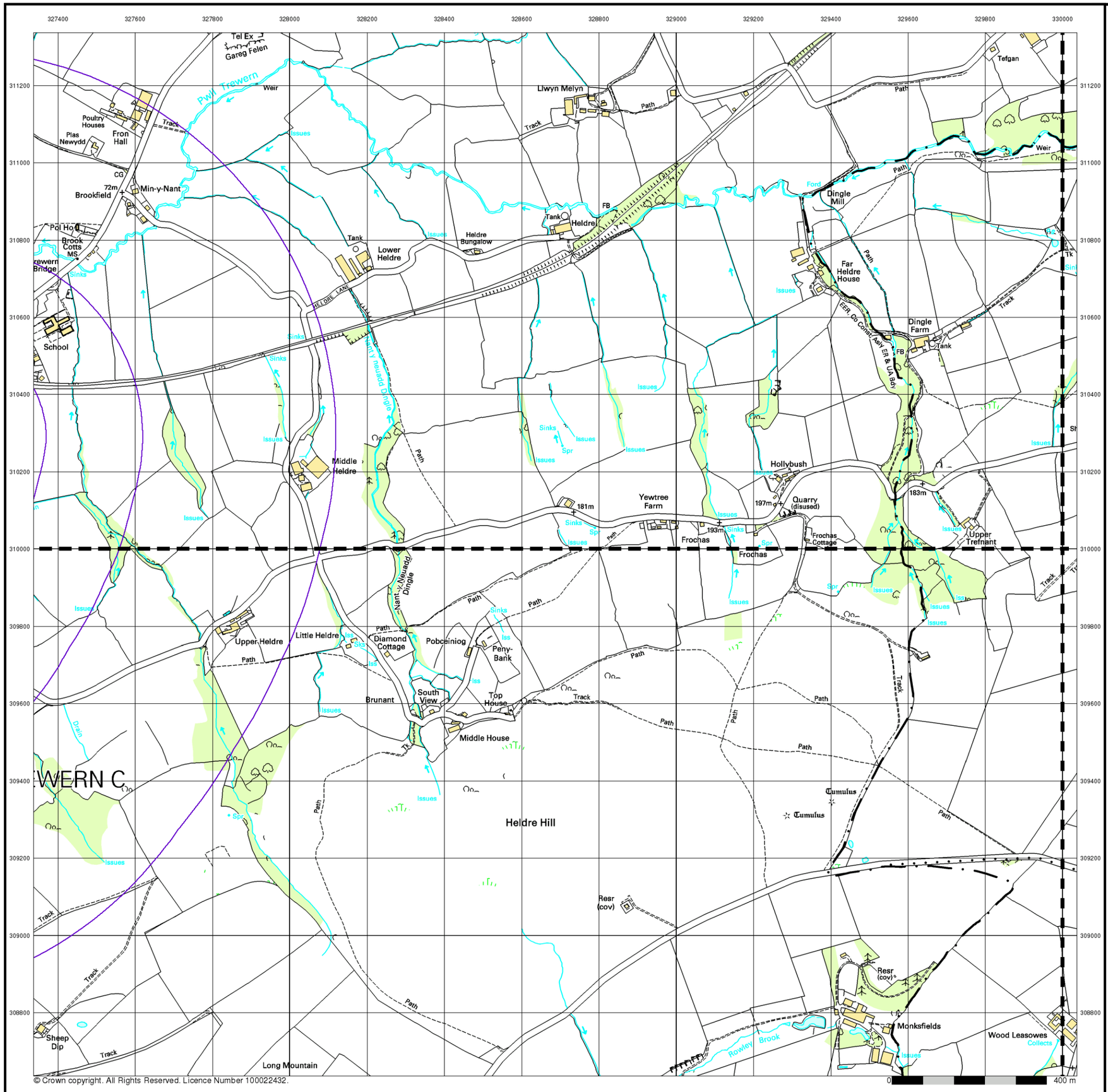

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10k Raster Mapping

Published 2000

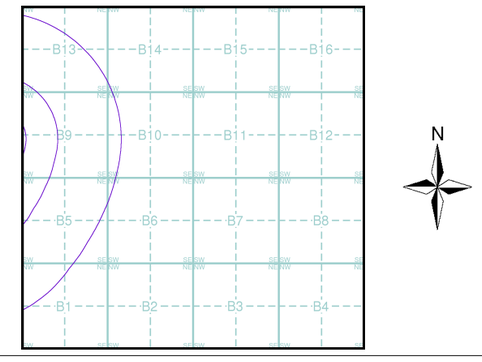
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

SJ21SE 2000 1:10,000	SJ31SW 2000 1:10,000
SJ20NE 2000 1:10,000	SJ30NW 2000 1:10,000

Historical Map - Slice B



Order Details

Order Number:	196125587_1_1
Customer Ref:	14880
National Grid Reference:	327660, 310170
Slice:	B
Site Area (Ha):	25.12
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Site Details

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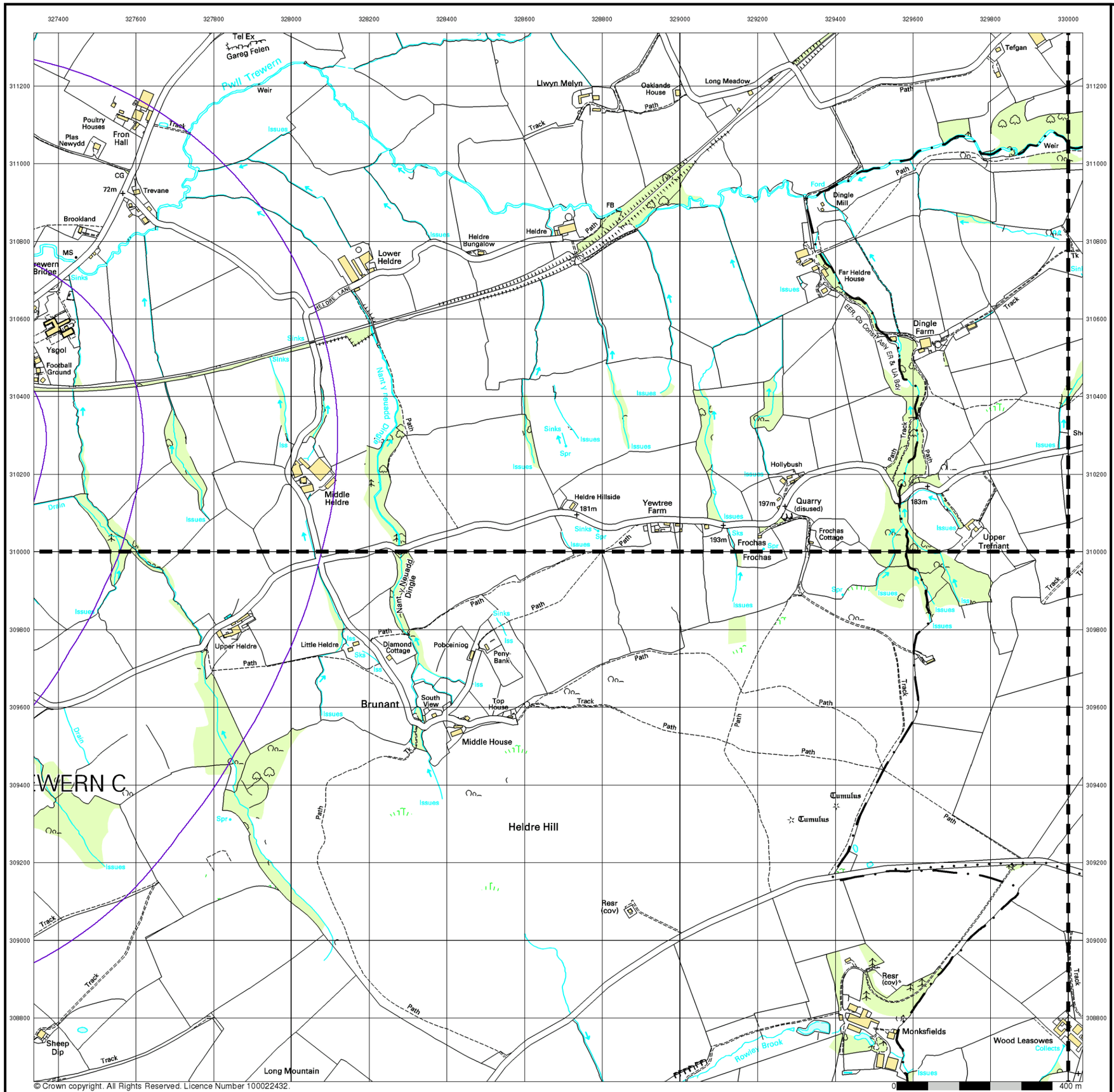

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10k Raster Mapping

Published 2006

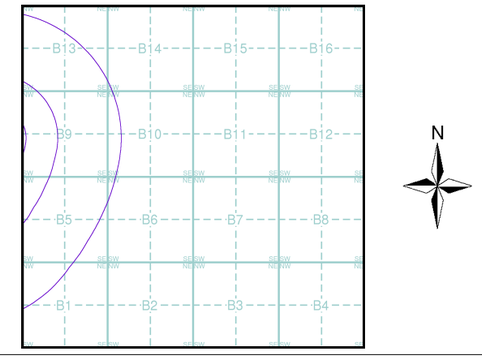
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

SJ21SE 2006 1:10,000	SJ31SW 2006 1:10,000
SJ20NE 2006 1:10,000	SJ30NW 2006 1:10,000

Historical Map - Slice B



Order Details

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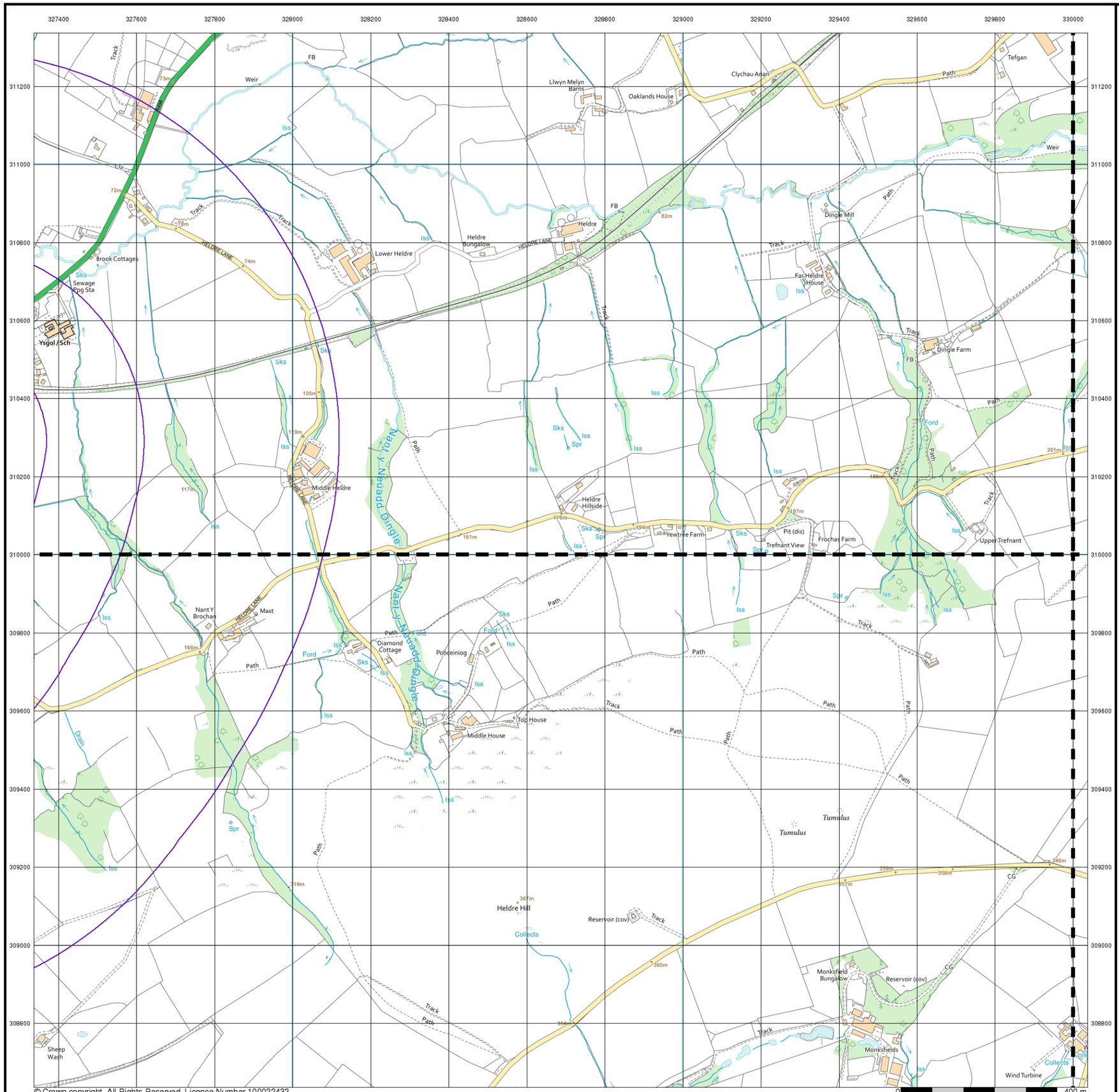

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VectorMap Local

Published 2019

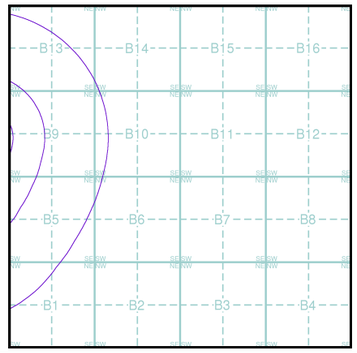
Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)

SJ21SE 2019 Variable	SJ31SW 2019 Variable
SJ20NE 2019 Variable	SJ30NW 2019 Variable

Historical Map - Slice B



Order Details

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Quarry, Buttington, Welshpool, SY21 8SZ

Landmark INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

ANNEX B
Risk Assessment Definitions

Risk Assessment Definitions

Environmental risk assessment evaluates the risk to receptors via an analysis of the 'source-pathway-receptor' linkage.

(1) A **CONTAMINANT** (hazard) - a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters

(2) A **RECEPTOR** (target) - something which could be adversely affected by a contaminant

(3) A **PATHWAY** - a route or means which either allows the contaminant to cause significant harm to that receptor, or that there is a significant possibility of such harm being caused to the receptor, or that pollution of controlled waters is being or likely to be caused.

The term 'Risk' is widely used in different contexts and situations, but a prescriptive definition is given by the Guidelines for Environmental Risk Assessment and Management (DEFRA *et al*, 2000):

'Risk is a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence'.

A 'Hazard' is defined as '*a property or situation that in particular circumstances could lead to harm'.*

The classification of consequences and probability and determining the risk category are defined in the following sections.

Table 1 Classification of Consequence

Classification	Definition
Severe	• Short term (acute) risk to human health likely to result in significant harm • Short term risk to controlled waters • Catastrophic damage to buildings/structures • Short term risk to an ecosystem or organism within the particular ecosystem
Medium	• Chronic damage to human health (long term risk) • Pollution of a sensitive water resource • A significant change in an ecosystem or organism within the ecosystem
Mild	• Pollution of non-sensitive water resources • Significant damage to buildings/structures
Negligible	• Harm (not necessarily significant) which may result in financial loss • Non permanent health effects to humans (easily prevented by PPE for example) • Easily repairable effects of structural (building) damage

Table 2 Classification of Probability	
Classification	**Definition**
High	• There is a complete pollution linkage and an event appears very likely to occur in the short term and is inevitable in the long term. • Evidence of harm to the receptor
Medium	• There is a complete pollution linkage which means that is it probable that an event will occur • The event is not inevitable but possible in short term and likely in the long term
Low	• There is a complete pollution linkage and circumstances are possible under which an event could occur • It is not certain that an event will occur in the long term, and it is less likely to occur in the short term
Negligible	• There is a complete pollution linkage but circumstances are such that it is improbable that an event would occur even in the long term

By comparing the consequences of a risk and the probability of the risk of a pollution linkage, the likely risk category can be determined as shown in **Table 3** below.

Table 3 Risk Assessment Matrix					
Increasing acceptability →		**Consequence**			
		Severe	**Medium**	**Mild**	**Negligible**
Probability	**High**	High	High	Medium / Low	Near zero
	Medium	High	Medium	Low	Near zero
	Low	High / medium	Medium / Low	Low	Near zero
	Negligible	High / medium / Low	Medium / Low	Low	Near zero

High Risk
There is a high probability that severe harm could risk a receptor, or there is evidence that a receptor is being harmed. The risk if realised is likely to result in liability, and urgent investigation or remediation will be required.

Medium Risk
It is probable that harm will arise to a receptor. However it is relatively unlikely that such harm would be severe, or if harm does occur the harm is likely to be relatively mild. Investigation will be required to determine the liability, and some remedial works may be required in the long term.

Low Risk
It is possible that harm may arise to a receptor, but it is likely that the harm would be mild.

Near Zero Risk
There is a very low risk of harm to the receptor. In the event of harm being realised the harm is

ANNEX C
Probehole Logs

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH1** Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326725.45 - 310068.78	Hole Type RC
Location:	Buttington, Welshpool		Level:	88.71	Scale 1:50
Client:	Broad Environmental		Dates:	17/10/2018 - 18/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
▼	0.00 - 1.00		34	50	34					Weak thickly laminated to thinly bedded dark reddish brown locally greenish grey MUDSTONE *Fractures are 10°- 40° closely spaced undulating smooth. Locally stained orangish brown*
	1.00 - 2.50		83	90	83					*Fracture: 40° undulating smooth. Stained orangish brown.* *Fracture: 30° undulating smooth. Stained orangish brown.*
	~~2.50~~	C								
	2.50 - 4.00		93	93	93					*Fracture: 10° planar smooth* *Fracture: 10° planar smooth*
	3.60	C								
	3.75	C								*Fracture: 20° planar smooth. Stained orange brown.*
	4.00 - 5.50		88	93	88					*Fracture: 10° planar smooth*
	5.50 - 7.00		88	93	88					*Fracture: 30° undulating smooth* *Fracture: 30° undulating smooth* *Bedding Fracture: 85° planar polished with rare pyrite mineralisation*
	7.00 - 8.50		100	100	100					*Fracture: 10° planar smooth* *Bedding Fracture: 85° planar polished* *Fracture: 50° undulating rough*
	~~8.50~~	C								
	8.50	C								
	9.00	C								
	8.50 - 10.00		98	98	98					*Fracture: 5°planar rough* *Fracture: 5°planar rough* *Fracture: 5°planar rough*

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH1
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326725.45 - 310068.78	Hole Type RC
Location:	Buttington, Welshpool		Level:	88.71	Scale 1:50
Client:	Broad Environmental		Dates:	17/10/2018 - 18/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	10.00 - 10.85		87	94	87					Weak thickly laminated to thinly bedded dark reddish brown locally greenish grey MUDSTONE *Fracture: 15°planar smooth*
	10.85 - 12.35		100	100	100					*Bedding Fracture: 75°planar smooth*
	12.35 - 13.85	C	90	90	90					*Fracture: 20°planar rough* *Fracture: 20°planar smooth* *Bedding Fracture: 75°planar polished*
	13.00 13.50	C				13.85	74.86			End of Borehole at 13.850m

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH2**
Sheet 1 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Environmental		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Made ground over very weak mudstone
						1.00	110.92			
	1.00 - 2.00		100	0	0					Weak brownish grey MUDSTONE. Fractures are very closely to closely and occasionally medium spaced 10° - 45° planar smooth. Stained orangish brown *Fracture: 75° planar smooth* *Fracture: 70° planar smooth* *Fracture: 75° planar smooth*
	2.00 - 3.40		100	0	0					*Fracture: 75° planar smooth* *Bedding Fracture: 80° planar rough* *Fracture: 70° planar smooth. Slight orangish brown staining* *Bedding Fracture: 80° planar smooth. Stained orangish brown.*
	3.40 - 4.80		100	9	9					*Bedding Fracture: 80° planar smooth* *Fracture: 75° planar smooth*
						4.80	107.12			
	4.80 - 6.20 5.80	C	100	64	45					Weak grey MUDSTONE. Fractures are very closely to medium spaced 10° - 45° planar smooth *Bedding Fracture: 80° planar smooth*
						6.20	105.72			
	6.20 - 7.60		100	43	43					Weak grey MUDSTONE. Graptolite fossils *Bedding Fracture: 80° planar smooth*
						7.30	104.62			
	7.60 - 9.00 8.50	C	100	78	78					Weak grey MUDSTONE. Fractures are very closely to medium spaced 10° - 45° planar smooth *Bedding Fracture: 85° planar infilled with 2cm thick layer of light grey very stiff clay with mudstone lithorelics*
	9.00 - 10.40		100	100	100					*Fracture: 55° planar smooth*

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH2**
Sheet 2 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Environmental		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak grey MUDSTONE. Fractures are very closely to medium spaced 10° - 45° planar smooth
	10.40 - 11.80		100	91	91					*Bedding Fracture: 85° planar smooth* *Bedding Fracture: 85° planar smooth* *Fracture: 55° planar smooth*
	11.80 - 13.20		100	100	96					*Fracture: 45° planar smooth, stained orangish brown* *Fracture: 65° planar smooth*
	13.20 - 14.60		100	100	88					*Fracture: 65° planar smooth* *Fracture: 65° planar smooth*
	14.60 - 16.00		100	91	86					*Fracture: sub-vertical planar smooth*
	16.00 - 17.40		86	80	0					*Bedding Fracture: 80° planar to curved smooth*
	17.40 - 18.80		93	93	93					*Bedding Fracture: 85° planar smooth with thin veneer of light grey clay infill* *Very soft grey CLAY*
	18.80 - 20.20		100	89	78					*Bedding Fracture: 85° planar smooth infilled with 1cm stiff grey clay*

11 12 13 14 15 16 17 18 19 20

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terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH2
Sheet 3 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Environmental		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak grey MUDSTONE. Fractures are very closely to medium spaced 10° - 45° planar smooth
	20.20 - 21.60		100	84	83					
	21.60 - 23.00		73	71	52					*Fracture: 50° planar smooth*
	23.00 - 23.80		100	84	65					*Very soft grey CLAY*
	23.80 - 25.10		100	64	53	23.70	88.22			Weak becoming medium strong dark grey MUDSTONE. Fractures are closely to very closely and occasionally widely spaced 5° - 20° planar smooth. Many closed but mineral fill fractures. *Bedding Fracture: 85° planar smooth with 0.5cm veneer of light grey stiff clay* *Fracture: 5° planar smooth* *Fracture: sub-vertical curved smooth* *Fracture: 5° planar stepped* *Fracture: 10° planar smooth with partial mineralisation*
	25.10 - 26.60		96	83	83					
	26.60 - 28.10		95	95	84					
	28.10 - 29.60		100	100	100					

21 22 23 24 25 26 27 28 29 30

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terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH2
Sheet 4 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Environmental		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	29.60 - 30.40		100	71	64					Weak becoming medium strong dark grey MUDSTONE. Fractures are closely to very closely and occasionally widely spaced 5° - 20° planar smooth. Many closed but mineral fill fractures.
	30.40 - 31.60		87	71	71					*Bedding Fracture: 85° 3cm infilled with light grey clay*
	31.60 - 32.90		100	100	89					
	32.90 - 34.40		100	86	76					
	34.40 - 35.80		100	199	71	35.50	76.42			Medium strong to strong grey MUDSTONE. Fractures are close to medium spaced 5° - 35° planar smooth to occasional undulating rough. Inconsistent and random patches of mineralisation.
	35.80 - 37.25		100	199	26					*Bedding Fracture: 80° planar polished. Some mineralisation paralleling fracture plane* *Bedding Fracture: 70° planar polished*
	37.25 - 38.65		100	199	57					*Bedding Fracture: 70° 1mm mineral infill* *Fracture: 60° planar rough* *Fracture: 60° planar rough* *Fracture: 65° planar smooth* *Fracture: 65° planar smooth* *Bedding Fracture: 75° planar rough*
	38.65 - 40.05		100	78	78					

31 32 33 34 35 36 37 38 39 40

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
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info@terrafirmawales.co.uk
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Borehole No.
PH2
Sheet 5 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Environmental		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	40.05 - 41.50		96	96	78	43.45	68.47			Medium strong to strong grey MUDSTONE. Fractures are close to medium spaced 5° - 35° planar smooth to occasional undulating rough. Inconsistent and random patches of mineralisation.
										Bedding Fracture: 75° planar rough
	41.50 - 43.00		100	37	37					*Bedding Fracture: 85° planar smooth with thin veneer of brown clay*
										Bedding Fracture: 80° planar rough with 2mm mineralised infill
	43.00 - 44.50		96	96	93					End of Borehole at 43.000m
	44.50 - 46.00		100	100	80					
	46.00 - 47.00		47	47	39					

41 42 43 44 45 46 47 48 49 50

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH3
Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326792.28 - 310009.40	Hole Type RC
Location:	Buttington, Welshpool		Level:	112.23	Scale 1:50
Client:	Broad Environmental		Dates:	08/11/2018 - 09/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey very gravelly CLAY
						1.00	111.23			
	1.00 - 2.50		60	0	0					Very weak brownish grey MUDSTONE. Recovered non-intact.
	2.50 - 4.00		30	0	0					
	4.00 - 5.00		80	0	0					
	5.00 - 6.30		92	0	0	5.70	106.53			Weak grey MUDSTONE. Fractures are very closely to closely spaced 35° - 50° planar rough. Some stained orangish brown.
	6.30 - 7.80		86	7	0					*Fracture: 70° planar rough*
	7.80 - 9.20		88	0	0					*Bedding Fracture: 70° - 85° undulating smooth*
										Bedding Fracture: 85° 2cm wide infilled with stiff orange brown clay and some partial mineralisation
	9.20 - 10.70		93	85	35	9.30	102.93			Weak grey MUDSTONE. Fractures are closely to medium spaced. *Fracture: 50° curved smooth. Stained orangish brown.*

Remarks:

terrafirma

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH3
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326792.28 - 310009.40	Hole Type RC
Location:	Buttington, Welshpool		Level:	112.23	Scale 1:50
Client:	Broad Environmental		Dates:	08/11/2018 - 09/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak grey MUDSTONE. Fractures are closely to medium spaced.
	10.70 - 12.20		100	20	20					*Bedding Fracture: 80° planar smooth. Stained orangish brown.*
	12.20 - 13.70		90	21	21					*Fracture: 50° planar smooth. Stained orangish brown.*
	13.70 - 15.20		100	63	63					*Fracture: 25° planar smooth. Stained orangish brown.*
	15.20 - 16.70		100	68	64					*Fracture: 5° planar smooth. Stained orangish brown.*
	16.70 - 18.10		100	100	100					*Fracture: 65° planar smooth. Stained orangish brown.*
										Fracture: 20° planar smooth. Stained orangish brown.
										Fracture: 75° curved smooth. Stained orangish brown.
										Fracture: 10° planar smooth. Stained orangish brown.
										Bedding Fracture: 75° planar rough. Stained orangish brown.
										Fracture: 60° planar smooth. Stained orangish brown.
										Bedding Fracture: 80° planar smooth. Stained orangish brown.
										Fracture: 75° planar smooth. Stained orangish brown.
										Fracture:: Sub-vertical curved. Stained orangish brown.
										Fracture: 20° planar rough. Stained orangish brown.
										Bedding Fracture: 80° undulating smooth. Stained orangish brown.
										Fracture: 60° planar smooth. Stained orangish brown.
										Bedding Fracture: 85° undulating smooth. Stained orangish brown.
										Fracture: 55° undulating rough. Stained orangish brown.
										Fracture: 25° planar smooth. Stained orangish brown.
										Fracture: 15° planar smooth.
										Fracture: 75° planar smooth. Stained orangish brown.
										Fracture: 60° undulating rough. Stained orangish brown.
										Fracture: 65° planar smooth. Stained orangish brown.
										Fracture: 25° planar smooth. Stained orangish brown.
										Fracture: 55° planar smooth.
										Fracture: 30° planar smooth.
						18.10	94.13			*Fracture: 40° planar smooth.*
										Fracture: 45° planar smooth.
										Fracture: 55° planar smooth.
										Fracture: 55° planar smooth.
										Fracture: 70° planar smooth.
										Fracture: 15° planar smooth.
										Fracture: 60° undulating rough.
										Fracture: 40° undulating rough..
										Fracture: 35° planar smooth.
										Fracture: 55° planar smooth.
										Fracture: 15° planar smooth.
										End of Borehole at 18.100m

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Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH4** Sheet 1 of 4

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326864.51 - 310105.86	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.35	Scale 1:50
Client:	Broad Environmental		Dates:	12/11/2018 - 15/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
						1.00	113.35			Grey gravelly CLAY grading in to weathered mudstone
	1.00 - 2.50		24	0	0					Weak grey MUDSTONE. Fractures are closely spaced 5° - 40° planar rough to planar smooth, often stained orangish brown. Sub-vertical fracture planar smooth from 1.0m to 2.6m depth.
	2.50 - 4.00		100	0	0					*Bedding Fracture: 75° planar rough. Stained orangish brown. Graptolite fossils visible on bedding surface.* *Bedding Fracture: 85° planar smooth. Stained orangish brown.*
	4.00 - 5.50		100	33	23	5.00	109.35			*Fracture: 80° - 90° curved rough. stained orangish brown.* Weak grey MUDSTONE. Fractures are close to medium spaced 10° - 20° planar smooth, stained orangish brown.
	5.50 - 6.80		100	77	38					*Fracture: 60° planar smooth. Stained orangish brown.* *Fracture: 60° planar rough. Stained orangish brown.* *Fracture: 65° planar smooth.* *Fracture: 75° undulating smooth.*
	6.80 - 8.30		100	70	62					
	8.30 - 9.50		100	16	16					*Bedding Fracture: 85° undulating rough with slight stiff light grey clay fill in places*
	9.50 - 10.00		80	80	80					
						10.00	104.35			

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH4
Sheet 2 of 4

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326864.51 - 310105.86	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.35	Scale 1:50
Client:	Broad Environmental		Dates:	12/11/2018 - 15/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										MUDSTONE

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terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH4
Sheet 3 of 4

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326864.51 - 310105.86	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.35	Scale 1:50
Client:	Broad Environmental		Dates:	12/11/2018 - 15/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										MUDSTONE
	25.00 - 26.50		24	23	21	25.00	89.35			Weak dark grey MUDSTONE. Fractures are widely but sometimes closely spaced. Graptolite fossils *Fracture: 15° planar smooth.*
	26.50 - 28.00		93	93	87					

21 22 23 24 25 26 27 28 29 30

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH4
Sheet 4 of 4

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326864.51 - 310105.86	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.35	Scale 1:50
Client:	Broad Environmental		Dates:	12/11/2018 - 15/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak dark grey MUDSTONE. Fractures are widely but sometimes closely spaced. Graptolite fossils
	31.20 - 32.50		88	88	88					*Fracture: 15° undulating rough*
	37.00 - 37.85		52	52	52					*Fracture: 30° planar smooth.*
	37.95 - 39.45		96	96	90					*Fracture: 30° planar smooth.*
						39.45	74.90			*Fracture: 10° planar smooth.* *Fracture: 10° planar smooth.* End of Borehole at 39.450m

31 32 33 34 35 36 37 38 39 40

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH5** Sheet 1 of 2

Project Name: Buttington Quarry	Project No. 14880	Co-ords: 326896.01 - 310052.91	Hole Type RC
Location: Buttington, Welshpool		Level: 118.22	Scale 1:50
Client: Broad Environmental		Dates: 29/10/2018 - 29/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
						1.00	117.22			Grey very gravelly CLAY grading into very weak mudstone
	1.00 - 2.10		91	0	0					Very weak brownish grey MUDSTONE retrieved mostly non-intact. Some preserved very closely spaced fractures 5° - 15°. *Fracture: 50° planar smooth infilled with 1cm band of light grey clay*
	2.10 - 3.30		96	0	0					
	3.30 - 4.60		100	0	0	4.00	114.22			Weak grey MUDSTONE. Fractures are very closely to medium spaced 25° - 45° planar smooth to planar rough. Some fracture planes stained orangish brown. *Fracture: 35° planar smooth 1mm mineralised infill*
	4.60 - 5.80		100	0	0					*Fracture: 70° planar smooth*
	6.00 5.80 - 7.30	C	90	40	32					*Three sub-vertical fractures planar smooth stained orangish brown*
	7.30 - 8.80		93	0	0					*Fracture: 70° - 85° curved to planar smooth. Stained orangish brown.* *Three sub-vertical fractures planar smooth stained orangish brown* *Fracture: 80° planar smooth. Stained orangish brown.*
	8.80 - 10.30 9.50	C	26	21	21	8.80	109.42			*Fracture: 80° planar smooth. Stained orangish brown.* Weak grey MUDSTONE. Fractures are closely to medium spaced 15° - 30° planar smooth to occasionally undulating smooth, often stained orangish brown. 9.23 - 17.6m numerous 45° closed <1.5mm thick mineralised fractures

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH5
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326896.01 - 310052.91	Hole Type RC
Location:	Buttington, Welshpool		Level:	118.22	Scale 1:50
Client:	Broad Environmental		Dates:	29/10/2018 - 29/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak grey MUDSTONE. Fractures are closely to medium spaced 15° - 30° planar smooth to occasionally undulating smooth, often stained orangish brown. 9.23 - 17.6m numerous 45° closed <1.5mm thick mineralised fractures
	10.30 - 11.80		93	33	33					*Fracture: Sub-vertical curved to planar smooth. Stained orangish brown.*
	11.80 - 13.30		93	45	45					*Fracture: 57° planar rough*
	13.30 - 14.80	C	100	44	40					*Fracture: 65° planar rough*
	14.00									*Fracture: 45° closed <1mm thick mineralised*
	15.40 14.80 - 16.30	C	96	45	26					*Fracture: 65° planar smooth*
	16.30 - 17.80		100	66	66					*Fracture: Sub-vertical planar to curved smooth*
						17.80	100.42			End of Borehole at 17.800m

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH6** Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326901.08 - 310180.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	89.17	Scale 1:50
Client:	Broad Environmental		Dates:	16/10/2018 - 17/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	0.00 - 1.00		63	6	0					Weak dark reddish brown locally light greenish grey MUDSTONE *Fractures are closely spaced 30° - 40° undulating rough. Stained orangish brown.*
	1.00 - 2.50		88	5	0					
	2.50 - 4.00		86	56	54					*Fracture: 10° undulating rough* *Bedding Fracture: 85° planar smooth*
	3.60	C								*Fracture: 15° undulating rough* *Fracture: 65° undulating smooth*
	4.00 - 5.50		94	94	94					
	5.00	C								*Fracture: 10° planar rough* *Fracture: 45° undulating smooth*
	5.50 - 7.00		92	92	92					*Fracture: 65° undulating smooth* *Fracture: 45° planar smooth*
	7.00 - 8.50		93	93	93					*Fracture: 10° planar smooth*
	~~8.50~~	C								*Fracture: 60° undulating rough* *Fracture: 15° undulating smooth*
	9.00	C								*Fracture: sub-horizontal planar smooth*
	8.50 - 10.00		94	70	64					*Fracture: 55° undulating smooth* *Bedding Fracture: 85° planar smooth*
										Fracture: 20° planar smooth

1 2 3 4 5 6 7 8 9 10

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH6
Sheet 2 of 2

Project Name: Buttington Quarry	Project No. 14880	Co-ords: 326901.08 - 310180.50	Hole Type RC
Location: Buttington, Welshpool		Level: 89.17	Scale 1:50
Client: Broad Environmental		Dates: 16/10/2018 - 17/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	10.00 - 11.50	C	92	78	78	14.00	75.17			Weak dark reddish brown locally light greenish grey MUDSTONE *Fracture: 45° undulating rough* *Fracture: 75° undulating smooth* *Fracture: 15° undulating smooth* *Fracture: 65° undulating smooth* *Bedding Fracture: 80° undulating rough* *Fracture: 35° undulating smooth* *Fracture: 40° undulating smooth* *Fracture: 75° undulating rough* *Fracture: 65° undulating rough* *Fracture: 40° undulating rough* End of Borehole at 14.000m
	11.50 - 13.00		93	93	84					
	13.00 - 14.00		97	74	74					

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH7**
Sheet 1 of 3

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326691.47 - 310125.99	Hole Type RC
Location:	Buttington, Welshpool		Level:	110.52	Scale 1:50
Client:	Broad Environmental		Dates:	15/11/2018 - 19/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey gravelly CLAY grading in to weathered mudstone
						1.00	109.52			
	1.00 - 1.75		93	93	58					Extremely weak dark grey MUDSTONE. Fractures are very closely to closely spaced 25° - 45° undulating smooth and polished stained orangish brown *Fracture: 65° planar rough. Stained orangish brown.* *Fracture: 60° planar rough. Stained orangish brown.*
	3.00 - 3.25		100	100	29					
	3.25 - 4.25		90	90	28	3.85	106.67			*Bedding Fracture: 85° planar rough. Stained orangish brown.* Non Intact: Weak laminated MUDSTONE and SILTSTONE retrieved as fine to coarse angular gravel
	4.25 - 5.75		99	99	0	5.05	105.47			Extremely weak grey MUDSTONE. Fractures are very closely to closely spaced 25° - 45° undulating striated and polished stained orangish brown *Fracture: 70° undulating polished and striated*
	5.75 - 7.15		68	0	0	6.45	104.07			Non Intact: Weak laminated MUDSTONE and SILTSTONE retrieved as fine to coarse angular gravel
	7.15 - 8.15		83	15	15	7.15	103.37			Extremely weak grey MUDSTONE. Fractures are close to medium spaced 15° - 45° undulating striated and polished *Fracture: 80° undulating rough* *Fracture: 70° undulating polished and striated*
	8.15 - 9.65		95	0	0					*Bedding Fracture: 80° planar rough*
						9.65	100.87			Non Intact: Weak laminated MUDSTONE and SILTSTONE retrieved as fine to coarse

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH7
Sheet 2 of 3

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326691.47 - 310125.99	Hole Type RC
Location:	Buttington, Welshpool		Level:	110.52	Scale 1:50
Client:	Broad Environmental		Dates:	15/11/2018 - 19/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	9.65 - 10.75		70	40	27	10.75	99.77			Non Intact: Weak laminated MUDSTONE and SILTSTONE retrieved as fine to coarse angular gravel
	10.75 - 12.25		66	23	0					Extremely weak grey MUDSTONE. Fractures are very close to medium spaced 35° - 60° undulating striated and polished *1cm wide band of dark grey mudstone 75°* *Bedding Fracture: 85° undulating rough striated*
	12.25 - 13.75		90	60	14					*Fracture: 50° Planar polished* *Fracture: 60° planar rough* *Band of dark grey mudstone 70° undulating rough striated* *Fracture: 60° planar rough*
	13.75 - 15.25		100	100	17					*Bedding Fracture: 80° - 90° undulating smooth striated*
	15.25 - 16.75		100	75	0					*Bedding Fracture: 80° planar smooth striated* *Fracture: 65° planar smooth* *Fracture: 65° undulating polished* *Bedding Fracture: 85° planar to undulating smooth striated* *3cm thick band of dark grey laminated mudstone 80°* *4cm band of light grey mudstone with thin veneer of soft light grey clay 80°* *Fracture: 65° undulating smooth striated* *Fracture: 65° undulating smooth striated* *Fracture: 65° undulating smooth striated* *Fracture: 65° undulating rough striated*
	16.75 - 18.25			19	19					
	18.25 - 19.75		93	55	12					

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Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH7
Sheet 3 of 3

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326691.47 - 310125.99	Hole Type RC
Location:	Buttington, Welshpool		Level:	110.52	Scale 1:50
Client:	Broad Environmental		Dates:	15/11/2018 - 19/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	19.75 - 21.25		93	11	11					Extremely weak grey MUDSTONE. Fractures are very close to medium spaced 35° - 60° undulating striated and polished *Sub-vertical Fracture : undulating curved polished striated* *Bedding Fracture: 80° undulating polished striated*
	21.25 - 22.75		95	0	0					*Fracture: 65° undulating polished* *Fracture: 65° planar polished* *Fracture: 80° undulating rough* *Sub-vertical Fracture undulation smooth* *1cm wide laminated band of dark mudstone 80°*
	22.75 - 24.25		95	0	0					*Bedding Fracture: 80° planar rough* *Bedding Fracture: 80° planar rough*
						24.25	86.27			End of Borehole at 24.250m

21 22 23 24 25 26 27 28 29 30

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH8
Sheet 1 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326934.10 - 310105.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	117.23	Scale 1:50
Client:	Broad Environmental		Dates:	22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey very gravelly CLAY grading in to very weak mudstone
						1.00	116.23			
	1.00 - 2.40		96	0	0					Very weak greenish brown MUDSTONE. Recovered non-intact.
	2.40 - 3.70		100	0	0					
						3.70	113.53			
	3.70 - 5.20		96	0	0					Weak dark brownish grey MUDSTONE. Fractures are 20° - 45° very closely to closely spaced planar smooth. Locally stained orangish brown.
										Fracture: Sub-vertical 3.7 - 8m planar smooth with very thin infill of light grey clay.
										Fracture: 50° undulating smooth
										Fracture: 45° undulating smooth
										Fracture: 80° undulating smooth. Stained orangish brown
	5.20 - 6.60		98	0	0					
										Fracture: 60° curved smooth. Stained orangish brown.
	6.60 - 8.00		97	0	0					*Fracture: 80° - 90° curved smooth. Stained orangish brown.*
						8.00	109.23			
	8.00 - 9.40		92	92	80					Weak dark grey MUDSTONE. Fractures 20° - 45° very closely to medium spaced planar smooth to undulating rough. Locally stained orangish brown.
										Fracture: 75° undulating rough

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH8** Sheet 2 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326934.10 - 310105.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	117.23	Scale 1:50
Client:	Broad Environmental		Dates:	22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	9.40 - 10.65		93	76	63					Weak dark grey MUDSTONE. Fractures 20° - 45° very closely to medium spaced planar smooth to undulating rough. Locally stained orangish brown.
	10.70	C								*Fracture: 55° undulating smooth. Slight orangish brown staining*
	10.65 - 12.15		96	74	87					*Fracture: 5° planar smooth*
										Fracture: 5° planar smooth
	12.15 - 13.65		96	88	80					
	14.00	C								
	13.65 - 15.00		98	92	81					
	15.00	C								
	15.00 - 16.40		91	85	85					*Fracture: 60° undulating rough. Stained orangish brown.*
▼										*Fracture: 60° undulating rough*
	16.40 - 17.70		100	80	69					*Fracture: 60° undulating smooth*
	17.70 - 19.10		100	76	76					*Fracture: 80° - 90° curved smooth*
	19.10 - 20.40		100	93	73					*Fracture: 20° - 60° curved smooth*
						19.80	97.43			Weak dark grey MUDSTONE. Sub-vertical

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terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH8
Sheet 3 of 5

Project Name: Buttington Quarry	Project No. 14880	Co-ords: 326934.10 - 310105.50	Hole Type RC
Location: Buttington, Welshpool		Level: 117.23	Scale 1:50
Client: Broad Environmental		Dates: 22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak dark grey MUDSTONE. Sub-vertical Fracture infilled with thin veneer of light grey clay. Fractures 15° - 30° very closely to medium spaced undulating rough.
	20.40 - 21.85		96	0	0					*Fracture: Sub-vertical planar smooth*
	21.85 - 23.30		96	0	0					*Fracture: 65° undulating smooth*
	23.30 - 24.75		100	0	0					
	24.50	C				24.70	92.53			
	24.75 - 26.15		100	89	89					Weak dark grey MUDSTONE. Fractures 10° - 30° very closely to medium spaced planar smooth
	26.50	C								
	26.15 - 27.35		89	89	86					
	27.35 - 28.80		100	95	95					
	28.60	C								
	28.80 - 30.20		94	94	94					

21 22 23 24 25 26 27 28 29 30

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terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH8
Sheet 4 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326934.10 - 310105.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	117.23	Scale 1:50
Client:	Broad Environmental		Dates:	22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak dark grey MUDSTONE. Fractures 10° - 30° very closely to medium spaced planar smooth
	30.20 - 31.50		100	92	92					*Fracture: 85° planar smooth*
										Fracture: Sub-vertical planar smooth
	31.50 - 34.00		100	0	0					*Bedding Fracture: 85° undulating smooth*
	33.50	C								
	34.00 - 35.40		100	66	66					*Fracture: 50° planar smooth*
	35.40 - 36.85		100	91	91					*Fracture: 40° planar smooth*
	36.85 - 38.35		93	90	70					*Fracture: 70° planar smooth*
										Fracture: 75° 1mm thick mineralised infilled fracture
	38.35 - 39.85		96	96	72					*Fracture: 45° planar smooth*
										Fracture: 45° planar rough

31 32 33 34 35 36 37 38 39 40

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terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH8**
Sheet 5 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326934.10 - 310105.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	117.23	Scale 1:50
Client:	Broad Environmental		Dates:	22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	40.30 39.85 - 41.35	C	92	57	43	41.35	75.88			Weak dark grey MUDSTONE. Fractures 10° - 30° very closely to medium spaced planar smooth *Fracture: 45° planar smooth*
	41.35 - 42.85		93	93	93					Medium strong dark grey MUDSTONE. Fractures 10° - 30° very closely to widely spaced planar smooth
	43.00 42.85 - 44.05	C	100	100	100					
	44.05 - 45.45		100	100	93					
	45.45 - 46.45 46.00	C	57	57	53					
						46.45	70.78			End of Borehole at 46.450m

41 42 43 44 45 46 47 48 49 50

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH9
Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326945.35 - 310072.94	Hole Type RC
Location:	Buttington, Welshpool		Level:	115.26	Scale 1:50
Client:	Broad Environmental		Dates:	18/10/2018 - 19/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey brown very gravelly CLAY grading into very weak mudstone
	1.00 - 2.30		100	0	0	1.00	114.26			Very weak dark greenish grey mudstone. Recovered non-intact.
	2.30 - 3.80		86	15	15	2.50	112.76			Very weak to weak dark greenish grey MUDSTONE. Fractures are 10°- 40° very closely to closely spaced, undulating rough tending to planar smooth. Fracture surfaces rarely stained orangish brown.
	3.80 - 5.25		89	0	0					*Very thin bed of very stiff light orangish brown and light grey CLAY*
	5.25 - 6.70		100	0	0					*Bedding Fracture: 70°-85° undulating smooth. Stained orangish brown.*
	6.70 - 7.85		95	42	42					*Bedding Fracture: 85° planar smooth. Stained orangish brown.*
	7.85 - 9.35		94	20	9					*Fracture: 65° planar smooth . Stained orangish brown* *Fracture: 60° planar smooth. Stained orangish brown.* *Bedding Fracture: 85° - 90° undulating smooth. Stained orangish brown.*
	9.00	C								*Bedding Fracture: 85° - 90° undulating rough. Stained orangish brown.*
	9.35 - 10.50		96	37	37					*Bedding Fracture: 85° - 90° undulating rough. Stained orangish brown.* *Fracture: 55° planar smooth. 1mm calcite mineralisation* *Fracture: 75 - 90° undulating smooth locally planar.*

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terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH9
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326945.35 - 310072.94	Hole Type RC
Location:	Buttington, Welshpool		Level:	115.26	Scale 1:50
Client:	Broad Environmental		Dates:	18/10/2018 - 19/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
						10.50	104.76			Very weak to weak dark greenish grey MUDSTONE. Fractures are 10°- 40° very closely to closely spaced, undulating rough tending to planar smooth. Fracture surfaces rarely stained orangish brown.
	11.00	C								*Fracture: 75 - 90° undulating smooth locally planar. Stained orangish brown.*
	10.50 - 12.00		78	78	78					*Fracture: 55° planar smooth. 1mm calcite mineralisation*
	~~12.00~~	C								Weak dark grey MUDSTONE. Fractures are 5°- 25° very closely to medium spaced, planar smooth. Fracture surfaces stained orangish brown.
	12.00 - 13.50		95	95	95					*Fracture: 55° planar smooth.*
	~~13.50~~	C								*Fracture: 55° planar smooth.*
	13.50 - 14.00		30	23	23					*Fracture: 50° planar smooth. Stained orangish brown.*
						14.00	101.26			End of Borehole at 14.000m

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH10
Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326833.57 - 310220.90	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.16	Scale 1:50
Client:	Broad Environmental		Dates:	01/11/2018 - 02/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey gravelly CLAY grading into weathered mudstone
						1.00	113.16			
	1.00 - 2.50		16	0	0					Non-Intact greenish grey MUDSTONE retrieved as fine to coarse angular gravel
	2.50 - 4.00		93	0	0	3.00	111.16			Very weak grey MUDSTONE. Fractures are very close to closely spaced, occasionally medium spaced 5° - 35° stained orangish brown and/or dark grey/black
										Bedding Fracture: 80° curved rough. Stained orangish brown/brown.
	4.00 - 5.50		96	13	13					*Fracture: sub-vertical planar rough. Stained orangish brown.* *Fracture: 45° planar rough. Stained orangish brown.* *Bedding Fracture: 80°planar rough. Stained orangish brown.* *Curved undulating rough. Stained orangish brown.* *Bedding Fracture: 85° Curved to planar rough. Stained orangish brown.*
	5.50 - 7.00		90	0	0					*Fracture: 70° to sub-vertical curved rough. Stained orangish brown.* *Fracture: 70° planar rough. Stained orangish brown.* *Bedding Fracture: 80° planar rough. Stained brown.*
	7.00 - 8.50		93	0	0					*Fracture: 65° planar to curved rough. Stained orange.*
	8.50 - 10.00		96	0	0					*Bedding Fracture: 80° planar rough. Stained orange.* *Bedding Fracture: 80° planar rough. Stained orangish brown.*

Remarks:

terrafirma

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH10
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326833.57 - 310220.90	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.16	Scale 1:50
Client:	Broad Environmental		Dates:	01/11/2018 - 02/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	10.00 - 11.50		76	10	10					Very weak grey MUDSTONE. Fractures are very close to closely spaced, occasionally medium spaced 5° - 35° stained orangish brown and/or dark grey/black *Fracture: 65° to sub-vertical curved. Stained orange.*
						11.50	102.66			End of Borehole at 11.500m

11 12 13 14 15 16 17 18 19 20

Remarks:

ANNEX D
Rock Core Photographs

PROBEHOLE 1


0.00 GL
1.00
BUTTINGTON QUARRY
BH1
BOX 1
1.00 mts
2.50 mts


2.50 mts
4.00 mts
BUTTINGTON QUARRY
BH 1
BOX 2
4.00 mts
5.50 mts


5.50mtr
7.00mtr
BH 1
Box 3


8.50mtr
10.00mtr
BH 1
Box 4
10.00mtr
10.85mtr


BUTTINGTON QUARRY
BH1
BOX 5
12.35m
13.85m

PROBEHOLE 2


6.80
7.60
BH2
Box 3


9.00
10.40
BH2
Box4


BH8
Box11


BH8
Box12


3400
3440
BH2
Box 13


3725
BH2
Box 14


44.50
46.80
BA2
Box 17
46.90
47.80

PROBEHOLE 3

PROBEHOLE 4


6.80
8.30


9.50
25.00
26.50


2650
3120
BH4
Box 5
2800
3230


3780
3795
BH4
Box6
3895
3945

PROBEHOLE 5


14.80
16.30
BH5
B6
16.30
17.80

PROBEHOLE 6


5.50
7.00mts
BUTTINGTON QUARRY
BH6
BOX 3
7.00mts
8.50mts

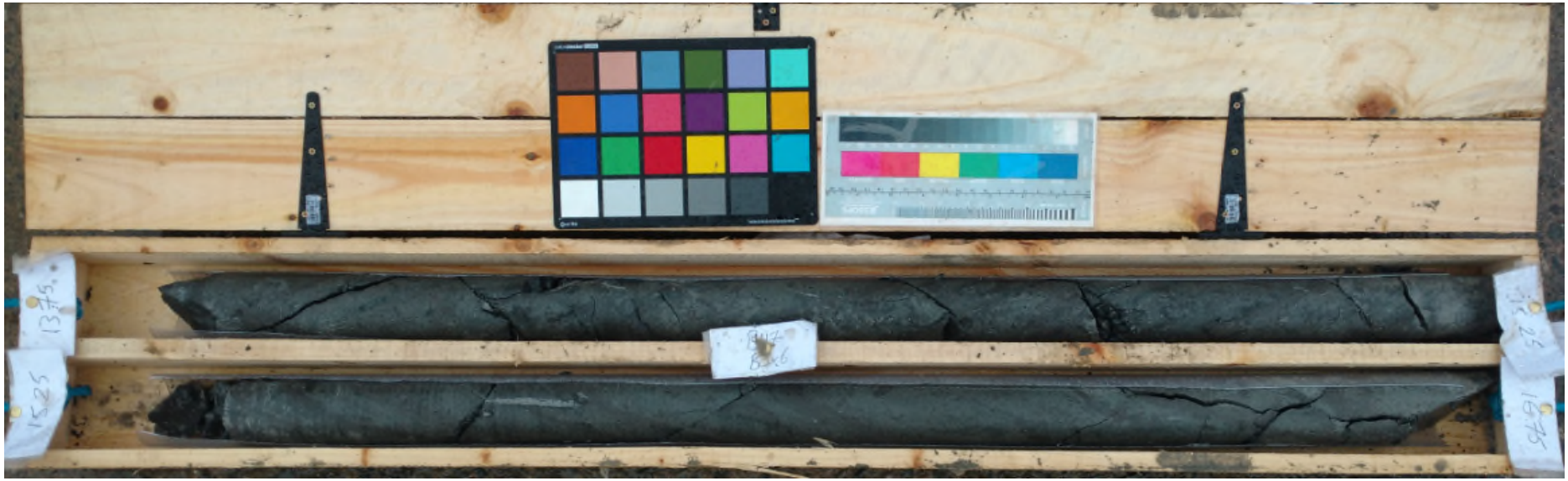

8.50mts
BUTTINGTON QUARRY
BH6
BOX 4
10.00mts
10.00
11.50


11·50m
13·00m
BLETCHLEY PARK
BH 6
BOX 5
13·00
14·00

PROBEHOLE 7


BH7
Box3
7.15
8.15


BH7
Box4
8.65
9.65
9.65
10.75



PROBEHOLE 8


6.60
8.00
BH8
Box 3


9.40
10.65
BH8
8.65
12.15


T3.85 12.15
BH8
Box 5
13.65
15.00


15.80
16.40
16.40
17.70


17.70
19.10
BH8
Box7
19.10
20.40


20.40
BH8
Box8
21.85


2306
2441
BH8
Box9
2475
2515


2515
2627
2735
BH8
Box10
2788
2988


28.80
30.20
BH8
Box 11
30.20
31.50


31.50
32.40
BH8
Box 12
32.40
34.00


BH8
Box 13


BH8
Box 14


BH8
Box 15

PROBEHOLE 9


1.00m
2.30m
BUTTINGTON QUARRY
CH 9
BOX 1
2.30m
3.80m


3.80m
5.25m
BUTTINGTON QUARRY
CH 9
Box 2


6.70m
7.85m
BATTINGTON QUARRY
BH9
Box 3
7.85m
9.35m


9.35m
10.50m
BATTINGTON QUARRY
BH9
Box 4
10.50m
12.00m


JESSOPS
BH 9
BOX 5

PROBEHOLE 10

ANNEX E
Rock Core Geotechnical Test Results

TEST REPORT
POINT LOAD INDEX TEST
ISRM: 1985

Project No: D8336-18

Project Name: Buttington Quarry

Client: Terra Firma Wales Ltd

Address: Deryn Court
5 Wharfdale Road
Cardiff
CF23 7HA

Borehole	Depth m	Sample Ref	Sample Type	Specimen Ref	Speciment Depth	Rock Type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions			LOAD P	De equivalent diameter, mm	Point Load Index Mpa $F=(De/50)^{0.45}$		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	Dps' mm	W mm	kN		I_s	$I_{s(50)}$	
BH8	10.70		C			MUDSTONE/ SILTSTONE	D	U	Y	50	72	72	8.91	72.00	1.72	2.02	
BH8	10.70		C			MUDSTONE/ SILTSTONE	A	U	Y		52	72	2.24	69.04	0.47	0.54	
BH8	15.00		C			MUDSTONE/ SILTSTONE	D	U	Y	100	72	72	7.45	72.00	1.44	1.69	
BH8	15.00		C			MUDSTONE/ SILTSTONE	A	U	Y		35	72	4.79	56.64	1.49	1.58	
BH8	33.50		C			MUDSTONE/ SILTSTONE	D	U	Y	55	72	72	15.36	72.00	2.96	3.49	
BH8	33.50		C			MUDSTONE/ SILTSTONE	A	U	Y		66	72	8.71	77.78	1.44	1.76	
BH8	28.60		C			MUDSTONE/ SILTSTONE	D	U	Y	50	72	72	8.75	72.00	1.69	1.99	
BH8	28.60		C			MUDSTONE/ SILTSTONE	A	U	Y		105	72	5.14	98.11	0.53	0.72	
BH9	9.00		C			MUDSTONE/ SILTSTONE	D	U	Y	40	72	72	5.72	72.00	1.10	1.30	
BH9	9.00		C			MUDSTONE/ SILTSTONE	A	U	Y		98	72	5.25	94.78	0.58	0.78	
BH9	12.00		C			MUDSTONE/ SILTSTONE	D	U	Y	60	72	72	10.02	72.00	1.93	2.28	
BH9	12.00		C			MUDSTONE/ SILTSTONE	A	U	Y		53	72	1.81	69.70	0.37	0.43	

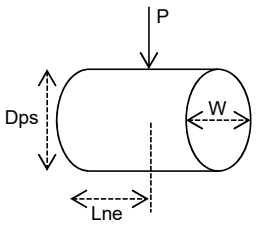
All specimens tested as received water content unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block

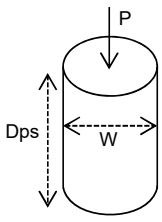
Direction
U - Unknown or Random
L - Parallel to planes of weakness
P - Perpendicular to planes of weakness

Dimensions
Dps' - Distance between platens at failure
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P

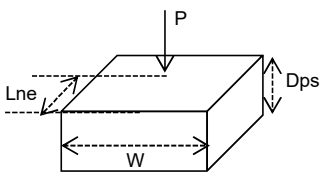
Diametral



Axial



Block / Irregular Lump



QA Ref.		Approver	Date	Fig.
ISRM Rev 2.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	R Figgis	08/11/2018	**PLT 2**
		R Figgis, Laboratory Supervisor		

SUMMARY OF RESULTS
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
ISRM 2007

Project No: D8336-18 **Project Name:** Buttington Quarry

Borehole	Sample No.	Depth (m) from	Depth (m) to	Type	Rock Type	Specimen Dimensions[2] Dia mm	Height mm	H/D	Bulk Density[2] Mg/m^3	Water Content[1] %	Uniaxial Compressive[3] Load Rate kN/min	Time to failure secs	Mode of failure	UCS Mpa	Remarks
BH2		12.90	13.10	C	Shale	72	200	2.8	2.67	1.9	0.7	144	A	17.1	
BH2		22.30	22.50	C	Shale	72	200	2.8	2.67	2.0	0.7	84	A	18.1	
BH2		32.40	32.58	C	Shale	72	148	2.1	2.69	1.2	0.7	241	A	43.2	
BH2		44.00	44.20	C	Shale	72	200	2.8	2.69	1.4	0.7	157	S	35.6	Slickenside
BH3		9.40	9.55	C	Shale	72	150	2.1	2.66	2.3	0.7	75	A	11.0	
BH3		14.00	14.20	C	Shale	72	200	2.8	2.67	1.9	0.7	128	A	21.2	
BH3		18.00	18.20	C	Shale	72	200	2.8	2.67	1.9	0.7	181	A	27.8	
BH5		9.50	9.70	C	Shale	72	200	2.8	2.67	1.6	0.7	145	A	25.9	
BH5		15.40	15.55	C	Shale	72	150	2.1	2.68	1.7	0.7	161	A	28.0	
BH8		40.30	40.50	C	Shale	72	200	2.8	2.70	1.2	0.7	253	A	50.2	
BH8		46.00	46.20	C	Shale	72	200	2.8	2.70	1.0	0.7	215	A	42.6	

Notes: Test Specification : International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

1 ISRM p87 test 1, water content at 105 ± 3^{o}C, specimen as received at the laboratory.

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1 determination of Uniaxial Compressive Strength (UCS) of Rock Materials

Mode of failure: S - Single Shear MS - Multiple Shear AC - Axial Cleavage F - Fragmented

QA Ref.		Approver	Date	Fig.
ISRM Rev 1.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	A Grogan A Grogan Laboratory Manager	21/11/2018	**UCS 1**

SUMMARY OF RESULTS
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
ISRM 2007

Project No: D8336-18 **Project Name:** Buttington Quarry

Borehole	Sample				Rock Type	Specimen Dimensions[2]			Bulk Density[2]	Water Content[1]	Uniaxial Compressive[3]				Remarks
	No.	Depth (m)		Type		Dia	Height	H/D			Load Rate	Time to failure	Mode of failure	UCS	
		from	to			mm	mm		Mg/m^3	%	kN/min	secs		Mpa	
BH4		25.30	25.45	C	Shale	72	150	2.1	2.90	1.6	0.7	147	A	28.0	
BH4		37.30	37.50	C	Shale	72	200	2.8	2.68	1.7	0.7	172	A	34.2	
BH4		N/A	N/A	C	Shale	72	200	2.8	2.69	1.7	0.7	218	A	35.8	
BH7		11.80	11.95	C	Shale	72	150	2.1	2.63	3.8	0.7	98	A	9.2	
BH7		16.80	17.00	C	Shale	72	200	2.8	2.62	3.4	0.7	68	A	5.7	
BH7		21.00	21.10	C	Shale	72	100	1.4	2.65	3.3	0.7	55	A	5.7	

Notes: Test Specification : International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

1 ISRM p87 test 1, water content at 105 ± 3^{o}C, specimen as received at the laboratory.

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1 determination of Uniaxial Compressive Strength (UCS) of Rock Materials

Mode of failure: S - Single Shear MS - Multiple Shear AC - Axial Cleavage F - Fragmented

QA Ref.	Apex Testing Solutions Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	Approver	Date	Fig.
ISRM Rev 1.0		A Grogan	27/11/2018	UCS 1
		A Grogan Laboratory Manager		

SUMMARY OF RESULTS
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
ISRM 2007

Project No:	**D8336-18**	**Project Name:**	**Buttington Quarry**

Borehole	Sample				Rock Type	Specimen Dimensions[2]			Bulk Density[2]	Water Content[1]	Uniaxial Compressive[3]				Remarks
	No.	Depth (m)		Type		Dia	Height	H/D			Load Rate	Time to failure	Mode of failure	UCS	
		from	to			mm	mm		Mg/m^3	%	kN/min	secs		Mpa	
BH1	N/A	2.50	2.70	C	Mudstone/Siltstone	72	200	2.8	2.71	2.9	0.7	154	AC	23.5	
BH1	N/A	8.50	8.70	C	Mudstone/Siltstone	72	200	2.8	2.69	2.5	0.7	165	AC	14.3	
BH6	N/A	5.00	5.20	C	Mudstone/Siltstone	72	200	2.8	2.69	2.8	0.7	85	AC	5.0	
BH6	N/A	9.00	9.20	C	Mudstone/Siltstone	72	200	2.8	2.67	3.0	0.7	150	A/C	6.3	
BH8	N/A	14.00	14.12	C	Mudstone/Siltstone	72	120	1.7	2.68	1.5	0.7	152	AC	18.4	
BH8	N/A	36.50	36.70	C	Mudstone/Siltstone	72	200	2.8	2.69	1.4	0.7	127	AC	21.3	
BH9	N/A	11.00	11.20	C	Limestone	72	200	2.8	2.68	1.6	0.7	177	AC	34.0	
BH9	N/A	13.50	13.70	C	Limestone	72	200	2.8	2.68	1.6	0.7	81	AC	14.2	

Notes: Test Specification : International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

1 ISRM p87 test 1, water content at 105 ± 3^{o}C, specimen as received at the laboratory.

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1 determination of Uniaxial Compressive Strength (UCS) of Rock Materials

Mode of failure: S - Single Shear MS - Multiple Shear AC - Axial Cleavage F - Fragmented

QA Ref. ISRM Rev 1.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	Approver: *A Grogan* A Grogan Laboratory Manager	Date: 09/11/2018	Fig. **UCS 1**

TEST REPORT
POINT LOAD INDEX TEST
ISRM: 1985

Project No: D8336-18

Project Name: Buttington Quarry

Client: Terra Firma Wales Ltd

Address: Deryn Court
5 Wharfdale Road
Cardiff
CF23 7HA

Borehole	Depth m	Sample Ref	Sample Type	Specimen Ref	Speciment Depth	Rock Type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions			LOAD P	De equivalent diameter, mm	Point Load Index Mpa $F=(De/50)^{0.45}$		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	Dps' mm	W mm	kN		I_s	$I_{s(50)}$	
BH1	3.75		C			MUDSTONE/ SILTSTONE	D	U	Y	62	72	72	2.49	72.00	0.48	0.57	
BH1	3.75		C			MUDSTONE/ SILTSTONE	A	U	Y		75	72	2.52	82.92	0.37	0.46	
BH1	9.00		C			MUDSTONE/ SILTSTONE	D	U	Y	55	72	72	4.35	72.00	0.84	0.99	
BH1	9.00		C			MUDSTONE/ SILTSTONE	A	U	Y		34	72	1.25	55.83	0.40	0.42	
BH1	13.00		C			MUDSTONE/ SILTSTONE	D	U	Y	45	72	72	4.61	72.00	0.89	1.05	
BH1	13.00		C			MUDSTONE/ SILTSTONE	A	U	Y		30	72	2.54	52.44	0.92	0.94	
BH6	3.60		C			MUDSTONE/ SILTSTONE	D	U	Y	62	72	72	2.49	72.00	0.48	0.57	No axial test as core split vertically
BH6	8.50		C			MUDSTONE/ SILTSTONE	D	U	Y	45	72	72	7.80	72.00	1.51	1.77	
BH6	8.50		C			MUDSTONE/ SILTSTONE	A	U	Y		55	72	0.41	71.01	0.08	0.09	
BH6	13.50		C			MUDSTONE/ SILTSTONE	D	U	Y	70	72	72	3.28	72.00	0.63	0.74	
BH6	13.50		C			MUDSTONE/ SILTSTONE	A	U	Y		90	72	1.90	90.83	0.23	0.30	

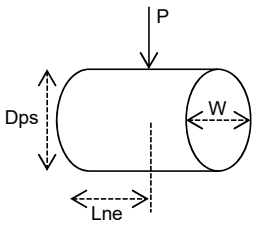
All specimens tested as received water content unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block

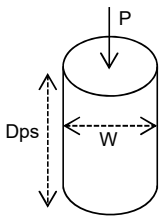
Direction
U - Unknown or Random
L - Parallel to planes of weakness
P - Perpendicular to planes of weakness

Dimensions
Dps' - Distance between platens at failure
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P

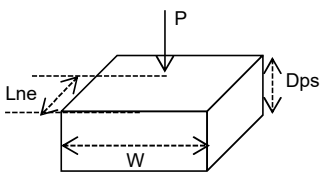
Diametral



Axial



Block / Irregular Lump



QA Ref.		Approver	Date	Fig.
ISRM Rev 2.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	R Figgis	08/11/2018	**PLT 1**
		R Figgis, Laboratory Supervisor		

TEST REPORT
POINT LOAD INDEX TEST
ISRM: 1985

Project No: D8336-18

Project Name: Buttington Quarry

Client: Terra Firma Wales Ltd

Address: Deryn Court
5 Wharfdale
Cardiff
CF23 7HA

Borehole	Depth m	Sample Ref	Sample Type	Specimen Ref	Speciment Depth	Rock Type	Test Type see ISRM Fig 5 and 8		Failure Valid (Y/N)	Dimensions			LOAD P	De equivalent diameter, mm	Point Load Index Mpa $F=(De/50)^{0.45}$		Remarks
							Type (D, A, I, B)	Direction (L, P or U)		Lne mm	Dps' mm	W mm	kN		I_s	$I_{s(50)}$	
BH2	8.50		C			MUDSTONE/ SILTSTONE	D	U	Y	100	72	72	5.50	72.00	1.06	1.25	No axial test as core split vertically
BH2	16.10		C			MUDSTONE/ SILTSTONE	D	U	Y	150	72	72	2.95	72.00	0.57	0.67	No axial test as core split vertically
BH2	39.00		C			MUDSTONE/ SILTSTONE	D	U	Y	290	72	72	6.31	72.00	1.22	1.43	No axial test as core split vertically
BH3	16.00		C			MUDSTONE/ SILTSTONE	D	U	Y	170	72	72	6.86	72.00	1.32	1.56	
BH3	16.00		C			MUDSTONE/ SILTSTONE	A	U	Y		105	72	3.62	98.11	0.38	0.51	
BH5	6.00		C			MUDSTONE/ SILTSTONE	D	U	Y	135	72	72	5.36	72.00	1.03	1.22	
BH5	6.00		C			MUDSTONE/ SILTSTONE	A	U	Y		110	72	3.17	100.42	0.31	0.43	
BH5	14.00		C			MUDSTONE/ SILTSTONE	D	U	Y	125	72	72	7.97	72.00	1.54	1.81	
BH5	14.00		C			MUDSTONE/ SILTSTONE	A	U	Y		100	72	6.38	95.75	0.70	0.93	
BH8	43.00		C			MUDSTONE/ SILTSTONE	I	U	Y	125	50	72	3.59	67.70	0.78	0.90	

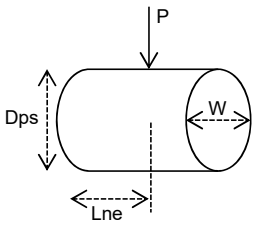
All specimens tested as received water content unless shown otherwise

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block

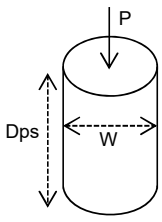
Direction
U - Unknown or Random
L - Parallel to planes of weakness
P - Perpendicular to planes of weakness

Dimensions
Dps' - Distance between platens at failure
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P

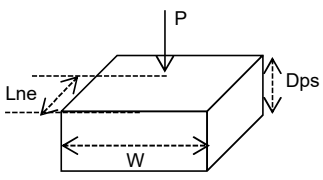
Diametral



Axial



Block / Irregular Lump



QA Ref.		Approver	Date	Fig.
ISRM Rev 2.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	*R Figgis*	19/11/2018	**PLT 3**
		R Figgis, Laboratory Supervisor		

ANNEX F
Groundwater Test Results

Certificate of Analysis

Certificate Number 18-27827

03-Dec-18

Client Terra Firma (Wales) Ltd
5 Deryn Court
Wharfdale Road
Pentwyn
Cardiff
CF23 7HB

Our Reference 18-27827

Client Reference 14880 RH

Order No 14880 RH

Contract Title B.Q-Buttington Quarry

Description 6 Water samples.

Date Received 23-Nov-18

Date Started 23-Nov-18

Date Completed 03-Dec-18

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Water Samples

Our Ref 18-27827
Client Ref 14880 RH
Contract Title B.Q-Buttington Quarry

			Lab No	1425213	1425214	1425215	1425216	1425217	1425218
			Sample ID	BH2	BH4	BH7	BH8	BH9	LAGOON
			Depth						
			Other ID						
			Sample Type	WATER	WATER	WATER	WATER	WATER	WATER
			Sampling Date	21/11/18	21/11/18	21/11/18	21/11/18	21/11/18	21/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Metals									
Aluminium, Dissolved	DETSC 2306	10	ug/l	88	140	790	92	140	540
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	45	26	12	0.73	1.2	1.2
Boron, Dissolved	DETSC 2306*	12	ug/l	260	180	330	150	45	140
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03
Calcium, Dissolved	DETSC 2306	0.09	mg/l	130	240	7.7	74	54	12
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	1.2	< 0.25	0.35	0.47
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	0.4	< 0.4	7.6	0.4	5.1	2.2
Iron, Dissolved	DETSC 2306	5.5	ug/l	7.5	5.5	660	38	32	130
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.13	0.10	14	0.22	0.34	0.29
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	39	75	1.9	27	18	3.9
Manganese, Dissolved	DETSC 2306	0.22	ug/l	97	270	34	41	16	3.9
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	6.9	12	2.5	0.7	5.7	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.83	0.92	7.4	1.2	5.3	2.2
Sodium, Dissolved	DETSC 2306	0.07	mg/l	110	45	130	30	24	56
Tin, Dissolved	DETSC 2306*	0.4	ug/l	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Zinc, Dissolved	DETSC 2306	1.3	ug/l	61	22	110	2.1	11	60
Inorganics									
Conductivity	DETSC 2009	1	uS/cm	1260	1630	639	734	551	451
pH	DETSC 2008			6.6	6.8	8.3	7.3	7.4	7.7
Biochemical Oxygen Demand, Total	DETSC 2031	1	mg/l	8.5	19	< 1.0	5.4	3.2	4.3
Chemical Oxygen Demand, Total	DETSC 2032	10	mg/l	< 10	10	26	< 10	34	< 10
Cyanide, Total	DETSC 2130	0.04	mg/l	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Hardness	DETSC 2303	0.1	mg/l	487	898	26.7	296	206	45.8
Suspended Solids	DETSC 2034	5	mg/l	150	880	960	62	640	130
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.41	0.85	0.23	0.13	0.079	0.14
Chloride	DETSC 2055	0.1	mg/l	18	13	17	13	11	8.8
Nitrite as N	DETSC 2201	0.035	mg/l	< 0.035	< 0.035	< 0.035	< 0.035	< 0.035	< 0.035
Ortho Phosphate as PO4	DETSC 2205	0.01	mg/l	0.07	0.04	0.20	< 0.01	0.02	0.10
Sulphate as SO4	DETSC 2055	0.1	mg/l	330	300	110	58	50	60
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	48	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	48	< 10	< 10	< 10

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Water Samples

Our Ref 18-27827
Client Ref 14880 RH
Contract Title B.Q-Buttington Quarry

			Lab No	1425213	1425214	1425215	1425216	1425217	1425218
			Sample ID	BH2	BH4	BH7	BH8	BH9	LAGOON
			Depth						
			Other ID						
			Sample Type	WATER	WATER	WATER	WATER	WATER	WATER
			Sampling Date	21/11/18	21/11/18	21/11/18	21/11/18	21/11/18	21/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10	48	< 10	< 10	< 10
C10-C24 Diesel Range Organics (DRO)	DETSC 3311	10	ug/l	< 10	< 10	140	< 10	< 10	43
EPH (C10-C40)	DETSC 3311	10	ug/l	< 10	< 10	770	< 10	< 10	55
PAHs									
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	0.09	< 0.05	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	0.01	< 0.01	0.02	< 0.01	< 0.01	0.03
Phenanthrene	DETSC 3304	0.01	ug/l	0.01	< 0.01	0.06	< 0.01	< 0.01	0.11
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20	0.20	< 0.20	< 0.20	0.25
Phenols									
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100	< 100	< 100	< 100	< 100	< 100

Key: * -not accredited. n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 18-27827
Client Ref 14880 RH
Contract B.Q-Buttington Quarry

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1425213	BH2 WATER	21/11/18	GB 1L x2, GV, PB 1L x2		
1425214	BH4 WATER	21/11/18	GB 1L x2, GV, PB 1L x2		
1425215	BH7 WATER	21/11/18	GB 1L x2, GV, PB 1L x2		
1425216	BH8 WATER	21/11/18	GB 1L x2, GV, PB 1L x2		
1425217	BH9 WATER	21/11/18	GB 1L x2, GV, PB 1L x2		
1425218	LAGOON WATER	21/11/18	GB 1L x2, GV, PB 1L x2		

Key: G-Glass P-Plastic B-Bottle V-Vial

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Certificate of Analysis

Certificate Number	18-26412
	14-Nov-18
Client	Terra Firma (Wales) Ltd 5 Deryn Court Wharfdale Road Pentwyn Cardiff CF23 7HB
Our Reference	18-26412
Client Reference	14880 RH
Order No	14880 RH
Contract Title	Buttington Quarry
Description	2 Water samples.
Date Received	06-Nov-18
Date Started	06-Nov-18
Date Completed	14-Nov-18
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Water Samples

Our Ref 18-26412
Client Ref 14880 RH
Contract Title Buttington Quarry

			Lab No	1417080	1417081
			Sample ID	BH1	BH6
			Depth		
			Other ID		
			Sample Type	WATER	WATER
			Sampling Date	02/11/18	02/11/18
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Aluminium, Dissolved	DETSC 2306	10	ug/l	220	58
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.89	12
Boron, Dissolved	DETSC 2306*	12	ug/l	310	240
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	0.17
Calcium, Dissolved	DETSC 2306	0.09	mg/l	9.0	7.9
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.88	75
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0	75
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	1.5	100
Iron, Dissolved	DETSC 2306	5.5	ug/l	220	1600
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.52	0.59
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	0.82	0.87
Manganese, Dissolved	DETSC 2306	0.22	ug/l	55	54
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.9	150
Selenium, Dissolved	DETSC 2306	0.25	ug/l	1.7	1.0
Sodium, Dissolved	DETSC 2306	0.07	mg/l	180	200
Tin, Dissolved	DETSC 2306*	0.4	ug/l	< 0.4	2.5
Zinc, Dissolved	DETSC 2306	1.3	ug/l	37	340
Inorganics					
Conductivity	DETSC 2009	1	uS/cm	722	939
pH	DETSC 2008			8.2	8.1
Biochemical Oxygen Demand, Total	DETSC 2031	1	mg/l	26	13
Chemical Oxygen Demand, Total	DETSC 2032	10	mg/l	11	< 10
Cyanide, Total	DETSC 2130	0.04	mg/l	< 0.04	< 0.04
Hardness	DETSC 2303	0.1	mg/l	25.8	23.3
Suspended Solids	DETSC 2034	5	mg/l	1200	330
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.039	0.46
Chloride	DETSC 2055	0.1	mg/l	1.5	1.1
Nitrite as N	DETSC 2201	0.035	mg/l	0.079	< 0.035
Ortho Phosphate as PO4	DETSC 2205	0.01	mg/l	0.05	0.05
Sulphate as SO4	DETSC 2055	0.1	mg/l	7.1	2.1
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Water Samples

Our Ref 18-26412
Client Ref 14880 RH
Contract Title Buttington Quarry

			Lab No	1417080	1417081
			Sample ID	BH1	BH6
			Depth		
			Other ID		
			Sample Type	WATER	WATER
			Sampling Date	02/11/18	02/11/18
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10
C10-C24 Diesel Range Organics (DRO)	DETSC 3311	10	ug/l	< 10	< 10
EPH (C10-C40)	DETSC 3311	10	ug/l	< 10	< 10
PAHs					
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20
Phenols					
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100	< 100

Key: * -not accredited. n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 18-26412
Client Ref 14880 RH
Contract Buttington Quarry

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1417080	BH1 WATER	02/11/18	GB 1L x2, GV, PB 1L x2	pH/Cond/TDS (2 days), Nitrite as N (2 days)	
1417081	BH6 WATER	02/11/18	GB 1L x2, GV, PB 1L x2	pH/Cond/TDS (2 days), Nitrite as N (2 days)	

Key: G-Glass P-Plastic B-Bottle V-Vial

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

ANNEX G
Soil Test Results

Certificate of Analysis

Certificate Number 18-26250

07-Dec-18

Client Terra Firma (Wales) Ltd
5 Deryn Court
Wharfdale Road
Pentwyn
Cardiff
CF23 7HB

Our Reference 18-26250

Client Reference 14880RH

Order No 14880RH

Contract Title B.Q. - Buttington Quarry

Description 25 Soil samples.

Date Received 05-Nov-18

Date Started 05-Nov-18

Date Completed 07-Dec-18

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
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Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

			Lab No	1416278	1416279	1416280	1416281	1416282	1416283
			Sample ID	S1	S2	S3	S4	S6	S7
			Depth						
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Preparation									
Moisture Content	DETSC 1004	0.1	%	8.4	8.4	6.3	11	6.7	5.1
Metals									
Aluminium	DETSC 2301*	1	mg/kg	20000	15000	15000	15000	15000	17000
Arsenic	DETSC 2301#	0.2	mg/kg	6.2	2.5	2.4	13	2.4	11
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	0.5	0.8	0.8	0.9	0.9	0.7
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Calcium	DETSC 2301*	1	mg/kg	3700	4300	10000	3800	2300	8000
Chromium	DETSC 2301#	0.15	mg/kg	26	21	21	21	25	22
Chromium III	DETSC 2301*	0.15	mg/kg	26	21	21	21	25	22
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	33	37	33	18	29	45
Iron	DETSC 2301	25	mg/kg	43000	35000	35000	32000	41000	35000
Lead	DETSC 2301#	0.3	mg/kg	7.9	5.4	18	17	6.3	20
Manganese	DETSC 2301#	20	mg/kg	680	650	830	450	260	430
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	36	34	33	27	35	28
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sodium	DETSC 2301*	0.1	mg/kg	210	200	180	330	290	210
Tin	DETSC 2301	1	mg/kg	1.1	1.2	< 1.0	< 1.0	1.1	< 1.0
Zinc	DETSC 2301#	1	mg/kg	84	80	72	64	76	63
Inorganics									
Conductivity	DETSC 2009	1	uS/cm	56	46	79	110	68	99
pH	DETSC 2008#			8.3	8.4	8.4	8.7	8.5	8.5
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	0.3	< 0.1	0.2	< 0.1
Organic matter	DETSC 2002#	0.1	%	0.4	< 0.1	0.2	0.1	0.1	0.2
Ammoniacal Nitrogen as N	DETSC 2119#	0.5	mg/kg	1.4	1.1	1.0	1.5	< 0.50	1.1
Chloride	DETSC 2055	1	mg/kg	10.9	< 1.0	< 1.0	2.3	1.4	3.5
Nitrite as NO2	DETSC 2055	1	mg/kg	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ortho Phosphate as P	DETSC 2205*	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.01	< 0.01	0.01	0.02	< 0.01	< 0.01
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

			Lab No	1416278	1416279	1416280	1416281	1416282	1416283
			Sample ID	S1	S2	S3	S4	S6	S7
			Depth						
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	13	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	29	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	6.9	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	49	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	49	< 10	< 10	< 10
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Fuel Identification	*			N	N	N	N	N	N
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

			Lab No	1416284	1416285	1416286	1416287	1416288	1416289
			Sample ID	S8	S9	S11	S12	S13	S14
			Depth						
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Preparation									
Moisture Content	DETSC 1004	0.1	%	6.3	6.7	7.5	5.1	7.2	7.1
Metals									
Aluminium	DETSC 2301*	1	mg/kg	17000	18000	17000	16000	5900	8400
Arsenic	DETSC 2301#	0.2	mg/kg	1.8	12	8.6	5.7	5.6	14
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	1.0	0.8	0.7	0.9	1.0	0.8
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.4	< 0.1
Calcium	DETSC 2301*	1	mg/kg	2500	9300	2000	4900	20000	44000
Chromium	DETSC 2301#	0.15	mg/kg	25	25	24	26	110	24
Chromium III	DETSC 2301*	0.15	mg/kg	25	25	24	26	110	24
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	23	51	17	34	10	21
Iron	DETSC 2301	25	mg/kg	43000	37000	38000	40000	11000	28000
Lead	DETSC 2301#	0.3	mg/kg	6.4	31	15	16	34	15
Manganese	DETSC 2301#	20	mg/kg	320	950	300	670	430	380
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	36	36	30	36	56	28
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sodium	DETSC 2301*	0.1	mg/kg	210	200	330	340	210	370
Tin	DETSC 2301	1	mg/kg	1.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	DETSC 2301#	1	mg/kg	80	72	67	76	130	74
Inorganics									
Conductivity	DETSC 2009	1	uS/cm	35	110	110	120	89	150
pH	DETSC 2008#			7.1	8.0	8.4	8.5	8.7	8.3
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%	0.1	0.4	0.2	< 0.1	0.2	0.5
Ammoniacal Nitrogen as N	DETSC 2119#	0.5	mg/kg	1.1	1.1	1.5	1.6	0.84	1.9
Chloride	DETSC 2055	1	mg/kg	1.5	4.8	2.6	1.8	5.3	19.8
Nitrite as NO2	DETSC 2055	1	mg/kg	< 1.0	1.6	< 1.0	< 1.0	< 1.0	1.3
Ortho Phosphate as P	DETSC 2205*	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Sulphate as SO4, Total	DETSC 2321#	0.01	%	< 0.01	0.02	< 0.01	0.02	< 0.01	0.06
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	2.8	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	9.9	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	14	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

			Lab No	1416284	1416285	1416286	1416287	1416288	1416289
			Sample ID	S8	S9	S11	S12	S13	S14
			Depth						
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	4.4	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	18	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	2.5	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	25	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	40	< 10	< 10	< 10	< 10	< 10
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Fuel Identification	*			N	N	N	N	N	N
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

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Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

			Lab No	1416290	1416291	1416292	1416293	1416294	1416295
			Sample ID	S15	S16	S17	S18	S20	S21
			Depth						
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Preparation									
Moisture Content	DETSC 1004	0.1	%	8.6	7.5	18	18	19	7.0
Metals									
Aluminium	DETSC 2301*	1	mg/kg	15000	17000	17000	22000	21000	22000
Arsenic	DETSC 2301#	0.2	mg/kg	47	33	11	12	6.4	12
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	0.6	0.7	0.7	0.8	0.7	1.1
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	0.3	0.1	< 0.1	0.3
Calcium	DETSC 2301*	1	mg/kg	41000	22000	3200	3200	2200	3300
Chromium	DETSC 2301#	0.15	mg/kg	24	27	31	39	31	38
Chromium III	DETSC 2301*	0.15	mg/kg	24	27	31	39	31	38
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	37	31	48	34	26	34
Iron	DETSC 2301	25	mg/kg	40000	37000	38000	42000	40000	41000
Lead	DETSC 2301#	0.3	mg/kg	19	17	34	27	15	37
Manganese	DETSC 2301#	20	mg/kg	470	340	350	570	160	590
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	37	41	58	42	35	44
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sodium	DETSC 2301*	0.1	mg/kg	210	150	130	160	150	160
Tin	DETSC 2301	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.1
Zinc	DETSC 2301#	1	mg/kg	82	85	130	90	74	100
Inorganics									
Conductivity	DETSC 2009	1	uS/cm	190	73	100	75	65	230
pH	DETSC 2008#			8.2	8.5	8.0	6.7	7.0	6.7
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3
Organic matter	DETSC 2002#	0.1	%	0.9	0.5	0.6	1.6	0.6	3.2
Ammoniacal Nitrogen as N	DETSC 2119#	0.5	mg/kg	4.0	5.2	4.9	2.0	1.7	3.3
Chloride	DETSC 2055	1	mg/kg	< 1.0	< 1.0	1.3	2.2	3.0	3.3
Nitrite as NO2	DETSC 2055	1	mg/kg	< 1.0	< 1.0	1.3	< 1.0	< 1.0	< 1.0
Ortho Phosphate as P	DETSC 2205*	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.10	0.01	0.01	0.04	0.02	0.05
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

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Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

			Lab No	1416290	1416291	1416292	1416293	1416294	1416295
			Sample ID	S15	S16	S17	S18	S20	S21
			Depth						
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18	02/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Fuel Identification	*			N	N	N	N	N	N
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

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Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

			Lab No	1416296	1416297	1416298	1416299	1420940	1425219
			Sample ID	S22	S23	S24	S25	S10	S5
			Depth						
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/11/18	02/11/18	02/11/18	02/11/18	n/s	20/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Preparation									
Moisture Content	DETSC 1004	0.1	%	6.1	9.5	6.0	6.3	11	10
Metals									
Aluminium	DETSC 2301*	1	mg/kg	13000	19000	16000	18000	21000	18000
Arsenic	DETSC 2301#	0.2	mg/kg	5.8	6.8	12	10	6.5	14
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	0.5	0.7	0.5	0.4	0.4	0.7
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	< 0.1	< 0.1	< 0.1	13	< 0.1
Calcium	DETSC 2301*	1	mg/kg	100000	2200	7000	2100	2200	4000
Chromium	DETSC 2301#	0.15	mg/kg	23	25	20	23	27	23
Chromium III	DETSC 2301*	0.15	mg/kg	23	25	20	23	27	23
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	23	38	17	23	260	27
Iron	DETSC 2301	25	mg/kg	21000	40000	34000	39000	39000	36000
Lead	DETSC 2301#	0.3	mg/kg	18	24	18	17	32	21
Manganese	DETSC 2301#	20	mg/kg	410	270	310	240	27000	330
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	22	30	23	30	170	30
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	9.7	< 0.5
Sodium	DETSC 2301*	0.1	mg/kg	190	200	150	160	2300	210
Tin	DETSC 2301	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	DETSC 2301#	1	mg/kg	68	74	64	71	690	76
Inorganics									
Conductivity	DETSC 2009	1	uS/cm	130	58	88	74	3700	160
pH	DETSC 2008#			8.5	7.6	8.4	7.8	7.1	8.4
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%	0.6	0.4	0.4	0.1	0.2	1.0
Ammoniacal Nitrogen as N	DETSC 2119#	0.5	mg/kg	1.5	2.7	1.7	1.1	6.1	19
Chloride	DETSC 2055	1	mg/kg	3.5	22.1	7.9	3.3	17.4	12.8
Nitrite as NO2	DETSC 2055	1	mg/kg	1.9	< 1.0	< 1.0	< 1.0	9.2	1.0
Ortho Phosphate as P	DETSC 2205*	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.04	< 0.01	0.01	< 0.01	0.27	< 0.01
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

			Lab No	1416296	1416297	1416298	1416299	1420940	1425219
			Sample ID	S22	S23	S24	S25	S10	S5
			Depth						
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	02/11/18	02/11/18	02/11/18	02/11/18	n/s	20/11/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Fuel Identification	*			N	N	N	N	N	N
EPH (C10-C40)	DETSC 3311#	10	mg/kg	45	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

Lab No	1425220
Sample ID	S19
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	20/11/18
Sampling Time	n/s

Test	Method	LOD	Units	
Preparation				
Moisture Content	DETSC 1004	0.1	%	9.0
Metals				
Aluminium	DETSC 2301*	1	mg/kg	19000
Arsenic	DETSC 2301#	0.2	mg/kg	8.2
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	0.6
Cadmium	DETSC 2301#	0.1	mg/kg	0.2
Calcium	DETSC 2301*	1	mg/kg	8700
Chromium	DETSC 2301#	0.15	mg/kg	30
Chromium III	DETSC 2301*	0.15	mg/kg	30
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	42
Iron	DETSC 2301	25	mg/kg	40000
Lead	DETSC 2301#	0.3	mg/kg	19
Manganese	DETSC 2301#	20	mg/kg	380
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05
Nickel	DETSC 2301#	1	mg/kg	50
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5
Sodium	DETSC 2301*	0.1	mg/kg	170
Tin	DETSC 2301	1	mg/kg	< 1.0
Zinc	DETSC 2301#	1	mg/kg	89
Inorganics				
Conductivity	DETSC 2009	1	uS/cm	220
pH	DETSC 2008#			9.9
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.1
Organic matter	DETSC 2002#	0.1	%	0.9
Ammoniacal Nitrogen as N	DETSC 2119#	0.5	mg/kg	16
Chloride	DETSC 2055	1	mg/kg	35.1
Nitrite as NO2	DETSC 2055	1	mg/kg	< 1.0
Ortho Phosphate as P	DETSC 2205*	0.1	mg/kg	0.11
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.02
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

Lab No	1425220
Sample ID	S19
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	20/11/18
Sampling Time	n/s

Test	Method	LOD	Units	
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg	< 10
Fuel Identification	*			N
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3

Summary of Asbestos Analysis
Soil Samples

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1416278	S1	SOIL	NAD	none	A Christodoulou
1416279	S2	SOIL	NAD	none	A Christodoulou
1416280	S3	SOIL	NAD	none	A Christodoulou
1416281	S4	SOIL	NAD	none	A Christodoulou
1416282	S6	SOIL	NAD	none	A Christodoulou
1416283	S7	SOIL	NAD	none	A Christodoulou
1416284	S8	SOIL	NAD	none	A Christodoulou
1416285	S9	SOIL	NAD	none	A Christodoulou
1416286	S11	SOIL	NAD	none	A Christodoulou
1416287	S12	SOIL	NAD	none	A Christodoulou
1416288	S13	SOIL	NAD	none	A Christodoulou
1416289	S14	SOIL	NAD	none	A Christodoulou
1416290	S15	SOIL	NAD	none	A Christodoulou
1416291	S16	SOIL	NAD	none	A Christodoulou
1416292	S17	SOIL	NAD	none	A Christodoulou
1416293	S18	SOIL	NAD	none	A Christodoulou
1416294	S20	SOIL	NAD	none	A Christodoulou
1416295	S21	SOIL	NAD	none	A Christodoulou
1416296	S22	SOIL	NAD	none	A Christodoulou
1416297	S23	SOIL	NAD	none	A Christodoulou
1416298	S24	SOIL	NAD	none	A Christodoulou
1416299	S25	SOIL	NAD	none	A Christodoulou
1420940	S10	SOIL	NAD	none	Keith Wilson
1425219	S5	SOIL	NAD	none	Colin Patrick
1425220	S19	SOIL	NAD	none	Colin Patrick

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

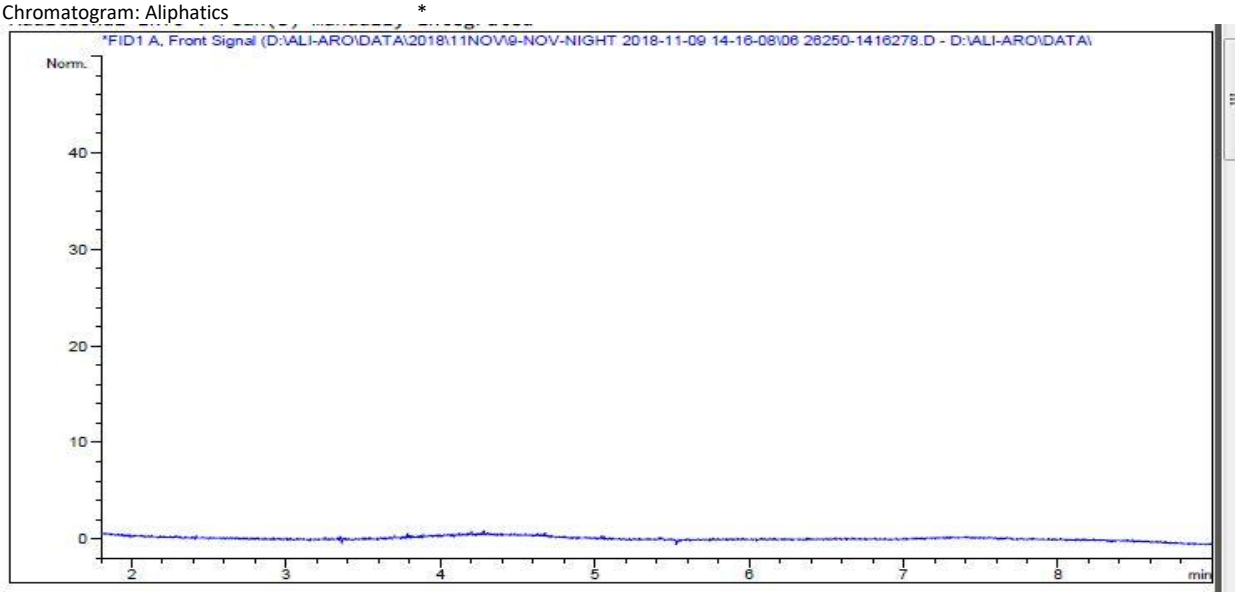
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

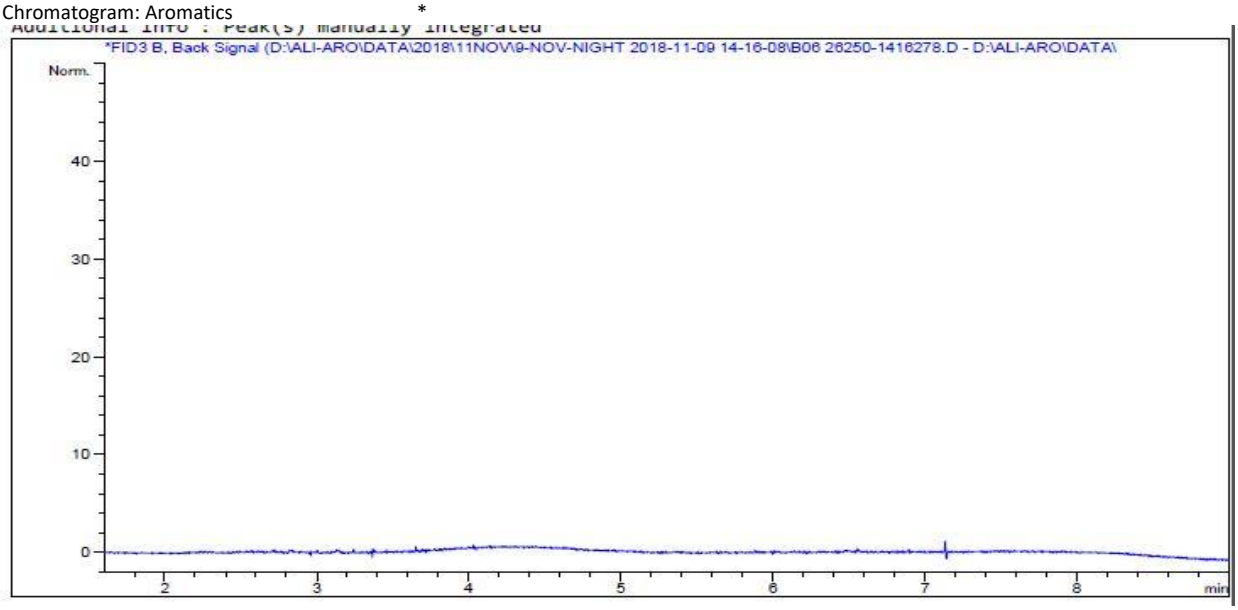
Lab No	1416278
Sample ID	S1
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



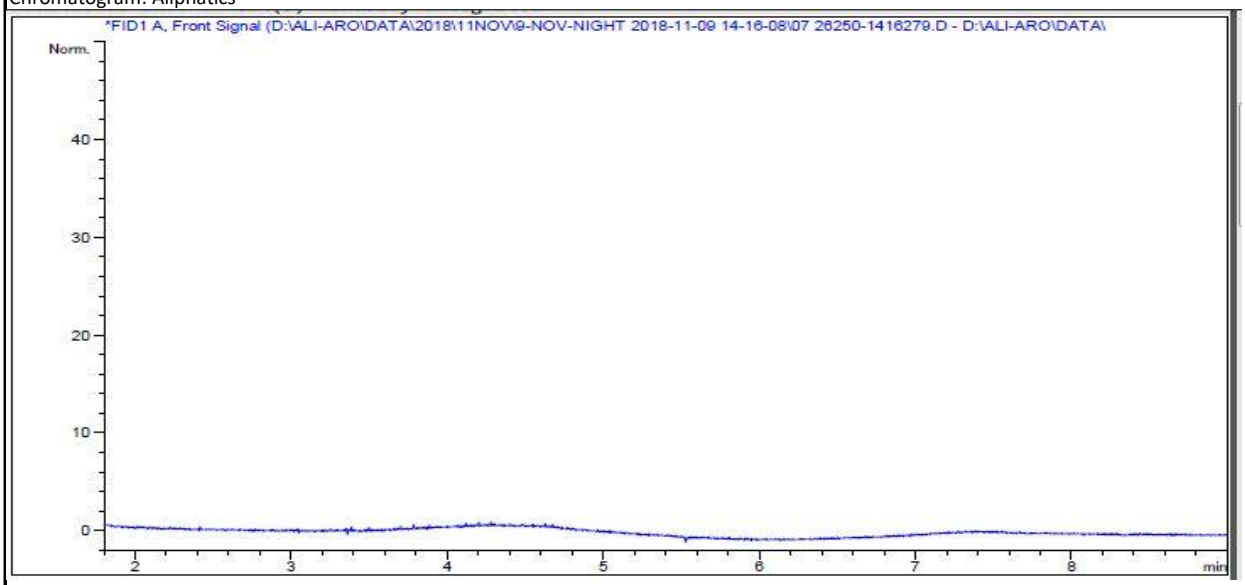
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

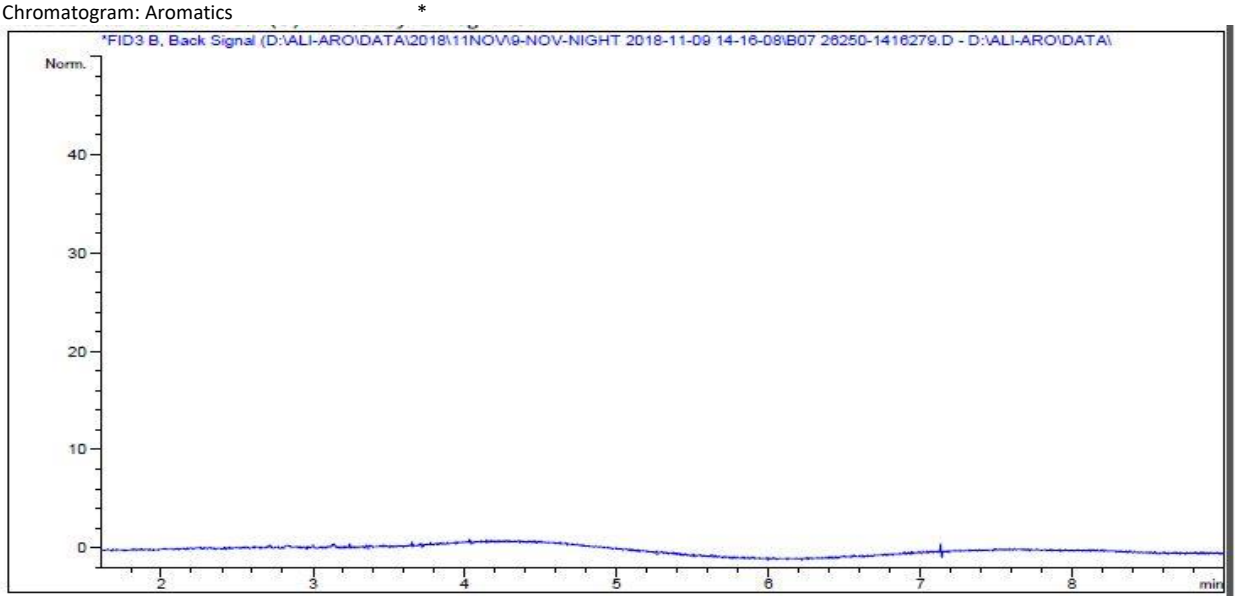
Lab No	1416279
Sample ID	S2
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



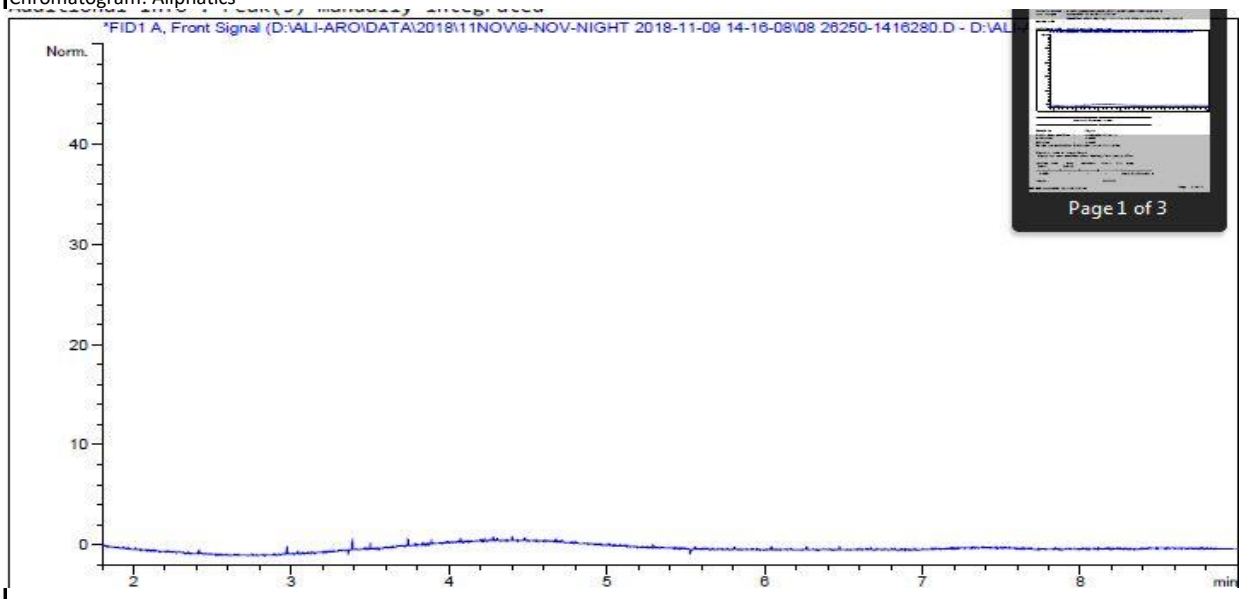
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

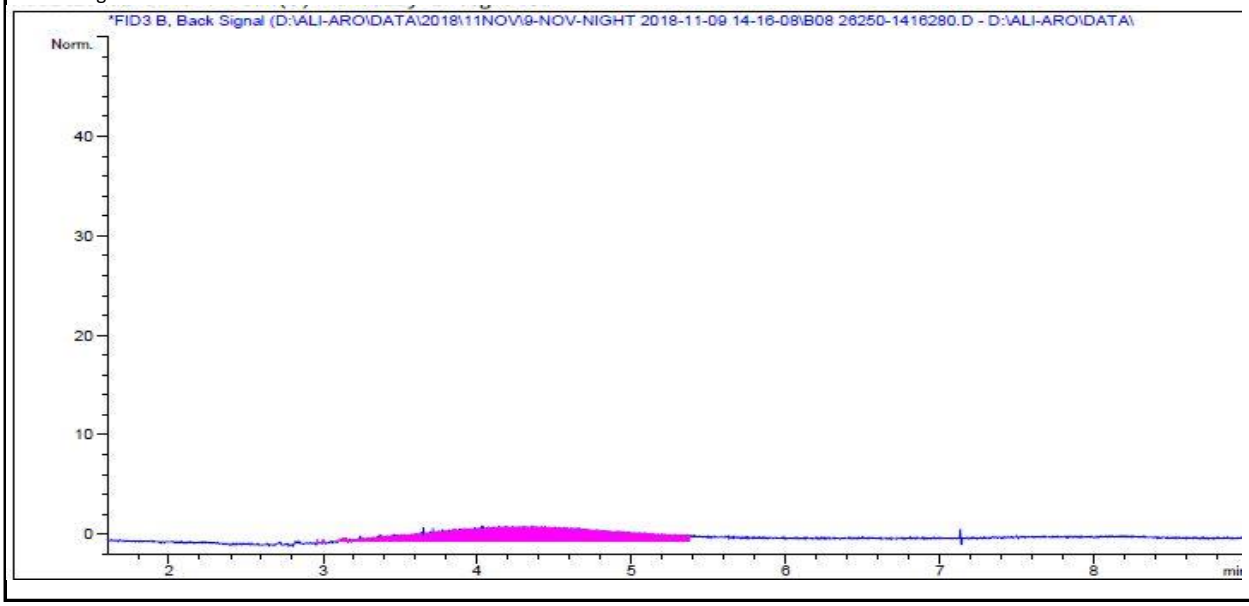
Lab No	1416280
Sample ID	S3
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



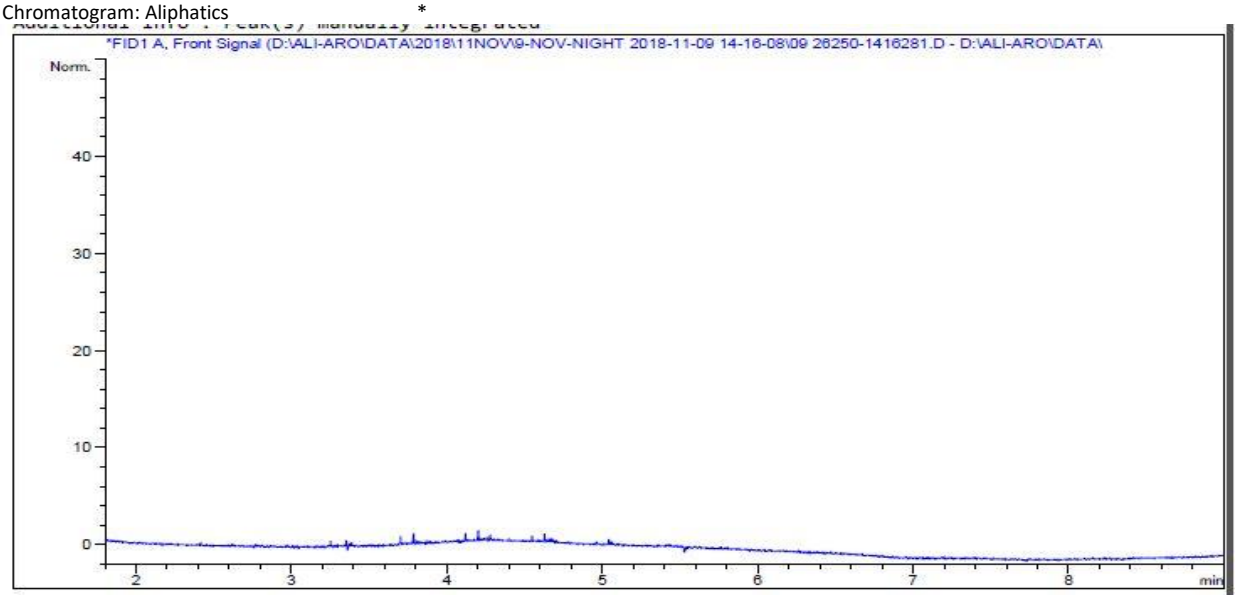
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

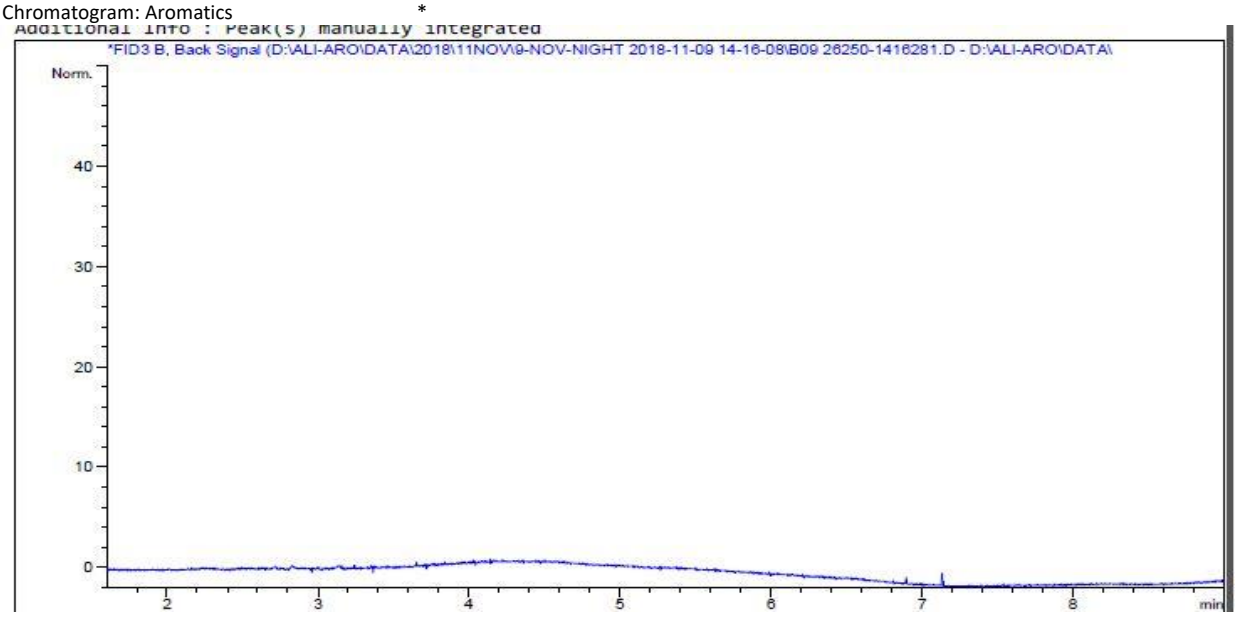
Lab No	1416281
Sample ID	S4
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



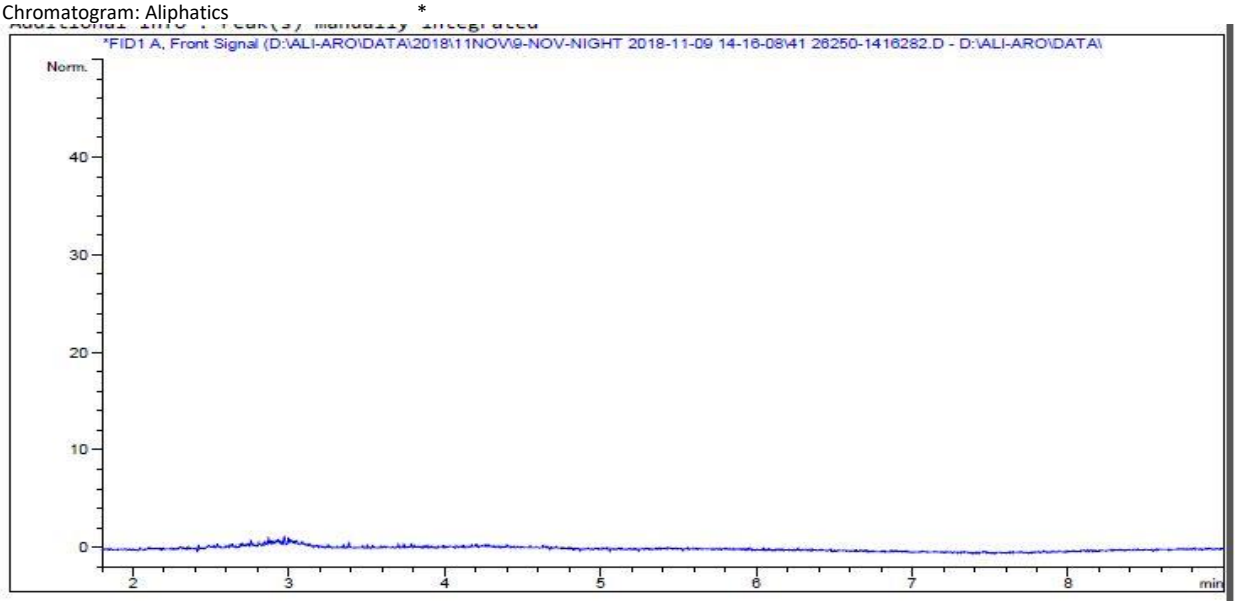
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

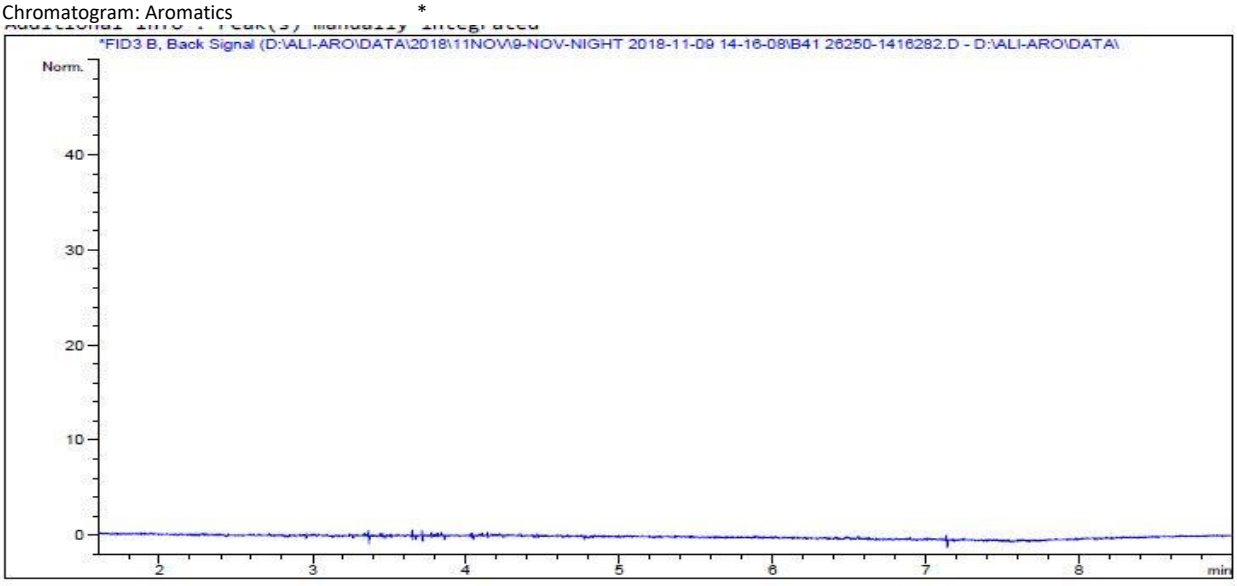
Lab No	1416282
Sample ID	S6
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



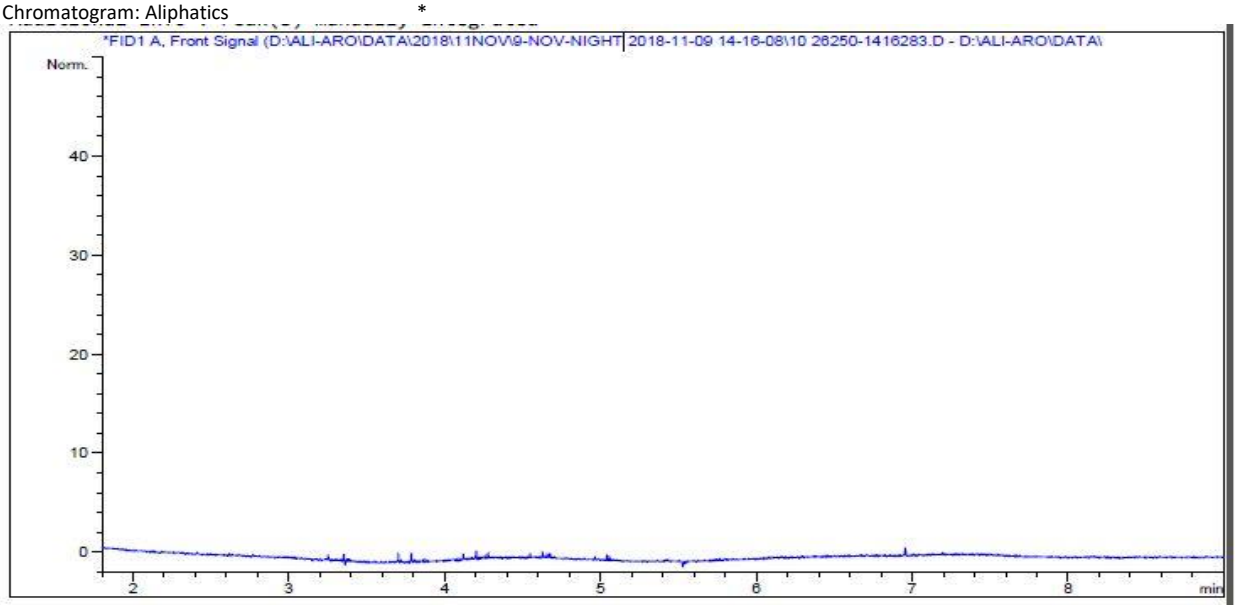
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

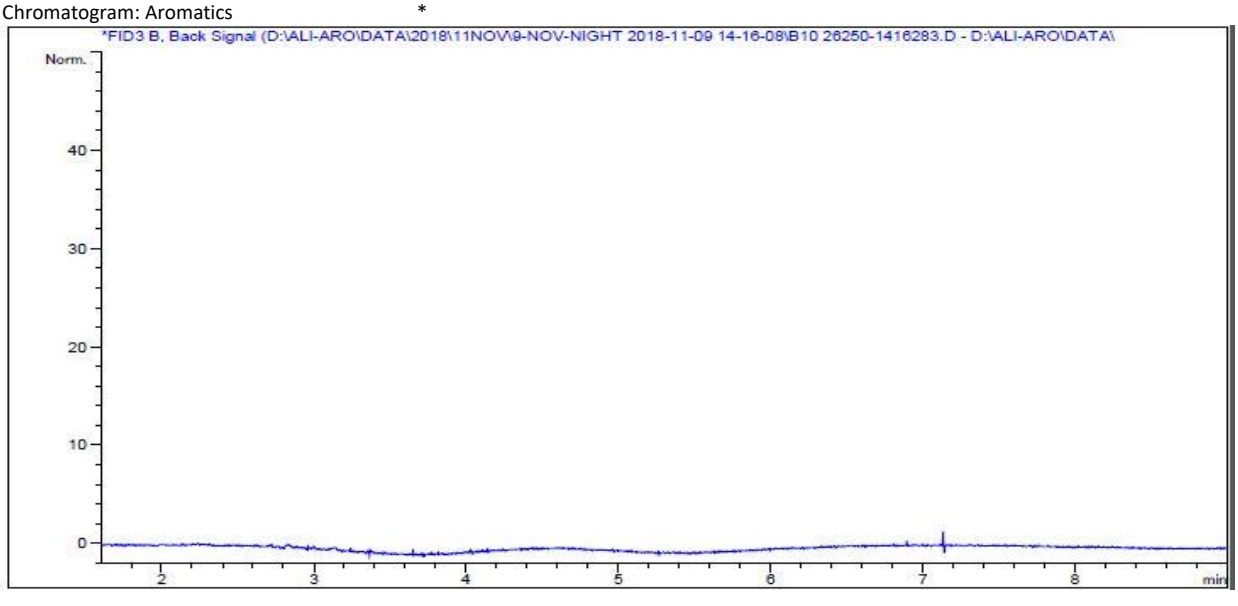
Lab No	1416283
Sample ID	S7
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



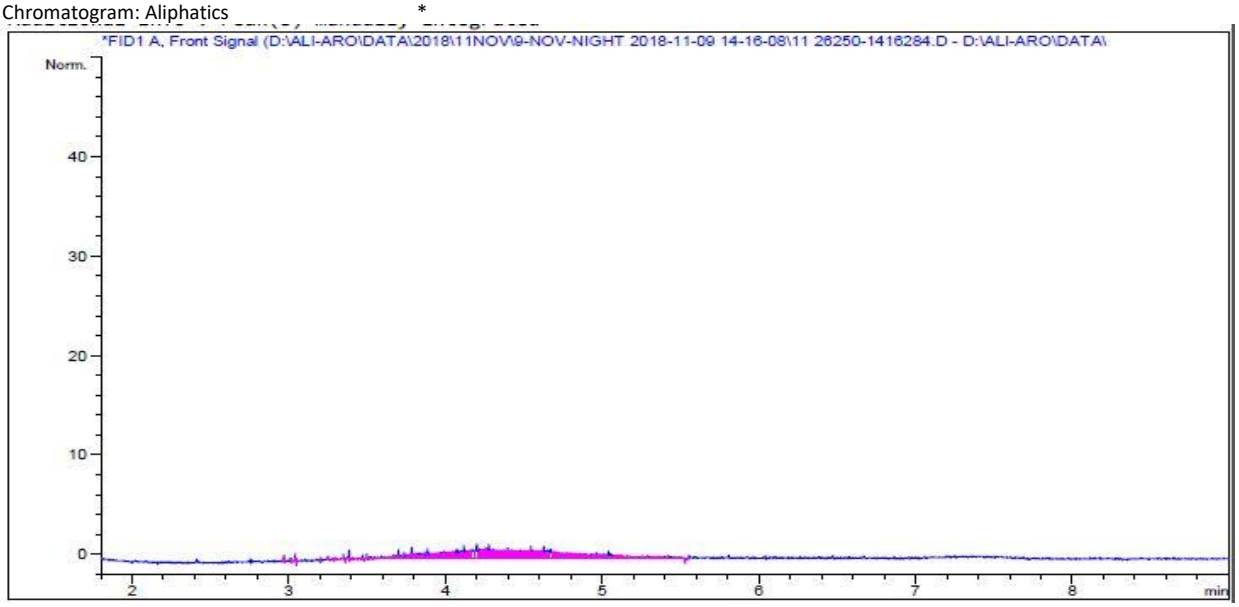
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

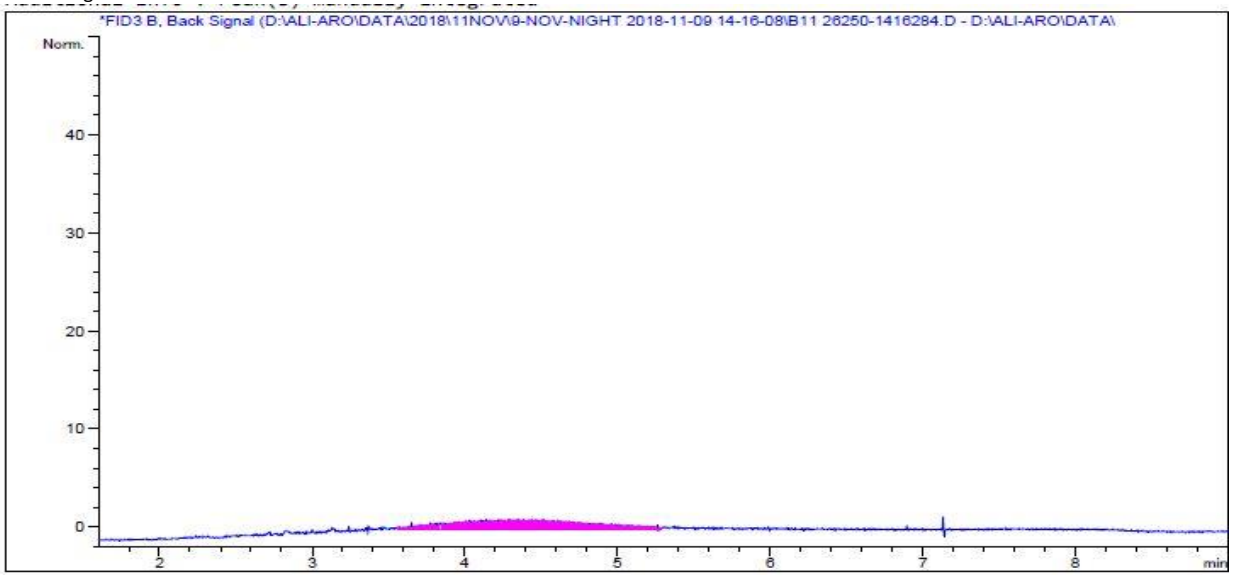
Lab No	1416284
Sample ID	S8
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



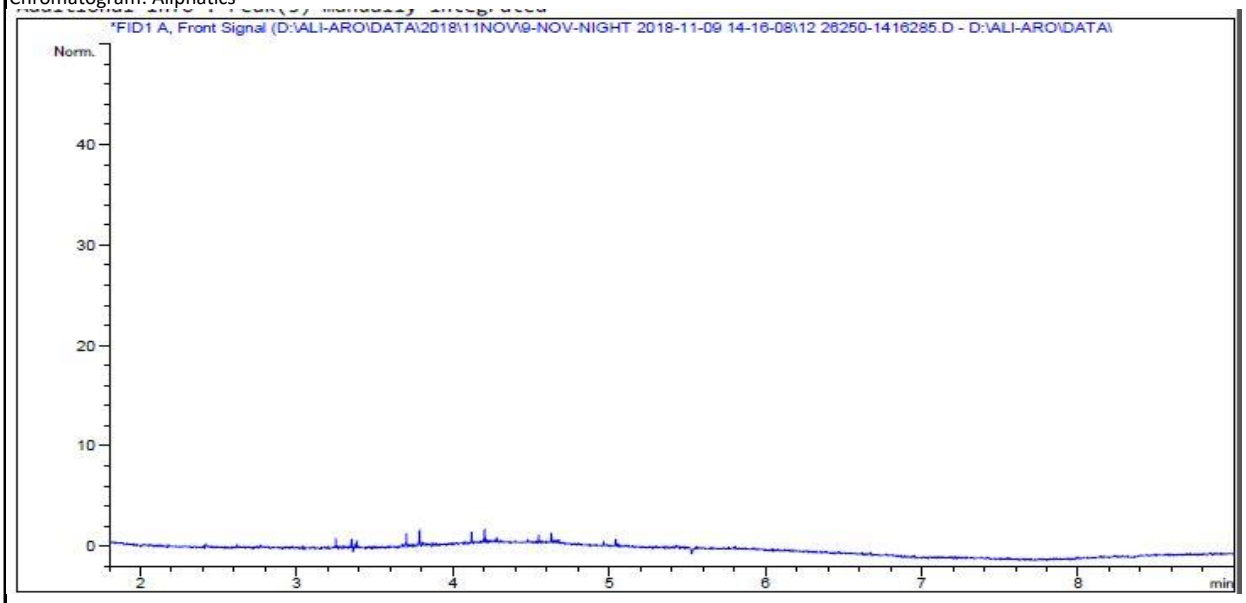
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

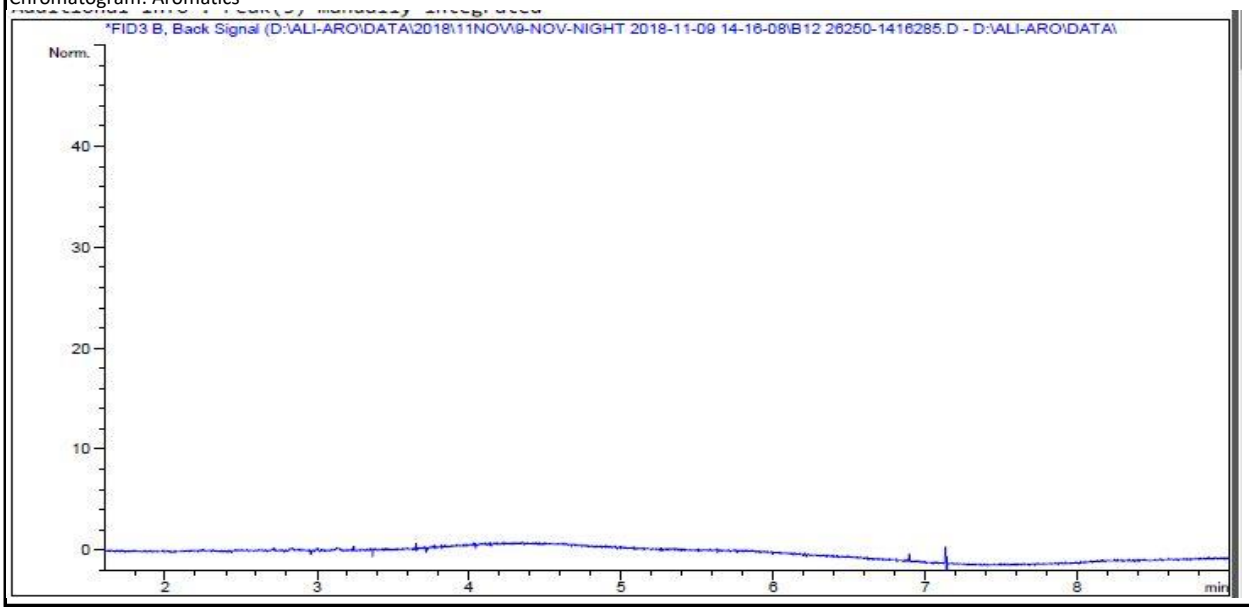
Lab No	1416285
Sample ID	S9
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



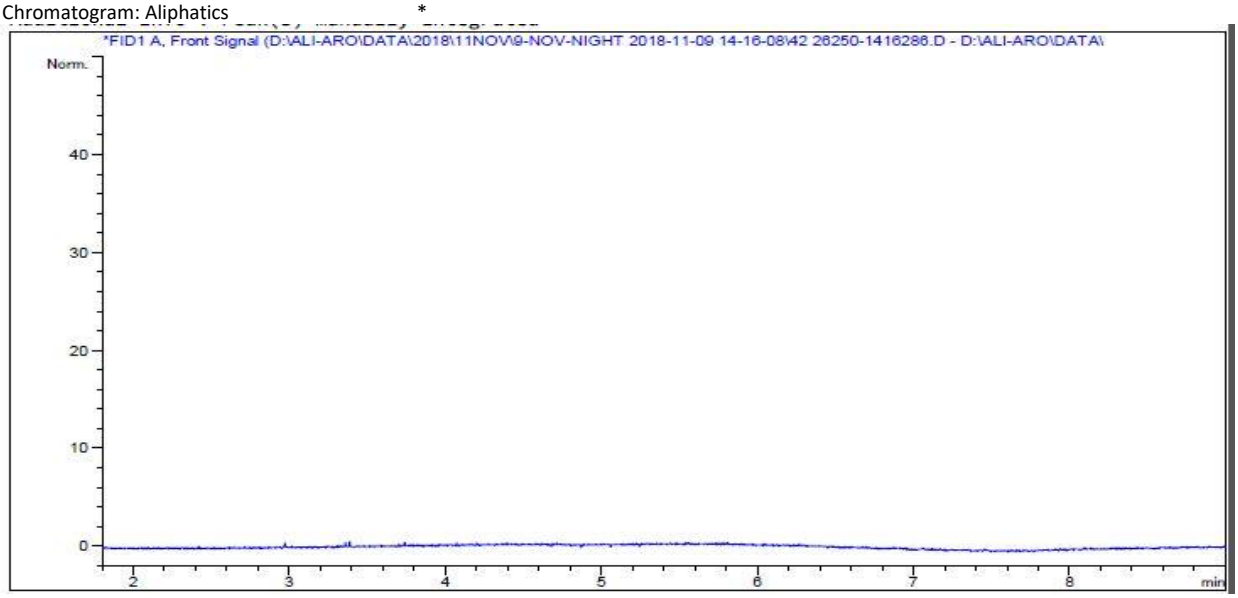
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

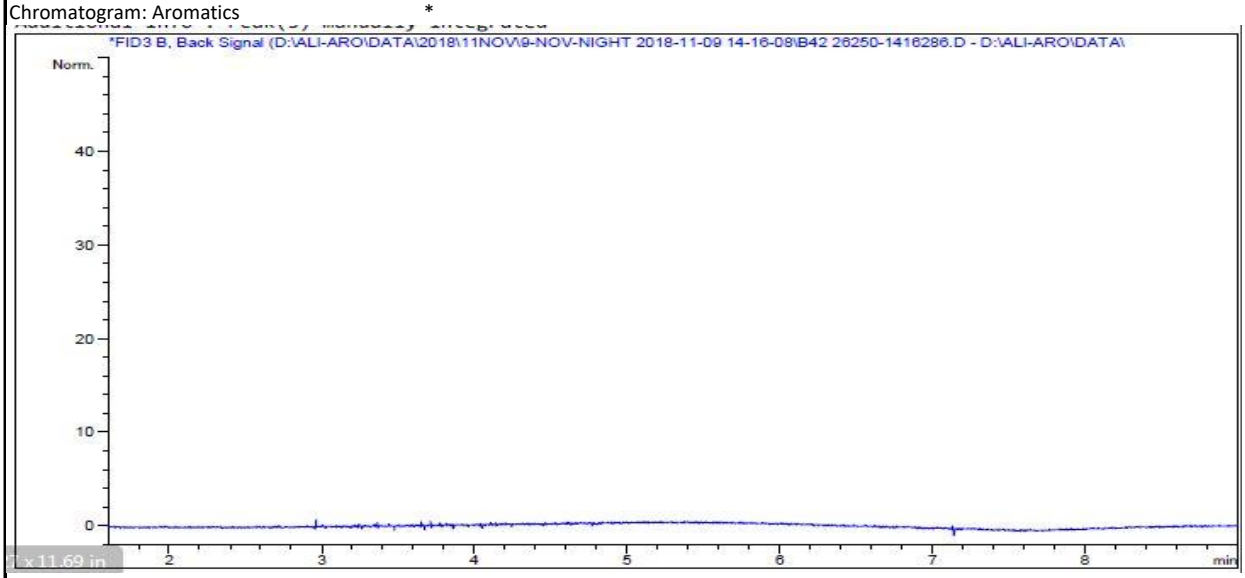
Lab No	1416286
Sample ID	S11
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



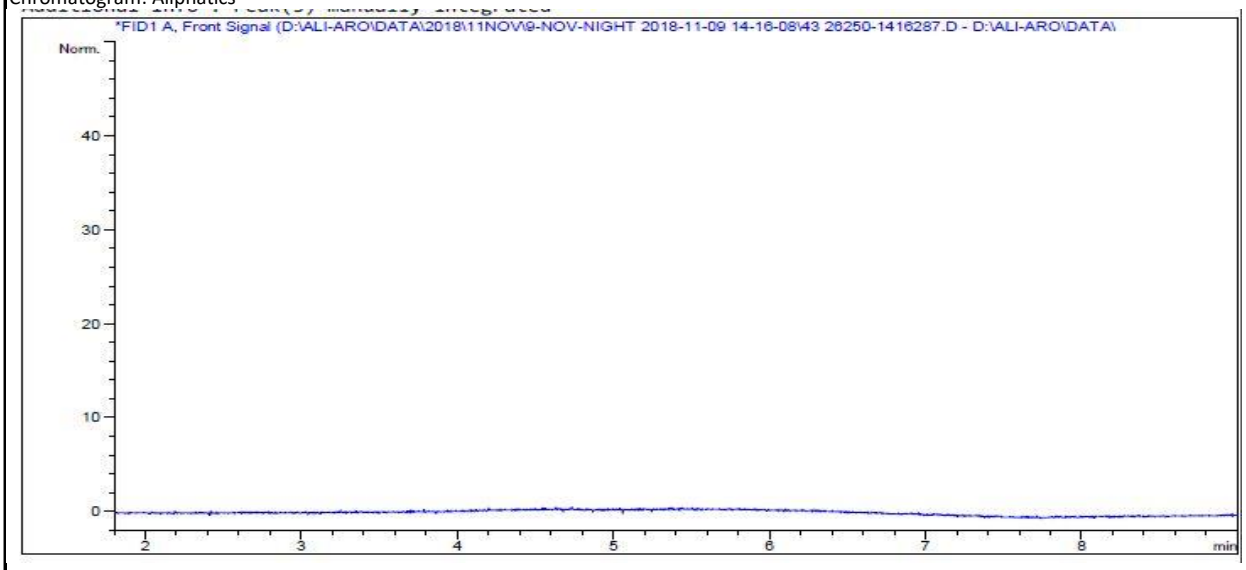
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

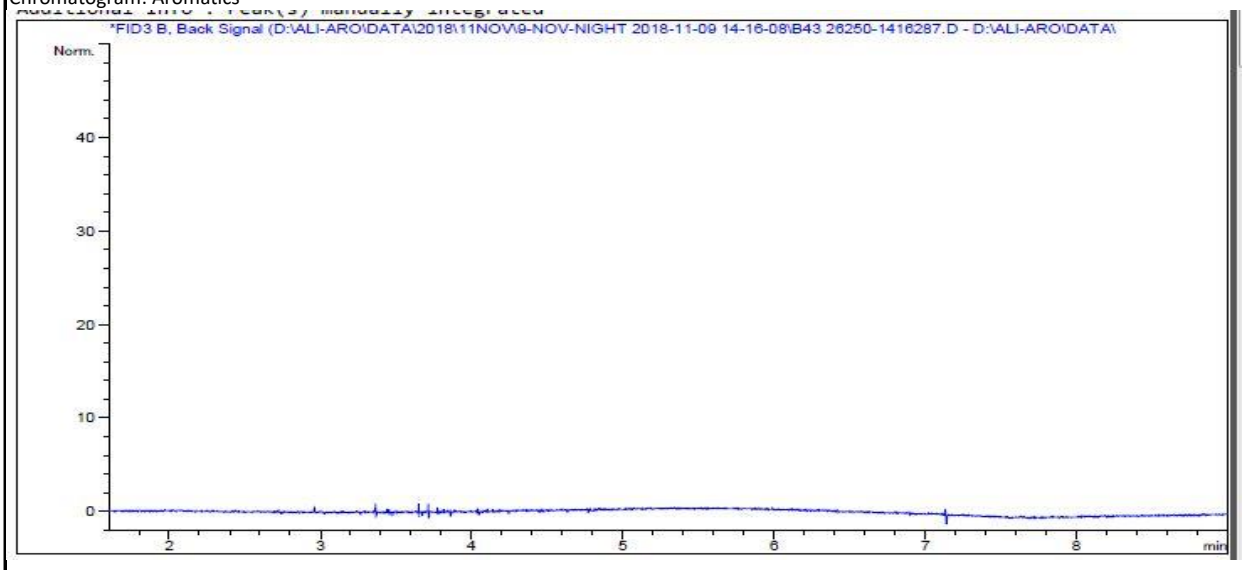
Lab No	1416287
Sample ID	S12
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



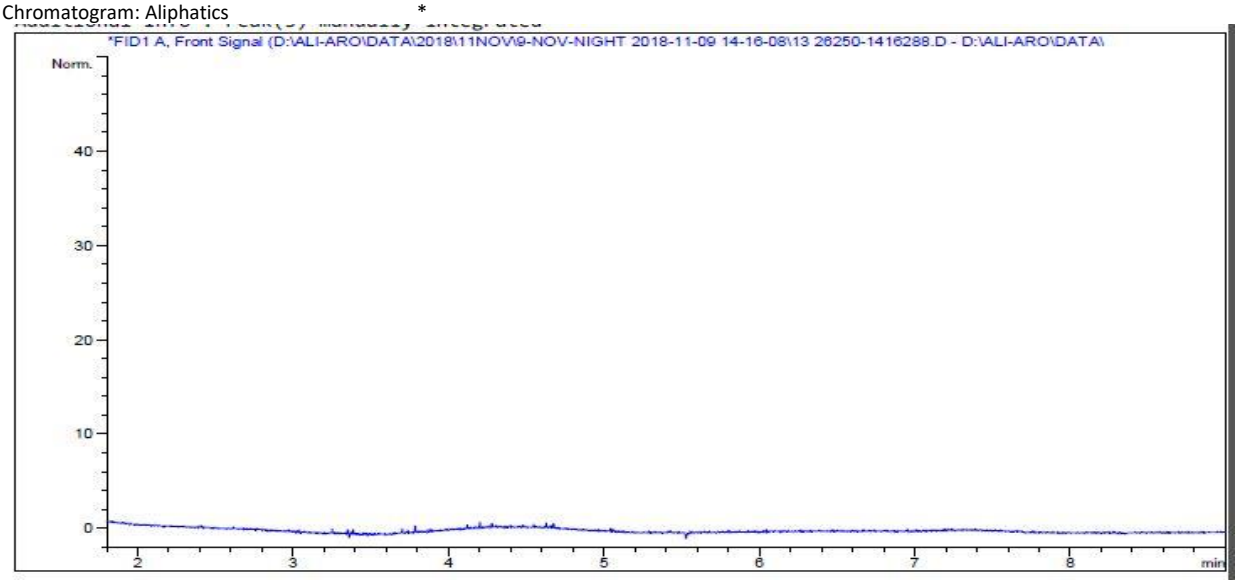
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

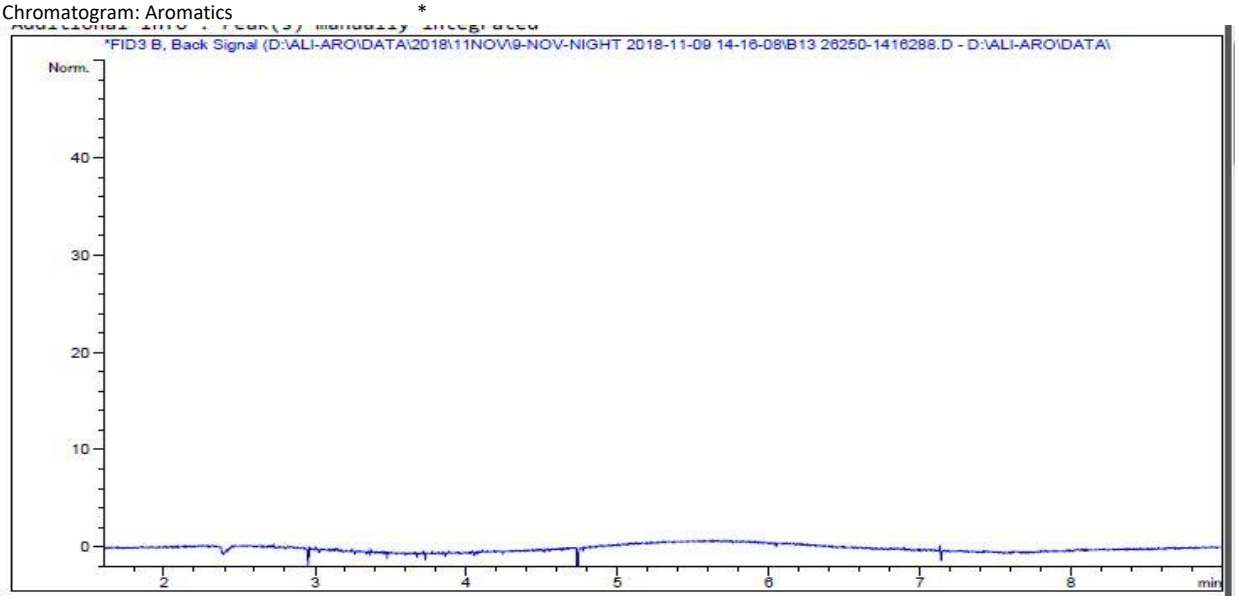
Lab No	1416288
Sample ID	S13
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



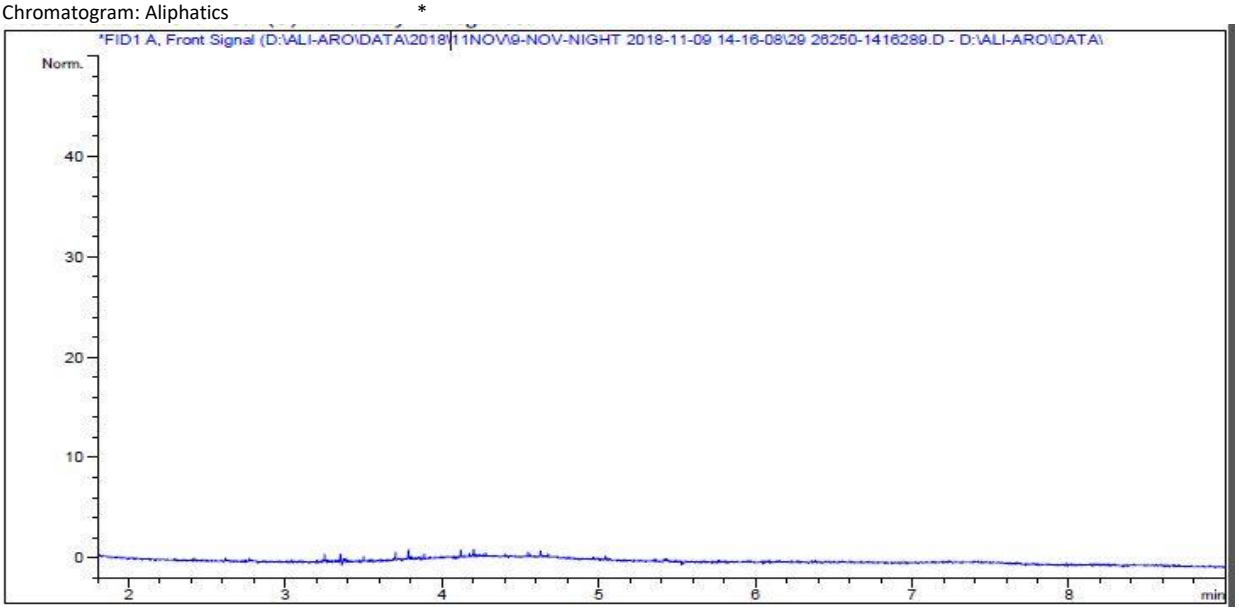
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

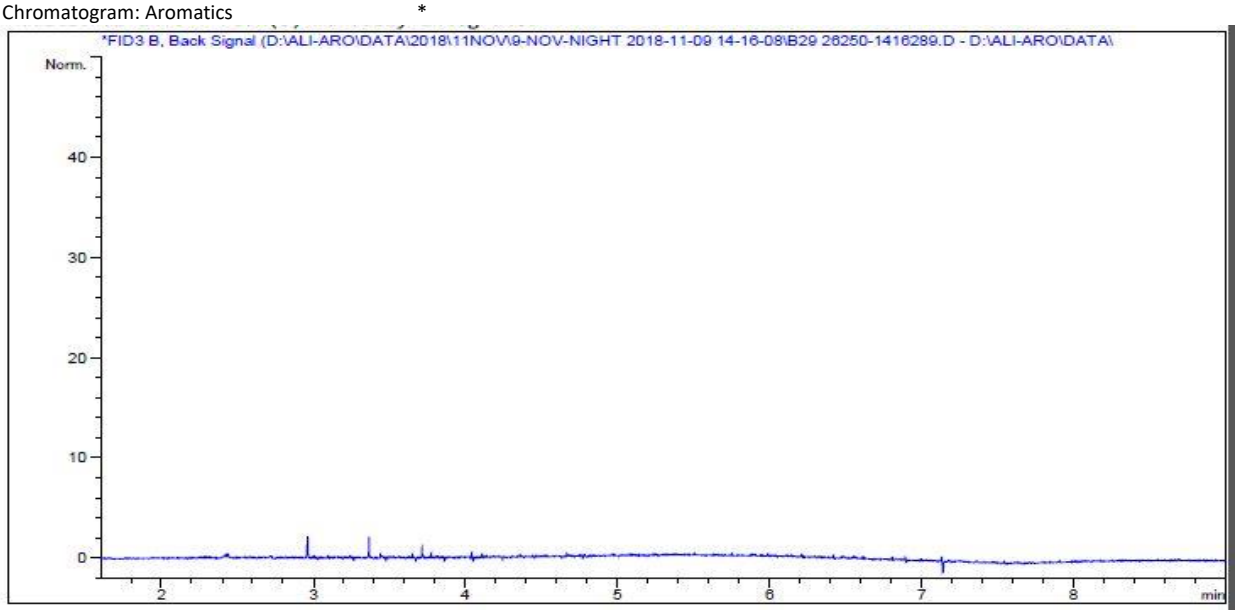
Lab No	1416289
Sample ID	S14
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



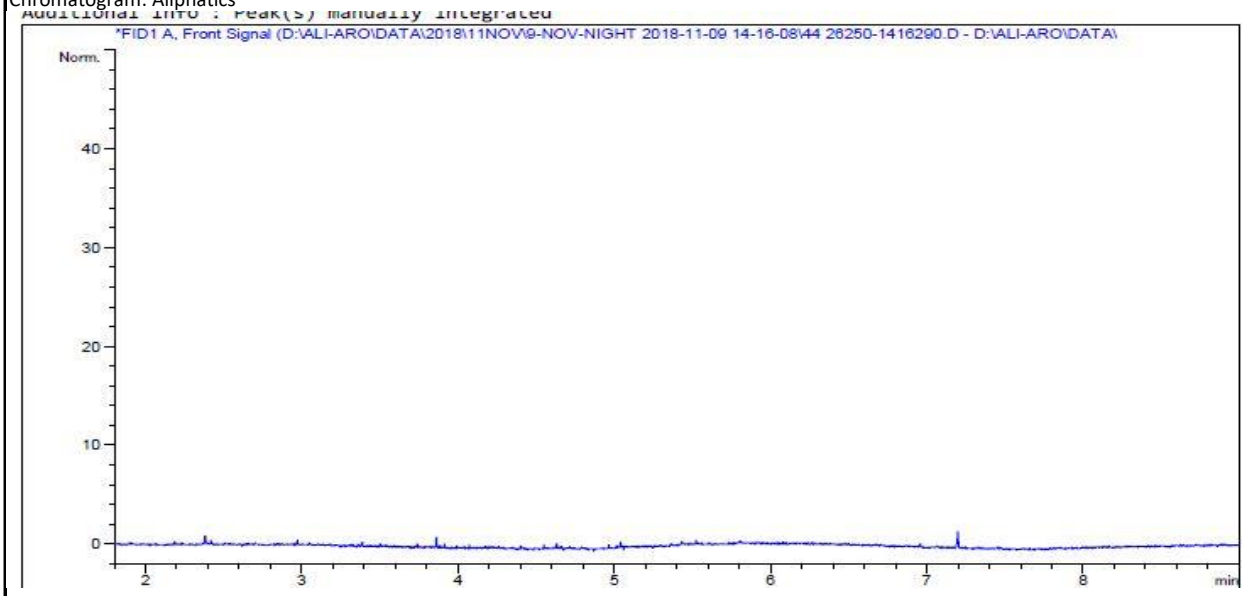
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

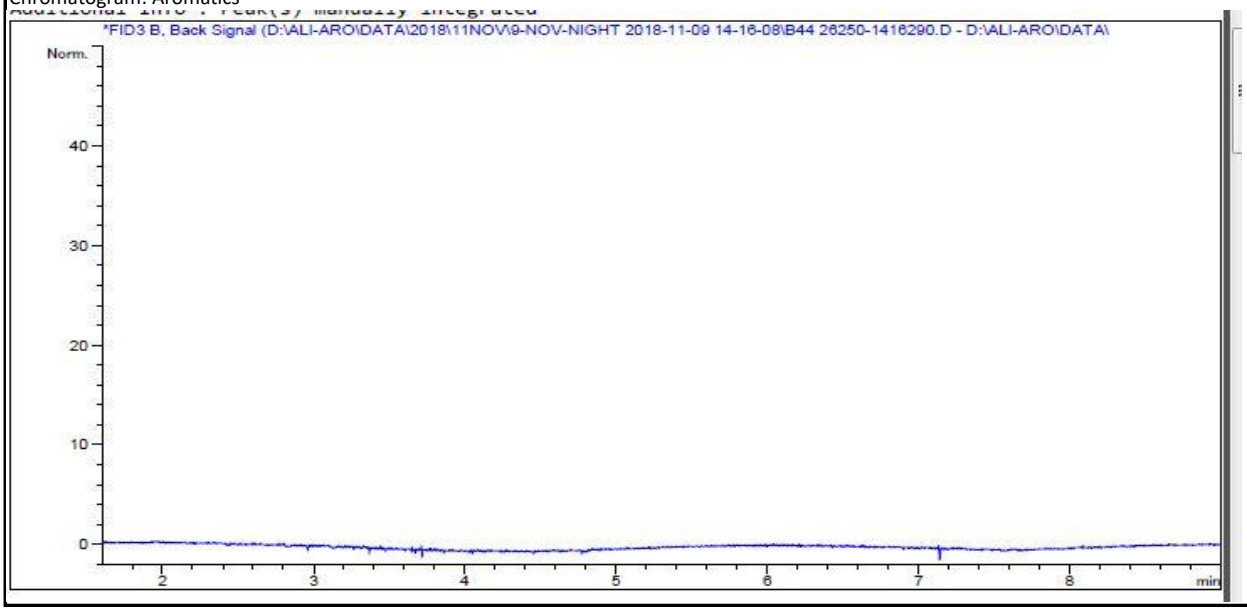
Lab No	1416290
Sample ID	S15
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



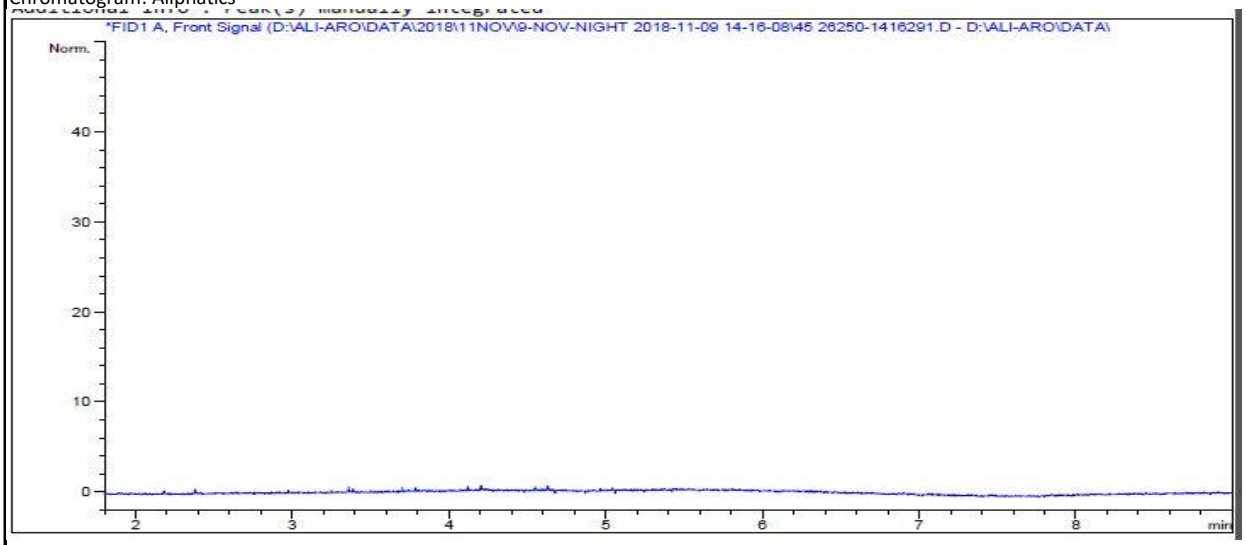
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

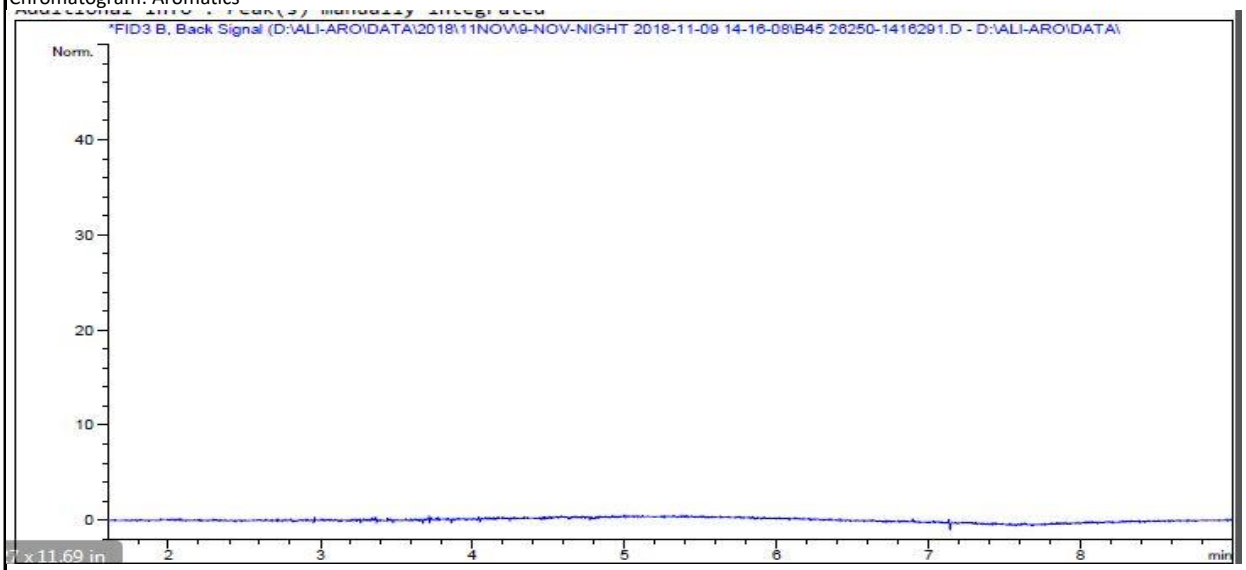
Lab No	1416291
Sample ID	S16
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



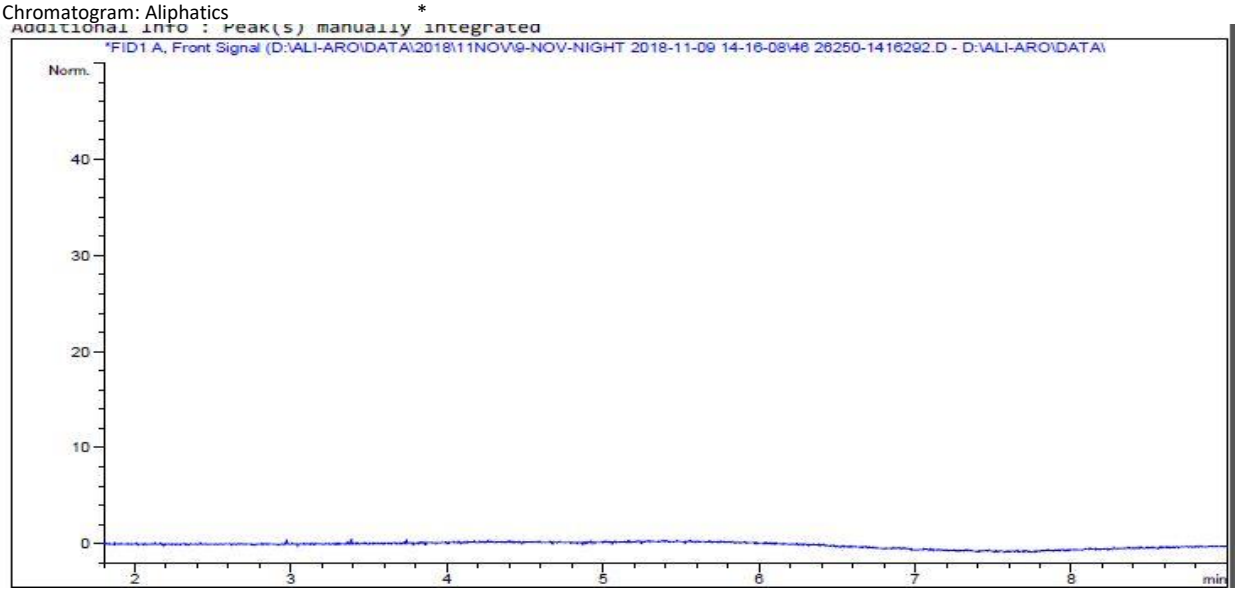
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

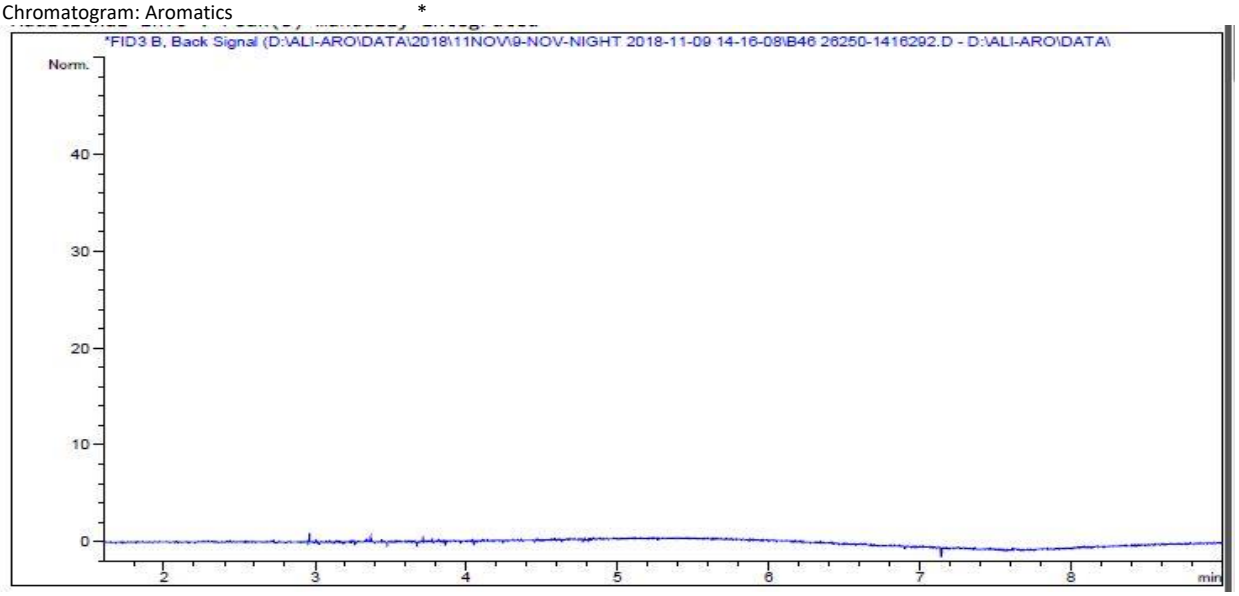
Lab No	1416292
Sample ID	S17
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



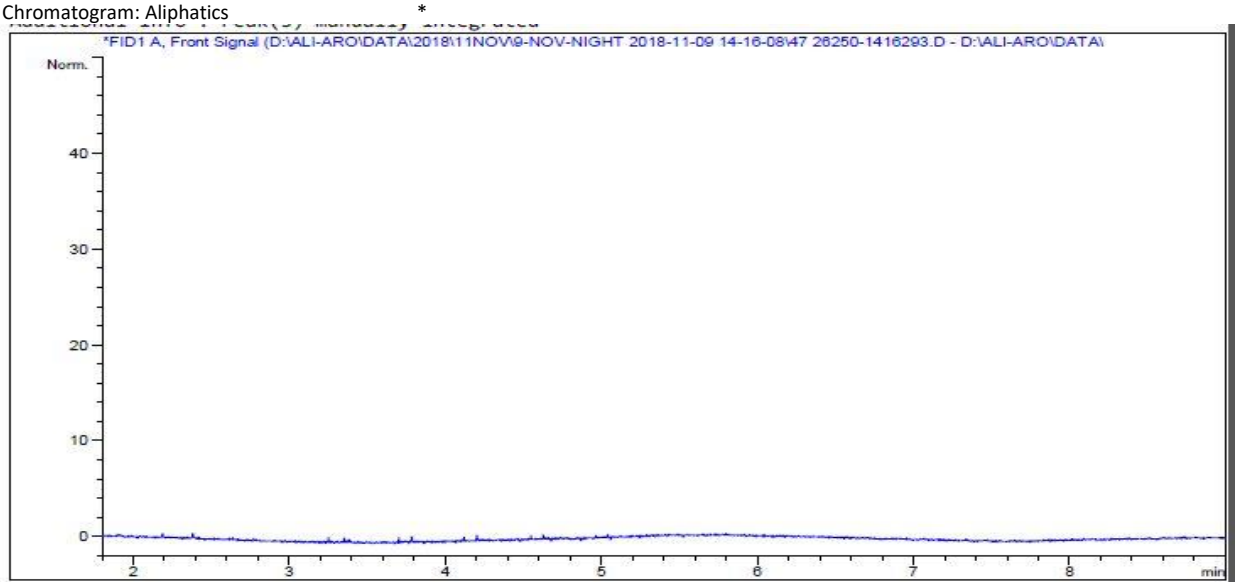
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

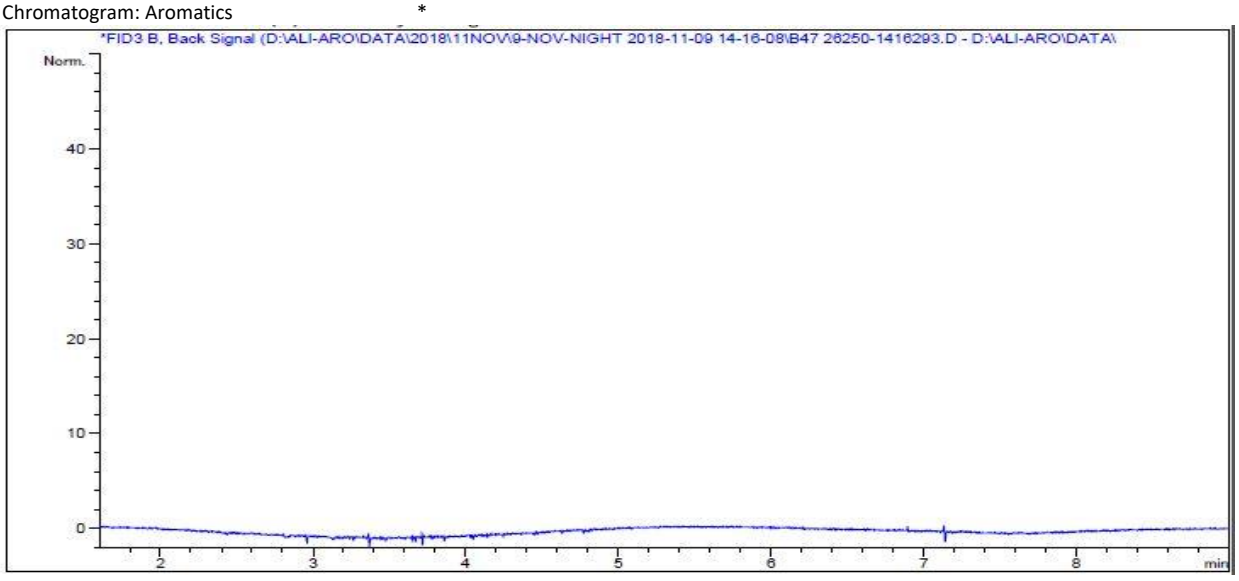
Lab No	1416293
Sample ID	S18
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



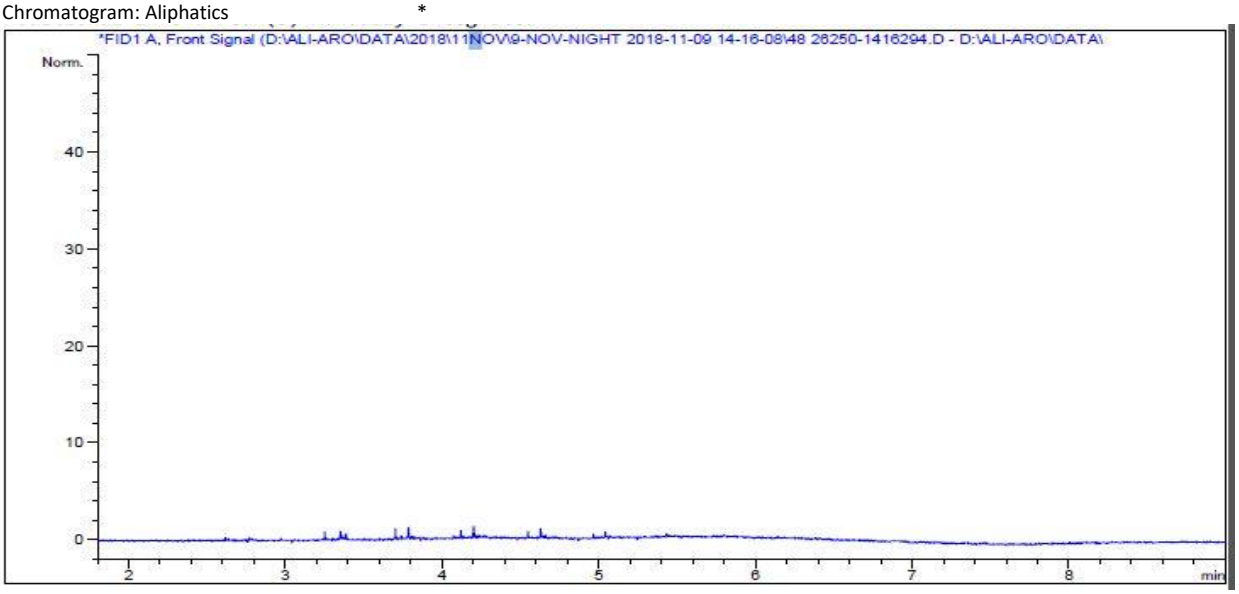
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

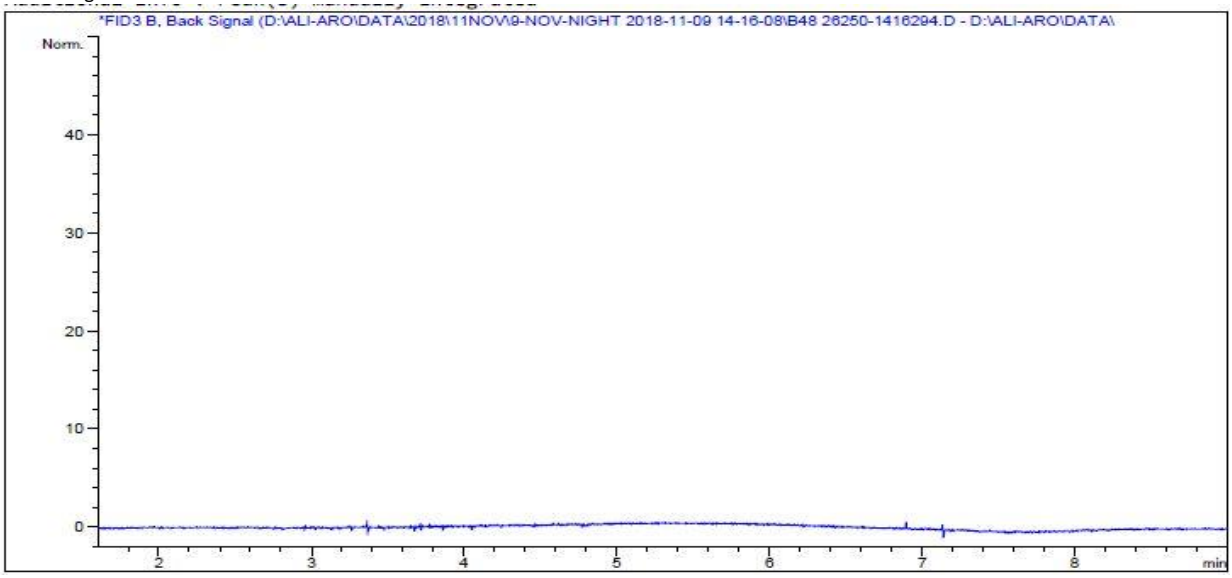
Lab No	1416294
Sample ID	S20
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



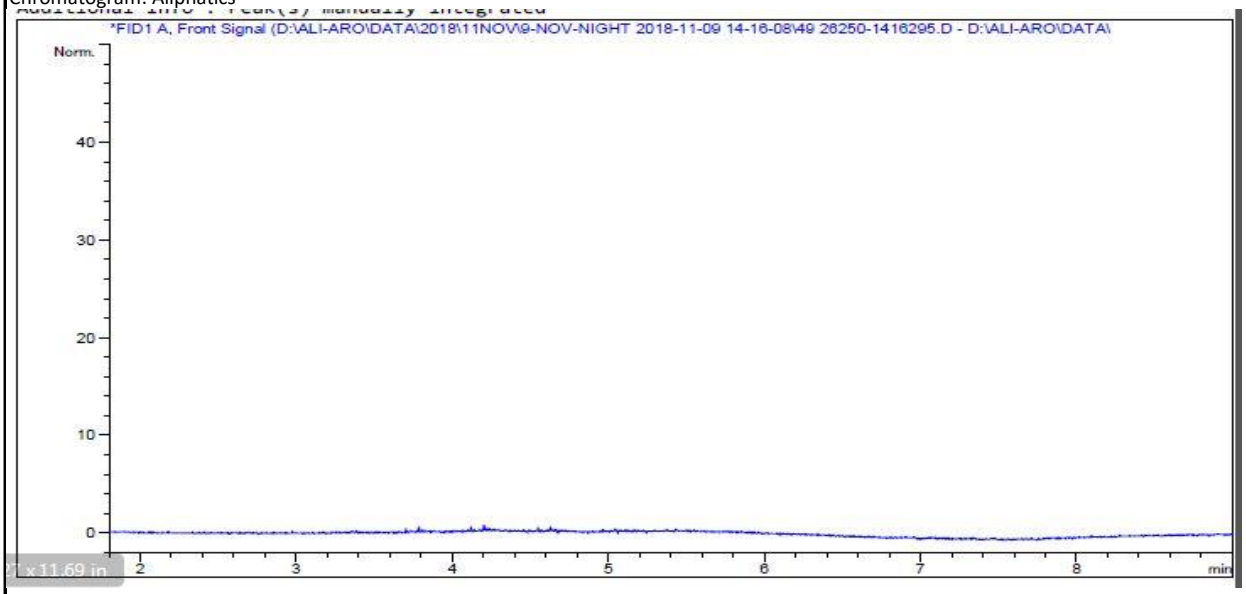
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

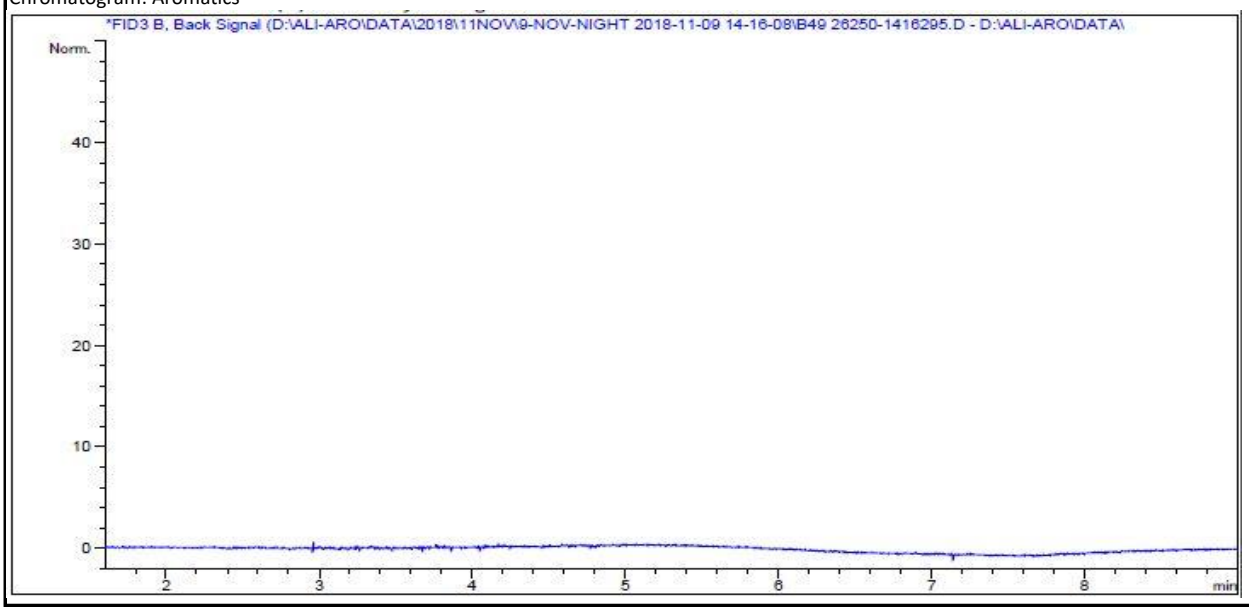
Lab No	1416295
Sample ID	S21
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



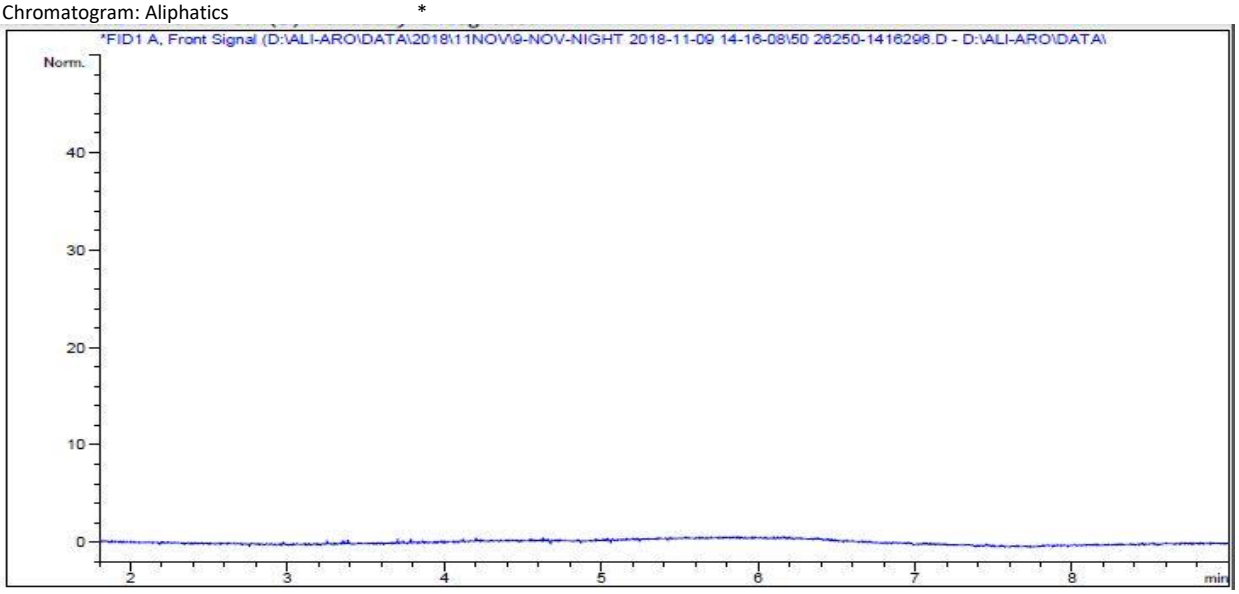
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

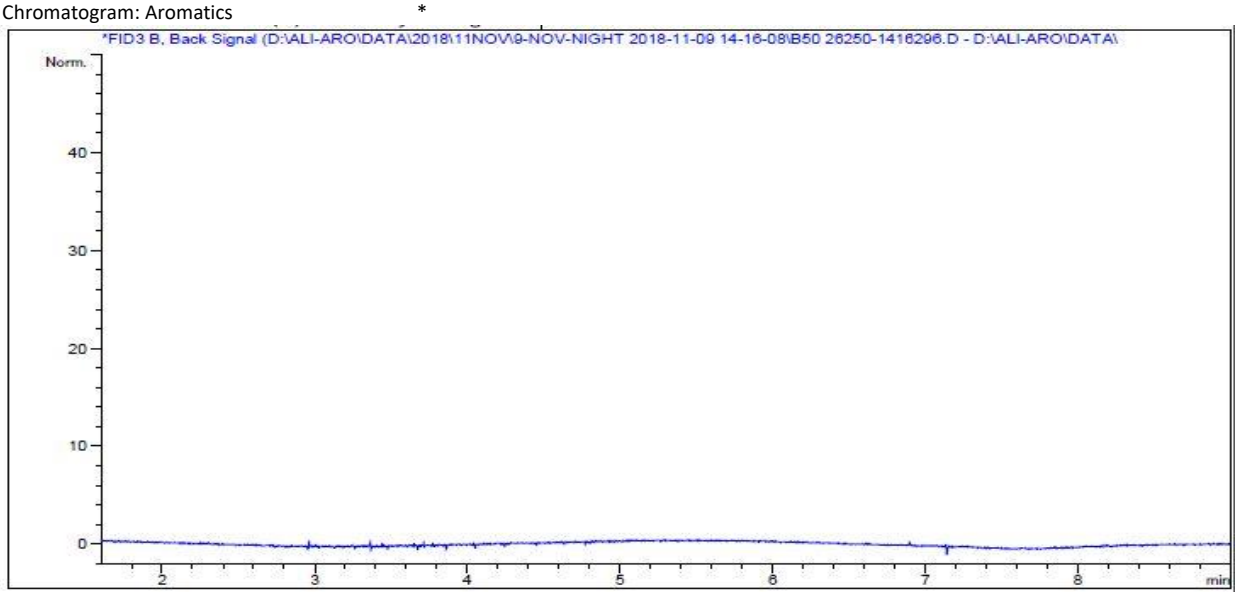
Lab No	1416296
Sample ID	S22
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



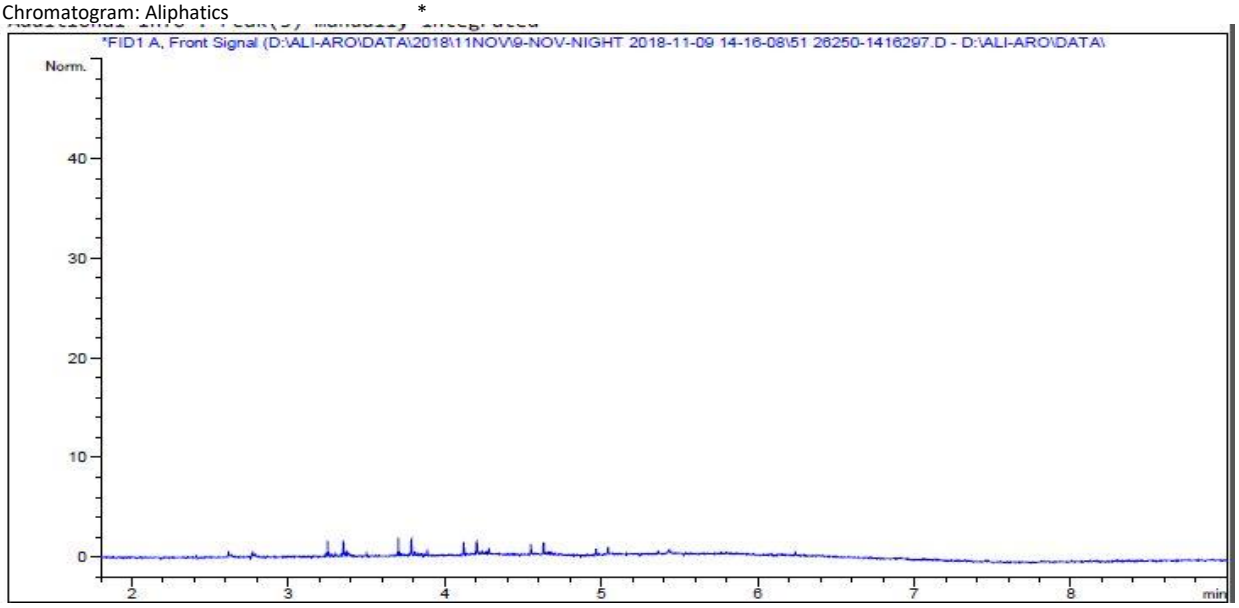
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

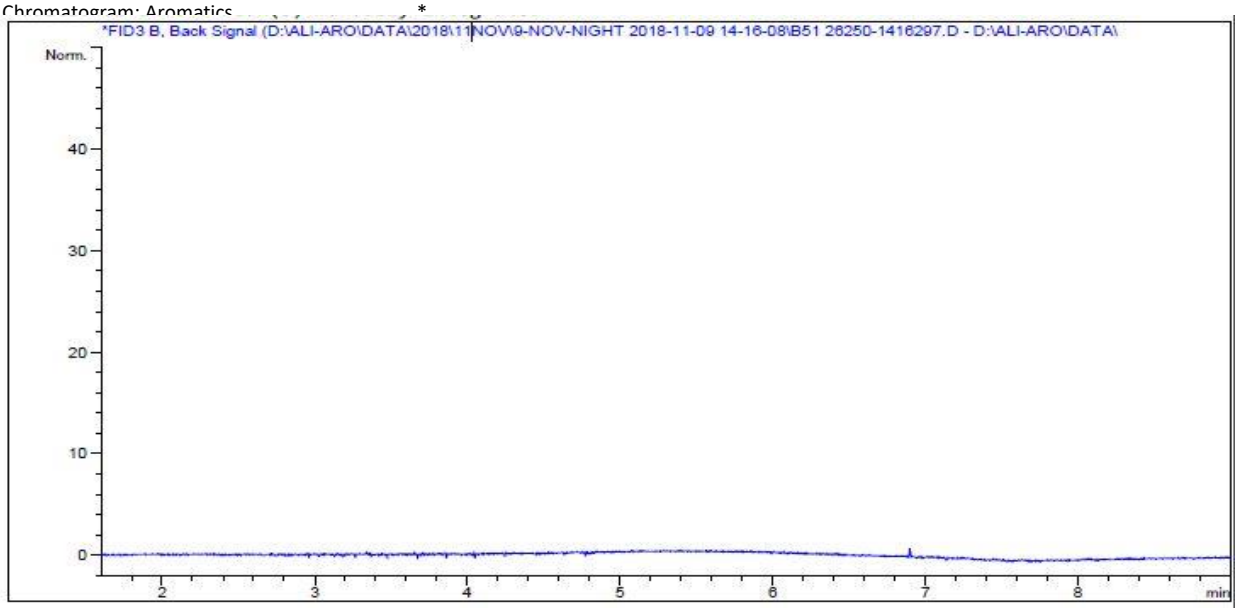
Lab No	1416297
Sample ID	S23
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *



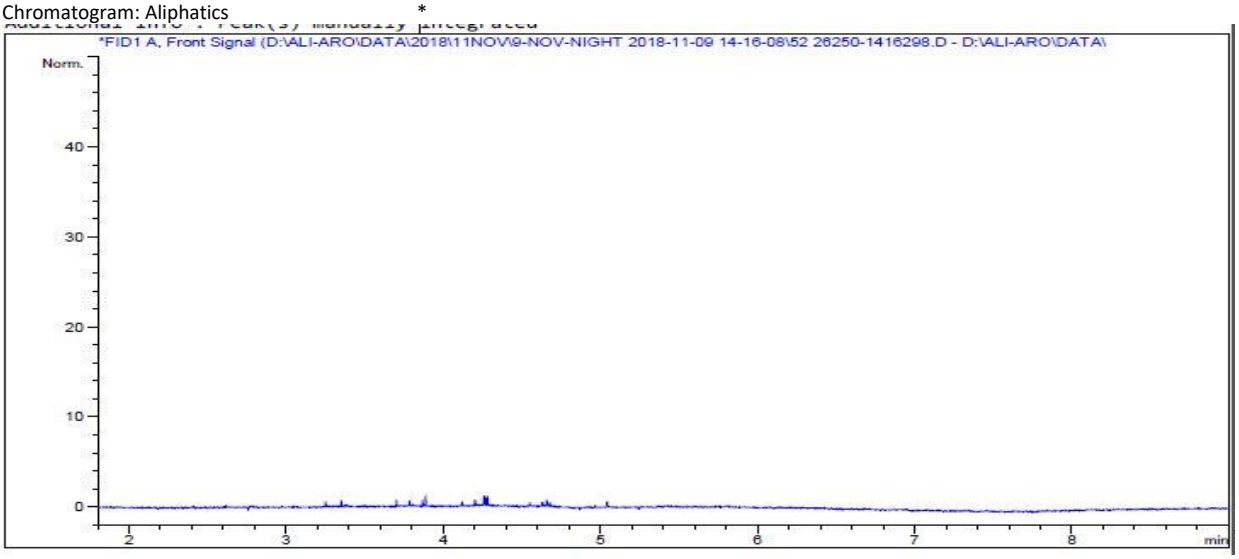
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

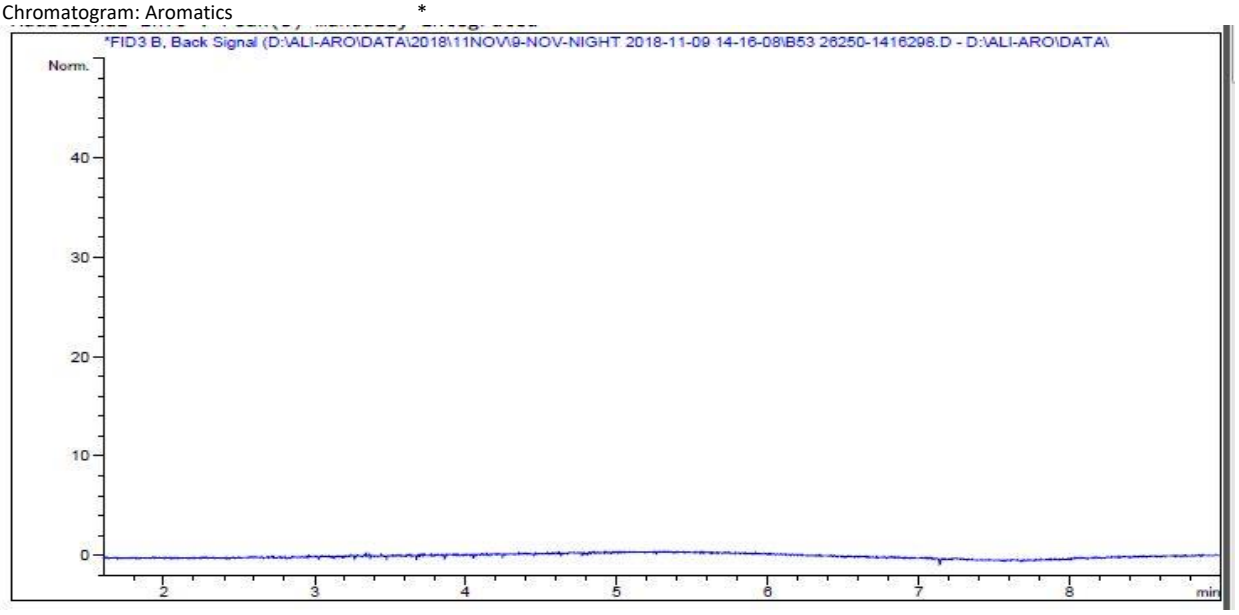
Lab No	1416298
Sample ID	S24
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: Aliphatics *



Chromatogram: Aromatics *

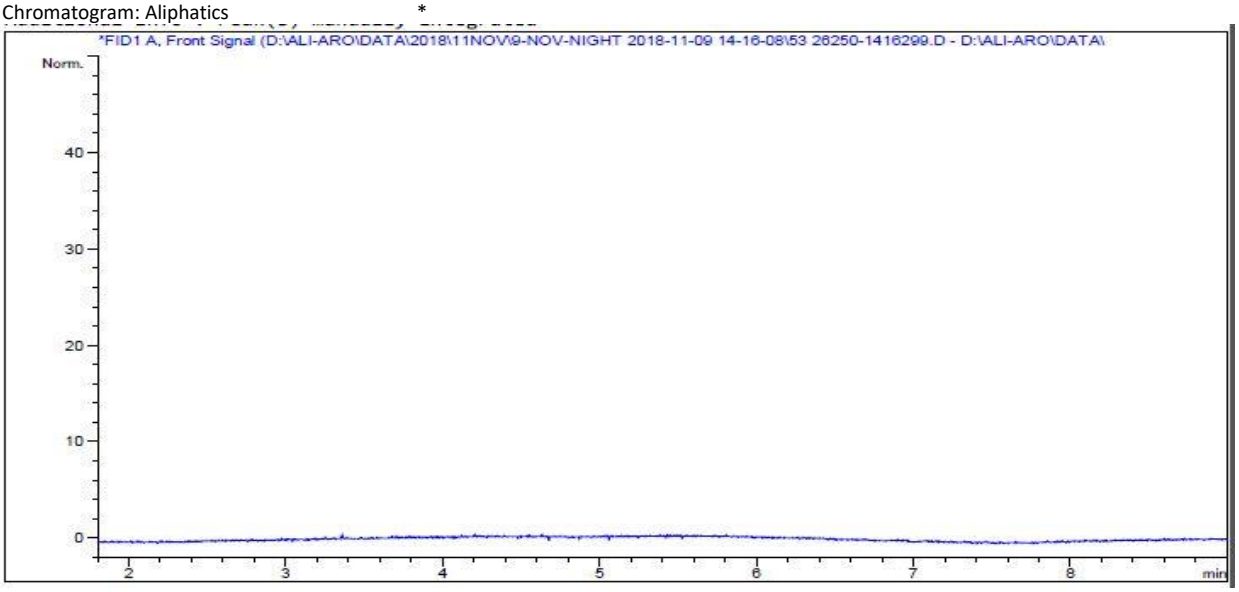


Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

Lab No	1416299
Sample ID	S25
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	11/02/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			
Chromatogram: Aliphatics	*		



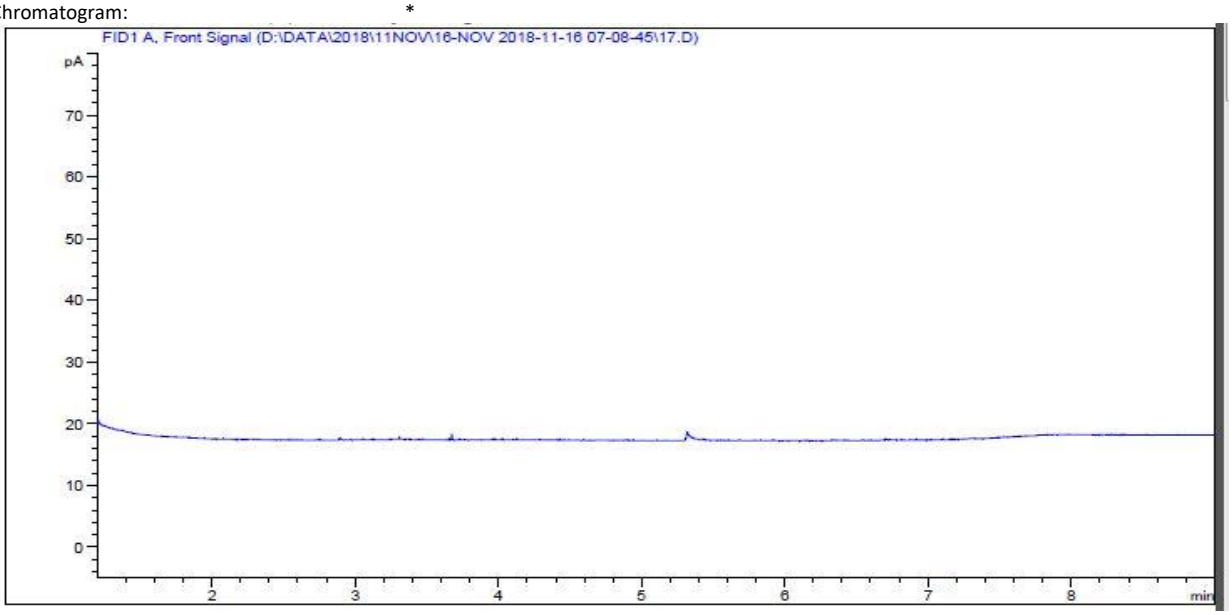
Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

Lab No	1420940
Sample ID	S10
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			

Chromatogram: *

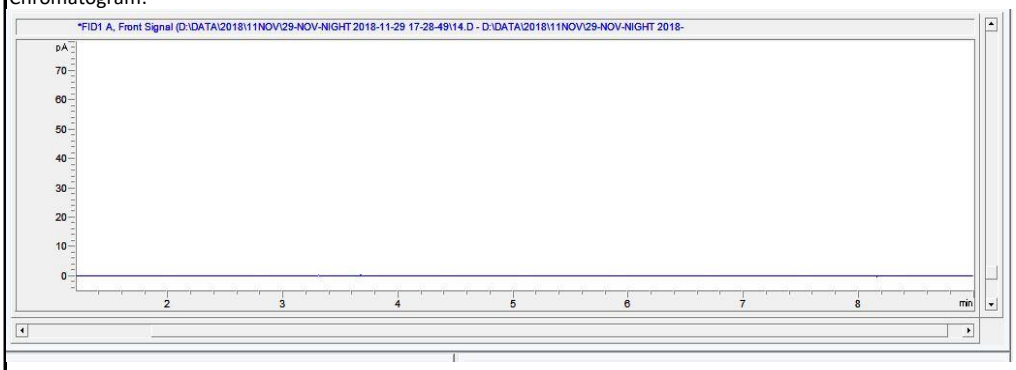


Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

Lab No	1425219
Sample ID	S5
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	20/11/2018
Sampling Time	

Test	Method	LOD	Units
Petroleum Hydrocarbons			
Chromatogram:	*		

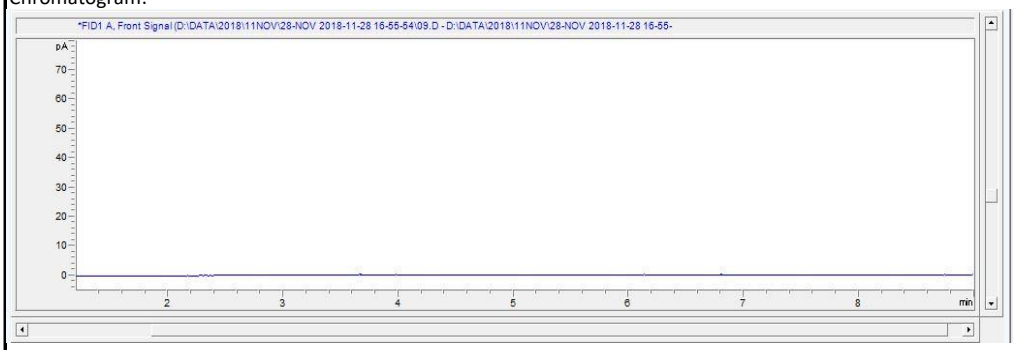


Summary of Chemical Analysis
Chromatograms

Our Ref 18-26250
Client Ref 14880RH
Contract Title B.Q. - Buttington Quarry

Lab No	1425220
Sample ID	S19
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	20/11/2018
Sampling Time	

Test	**Method**	**LOD**	**Units**
Petroleum Hydrocarbons			
Chromatogram:	*		



Information in Support of the Analytical Results

Our Ref 18-26250
Client Ref 14880RH
Contract B.Q. - Buttington Quarry

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1416278	S1 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416279	S2 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416280	S3 SOIL	02/11/18	GJ 250ml x2, PT 1L x2		
1416281	S4 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L		
1416282	S6 SOIL	02/11/18	GJ 250ml		
1416283	S7 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416284	S8 SOIL	02/11/18	GJ 250ml x2, PT 1L x2		
1416285	S9 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416286	S11 SOIL	02/11/18	PT 1L x2		Aliphatics/Aromatics, BTEX, Chromium, Naphthalene, PAH MS, EPH/TPH
1416287	S12 SOIL	02/11/18	PT 1L		Aliphatics/Aromatics, BTEX, Chromium, Naphthalene, PAH MS, EPH/TPH
1416288	S13 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416289	S14 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416290	S15 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416291	S16 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416292	S17 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416293	S18 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416294	S20 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416295	S21 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416296	S22 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416297	S23 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416298	S24 SOIL	02/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1416299	S25 SOIL	02/11/18	GJ 250ml x2, PT 1L x2		
1420940	S10 SOIL		GJ 250ml x2, GJ 60ml x2, PT 1L x2	Sample date not supplied, Aliphatics/Aromatics (14 days), Ammonia (1095 days), Boron (365 days), BTEX (14 days), Chromium (14 days), Chromium, Hexavalent (365 days), Fuel Id (14 days), Mercury (365 days), Total Sulphate ICP (730 days), Metals ICP (365 days), Metals ICP Prep (365 days), Anions (365 days), Kone Cr6 (1095 days), Kone PO4 (1095 days), Naphthalene (14 days), Ammoniacal Nitrogen as N (365 days), Organic Matter (Manual) (28 days), PAH MS (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), EPH/TPH (14 days)	
1425219	S5 SOIL	20/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		
1425220	S19 SOIL	20/11/18	GJ 250ml x2, GJ 60ml, PT 1L x2		

Information in Support of the Analytical Results

Our Ref 18-26250
Client Ref 14880RH
Contract B.Q. - Buttington Quarry

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

ANNEX H
Bulk Sample Geotechnical Test Results

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 41501

Client Ref:

Client PO: **14880RH**

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

Client **Terrafirma Wales Ltd**
5 Deryn Court
Wharfedale Road
Pentwyn
Cardiff
CF23 7HB

Contract Title: **Buttington Quarry (B.Quarry)**

For the attention of: **Ruth Howells**

Date Received: **06-11-2018**

Date Commenced: **06-11-2018**

Date Completed: **20-11-2018**

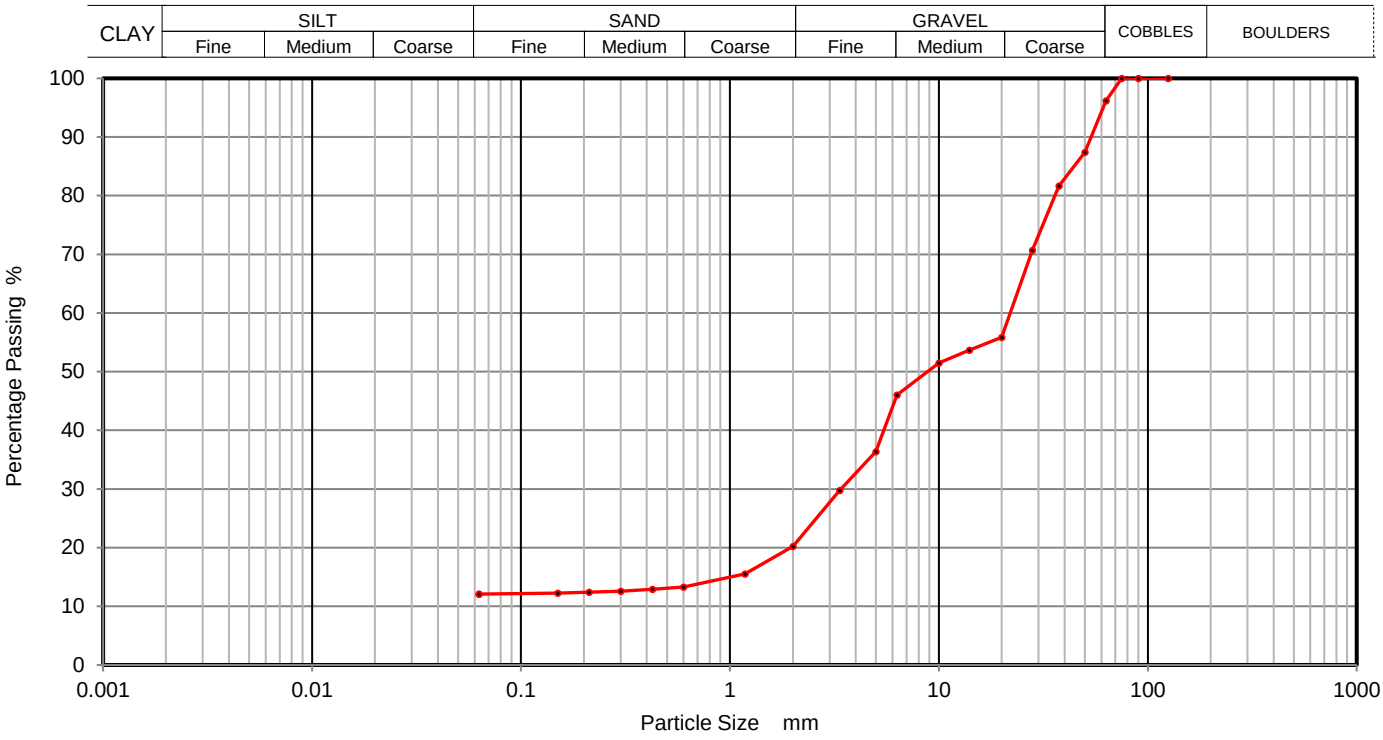
Test Description	Qty
Particle size Distribution (Aggregate) BS EN 933-1 - * UKAS	6
Determination of the slake durability index, two cycles. ISRM Suggested Method For Determining Slake Durability - @ Non Accredited Test	6
Large Shear Box 300mm Peak with 3 confining pressures includes remoulding BS 1377:1990 - Part 7 : 5 and Specification for Highway Works Vol.1 Clause 636 Part 2 - @ Non Accredited Test	6
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

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

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S1
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty clayey fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	96		
50	87		
37.5	82		
28	71		
20	56		
14	54		
10	51		
6.3	46		
5	36		
3.35	30		
2	20		
1.18	16		
0.6	13		
0.425	13		
0.3	13		
0.212	12		
0.15	12		
0.063	12		

Sample Proportions	% dry mass
Cobbles	4
Gravel	76
Sand	8
Silt and Clay	12

Grading Analysis	
Uniformity Coefficient	

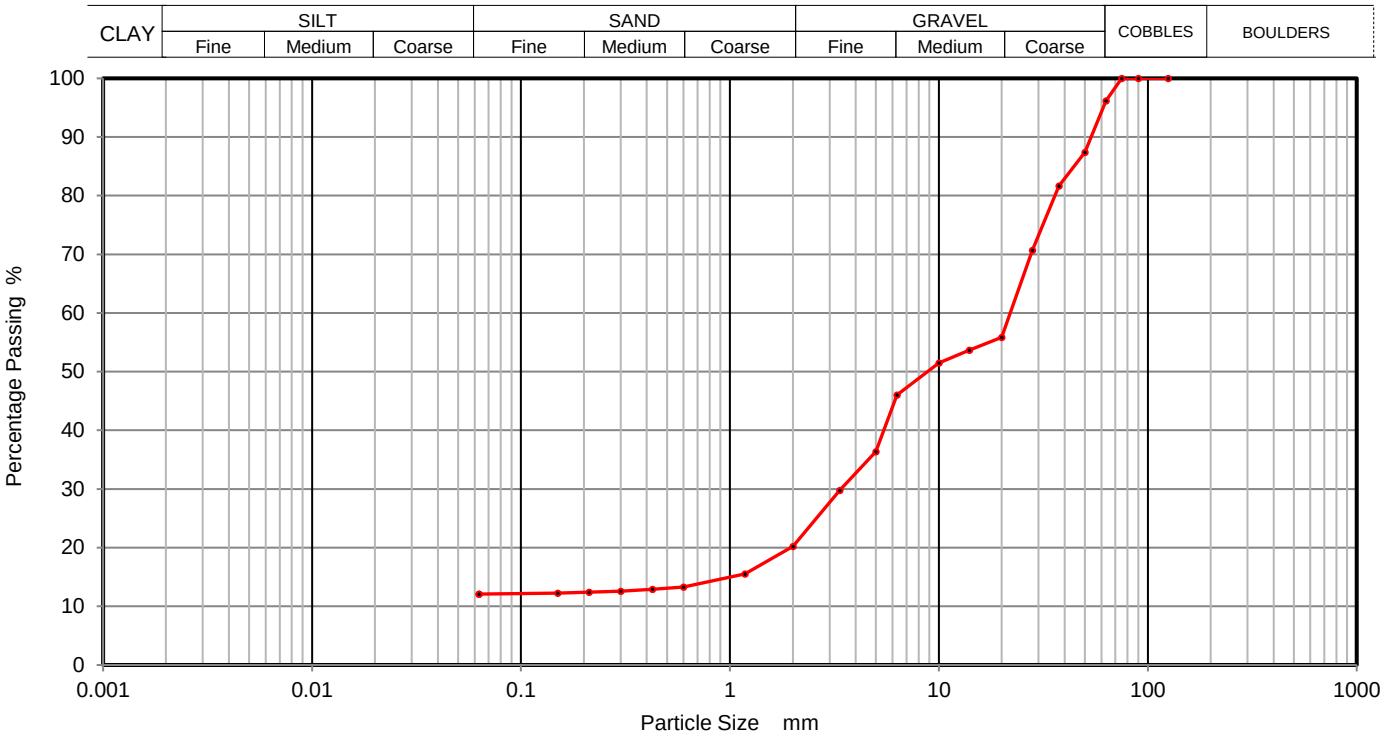
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S1
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty clayey fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	96		
50	87		
37.5	82		
28	71		
20	56		
14	54		
10	51		
6.3	46		
5	36		
3.35	30		
2	20		
1.18	16		
0.6	13		
0.425	13		
0.3	13		
0.212	12		
0.15	12		
0.063	12		

Sample Proportions	% dry mass
Cobbles	4
Gravel	76
Sand	8
Silt and Clay	12

Grading Analysis	
Uniformity Coefficient	

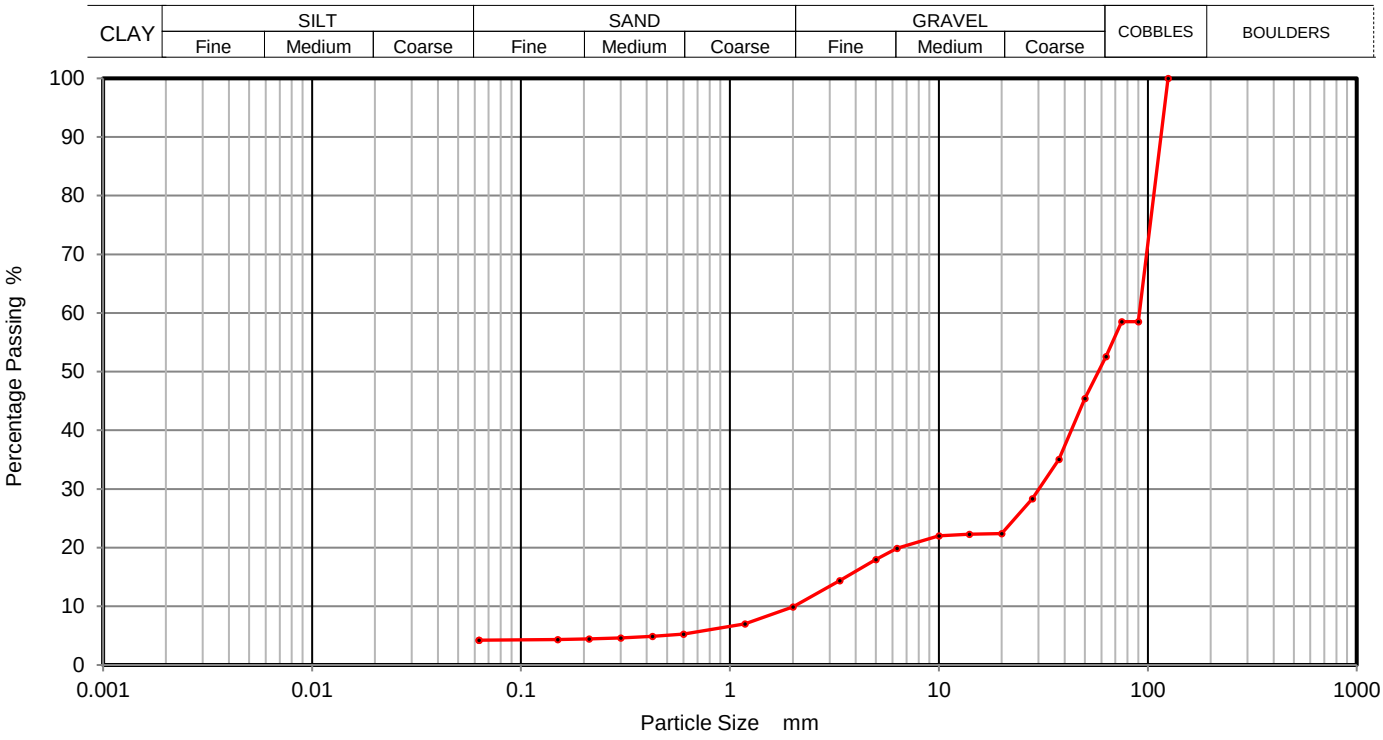
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S2
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown silty fine to medium slightly sandy fine to coarse GRAVEL with many cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	59	0.0060	
75	59	0.0019	
63	53		
50	45		
37.5	35		
28	28		
20	22		
14	22		
10	22		
6.3	20		
5	18		
3.35	14		
2	10		
1.18	7		
0.6	5		
0.425	5		
0.3	5		
0.212	4		
0.15	4		
0.063	4		

Sample Proportions	% dry mass
Cobbles	47
Gravel	43
Sand	6
Silt and Clay	4

Grading Analysis	
Uniformity Coefficient	

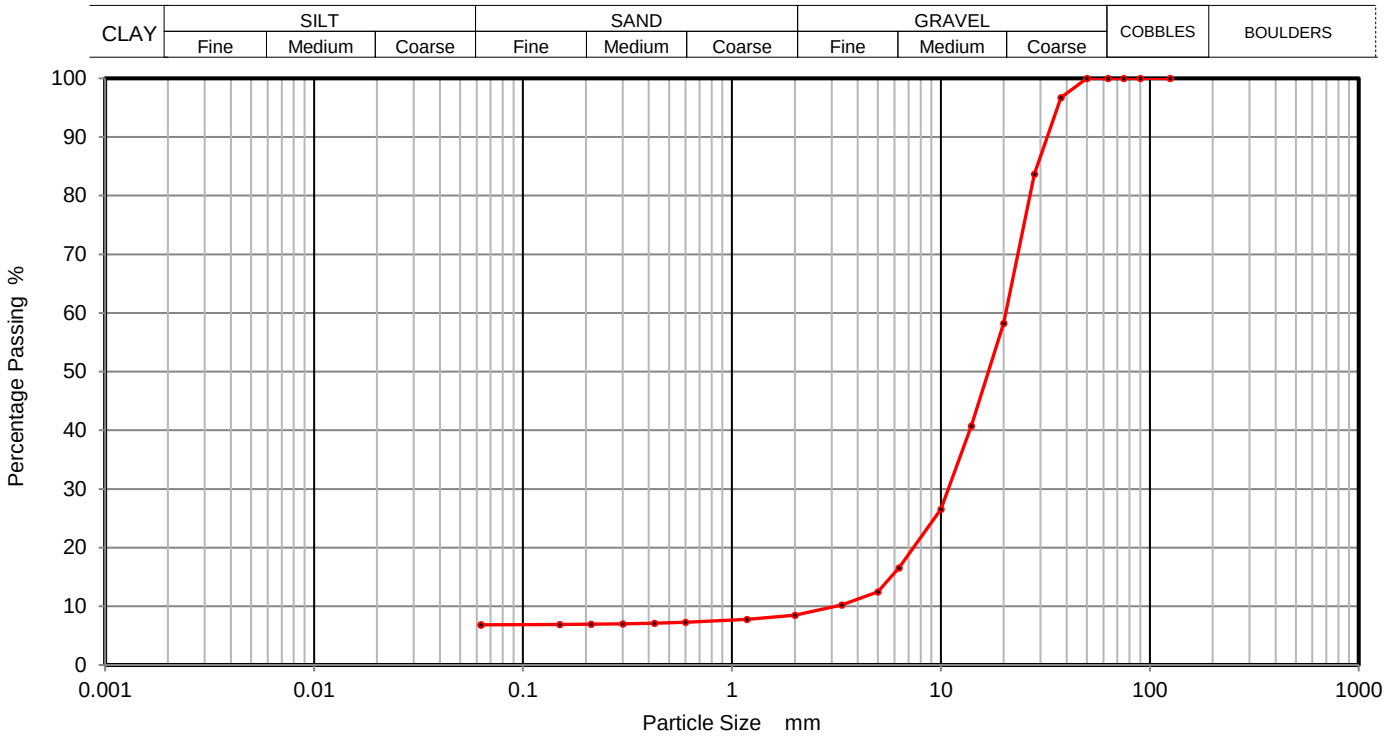
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S3
Site Name	Buttington Quarry (B.Quarry)	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	97		
28	84		
20	58		
14	41		
10	27		
6.3	17		
5	12		
3.35	10		
2	9		
1.18	8		
0.6	7		
0.425	7		
0.3	7		
0.212	7		
0.15	7		
0.063	7		

Sample Proportions	% dry mass
Cobbles	0
Gravel	91
Sand	2
Silt and Clay	7

Grading Analysis	
Uniformity Coefficient	

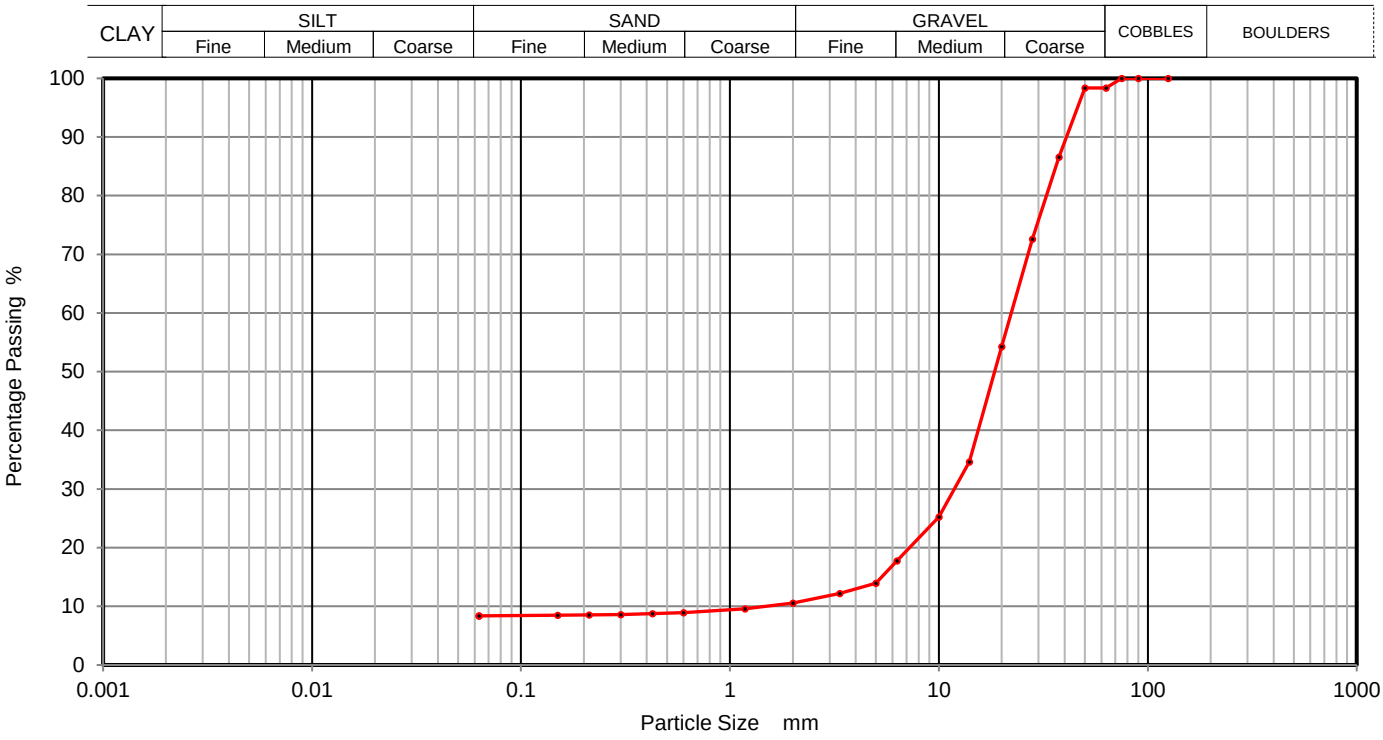
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S4
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	98		
50	98		
37.5	87		
28	73		
20	54		
14	35		
10	25		
6.3	18		
5	14		
3.35	12		
2	11		
1.18	10		
0.6	9		
0.425	9		
0.3	9		
0.212	9		
0.15	8		
0.063	8		

Sample Proportions	% dry mass
Cobbles	2
Gravel	87
Sand	3
Silt and Clay	8

Grading Analysis	
Uniformity Coefficient	

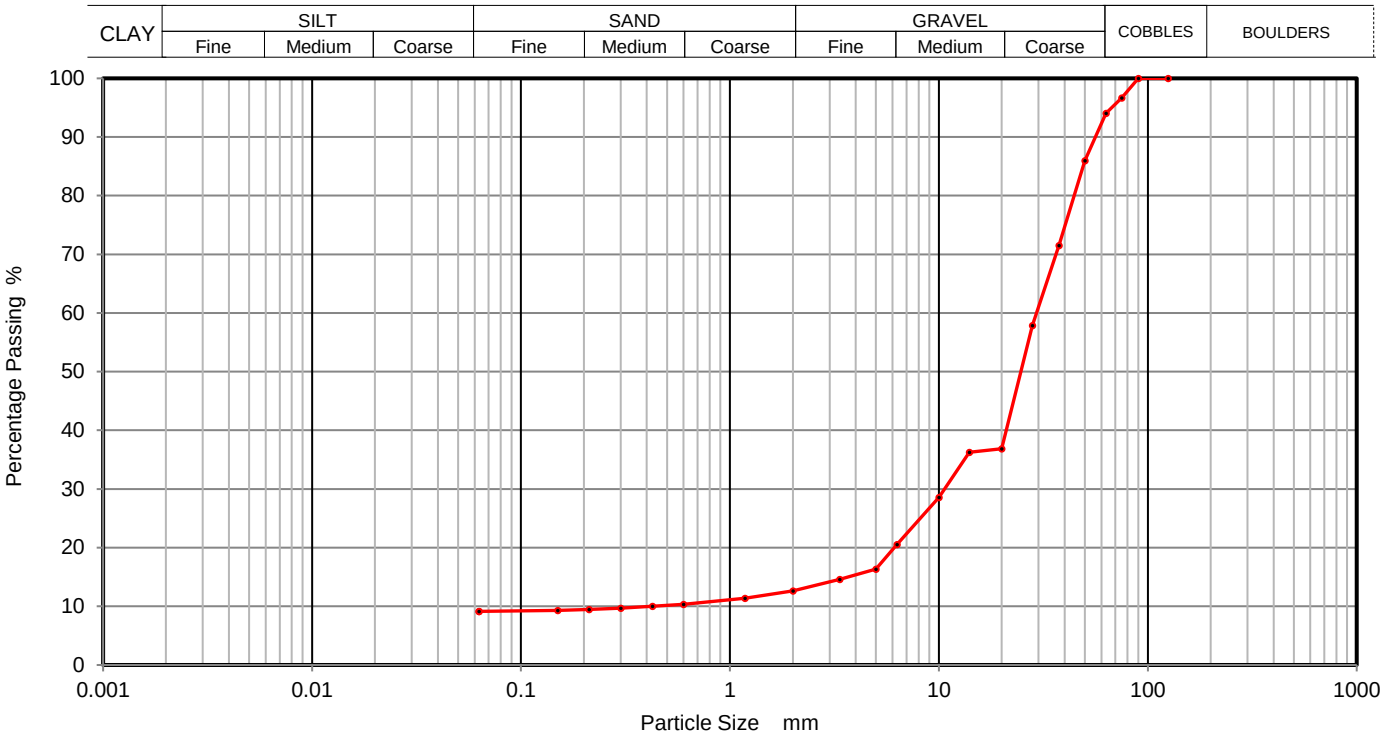
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S5
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	97	0.0019	
63	94		
50	86		
37.5	71		
28	58		
20	37		
14	36		
10	29		
6.3	21		
5	16		
3.35	15		
2	13		
1.18	11		
0.6	10		
0.425	10		
0.3	10		
0.212	9		
0.15	9		
0.063	9		

Sample Proportions	% dry mass
Cobbles	6
Gravel	81
Sand	4
Silt and Clay	9

Grading Analysis	
Uniformity Coefficient	

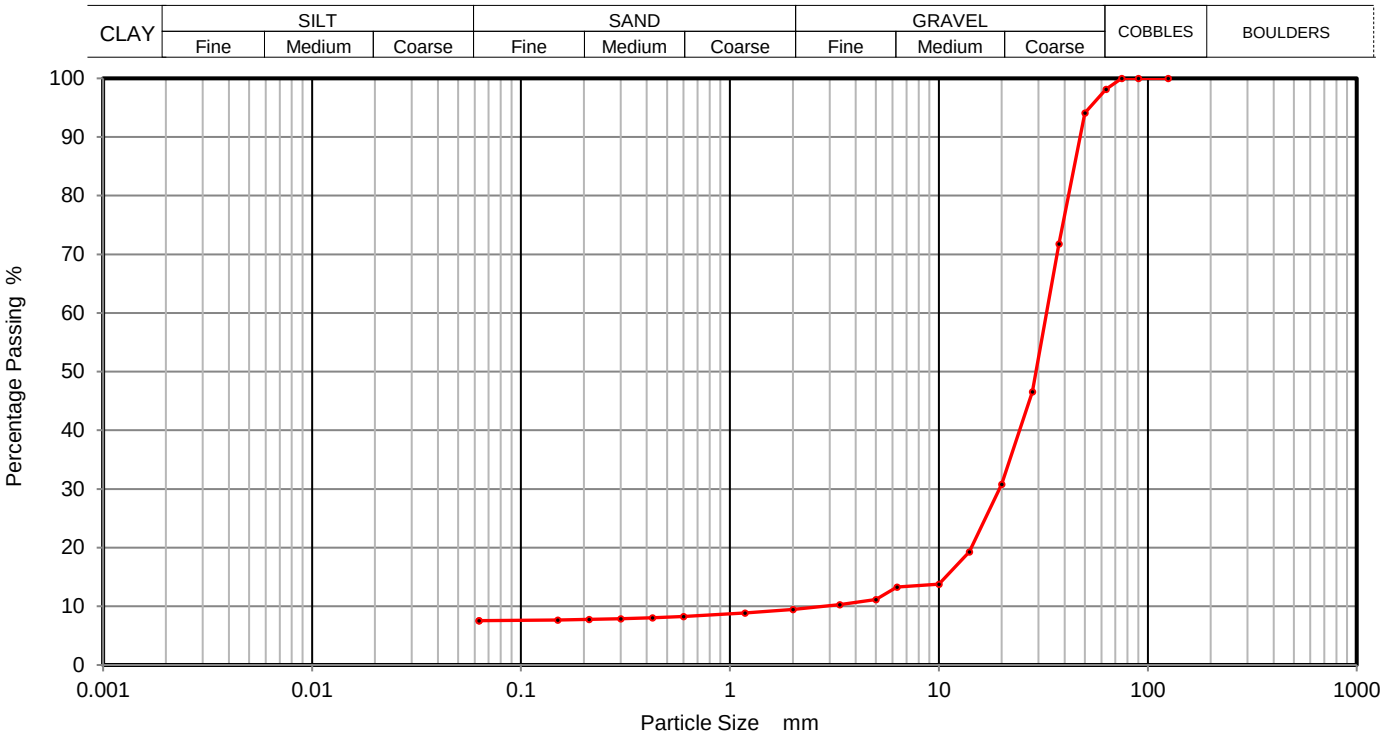
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S6
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	98		
50	94		
37.5	72		
28	47		
20	31		
14	19		
10	14		
6.3	13		
5	11		
3.35	10		
2	9		
1.18	9		
0.6	8		
0.425	8		
0.3	8		
0.212	8		
0.15	8		
0.063	8		

Sample Proportions	% dry mass
Cobbles	2
Gravel	89
Sand	1
Silt and Clay	8

Grading Analysis	
Uniformity Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S1	Depth from (m):	0.00
Sample Number :	1	Depth to (m):	0.00

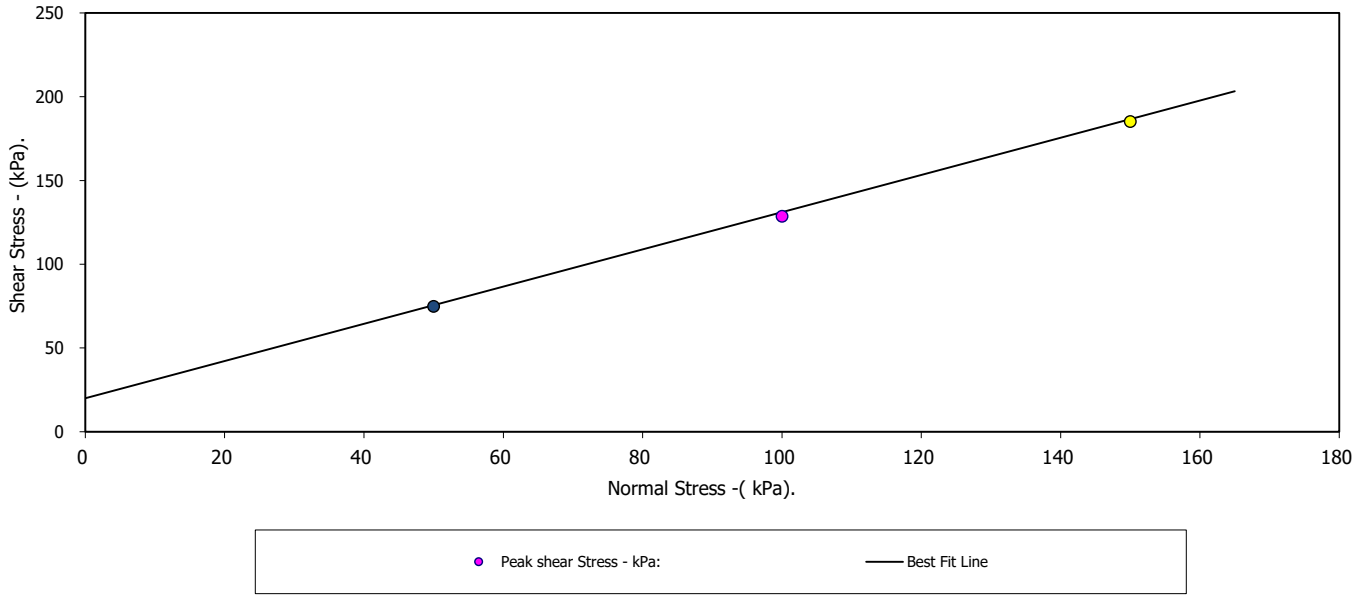
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	136.00	136.00	136.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.04	2.04	2.04
Dry Density - Mg/m3:	1.85	1.85	1.85
Voids Ratio:	0.4316	0.4317	0.4318
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	133.03	131.54	129.77
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	58.55	60.41	63.30
Peak shear Stress - kPa:	75	129	185

PEAK	
Angle of Shearing Resistance:(θ)	**48.0**
Effective Cohesion - kPa:	**20**

FAILURE CONDITIONS



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Contract No.:
41501

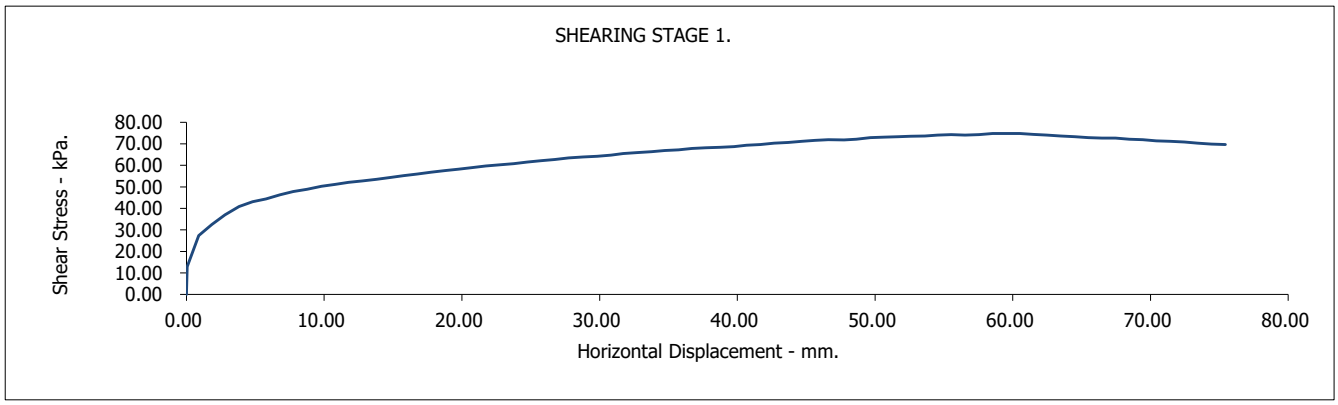
Client Ref Number:
14880RH

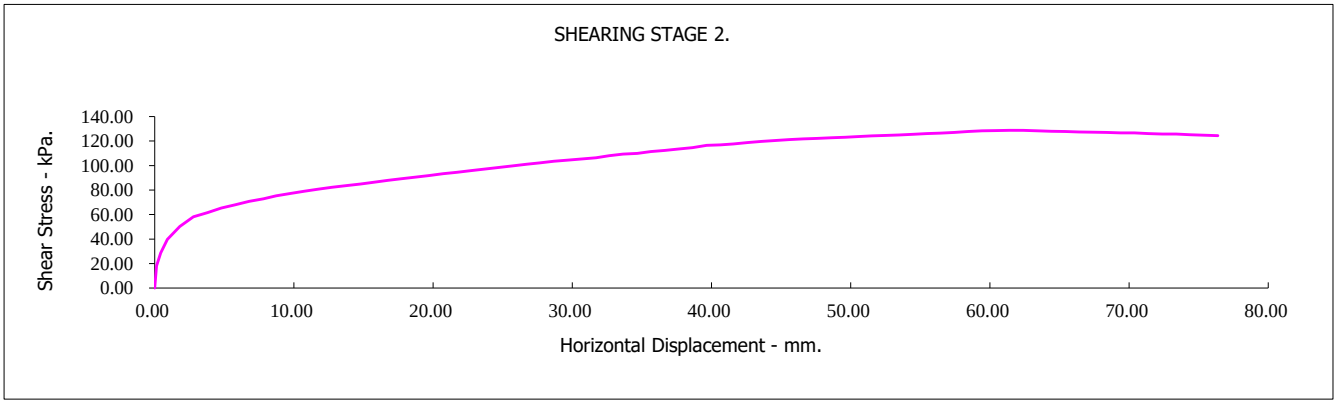
Buttington Quarry (B.Quarry)

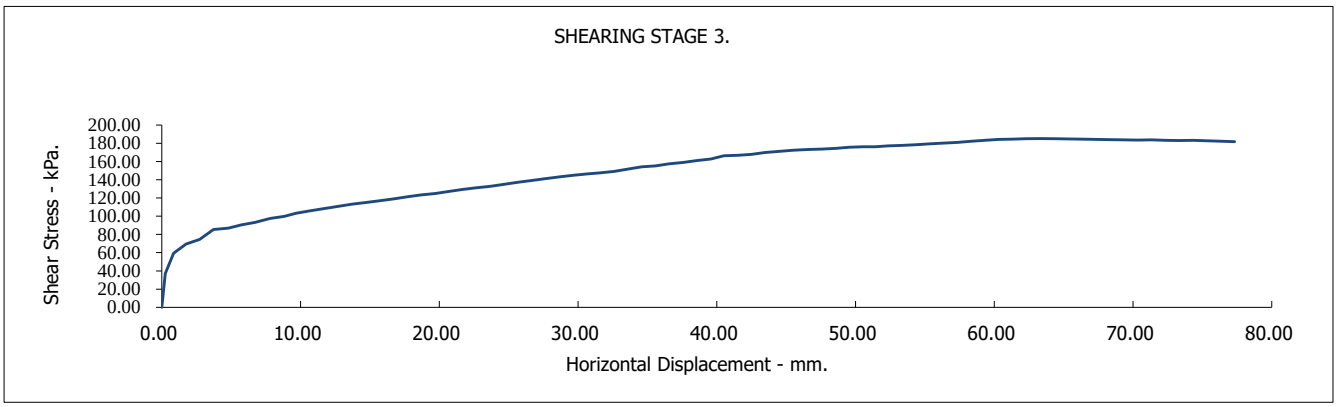
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

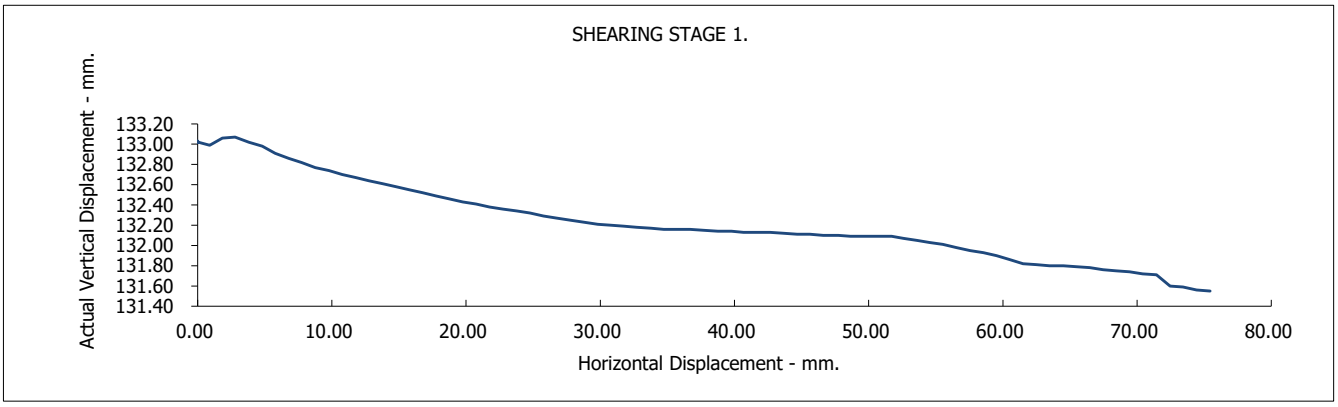
Client Ref Number: **14880RH**

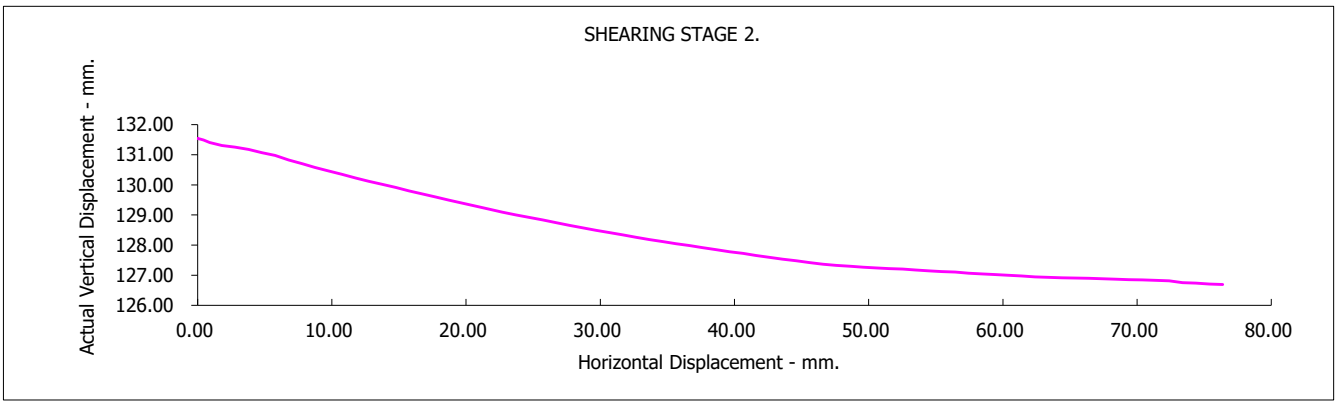
Figure.

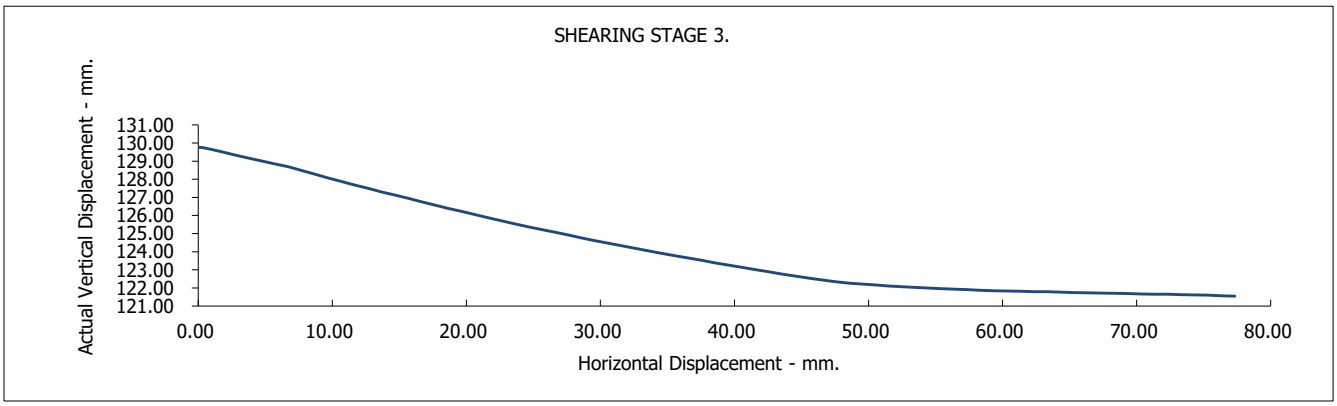
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

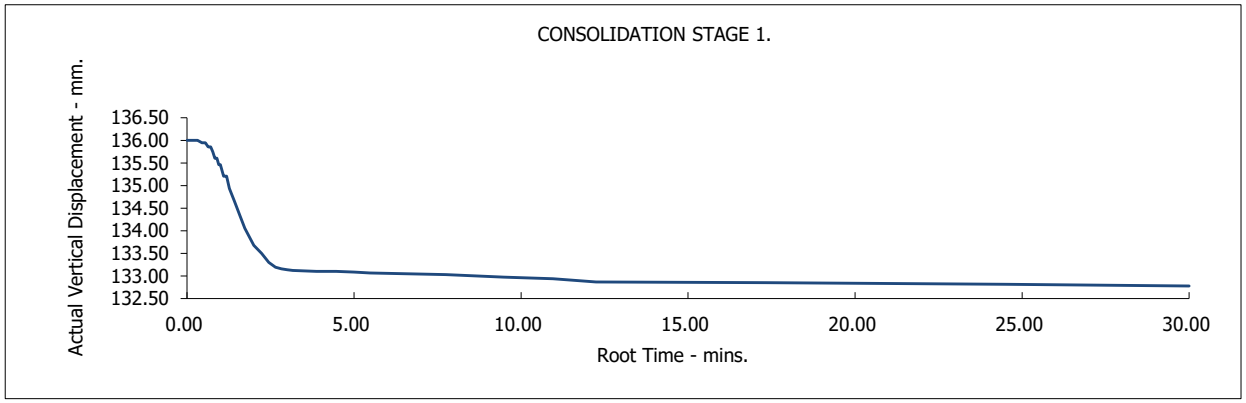
Client Ref Number: **14880RH**

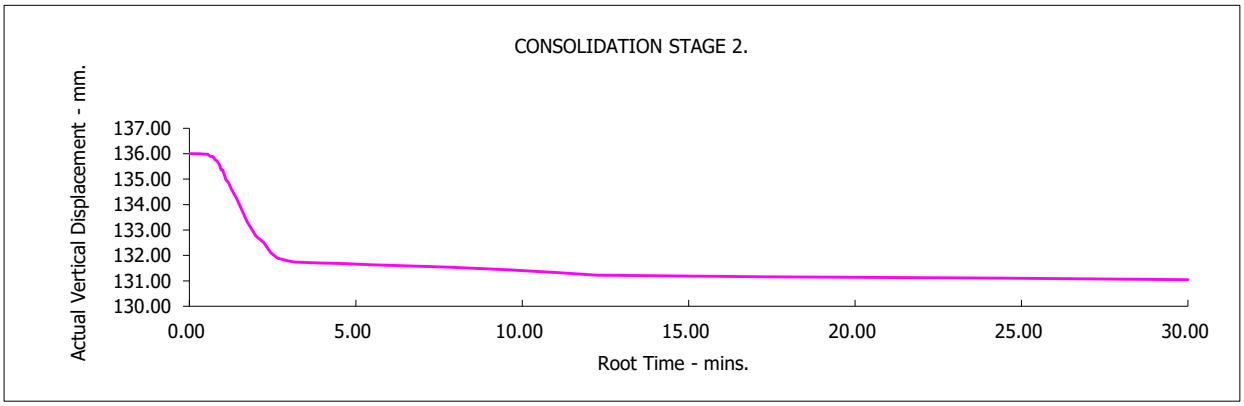
Figure.

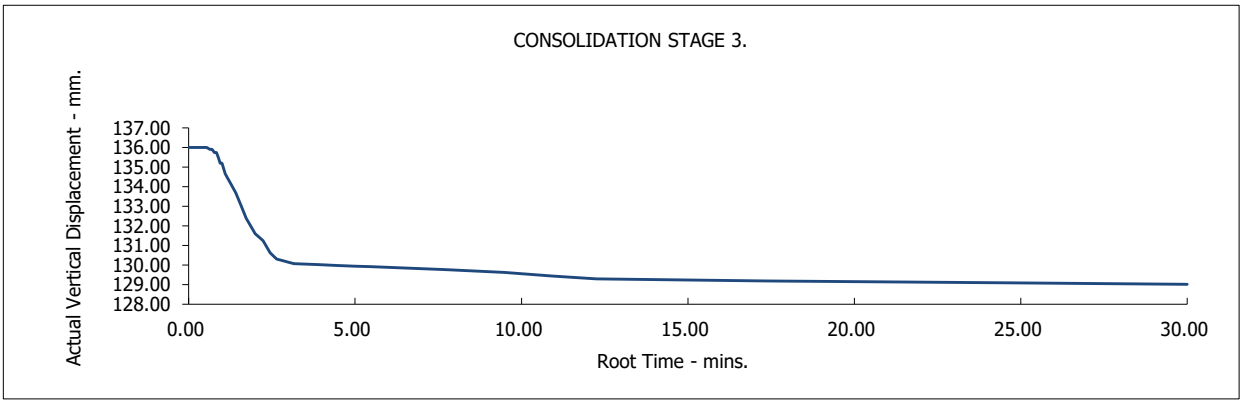
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S2	Depth from (m):	0.00
Sample Number :	2	Depth to (m):	0.00

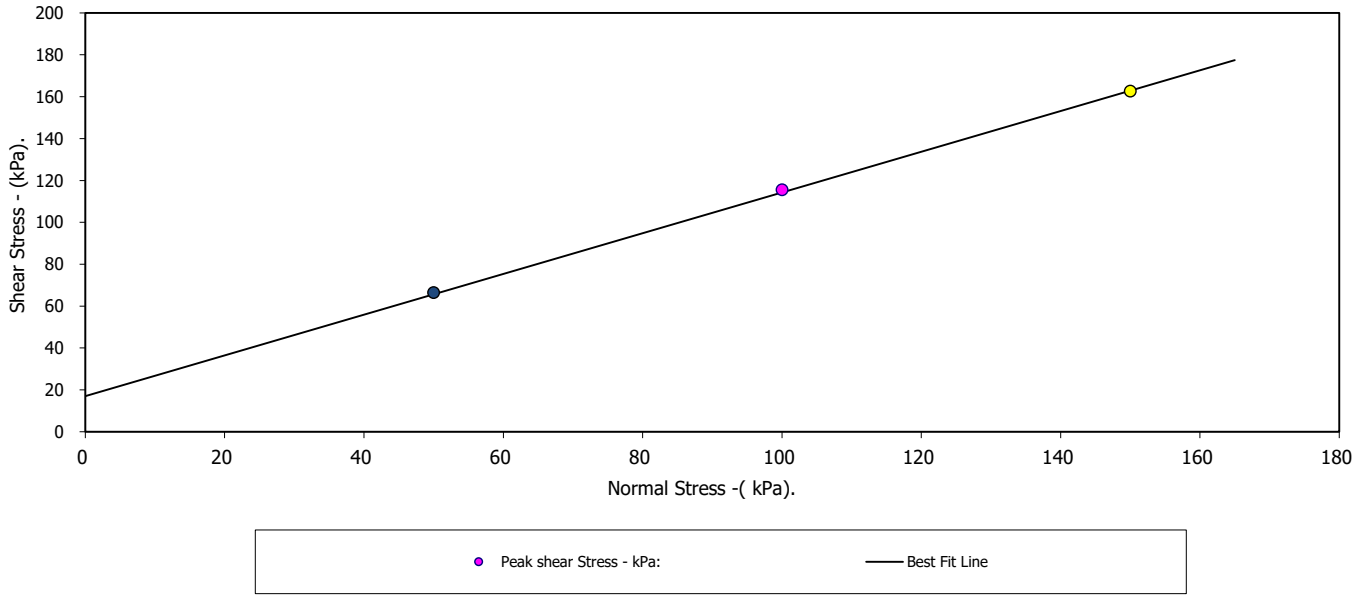
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	130.00	130.00	130.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.02	2.02	2.02
Dry Density - Mg/m3:	1.83	1.83	1.83
Voids Ratio:	0.4478	0.4478	0.4477
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	126.40	121.96	117.52
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	55.06	55.19	57.32
Peak shear Stress - kPa:	66	116	163

PEAK	
Angle of Shearing Resistance:(θ)	**44.2**
Effective Cohesion - kPa:	**17**

FAILURE CONDITIONS



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Contract No.:
41501

Buttington Quarry (B.Quarry)

Client Ref Number:
14880RH

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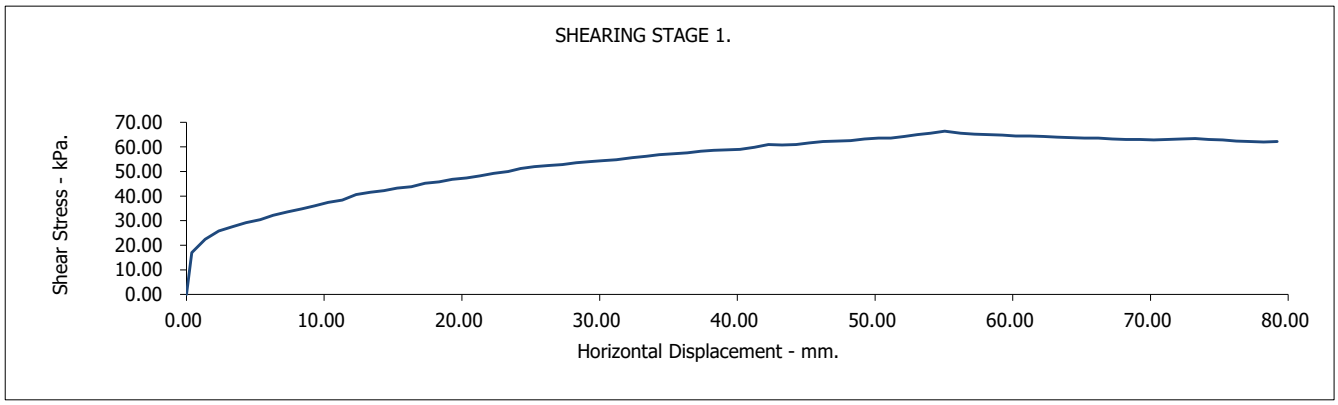
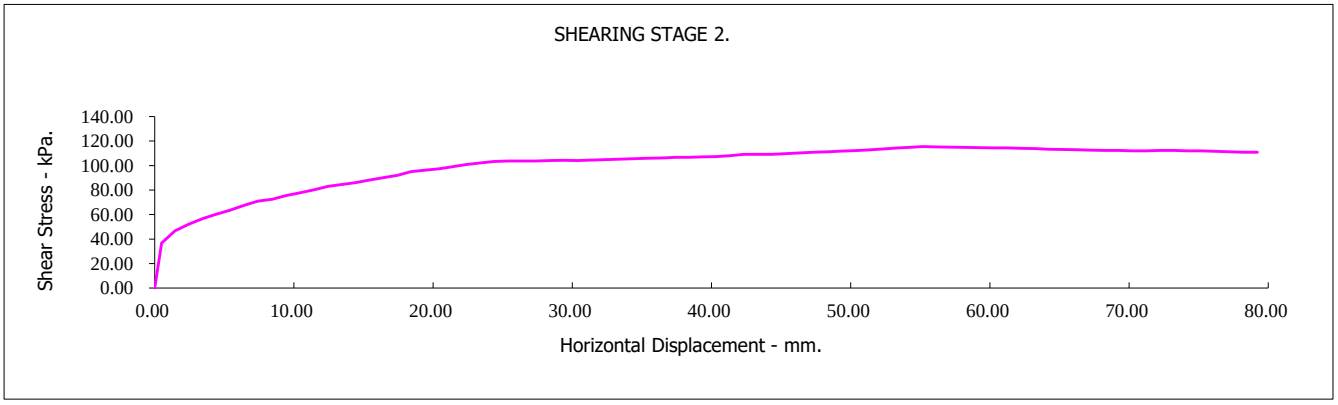
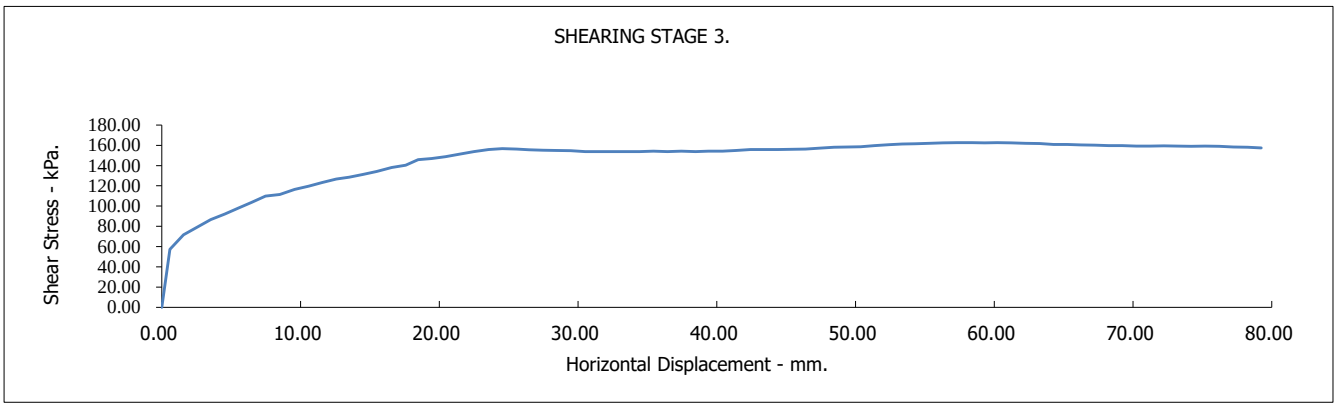
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

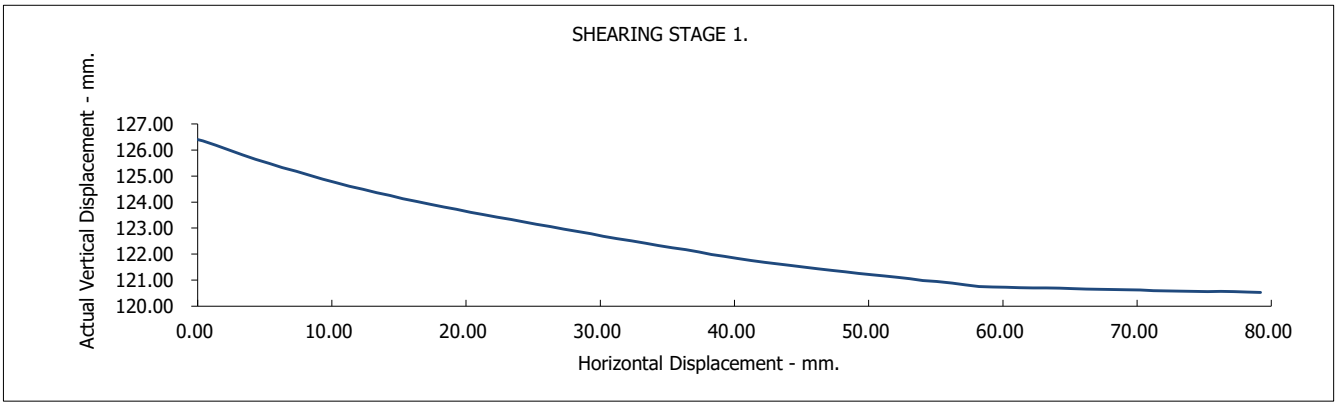
Client Ref Number: **14880RH**

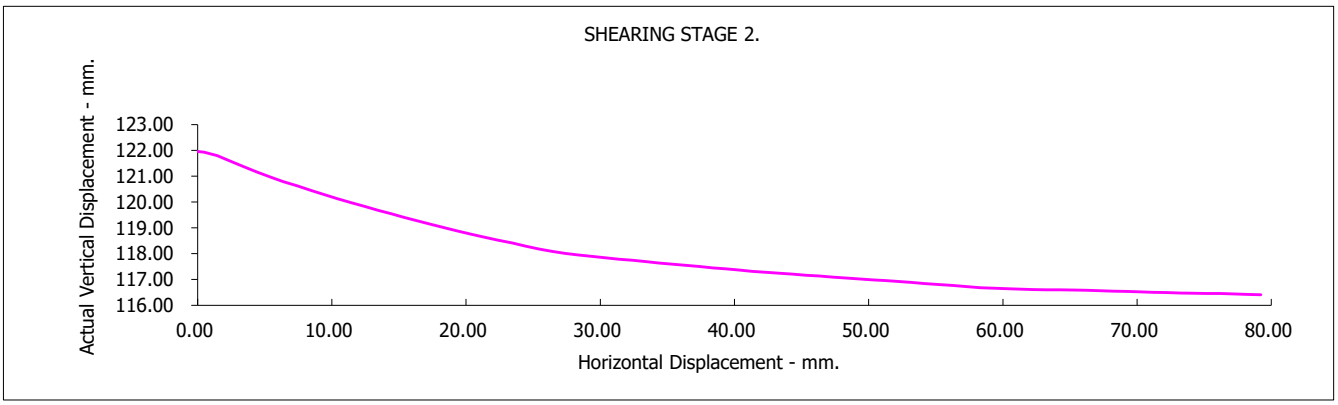
Figure.

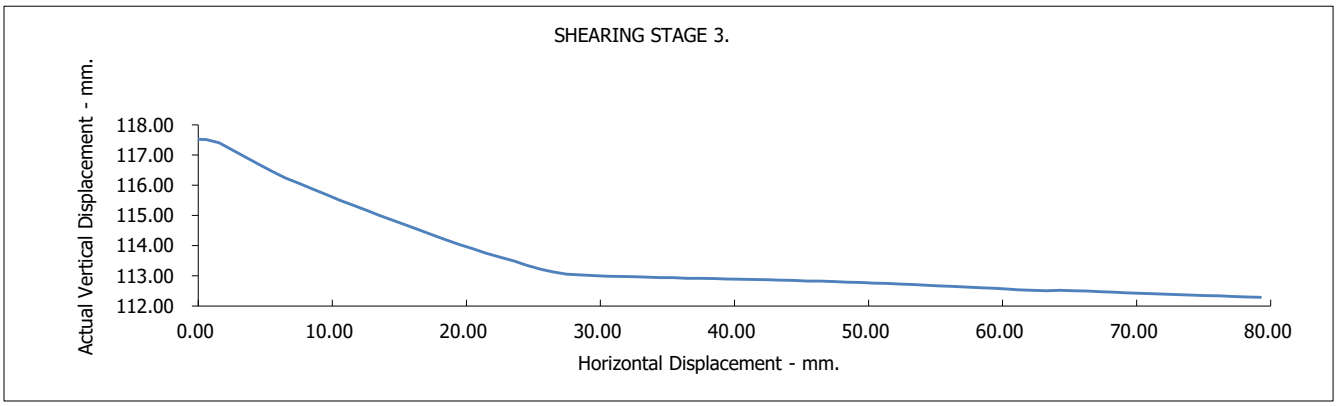
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

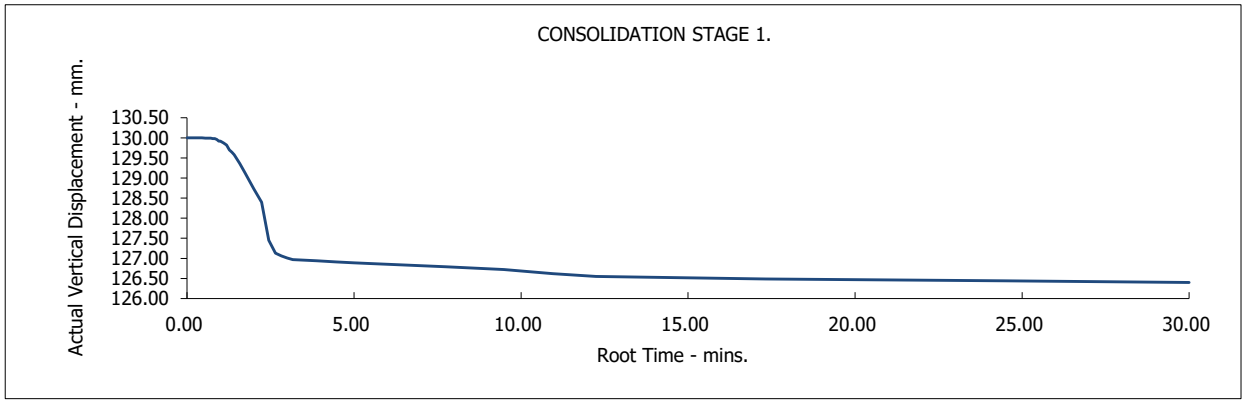
Client Ref Number: **14880RH**

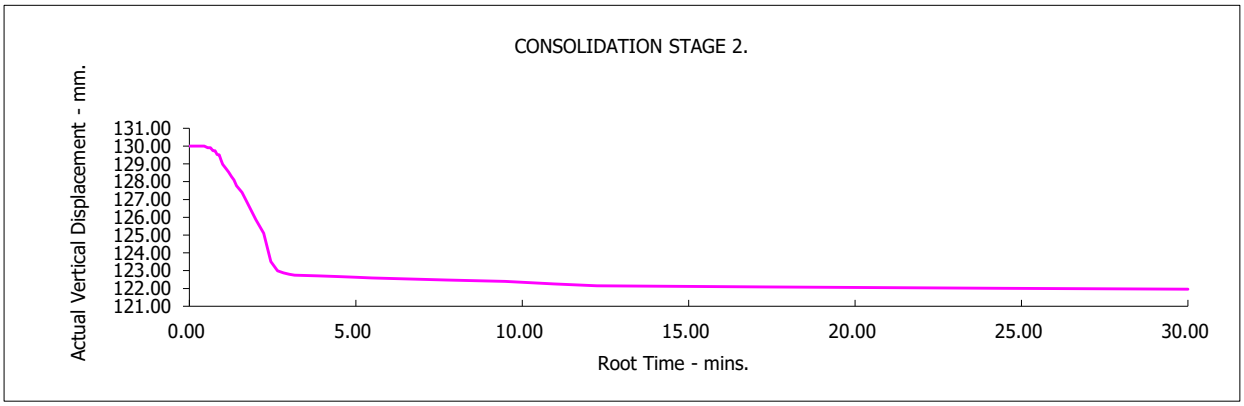
Figure.

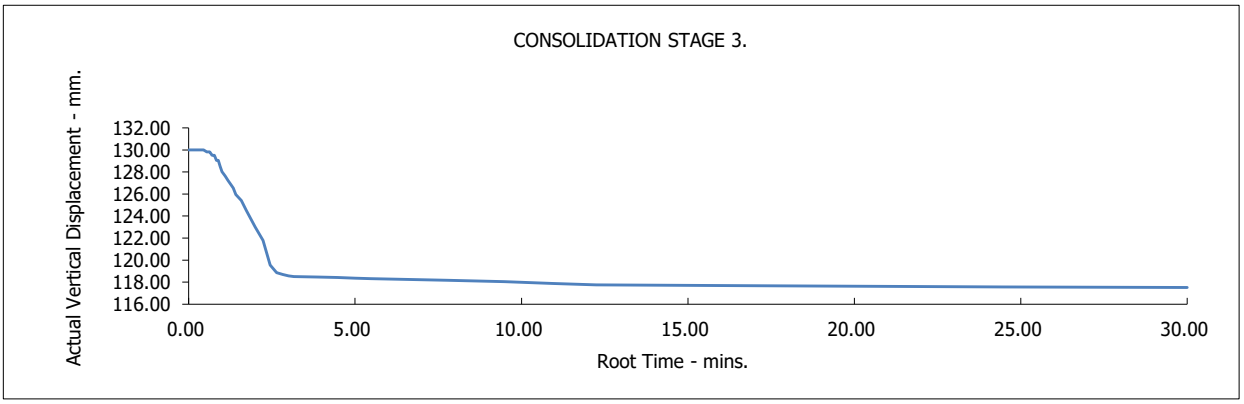
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S3	Depth from (m):	0.00
Sample Number :	3	Depth to (m):	0.00

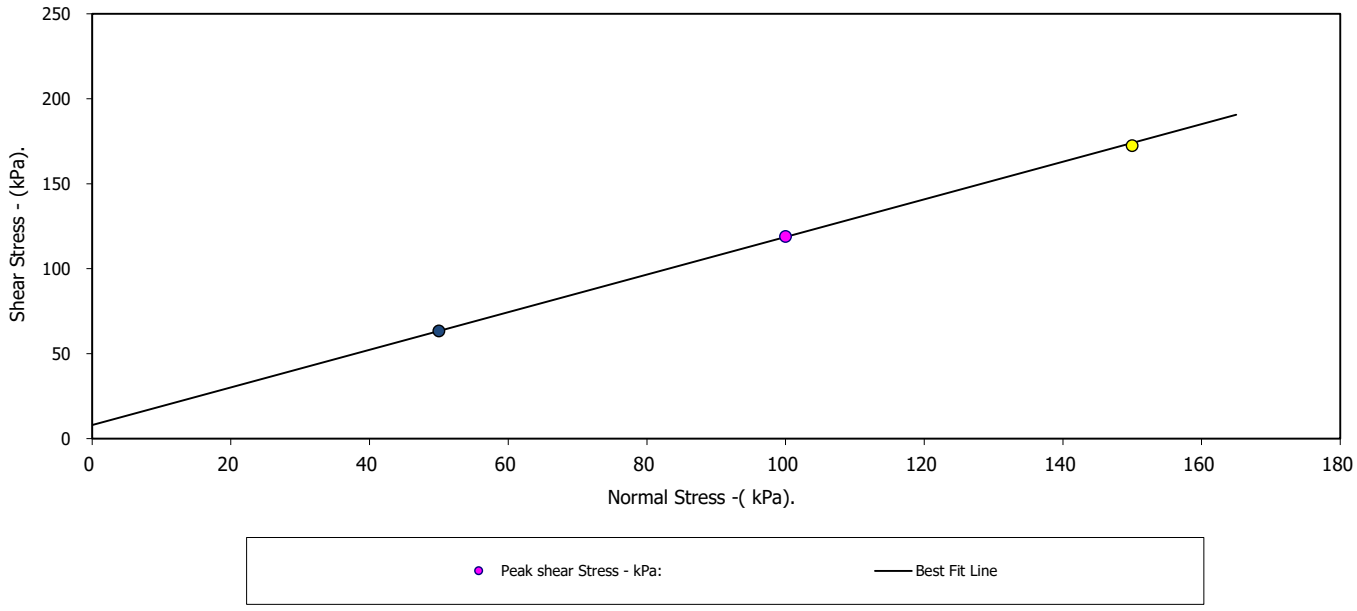
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	134.00	134.00	134.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	7	7	7
Bulk Density - Mg/m3:	1.62	1.62	1.62
Dry Density - Mg/m3:	1.52	1.52	1.52
Voids Ratio:	0.7425	0.7426	0.7427
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	129.93	127.63	125.80
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	54.10	65.71	66.42
Peak shear Stress - kPa:	63	119	173

PEAK	
Angle of Shearing Resistance:(θ)	**47.9**
Effective Cohesion - kPa:	**8**

FAILURE CONDITIONS



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Contract No.:
41501

Client Ref Number:
14880RH

Buttington Quarry (B.Quarry)

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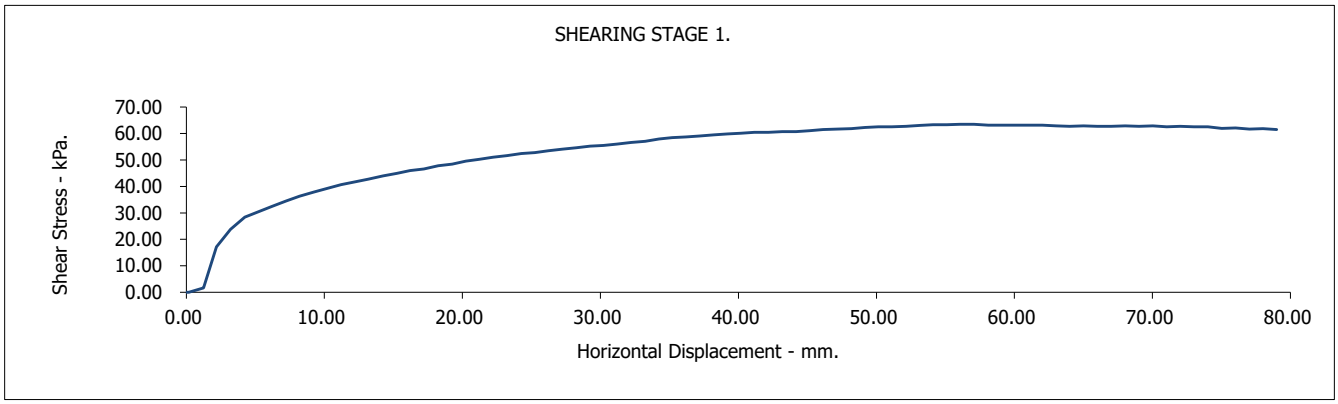
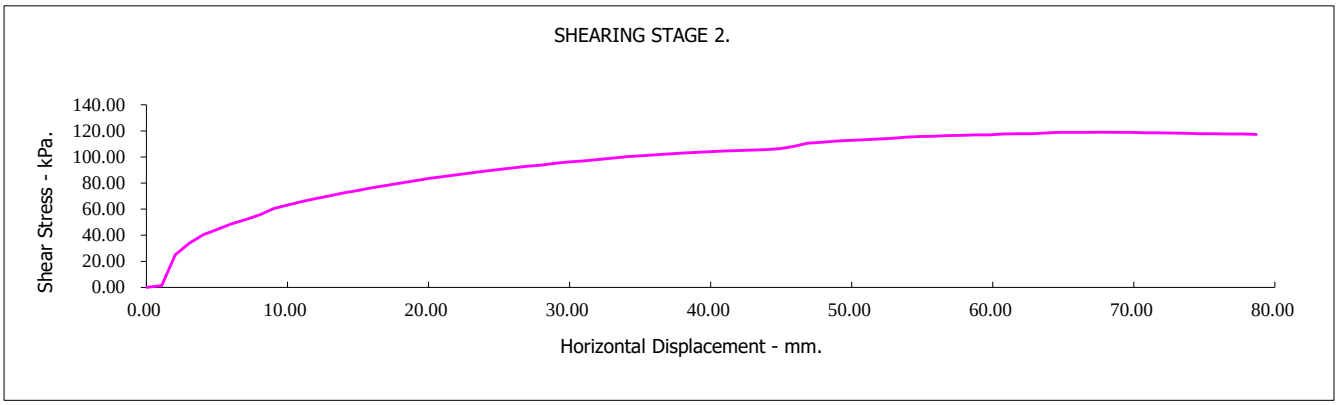
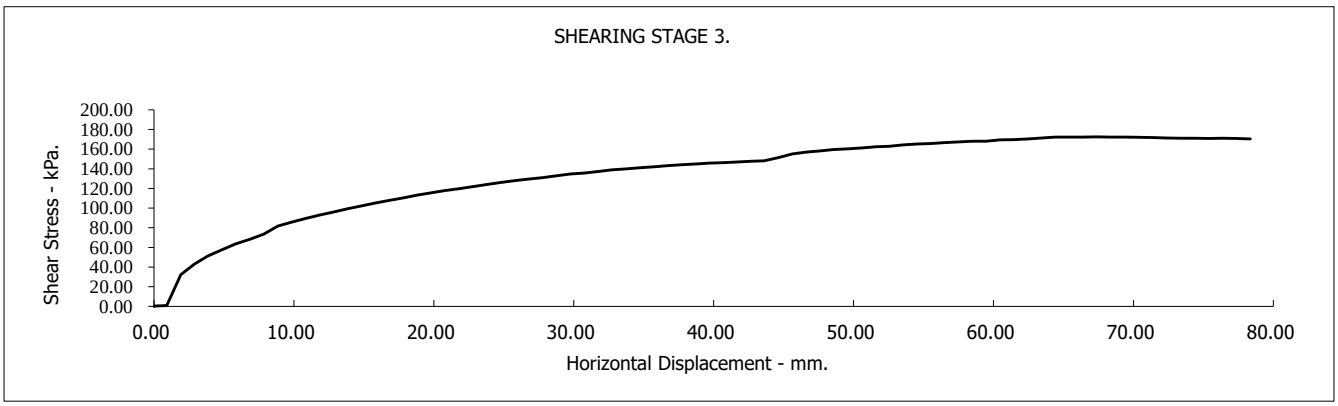
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

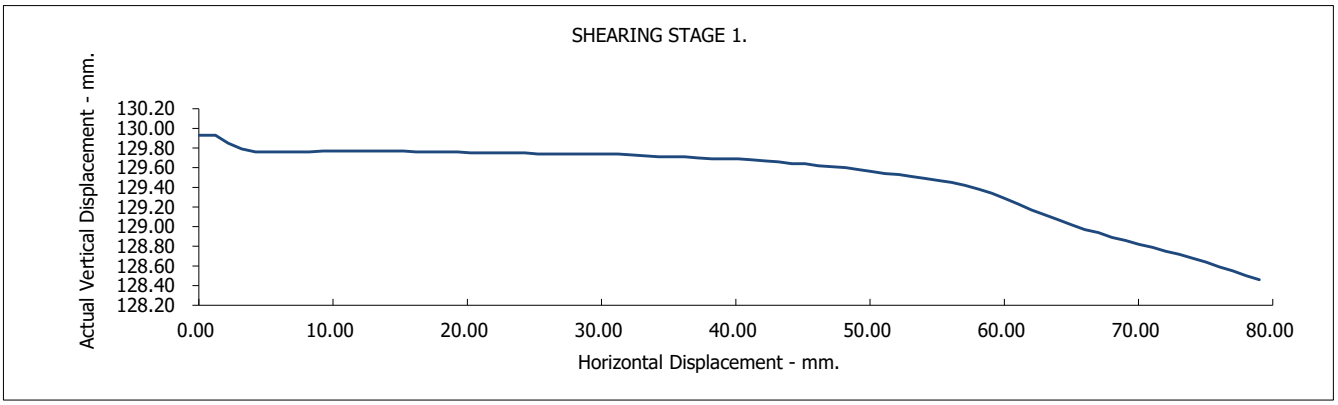
Client Ref Number: **14880RH**

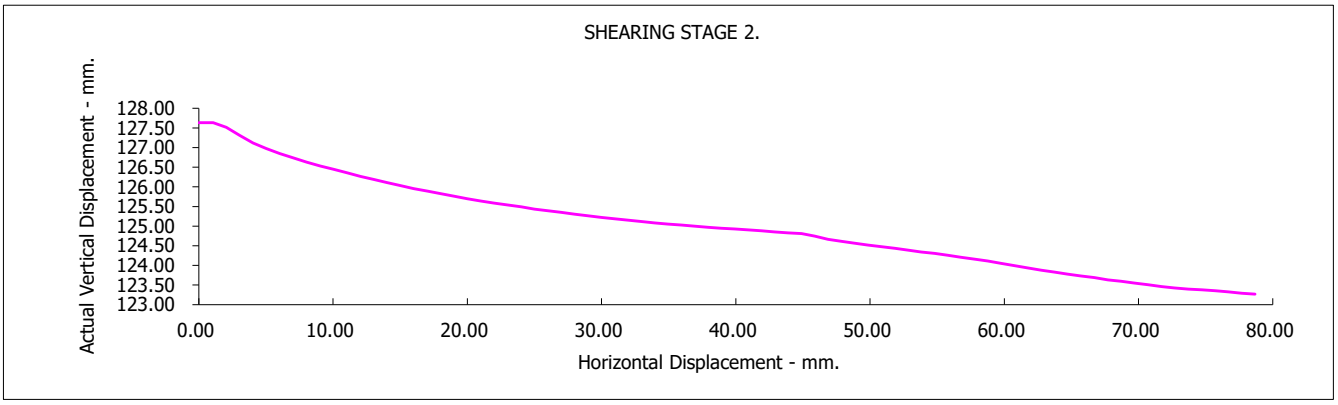
Figure.

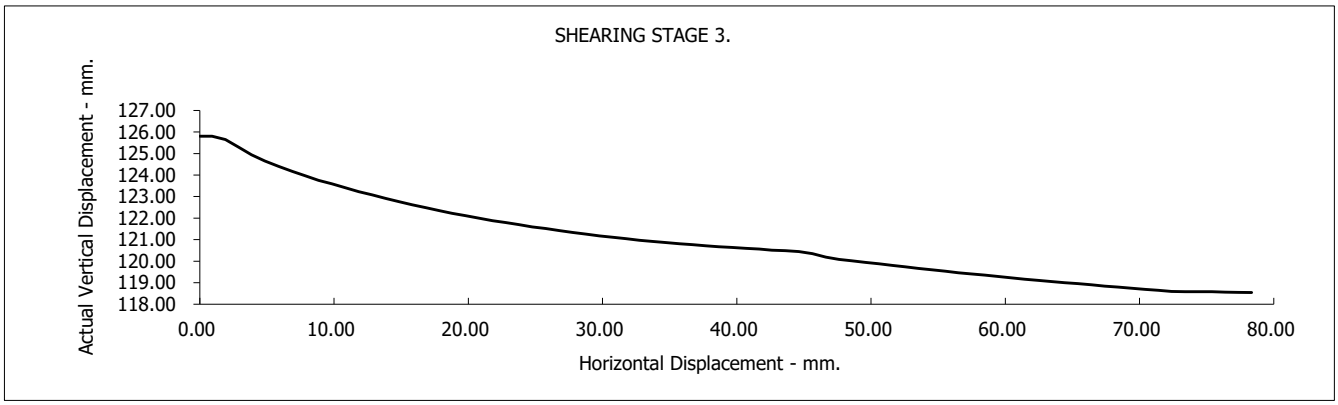
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

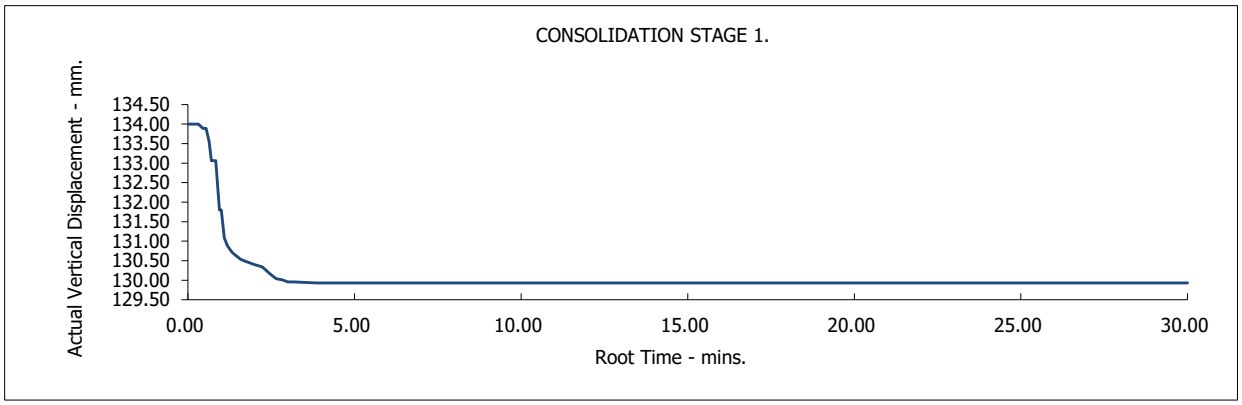
Client Ref Number: **14880RH**

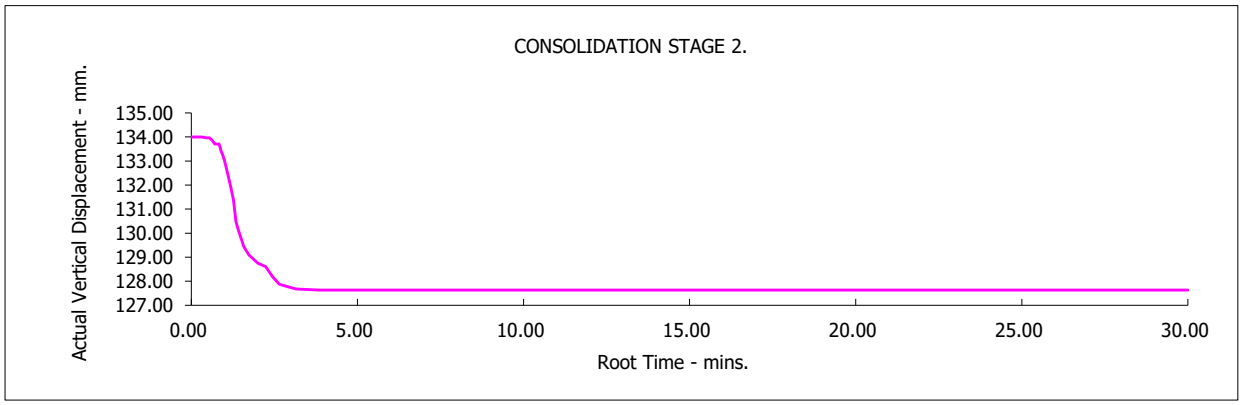
Figure.

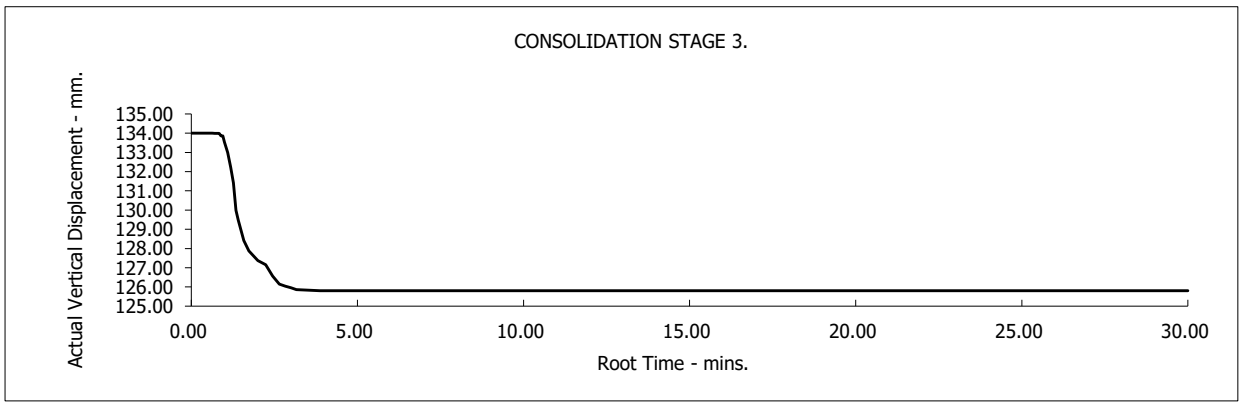
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S4	Depth from (m):	0.00
Sample Number :	4	Depth to (m):	0.00

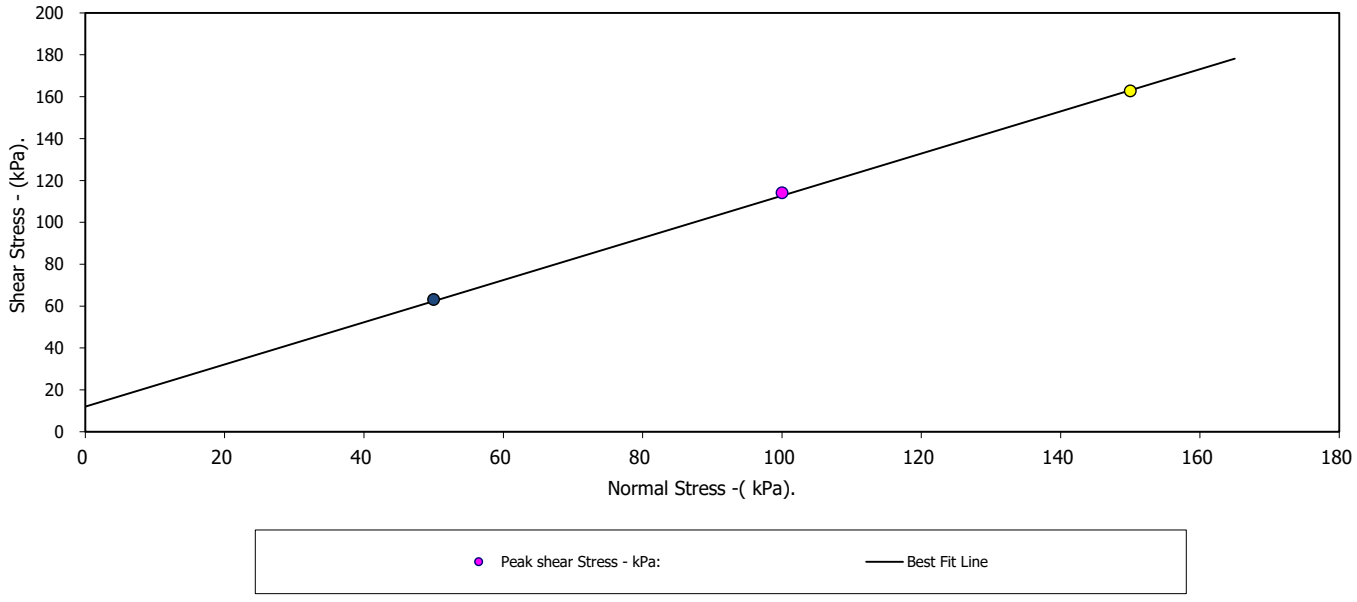
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	134.00	134.00	134.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	12	12	12
Bulk Density - Mg/m3:	1.59	1.59	1.59
Dry Density - Mg/m3:	1.43	1.43	1.43
Voids Ratio:	0.8575	0.8577	0.8575
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	130.29	129.03	127.07
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	53.12	52.66	56.20
Peak shear Stress - kPa:	63	114	163

PEAK	
Angle of Shearing Resistance:(θ)	**45.2**
Effective Cohesion - kPa:	**12**

FAILURE CONDITIONS



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Contract No.:
41501

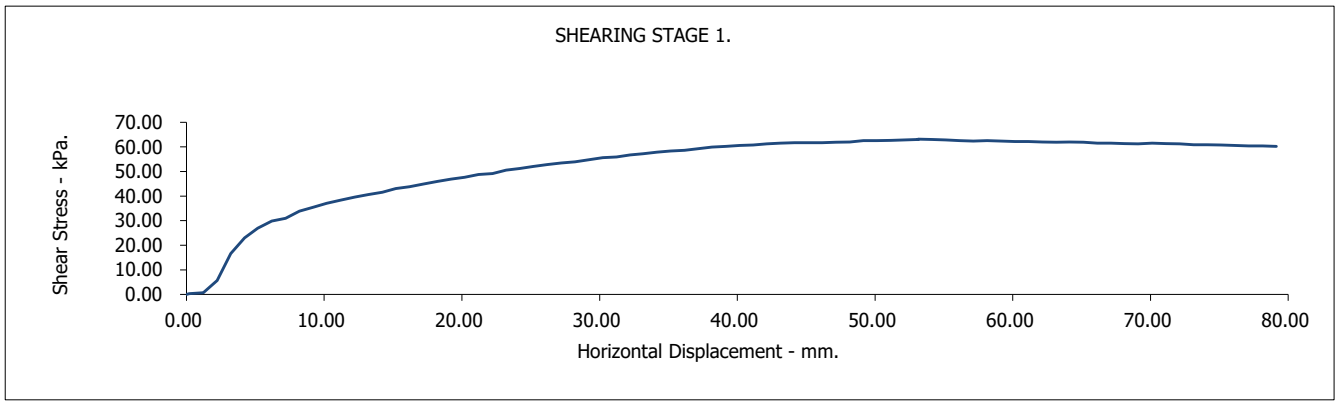
Client Ref Number:
14880RH

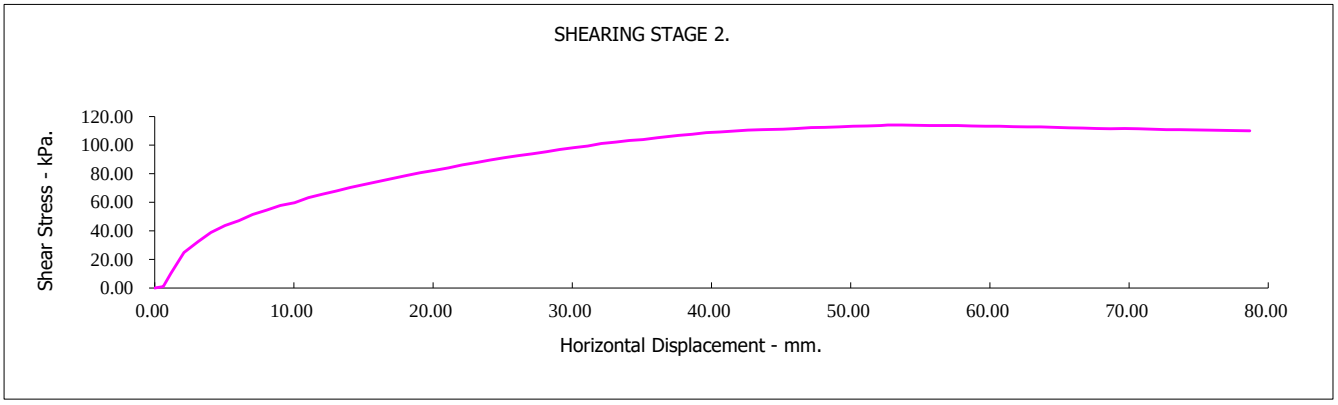
Buttington Quarry (B.Quarry)

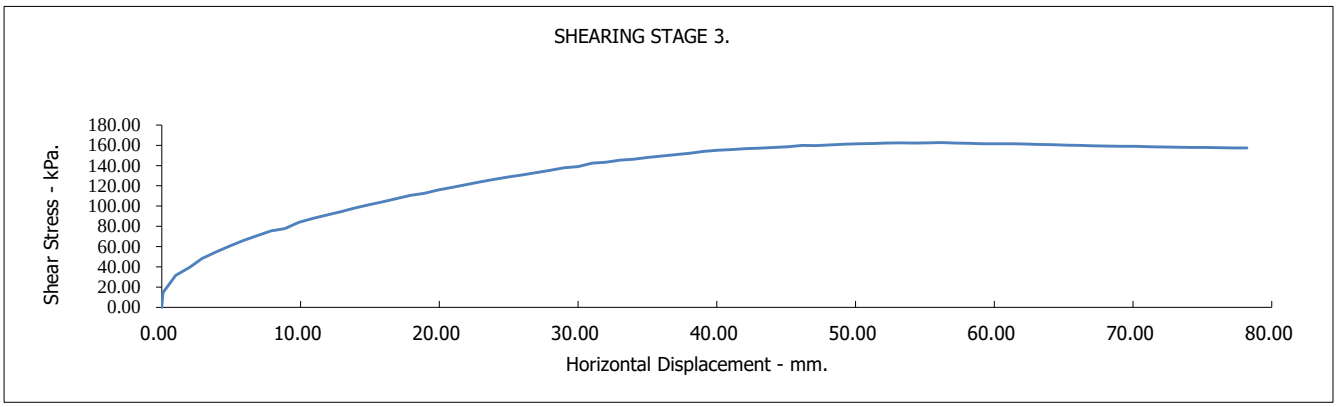
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

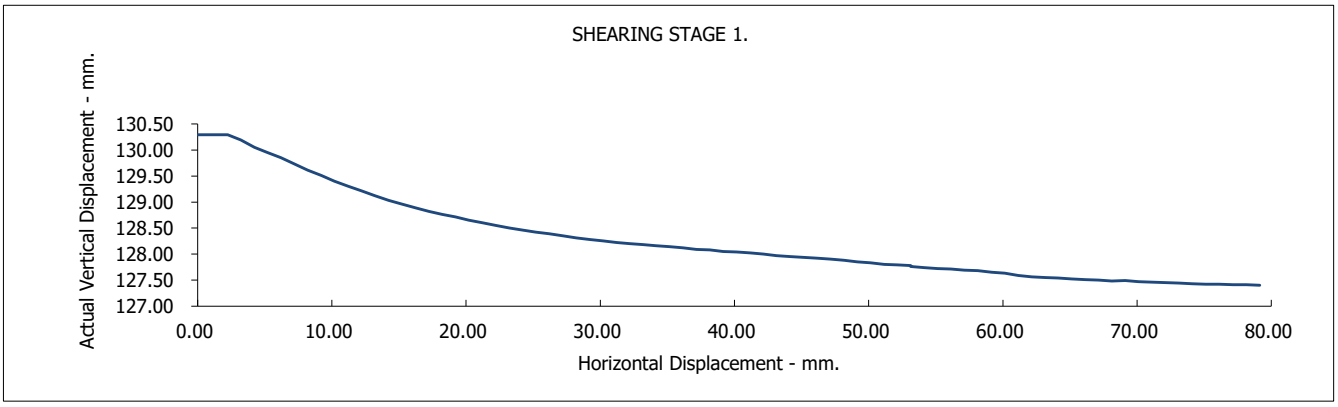
Client Ref Number: **14880RH**

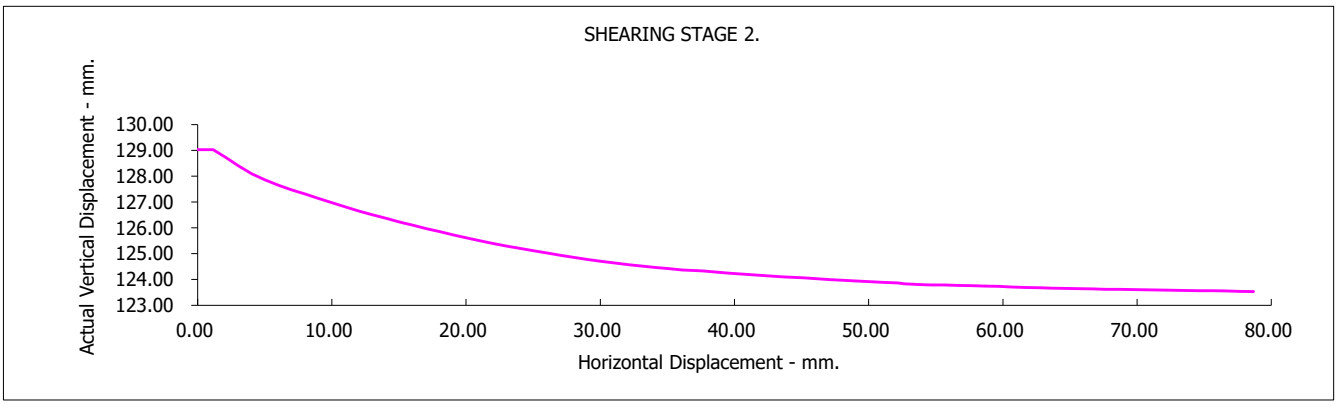
Figure.

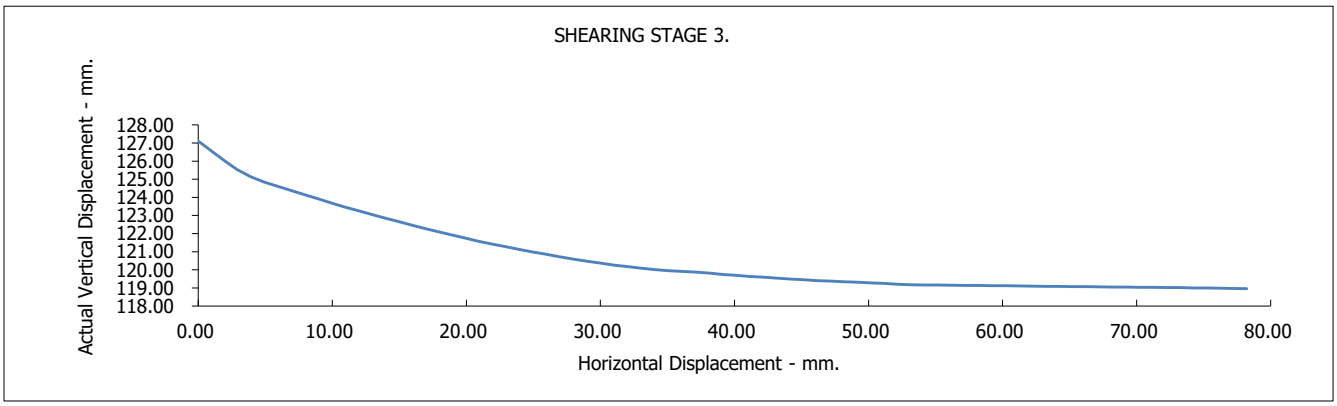
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

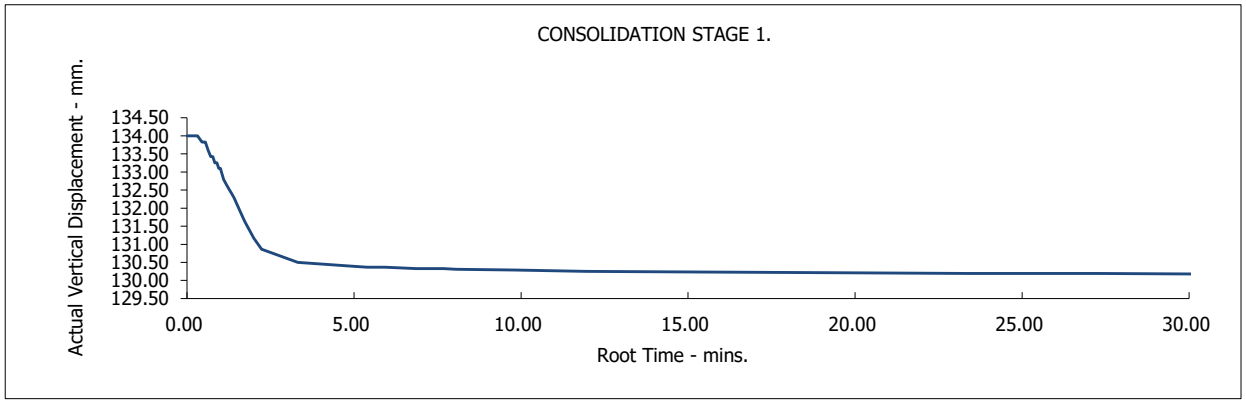
Client Ref Number: **14880RH**

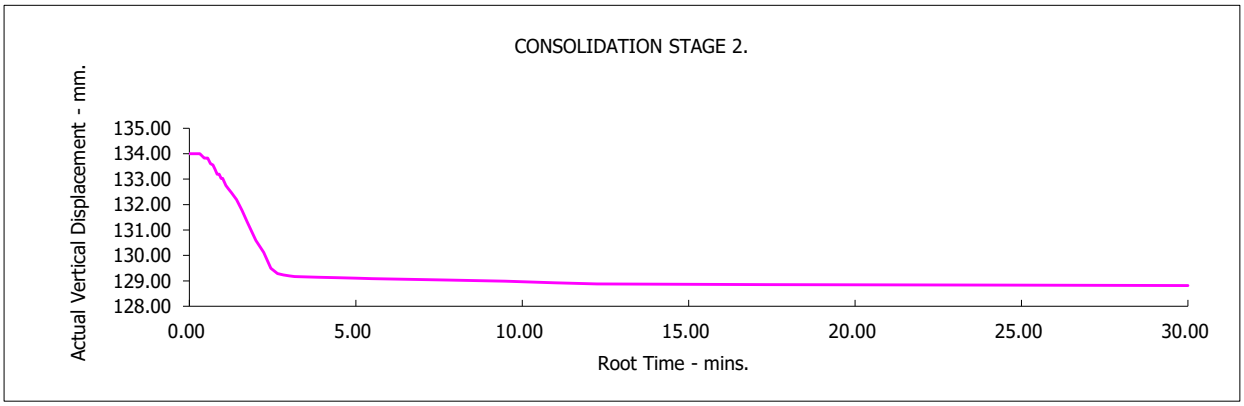
Figure.

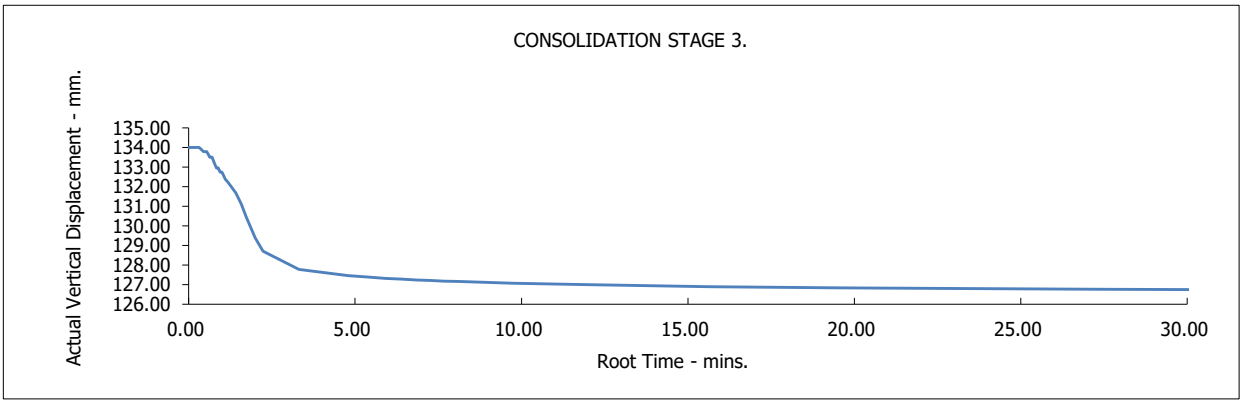
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S5	Depth from (m):	0.00
Sample Number :	5	Depth to (m):	0.00

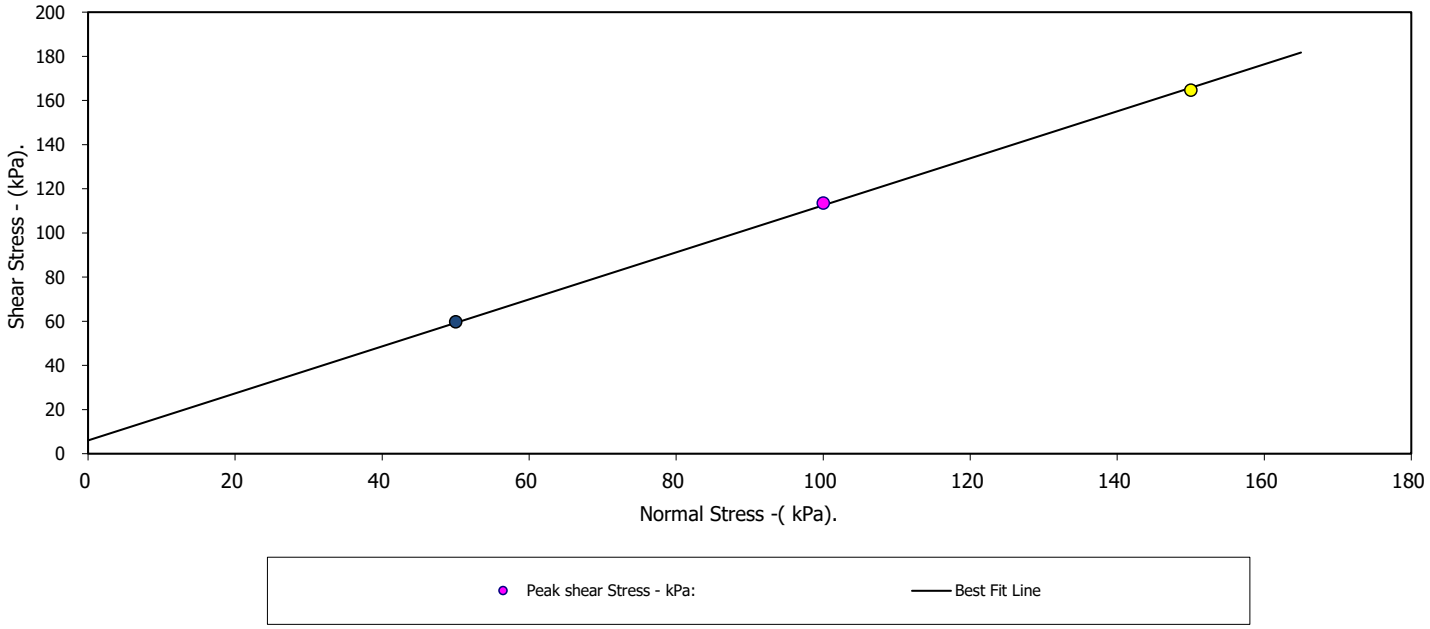
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	132.50	132.50	132.50
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	6	6	6
Bulk Density - Mg/m3:	1.65	1.65	1.65
Dry Density - Mg/m3:	1.55	1.55	1.55
Voids Ratio:	0.7053	0.7049	0.7050
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	128.00	126.20	124.88
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	60.01	61.02	61.02
Peak shear Stress - kPa:	60	113	165

PEAK	
Angle of Shearing Resistance:(θ)	**46.8**
Effective Cohesion - kPa:	**6**

FAILURE CONDITIONS



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41501

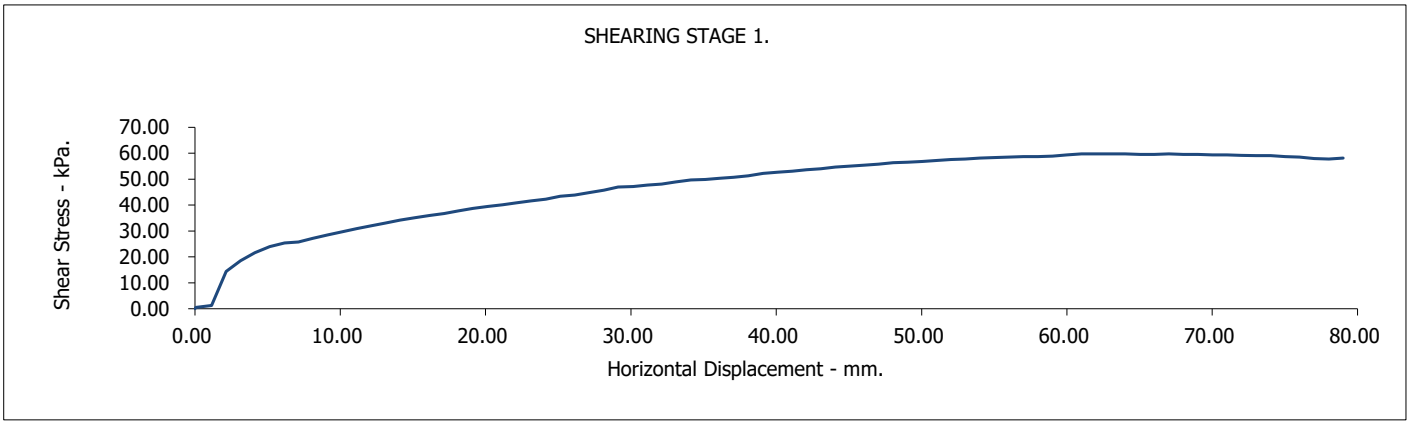
Buttington Quarry (B.Quarry)

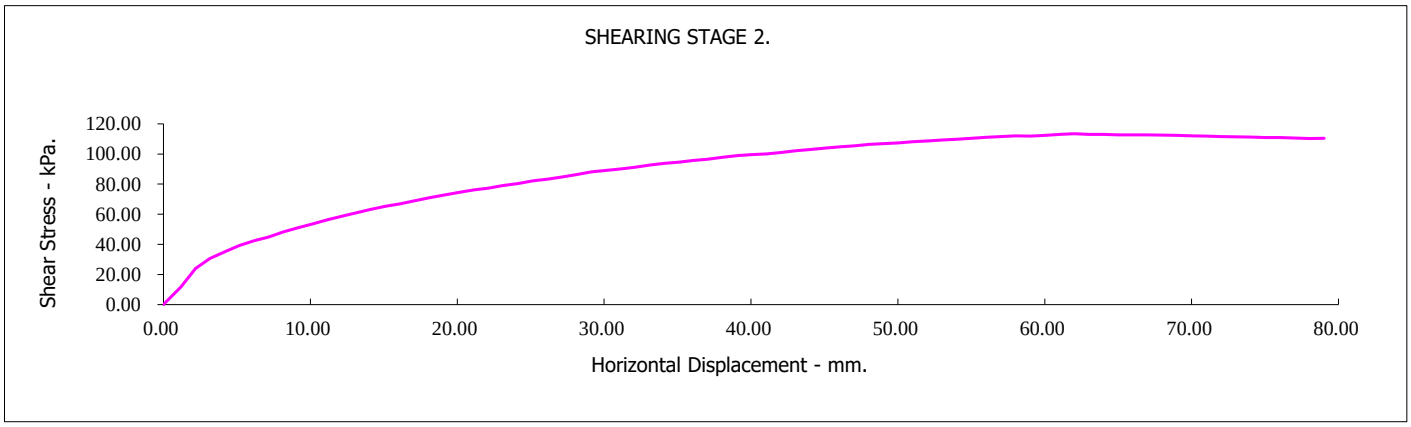
Client Ref Number:
14880RH

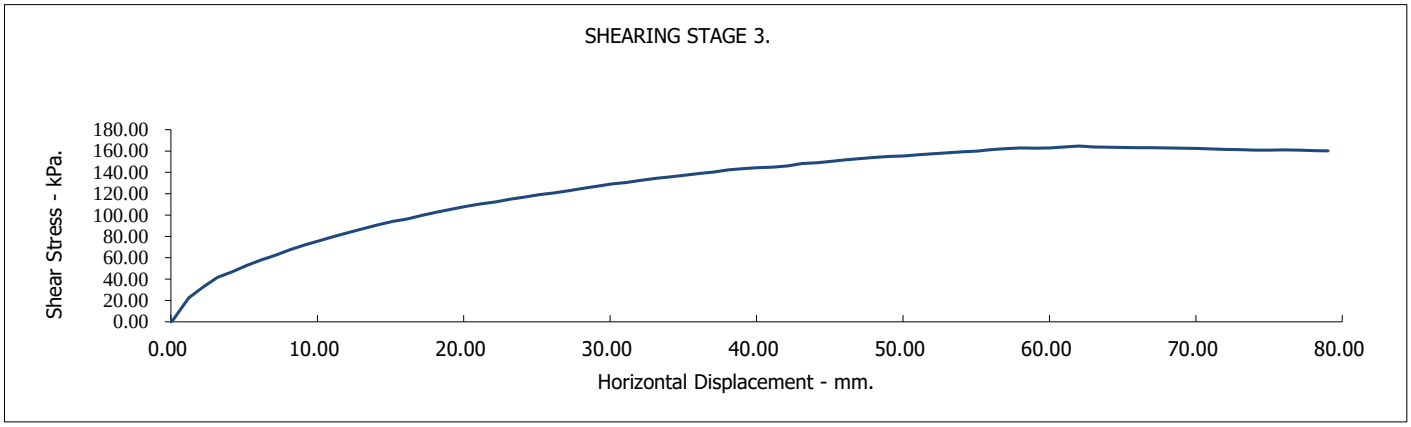
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

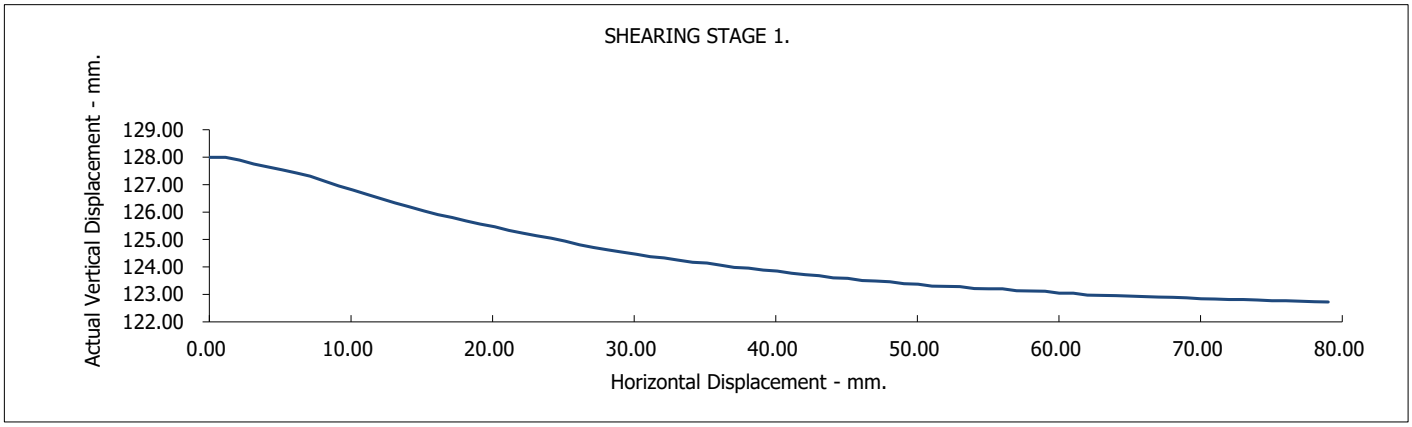
Client Ref Number: **14880RH**

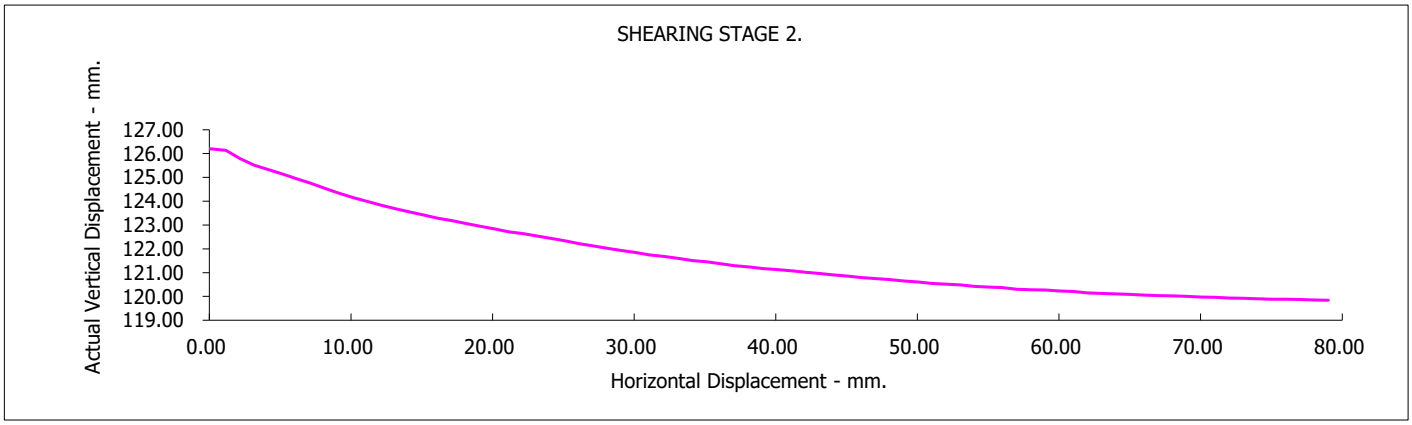
Figure.

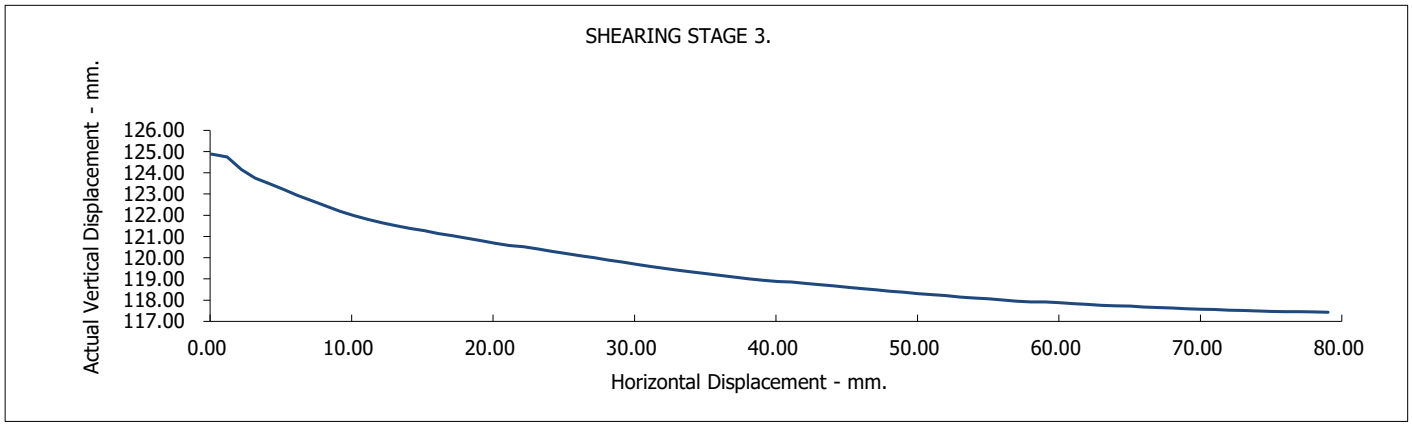
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

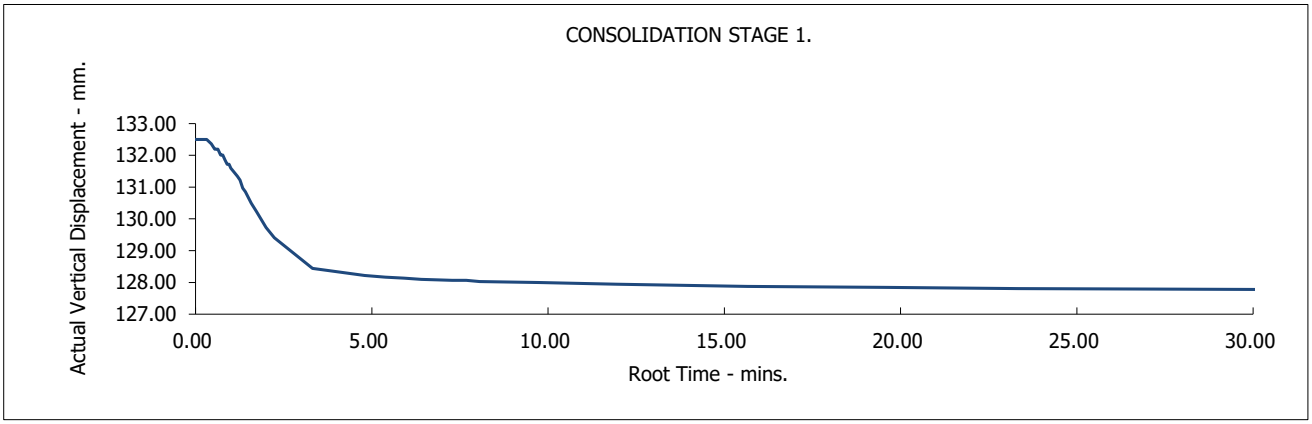
Client Ref Number: **14880RH**

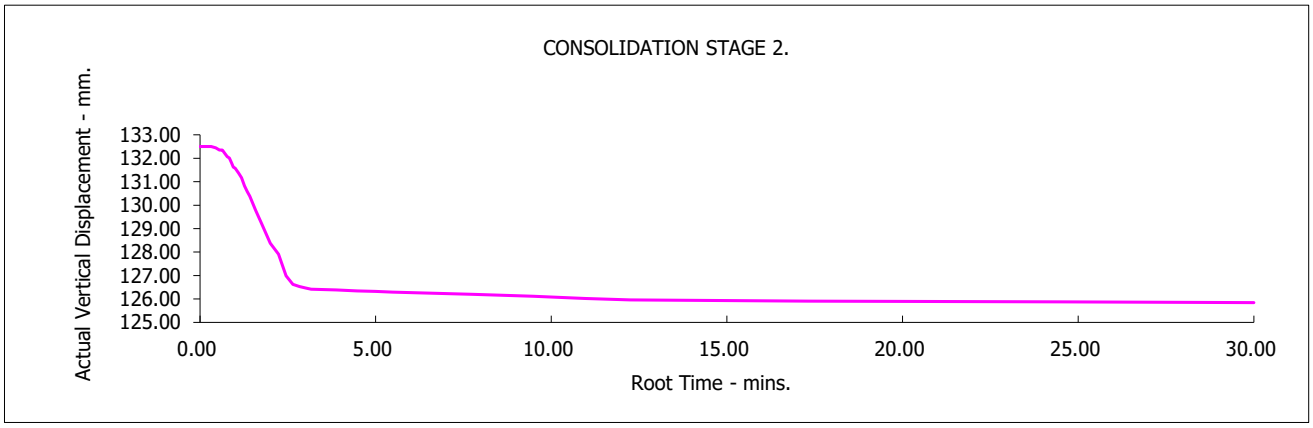
Figure.

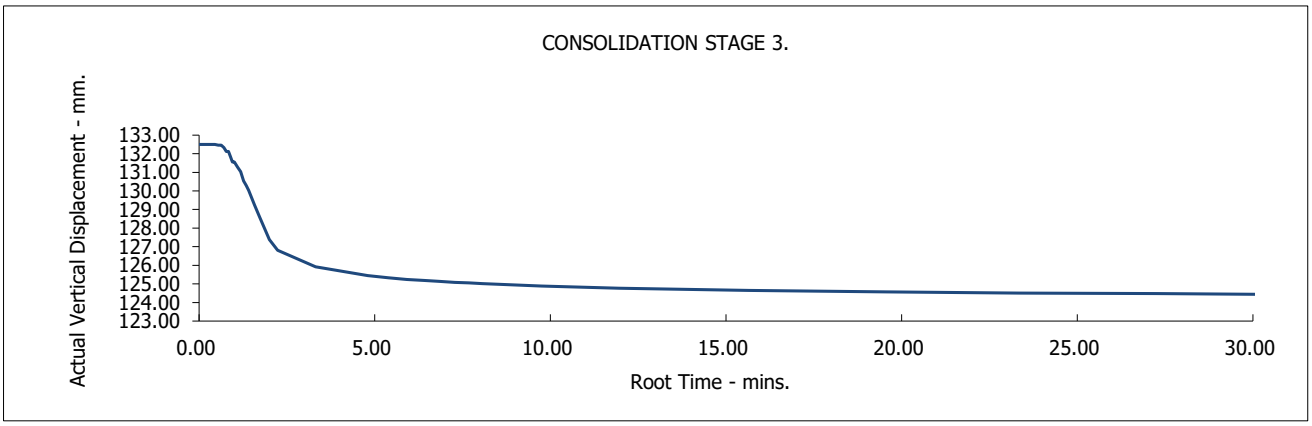
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

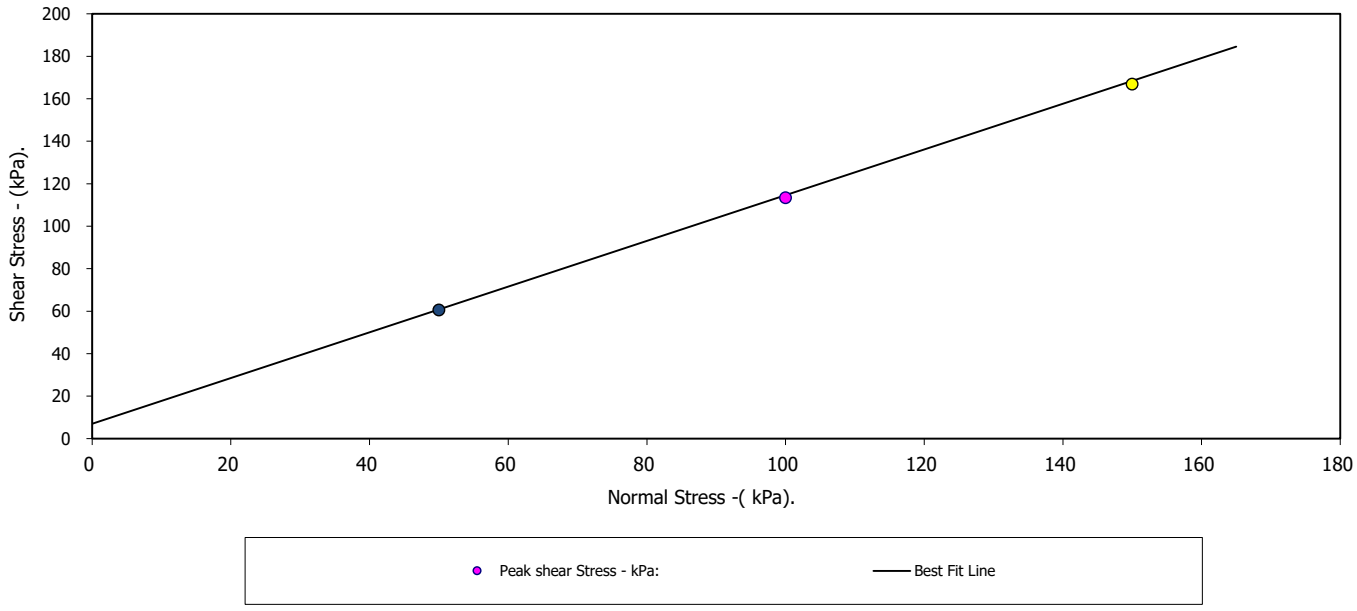
Borehole Number:	S6	Depth from (m):	0.00
Sample Number :	6	Depth to (m):	0.00

Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.
Sample Description: **Brown slightly clayey fine to medium GRAVEL**	

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	135.00	135.00	135.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	1.60	1.60	1.60
Dry Density - Mg/m3:	1.44	1.44	1.44
Voids Ratio:	0.8353	0.8351	0.8355
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	132.22	129.72	128.51
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	66.14	67.37	57.68
Peak shear Stress - kPa:	61	113	167

PEAK	
Angle of Shearing Resistance:(θ)	**47.1**
Effective Cohesion - kPa:	**7**

FAILURE CONDITIONS



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Contract No.:
41501

Client Ref Number:
14880RH

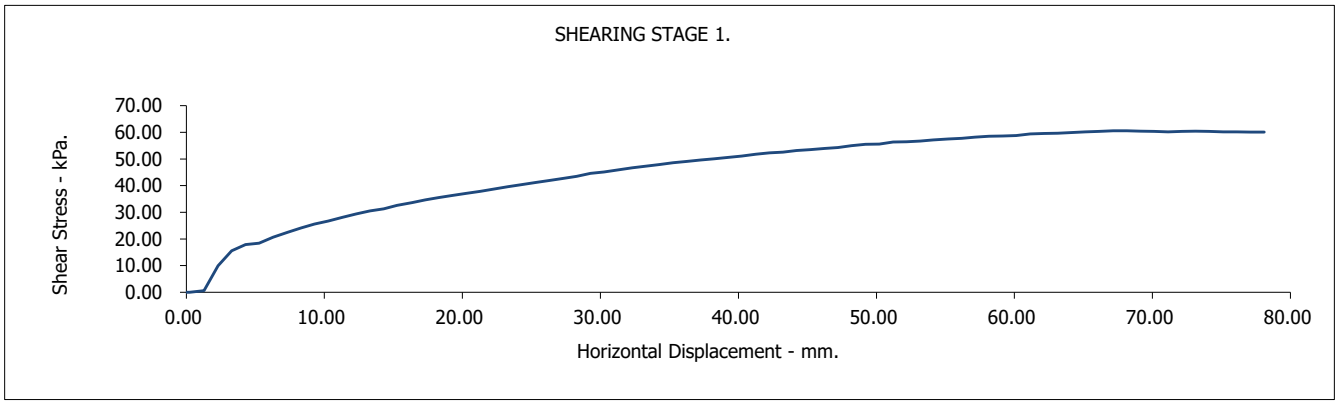
Buttington Quarry (B.Quarry)

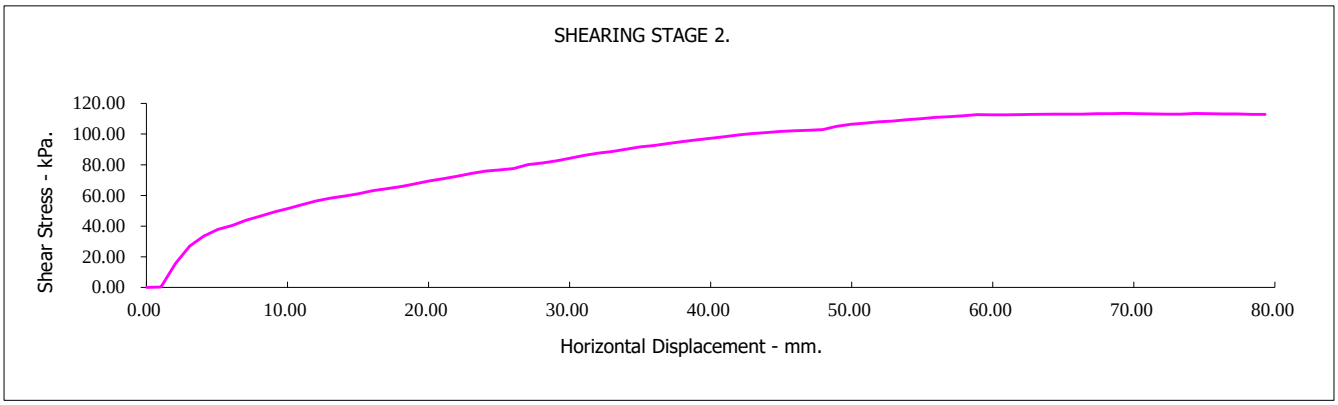
GSTL
GEO SITE & TESTING SERVICES LTD

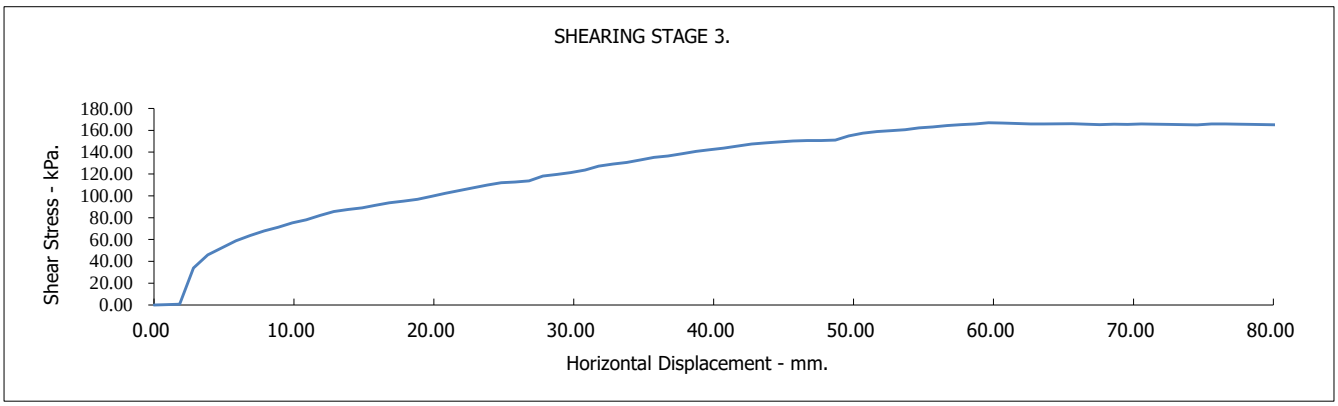
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

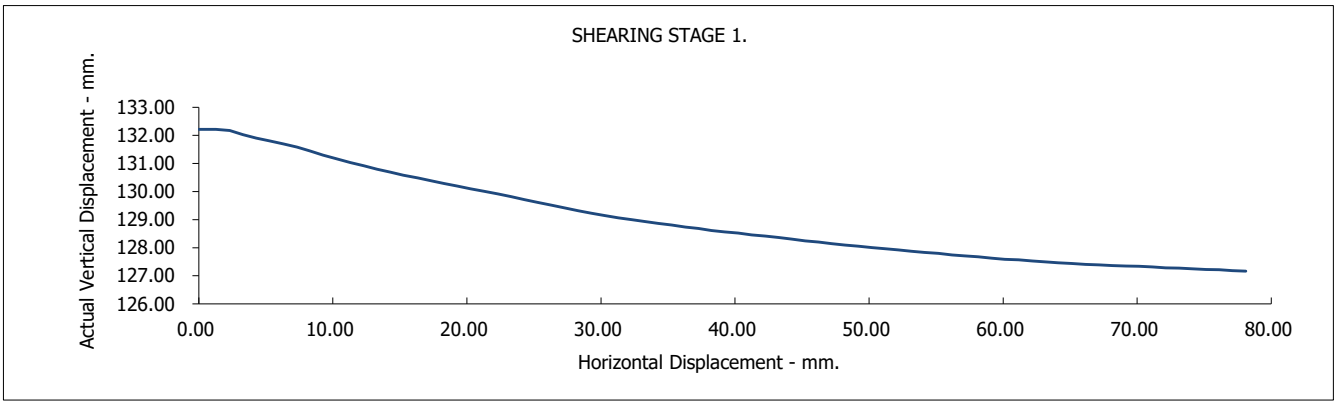
Client Ref Number: **14880RH**

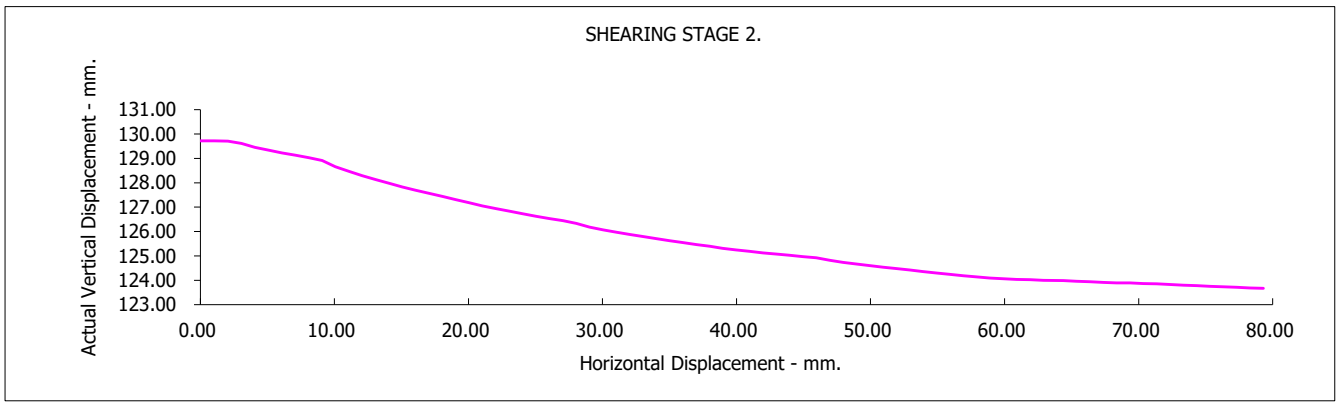
Figure.

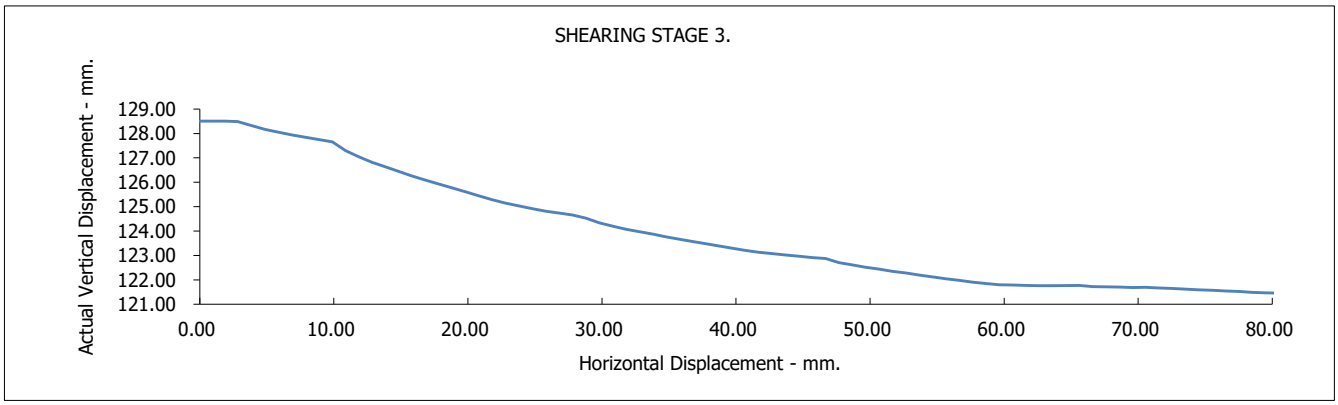
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

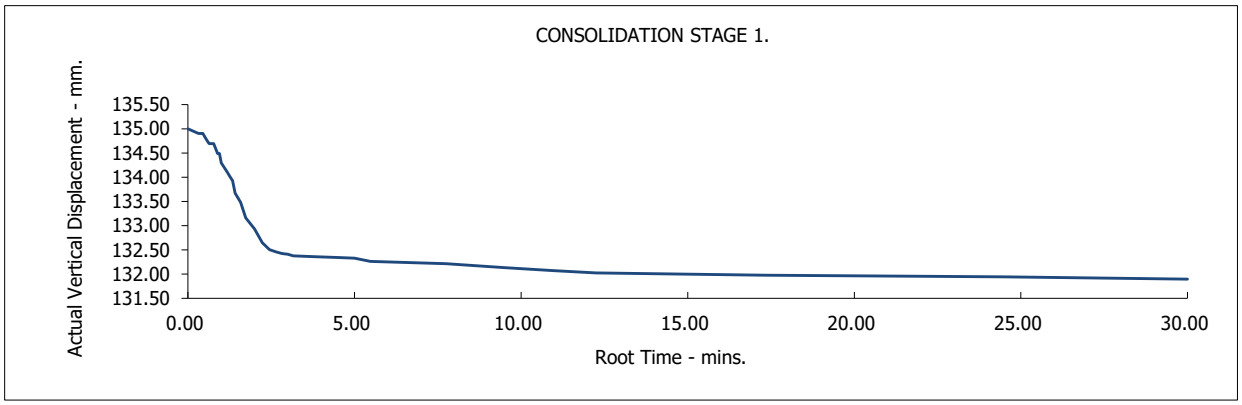
Client Ref Number: **14880RH**

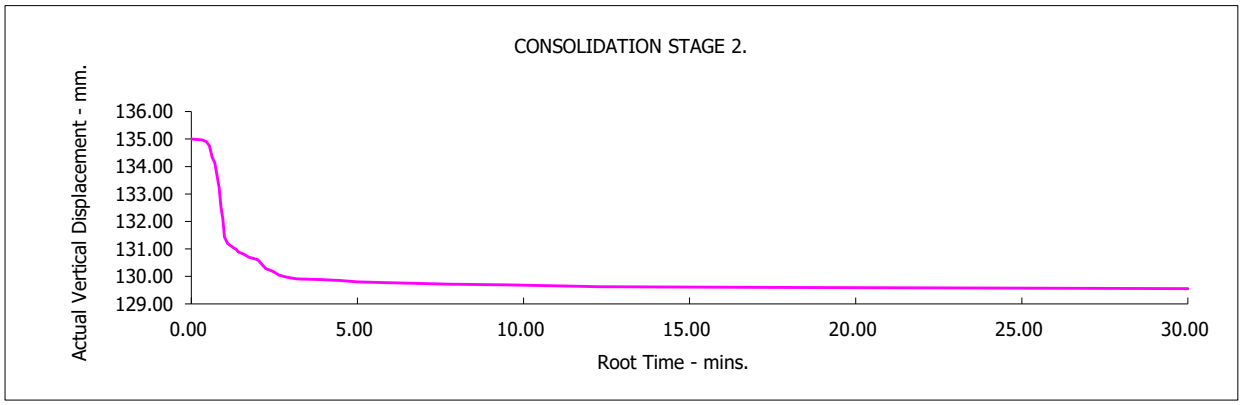
Figure.

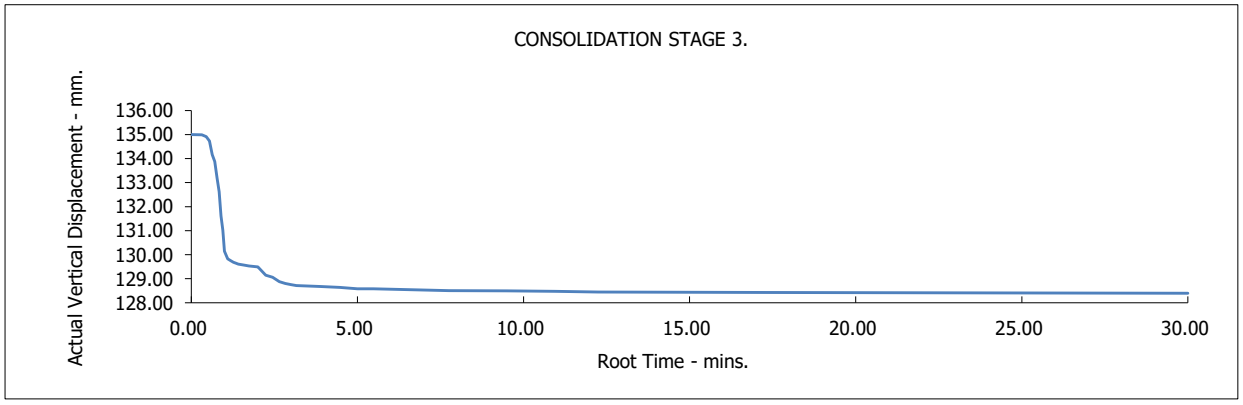
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

GSTL	Determination of Slake Durability Index ISRM Part 2.2	
Contract Number	41501	
Site Name	Buttington Quarry (B.Quarry)	
Nature of Slaking Fluid	Water at 20°C	
Date Tested	19/11/2018	

Hole Reference	Depth (m)			Slake First Cycle	Slake Second Cycle	Appearance Of Material Retained In The Drum	Appearance Of Material Passing Through The Drum
S1				87.79	75.84	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S2				88.18	74.93	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S3				95.84	92.97	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S4				92.52	88.10	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S5				93.77	89.44	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S6				91.14	88.01	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.

Key	Reported As
Slake First Cycle	%
Slake Second Cycle	%

Operators	Checked	19/11/2018	Wayne Honey	W. Honey
JD	Approved	20/11/2018	Ben Sharp	

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S1	Depth from (m):	0.00
Sample Number :	1	Depth to (m):	0.00

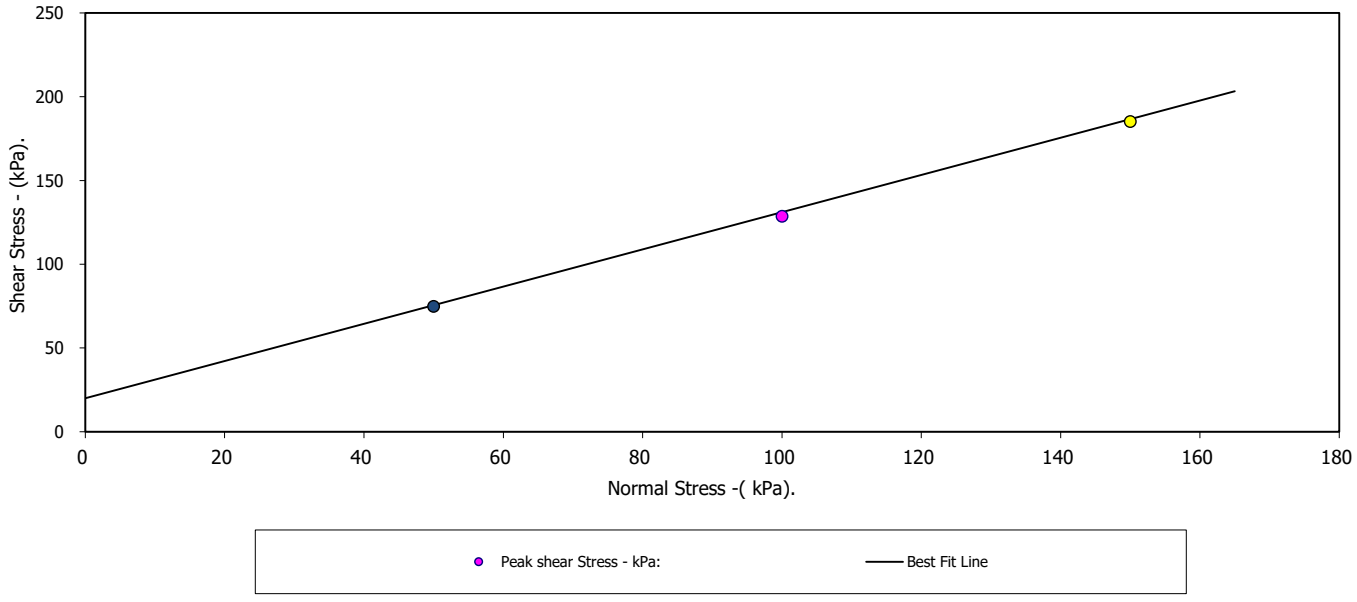
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	136.00	136.00	136.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.04	2.04	2.04
Dry Density - Mg/m3:	1.85	1.85	1.85
Voids Ratio:	0.4316	0.4317	0.4318
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	133.03	131.54	129.77
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	58.55	60.41	63.30
Peak shear Stress - kPa:	75	129	185

PEAK	
Angle of Shearing Resistance:(θ)	**48.0**
Effective Cohesion - kPa:	**20**

FAILURE CONDITIONS



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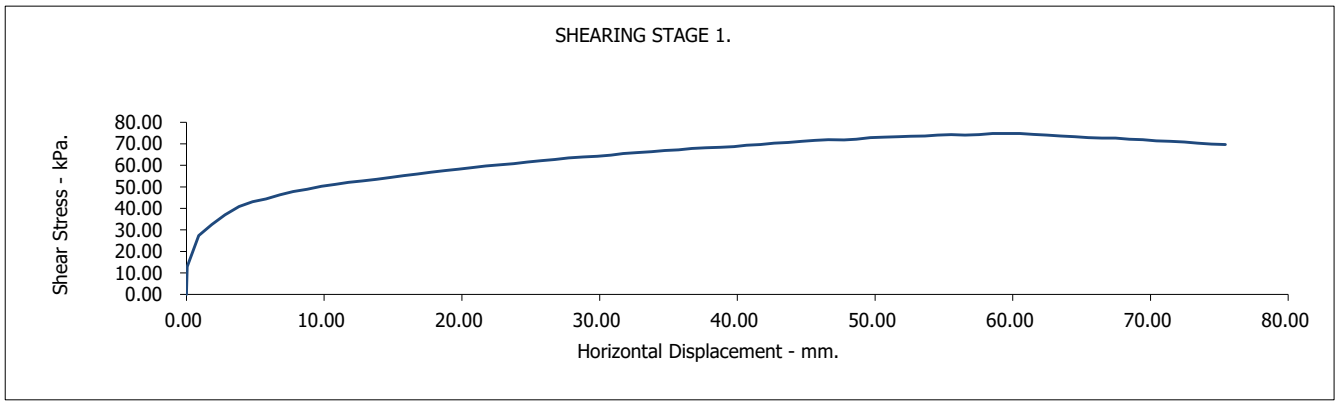
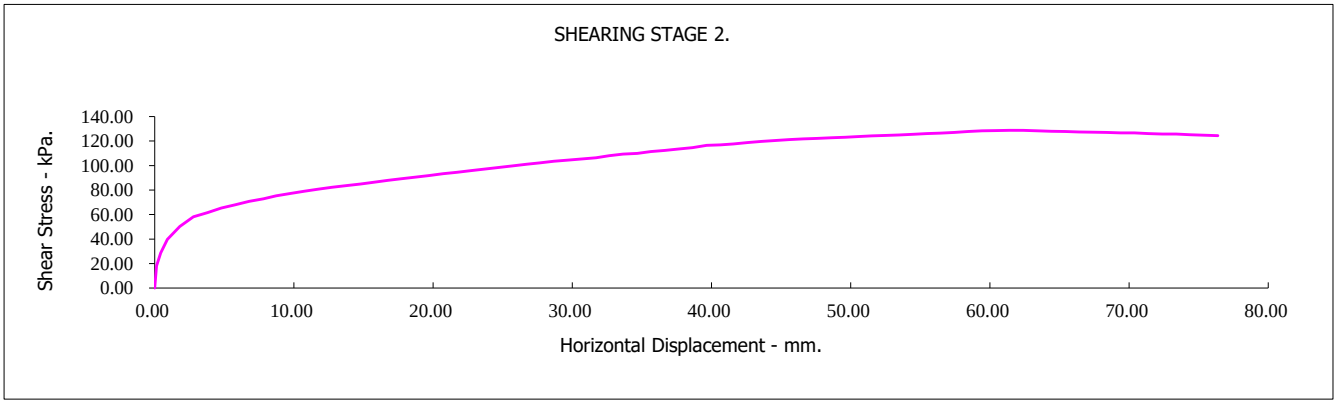
Buttington Quarry (B.Quarry)

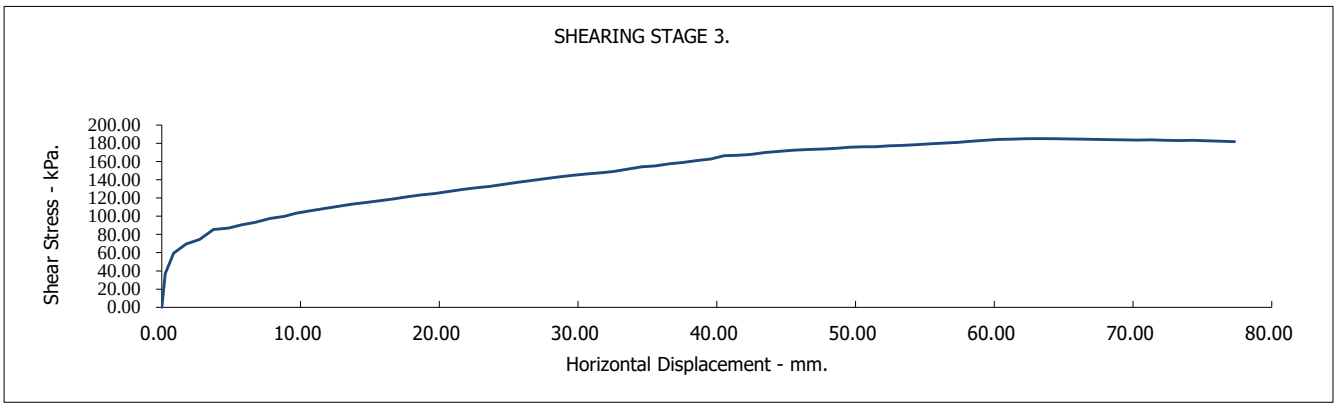
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

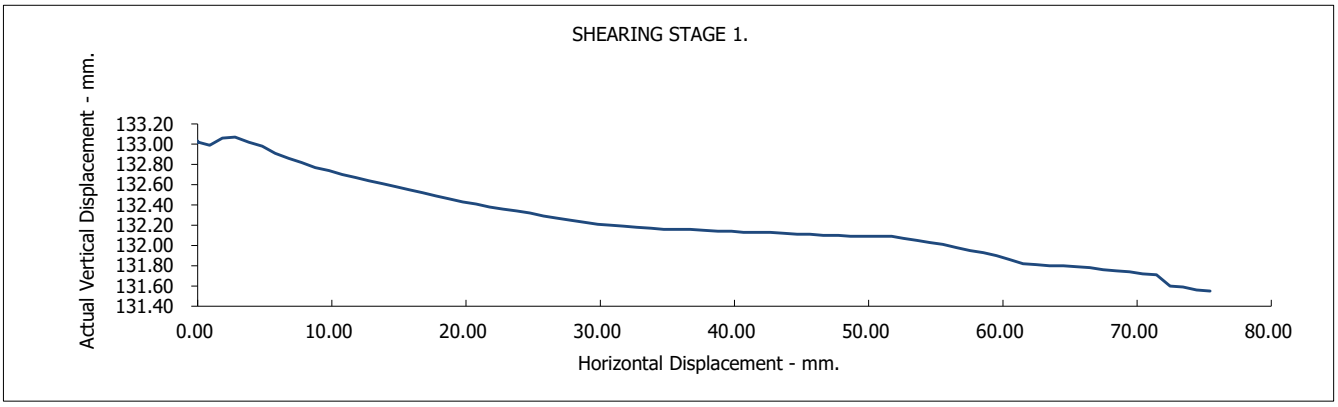
Client Ref Number: **14880RH**

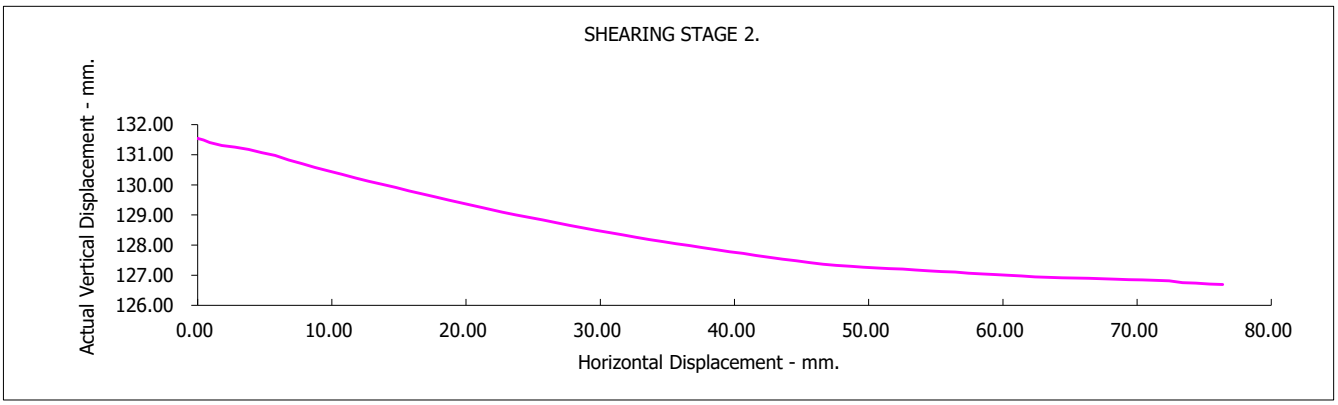
Figure.

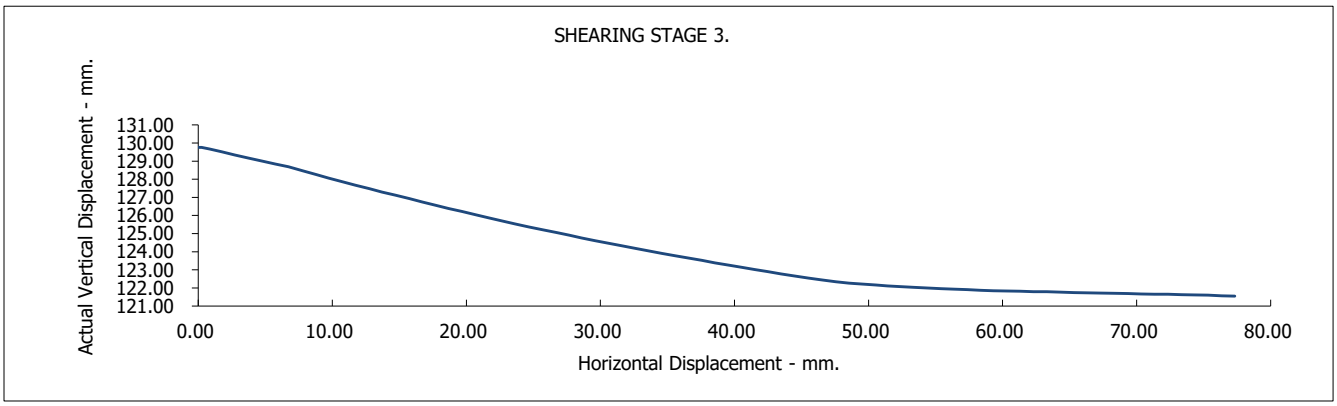
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

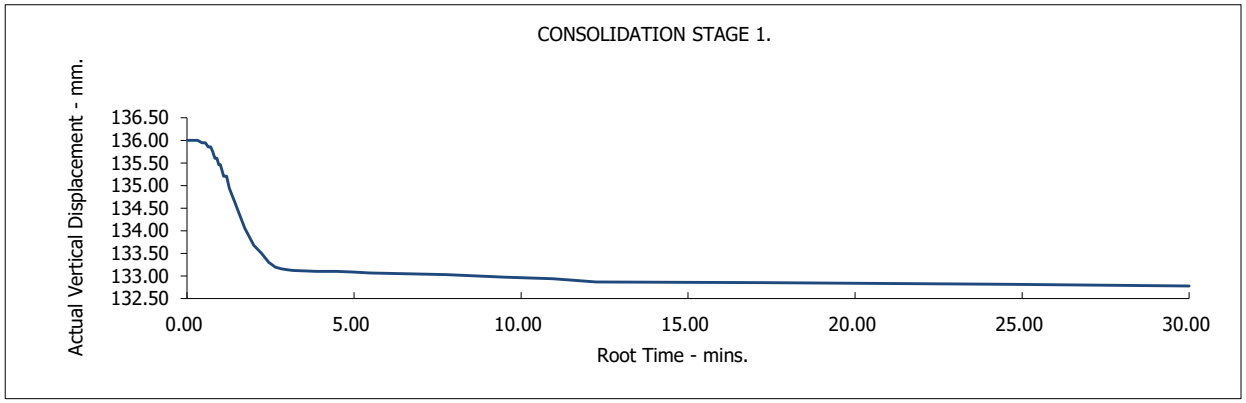
Client Ref Number: **14880RH**

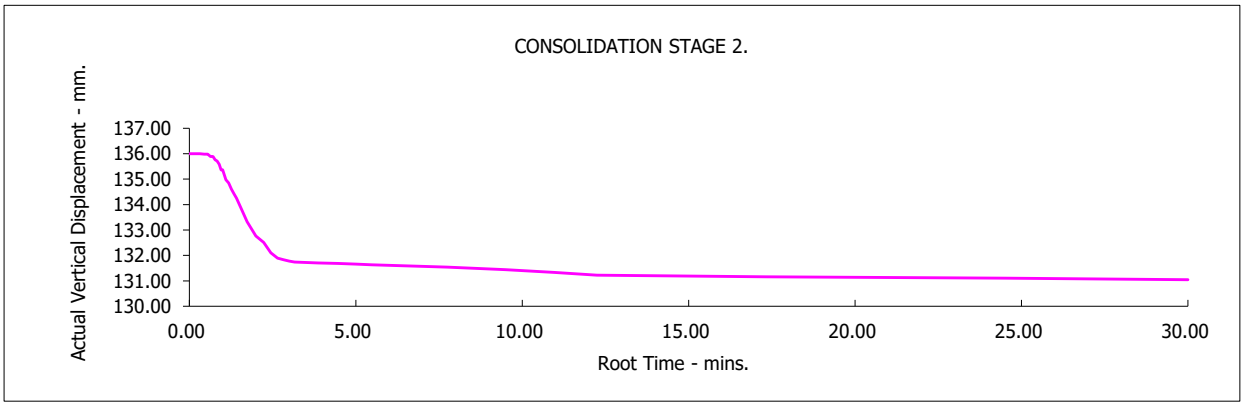
Figure.

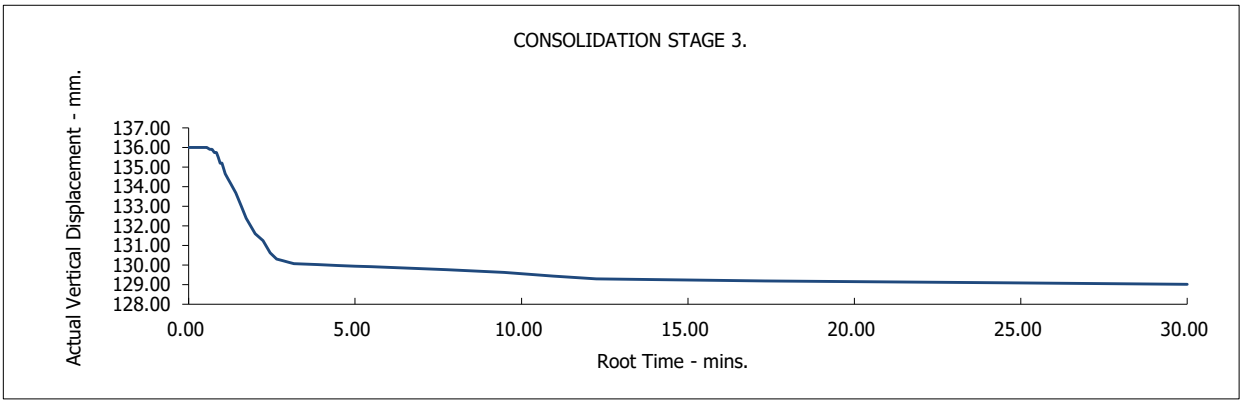
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S2	Depth from (m):	0.00
Sample Number :	2	Depth to (m):	0.00

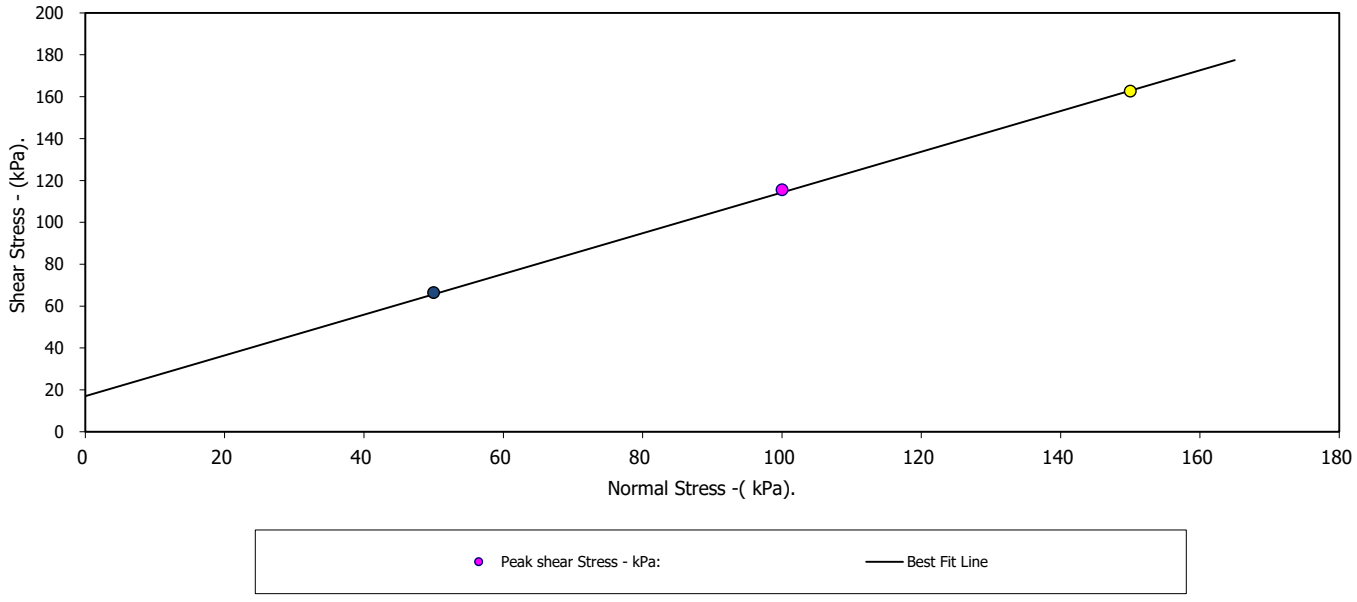
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	130.00	130.00	130.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.02	2.02	2.02
Dry Density - Mg/m3:	1.83	1.83	1.83
Voids Ratio:	0.4478	0.4478	0.4477
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	126.40	121.96	117.52
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	55.06	55.19	57.32
Peak shear Stress - kPa:	66	116	163

PEAK	
Angle of Shearing Resistance:(θ)	**44.2**
Effective Cohesion - kPa:	**17**

FAILURE CONDITIONS



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Buttington Quarry (B.Quarry)

Client Ref Number:
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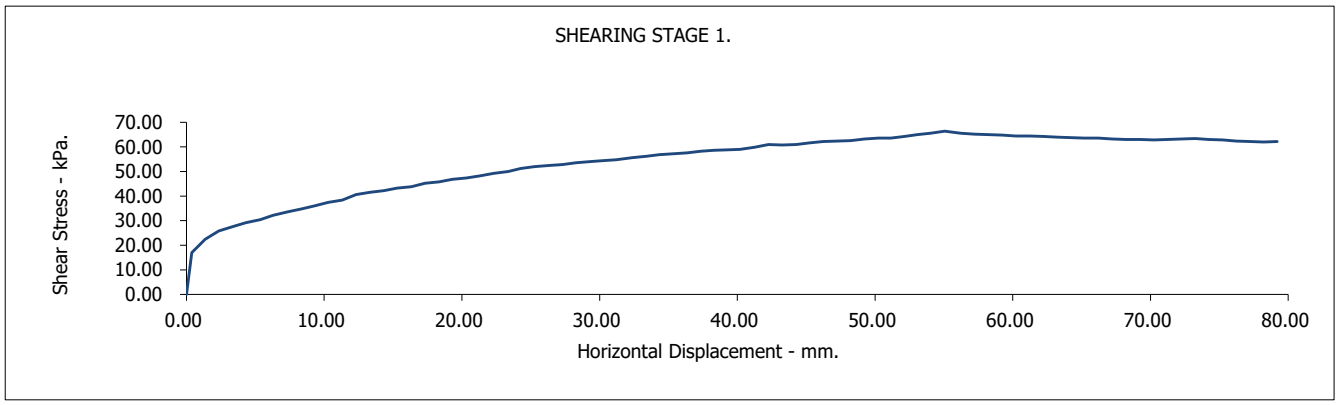
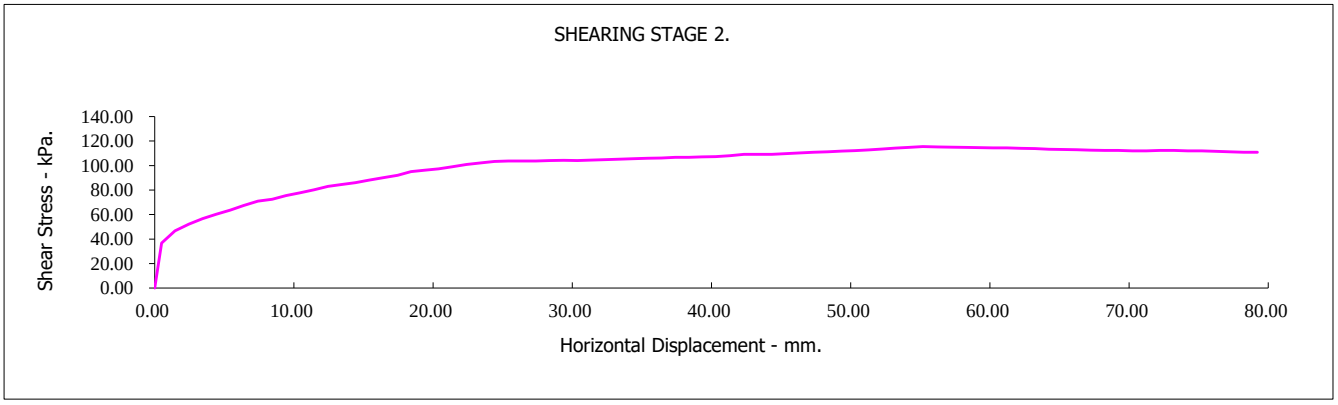
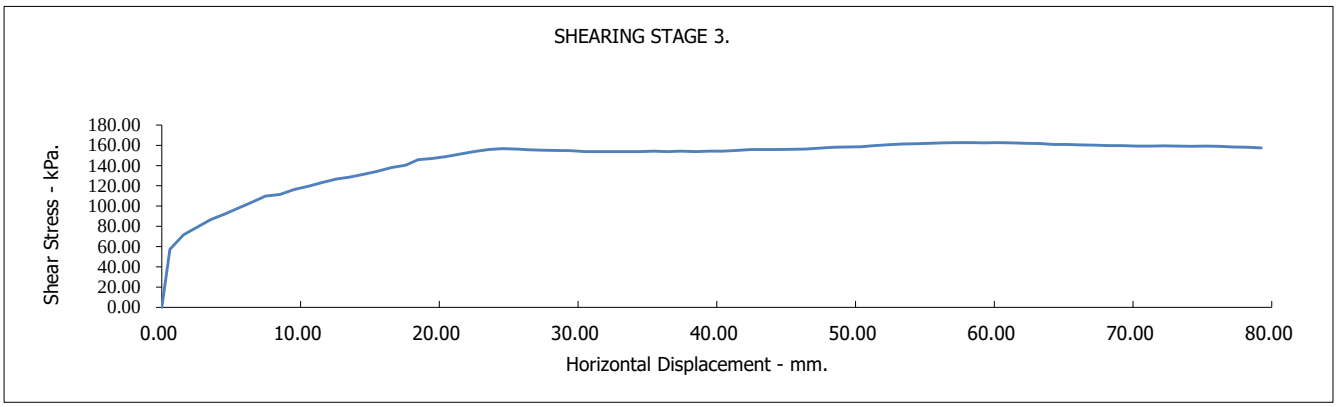
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

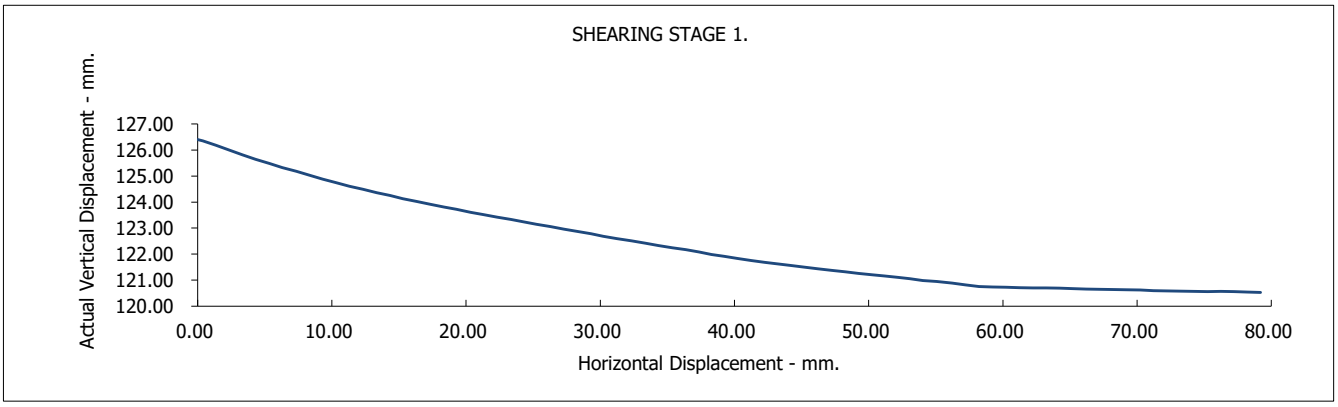
Client Ref Number: **14880RH**

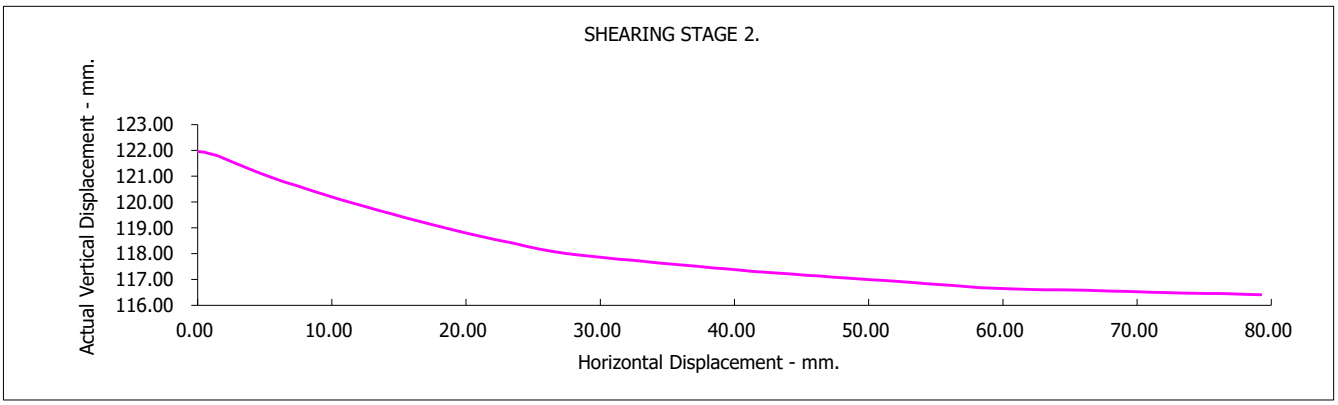
Figure.

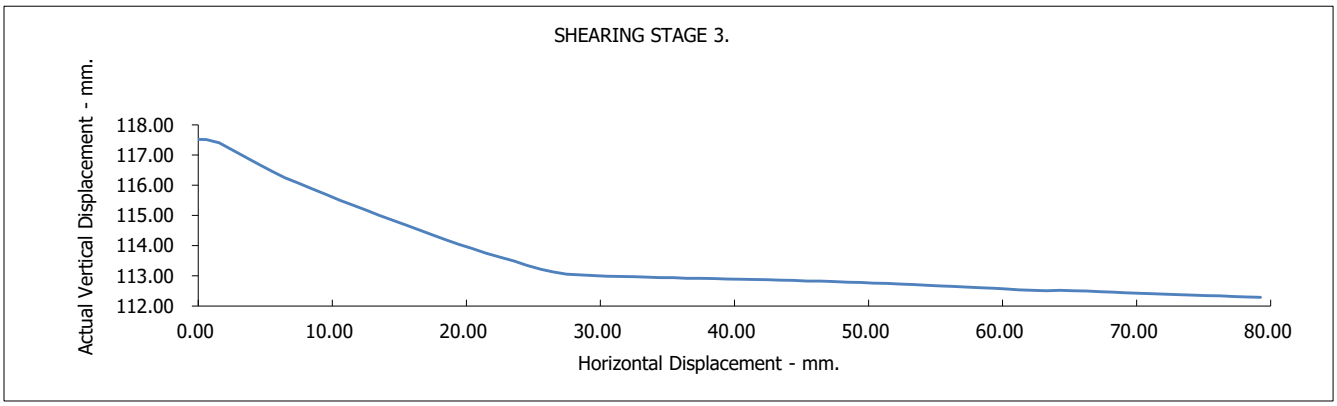
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

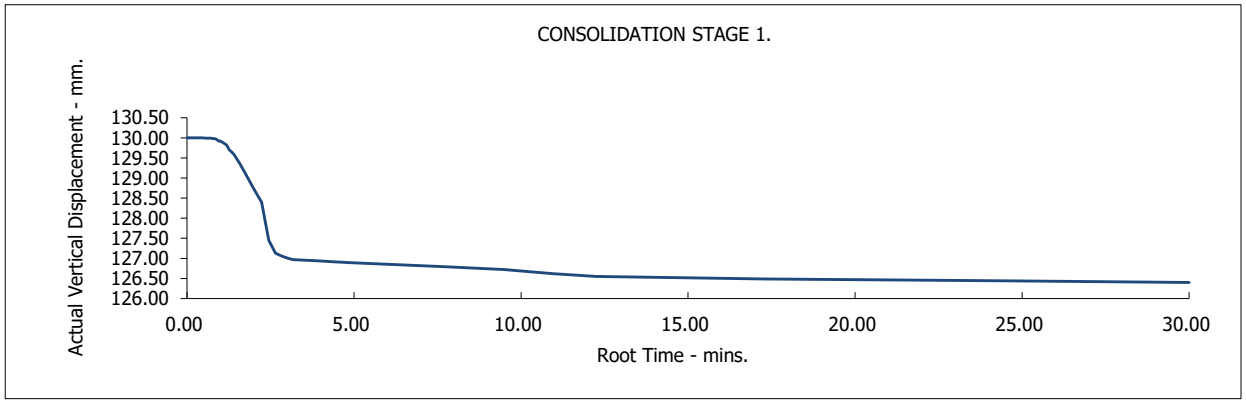
Client Ref Number: **14880RH**

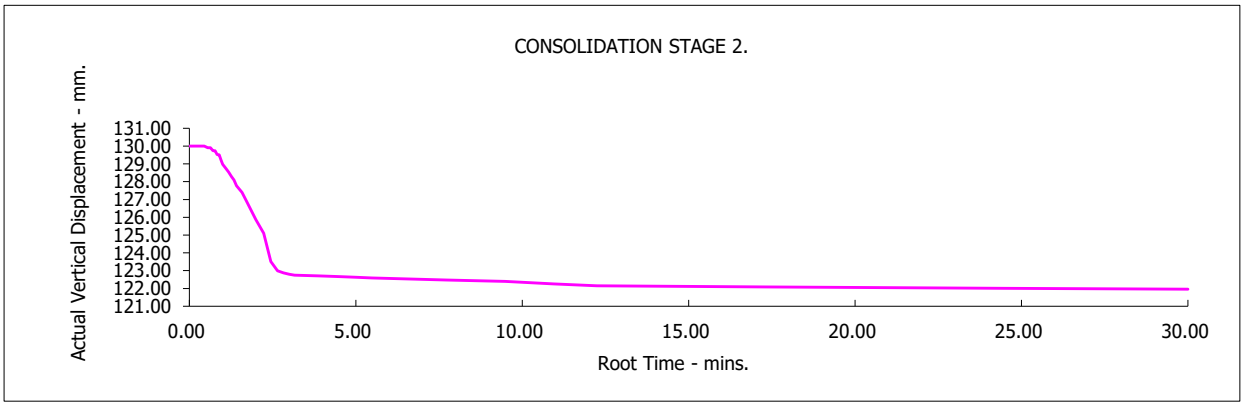
Figure.

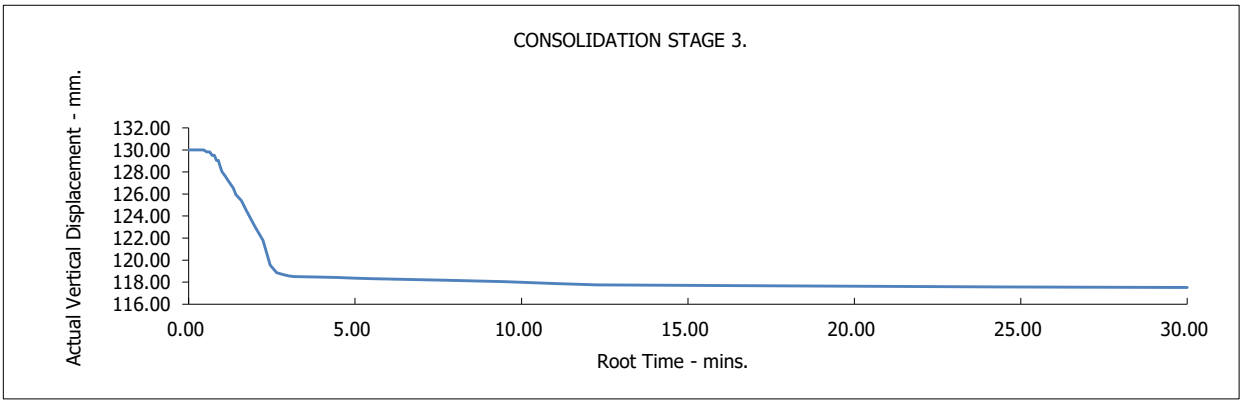
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S3	Depth from (m):	0.00
Sample Number :	3	Depth to (m):	0.00

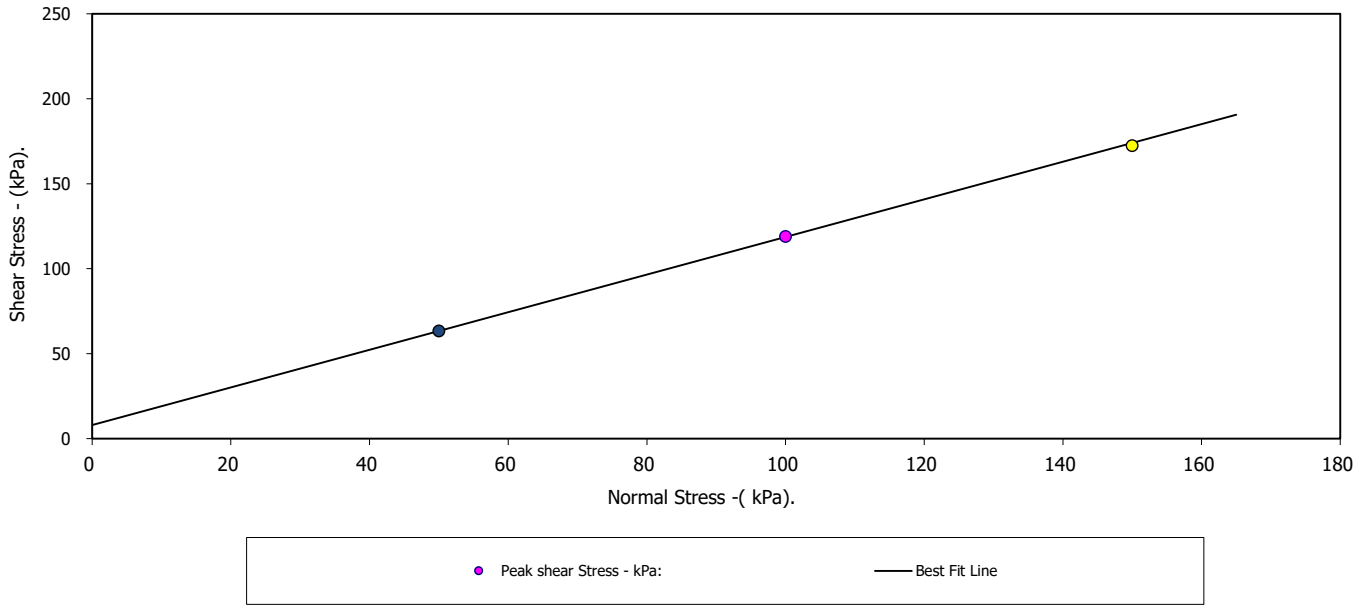
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	134.00	134.00	134.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	7	7	7
Bulk Density - Mg/m3:	1.62	1.62	1.62
Dry Density - Mg/m3:	1.52	1.52	1.52
Voids Ratio:	0.7425	0.7426	0.7427
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	129.93	127.63	125.80
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	54.10	65.71	66.42
Peak shear Stress - kPa:	63	119	173

PEAK	
Angle of Shearing Resistance:(θ)	**47.9**
Effective Cohesion - kPa:	**8**

FAILURE CONDITIONS



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Buttington Quarry (B.Quarry)

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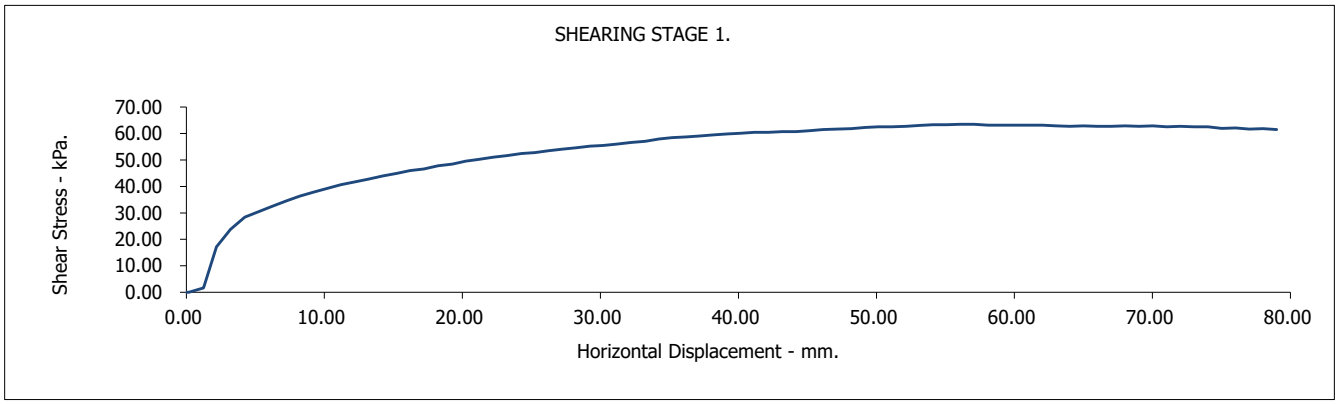
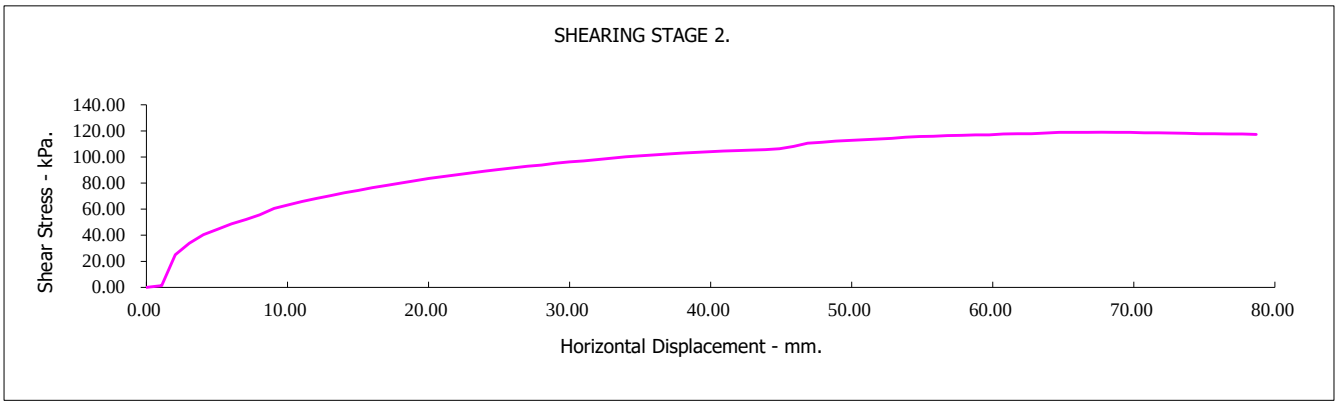
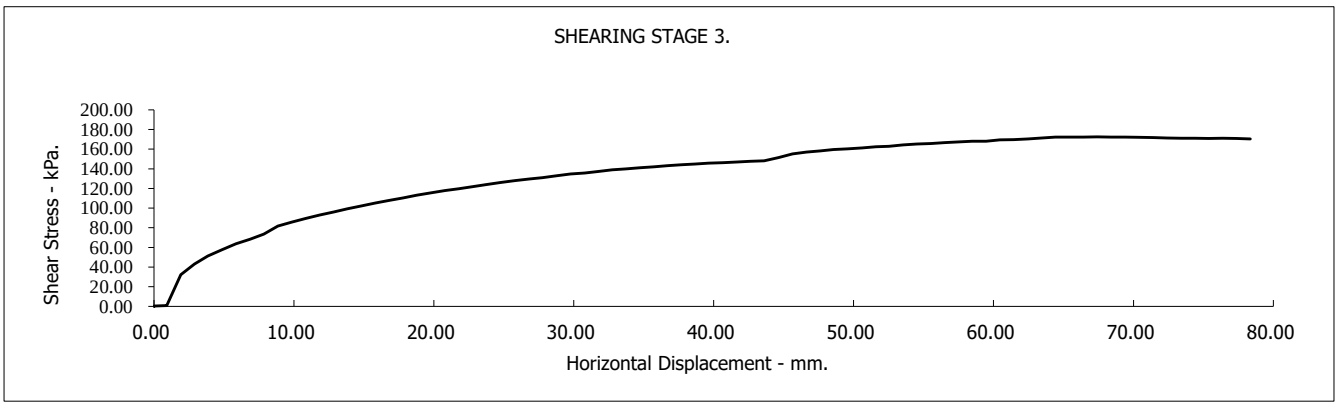
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

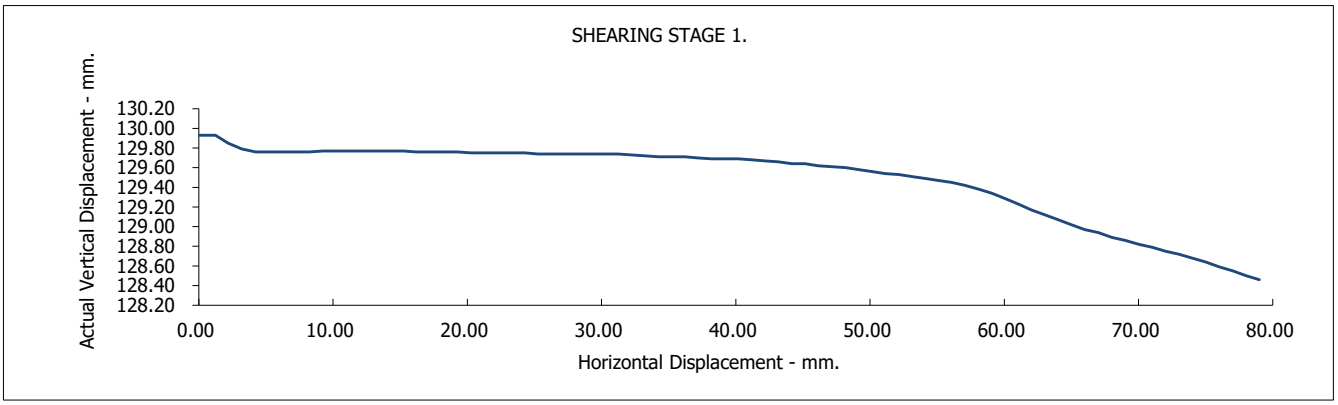
Client Ref Number: **14880RH**

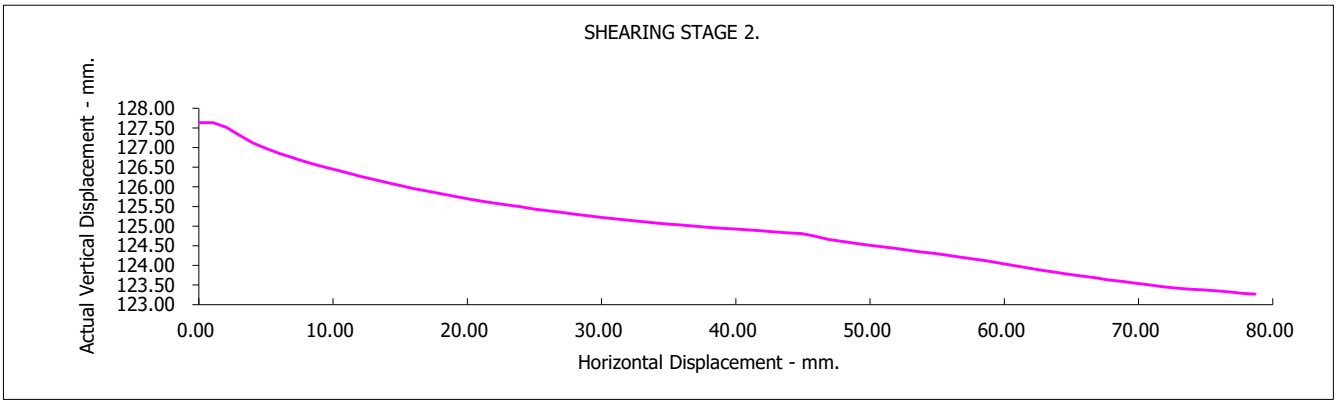
Figure.

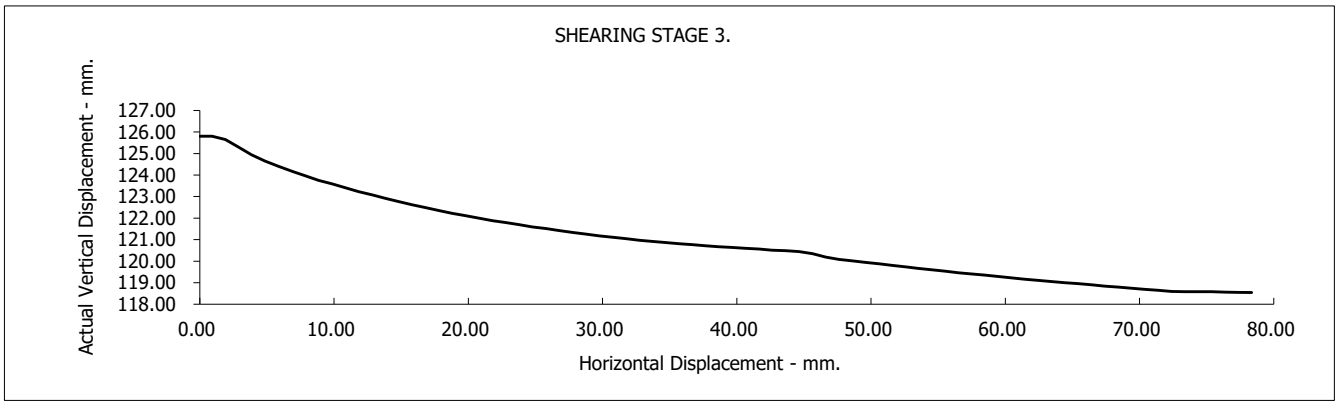
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

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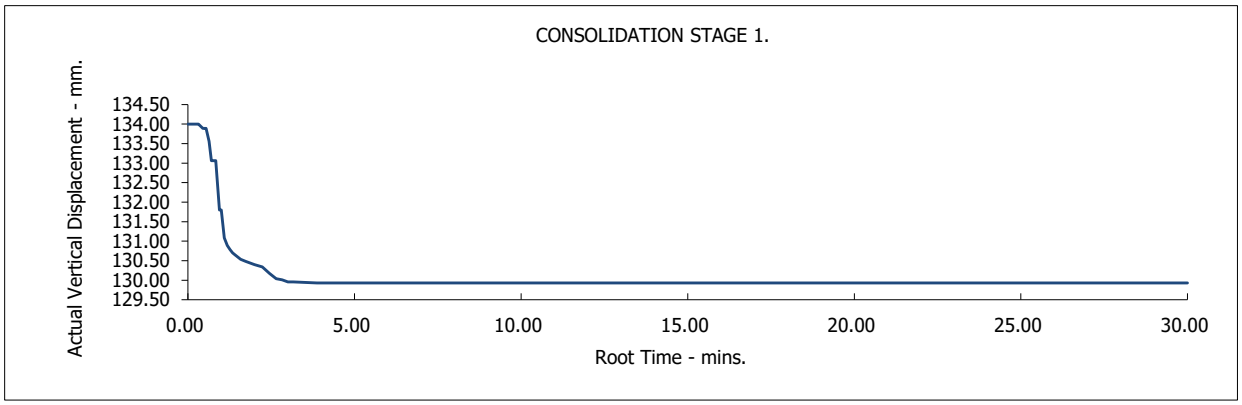
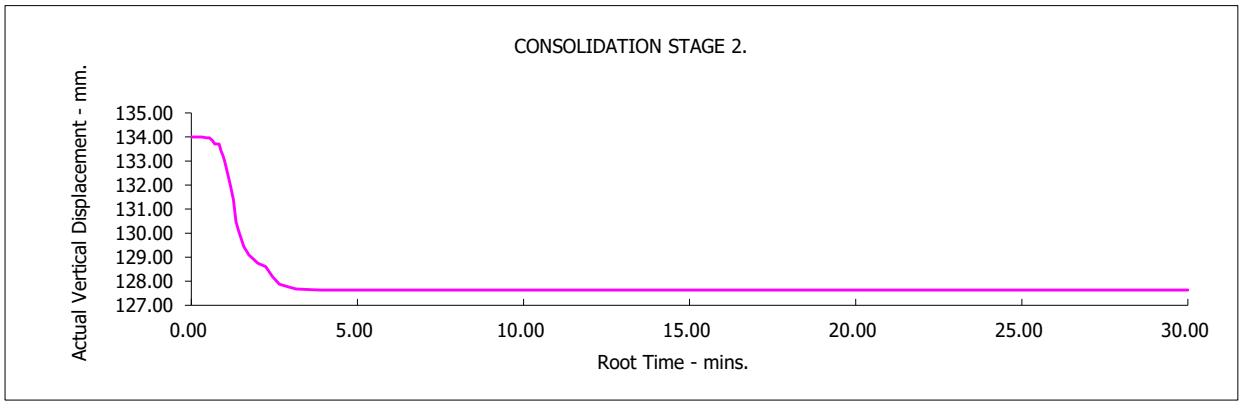
Figure.

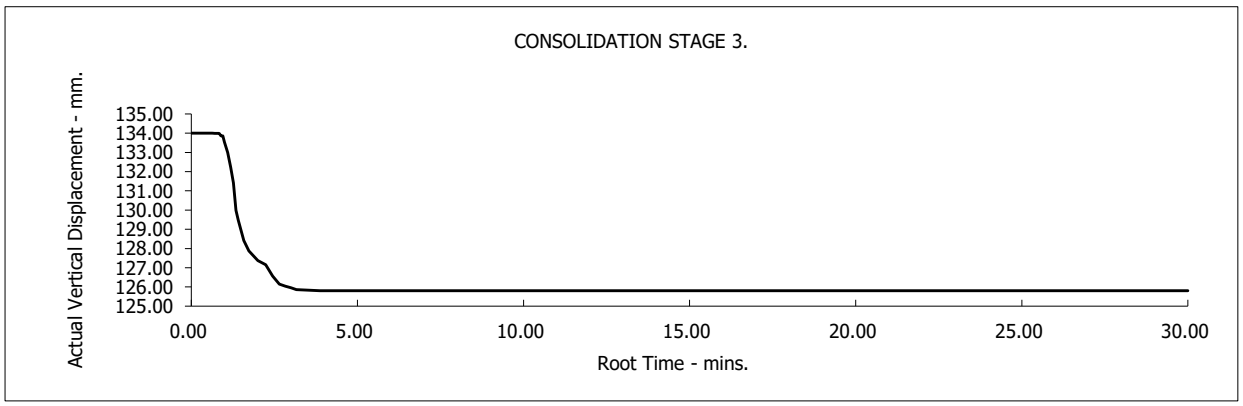
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S4	Depth from (m):	0.00
Sample Number :	4	Depth to (m):	0.00

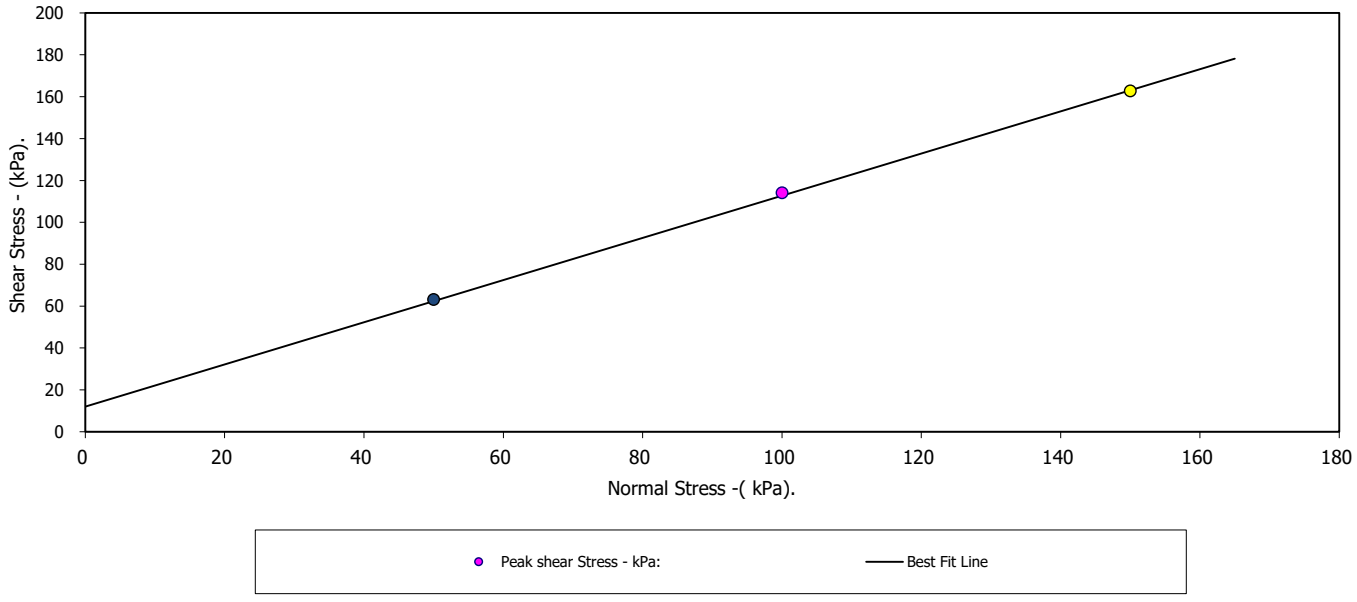
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	134.00	134.00	134.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	12	12	12
Bulk Density - Mg/m3:	1.59	1.59	1.59
Dry Density - Mg/m3:	1.43	1.43	1.43
Voids Ratio:	0.8575	0.8577	0.8575
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	130.29	129.03	127.07
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	53.12	52.66	56.20
Peak shear Stress - kPa:	63	114	163

PEAK	
Angle of Shearing Resistance:(θ)	**45.2**
Effective Cohesion - kPa:	**12**

FAILURE CONDITIONS



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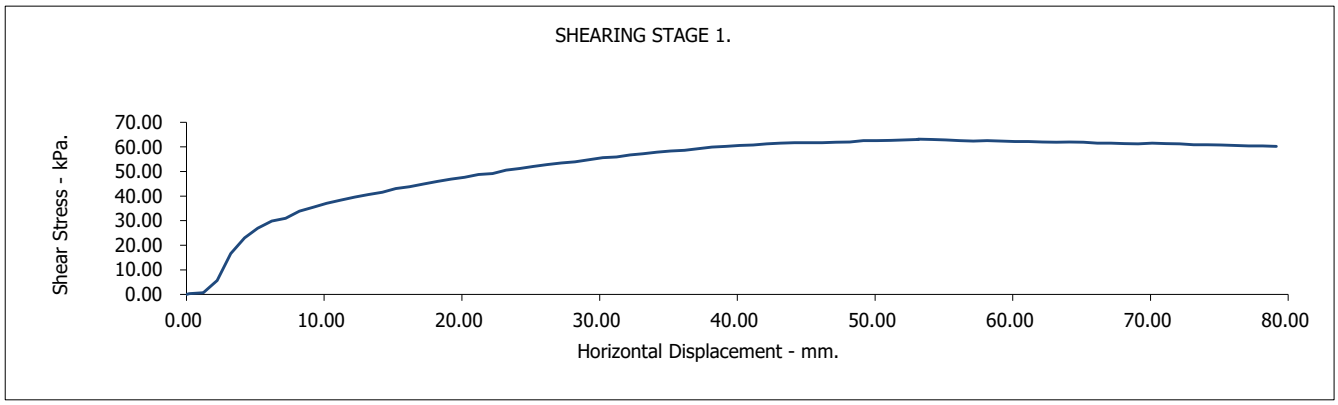
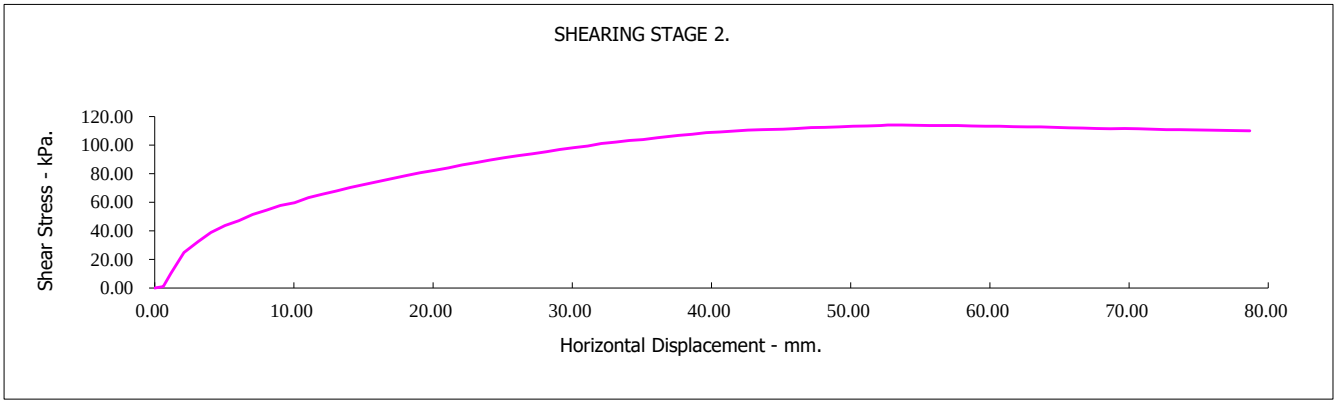
Buttington Quarry (B.Quarry)

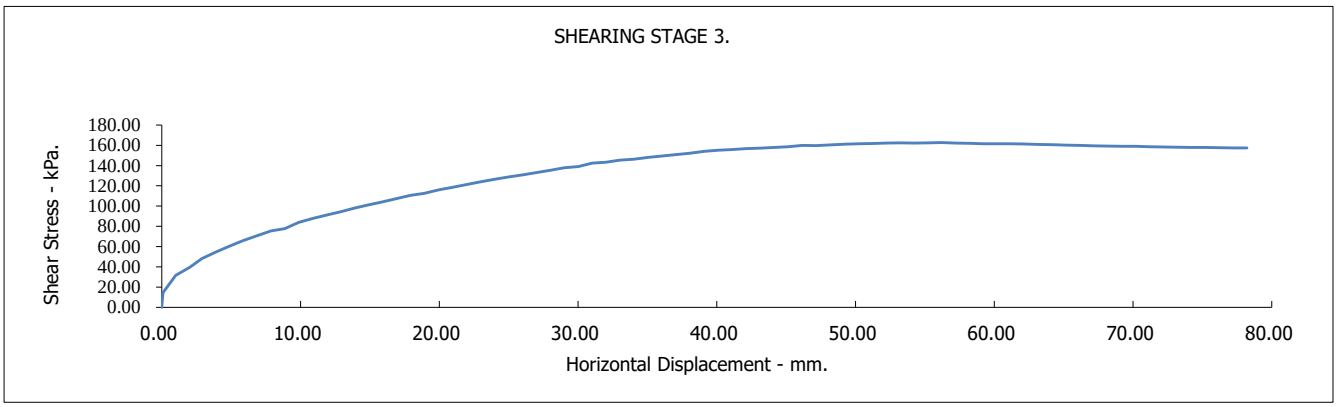
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

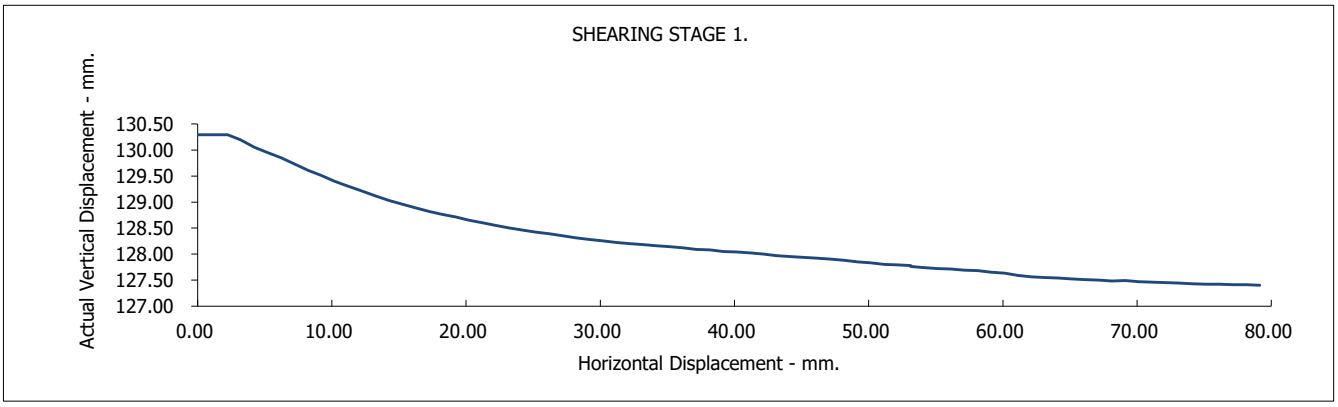
Client Ref Number: **14880RH**

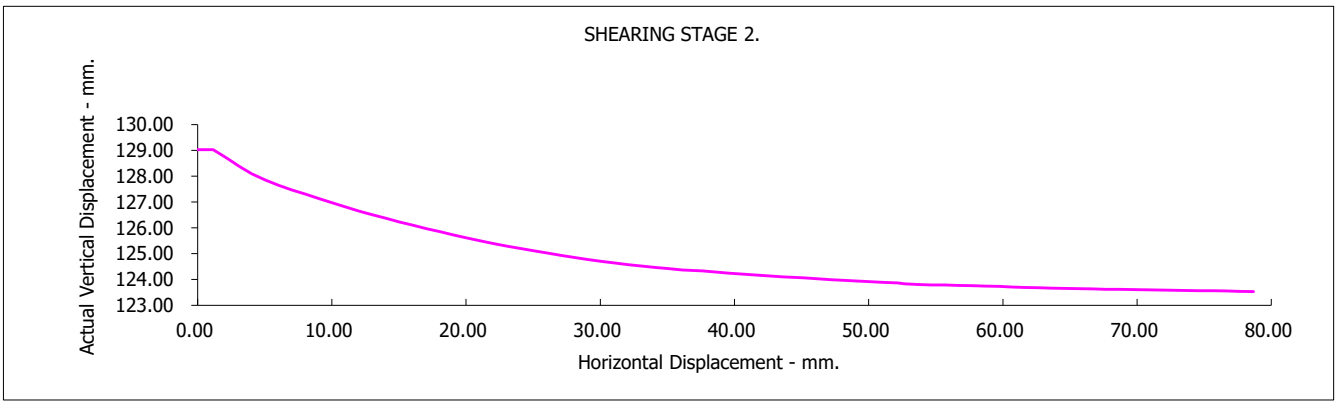
Figure.

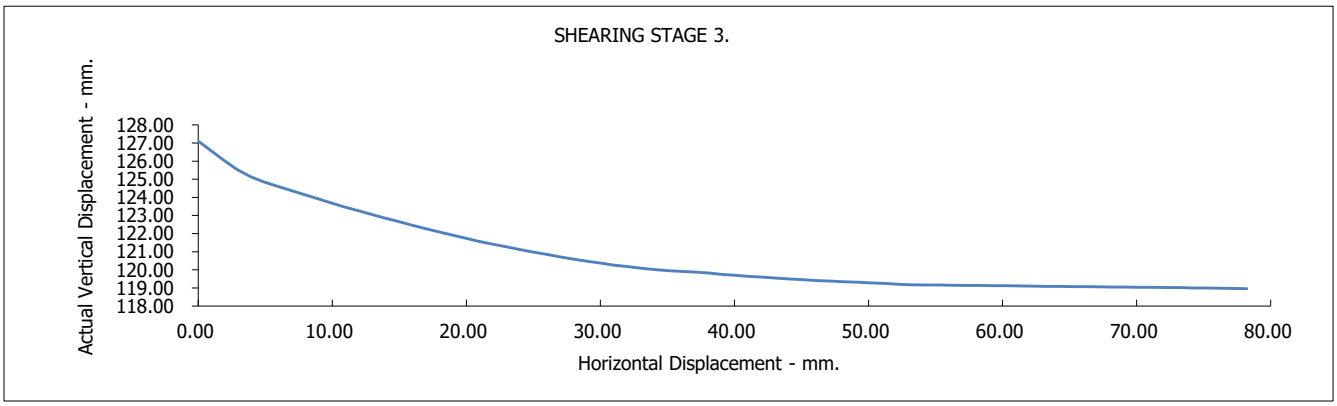
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

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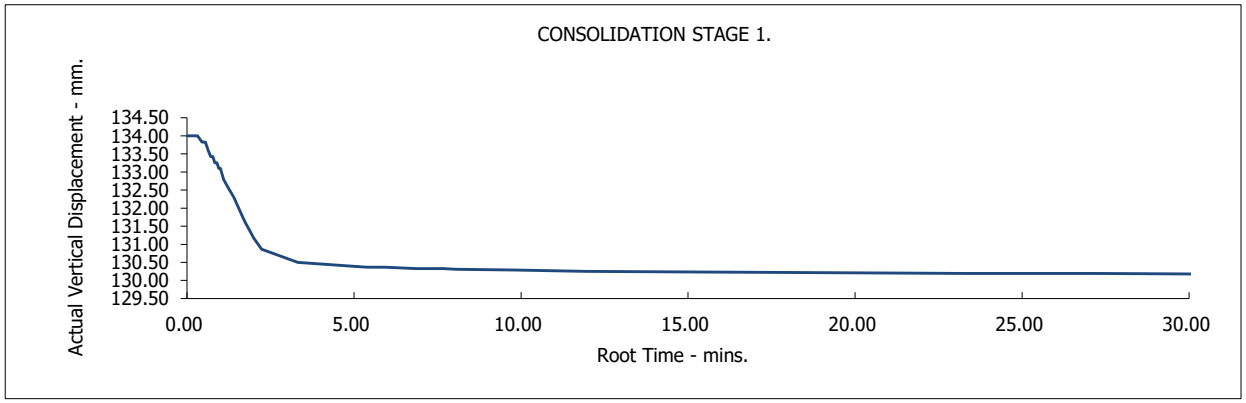
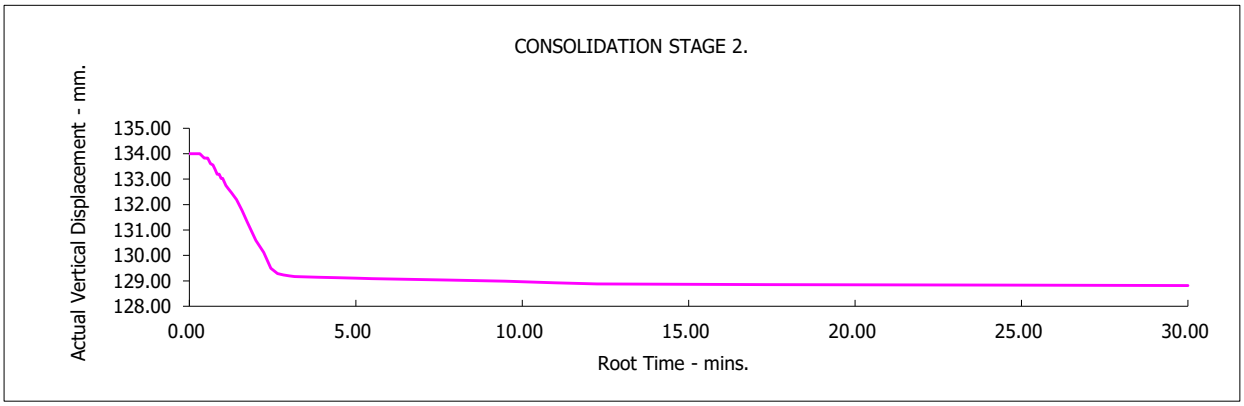
Figure.

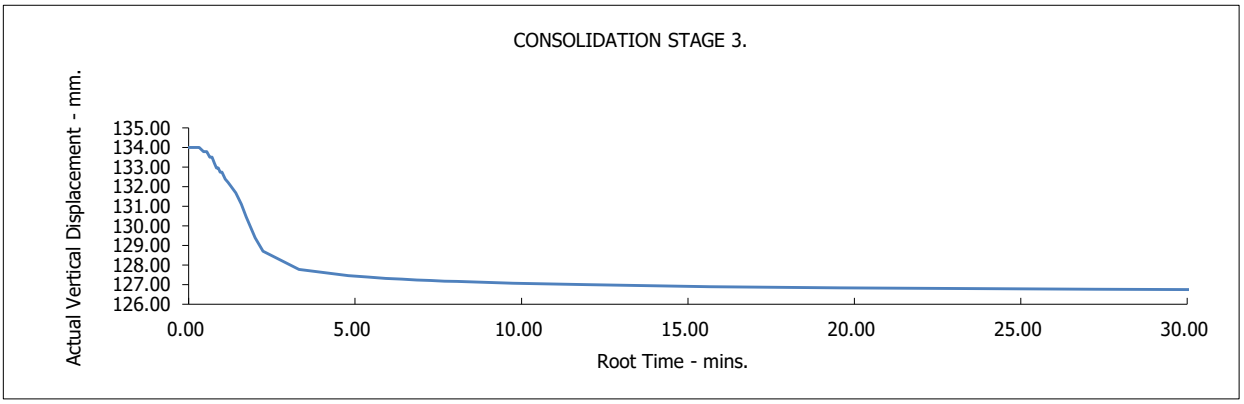
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S5	Depth from (m):	0.00
Sample Number :	5	Depth to (m):	0.00

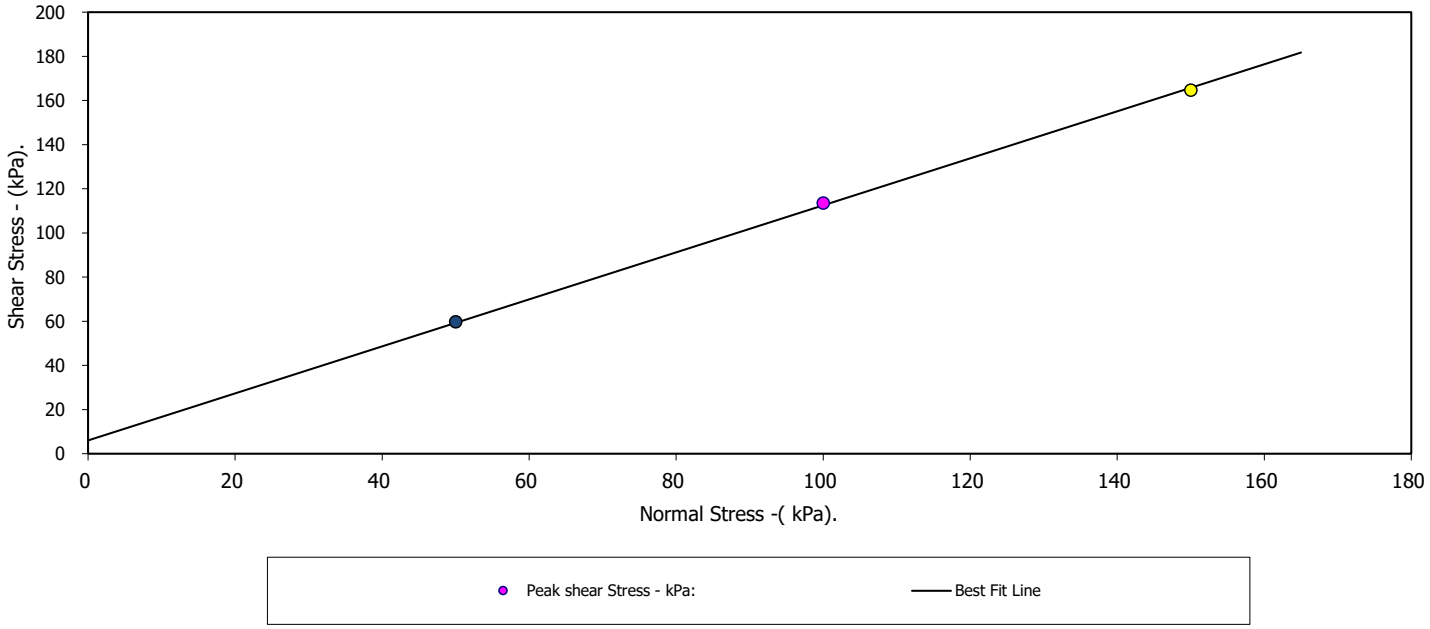
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	132.50	132.50	132.50
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	6	6	6
Bulk Density - Mg/m3:	1.65	1.65	1.65
Dry Density - Mg/m3:	1.55	1.55	1.55
Voids Ratio:	0.7053	0.7049	0.7050
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	128.00	126.20	124.88
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	60.01	61.02	61.02
Peak shear Stress - kPa:	60	113	165

PEAK	
Angle of Shearing Resistance:(θ)	**46.8**
Effective Cohesion - kPa:	**6**

FAILURE CONDITIONS



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D P Evans 20/11/18
Approved Pages 1-4 by: Date

Contract No.:
41501

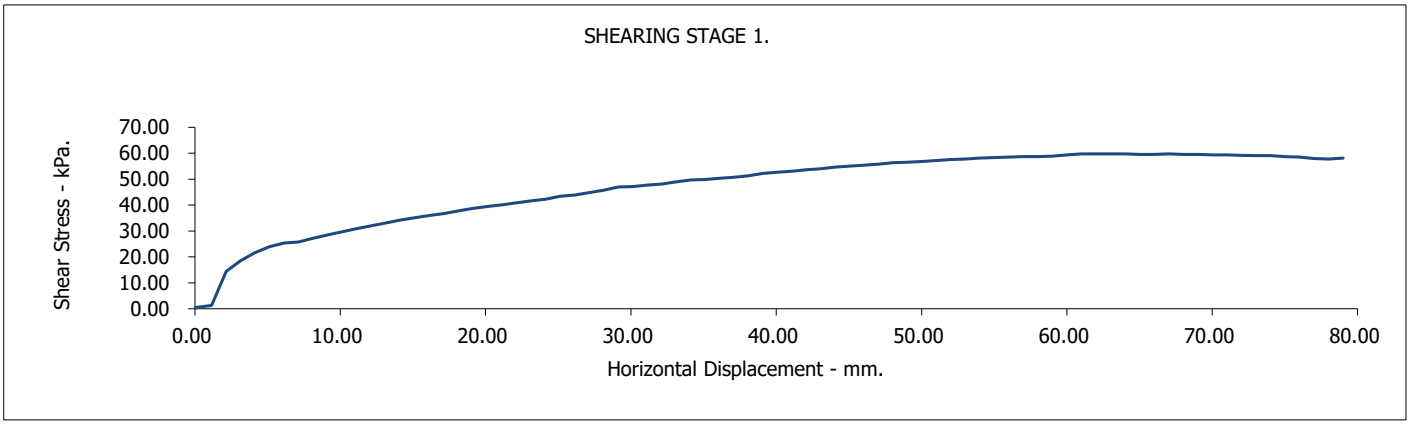
Buttington Quarry (B.Quarry)

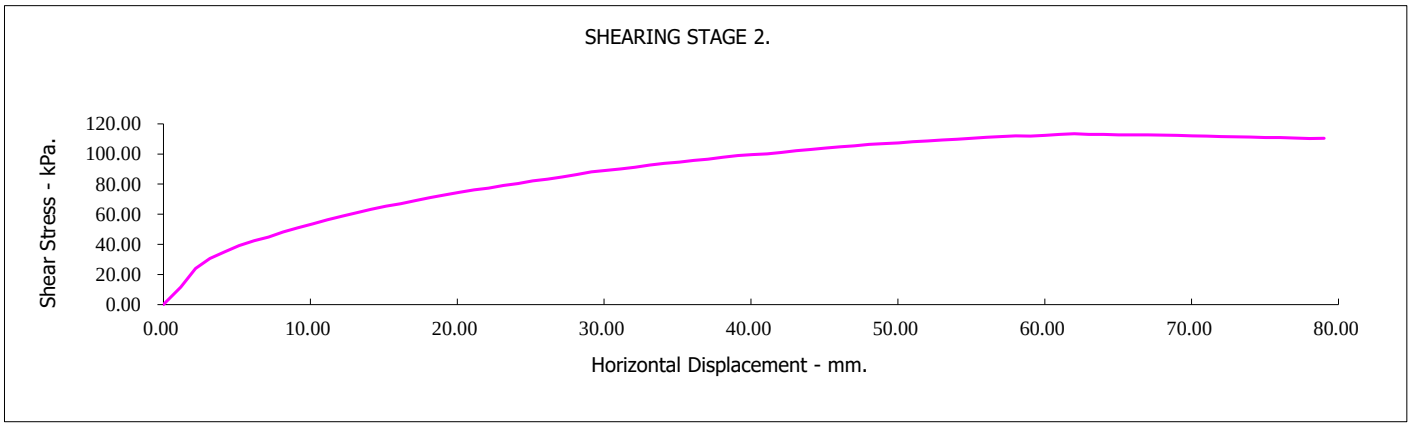
Client Ref Number:
14880RH

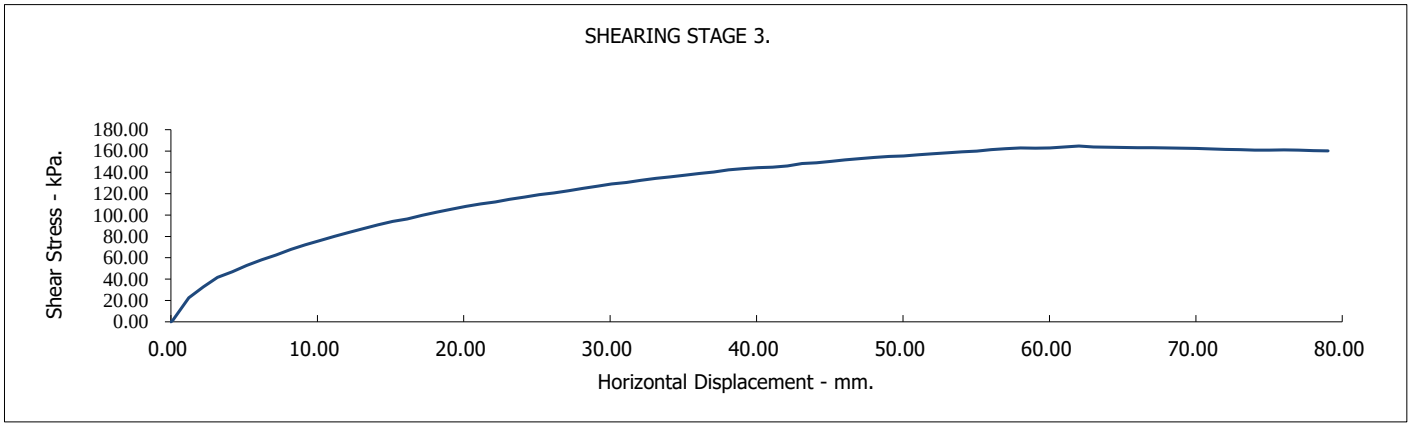
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

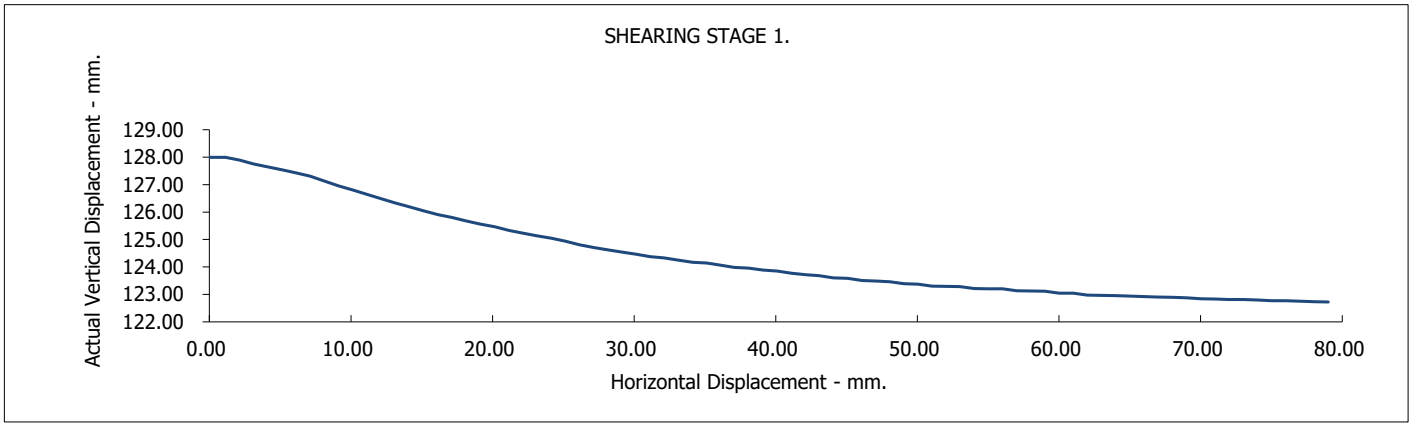
Client Ref Number: **14880RH**

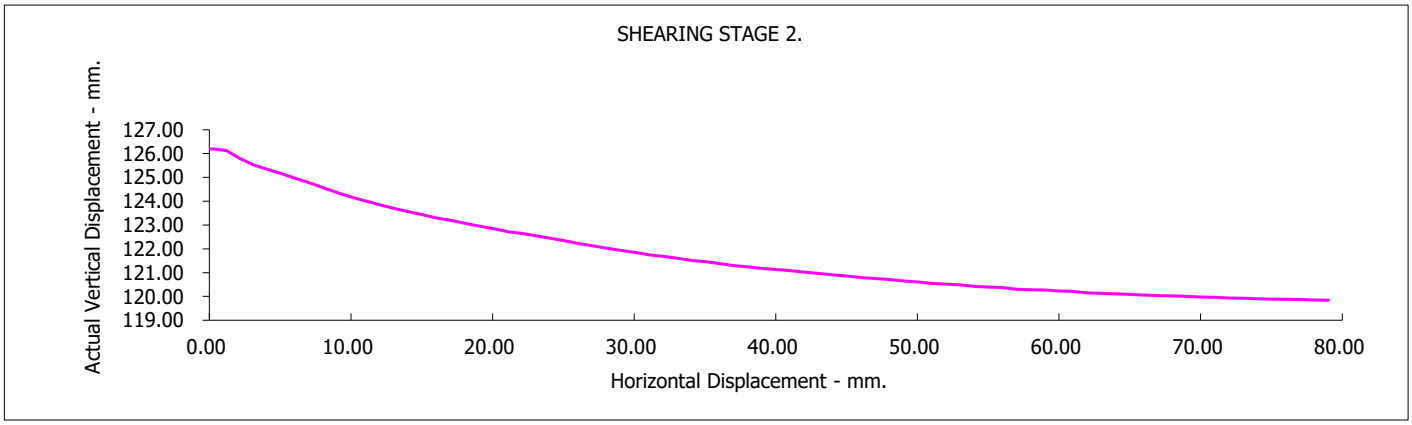
Figure.

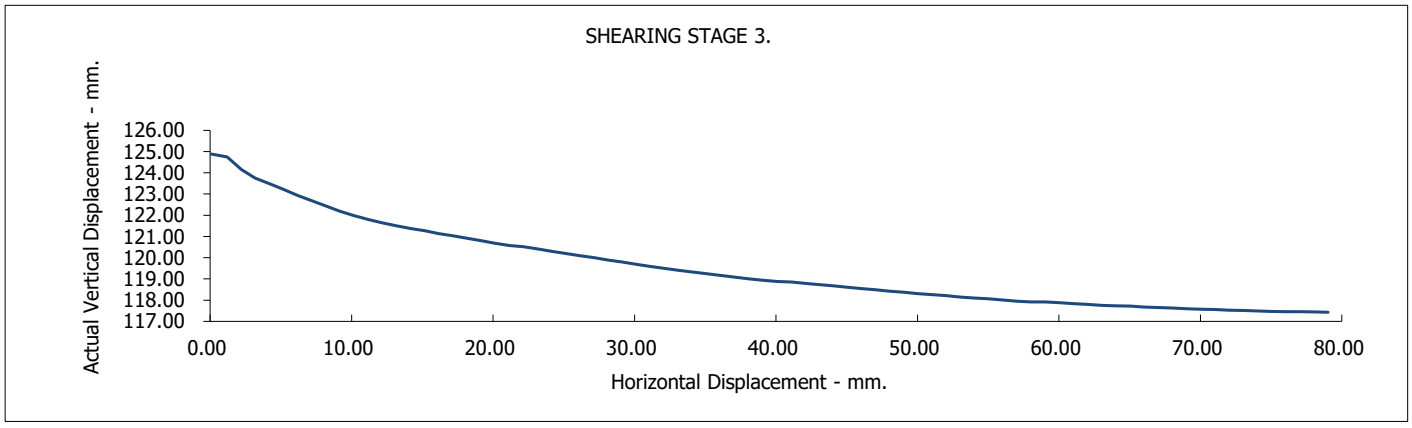
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

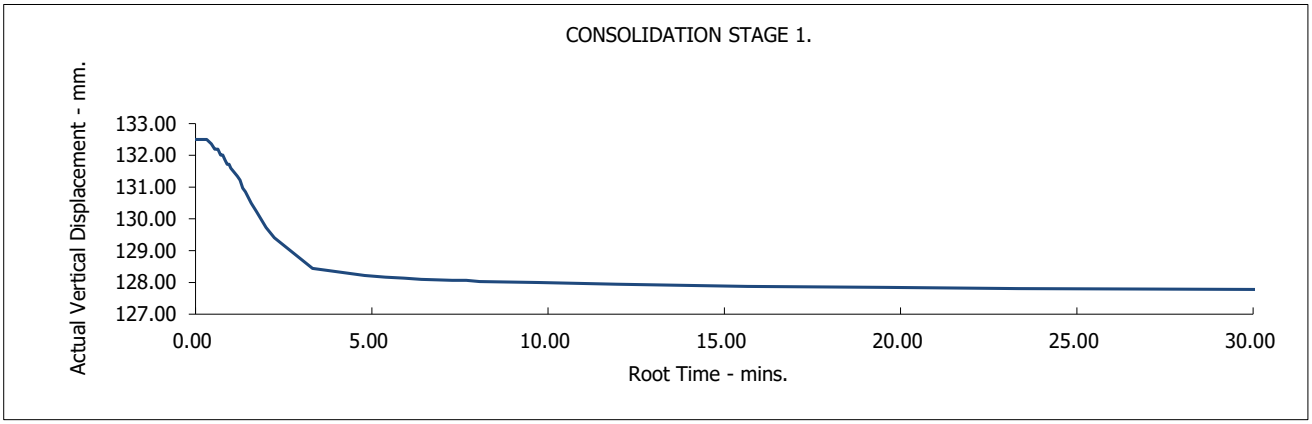
Client Ref Number: **14880RH**

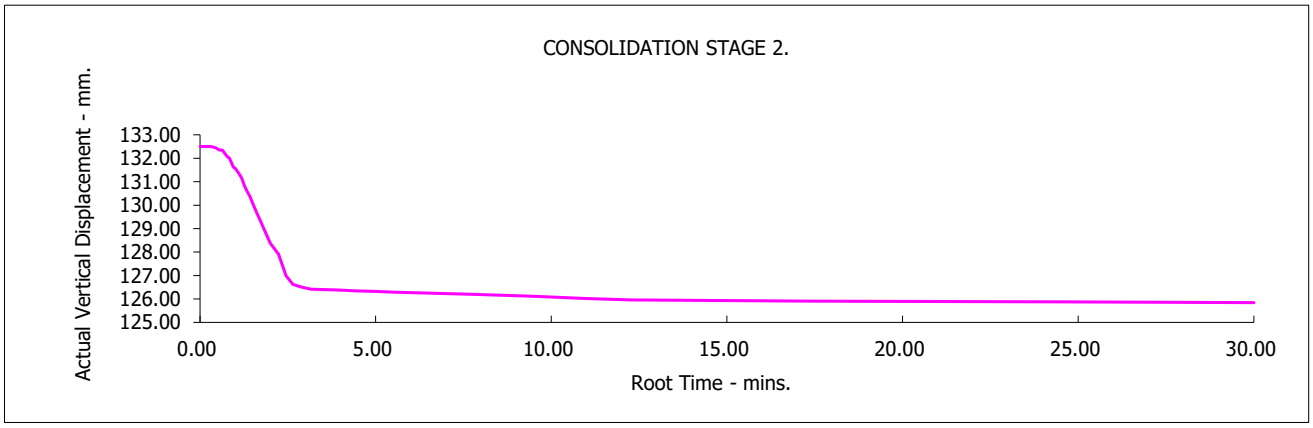
Figure.

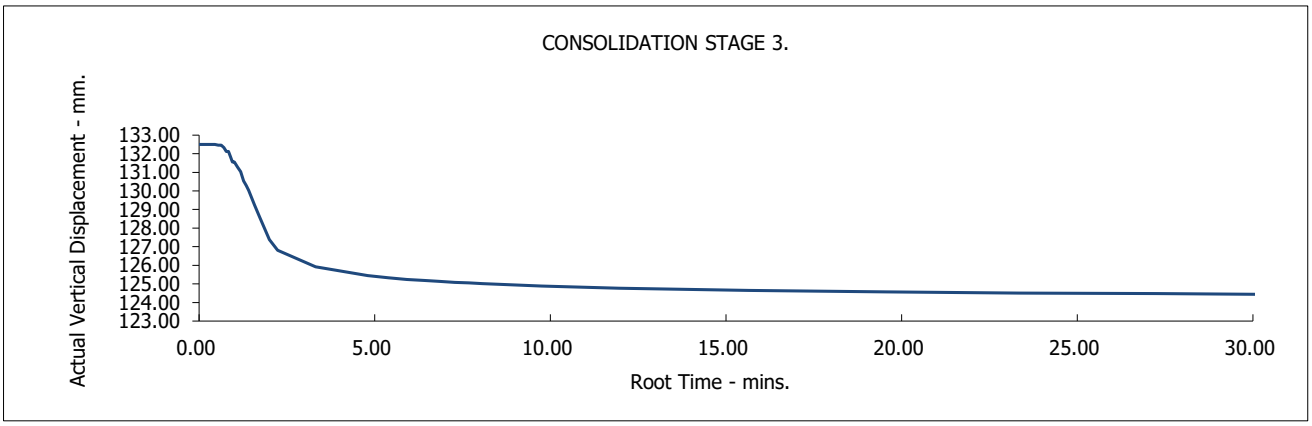
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

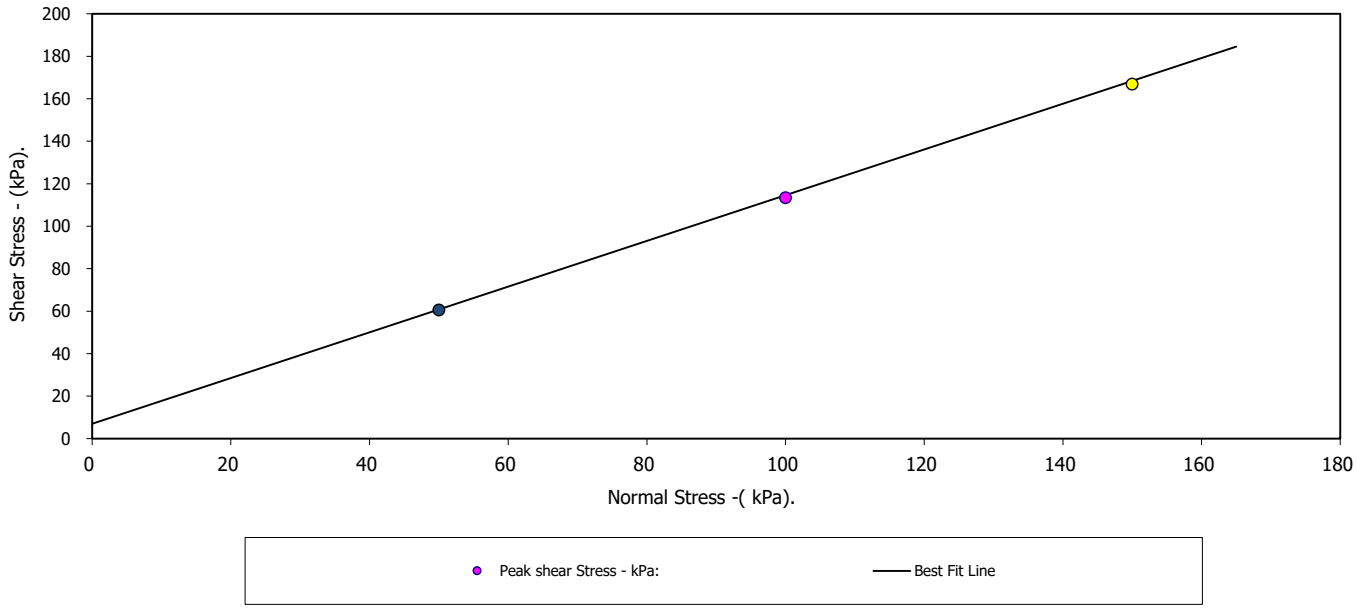
Borehole Number:	S6	Depth from (m):	0.00
Sample Number :	6	Depth to (m):	0.00

Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.
Sample Description: **Brown slightly clayey fine to medium GRAVEL**	

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	135.00	135.00	135.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	1.60	1.60	1.60
Dry Density - Mg/m3:	1.44	1.44	1.44
Voids Ratio:	0.8353	0.8351	0.8355
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	132.22	129.72	128.51
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	66.14	67.37	57.68
Peak shear Stress - kPa:	61	113	167

PEAK	
Angle of Shearing Resistance:(θ)	**47.1**
Effective Cohesion - kPa:	**7**

FAILURE CONDITIONS



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DP Evans 20/11/18
Approved Pages 1-4 by: Date

Contract No.:
41501

Client Ref Number:
14880RH

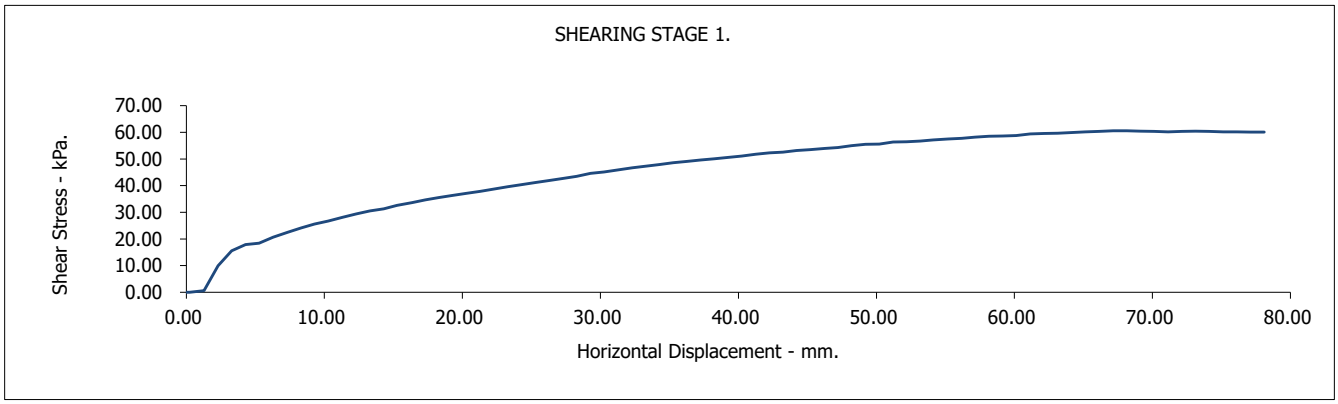
Buttington Quarry (B.Quarry)

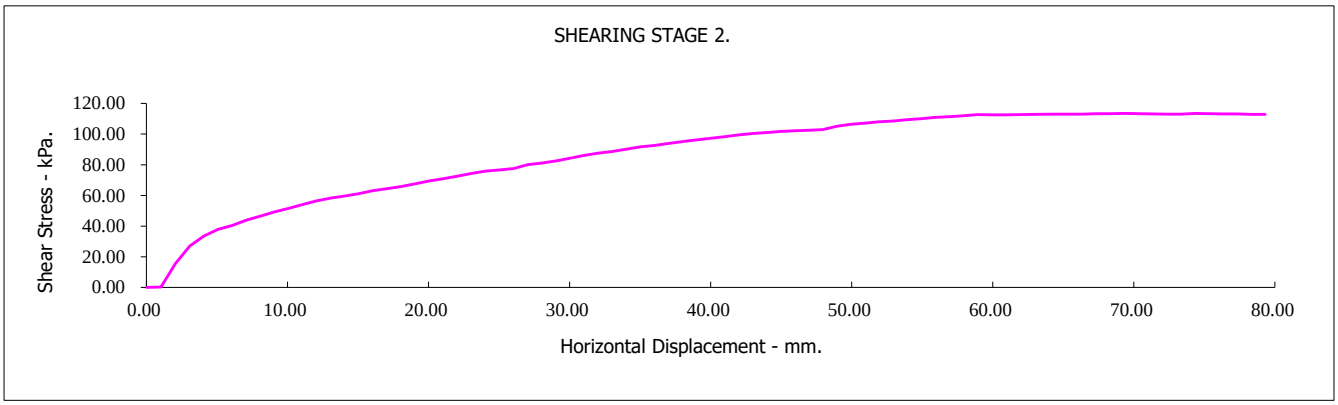
GSTL
GEO SITE & TESTING SERVICES LTD

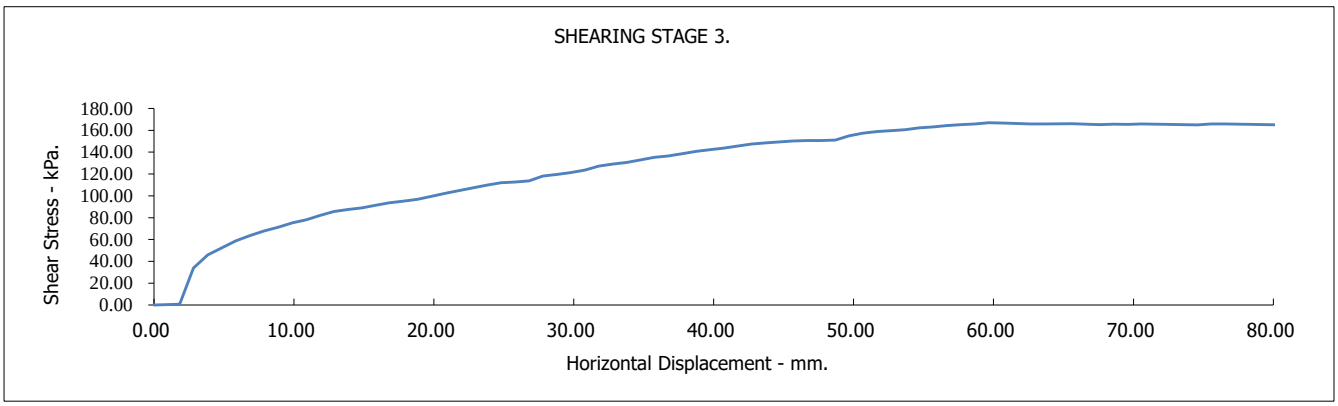
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

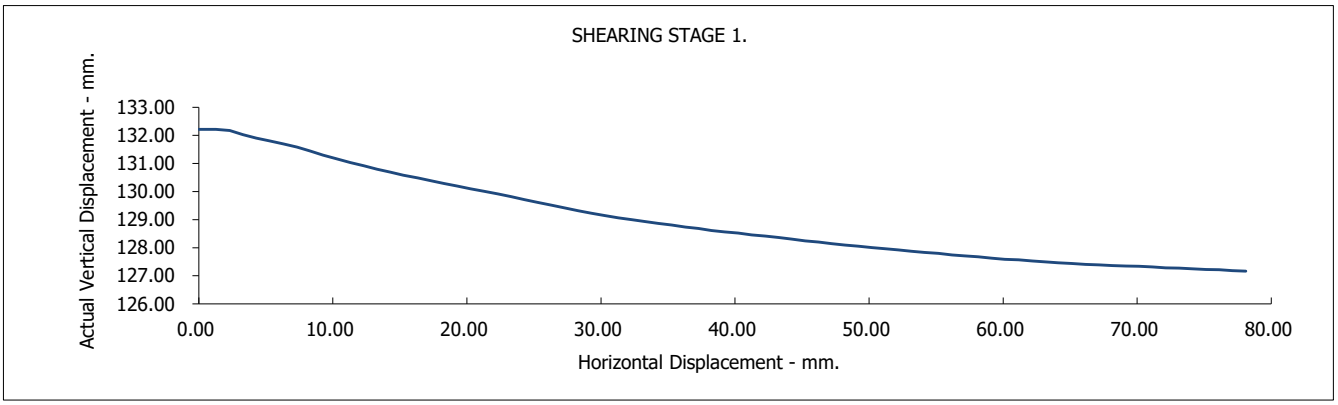
Client Ref Number: **14880RH**

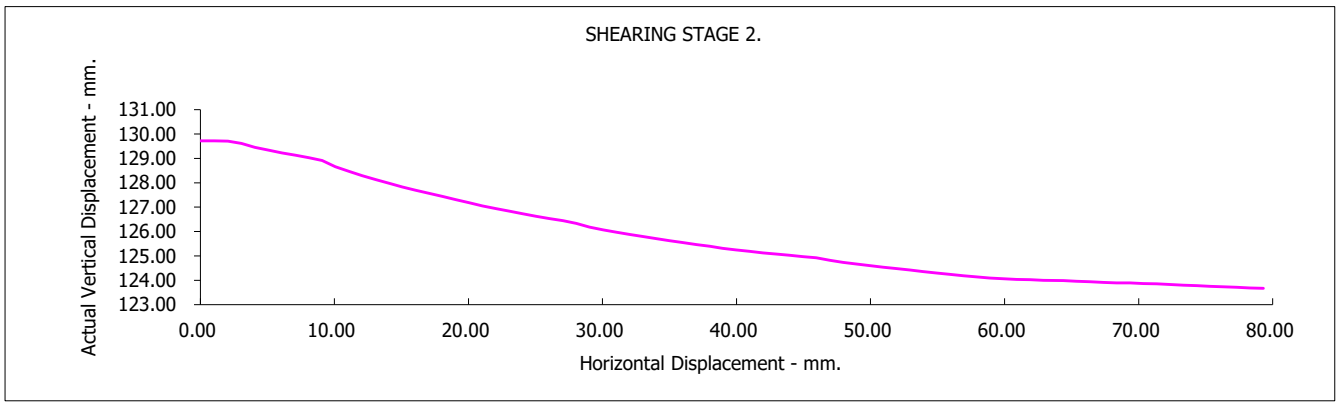
Figure.

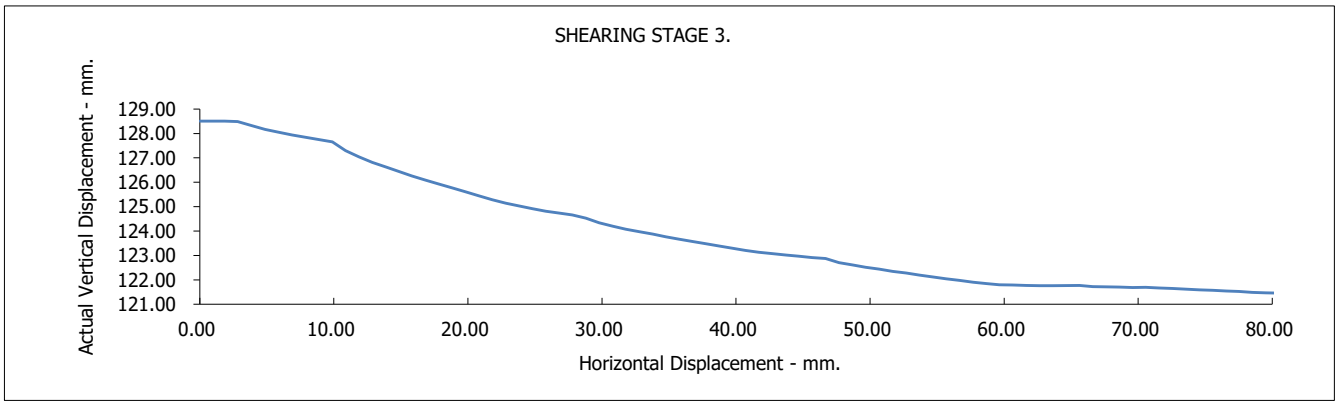
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

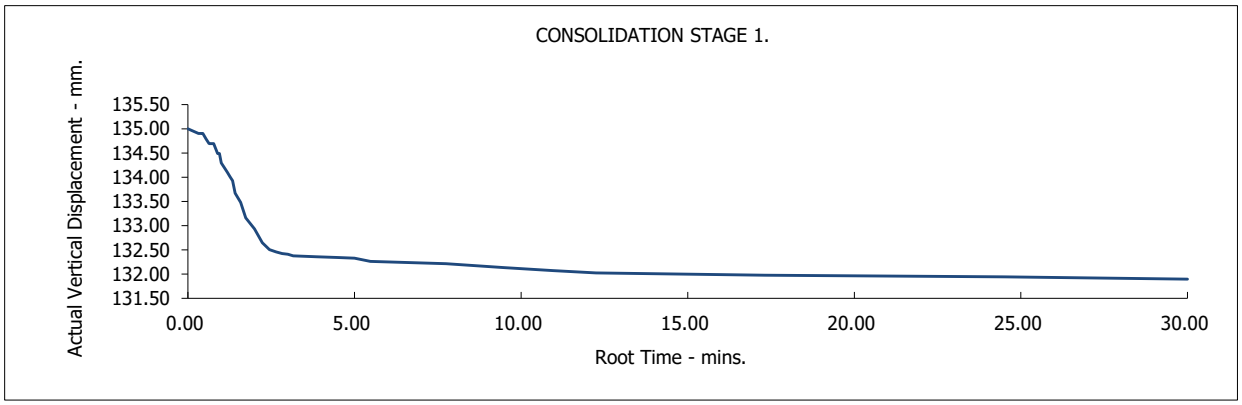
Client Ref Number: **14880RH**

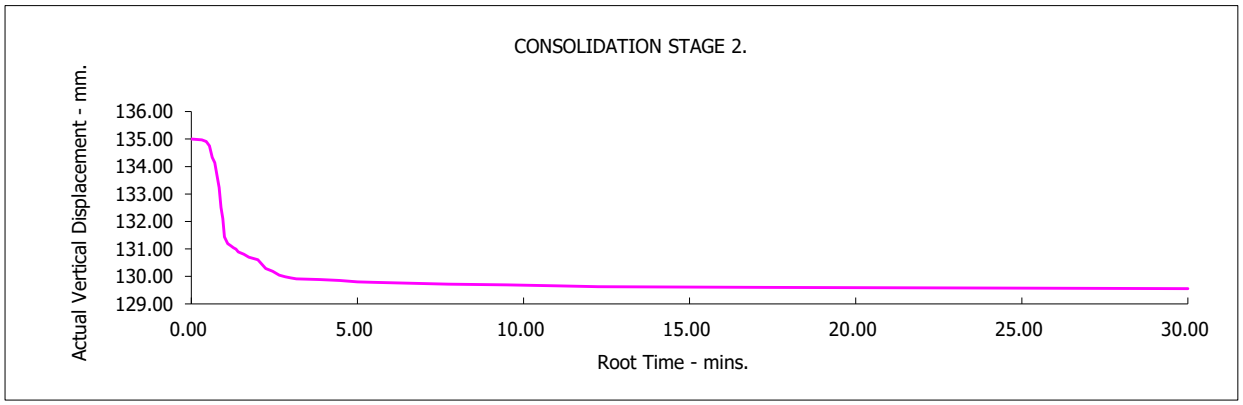
Figure.

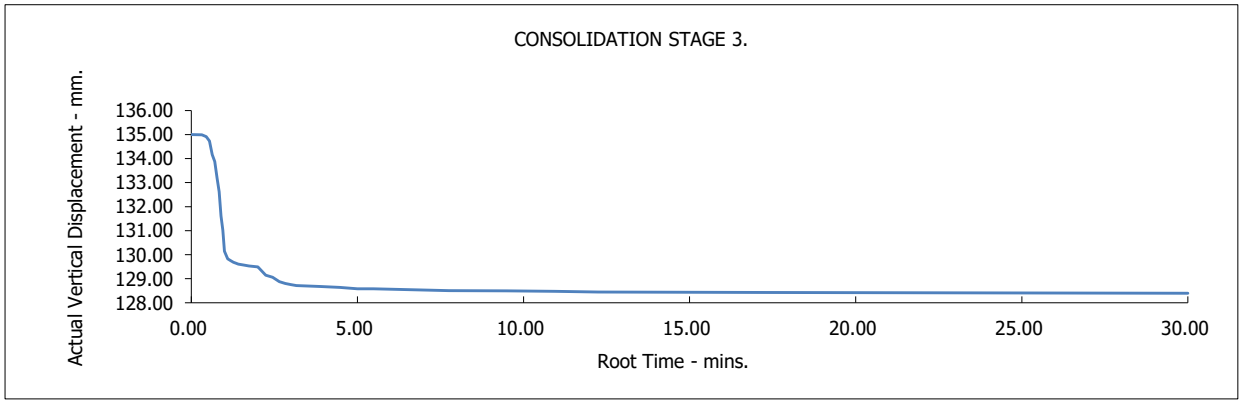
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

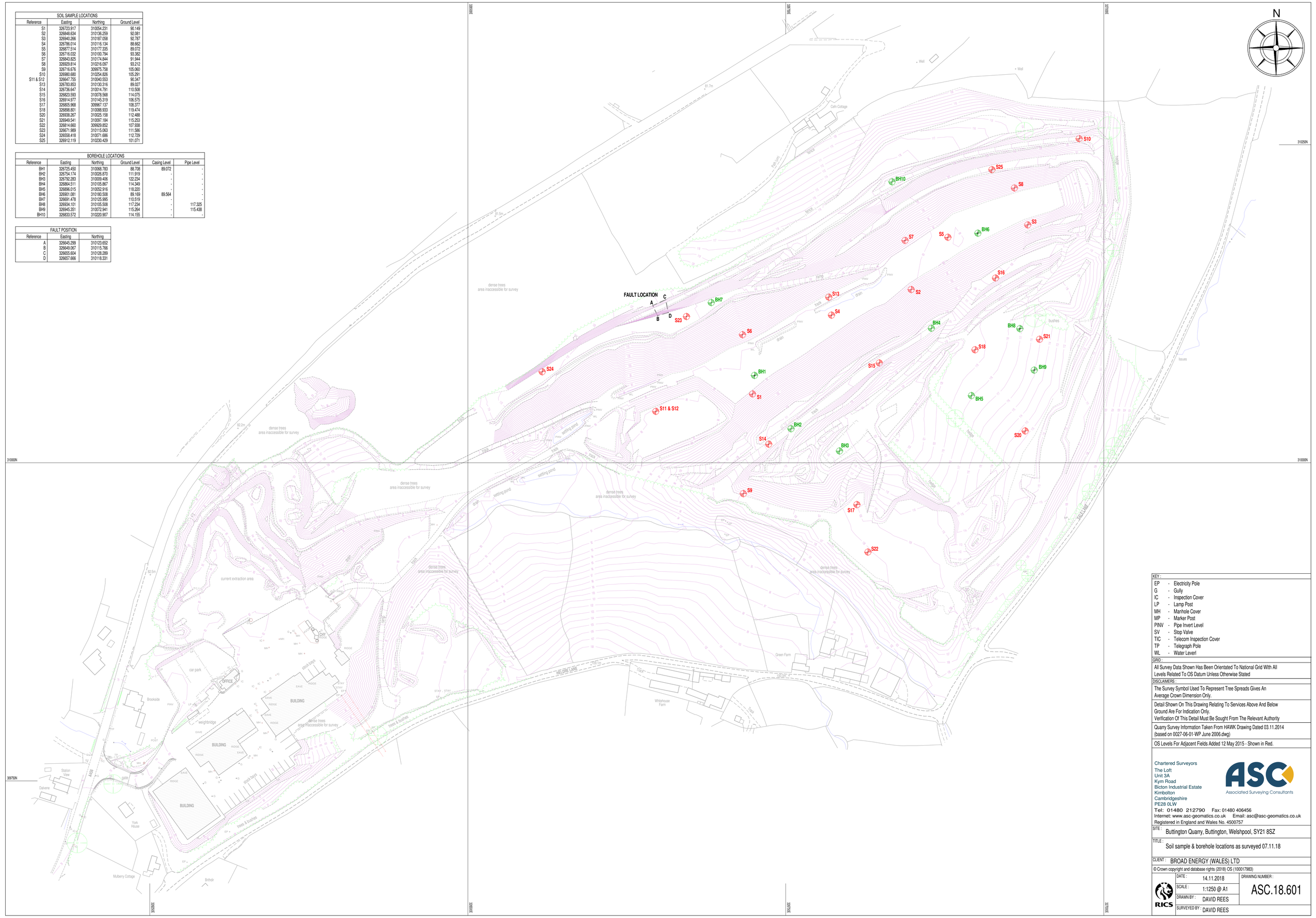
Figure.

DRAWINGS

SOIL SAMPLE LOCATIONS			
Reference	Easting	Northing	Ground Level
S1	326723.917	310054.231	90.149
S2	326848.634	310136.259	92.081
S3	326940.266	310187.058	92.787
S4	326786.014	310116.134	88.682
S5	326877.514	310177.335	89.072
S6	326716.032	310100.794	93.382
S7	326843.825	310174.844	91.844
S8	326929.814	310216.097	93.212
S9	326716.676	309975.758	105.060
S10	326980.680	310254.826	105.291
S11 & S12	326947.755	310040.553	90.347
S13	326783.853	310130.316	89.027
S14	326736.647	310014.791	110.508
S15	326823.593	310078.568	114.075
S16	326914.977	310145.319	106.575
S17	326805.968	309967.137	108.377
S18	326898.801	310088.933	119.474
S20	326938.267	310025.158	112.488
S21	326949.541	310097.184	115.253
S22	326814.660	309929.852	107.938
S23	326671.989	310115.563	111.586
S24	326558.418	310071.686	112.729
S25	326912.119	310230.429	101.071

BOREHOLE LOCATIONS					
Reference	Easting	Northing	Ground Level	Casing Level	Pipe Level
BH1	326725.450	310068.783	88.708	89.072	-
BH2	326754.174	310026.870	111.919	-	-
BH3	326792.283	310009.406	122.234	-	-
BH4	326864.511	310105.667	114.349	-	-
BH5	326896.015	310052.916	118.220	-	-
BH6	326901.081	310180.508	89.169	89.564	-
BH7	326691.478	310125.995	110.519	-	-
BH8	326934.101	310105.508	117.234	-	117.325
BH9	326945.351	310072.941	115.264	-	115.438
BH10	326833.572	310220.907	114.155	-	-

FAULT POSITION		
Reference	Easting	Northing
A	326945.299	310123.652
B	326849.067	310115.766
C	326835.604	310128.289
D	326657.666	310118.331



KEY :

EP	-	Electricity Pole
G	-	Gully
IC	-	Inspection Cover
LP	-	Lamp Post
MH	-	Manhole Cover
MP	-	Marker Post
PINV	-	Pipe Invert Level
SV	-	Stop Valve
TIC	-	Telecom Inspection Cover
TP	-	Telegraph Pole
WL	-	Water Level

GRID :

All Survey Data Shown Has Been Orientated To National Grid With All Levels Related To OS Datum Unless Otherwise Stated

DISCLAIMERS :

The Survey Symbol Used To Represent Tree Spreads Gives An Average Crown Dimension Only.

Detail Shown On This Drawing Relating To Services Above And Below Ground Are For Indication Only.
Verification Of This Detail Must Be Sought From The Relevant Authority

Quarry Survey Information Taken From HAWK Drawing Dated 03.11.2014 (based on 0027-06-01-WP June 2006.dwg)

OS Levels For Adjacent Fields Added 12 May 2015 - Shown in Red.

Chartered Surveyors
The Loft
Unit 3A
Kym Road
Blcton Industrial Estate
Kimbolton
Cambridgeshire
PE28 0LW
Tel: 01480 212790 Fax: 01480 406456
Internet: www.asc-geomatics.co.uk Email: asc@asc-geomatics.co.uk
Registered in England and Wales No. 4500757

Associated Surveying Consultants

SITE : Buttington Quarry, Buttington, Welshpool, SY21 8SZ

TITLE : Soil sample & borehole locations as surveyed 07.11.18

CLIENT : BROAD ENERGY (WALES) LTD

RICS

DATE : 14.11.2018

SCALE : 1:1250 @ A1

DRAWN BY : DAVID REES

SURVEYED BY : DAVID REES

DRAWING NUMBER : ASC.18.601

Technical Appendix 13-2
Slope Stability Report

Slope Stability Assessment

Buttington Quarry
Buttington
Welshpool

Prepared for:
Broad Environmental Limited

February 2019

Job No: 14880/SS

terrafirma

REPORT TITLE	**:**	**Slope Stability Assessment:** Buttington Quarry, Buttington, Welshpool
REPORT STATUS	**:**	**FINAL**
JOB NUMBER	**:**	**14880**
DATE	**:**	**February 2019**
PREPARED BY	**:**	R. Howells. …….. **(Mrs R. Howells)**
REVIEWED BY	**:**	…….. **(Mr D. Emanuel)**
APPROVED BY	**:**	…….. **(Dr G. C. Lake)**

Executive Summary

Broad Energy (Wales) Limited is proposing the development of an Energy Recovery Facility (ERF) at Buttington Quarry. The new ERF is to be constructed in the bottom of the former quarry. To accommodate this the quarry is to be widened.

Terra Firma (Wales) Limited has been commissioned to undertake a slope stability assessment.

To undertake the assessment field observations of the site geology were recorded and a physical site investigation undertaken in the form of rotary probeholes performed including rock coring. Data collected was utilised to complete a stability assessment of the current northwest quarry slope using the Geo5 slope stability model and to perform a stereonet exercise to determine the risks to newly created slopes from failure.

Upon development it is intended that the existing northwest quarry face will remain unchanged. The slope stability analysis confirmed that the existing 34 degree scree slope, is generally stable with only a very low risk of shallow slips. It is recommended that to protect the new development against any such minor scree slips or rogue rock falls that a 3m buffer zone be assigned between the base of the existing quarry face and edge of the new development area comprising a shallow trench and a catch fence.

The proposed new southeast slope will be within the Trewern Broom Mudstone Formation. This is deemed to have the same geotechnical properties as the Cefn Formation and Tarannon Mudstone Formation to the northwest. For this reason, this strata may be expected to behave in an identical way, naturally weathering to a slope of 34°, at which angle any slope instability may be expected to be minor.

The new south-eastern side of the development area upon development will be within the TBMF and align northeast-southwest at an orientation approximately 60 and 85 degrees, and dip towards the northwest. The angle of dip will determine the degree of slope stabilisation required.

For a 34° slope there are two options.

1. ***Assign a 3m buffer zone comprising a shallow trench between the development area and new base of slope and install a catch /debris barrier on the edge of the development area. Appropriate drainage measures should be installed within the base of the trench.***
2. ***Cut a 34° slope from the edge of the development area and apply slope protection in the form of erosion control measures. This will act to minimise surface weathering and prevent degradation that could lead to wedge or toppling failure.***

Stereonet analyses have shown that at 60° the rock will not remain stable unless stabilisation measures are introduced. Stabilisation should be achieved by:

1. ***Assign a 5m buffer zone comprising a shallow trench between the development area and new base of slope and install a catch fence on the edge of the development area. Appropriate drainage measures should be installed within the base of the trench.***
2. ***Creation of the slope in two sections, stepped mid-way by a 5m long shelf. A drain should be installed along the base of the upper slope section.***
3. ***Stabilisation of all 60° slopes with appropriate ground anchors or soil nails/bolts combined with rock netting to retain any loose debris. Erosion control may also be incorporated.***

Slope stabilisation design and management should be performed by a specialist.

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SECTION 1 Introduction

1.1 General

Broad Energy (Wales) Limited is proposing the development of an Energy Recovery Facility (ERF) at Buttington Quarry, near Welshpool, a renewable energy plant that will fuelled by non-recyclable waste.

The new ERF is to be constructed in the bottom of the former quarry. To accommodate this the quarry is to be widened.

Terra Firma (Wales) Limited has been commissioned to undertake a slope stability assessment.

The objectives of the slope stability are:

- To inspect the nature and quality of existing quarry slopes
- To determine surface and sub-surface ground conditions including the structure and competency of the different geological units
- Provide recommendations for the most viable future quarry configuration and how the long-term integrity all new quarry faces, and slopes may be maintained.

1.2 Limitations and Exceptions of Investigation

Broad Energy (Wales) Limited has requested that a Slope Stability Assessment be undertaken

The slope stability analysis was conducted and this report has been prepared for the sole internal reliance of Broad Energy (Wales) Limited and its design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The report represents the findings and opinions of experienced geo-technical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may also be required.

The subsurface geological profiles are based on the information found at the locations of the exploratory holes and depths sampled and tested.

SECTION 2 Site Setting

Buttington Quarry sits into a natural hillside just northeast of Buttington, adjacent to and east of the A458 between Welshpool and Shrewsbury. The surrounding area is entirely rural.

There is a history of quarrying and clay pits dating back to the late 1800s, which has gradually formed the quarry that is present today. There have been no extractions from the existing quarry for circa 20 years. An associated brick works was in operation near to the quarry, established between 1885 and 1903. It is understood that the brick works closed in 1990.

The quarry is accessed through the site of the former brick works, which is now used for commercial purposes. Low-scale quarrying of materials between the former brick works land and the A482 presently continues.

The base of the quarry aligns northeast-southwest and lies at 88m - 89m AOD. The quarry sides extend up to approximately 118.5m - 127m to the northwest and a maximum of 119.5m AOD to the southeast.

Quarry faces on both sides are stepped at various intervals, forming trackways mid-slope to the southeast and mid to top slope to the northwest.

The quarry sides remain exposed and unvegetated, and weathering of these surfaces has led to ravelling where the rock has deteriorated to form a scree of fine gravel. Where rock faces are exposed this gravel debris has accumulated at the base of the face. The gravel is loose but remains stable having settled at its natural angle of repose. No evidence of any rockfalls is evident within the quarry.

Exposed rock faces are primarily present towards the top of the quarry sides, particularly on its north-western side.

The area south-east of the quarry, which is included in the development area, slopes downhill towards the southeast. It may be accessed via an inclined track that cuts from the main entrance track into the bottom of the quarry. The hillside remains unaltered towards the northeast and comprises two grassy fields declining from around 119.5m to 111.5m AOD. The smaller of these fields is heavily overgrown and largely enclosed by hedgerows. The hillside has also been quarried south of the fields and numerous stockpiles of stone material remain. A through-track to other areas of the property passes through this section of the site, which sits at around 108m – 109.5m AOD.

A newly formed earth bund defines the south-eastern boundary of the development area.

Two settlement ponds are present at the entrance to the quarry, either side of the access track. During wet weather surface waters were also noted to collect in areas of the quarry floor.

SECTION 3 Geology

The solid geology at the quarry is illustrated in **Figure 3.1** below. Please note that this plan is not to scale and actual boundaries between each strata will vary.

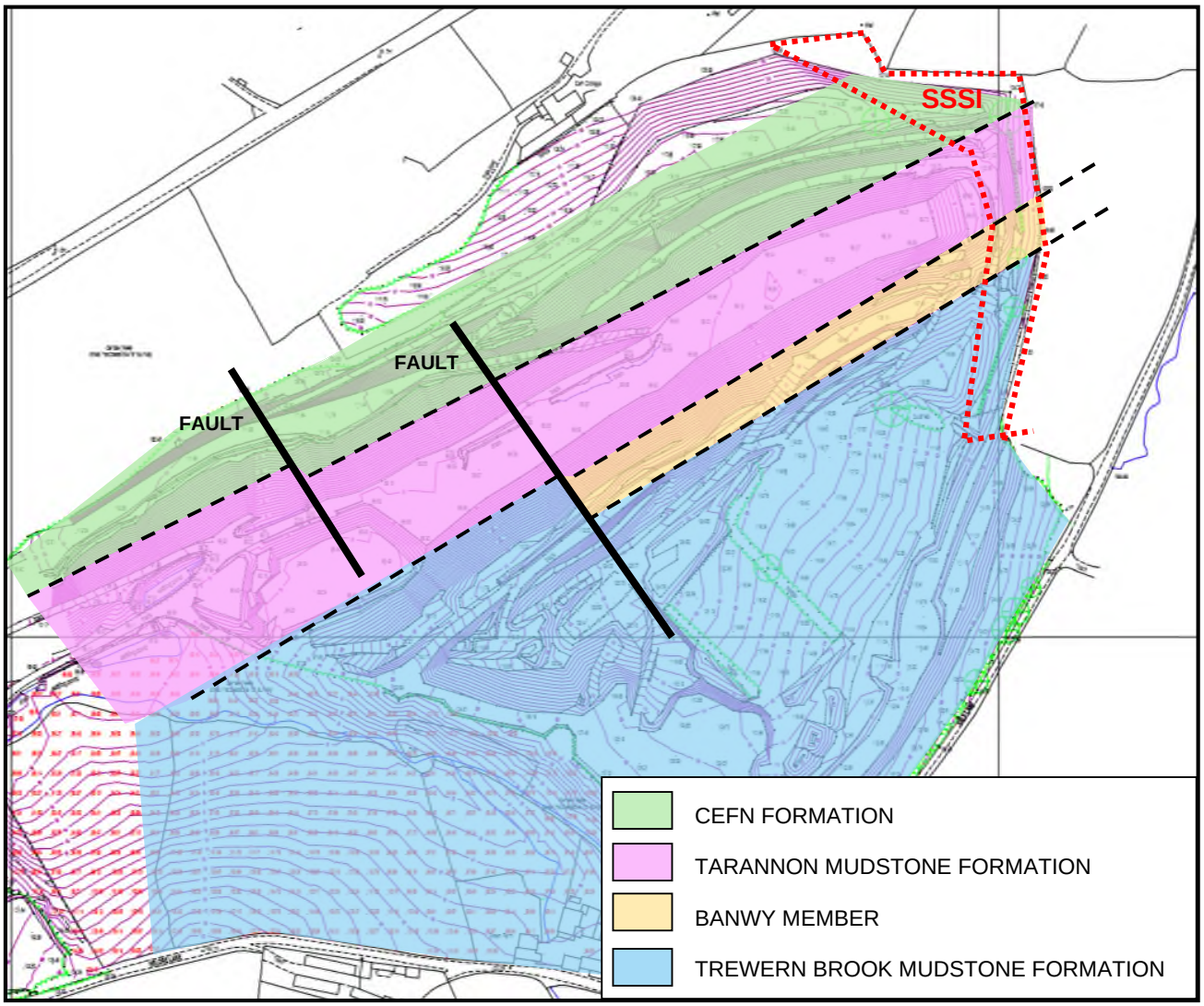


Figure 3.1: Site Geology

Figure 3.1 shows four different strata to be present at Buttington Quarry, younging towards the southeast. **Table 3.1** summarises the stratigraphic sequence.

Silurian	Wenlock	Sheinwoodian	Trewern Brook Mudstone Formation
			Banwy River Member
	Llandovery	Telychian	Tarannon Mudstone Formation
			Cefn Formation

Table 3.1: Stratigraphic Sequence

Geology (Continued)

Cefn Formation (CF)
This is comprised of primarily of grey to dark grey mudstones, with thin sandstone beds. Concretions and nodules recorded.

Tarannon Mudstone Formation (TMF)
The Tarannon Mudstone Formation is comprised of purple/red brown mudstone/shale, also fossiliferous, with graptolites. It is this strata that has been extracted for brick making.

Banwy Member (BM)
A section of mudstone upon the quarry face that is defined by its specific graptolite fossil biostratigraphy that spans the lower Wenlock and upper Llandovery boundary.

Trewern Brook Mudstone Formation (TBMF)
Comprised of blue-grey mudstone beds, also host to graptolite fossils. At the base of the TBMF the Butterley Member is recorded, comprising an approximate 9m thick horizon of bio-turbated silty mudstone with shelly, trilobite and graptolite fossils (Lydell *et al*).

Two faults have been found to cross roughly perpendicular to the length of the quarry, as illustrated in **Figure 3.1**. These down-throw strata towards the southwest.

A continuous sequence of Llandovery to Wenlock rocks is designated as a geological SSSI (Site of Special Scientific Interest). This encompasses the Buttington Shale Formation (TMF) from the upper Llandovery through to the TBMF. The approximate area of the SSSI is illustrated on **Figure 3.1.**

Superficial Devensian fluvioglacial fan deposits (sand and gravel) or Devensian till is recorded in the immediate areas surrounding the quarry top but cover is anticipated to be very shallow, with bedrock at or near the surface.

SECTION 4 Site Investigation

Data was compiled to enable assessment of the quarry through field observations and intrusive investigation works.

4.1 Field Observations

Geologically trained TFW engineers visited the site to inspect the different geological units exposed at the surface.

Due to the vivid purple colour of the Tarannon Mudstone each lithology was easily distinguishable. **Figure 4.1** provides a generalised view of the different strata.

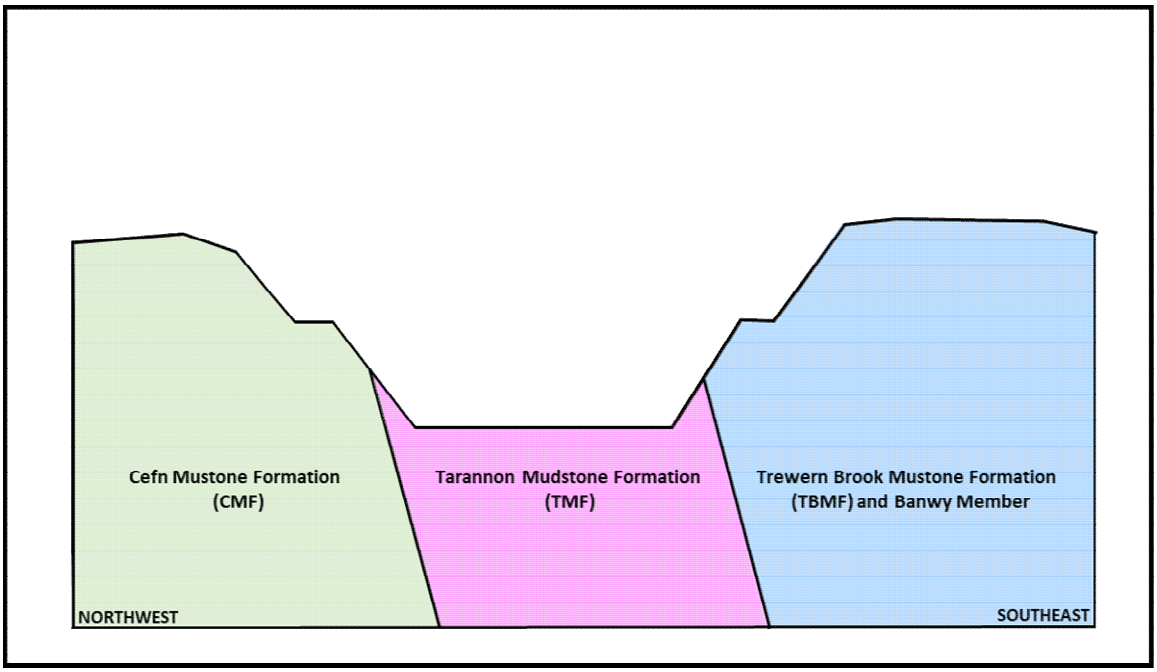


Figure 4.1: Generalised Cross-Section of Buttington Quarry

The bedding orientation of each of the geological unit was measured from exposed bedding planes, i.e. the divide between different geological units/beds.

Bedding is found to dip very steeply, typically between 75˚–85˚ towards the southeast, although this does vary on a localised scale and shallower/steeper readings were recorded.

Numerous fractures and joints were also observed in the TBMF from different exposure locations. Fracture and joint planes were found to be variable in both orientation and dip and no dominant fracture groups could be deciphered with the exception of where mineralisation of some parallel fracture planes in localised areas was evident. Mineralised fractures were found to be a maximum width of only a few millimetres.

TMF exposures were limited and highly weathered so no fracture or joint readings could be reliably taken.

The CF will not be further exposed upon development and so limited data for this strata was obtained.

4.1 Field Observations (Continued)

Several faults are documented to be present. The western most fault shown in **Figure 3.1** was confirmed in the north-western face of the quarry.

Figure 4.2: Fault line as seen in upper north-western quarry face

The two sides of this fault may be seen on **Drawing 01.**

Several small unmapped faults may also be clearly observed in the lower north-eastern end of the north-western quarry face, down-throwing strata towards the northeast, see **Figure 4.3**.

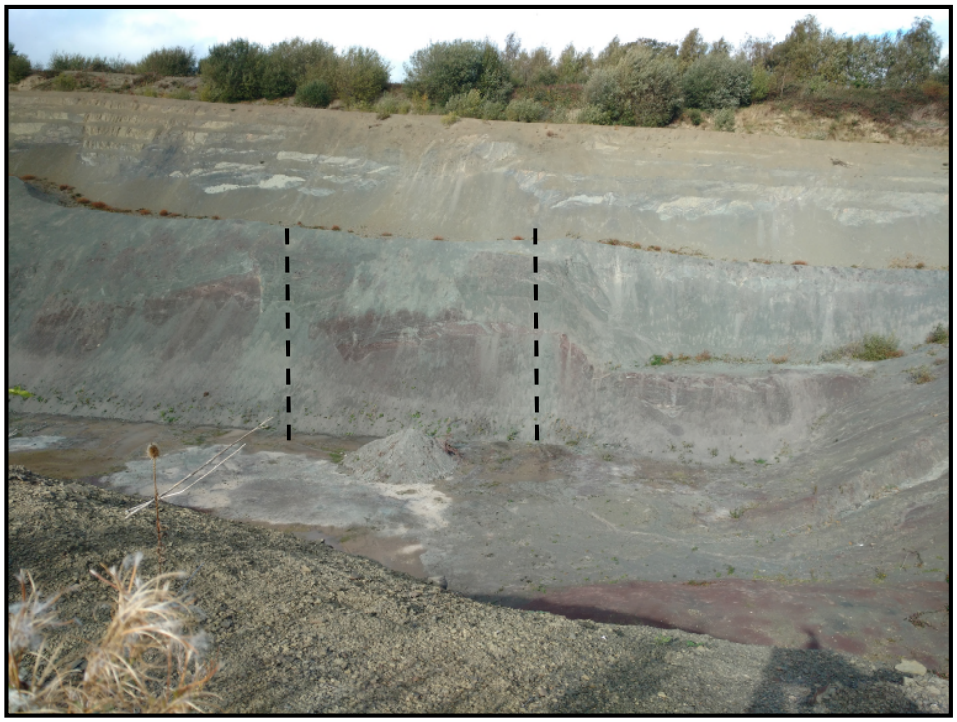


Figure 4.3: Localised faults towards the northeast end of the quarry

4.2 Physical Investigation

4.2.1 Probeholes

An intrusive investigation was undertaken to obtain representative samples of the different geological units at depth and from areas where the new northeast quarry face may be anticipated to intersect the landscape.

Ten rotary probeholes (PH1–PH10) were sunk in accessible areas, positioned along pre-determined cross-sectional lines across the quarry, during October and November 2018.

PH1 and PH6 were situated with the quarry bottom, targeting the TMF. PH7 and PH10 were drilled in to the CMF. The remaining probeholes extended in to the TBMF.

The exploratory hole locations are illustrated on **Figure 4.4** below.

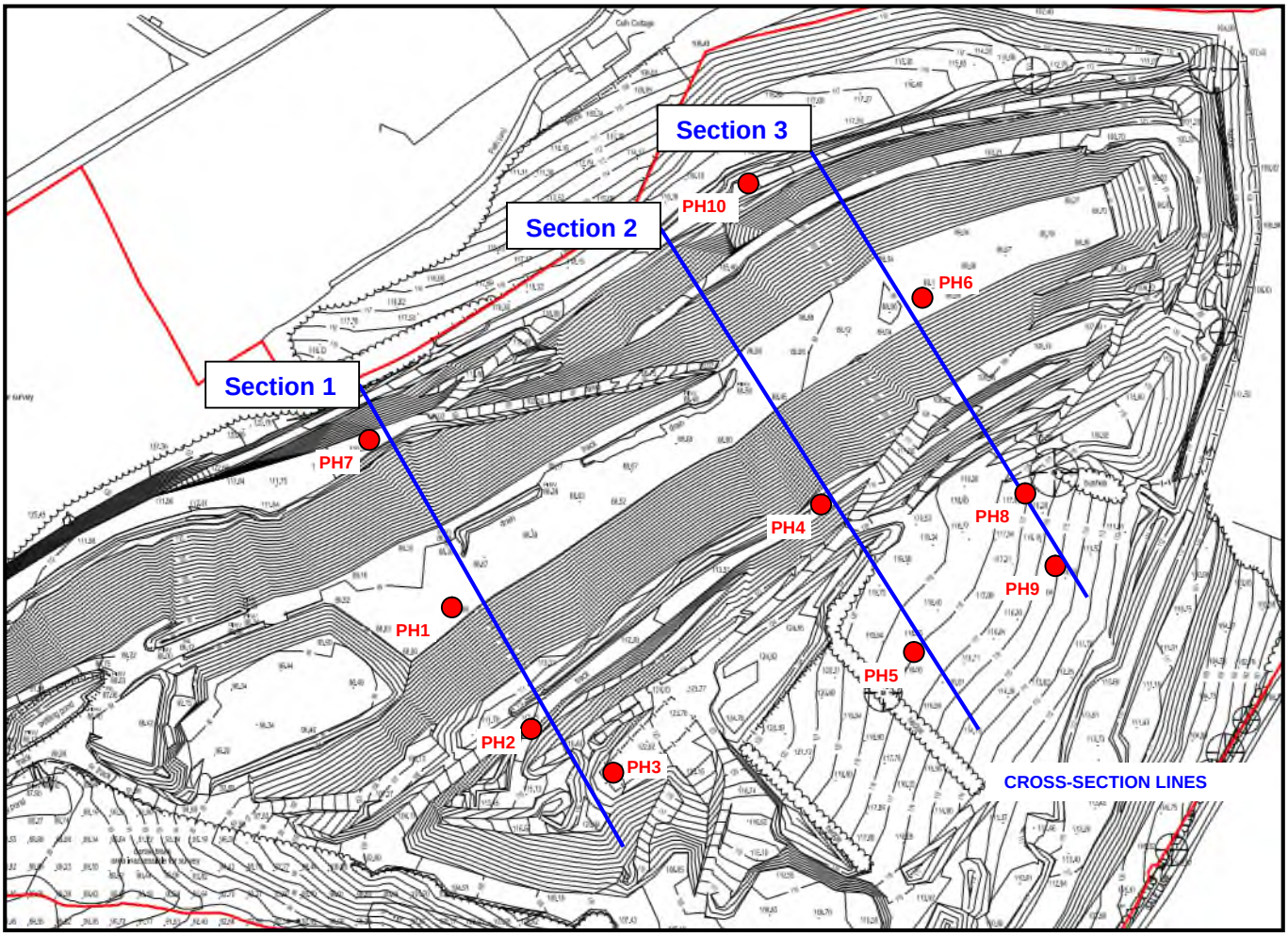


Figure 4.4: Probehole Locations

The exact borehole co-ordinates and levels are detailed on the probehole logs, see **Annex A**.

4.2.1 **Probeholes** (Continued)

The probeholes were sunk using a Beretta T44 drilling rig.

The probeholes were almost entirely drilled via core sampling and only limited open hole drilling was carried out. Open hole drilling was carried out using compressed air as the flushing medium.

The fieldworks were supervised by Terra Firma (Wales) Limited. The probehole cores were logged to the requirements of BS5930: 2015. Copies of the probehole logs are presented in **Annex A**.

Photographs of the extracted rock cores may be found in **Annex B**.

The Tarannon Mudstone (PH1 and PH6) was found as weak dark reddish brown locally light greenish grey mudstone with closely spaced fractures stained orangish brown. Bedding fractures were recorded as orientated 75°- 85° with primarily planar smooth to polished surfaces. Other fractures were found to be variable in orientation with no consistent fracture surface type, but fractures were clean and generally tight to open.

The Cefn Mudstone (PH7 and PH10) was found to be completed weathered to soil to around 1m depth. In PH7 this grades in to extremely weak dark grey mudstone with bands of non-intact laminated mudstone and siltstone retrieved as angular gravel between 3.85–5.05m, 6.45–7.15m and 9.65m–10.75m depth. Bedding fractures are identified by their 80°- 85° orientation, with variable surfaces but often striated. Other fracture planes are dominantly found to be 15°- 45° to around 11m depth before favouring a 35°- 60° orientation but 60°- 70° fracture planes were also found to regularly feature to the full depth of the probehole. Fractures were generally clean. Non-intact greenish grey mudstone retrieved as gravel extended to 3.0m depth in PH10, succeeded by very weak grey mudstone with very close to closely and occasionally medium spaced fractures dominantly orientated 5°- 35° and stained orangish brown or dark grey/black. Bedding fractures were consistently dipping 80°- 85°.

The Trewern Brook Mudstone Formation (PH2 – PH6) was found weathered to very gravelly clay soil in some areas to 1.0m depth, and made ground was noted in PH2 to 1.0m depth comprised of rubble hardcore material. In general, the strata is formed of weak grey to dark grey mudstone beds, initially non-intact or very weak in areas and becoming medium strong to strong at depth (PH2 & PH8). Bedding fractures follow a 75°- 85° orientation. Other fractures and joints are prevalent but no relationship between spacing and orientation may be determined between different boreholes. Most fractures are clean but occasionally found to be infilled with soft to stiff grey clay to no more than a few centimetres in thickness. Mineralisation of some fractures was also noted, but these were typically no wider than 1mm. Graptolite fossils (monograptids) were observed in particular beds and often seen on bedding fracture surfaces.

4.2.2 Groundwater

Groundwater was only recorded in two probeholes during drilling works.

Groundwater monitoring wells were installed in seven of the ten probeholes. A return visit to site on the 21.11.2018 was made to dip the wells and ascertain groundwater levels.

Table 4.1 Groundwater Levels

Borehole	Groundwater noted during drilling	Water level 21.11.2018 (mbgl)	Water level AOD 21.11.2018
BH1	0.6	0.3	88.408
BH2	-	18.35	93.569
BH3	-	-	
BH4	-	12.69	101.649
BH5	-	-	
BH6		0.27	89.499
BH7	-	11.8	98.719
BH8	-	11.3	105.934
BH9	6.7m borehole wet	10.2	105.064
BH10	-	-	-

4.2.3 Geotechnical Testing

In order to confirm the competency and strength of the quarry rocks in-situ CPT tests were performed in the probeholes and core sections were retrieved and submitted for laboratory testing for unconfined compressive strength (UCS) and point load testing.

CPT results are not included on the probehole logs (**Annex A**) due to difficulties presenting test data alongside coring data, but most tests met refusal.

Samples of weathered rock material were also retrieved and submitted for laboratory shear box, grading and slake durability testing. These results are discussed in **Section 7**.

Laboratory test results may be found in **Annexes C and F**.

SECTION 5 Slope Stability Modelling

5.1 General

Geological planes comprise bedding planes and fractures/joints.

The dip of the bedding within the quarry is known to generally be 75˚–85˚ towards the southeast, with local variation in this range.

Field measurements taken in the TBMF recorded numerous fracture and joint planes, which had variable and inconsistent alignment. A list of readings taken may be found in **Annex D**.

TMF exposures were limited and highly weathered so no fracture or joint readings were could be reliably taken. Limited readings from the CF were taken.

Upon development it is intended that the existing northwest quarry face will remain unchanged and the CF and TMF will not be disturbed other than for localised earthworks related to filling towards the far northwest of the quarry.

Rock failure can occur in a number of ways:

1. **Ravelling:** This is the natural weathering and disintegration of rock to scree where exposed. The weathered material will settle at its natural angle of repose, i.e. the maximum angle before instability occurs. Ravelling has occurred along the lower quarry slopes and further up the quarry side at the base of rock faces.
2. **Plane Failure:** Where a section of rock may slide along a single plane.
3. **Toppling Failure:** This is where steeply dipping beds may weaken and topple forwards
4. **Wedge Failure:** Where failure occurs where two planes intersect forming a ‘wedge’.

Two methods of slope stability analysis were employed, use of the Geo5 Geotechnical Software for stability analysis and stereonet assessment.

Whilst the Geo5 software can model stability of soil and rock, given the steepness of the bedding and frequency of fractures and joints in all three rock formations this method has only limited application as the model assumes a homogenous rock unit. This program has been used only for assessment of the existing northwest quarry face, specifically to verify that the current degraded slopes faces are indeed acceptably stable at their acquired natural angle of repose.

Please refer to **Section 5.2** for details on the Geo5 Assessment.

A stereonet is a geological graphical method of assessment whereby the orientation and dip of 3D geological planes may be illustrated in 2D on a circular projection plane. Stereographic projection permits a 3D representation of the planes on a half-sphere pictorially. A stereonet may be used to understand the relationship between different geological planes and whether the intersection between different geological planes may indicate a potential method of rock failure.

Please refer to **Section 5.3** for the stereonet assessment.

5.2 Geo5 Slope Stability Assessment

The current northwest face of the quarry comprises both exposed bedding planes and rock surfaces, and weathered rock material that has accumulated as a result of ravelling. The weathered material is located primarily along the lower part of the quarry face, with rock out-cropping mid-way up the slope and above and localised ravelling at the base of these outcrops.

The naturally formed slopes of weathered material have been measured to be at an approximate angle of 34°.

The original profile of the quarry face prior to weathering is unknown, and the thickness of the scree material that has accumulated is therefore unknown and may be variable.

As the thickness of the scree material is unknown stability assessment for two different scree thickness scenarios has been performed.

The boundary between the TMF and the CF has been determined from drilling records and visual inspection of the slope, estimated though extrapolation taking into account the known dip of the strata.

Circular slip mechanisms were considered during computer analysis. Circular slopes were assessed by the Bishop Method. Further details of this method can be found in published literature. Analyses were performed based on shear strength parameters. The circular slips were derived automatically using the optimisation function. All other settings were left in default mode.

Upon completion of the Bishop Method analysis the model was re-run under the Safety Factors setting to obtain the value of the minimum factor of safety calculated.

5.2.1 Geotechnical Parameters

Parameters used in the assessment are detailed below:

Table 5.1 Geotechnical Soil and Rock Parameters for Geo5 Assessment

Strata	Angle of Shearing Resistance, ° (ϕ´)	Effective Cohesion, kPa (c´)	Bulk Density kN/m^3
Cefn Formation	60^o	20	26
Tarannon Mudstone (quarried)	60^o	20	26
Cefn Formation scree	34^o	0	16
Tarannon Mudstone (quarried) scree	34^o	0	20

Notes:

- The angle of shearing resistance for the bedrock is taken from BS 6031
- The angle of shearing resistance for the scree is taken as the approximate angle of the current scree slopes
- The bulk density of the materials is taken from laboratory unconfined compressive strength (UCS) and shear box tests of scree and rock samples taken on site.

Laboratory test results may be found in **Annex C**.

5.2.2 Groundwater

The scree material was found to be damp upon the surface following periods of wet weather. Due to its loose consistency, on-going stability and absence of any localised water-formed erosive features it may be assumed that this material is free-draining enabling it to maintain a stable 34° the slope. A water table has therefore not been applied to the model.

5.2.3 Factor of Safety

The programme assesses multiple failure circles rotating about centre points within the predetermined grid.

The minimum acceptable factor of safety applied is 1.3 to the model. Slopes with slip circles that have a factor of safety greater than 1.3 are considered sufficiently stable that a slip is unlikely to occur.

Any slope with a factor of safety less than 1 is considered to be unstable. The minimum acceptable factor of safety is 1.3.

Slips achieving a factor of safety of between 1 and 1.3 although unlikely, are considered to have the potential to occur.

5.2.4 Assessment Results

Analysis of the northwest quarry face was carried out across three cross-sections of the slope, along the section lines illustrated in **Figure 4.4**.

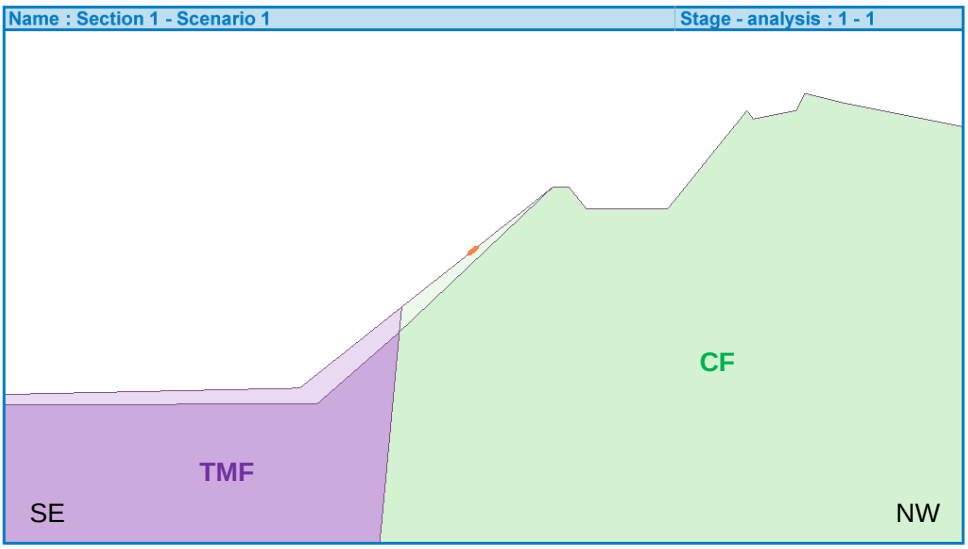
The slope is divided part-way up by a level cut, and any future weathering and creation of scree on the upper slope above this would not be expected to affect the lower slope. The lower slope only is therefore considered in the assessment.

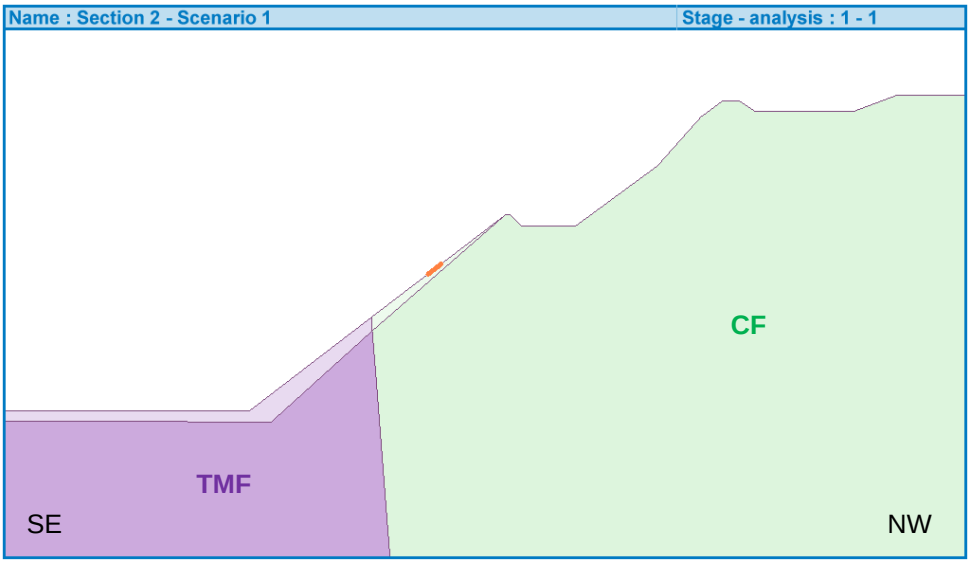
The model is run several times, with variation in the applied potential slip plane.

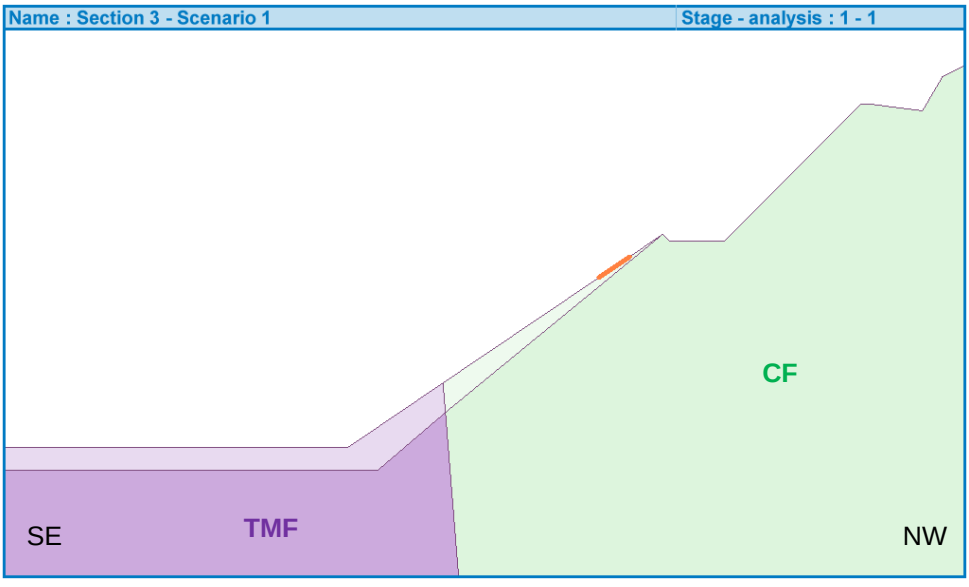
Examples of the output of the analysis for the different model runs are illustrated in **Sections 5.2.4.1 and 5.2.4.2**. The failure slip circle with the lowest factor of safety identified are illustrated in orange on each model run.

5.2.4.1 Scenario 1

The scree thickness has been set as a few metres thick at its base, thinning towards the top (light shading).

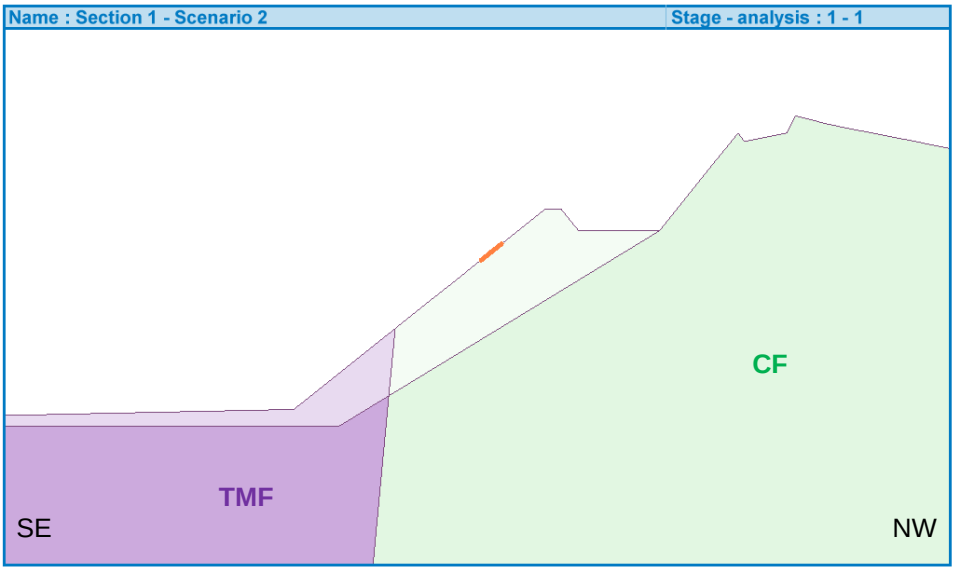


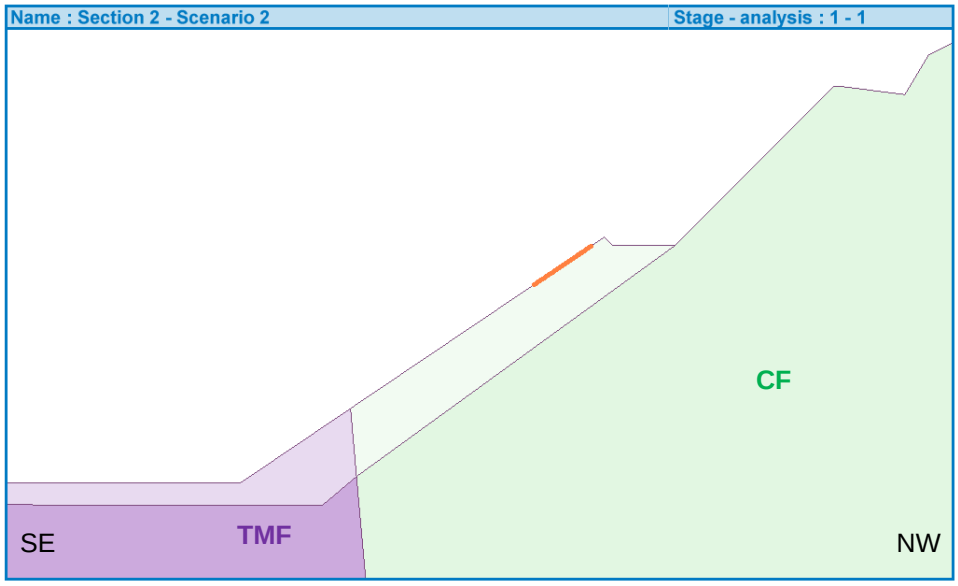


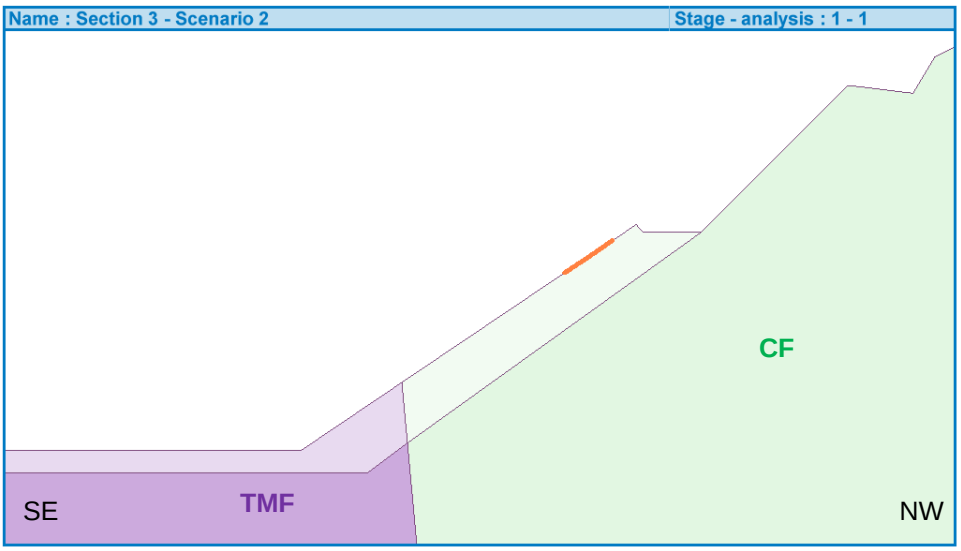


5.2.4.2 Scenario 2

The scree (light shading) thickness has been increased significantly to include the terrace above.







5.2.4.3 Conclusions of Geo5 Assessment

The resultant factors of safety calculated for the most unstable circles are listed in **Table 5.2**.

Table 5.2 Lowest Calculated Factors of Safety

Analysis Run	Factor of Safety
Section 1 – Scenario 1	0.84 – 0.85
Section 1 – Scenario 2	0.84 – 0.85
Section 2 – Scenario 1	0.87 – 0.88
Section 2 – Scenario 2	0.87 – 0.88
Section 3 – Scenario 1	1.0
Section 3 – Scenario 2	1.0

These results confirmed that the degree of weathering and the thickness of the scree has no bearing on the stability of the existing 34° slope.

The analyses found the lowest factor of safety values for Section 1 and Section 2 analyses to fall below 1.0, signifying that the slopes are unstable.

Section 3 achieved a factor of safety of 1.0. This suggests the slope is stable and that the potential for slips is very low.

However, as the analyses sections show, the low factors of safety are actually attributed to superficial slips on the surface of the scree slopes and not significant failures.

Please refer to **Section 6** for recommendations for maintaining future stability of the northwest quarry slope.

The TBMF, on the opposing side of the quarry where the new slope face will be created, is deemed to have the same geotechnical properties as the CF and TMF. For this reason, this strata may be expected to behave in an identical way, naturally weathering to a slope of 34°, at which angle any slope instability may be expected to be minor.

5.3 Stereonet Assessment

The new south-eastern side of the development area upon development will be within the TBMF and align northeast-southwest at an orientation of 59.5° (239.5°), 84.63° (264.63°), 84.23° (264.23°) and 10° (190°) and dip towards the northwest.

For assessment the natural dip angle of repose of the strata has been taken to be 34°.

The maximum recommended angle of cut/slopes for the mudstone/shale is 60°. This is the angle of shearing resistance (ϕ´), and this value is taken from BS 6031:1009 Code of Practice for Earthworks, Table 3.

Based on the proposed orientation of the new development footprint, stereonets were produced for the following scenarios:

- 190 orientation, 34° dip (190/34)
- 190 orientation, 60° dip (190/34)
- 240 orientation, 34° dip (240/34)
- 240 orientation, 60° dip (240/60)
- 265 orientation, 34° dip (265/34)
- 265 orientation, 60° dip (265/60)

Please refer to **Annex E** for the stereonet projections. Both 2D and 3D views are provided.

The planes of the above slope profiles are shown in red.

The bedding planes are shown in green and fracture/joint places in blue.

The stereonets were utilised to determine the risk from plane, toppling failure and wedge.

The typical angle of friction of the rock fracture/joint surfaces is applied to the assessment. This is the extent to which the rock can withstand shear stress before failure.

A fracture/joint surface friction angle of 27° has been used for the TBMF, the value for a shale or mudstone/marl, as quoted in publication Rock Slope Engineering, Table 4.1.

5.3.1 Potential for Plane Failure

It is intended that the new south-eastern quarry face will dip towards the northwest on a 190°, 240° and 85° alignment.

The strata on site follow a similar broadly northeast-southwest alignment between 052° (232) and 068° (248) but dip towards the southeast.

Due to these opposing directions there is no opportunity for plane failure.

5.3.2 Potential for Toppling Failure

The proposed slope profiles were compared against recorded bedding planes.

Where poles to the bedding surfaces lie within the toppling failure window a risk from toppling is recognised. The toppling failure window is defined at 27° (angle of friction for fracture surfaces) from the slope plane.

A high potential for toppling failure on a new slope configuration of 240/60 is indicated.

A low risk from toppling was identified for a 240/34 slope.

For a slope cut at 265/60 no risk from toppling failure has been identified but recorded bedding data fall close to the toppling failure window.

There is no risk of toppling failure for the slope cut at 190/34 or 190/60.

5.3.3 Potential for Wedge Failure

The proposed slope profiles were compared against measured fracture/joint planes.

Sliding can occur where the plunge of the line of intersection between two joints or fractures exceed the angle of internal friction of the fracture/joint plane.

A very low risk was identified for a slopes cut at a dip of 34° because the failure window is very small.

Given the steepness of the 60° slopes a much a larger fracture window is defined for all three slope face orientations, illustrating that more fracture/joint planes would be exposed upon the slope face.

5.3.4 Conclusions of Stereonet Assessment

The assessment has shown that new slopes cut at 34° are at low risk from failure. This is especially so as the rock is known to naturally degrade to a natural angle of repose of 34°.

A slope of 240/60 is a high risk from both toppling and wedge failure.

For a slope of 265/60 wedge failure can be expected, but toppling failure is unlikely to occur.

For a slope of 190/60 wedge failure can be expected, but toppling failure will not occur.

SECTION 6 Recommendations For Slope Stability

6.1 Northwest Quarry Face

The Geo5 slope stability modelling on the existing scree slopes identified a risk of low-scale localised surface failures only. Any such failures are not expected to compromise the overall stability of the quarry face.

The exposed rock outcrops higher up the quarry face will continue to degrade with the effects of weathering. However, all new scree material will degrade to the same 34° angle of repose. It will also predominantly accumulate on current trackways/breaks or slope mid-way up the quarry face, above the lower slope sections analysed. The likelihood of any rock falls is considered extremely low; no evidence of any previous rock falls have been identified or recorded.

It is recommended that to protect the new development against any such minor scree slips or rogue rock falls that a 3m buffer zone be assigned between the base of the existing quarry face and edge of the new development area.

The buffer zone should comprise a shallow trench and a catch fence. Any unwanted materials can then be removed periodically as part of a maintenance contract.

6.2 New Southeast Face

Taking the footprint of the new development in to account and the above requirement for a 3m buffer zone along the northwest edge of the development area, the position of the proposed development area has been set to align northeast-southwest at an orientation of 59.5° (239.5°), 84.63° (264.63°) and 84.23° (264.23°) and dip towards the northwest.

The angle that the new face is cut to will directly determine the volume of rock to be extracted. It will also have an impact on the resultant area of the remainder of quarry land above and southeast of the new development area.

The degree of any slope stabilisation is dependent on the angle of the new slope.

A stereonet assessment was performed for the strata at a proposed slope angle of 34° or 60°. An angle of 34° is deemed to be that at which the strata will naturally attain through if left exposed. This is the steepest angle slope to require the minimum protection measures. An angle of 60° is considered the steepest angle at which the slope may be safety stabilised for long term integrity. A steeper slope will keep the volume of rock to be extracted to a minimum but will present the need for greater and more extensive slope stabilisation.

Any material extracted will be re-used on site where possible, and the remainder taken off site. There are implications for managing storage and movement of a large volume materials on site. Taking material away also presents logistical organisation and environmental concerns.

Design of development should not encroach at any point upon the nearby SSSI.

During creation of the new slopes inspection should be carried out where the geological faults are identified by a geotechnical engineer or proprietary specialist and any necessary localised dental work carried out to stabilise individual sections.

6.2.1 34 Degree Slope

Slope stability assessment has confirmed that at 34° the TBMF may be expected to stable, with minor risk of slippages once extensive weathering of the newly exposed rock surface has occurred.

Stereonet analysis has identified a very low risk wedge failure for a slope cut at 34° and a low risk for topping failure of a slope cut to 240/34.

Based on the above, there are two options for a 34° slope.

1. Assign a 3m buffer zone comprising a shallow trench between the development area and new base of slope and install a catch /debris barrier on the edge of the development area. The barrier will ensure any stray debris is managed and prevented from entering the development area. The most suitable barrier should be recommended by a specialist.

   Appropriate drainage measures should be installed within the base of the trench. No further stability mitigation or stabilisation measures required.

2. Cut a 34° slope from the edge of the development area and apply slope protection in the form of erosion control measures. This will act to minimise surface weathering and prevent degradation that could lead to wedge or toppling failure.

   Erosion control in its simplest form would comprise a passive drapery system whereby a high tensile steel mesh is used to provide a curtain, beyond which falling rock cannot pass. Upon detachment from the face, the loose rock will impact on the mesh curtain and then rebound on the rock face, each time dissipating energy and preventing high velocities from developing.

   Drapery systems utilise bolts at the crest and optionally at the toe of the rock face.

   The fallen materials can then be removed from the preformed trench at the base of the cliff.

Slope stabilisation design and management should be performed by a specialist.

6.2.2 60 Degree Slope

Stereonet analyses have shown that at 60° the rock will not remain stable unless stabilisation measures are introduced. Stabilisation should be achieved by:

1. Assign a 5m buffer zone comprising a shallow trench between the development area and new base of slope and install a catch fence on the edge of the development area. Appropriate drainage measures should be installed within the base of the trench.
2. Creation of the slope in two sections, stepped mid-way by a 5m long shelf. A drain should be installed along the base of the upper slope section.
3. Stabilisation of all 60° slopes with appropriate ground anchors or soil nails/bolts combined with rock netting to retain any loose debris. Erosion control may also be incorporated.

Slope stabilisation design and management should be performed by a specialist.

6.2.3 Other Slope Configurations

Depending on economical restrictions and management of slope excavation it may be preferable to create an alternative slope.

Creation of a slope greater between 34° and 60° is not recommended as slope stabilisation measures will be required.

A combination of a 34° and 60° would however be feasible, with a lower 34° and upper fully stabilised 60° slope, separated by a mid-way step with appropriate drainage.

SECTION 7 Earthworks

7.1 General

Upon development the excavated rock material is to be retained on site where possible. This will include filling the current quarry bottom from approximately 88 - 89AOD to 95AOD.

Some filling on land southeast of the quarry is also intended.

During site works representative bulk samples of each of the three main strata were taken for laboratory geotechnical property testing.

Samples 1 and 2 were taken from the Tarannon Mudstone. Sample 3 was taken from the Cefn Formation. Samples 4, 5 and 6 represent the Trewern Mudstone Formation.

It should be noted that the samples tested represent weathered materials that could be retrieved at or close to the surface.

Test certificates may be found in **Annex F**.

7.2 Slake Durability Testing

Slake durability testing may be used to understand how susceptible rock may be to degradation when subject to weathering processes such as wetting and drying and freezing and thawing cycles. This is particularly important with respect to mudstones and shales.

Slake durability test results are compared to Gamble's Slake Durability Classification

Table 7.1 Slake Durability Test Results

Sample	Strata	% retained after one 10 min cycle	Durability Classification	% retained after two 10 min cycles	Durability Classification
S1	TMF	88	Medium	76	Medium
S2	TMF	88	Medium	75	Medium
S3	CF	96	Medium High	93	Medium High
S4	TBMF	93	Medium	88	Medium High
S5	TBMF	94	Medium	89	Medium High
S6	TBMF	91	Medium	88	Medium High

The samples used for testing comprised weathered rock (although not as weathered as the exposed scree materials) and results for more competent undisturbed rock may be expected to show the rock to be more durable.

7.3 Grading Analysis

All our samples were tested in the laboratory by dry and wet sieving analysis to determine their grading characteristics. These tests were conducted in accordance with BS1377: Part 2, Clause 9.2: 1990.

Based upon the soil property test results, and referring to Table 6/1: Acceptable Earthworks Materials: Classification and Compaction Requirements and Table 6/2: Grading Requirements for Acceptable Earthworks Materials, of the 'Series 600 Specification for Highway Works', the samples can be classified as:

Table 7.2 Grading Analysis Results and Soil Classification

Sample	Strata	Type (Table 6/2)	Classification (Table 6/1)
S1	TMF	1A	Well graded granular material Compaction Method 2
S2	TMF		
S3	CF		
S4	TBMF		
S5	TBMF		
S6	TBMF		

A 1A classification assumes a maximum particle size of 300mm. Please note that on removal, how the rock will fragment will be governed largely by the bedding and fracture planes and the way it is extracted.

Segments larger than 300mm are likely to be retrieved, particularly with depth where the competency of the rock increases.

Where this occurs, the rock should be crushed to conform with a 1A particle size classification or re-classified and the appropriate compaction method determined.

7.4 Compaction Specification

Compaction should be undertaken in accordance with Table 6/4: Method Compaction for Earthworks Materials: Plant and Methods of the 'Series 600 Specification for Highway Works', as summarised in **Table 7.3**

The minimum number of passes, 'N', is the minimum number of times that each point on the surface of the layer being compacted should be traversed by the compaction plant, in its operating mode 'D' is the maximum depth of the compacted layer.

Table 7.3 Compaction Method

Plant Type		Plant Type	
Smooth Wheeled Roller	D = 125mm 2100-2700kg N = 8 2700-5400kg N = 6 D = 150mm >5400kg N = 4	**Grid Roller**	D = 125mm 5400-8000kg N = 12 D = 150mm >8000kg N = 12
Dead Weight Tamping Roller	D = 150mm 4000-6000kg N = 12 D = 200mm >6000kg N = 12	**Pneumatic Tyred Roller**	D = 125mm 2000-2500kg N = 12 2500-4000kg N = 10 4000-6000kg N = 10 D = 150mm 6000-8000kg N = 8 8000-12000kg N = 8 D = 175mm >12000kg N = 6

Please refer to Series 600 Specification for Highway Works for specifications for alternative plant.

Compaction should be undertaken in accordance with Table 6/1 and 6/4, as soon as practicable after deposition.

Where combinations of different types or categories of plant are used, the depth of the layer should be for the type of plant requiring the least depth of layer, and the number of passes should be that for the type of plant requiring the greatest number of passes.

Earthmoving plants are not recommended for use as compaction plant, nor are lighter categories of plants used to provide preliminary compaction to assist the use of heavier plant.

The maximum particle size of any fill material should not exceed more than two thirds of the compacted layer thickness. Any larger fragments should be crushed or removed prior to use.

The stability of excavations or fills should not be compromised by the location of stockpiled materials or use of plant or location of temporary buildings/structures.

All earthworks must be kept free of water including arranging for the rapid removal of water, water shed onto the earthworks and water entering the earthworks from any source.

7.4 Compaction Specification (Continued)

All exposed fill surfaces must be adequately weather proofed during inclement weather or at the end of the working day/compaction process.

Any exposed cohesive fill that becomes wet and slurrified due to water ingress or weather erosion must be stripped off, spread into thin layers and aerated. The fill should then be re-compacted.

Plant movement across compaction layers should be restricted to that plant necessary for its deposition, spreading and compaction.

Fill areas should be constructed evenly over their full width and their fullest possible extent and the contractor should control and direct constructional plant and other traffic uniformly over them. Damage by construction plant should be made good with material having the same characteristics and strength as the material had before it was damaged.

Where fill is to be placed against an existing slope, the existing slope should be cut and benched before placing the fill.

It is recommended that a number of in-situ plate load tests be performed throughout the earthworks and at the final finished level, particularly beneath any proposed buildings or the access road. This is to confirm the the compaction works have been carried out satisfactorily.

The earthworks should be supervised by a suitably qualified engineer.

The tests should be conducted in accordance with BS 1377: Part 9: 1990 under the supervision of a qualified geotechnical engineer.

Allowances should also be made for the removal of soft spots and their replacement with imported suitable selected inert granular materials or suitable inert site won materials.

ANNEX A
Probehole Logs

terrafirma

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH1
Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326725.45 - 310068.78	Hole Type RC
Location:	Buttington, Welshpool		Level:	88.71	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	17/10/2018 - 18/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
▼	0.00 - 1.00		34	50	34					Weak thickly laminated to thinly bedded dark reddish brown locally greenish grey MUDSTONE *Fractures are 10°- 40° closely spaced undulating smooth. Locally stained orangish brown*
	1.00 - 2.50		83	90	83					*Fracture: 40° undulating smooth. Stained orangish brown.* *Fracture: 30° undulating smooth. Stained orangish brown.*
	~~2.50~~	C								
	2.50 - 4.00		93	93	93					*Fracture: 10° planar smooth* *Fracture: 10° planar smooth*
	3.60	C								
	3.75	C								*Fracture: 20° planar smooth. Stained orange brown.*
	4.00 - 5.50		88	93	88					*Fracture: 10° planar smooth* *Fracture: 30° undulating smooth* *Fracture: 30° undulating smooth*
	5.50 - 7.00		88	93	88					*Bedding Fracture: 85° planar polished with rare pyrite mineralisation*
	7.00 - 8.50		100	100	100					*Fracture: 10° planar smooth* *Bedding Fracture: 85° planar polished* *Fracture: 50° undulating rough*
	~~8.50~~	C								
	8.50	C								
	9.00	C								
	8.50 - 10.00		98	98	98					*Fracture: 5°planar rough* *Fracture: 5°planar rough* *Fracture: 5°planar rough*

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH1
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326725.45 - 310068.78	Hole Type RC
Location:	Buttington, Welshpool		Level:	88.71	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	17/10/2018 - 18/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	10.00 - 10.85		87	94	87					Weak thickly laminated to thinly bedded dark reddish brown locally greenish grey MUDSTONE *Fracture: 15°planar smooth*
	10.85 - 12.35		100	100	100					*Bedding Fracture: 75°planar smooth*
	12.35 - 13.85	C	90	90	90					*Fracture: 20°planar rough* *Fracture: 20°planar smooth* *Bedding Fracture: 75°planar polished*
	13.00 13.50	C				13.85	74.86			End of Borehole at 13.850m

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH2**
Sheet 1 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Made ground over very weak mudstone
						1.00	110.92			
	1.00 - 2.00		100	0	0					Weak brownish grey MUDSTONE. Fractures are very closely to closely and occasionally medium spaced 10° - 45° planar smooth. Stained orangish brown *Fracture: 75° planar smooth* *Fracture: 70° planar smooth* *Fracture: 75° planar smooth*
	2.00 - 3.40		100	0	0					*Fracture: 75° planar smooth* *Bedding Fracture: 80° planar rough* *Fracture: 70° planar smooth. Slight orangish brown staining* *Bedding Fracture: 80° planar smooth. Stained orangish brown.*
	3.40 - 4.80		100	9	9					*Bedding Fracture: 80° planar smooth* *Fracture: 75° planar smooth*
						4.80	107.12			
	4.80 - 6.20 5.80	C	100	64	45					Weak grey MUDSTONE. Fractures are very closely to medium spaced 10° - 45° planar smooth *Bedding Fracture: 80° planar smooth*
						6.20	105.72			
	6.20 - 7.60		100	43	43					Weak grey MUDSTONE. Graptolite fossils *Bedding Fracture: 80° planar smooth*
						7.30	104.62			
	7.60 - 9.00 8.50	C	100	78	78					Weak grey MUDSTONE. Fractures are very closely to medium spaced 10° - 45° planar smooth *Bedding Fracture: 85° planar infilled with 2cm thick layer of light grey very stiff clay with mudstone lithorelics*
	9.00 - 10.40		100	100	100					*Fracture: 55° planar smooth*

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH2**
Sheet 2 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak grey MUDSTONE. Fractures are very closely to medium spaced 10° - 45° planar smooth
	10.40 - 11.80		100	91	91					*Bedding Fracture: 85° planar smooth* *Bedding Fracture: 85° planar smooth* *Fracture: 55° planar smooth*
	11.80 - 13.20		100	100	96					*Fracture: 45° planar smooth, stained orangish brown* *Fracture: 65° planar smooth*
	13.20 - 14.60		100	100	88					*Fracture: 65° planar smooth* *Fracture: 65° planar smooth*
	14.60 - 16.00		100	91	86					*Fracture: sub-vertical planar smooth*
	16.00 - 17.40		86	80	0					*Bedding Fracture: 80° planar to curved smooth*
	17.40 - 18.80		93	93	93					*Bedding Fracture: 85° planar smooth with thin veneer of light grey clay infill* *Very soft grey CLAY*
	18.80 - 20.20		100	89	78					*Bedding Fracture: 85° planar smooth infilled with 1cm stiff grey clay*

11 12 13 14 15 16 17 18 19 20

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH2
Sheet 3 of 5

Project Name: Buttington Quarry	Project No. 14880	Co-ords: 326754.17 - 310026.87	Hole Type RC
Location: Buttington, Welshpool		Level: 111.92	Scale 1:50
Client: Broad Energy (Wales) Limited		Dates: 30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak grey MUDSTONE. Fractures are very closely to medium spaced 10° - 45° planar smooth
	20.20 - 21.60		100	84	83					
	21.60 - 23.00		73	71	52					*Fracture: 50° planar smooth*
	23.00 - 23.80		100	84	65					*Very soft grey CLAY*
	23.80 - 25.10		100	64	53	23.70	88.22			Weak becoming medium strong dark grey MUDSTONE. Fractures are closely to very closely and occasionally widely spaced 5° - 20° planar smooth. Many closed but mineral fill fractures. *Bedding Fracture: 85° planar smooth with 0.5cm veneer of light grey stiff clay* *Fracture: 5° planar smooth* *Fracture: sub-vertical curved smooth* *Fracture: 5° planar stepped* *Fracture: 10° planar smooth with partial mineralisation*
	25.10 - 26.60		96	83	83					
	26.60 - 28.10		95	95	84					
	28.10 - 29.60		100	100	100					

21 22 23 24 25 26 27 28 29 30

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH2
Sheet 4 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	29.60 - 30.40		100	71	64					Weak becoming medium strong dark grey MUDSTONE. Fractures are closely to very closely and occasionally widely spaced 5° - 20° planar smooth. Many closed but mineral fill fractures.
	30.40 - 31.60		87	71	71					*Bedding Fracture: 85° 3cm infilled with light grey clay*
	31.60 - 32.90		100	100	89					
	32.90 - 34.40		100	86	76					
	34.40 - 35.80		100	199	71					
	35.80 - 37.25		100	199	26	35.50	76.42			Medium strong to strong grey MUDSTONE. Fractures are close to medium spaced 5° - 35° planar smooth to occasional undulating rough. Inconsistent and random patches of mineralisation. *Bedding Fracture: 80° planar polished. Some mineralisation paralleling fracture plane* *Bedding Fracture: 70° planar polished*
	37.25 - 38.65		100	199	57					*Bedding Fracture: 70° 1mm mineral infill* *Fracture: 60° planar rough* *Fracture: 60° planar rough* *Fracture: 65° planar smooth* *Fracture: 65° planar smooth* *Bedding Fracture: 75° planar rough*
	38.65 - 40.05		100	78	78					

31 32 33 34 35 36 37 38 39 40

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH2
Sheet 5 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326754.17 - 310026.87	Hole Type RC
Location:	Buttington, Welshpool		Level:	111.92	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	30/10/2018 - 07/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	40.05 - 41.50		96	96	78					Medium strong to strong grey MUDSTONE. Fractures are close to medium spaced 5° - 35° planar smooth to occasional undulating rough. Inconsistent and random patches of mineralisation.
										Bedding Fracture: 75° planar rough
	41.50 - 43.00		100	37	37					*Bedding Fracture: 85° planar smooth with thin veneer of brown clay*
										Bedding Fracture: 80° planar rough with 2mm mineralised infill
	43.00 - 44.50		96	96	93	43.45	68.47			End of Borehole at 43.000m
	44.50 - 46.00		100	100	80					
	46.00 - 47.00		47	47	39					

41 42 43 44 45 46 47 48 49 50

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH3
Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326792.28 - 310009.40	Hole Type RC
Location:	Buttington, Welshpool		Level:	112.23	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	08/11/2018 - 09/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey very gravelly CLAY
						1.00	111.23			
	1.00 - 2.50		60	0	0					Very weak brownish grey MUDSTONE. Recovered non-intact.
	2.50 - 4.00		30	0	0					
	4.00 - 5.00		80	0	0					
	5.00 - 6.30		92	0	0	5.70	106.53			
										Weak grey MUDSTONE. Fractures are very closely to closely spaced 35° - 50° planar rough. Some stained orangish brown.
	6.30 - 7.80		86	7	0					*Fracture: 70° planar rough*
										Bedding Fracture: 70° - 85° undulating smooth
	7.80 - 9.20		88	0	0					*Bedding Fracture: 85° 2cm wide infilled with stiff orange brown clay and some partial mineralisation*
						9.30	102.93			
	9.20 - 10.70		93	85	35					Weak grey MUDSTONE. Fractures are closely to medium spaced.
										Fracture: 50° curved smooth. Stained orangish brown.

Remarks:

terrafirma

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH3
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326792.28 - 310009.40	Hole Type RC
Location:	Buttington, Welshpool		Level:	112.23	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	08/11/2018 - 09/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak grey MUDSTONE. Fractures are closely to medium spaced.
	10.70 - 12.20		100	20	20					*Bedding Fracture: 80° planar smooth. Stained orangish brown.*
	12.20 - 13.70		90	21	21					*Fracture: 50° planar smooth. Stained orangish brown.*
	13.70 - 15.20		100	63	63					*Fracture: 25° planar smooth. Stained orangish brown.*
	15.20 - 16.70		100	68	64					*Fracture: 5° planar smooth. Stained orangish brown.*
	16.70 - 18.10		100	100	100					*Fracture: 65° planar smooth. Stained orangish brown.*
										Fracture: 20° planar smooth. Stained orangish brown.
										Fracture: 75° curved smooth. Stained orangish brown.
										Fracture: 10° planar smooth. Stained orangish brown.
										Bedding Fracture: 75° planar rough. Stained orangish brown.
										Fracture: 60° planar smooth. Stained orangish brown.
										Bedding Fracture: 80° planar smooth. Stained orangish brown.
										Fracture: 75° planar smooth. Stained orangish brown.
										Fracture:: Sub-vertical curved. Stained orangish brown.
										Fracture: 20° planar rough. Stained orangish brown.
										Bedding Fracture: 80° undulating smooth. Stained orangish brown.
										Fracture: 60° planar smooth. Stained orangish brown.
										Bedding Fracture: 85° undulating smooth. Stained orangish brown.
										Fracture: 55° undulating rough. Stained orangish brown.
										Fracture: 25° planar smooth. Stained orangish brown.
										Fracture: 15° planar smooth.
										Fracture: 75° planar smooth. Stained orangish brown.
										Fracture: 60° undulating rough. Stained orangish brown.
										Fracture: 65° planar smooth. Stained orangish brown.
										Fracture: 25° planar smooth. Stained orangish brown.
										Fracture: 55° planar smooth.
										Fracture: 30° planar smooth.
						18.10	94.13			*Fracture: 40° planar smooth.*
										Fracture: 45° planar smooth.
										Fracture: 55° planar smooth.
										Fracture: 55° planar smooth.
										Fracture: 70° planar smooth.
										Fracture: 15° planar smooth.
										Fracture: 60° undulating rough.
										Fracture: 40° undulating rough..
										Fracture: 35° planar smooth.
										Fracture: 55° planar smooth.
										Fracture: 15° planar smooth.
										End of Borehole at 18.100m

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH4** Sheet 1 of 4

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326864.51 - 310105.86	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.35	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	12/11/2018 - 15/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey gravelly CLAY grading in to weathered mudstone
						1.00	113.35			
	1.00 - 2.50		24	0	0					Weak grey MUDSTONE. Fractures are closely spaced 5° - 40° planar rough to planar smooth, often stained orangish brown. Sub-vertical fracture planar smooth from 1.0m to 2.6m depth.
	2.50 - 4.00		100	0	0					*Bedding Fracture: 75° planar rough. Stained orangish brown. Graptolite fossils visible on bedding surface.* *Bedding Fracture: 85° planar smooth. Stained orangish brown.*
	4.00 - 5.50		100	33	23					*Fracture: 80° - 90° curved rough. stained orangish brown.*
						5.00	109.35			Weak grey MUDSTONE. Fractures are close to medium spaced 10° - 20° planar smooth, stained orangish brown.
	5.50 - 6.80		100	77	38					*Fracture: 60° planar smooth. Stained orangish brown.* *Fracture: 60° planar rough. Stained orangish brown.* *Fracture: 65° planar smooth.* *Fracture: 75° undulating smooth.*
	6.80 - 8.30		100	70	62					
	8.30 - 9.50		100	16	16					*Bedding Fracture: 85° undulating rough with slight stiff light grey clay fill in places*
	9.50 - 10.00		80	80	80					
						10.00	104.35			

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH4
Sheet 2 of 4

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326864.51 - 310105.86	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.35	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	12/11/2018 - 15/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										MUDSTONE

11
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Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH4
Sheet 3 of 4

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326864.51 - 310105.86	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.35	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	12/11/2018 - 15/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										MUDSTONE
	25.00 - 26.50		24	23	21	25.00	89.35			Weak dark grey MUDSTONE. Fractures are widely but sometimes closely spaced. Graptolite fossils *Fracture: 15° planar smooth.*
	26.50 - 28.00		93	93	87					

21 22 23 24 25 26 27 28 29 30

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH4
Sheet 4 of 4

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326864.51 - 310105.86	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.35	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	12/11/2018 - 15/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak dark grey MUDSTONE. Fractures are widely but sometimes closely spaced. Graptolite fossils
	31.20 - 32.50		88	88	88					*Fracture: 15° undulating rough*
	37.00 - 37.85		52	52	52					*Fracture: 30° planar smooth.*
	37.95 - 39.45		96	96	90					*Fracture: 30° planar smooth.*
						39.45	74.90			*Fracture: 10° planar smooth.* *Fracture: 10° planar smooth.* End of Borehole at 39.450m

31 32 33 34 35 36 37 38 39 40

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terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH5** Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326896.01 - 310052.91	Hole Type RC
Location:	Buttington, Welshpool		Level:	118.22	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	29/10/2018 - 29/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey very gravelly CLAY grading into very weak mudstone
						1.00	117.22			
	1.00 - 2.10		91	0	0					Very weak brownish grey MUDSTONE retrieved mostly non-intact. Some preserved very closely spaced fractures 5° - 15°. *Fracture: 50° planar smooth infilled with 1cm band of light grey clay*
	2.10 - 3.30		96	0	0					
	3.30 - 4.60		100	0	0	4.00	114.22			Weak grey MUDSTONE. Fractures are very closely to medium spaced 25° - 45° planar smooth to planar rough. Some fracture planes stained orangish brown. *Fracture: 35° planar smooth 1mm mineralised infill*
	4.60 - 5.80		100	0	0					*Fracture: 70° planar smooth*
	6.00 5.80 - 7.30	C	90	40	32					*Three sub-vertical fractures planar smooth stained orangish brown*
	7.30 - 8.80		93	0	0					*Fracture: 70° - 85° curved to planar smooth. Stained orangish brown.* *Three sub-vertical fractures planar smooth stained orangish brown* *Fracture: 80° planar smooth. Stained orangish brown.*
	8.80 - 10.30 9.50	C	26	21	21	8.80	109.42			*Fracture: 80° planar smooth. Stained orangish brown.* Weak grey MUDSTONE. Fractures are closely to medium spaced 15° - 30° planar smooth to occasionally undulating smooth, often stained orangish brown. 9.23 - 17.6m numerous 45° closed <1.5mm thick mineralised fractures

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH5** Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326896.01 - 310052.91	Hole Type RC
Location:	Buttington, Welshpool		Level:	118.22	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	29/10/2018 - 29/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak grey MUDSTONE. Fractures are closely to medium spaced 15° - 30° planar smooth to occasionally undulating smooth, often stained orangish brown. 9.23 - 17.6m numerous 45° closed <1.5mm thick mineralised fractures
	10.30 - 11.80		93	33	33					*Fracture: Sub-vertical curved to planar smooth. Stained orangish brown.*
										Fracture: 57° planar rough
										Fracture: 65° planar rough
	11.80 - 13.30		93	45	45					*Fracture: 45° closed <1mm thick mineralised*
	13.30 - 14.00 14.80	C	100	44	40					*Fracture: 65° planar smooth*
										Fracture: Sub-vertical planar to curved smooth
	15.40 14.80 - 16.30	C	96	45	26					
	16.30 - 17.80		100	66	66					
						17.80	100.42			End of Borehole at 17.800m

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH6
Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326901.08 - 310180.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	89.17	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	16/10/2018 - 17/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	0.00 - 1.00		63	6	0					Weak dark reddish brown locally light greenish grey MUDSTONE *Fractures are closely spaced 30° - 40° undulating rough. Stained orangish brown.*
	1.00 - 2.50		88	5	0					
	2.50 - 4.00		86	56	54					*Fracture: 10° undulating rough* *Bedding Fracture: 85° planar smooth*
	3.60	C								*Fracture: 15° undulating rough* *Fracture: 65° undulating smooth*
	4.00 - 5.50		94	94	94					
	5.00	C								*Fracture: 10° planar rough* *Fracture: 45° undulating smooth*
	5.50 - 7.00		92	92	92					*Fracture: 65° undulating smooth* *Fracture: 45° planar smooth*
	7.00 - 8.50		93	93	93					*Fracture: 10° planar smooth*
	~~8.50~~	C								*Fracture: 60° undulating rough* *Fracture: 15° undulating smooth*
	9.00	C								*Fracture: sub-horizontal planar smooth*
	8.50 - 10.00		94	70	64					*Fracture: 55° undulating smooth* *Bedding Fracture: 85° planar smooth*
										Fracture: 20° planar smooth

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Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH6
Sheet 2 of 2

Project Name: Buttington Quarry	Project No. 14880	Co-ords: 326901.08 - 310180.50	Hole Type RC
Location: Buttington, Welshpool		Level: 89.17	Scale 1:50
Client: Broad Energy (Wales) Limited		Dates: 16/10/2018 - 17/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	10.00 - 11.50	C	92	78	78	14.00	75.17			Weak dark reddish brown locally light greenish grey MUDSTONE *Fracture: 45° undulating rough* *Fracture: 75° undulating smooth* *Fracture: 15° undulating smooth* *Fracture: 65° undulating smooth* *Bedding Fracture: 80° undulating rough*
	11.50 - 13.00		93	93	84					*Fracture: 35° undulating smooth* *Fracture: 40° undulating smooth* *Fracture: 75° undulating rough* *Fracture: 65° undulating rough*
	13.00 - 14.00		97	74	74					*Fracture: 40° undulating rough*
										End of Borehole at 14.000m

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH7**
Sheet 1 of 3

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326691.47 - 310125.99	Hole Type RC
Location:	Buttington, Welshpool		Level:	110.52	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	15/11/2018 - 19/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
						1.00	109.52			Grey gravelly CLAY grading in to weathered mudstone
	1.00 - 1.75		93	93	58					Extremely weak dark grey MUDSTONE. Fractures are very closely to closely spaced 25° - 45° undulating smooth and polished stained orangish brown *Fracture: 65° planar rough. Stained orangish brown.* *Fracture: 60° planar rough. Stained orangish brown.*
	3.00 - 3.25		100	100	29					
	3.25 - 4.25		90	90	28	3.85	106.67			*Bedding Fracture: 85° planar rough. Stained orangish brown.* Non Intact: Weak laminated MUDSTONE and SILTSTONE retrieved as fine to coarse angular gravel
	4.25 - 5.75		99	99	0	5.05	105.47			Extremely weak grey MUDSTONE. Fractures are very closely to closely spaced 25° - 45° undulating striated and polished stained orangish brown *Fracture: 70° undulating polished and striated*
	5.75 - 7.15		68	0	0	6.45	104.07			Non Intact: Weak laminated MUDSTONE and SILTSTONE retrieved as fine to coarse angular gravel
	7.15 - 8.15		83	15	15	7.15	103.37			Extremely weak grey MUDSTONE. Fractures are close to medium spaced 15° - 45° undulating striated and polished *Fracture: 80° undulating rough* *Fracture: 70° undulating polished and striated*
	8.15 - 9.65		95	0	0					*Bedding Fracture: 80° planar rough*
						9.65	100.87			Non Intact: Weak laminated MUDSTONE and SILTSTONE retrieved as fine to coarse

1 2 3 4 5 6 7 8 9 10

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH7** Sheet 2 of 3

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326691.47 - 310125.99	Hole Type RC
Location:	Buttington, Welshpool		Level:	110.52	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	15/11/2018 - 19/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	9.65 - 10.75		70	40	27	10.75	99.77			Non Intact: Weak laminated MUDSTONE and SILTSTONE retrieved as fine to coarse angular gravel
	10.75 - 12.25		66	23	0					Extremely weak grey MUDSTONE. Fractures are very close to medium spaced 35° - 60° undulating striated and polished *1cm wide band of dark grey mudstone 75°* *Bedding Fracture: 85° undulating rough striated*
	12.25 - 13.75		90	60	14					*Fracture: 50° Planar polished* *Fracture: 60° planar rough* *Band of dark grey mudstone 70° undulating rough striated* *Fracture: 60° planar rough*
	13.75 - 15.25		100	100	17					*Bedding Fracture: 80° - 90° undulating smooth striated*
	15.25 - 16.75		100	75	0					
	16.75 - 18.25			19	19					*Bedding Fracture: 80° planar smooth striated* *Fracture: 65° planar smooth* *Fracture: 65° undulating polished* *Bedding Fracture: 85° planar to undulating smooth striated* *3cm thick band of dark grey laminated mudstone 80°* *4cm band of light grey mudstone with thin veneer of soft light grey clay 80°* *Fracture: 65° undulating smooth striated* *Fracture: 65° undulating smooth striated* *Fracture: 65° undulating smooth striated* *Fracture: 65° undulating rough striated*
	18.25 - 19.75		93	55	12					

11 12 13 14 15 16 17 18 19 20

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH7
Sheet 3 of 3

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326691.47 - 310125.99	Hole Type RC
Location:	Buttington, Welshpool		Level:	110.52	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	15/11/2018 - 19/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	19.75 - 21.25		93	11	11					Extremely weak grey MUDSTONE. Fractures are very close to medium spaced 35° - 60° undulating striated and polished *Sub-vertical Fracture : undulating curved polished striated* *Bedding Fracture: 80° undulating polished striated*
	21.25 - 22.75		95	0	0					*Fracture: 65° undulating polished* *Fracture: 65° planar polished* *Fracture: 80° undulating rough* *Sub-vertical Fracture undulation smooth* *1cm wide laminated band of dark mudstone 80°*
	22.75 - 24.25		95	0	0					*Bedding Fracture: 80° planar rough* *Bedding Fracture: 80° planar rough*
						24.25	86.27			End of Borehole at 24.250m

21 22 23 24 25 26 27 28 29 30

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH8
Sheet 1 of 5

Project Name: Buttington Quarry	Project No. 14880	Co-ords: 326934.10 - 310105.50	Hole Type RC
Location: Buttington, Welshpool		Level: 117.23	Scale 1:50
Client: Broad Energy (Wales) Limited		Dates: 22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey very gravelly CLAY grading in to very weak mudstone
						1.00	116.23			
	1.00 - 2.40		96	0	0					Very weak greenish brown MUDSTONE. Recovered non-intact.
	2.40 - 3.70		100	0	0					
						3.70	113.53			
	3.70 - 5.20		96	0	0					Weak dark brownish grey MUDSTONE. Fractures are 20° - 45° very closely to closely spaced planar smooth. Locally stained orangish brown.
										Fracture: Sub-vertical 3.7 - 8m planar smooth with very thin infill of light grey clay.
										Fracture: 50° undulating smooth
										Fracture: 45° undulating smooth
										Fracture: 80° undulating smooth. Stained orangish brown
	5.20 - 6.60		98	0	0					
										Fracture: 60° curved smooth. Stained orangish brown.
	6.60 - 8.00		97	0	0					*Fracture: 80° - 90° curved smooth. Stained orangish brown.*
						8.00	109.23			
	8.00 - 9.40		92	92	80					Weak dark grey MUDSTONE. Fractures 20° - 45° very closely to medium spaced planar smooth to undulating rough. Locally stained orangish brown.
										Fracture: 75° undulating rough

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH8** Sheet 2 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326934.10 - 310105.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	117.23	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	9.40 - 10.65		93	76	63					Weak dark grey MUDSTONE. Fractures 20° - 45° very closely to medium spaced planar smooth to undulating rough. Locally stained orangish brown.
	10.70	C								*Fracture: 55° undulating smooth. Slight orangish brown staining*
	10.65 - 12.15		96	74	87					*Fracture: 5° planar smooth* *Fracture: 5° planar smooth*
	12.15 - 13.65		96	88	80					
	14.00	C								
	13.65 - 15.00		98	92	81					
	15.00	C								
	15.00 - 16.40		91	85	85					*Fracture: 60° undulating rough. Stained orangish brown.* *Fracture: 60° undulating rough*
▼	16.40 - 17.70		100	80	69					*Fracture: 60° undulating smooth*
	17.70 - 19.10		100	76	76					*Fracture: 80° - 90° curved smooth*
	19.10 - 20.40		100	93	73					*Fracture: 20° - 60° curved smooth*
						19.80	97.43			Weak dark grey MUDSTONE. Sub-vertical

Remarks:

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH8
Sheet 3 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords: 326934.10 - 310105.50
Location:	Buttington, Welshpool		Level: 117.23
Client:	Broad Energy (Wales) Limited		Dates: 22/10/2018 - 26/10/2018

Hole Type: RC
Scale: 1:50
Logged By:

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
						24.70	92.53			Weak dark grey MUDSTONE. Sub-vertical Fracture infilled with thin veneer of light grey clay. Fractures 15° - 30° very closely to medium spaced undulating rough.
	20.40 - 21.85		96	0	0					*Fracture: Sub-vertical planar smooth*
	21.85 - 23.30		96	0	0					*Fracture: 65° undulating smooth*
	23.30 - 24.75		100	0	0					
	24.50	C								
	24.75 - 26.15		100	89	89					Weak dark grey MUDSTONE. Fractures 10° - 30° very closely to medium spaced planar smooth
	26.50	C								
	26.15 - 27.35		89	89	86					
	27.35 - 28.80		100	95	95					
	28.60	C								
	28.80 - 30.20		94	94	94					

21 22 23 24 25 26 27 28 29 30

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH8
Sheet 4 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326934.10 - 310105.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	117.23	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Weak dark grey MUDSTONE. Fractures 10° - 30° very closely to medium spaced planar smooth
	30.20 - 31.50		100	92	92					*Fracture: 85° planar smooth*
										Fracture: Sub-vertical planar smooth
	31.50 - 34.00		100	0	0					*Bedding Fracture: 85° undulating smooth*
	33.50	C								
	34.00 - 35.40		100	66	66					*Fracture: 50° planar smooth*
	35.40 - 36.85		100	91	91					*Fracture: 40° planar smooth*
	36.85 - 38.35		93	90	70					*Fracture: 70° planar smooth*
										Fracture: 75° 1mm thick mineralised infilled fracture
	38.35 - 39.85		96	96	72					*Fracture: 45° planar smooth*
										Fracture: 45° planar rough

31 32 33 34 35 36 37 38 39 40

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH8
Sheet 5 of 5

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326934.10 - 310105.50	Hole Type RC
Location:	Buttington, Welshpool		Level:	117.23	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	22/10/2018 - 26/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	40.30 39.85 - 41.35	C	92	57	43	41.35	75.88			Weak dark grey MUDSTONE. Fractures 10° - 30° very closely to medium spaced planar smooth *Fracture: 45° planar smooth*
	41.35 - 42.85		93	93	93					Medium strong dark grey MUDSTONE. Fractures 10° - 30° very closely to widely spaced planar smooth
	43.00 42.85 - 44.05	C	100	100	100					
	44.05 - 45.45		100	100	93					
	45.45 - 46.45 46.00	C	57	57	53	46.45	70.78			End of Borehole at 46.450m

41 42 43 44 45 46 47 48 49 50

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No. **PH9** Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326945.35 - 310072.94	Hole Type RC
Location:	Buttington, Welshpool		Level:	115.26	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	18/10/2018 - 19/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
										Grey brown very gravelly CLAY grading into very weak mudstone
	1.00 - 2.30		100	0	0	1.00	114.26			Very weak dark greenish grey mudstone. Recovered non-intact.
	2.30 - 3.80		86	15	15	2.50	112.76			Very weak to weak dark greenish grey MUDSTONE. Fractures are 10°- 40° very closely to closely spaced, undulating rough tending to planar smooth. Fracture surfaces rarely stained orangish brown.
	3.80 - 5.25		89	0	0					*Very thin bed of very stiff light orangish brown and light grey CLAY*
	5.25 - 6.70		100	0	0					*Bedding Fracture: 70°-85° undulating smooth. Stained orangish brown.*
	6.70 - 7.85		95	42	42					*Bedding Fracture: 85° planar smooth. Stained orangish brown.*
	7.85 - 9.35		94	20	9					*Fracture: 65° planar smooth . Stained orangish brown* *Fracture: 60° planar smooth. Stained orangish brown.* *Bedding Fracture: 85° - 90° undulating smooth. Stained orangish brown.*
	9.00	C								*Bedding Fracture: 85° - 90° undulating rough. Stained orangish brown.*
	9.35 - 10.50		96	37	37					*Bedding Fracture: 85° - 90° undulating rough. Stained orangish brown.* *Fracture: 55° planar smooth. 1mm calcite mineralisation* *Fracture: 75 - 90° undulating smooth locally planar.*

Remarks:

terrafirma
Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH9
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326945.35 - 310072.94	Hole Type RC
Location:	Buttington, Welshpool		Level:	115.26	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	18/10/2018 - 19/10/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
						10.50	104.76			Very weak to weak dark greenish grey MUDSTONE. Fractures are 10°- 40° very closely to closely spaced, undulating rough tending to planar smooth. Fracture surfaces rarely stained orangish brown.
	11.00	C								*Fracture: 75 - 90° undulating smooth locally planar. Stained orangish brown.*
	10.50 - 12.00		78	78	78					*Fracture: 55° planar smooth. 1mm calcite mineralisation*
	~~12.00~~	C								Weak dark grey MUDSTONE. Fractures are 5°- 25° very closely to medium spaced, planar smooth. Fracture surfaces stained orangish brown.
	12.00 - 13.50		95	95	95					*Fracture: 55° planar smooth.*
	~~13.50~~	C								*Fracture: 55° planar smooth.*
	13.50 - 14.00		30	23	23					*Fracture: 50° planar smooth. Stained orangish brown.*
						14.00	101.26			End of Borehole at 14.000m

Remarks:

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Pentwyn, Cardiff
CF23 7HA
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Borehole No.
PH10
Sheet 1 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326833.57 - 310220.90	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.16	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	01/11/2018 - 02/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
						1.00	113.16			Grey gravelly CLAY grading into weathered mudstone
	1.00 - 2.50		16	0	0					Non-Intact greenish grey MUDSTONE retrieved as fine to coarse angular gravel
	2.50 - 4.00		93	0	0	3.00	111.16			Very weak grey MUDSTONE. Fractures are very close to closely spaced, occasionally medium spaced 5° - 35° stained orangish brown and/or dark grey/black
	4.00 - 5.50		96	13	13					*Bedding Fracture: 80° curved rough. Stained orangish brown/brown.* *Fracture: sub-vertical planar rough. Stained orangish brown.* *Fracture: 45° planar rough. Stained orangish brown.* *Bedding Fracture: 80°planar rough. Stained orangish brown.* *Curved undulating rough. Stained orangish brown.* *Bedding Fracture: 85° Curved to planar rough. Stained orangish brown.*
	5.50 - 7.00		90	0	0					*Fracture: 70° to sub-vertical curved rough. Stained orangish brown.* *Fracture: 70° planar rough. Stained orangish brown.* *Bedding Fracture: 80° planar rough. Stained brown.*
	7.00 - 8.50		93	0	0					*Fracture: 65° planar to curved rough. Stained orange.* *Bedding Fracture: 80° planar rough. Stained orange.*
	8.50 - 10.00		96	0	0					*Bedding Fracture: 80° planar rough. Stained orangish brown.*

1 2 3 4 5 6 7 8 9 10

Remarks:

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Borehole No.
PH10
Sheet 2 of 2

Project Name:	Buttington Quarry	Project No. 14880	Co-ords:	326833.57 - 310220.90	Hole Type RC
Location:	Buttington, Welshpool		Level:	114.16	Scale 1:50
Client:	Broad Energy (Wales) Limited		Dates:	01/11/2018 - 02/11/2018	Logged By

Water Strikes	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Well	Legend	Stratum Description
	10.00 - 11.50		76	10	10					Very weak grey MUDSTONE. Fractures are very close to closely spaced, occasionally medium spaced 5° - 35° stained orangish brown and/or dark grey/black *Fracture: 65° to sub-vertical curved. Stained orange.*
						11.50	102.66			End of Borehole at 11.500m

11
12
13
14
15
16
17
18
19
20

Remarks:

ANNEX B
Photographs of Probehole Rock Cores

PROBEHOLE 1


0.00 GL
1.00
BUTTINGTON QUARRY
BH1
BOX 1
1.00 mts
2.50 mts


2.50 mts
4.00 mts
BUTTINGTON QUARRY
BH 1
BOX 2
4.00 mts
5.50 mts


5.50mtr
7.00mtr
BH 1
Box 3


8.50mtr
10.00mtr
BH 1
Box 4
10.00mtr
10.85mtr


BUTTINGTON QUARRY
BH1
BOX 5
12.35m
13.85m

PROBEHOLE 2


6.80
7.60
BH2
Box 3


9.00
10.40
BH2
Box4


BH8
Box11


BH8
Box12


3400
3440
BH2
Box 13


3725
BH2
Box 14


44.50
46.80
BA2
Box 17
46.90
47.80

PROBEHOLE 3

PROBEHOLE 4


6.80
8.30


9.50
25.00
26.50


2650
3120
BH4
Box 5
2800
3230


3780
3795
BH4
Box6
3895
3945

PROBEHOLE 5


14.80
16.30
BH5
B6
16.30
17.80

PROBEHOLE 6


5.50
7.00mts
BUTTINGTON QUARRY
BH6
BOX 3
7.00mts
8.50mts

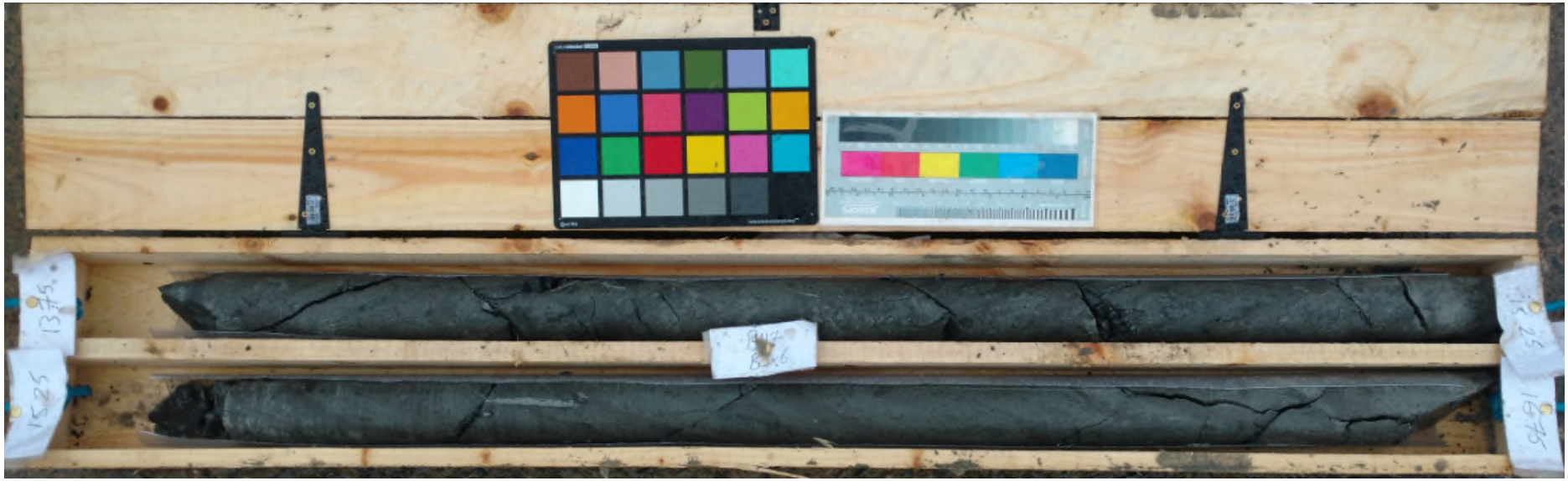

8.50mts
BUTTINGTON QUARRY
BH6
BOX 4
10.00mts
10.00
11.50


11·50m
13·00m
BLETCHLEY PARK
BH 6
BOX 5
13·00
14·00

PROBEHOLE 7


BH7
Box3
7.15
8.15


BH7
Box4
8.65
9.65
9.65
10.75



PROBEHOLE 8


6.60
8.00
BH8
Box 3


9.40
10.65
BH8
8.65
12.15


T3.85 12.15
BH8
Box 5
13.65
15.00


15.80
16.40
16.40
17.70


17.70
19.10
BH8
Box7
19.10
20.40


20.40
BH8
Box8
21.85


2306
2441
BH8
Box9
2475
2515


2515
2627
2735
BH8
Box10
2788
2988


28.80
30.20
BH8
Box 11
30.20
31.50


31.50
32.40
BH8
Box 12
32.40
34.00


BH8
Box 13


BH8
Box 14


BH8
Box 15

PROBEHOLE 9


1.00m
2.30m
BUTTINGTON QUARRY
CH 9
BOX 1
2.30m
3.80m


3.80m
5.25m
BUTTINGTON QUARRY
CH 9
Box 2


6.70m
7.85m
BATTINGTON QUARRY
BH9
Box 3
7.85m
9.35m


9.35m
10.50m
BATTINGTON QUARRY
BH9
Box 4
10.50m
12.00m


JESSOPS
BH 9
BOX 5

PROBEHOLE 10

ANNEX C
UCS, Point Load and Shear Box Test Results

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 41501

Client Ref:

Client PO: **14880RH**

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

Client **Terrafirma Wales Ltd**
5 Deryn Court
Wharfedale Road
Pentwyn
Cardiff
CF23 7HB

Contract Title: **Buttington Quarry (B.Quarry)**

For the attention of: **Ruth Howells**

Date Received: **06-11-2018**

Date Commenced: **06-11-2018**

Date Completed: **20-11-2018**

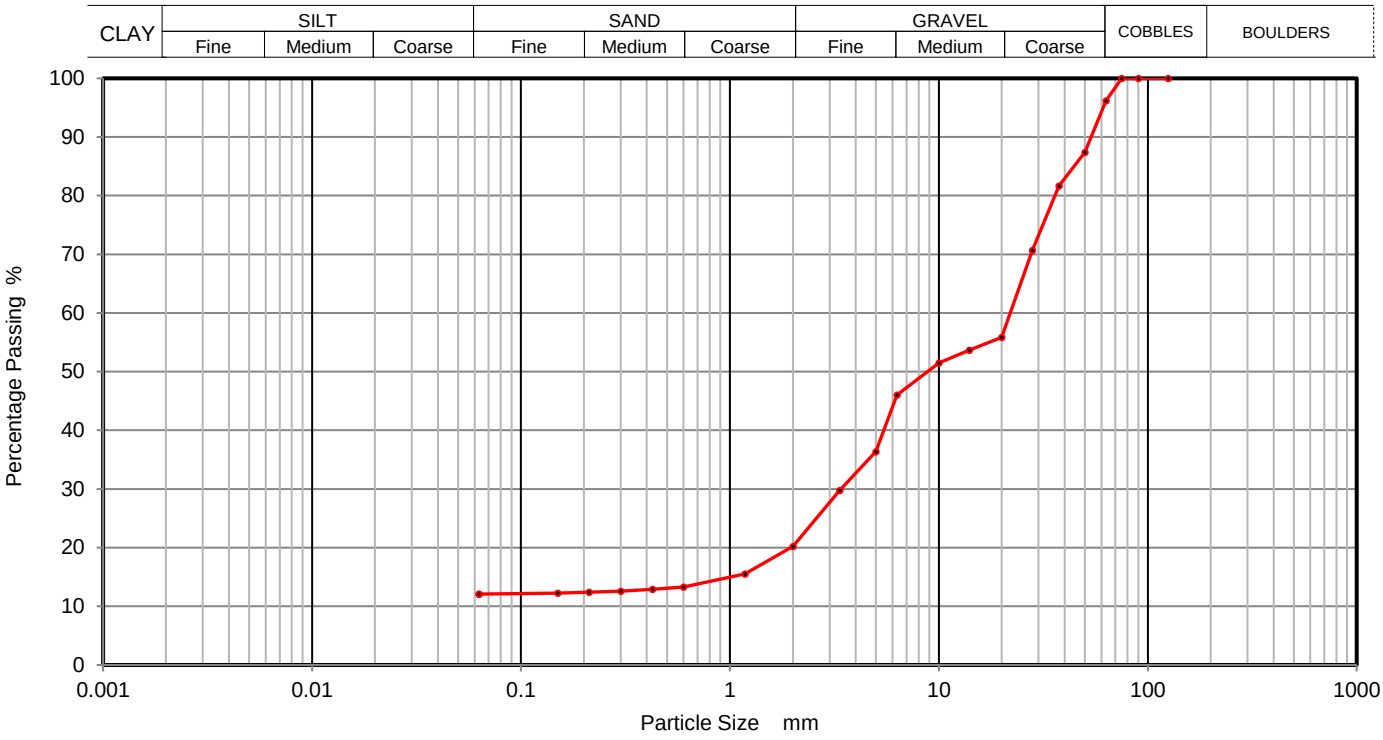
Test Description	Qty
Particle size Distribution (Aggregate) BS EN 933-1 - * UKAS	6
Determination of the slake durability index, two cycles. ISRM Suggested Method For Determining Slake Durability - @ Non Accredited Test	6
Large Shear Box 300mm Peak with 3 confining pressures includes remoulding BS 1377:1990 - Part 7 : 5 and Specification for Highway Works Vol.1 Clause 636 Part 2 - @ Non Accredited Test	6
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

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

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S1
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty clayey fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	96		
50	87		
37.5	82		
28	71		
20	56		
14	54		
10	51		
6.3	46		
5	36		
3.35	30		
2	20		
1.18	16		
0.6	13		
0.425	13		
0.3	13		
0.212	12		
0.15	12		
0.063	12		

Sample Proportions	% dry mass
Cobbles	4
Gravel	76
Sand	8
Silt and Clay	12

Grading Analysis	
Uniformity Coefficient	

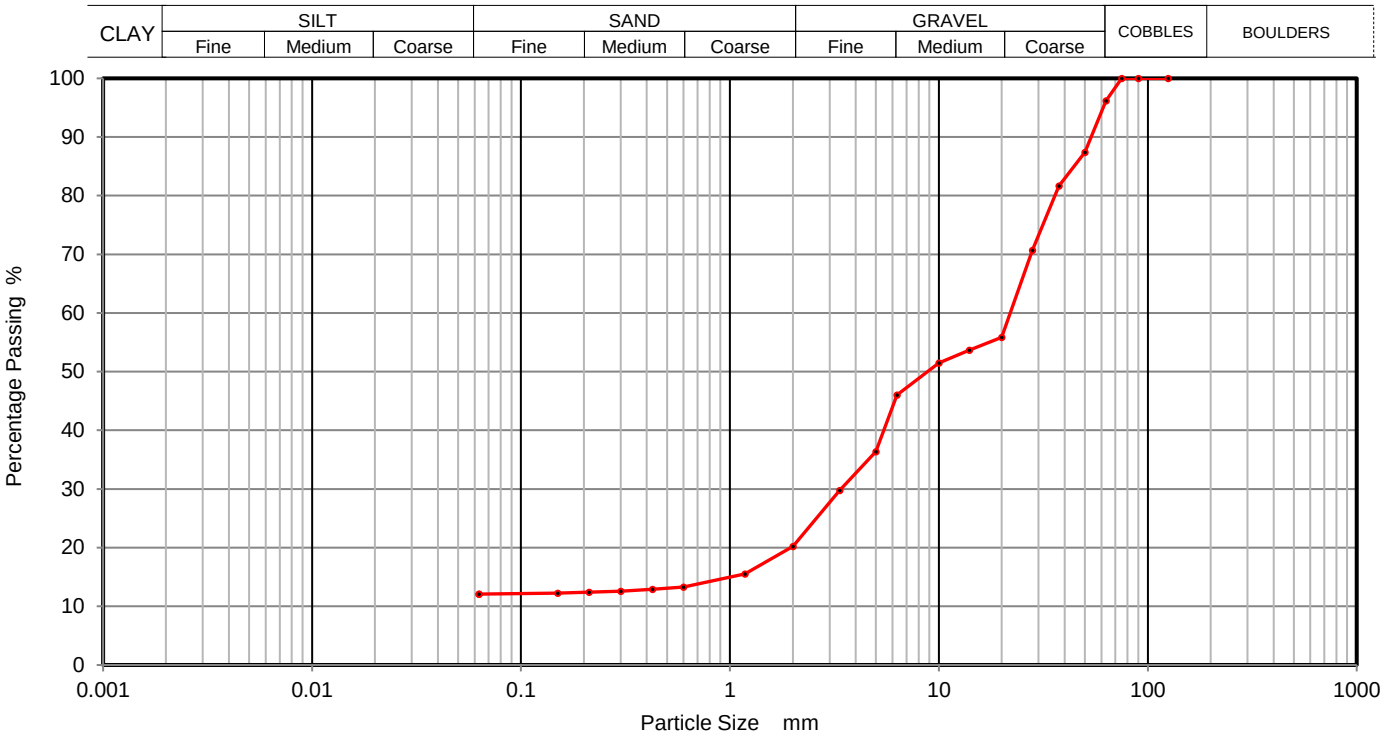
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S1
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty clayey fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	96		
50	87		
37.5	82		
28	71		
20	56		
14	54		
10	51		
6.3	46		
5	36		
3.35	30		
2	20		
1.18	16		
0.6	13		
0.425	13		
0.3	13		
0.212	12		
0.15	12		
0.063	12		

Sample Proportions	% dry mass
Cobbles	4
Gravel	76
Sand	8
Silt and Clay	12

Grading Analysis	
Uniformity Coefficient	

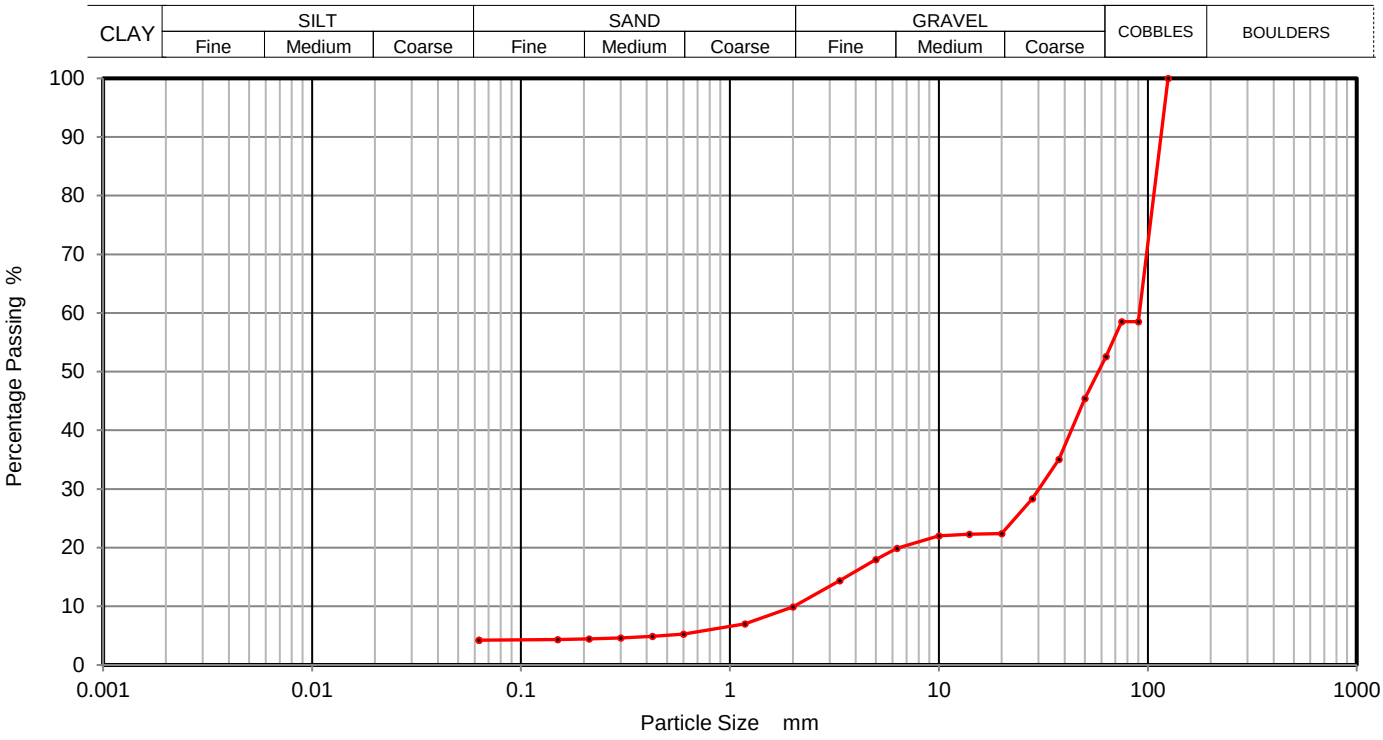
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S2
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown silty fine to medium slightly sandy fine to coarse GRAVEL with many cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	59	0.0060	
75	59	0.0019	
63	53		
50	45		
37.5	35		
28	28		
20	22		
14	22		
10	22		
6.3	20		
5	18		
3.35	14		
2	10		
1.18	7		
0.6	5		
0.425	5		
0.3	5		
0.212	4		
0.15	4		
0.063	4		

Sample Proportions	% dry mass
Cobbles	47
Gravel	43
Sand	6
Silt and Clay	4

Grading Analysis	
Uniformity Coefficient	

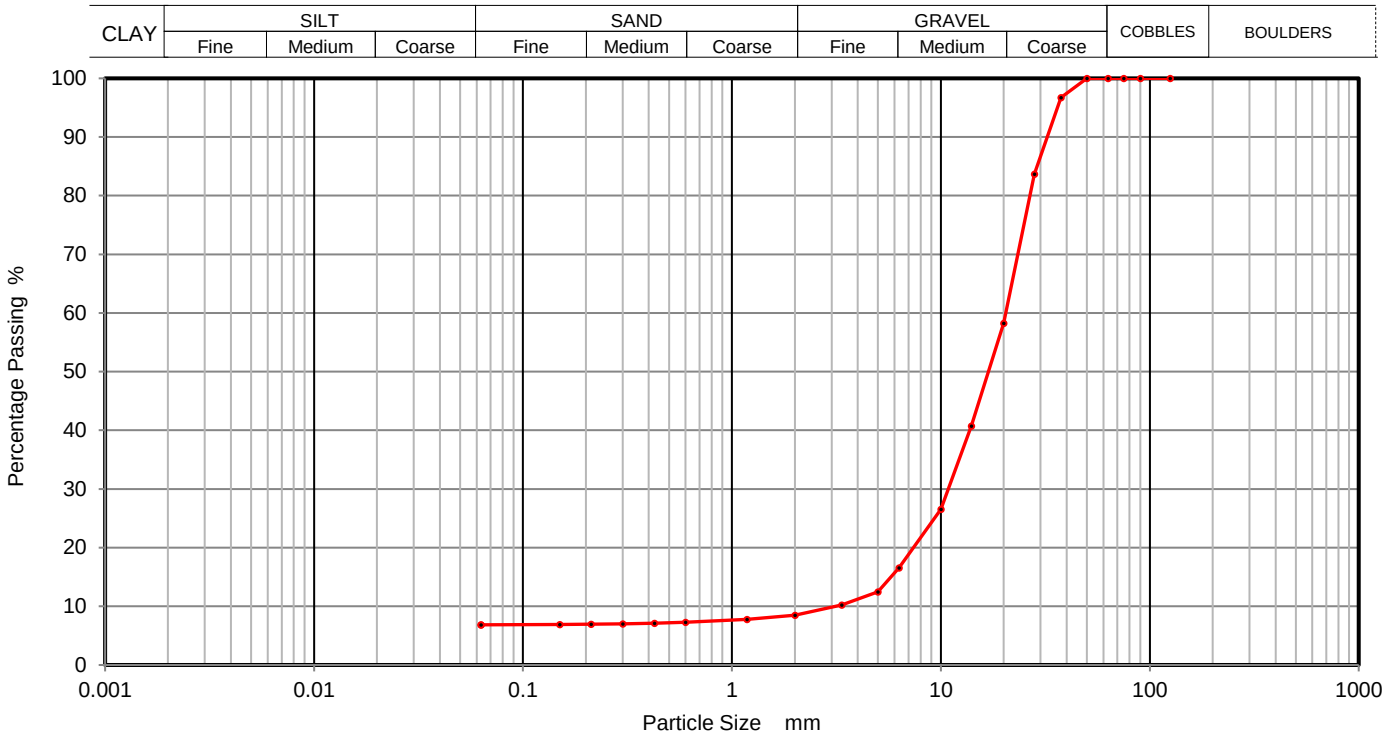
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S3
Site Name	Buttington Quarry (B.Quarry)	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	97		
28	84		
20	58		
14	41		
10	27		
6.3	17		
5	12		
3.35	10		
2	9		
1.18	8		
0.6	7		
0.425	7		
0.3	7		
0.212	7		
0.15	7		
0.063	7		

Sample Proportions	% dry mass
Cobbles	0
Gravel	91
Sand	2
Silt and Clay	7

Grading Analysis	
Uniformity Coefficient	

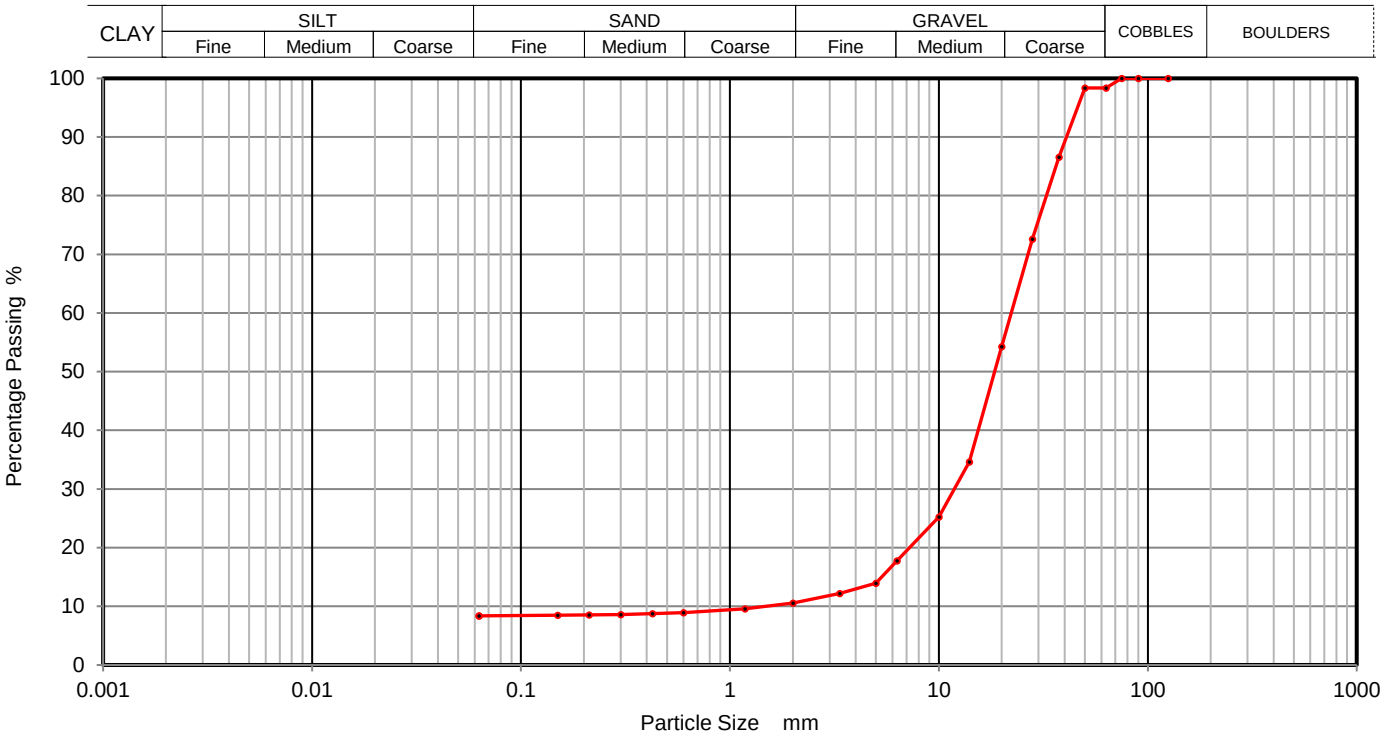
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S4
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	98		
50	98		
37.5	87		
28	73		
20	54		
14	35		
10	25		
6.3	18		
5	14		
3.35	12		
2	11		
1.18	10		
0.6	9		
0.425	9		
0.3	9		
0.212	9		
0.15	8		
0.063	8		

Sample Proportions	% dry mass
Cobbles	2
Gravel	87
Sand	3
Silt and Clay	8

Grading Analysis	
Uniformity Coefficient	

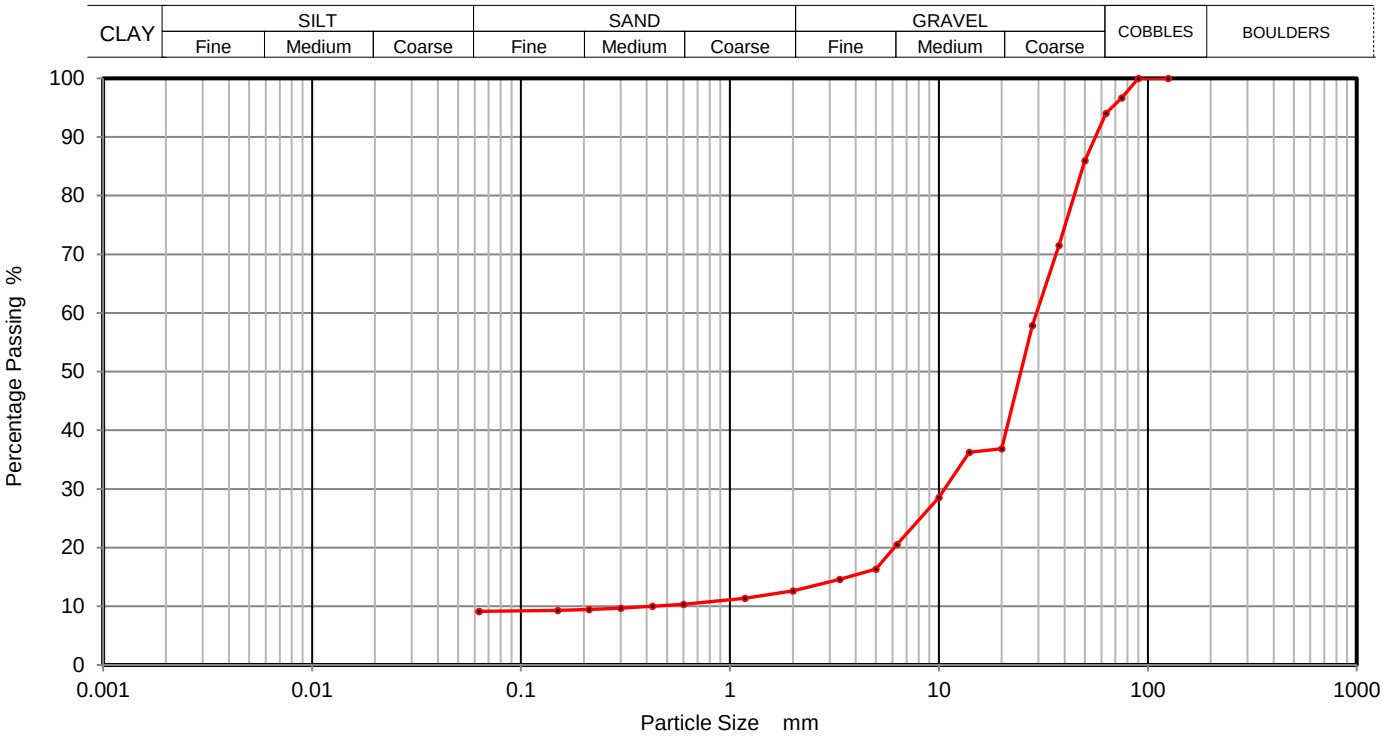
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S5
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	97	0.0019	
63	94		
50	86		
37.5	71		
28	58		
20	37		
14	36		
10	29		
6.3	21		
5	16		
3.35	15		
2	13		
1.18	11		
0.6	10		
0.425	10		
0.3	10		
0.212	9		
0.15	9		
0.063	9		

Sample Proportions	% dry mass
Cobbles	6
Gravel	81
Sand	4
Silt and Clay	9

Grading Analysis	
Uniformity Coefficient	

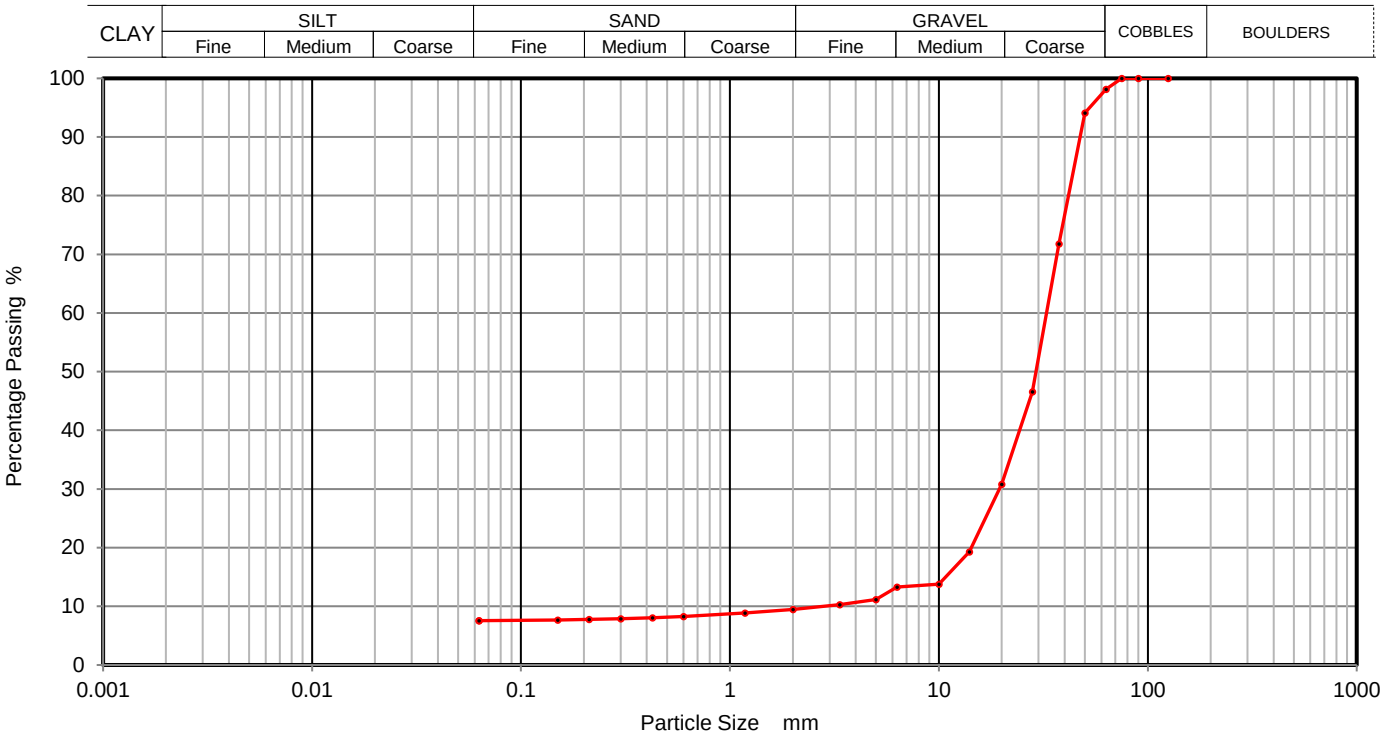
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S6
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	98		
50	94		
37.5	72		
28	47		
20	31		
14	19		
10	14		
6.3	13		
5	11		
3.35	10		
2	9		
1.18	9		
0.6	8		
0.425	8		
0.3	8		
0.212	8		
0.15	8		
0.063	8		

Sample Proportions	% dry mass
Cobbles	2
Gravel	89
Sand	1
Silt and Clay	8

Grading Analysis	
Uniformity Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S1	Depth from (m):	0.00
Sample Number :	1	Depth to (m):	0.00

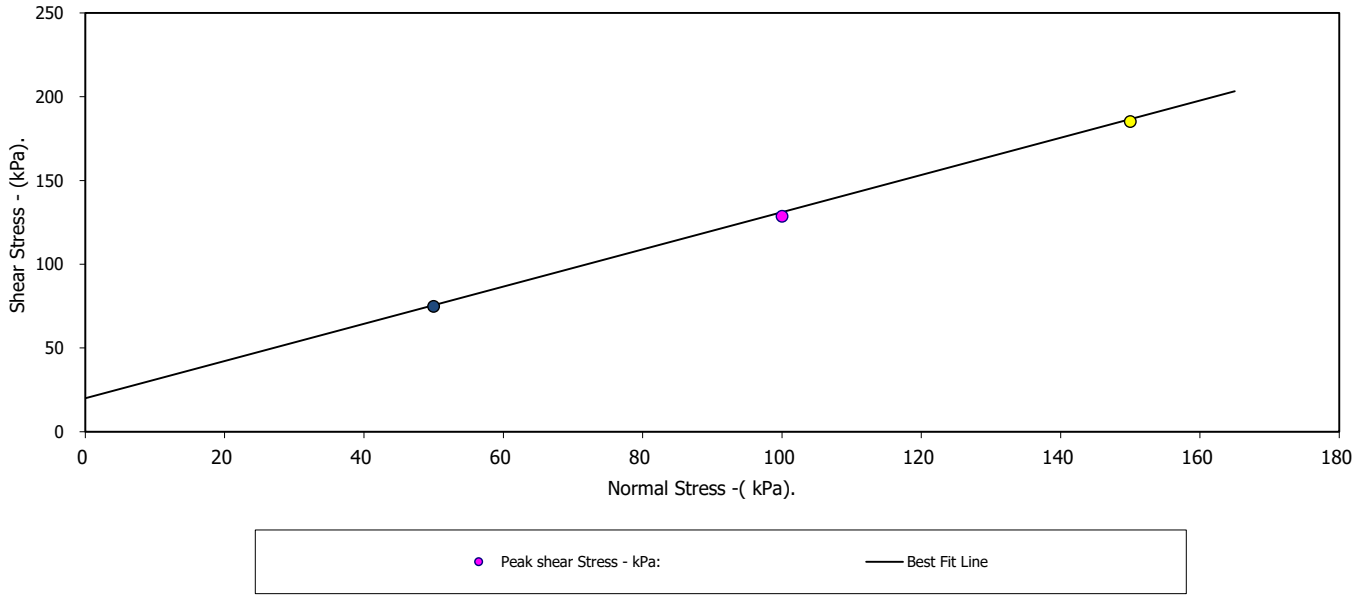
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	136.00	136.00	136.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.04	2.04	2.04
Dry Density - Mg/m3:	1.85	1.85	1.85
Voids Ratio:	0.4316	0.4317	0.4318
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	133.03	131.54	129.77
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	58.55	60.41	63.30
Peak shear Stress - kPa:	75	129	185

PEAK	
Angle of Shearing Resistance:(θ)	**48.0**
Effective Cohesion - kPa:	**20**

FAILURE CONDITIONS



D P Evans 20/11/18
Checked Pages 1-4 by: Date

D P Evans 20/11/18
Approved Pages 1-4 by: Date

Contract No.:
41501

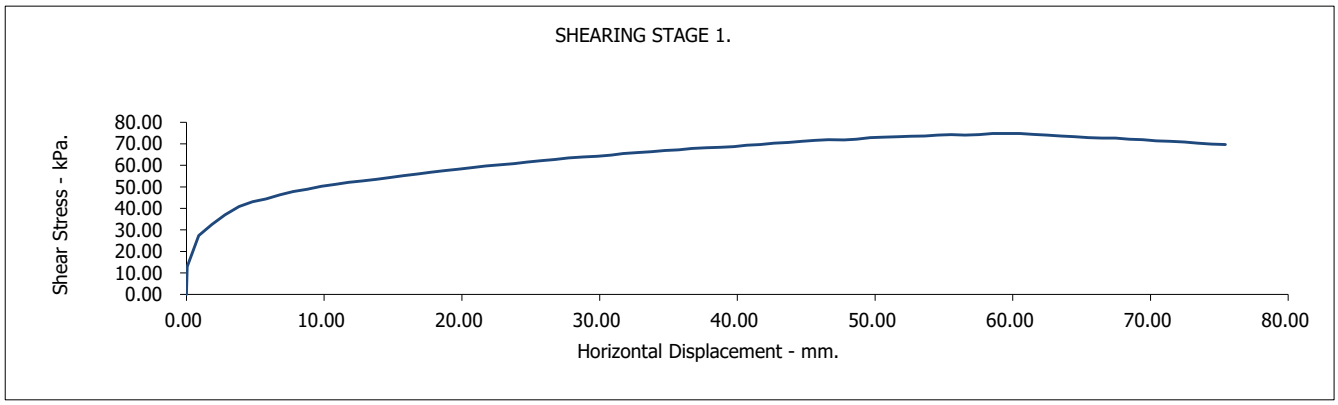
Client Ref Number:
14880RH

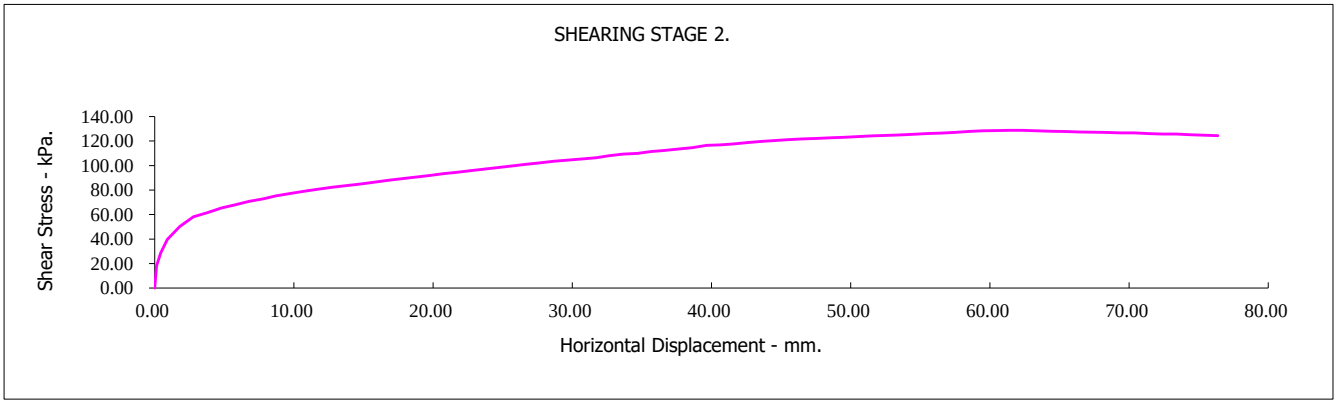
Buttington Quarry (B.Quarry)

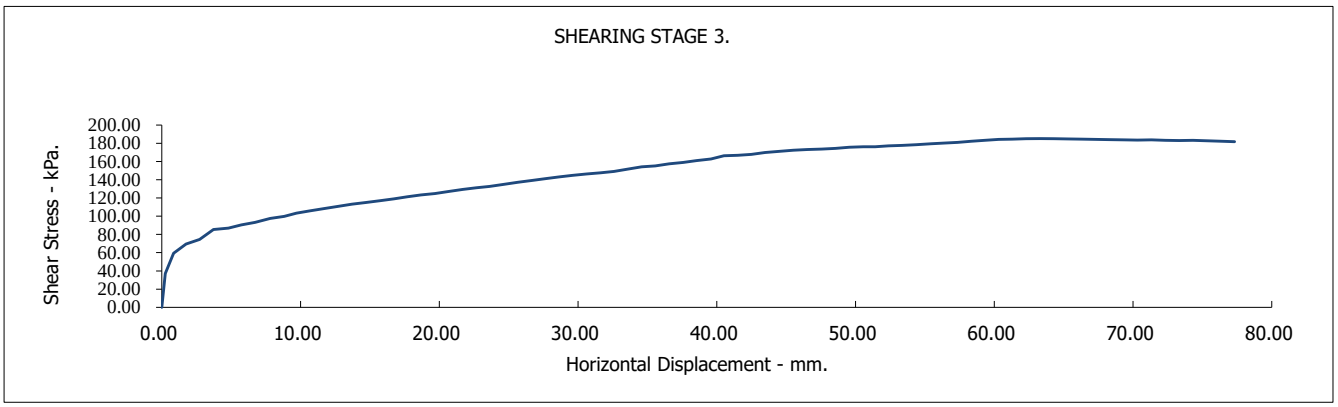
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

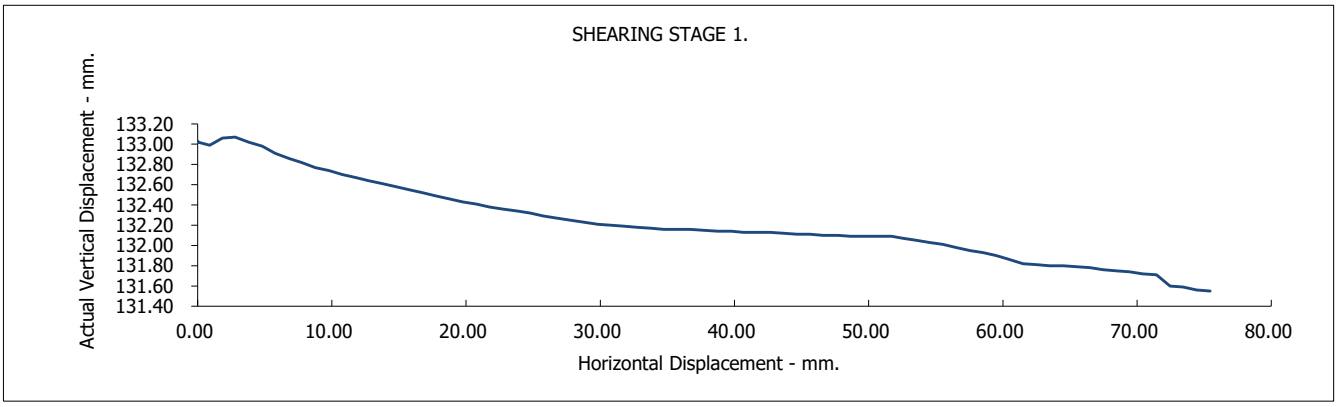
Client Ref Number: **14880RH**

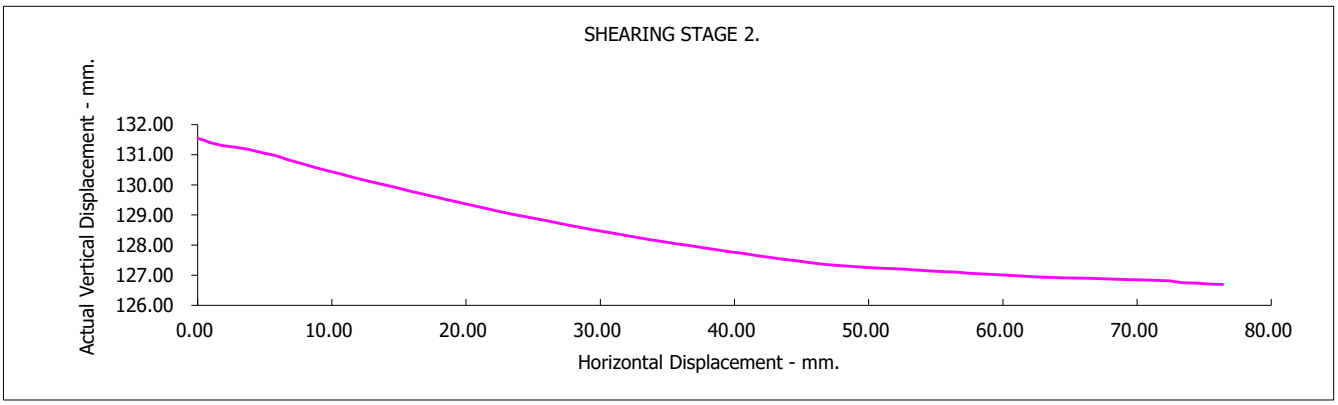
Figure.

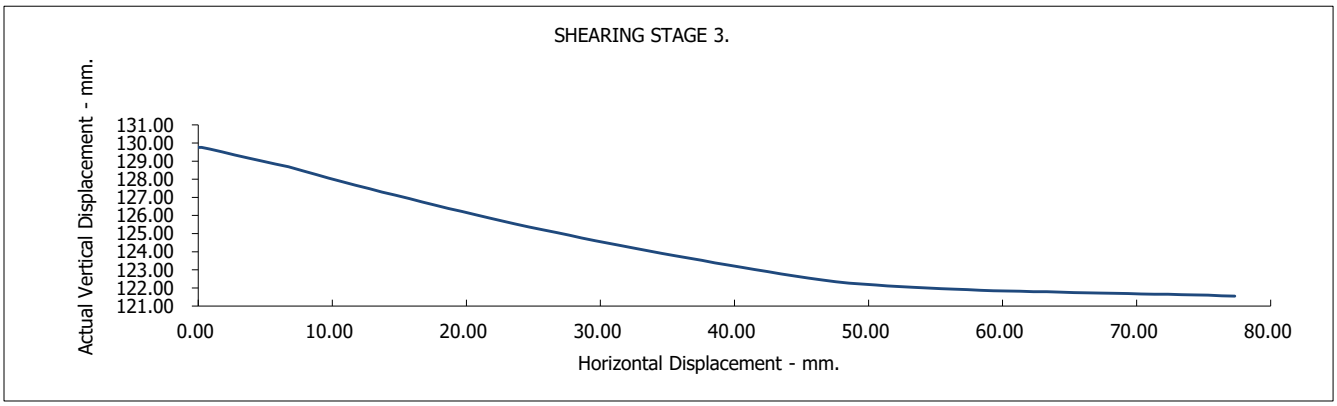
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

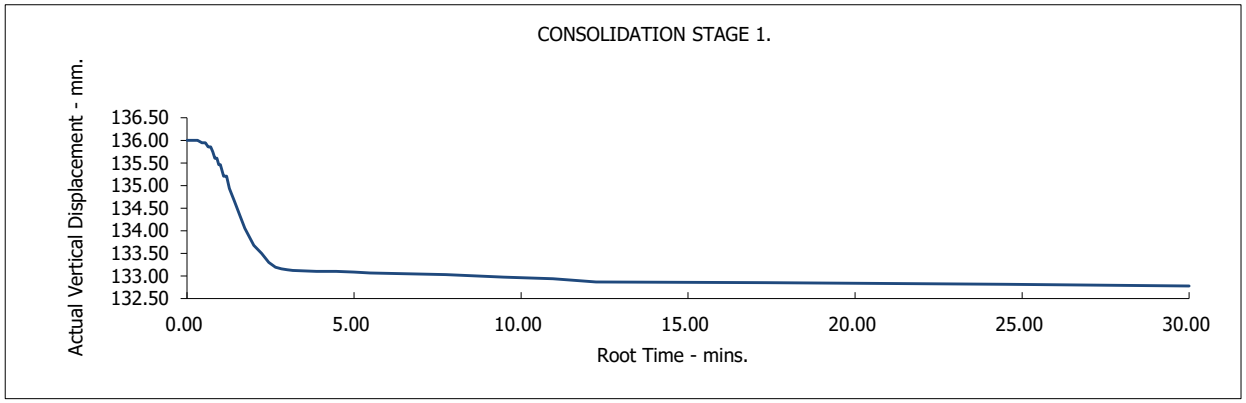
Client Ref Number: **14880RH**

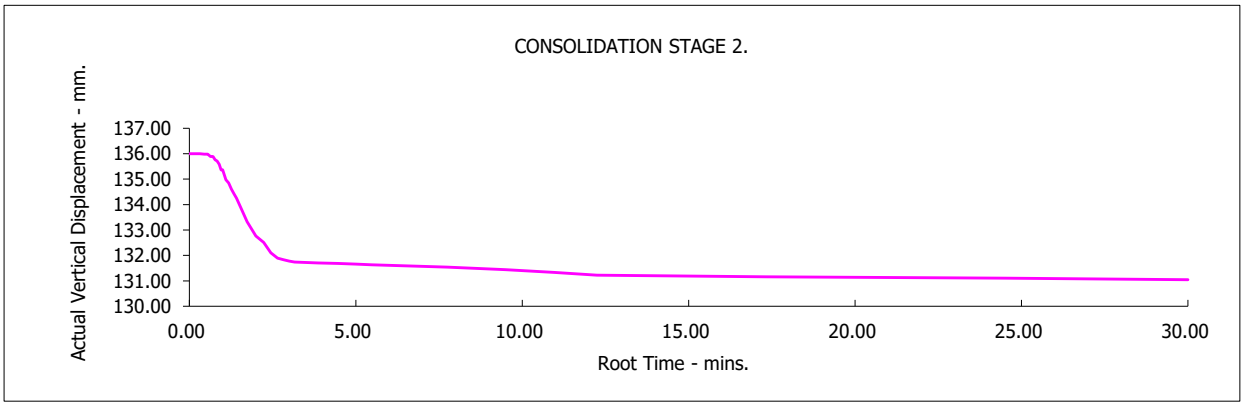
Figure.

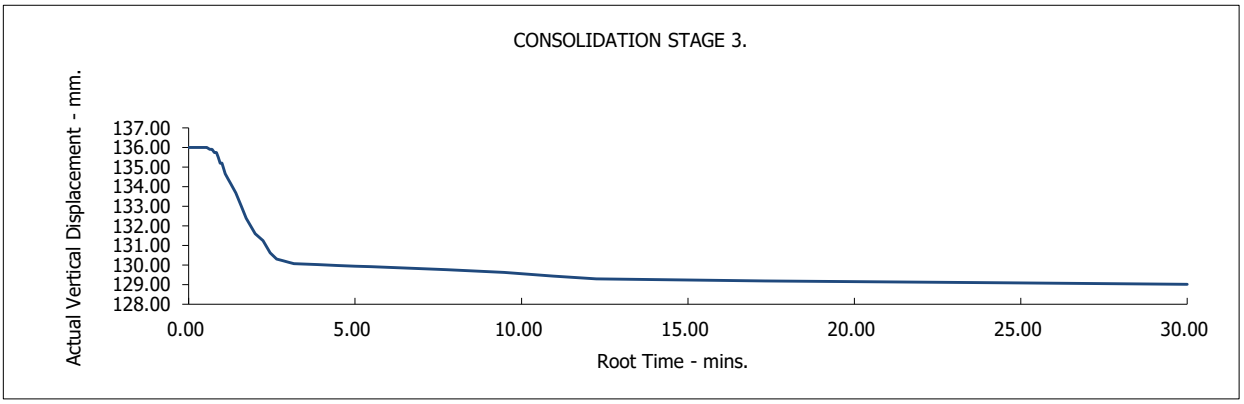
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S2	Depth from (m):	0.00
Sample Number :	2	Depth to (m):	0.00

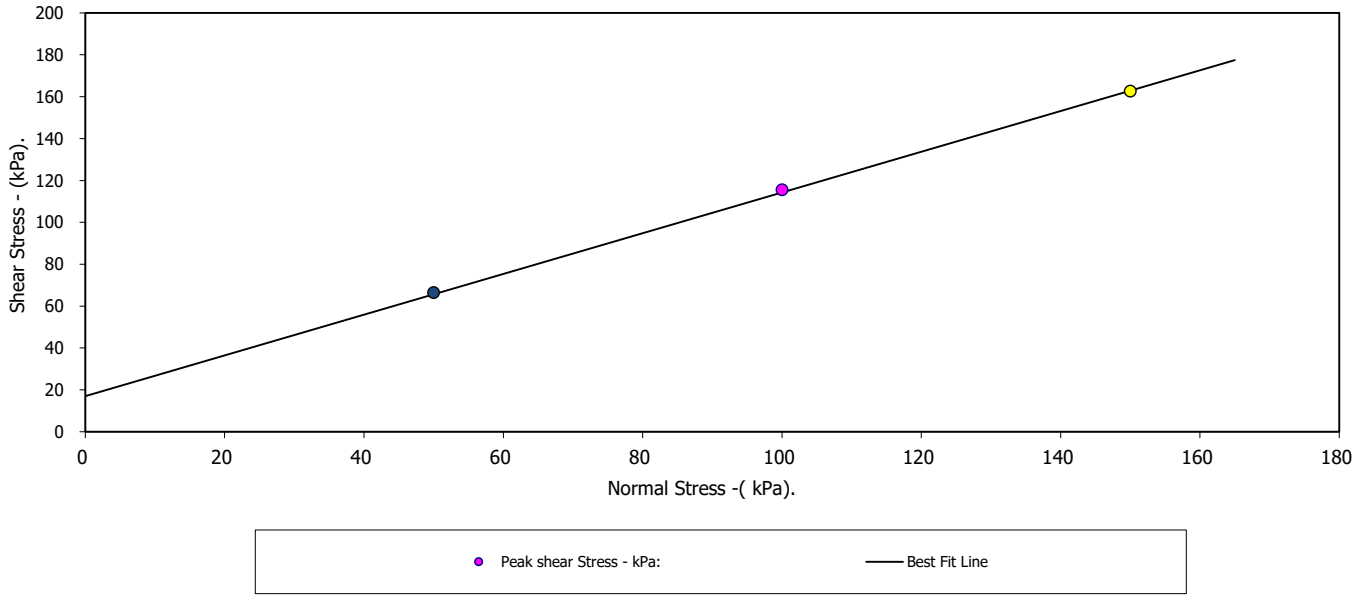
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	130.00	130.00	130.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.02	2.02	2.02
Dry Density - Mg/m3:	1.83	1.83	1.83
Voids Ratio:	0.4478	0.4478	0.4477
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	126.40	121.96	117.52
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	55.06	55.19	57.32
Peak shear Stress - kPa:	66	116	163

PEAK	
Angle of Shearing Resistance:(θ)	**44.2**
Effective Cohesion - kPa:	**17**

FAILURE CONDITIONS



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Buttington Quarry (B.Quarry)

Client Ref Number:
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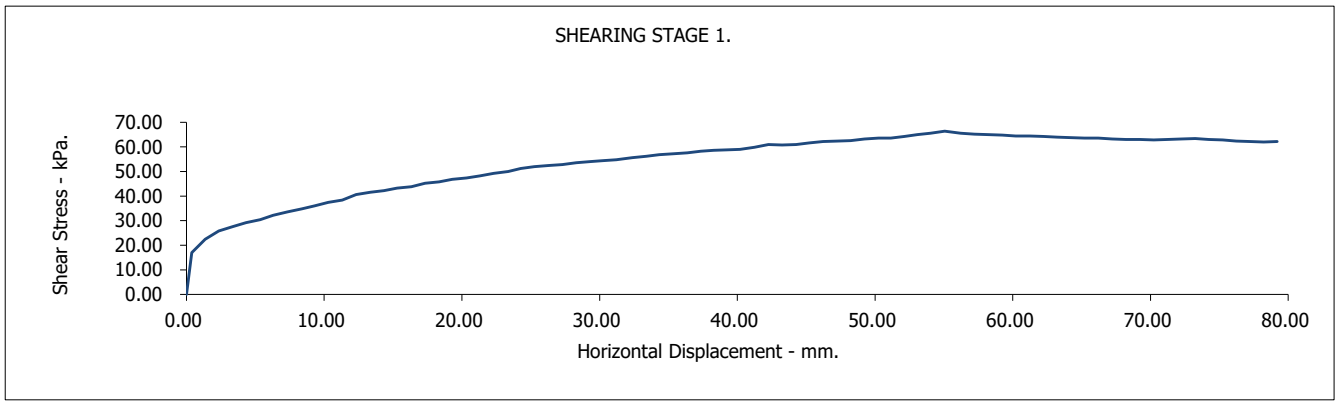
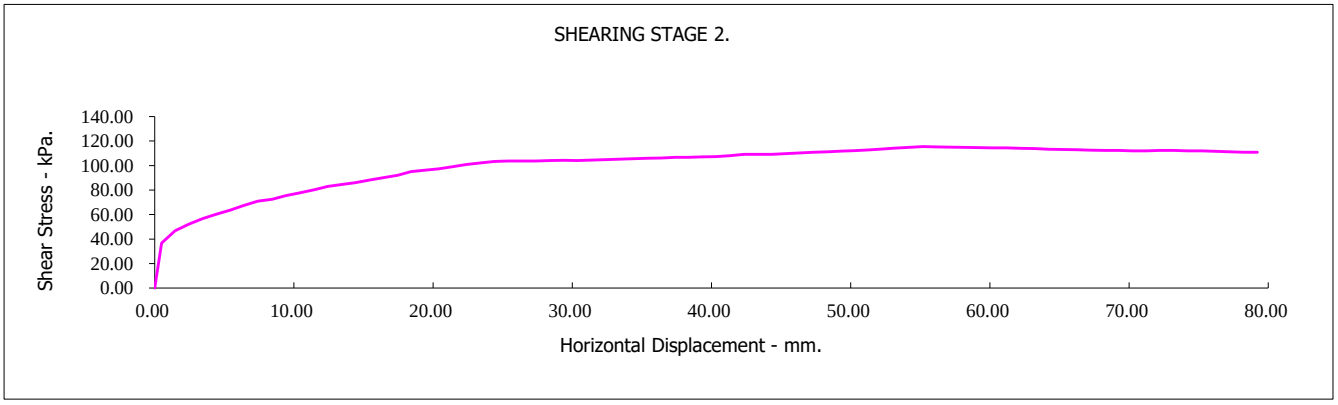
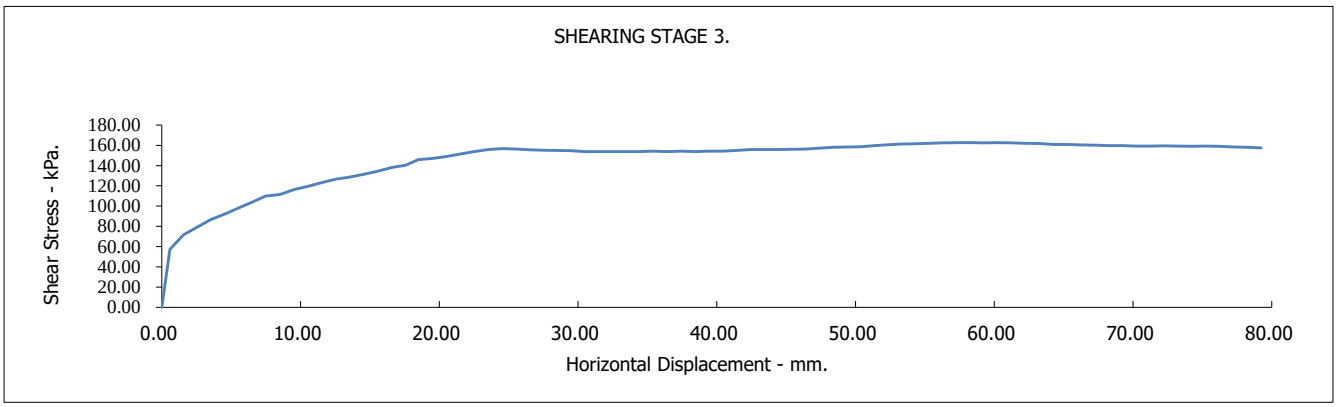
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

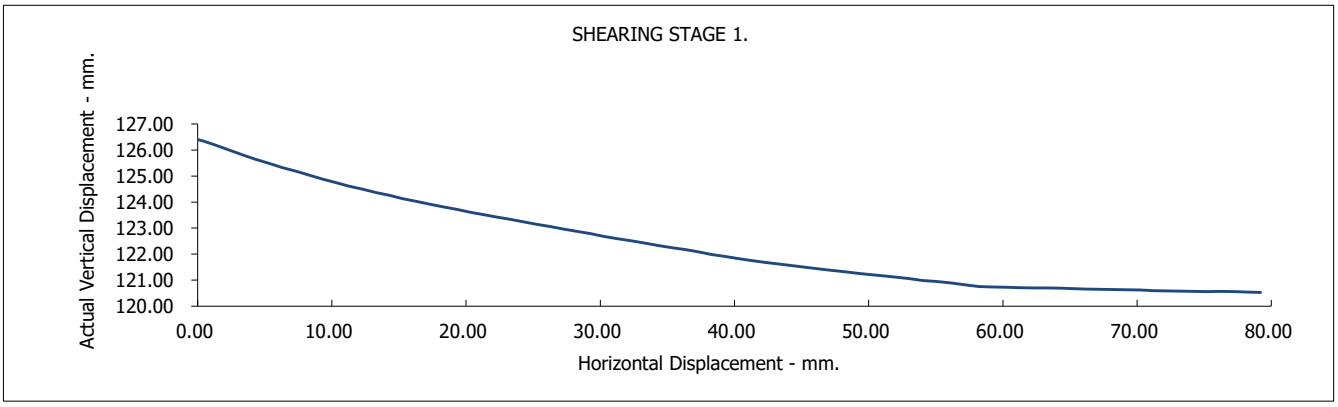
Client Ref Number: **14880RH**

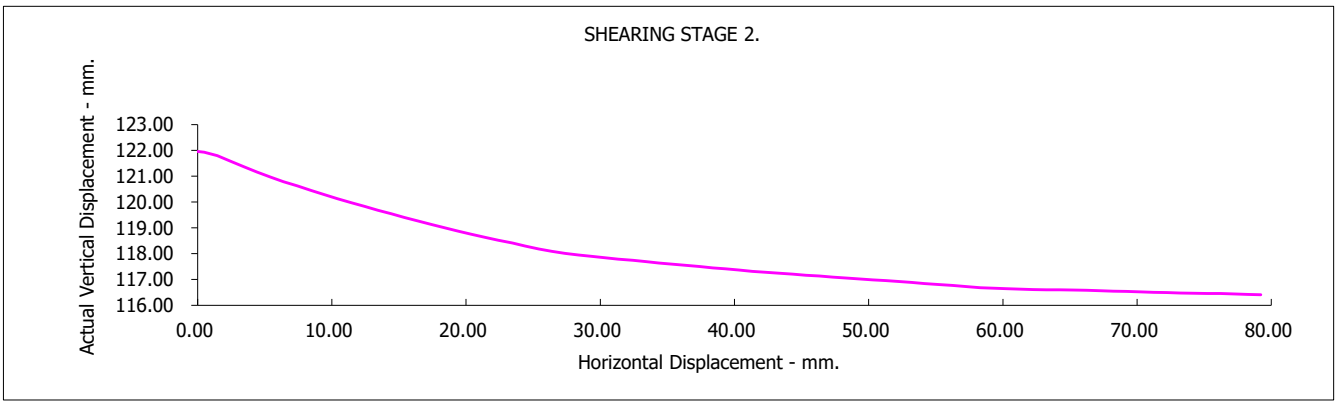
Figure.

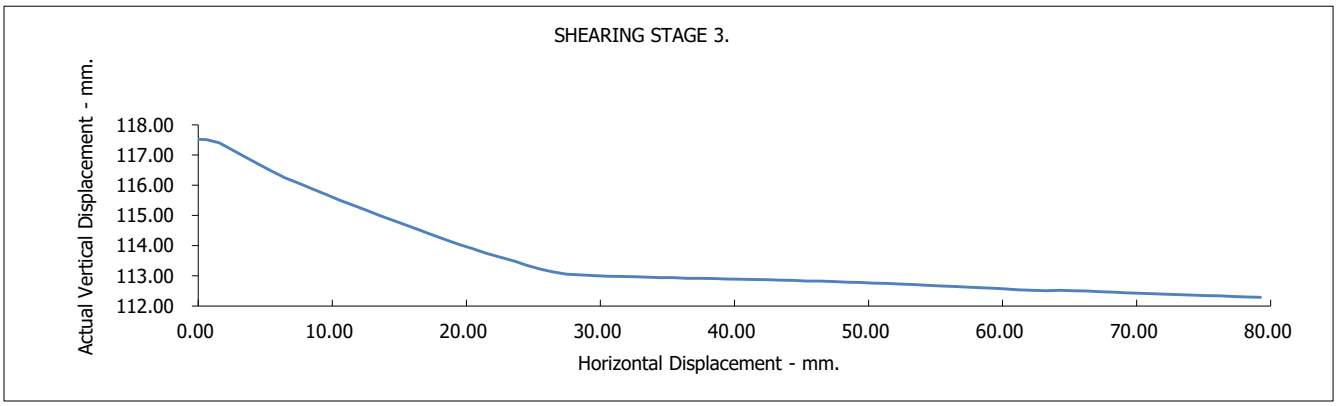
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

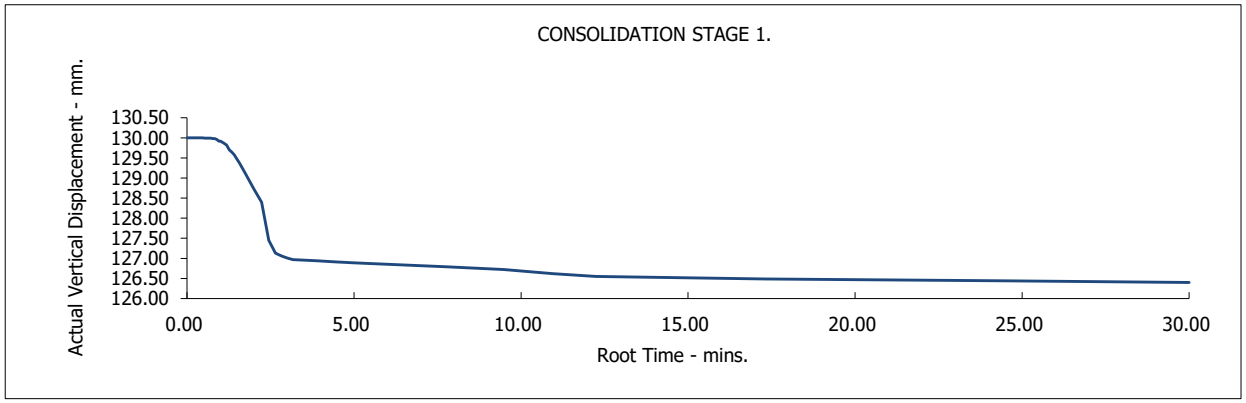
Client Ref Number: **14880RH**

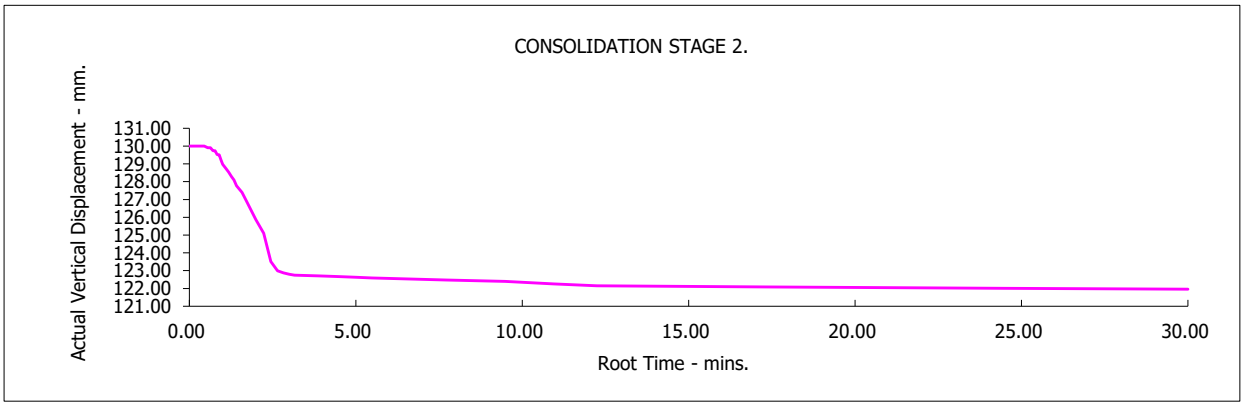
Figure.

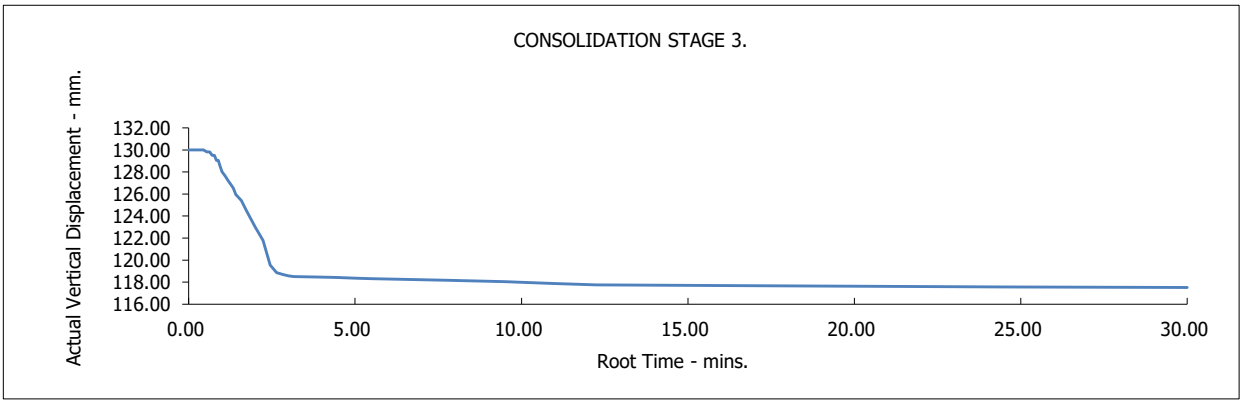
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S3	Depth from (m):	0.00
Sample Number :	3	Depth to (m):	0.00

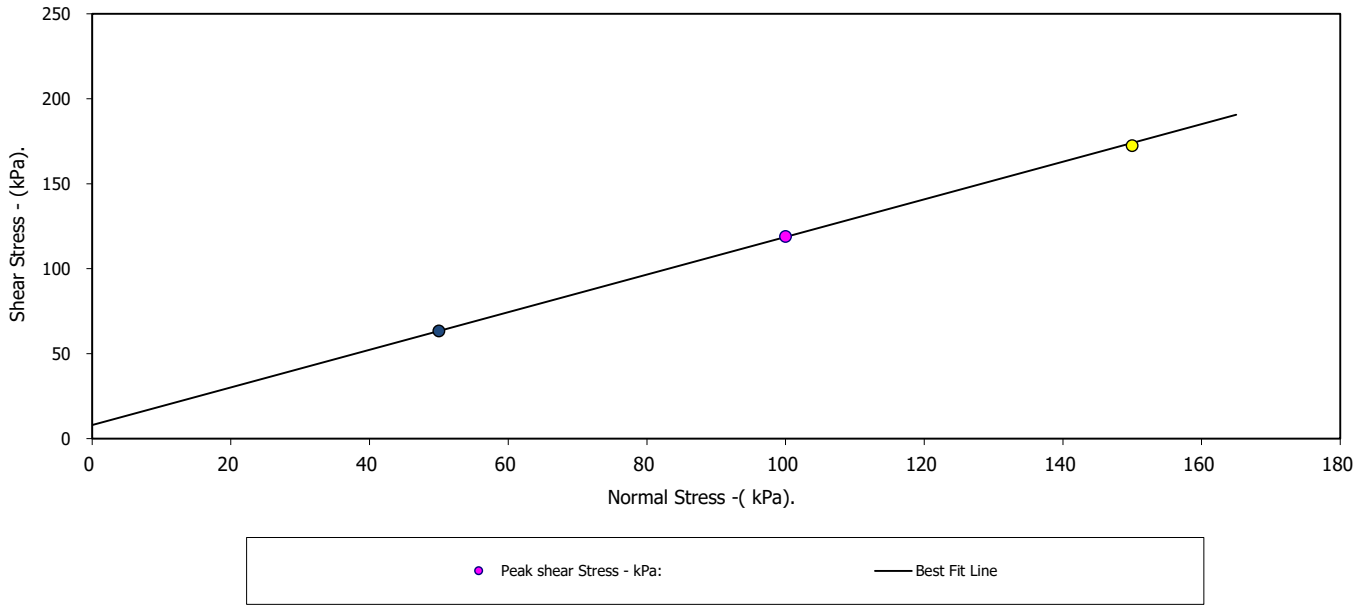
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	134.00	134.00	134.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	7	7	7
Bulk Density - Mg/m3:	1.62	1.62	1.62
Dry Density - Mg/m3:	1.52	1.52	1.52
Voids Ratio:	0.7425	0.7426	0.7427
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	129.93	127.63	125.80
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	54.10	65.71	66.42
Peak shear Stress - kPa:	63	119	173

PEAK	
Angle of Shearing Resistance:(θ)	**47.9**
Effective Cohesion - kPa:	**8**

FAILURE CONDITIONS



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Buttington Quarry (B.Quarry)

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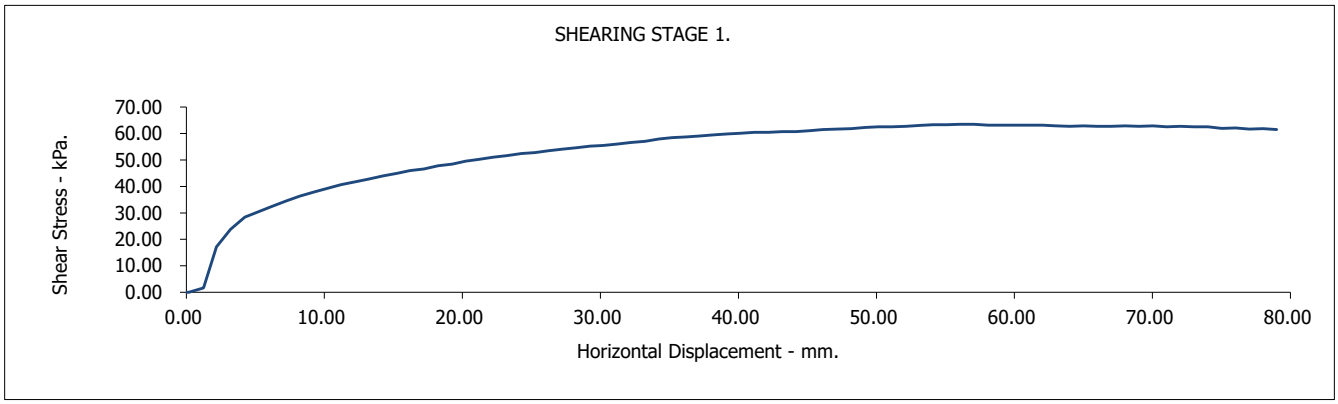
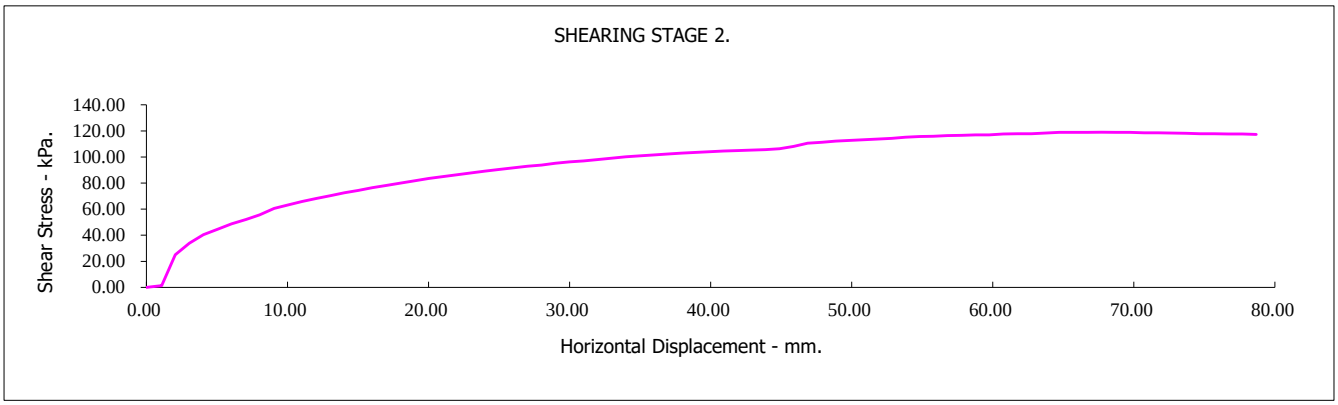
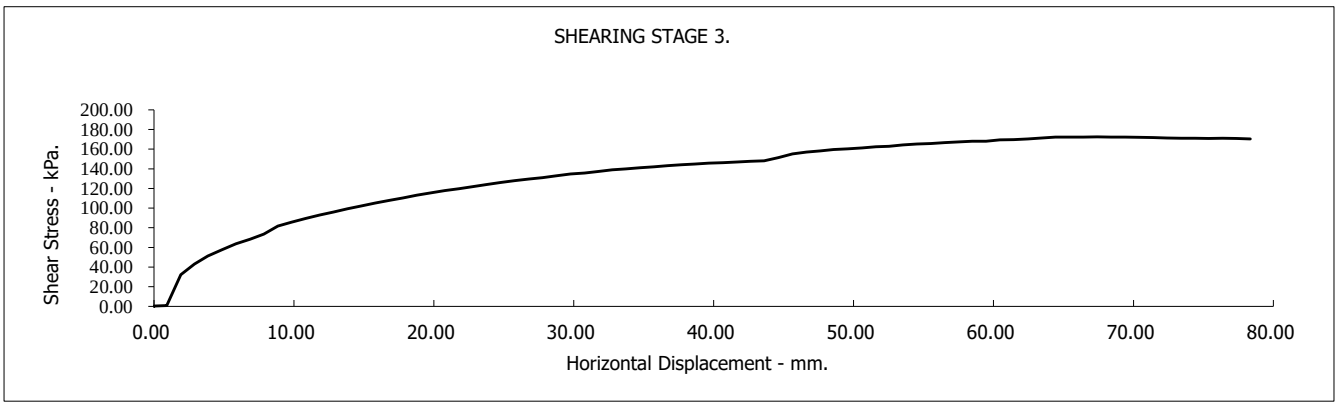
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

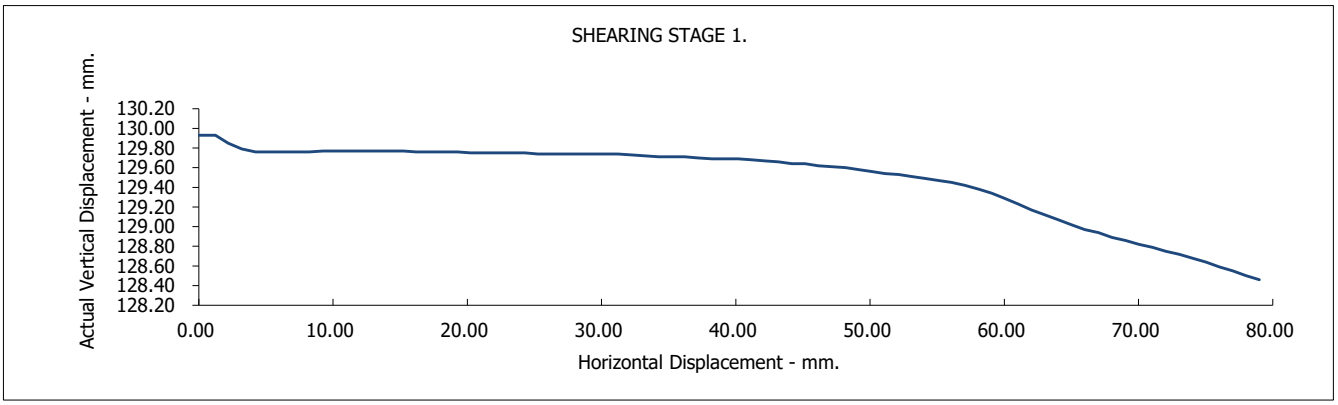
Client Ref Number: **14880RH**

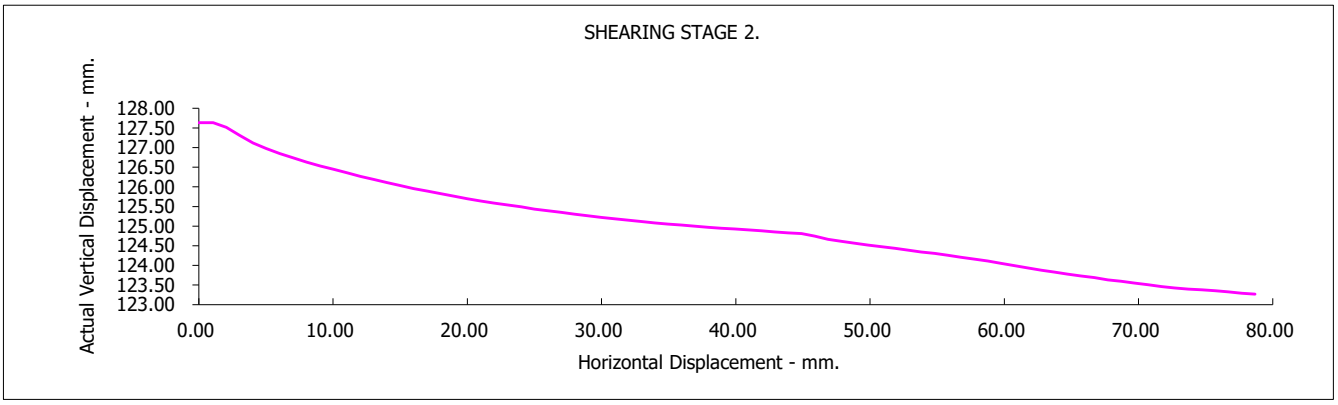
Figure.

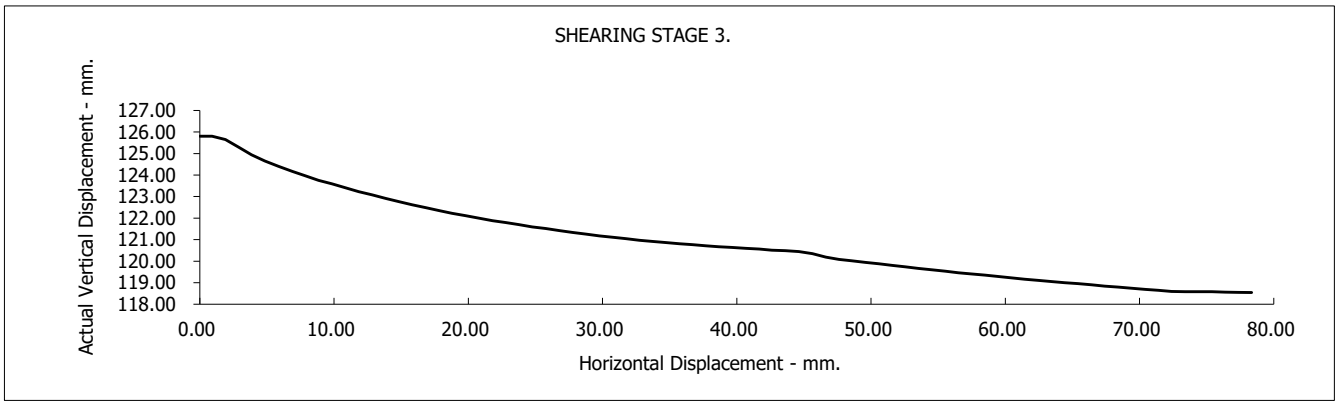
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

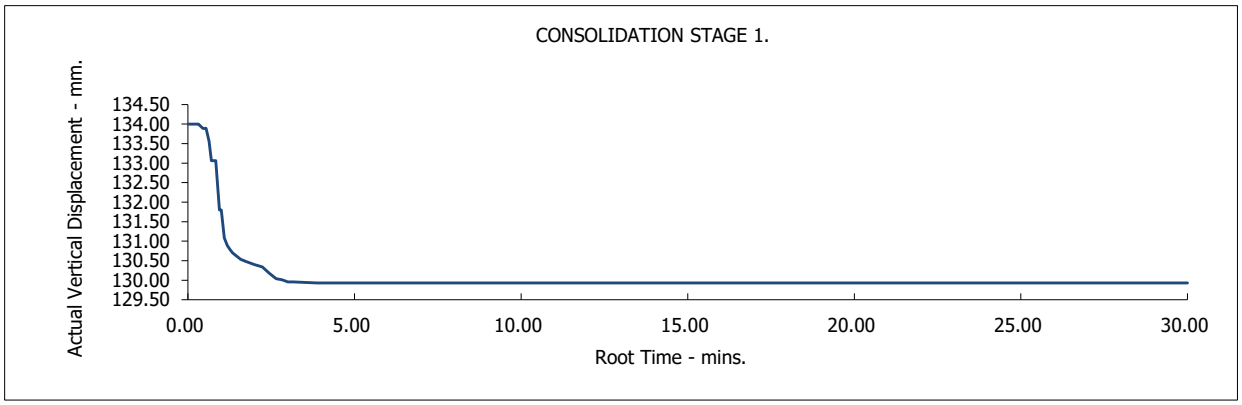
Client Ref Number: **14880RH**

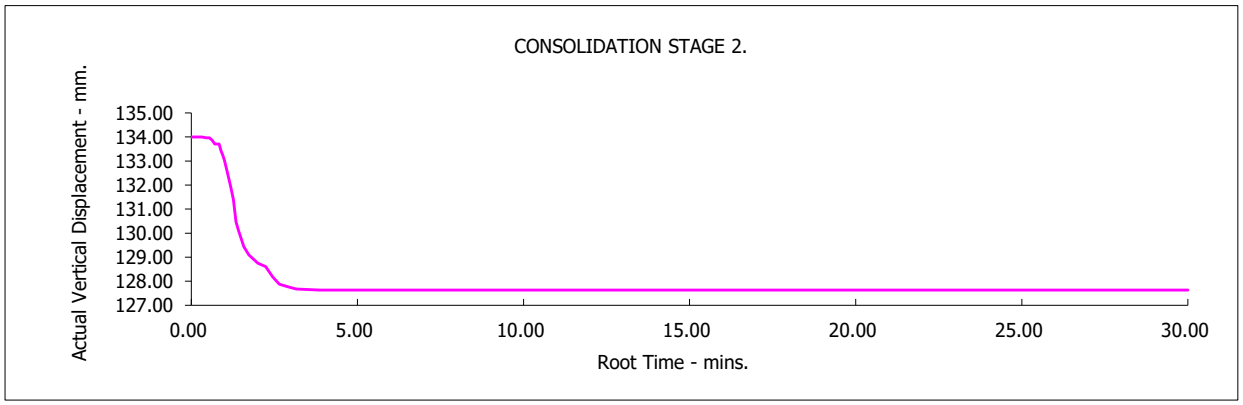
Figure.

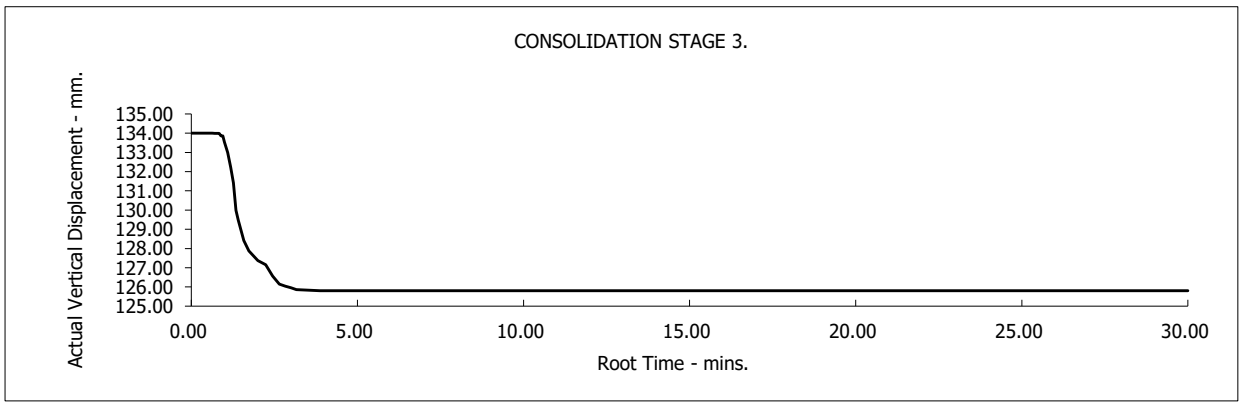
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S4	Depth from (m):	0.00
Sample Number :	4	Depth to (m):	0.00

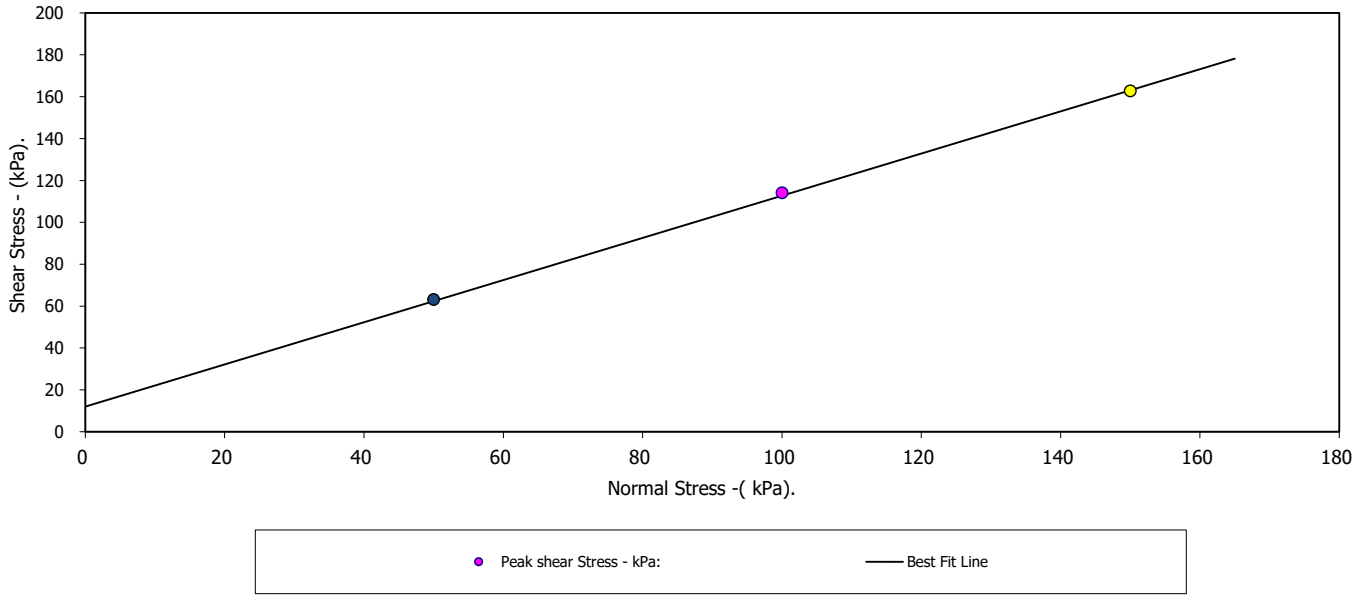
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	134.00	134.00	134.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	12	12	12
Bulk Density - Mg/m3:	1.59	1.59	1.59
Dry Density - Mg/m3:	1.43	1.43	1.43
Voids Ratio:	0.8575	0.8577	0.8575
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	130.29	129.03	127.07
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	53.12	52.66	56.20
Peak shear Stress - kPa:	63	114	163

PEAK	
Angle of Shearing Resistance:(θ)	**45.2**
Effective Cohesion - kPa:	**12**

FAILURE CONDITIONS



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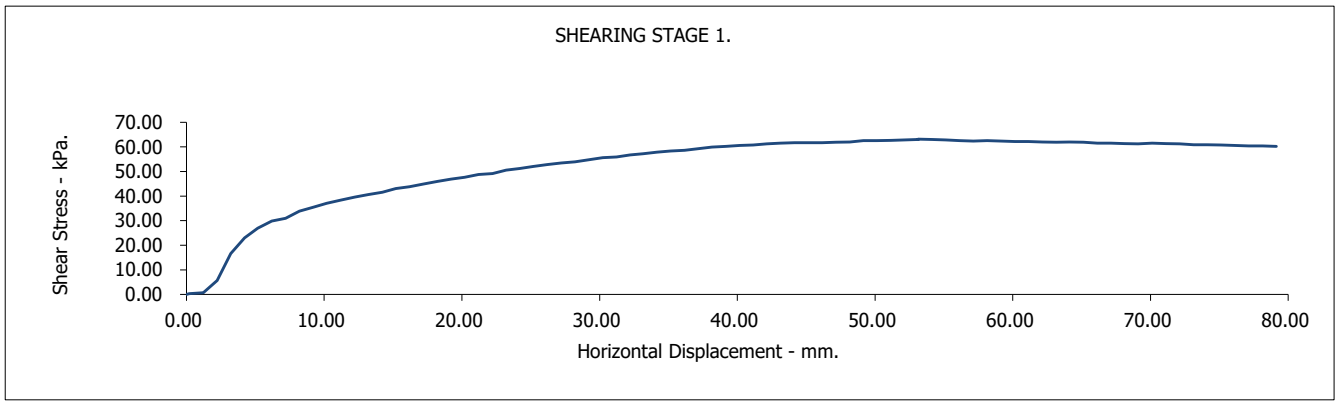
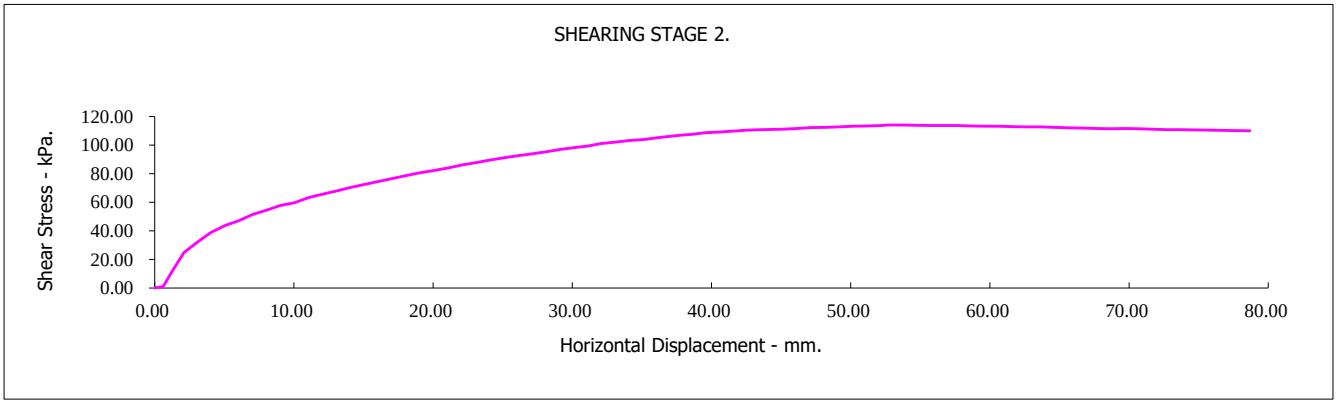
Buttington Quarry (B.Quarry)

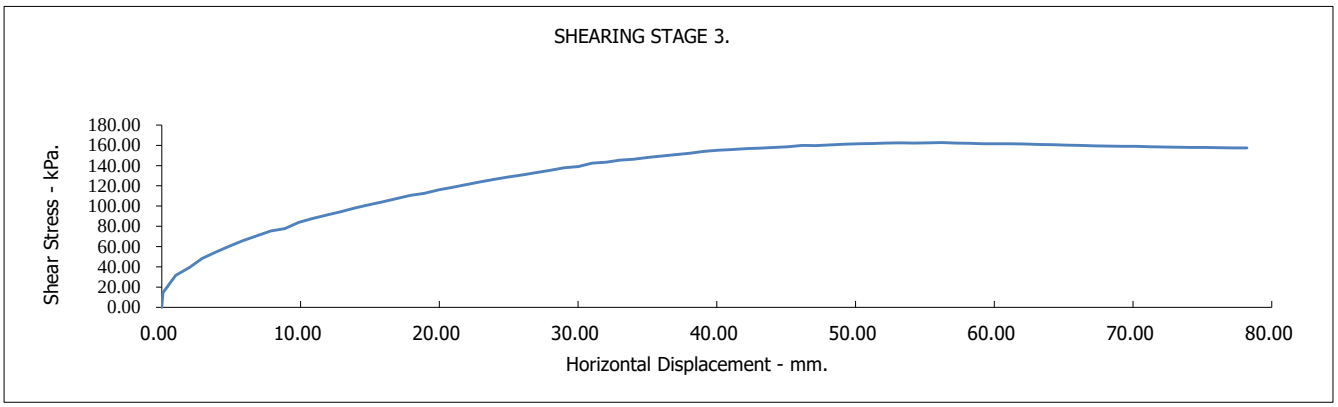
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

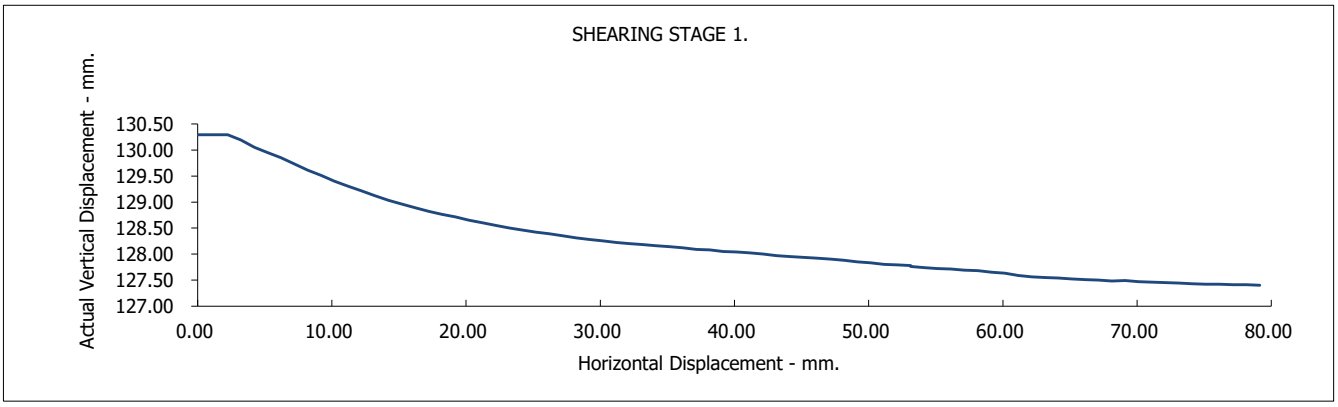
Client Ref Number: **14880RH**

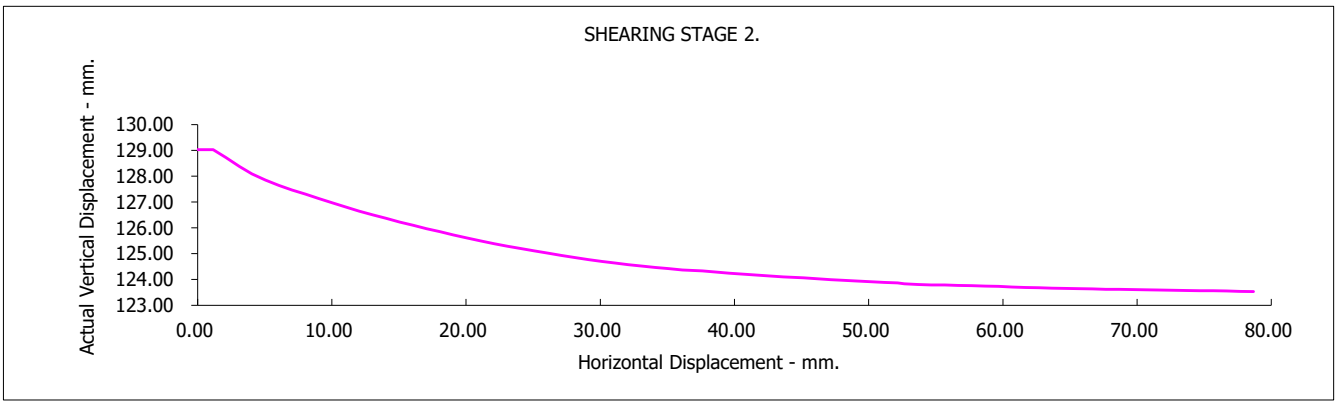
Figure.

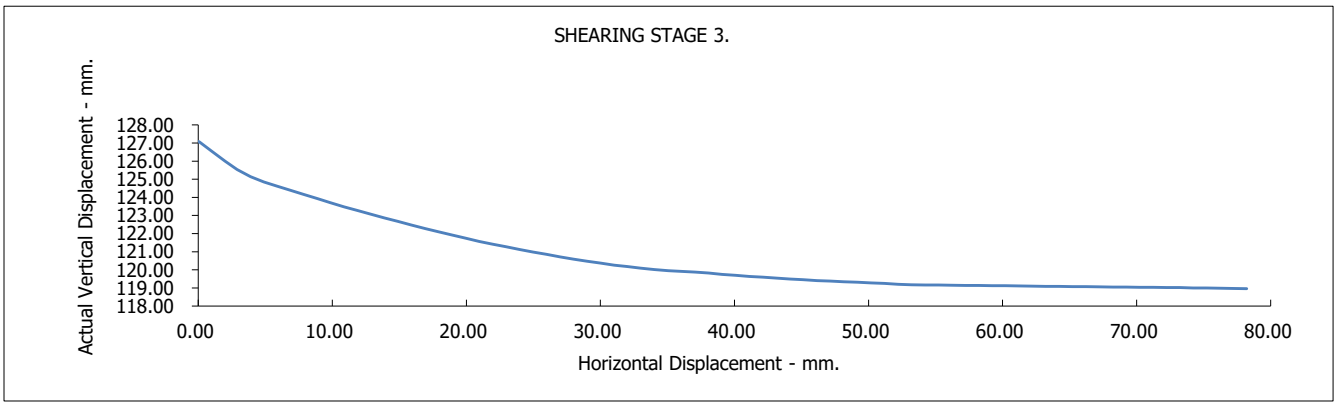
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

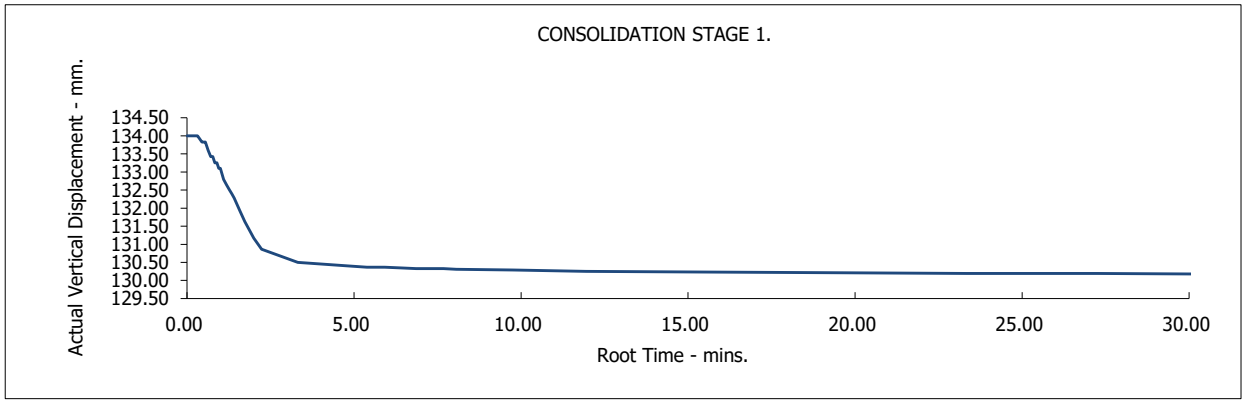
Client Ref Number: **14880RH**

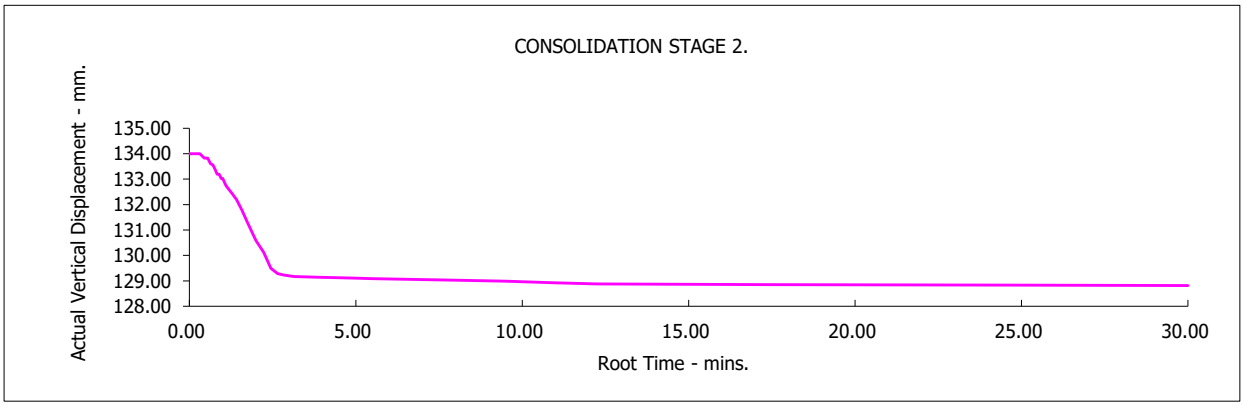
Figure.

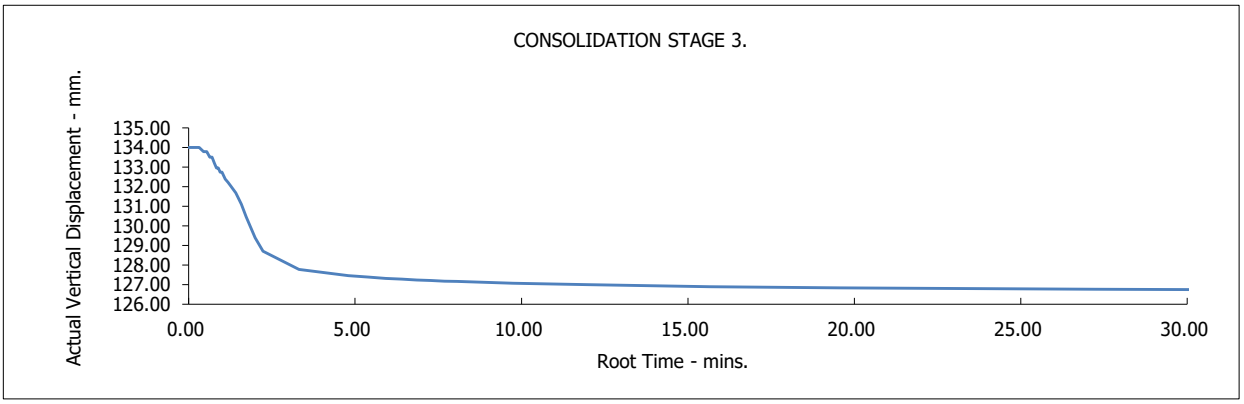
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S5	Depth from (m):	0.00
Sample Number :	5	Depth to (m):	0.00

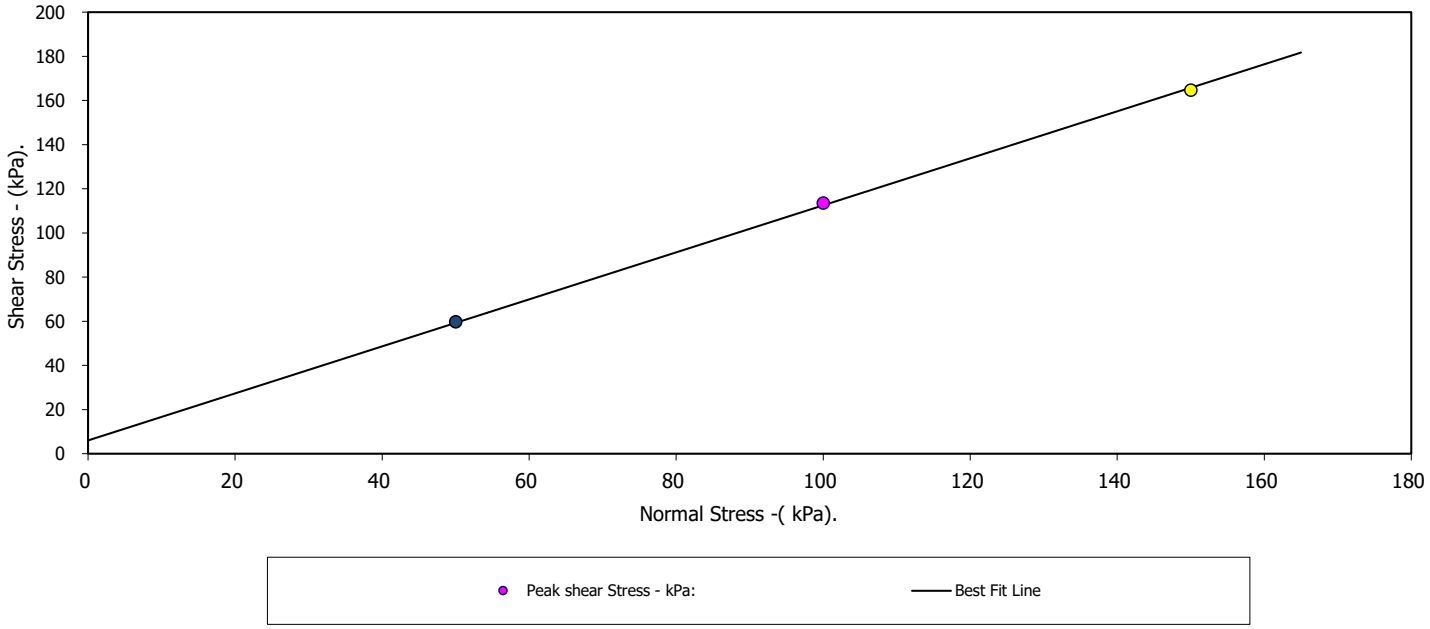
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	132.50	132.50	132.50
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	6	6	6
Bulk Density - Mg/m3:	1.65	1.65	1.65
Dry Density - Mg/m3:	1.55	1.55	1.55
Voids Ratio:	0.7053	0.7049	0.7050
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	128.00	126.20	124.88
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	60.01	61.02	61.02
Peak shear Stress - kPa:	60	113	165

PEAK	
Angle of Shearing Resistance:(θ)	**46.8**
Effective Cohesion - kPa:	**6**

FAILURE CONDITIONS



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Contract No.:
41501

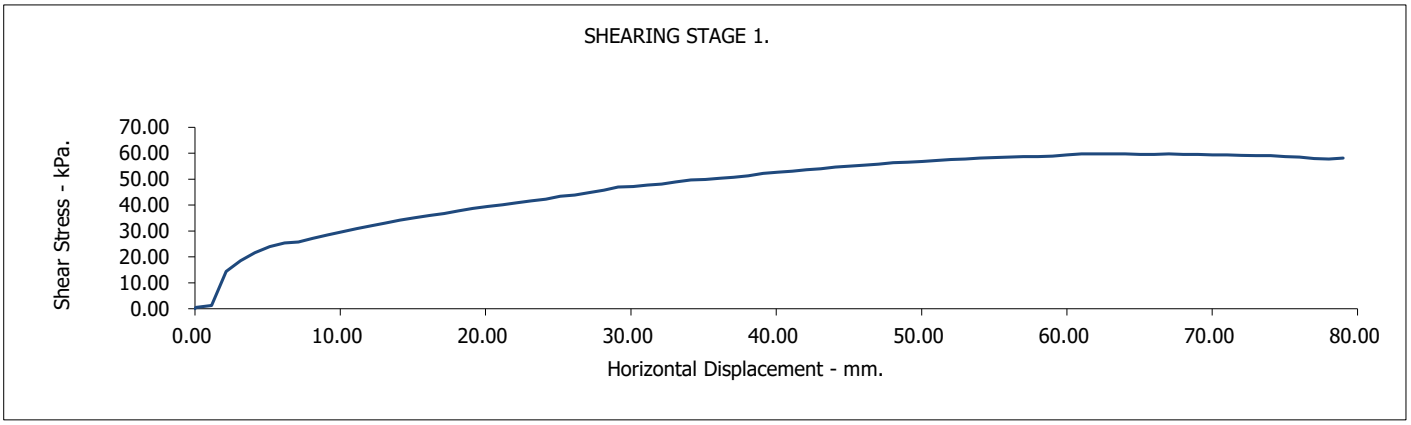
Buttington Quarry (B.Quarry)

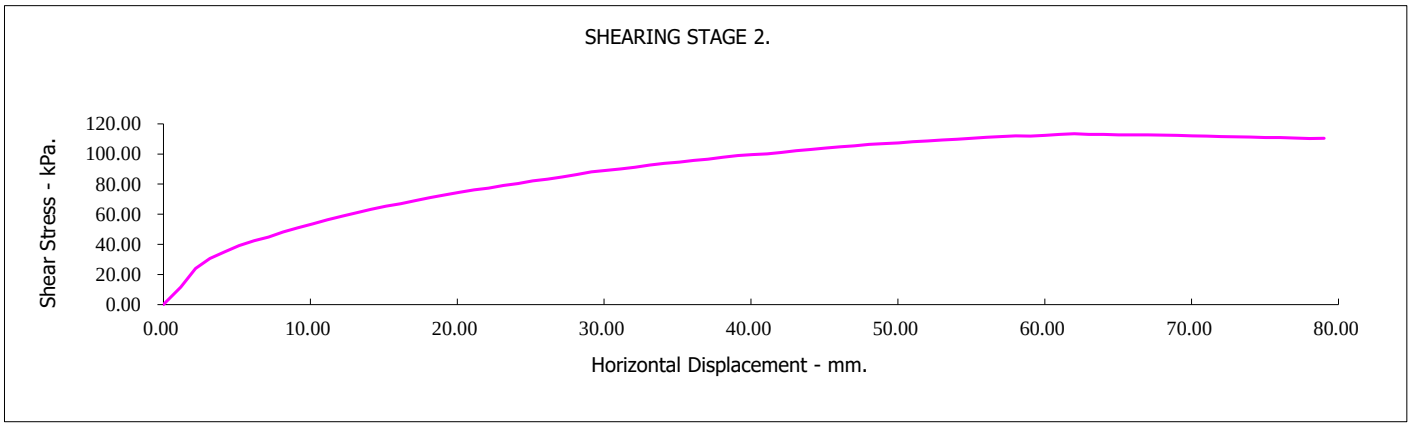
Client Ref Number:
14880RH

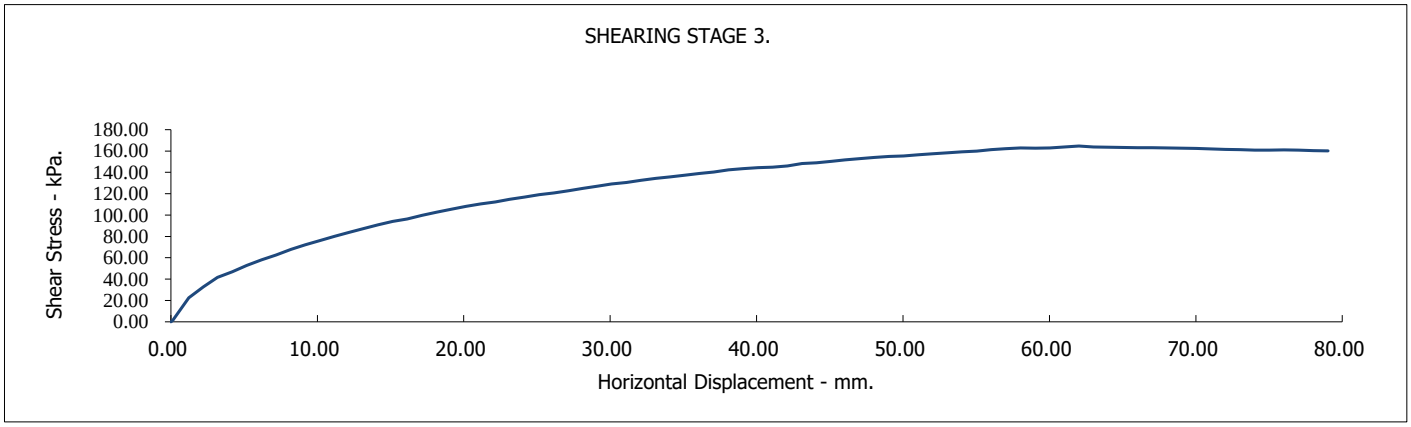
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

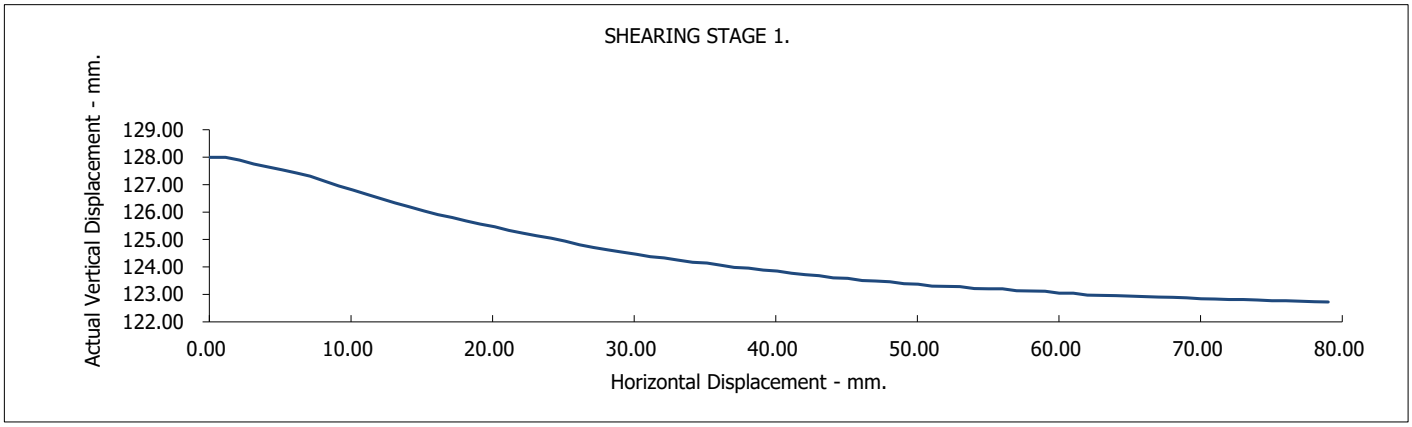
Client Ref Number: **14880RH**

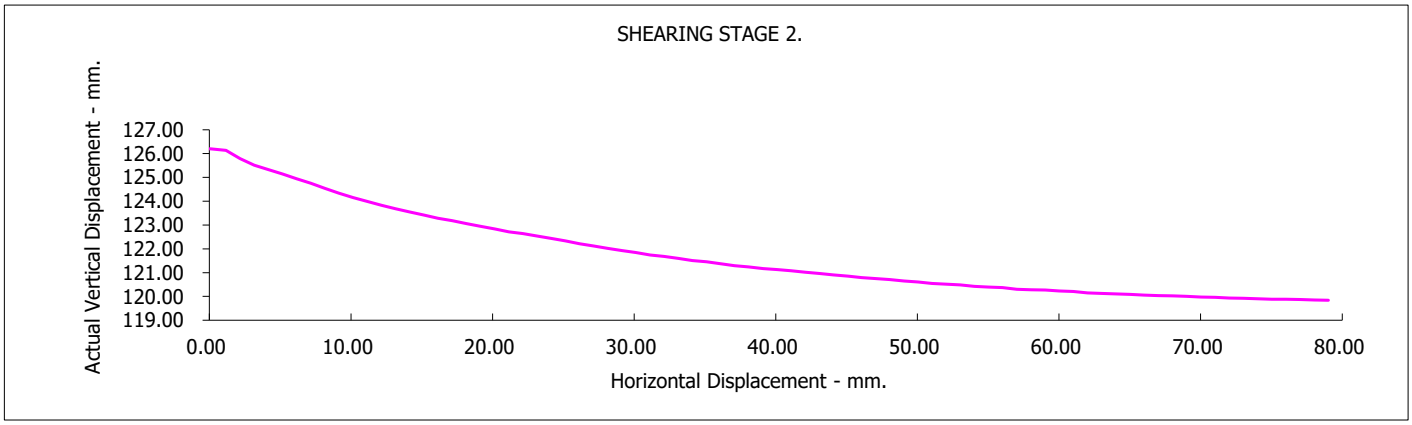
Figure.

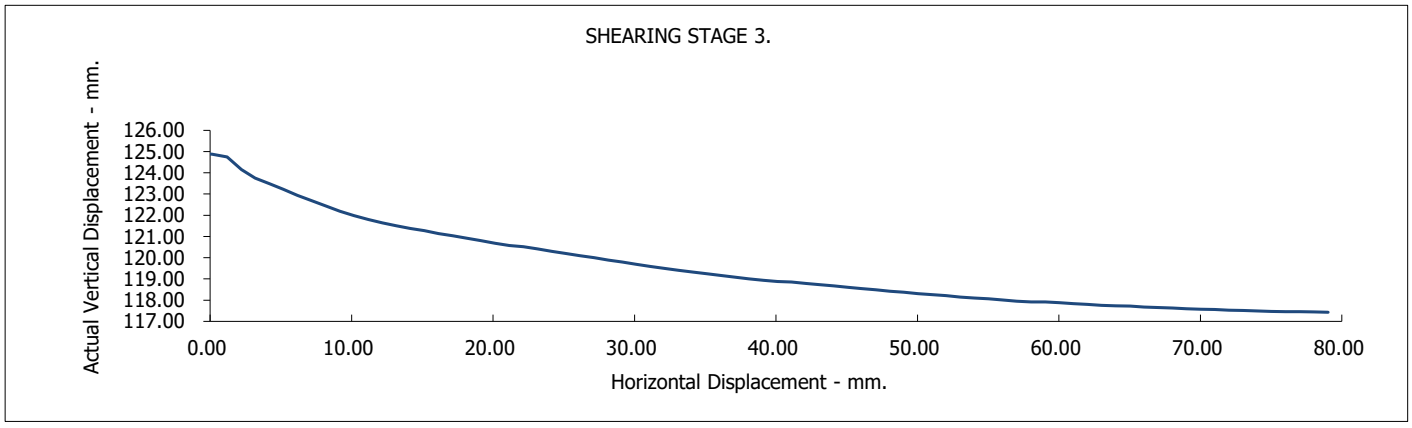
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

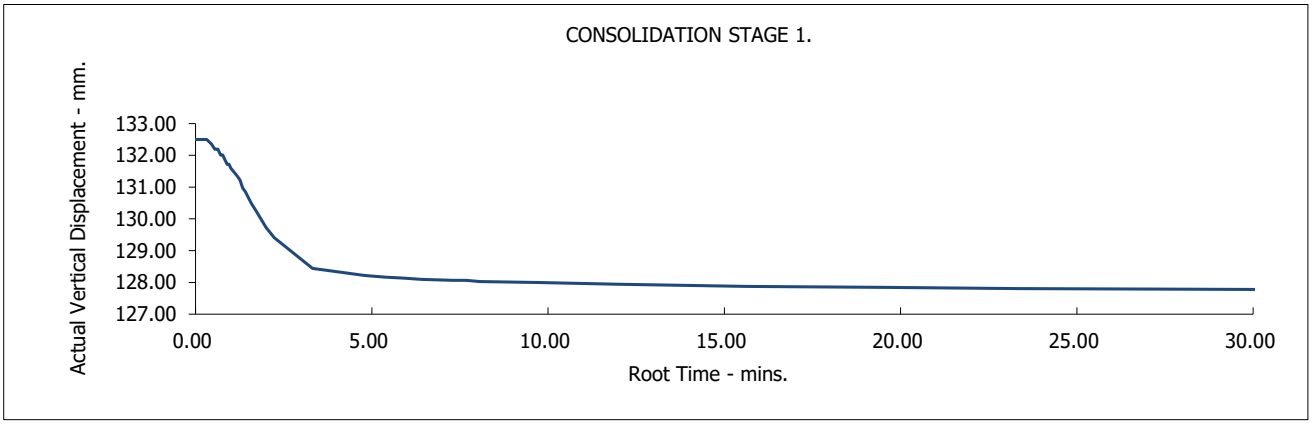
Client Ref Number: **14880RH**

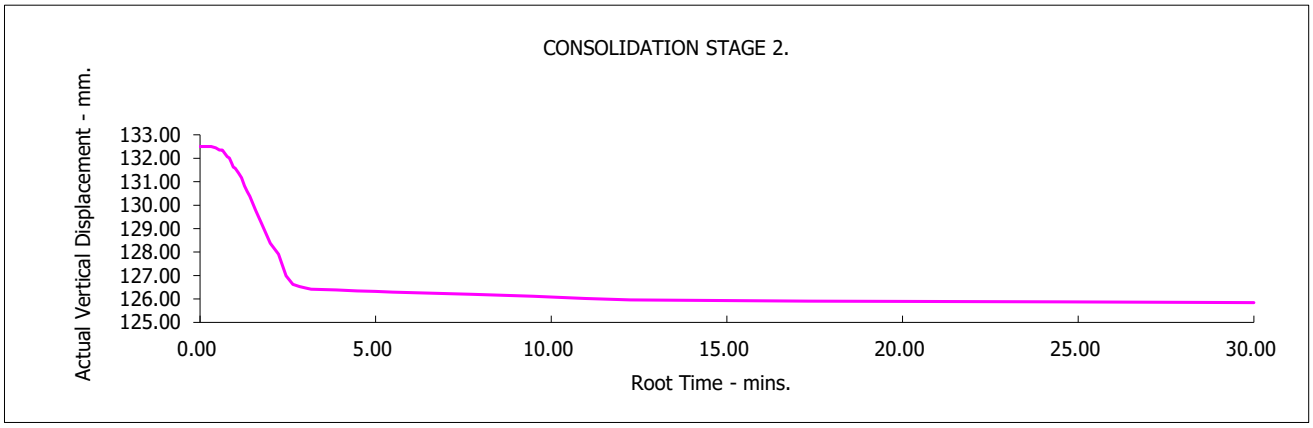
Figure.

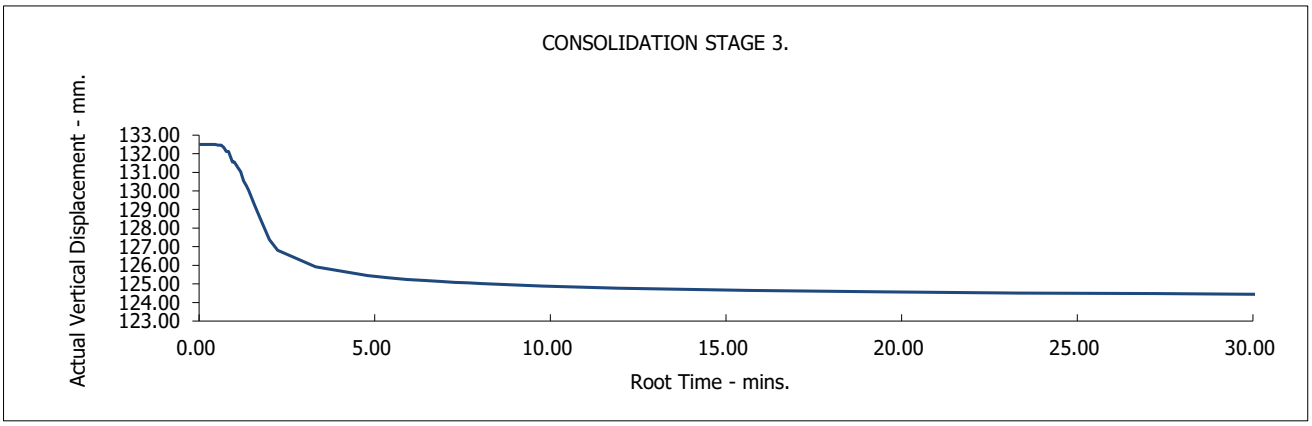
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

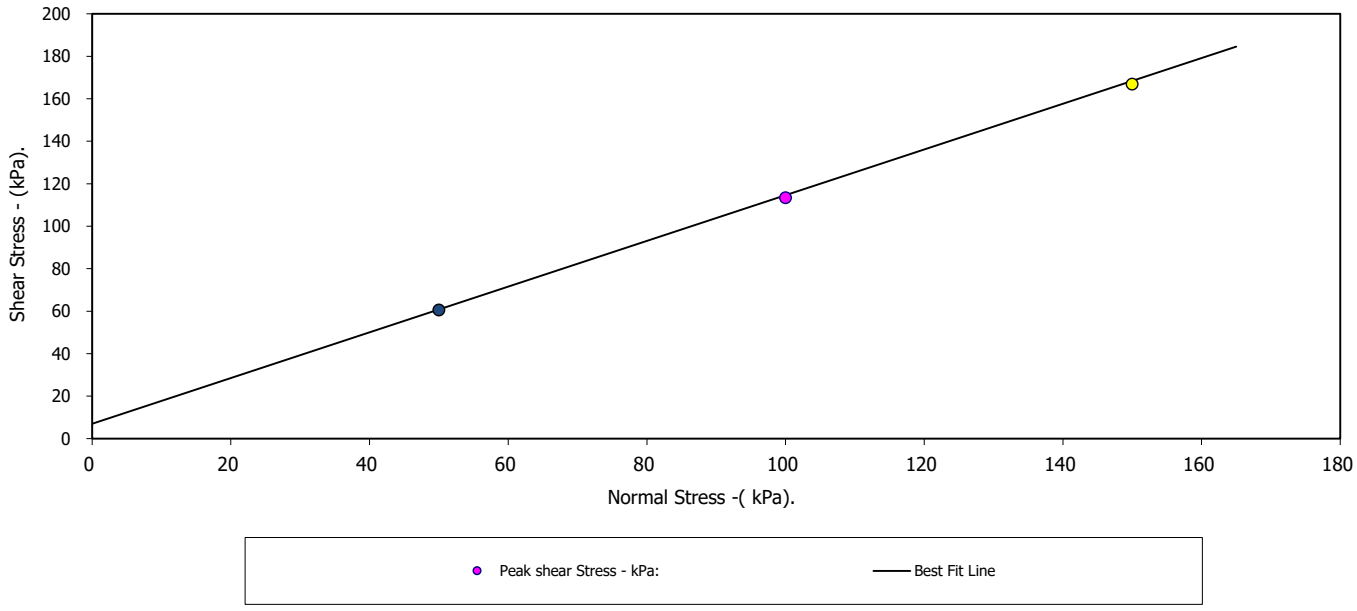
Borehole Number:	S6	Depth from (m):	0.00
Sample Number :	6	Depth to (m):	0.00

Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.
Sample Description: **Brown slightly clayey fine to medium GRAVEL**	

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	135.00	135.00	135.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	1.60	1.60	1.60
Dry Density - Mg/m3:	1.44	1.44	1.44
Voids Ratio:	0.8353	0.8351	0.8355
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	132.22	129.72	128.51
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	66.14	67.37	57.68
Peak shear Stress - kPa:	61	113	167

PEAK	
Angle of Shearing Resistance:(θ)	**47.1**
Effective Cohesion - kPa:	**7**

FAILURE CONDITIONS



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Contract No.:
41501

Client Ref Number:
14880RH

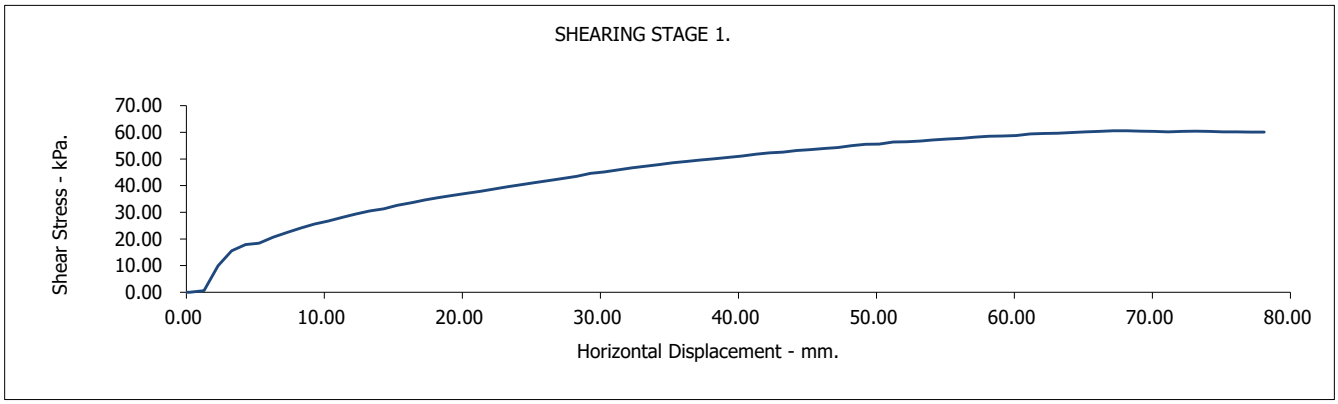
Buttington Quarry (B.Quarry)

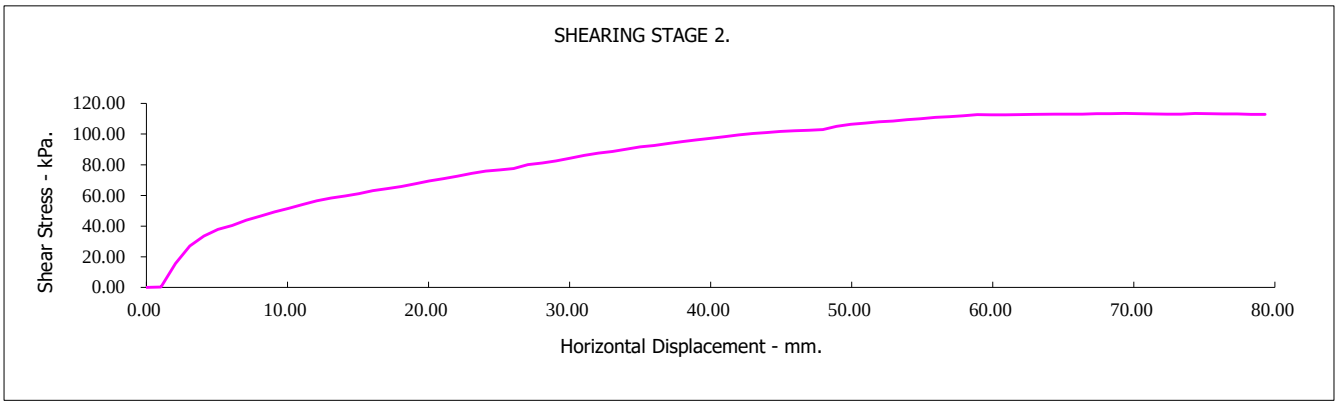
GSTL
GEO SITE & TESTING SERVICES LTD

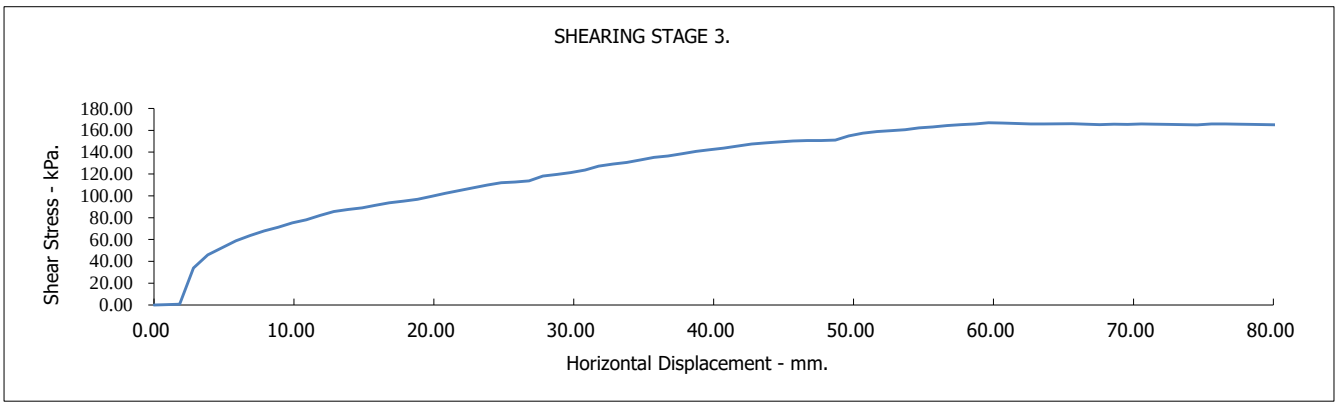
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

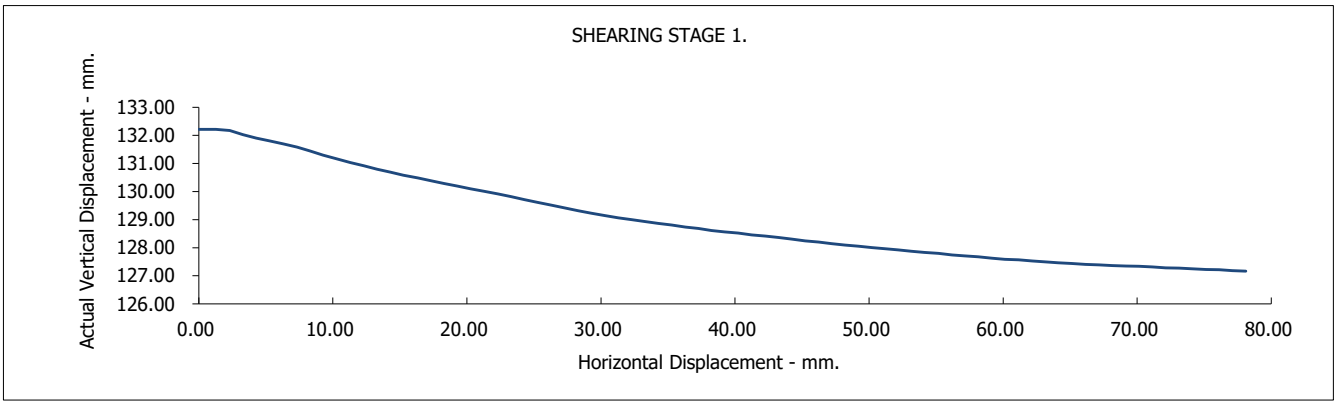
Client Ref Number: **14880RH**

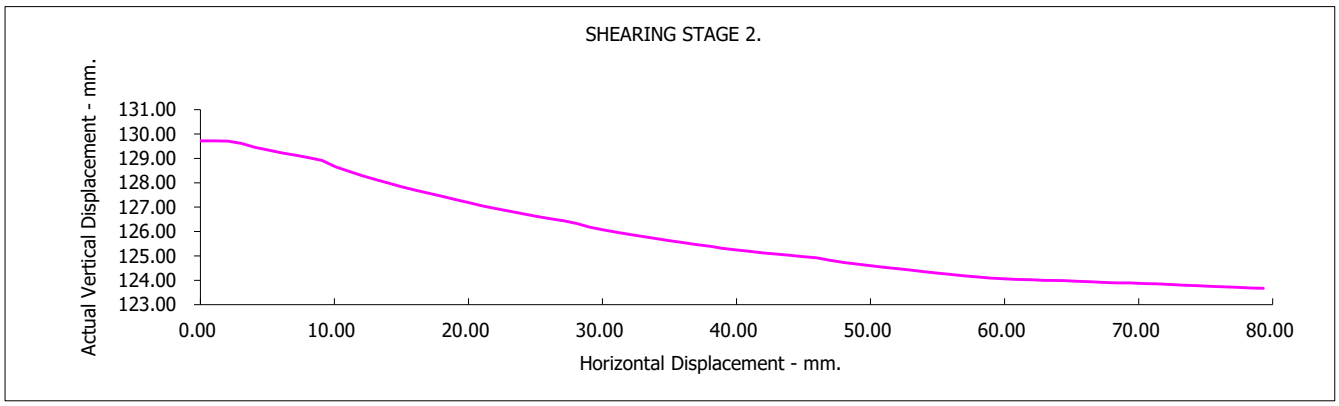
Figure.

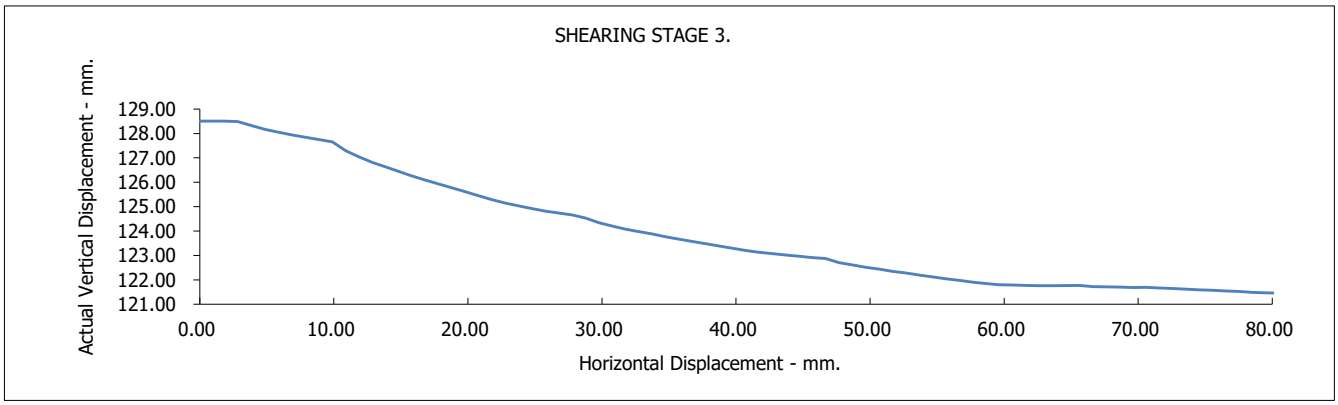
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

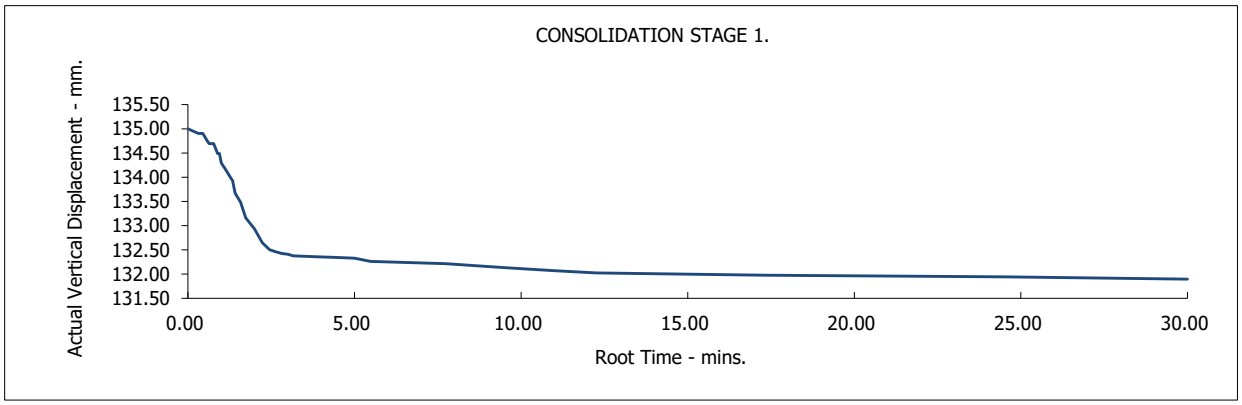
Client Ref Number: **14880RH**

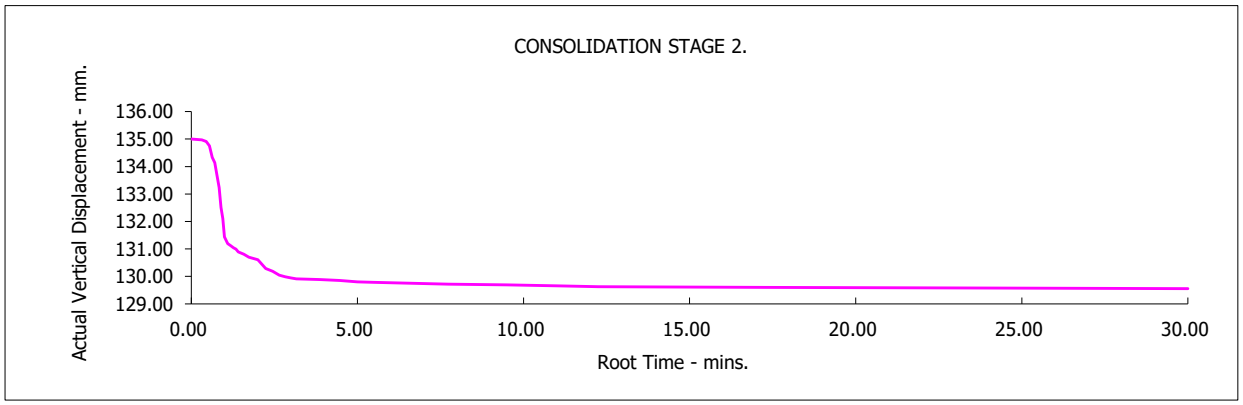
Figure.

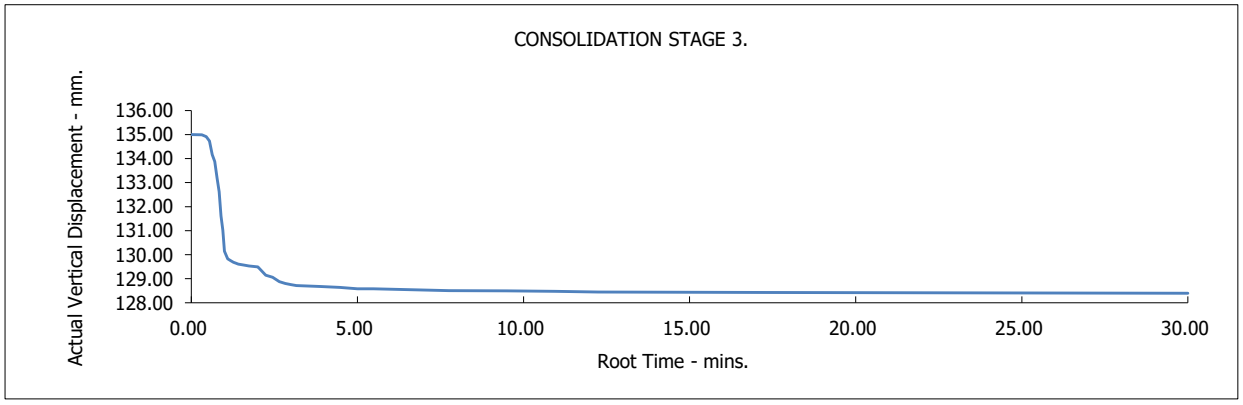
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

GSTL	Determination of Slake Durability Index ISRM Part 2.2	
Contract Number	41501	
Site Name	Buttington Quarry (B.Quarry)	
Nature of Slaking Fluid	Water at 20°C	
Date Tested	19/11/2018	

Hole Reference	Depth (m)			Slake First Cycle	Slake Second Cycle	Appearance Of Material Retained In The Drum	Appearance Of Material Passing Through The Drum
S1				87.79	75.84	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S2				88.18	74.93	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S3				95.84	92.97	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S4				92.52	88.10	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S5				93.77	89.44	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S6				91.14	88.01	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.

Key	Reported As
Slake First Cycle	%
Slake Second Cycle	%

Operators	Checked	19/11/2018	Wayne Honey	W. Honey
JD	Approved	20/11/2018	Ben Sharp	

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S1	Depth from (m):	0.00
Sample Number :	1	Depth to (m):	0.00

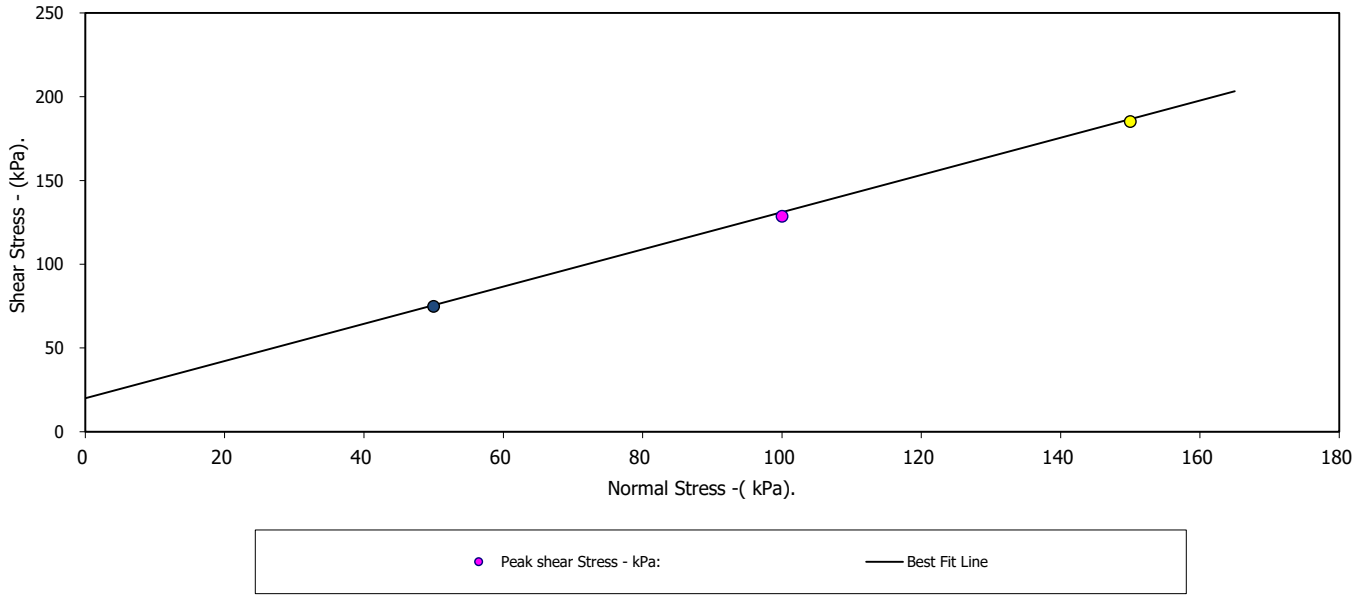
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	136.00	136.00	136.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.04	2.04	2.04
Dry Density - Mg/m3:	1.85	1.85	1.85
Voids Ratio:	0.4316	0.4317	0.4318
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	133.03	131.54	129.77
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	58.55	60.41	63.30
Peak shear Stress - kPa:	75	129	185

PEAK	
Angle of Shearing Resistance:(θ)	**48.0**
Effective Cohesion - kPa:	**20**

FAILURE CONDITIONS



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Contract No.:
41501

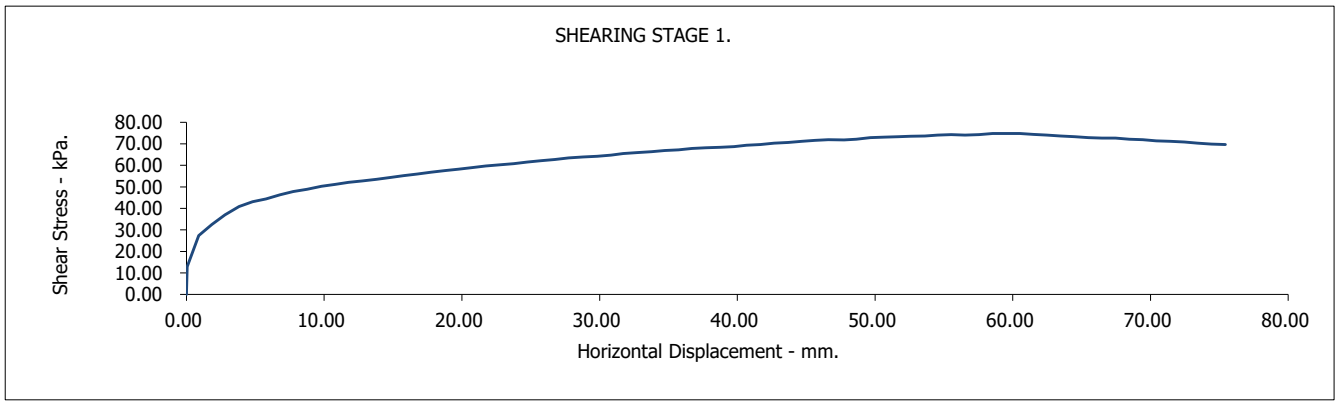
Client Ref Number:
14880RH

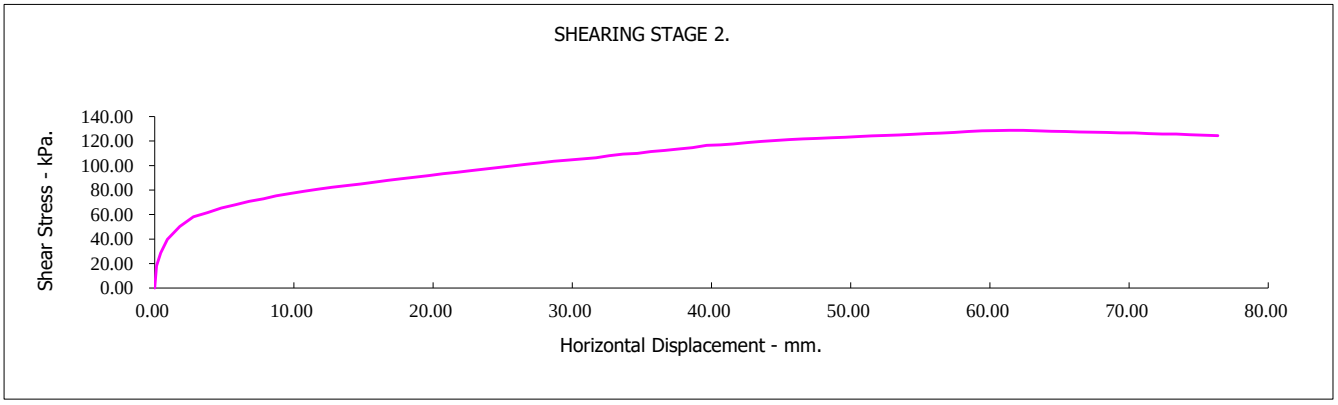
Buttington Quarry (B.Quarry)

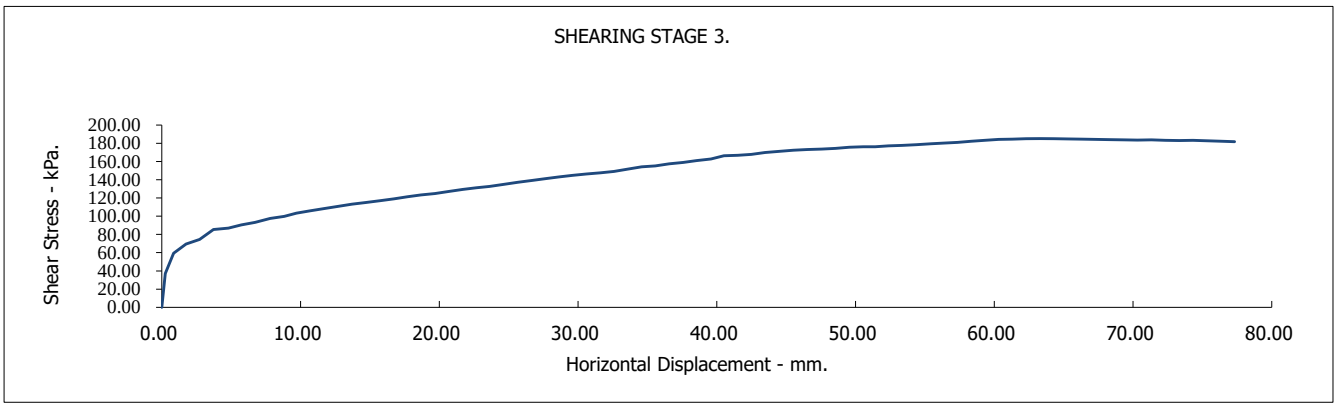
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

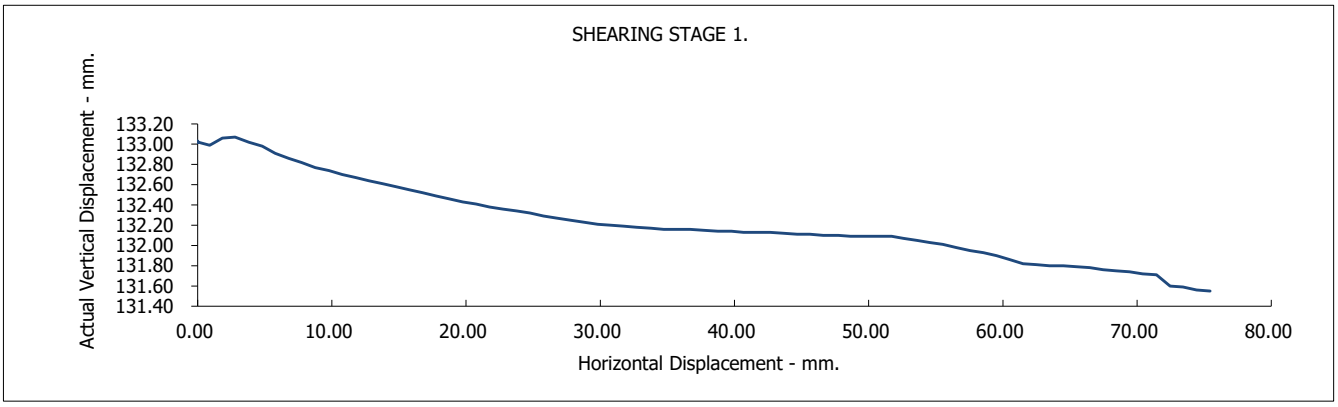
Client Ref Number: **14880RH**

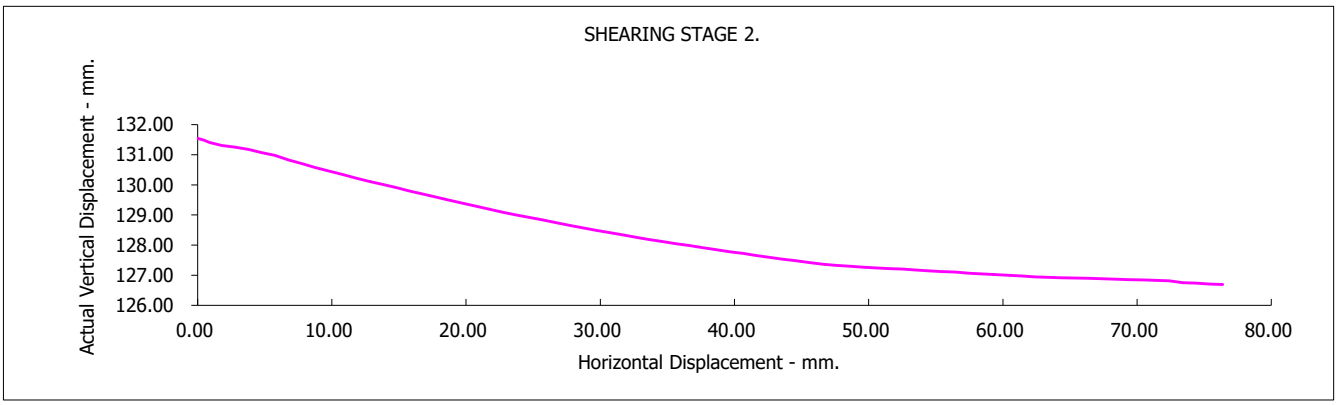
Figure.

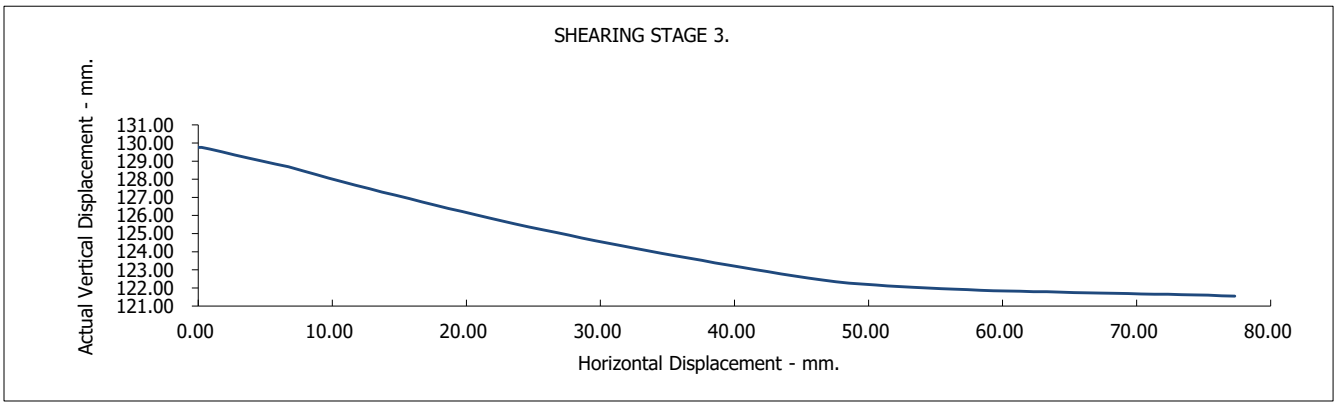
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

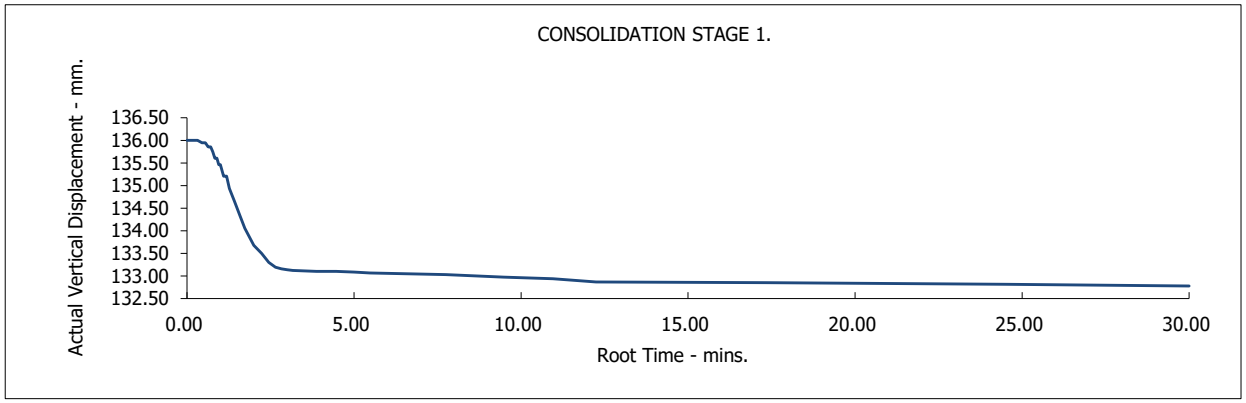
Client Ref Number: **14880RH**

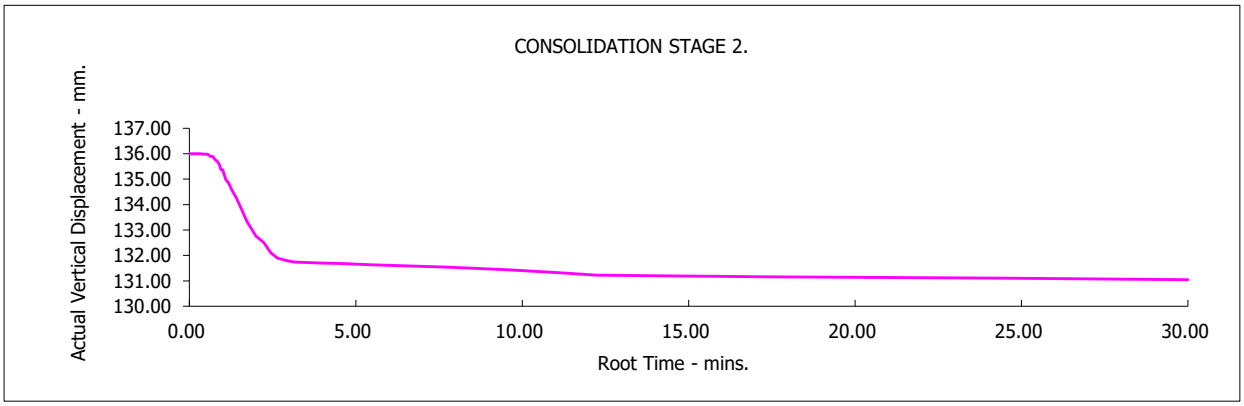
Figure.

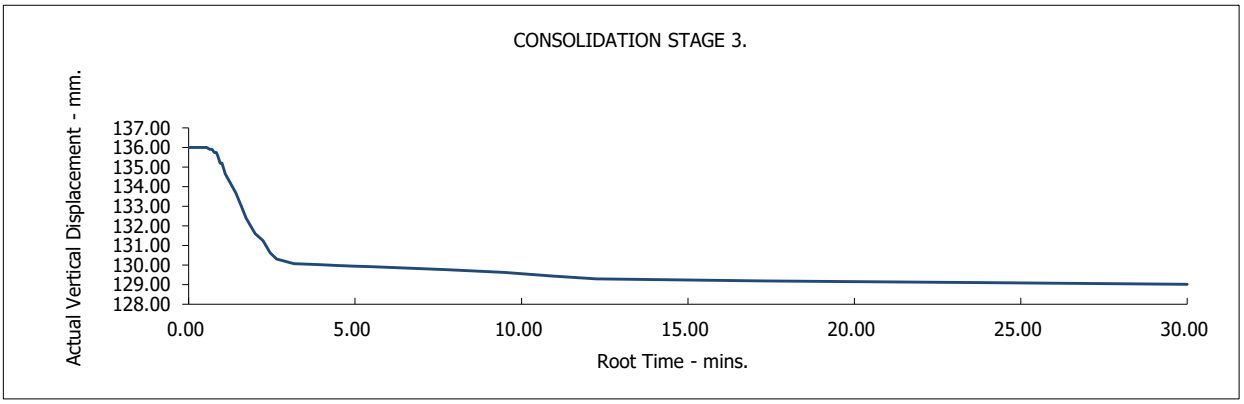
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S1 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S2	Depth from (m):	0.00
Sample Number :	2	Depth to (m):	0.00

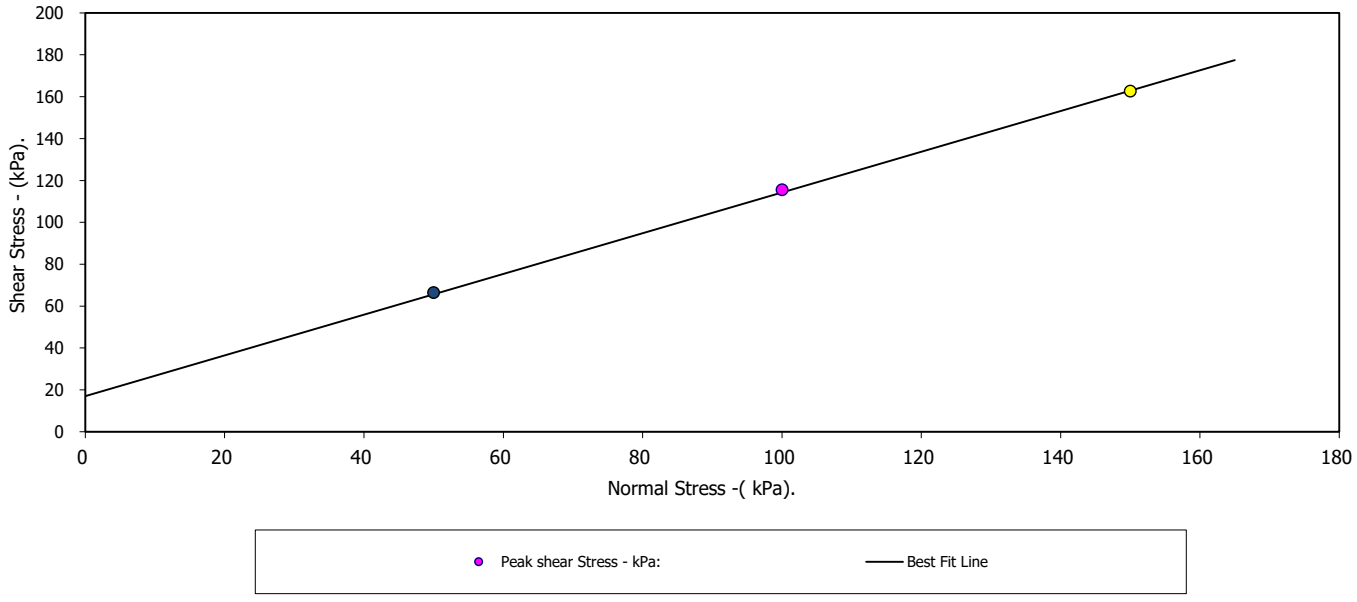
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	130.00	130.00	130.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.02	2.02	2.02
Dry Density - Mg/m3:	1.83	1.83	1.83
Voids Ratio:	0.4478	0.4478	0.4477
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	126.40	121.96	117.52
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	55.06	55.19	57.32
Peak shear Stress - kPa:	66	116	163

PEAK	
Angle of Shearing Resistance:(θ)	**44.2**
Effective Cohesion - kPa:	**17**

FAILURE CONDITIONS



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Buttington Quarry (B.Quarry)

Client Ref Number:
14880RH

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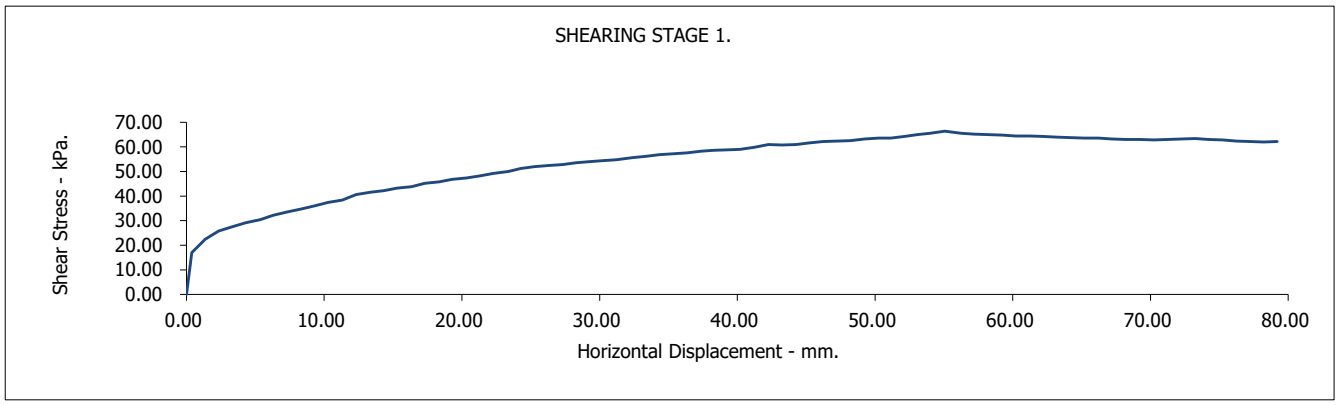
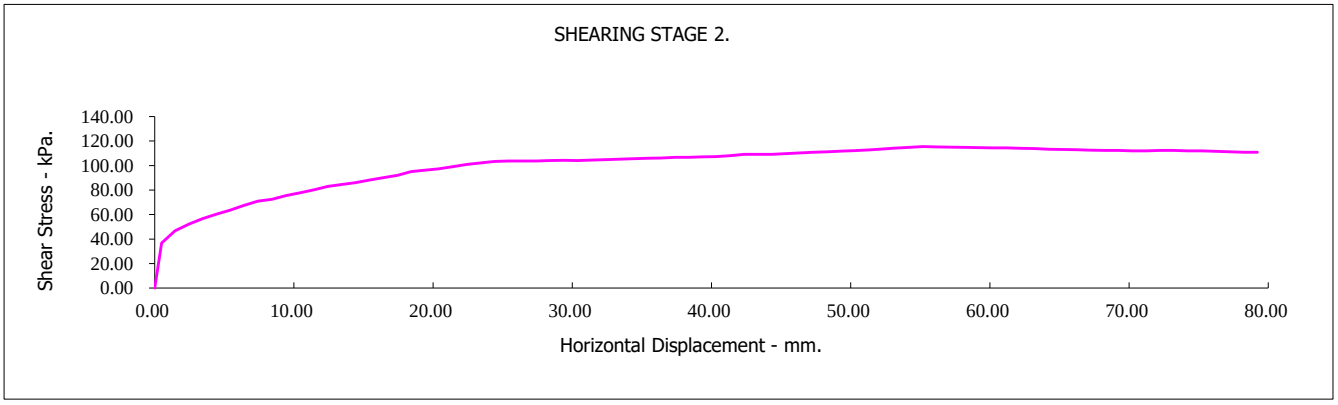
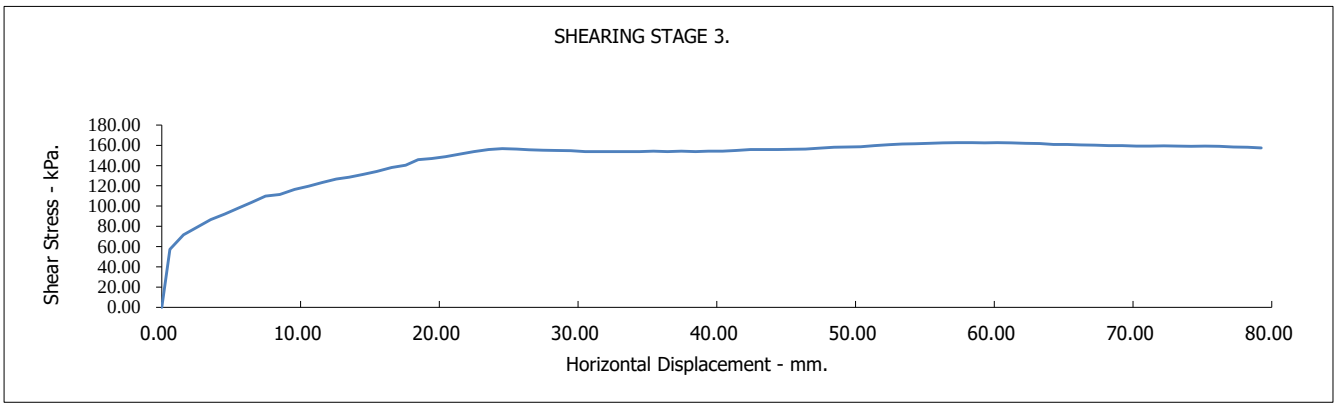
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

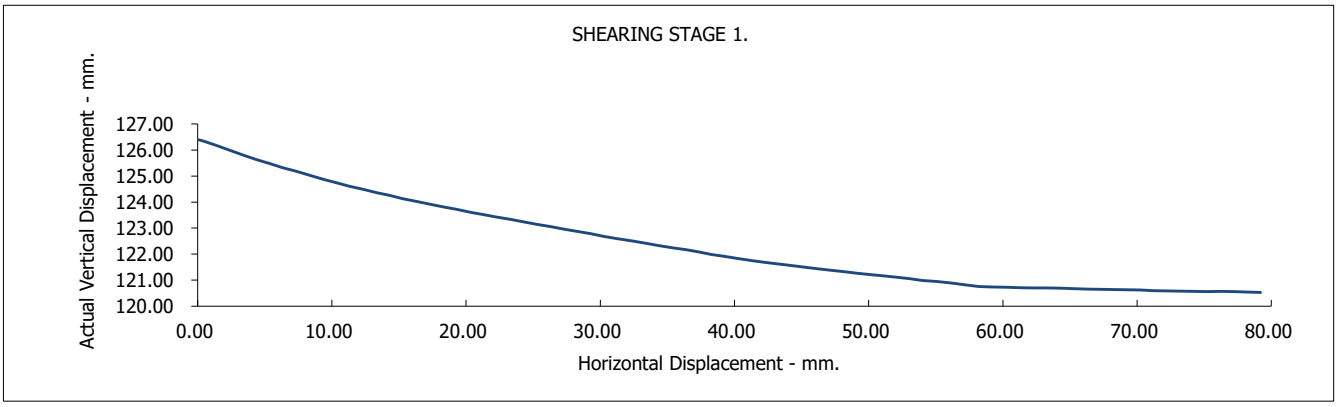
Client Ref Number: **14880RH**

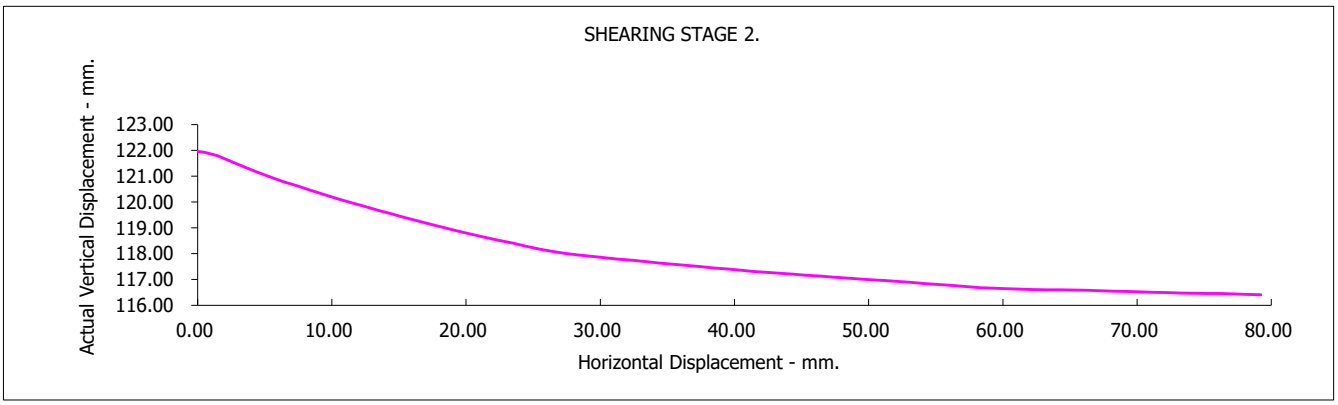
Figure.

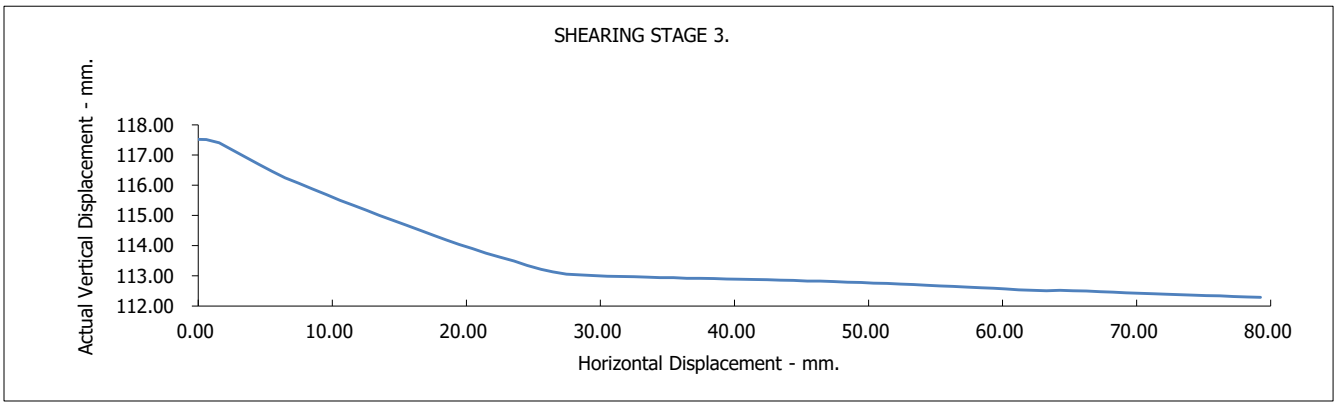
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

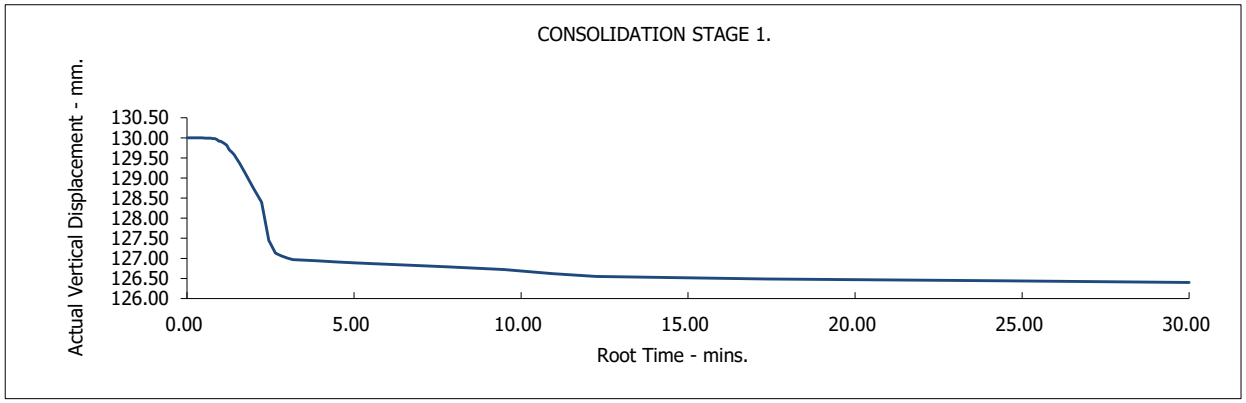
Client Ref Number: **14880RH**

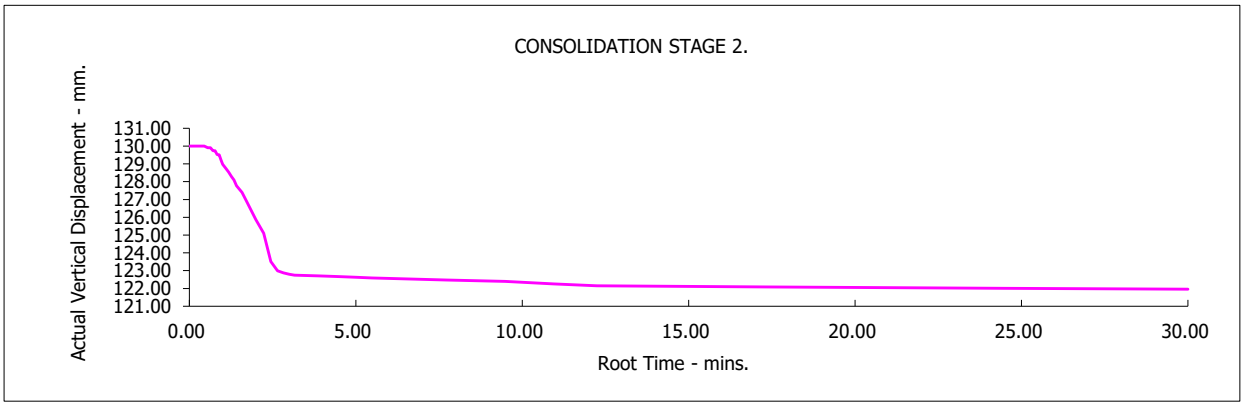
Figure.

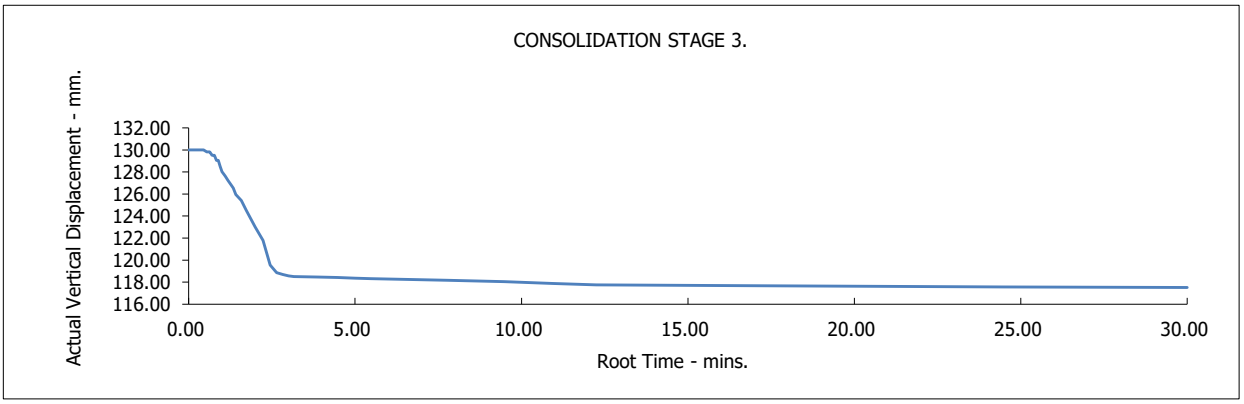
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S2 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S3	Depth from (m):	0.00
Sample Number :	3	Depth to (m):	0.00

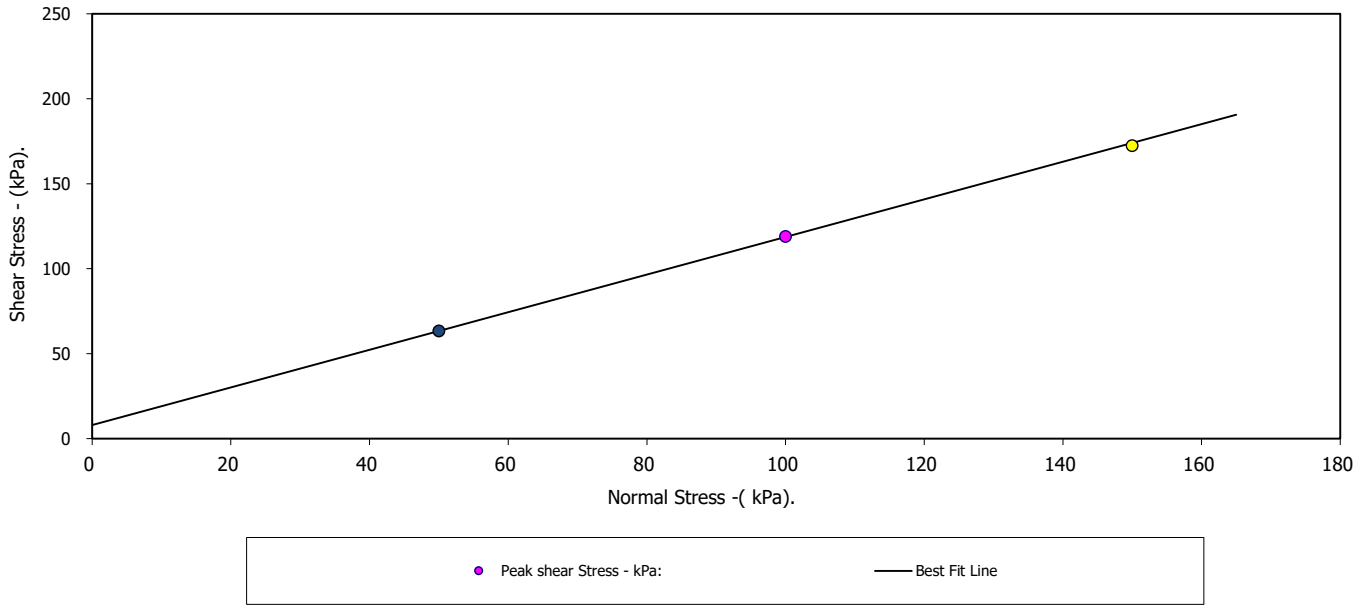
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	134.00	134.00	134.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	7	7	7
Bulk Density - Mg/m3:	1.62	1.62	1.62
Dry Density - Mg/m3:	1.52	1.52	1.52
Voids Ratio:	0.7425	0.7426	0.7427
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	129.93	127.63	125.80
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	54.10	65.71	66.42
Peak shear Stress - kPa:	63	119	173

PEAK	
Angle of Shearing Resistance:(θ)	**47.9**
Effective Cohesion - kPa:	**8**

FAILURE CONDITIONS



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Buttington Quarry (B.Quarry)

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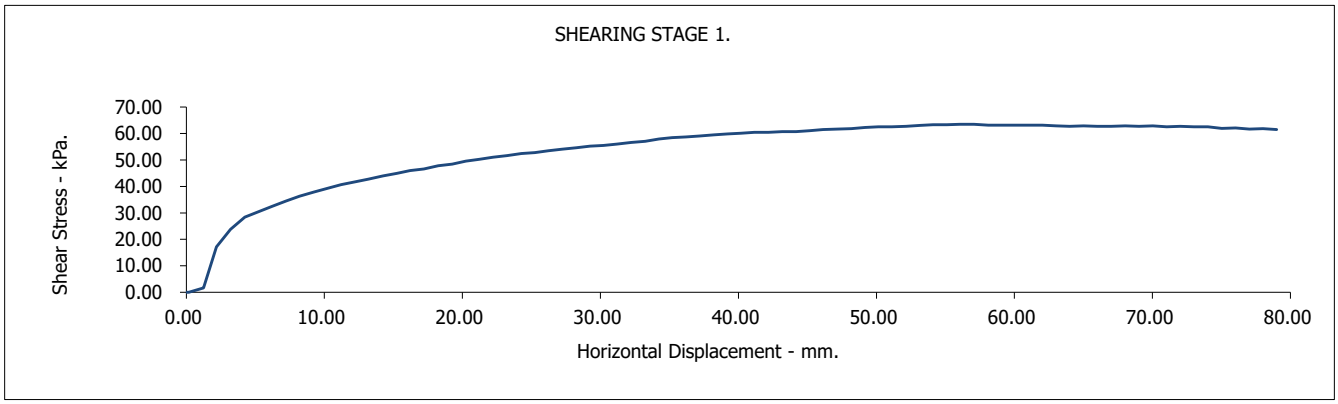
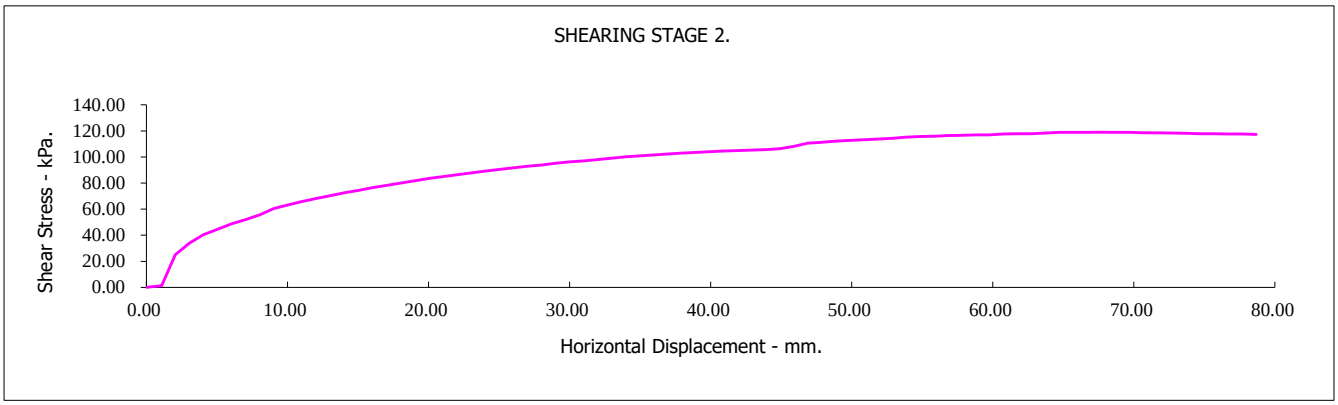
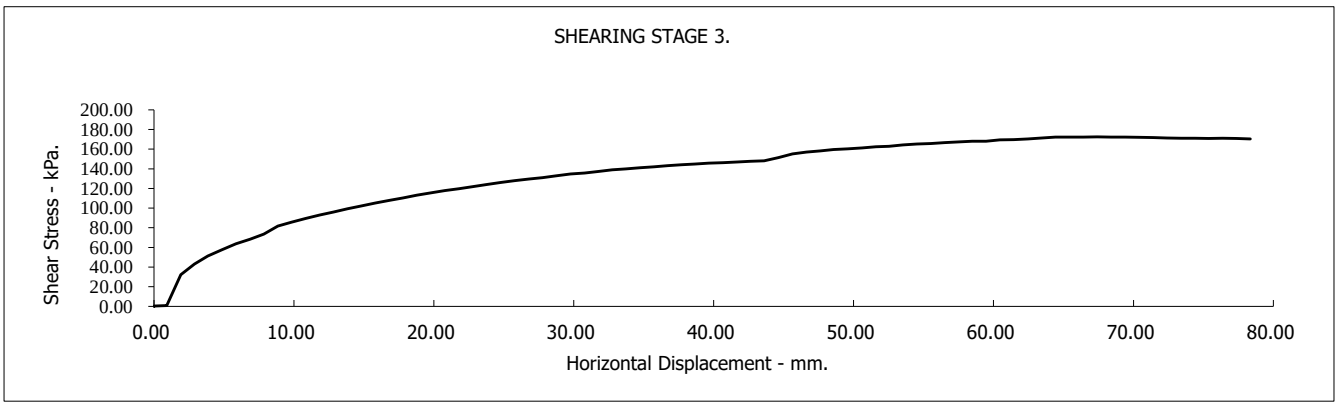
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

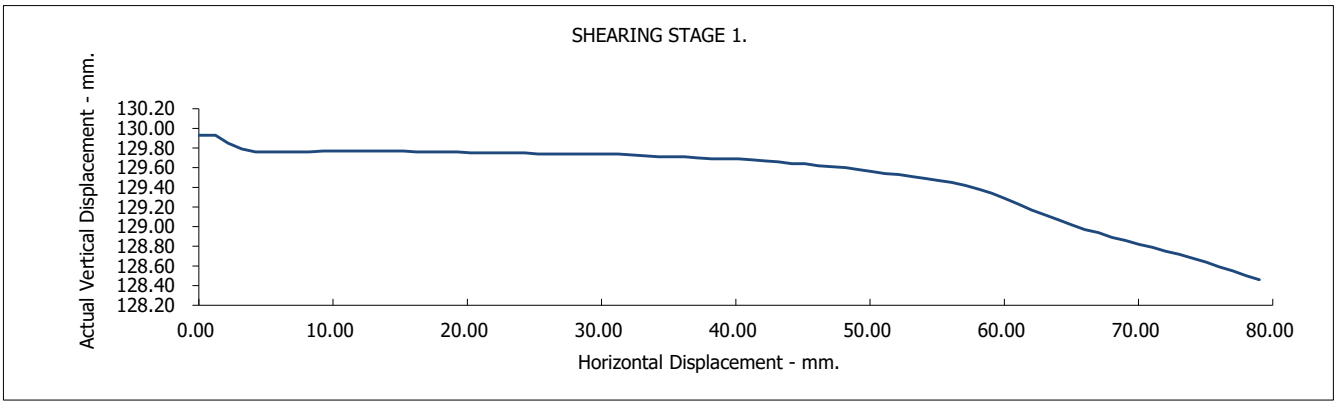
Client Ref Number: **14880RH**

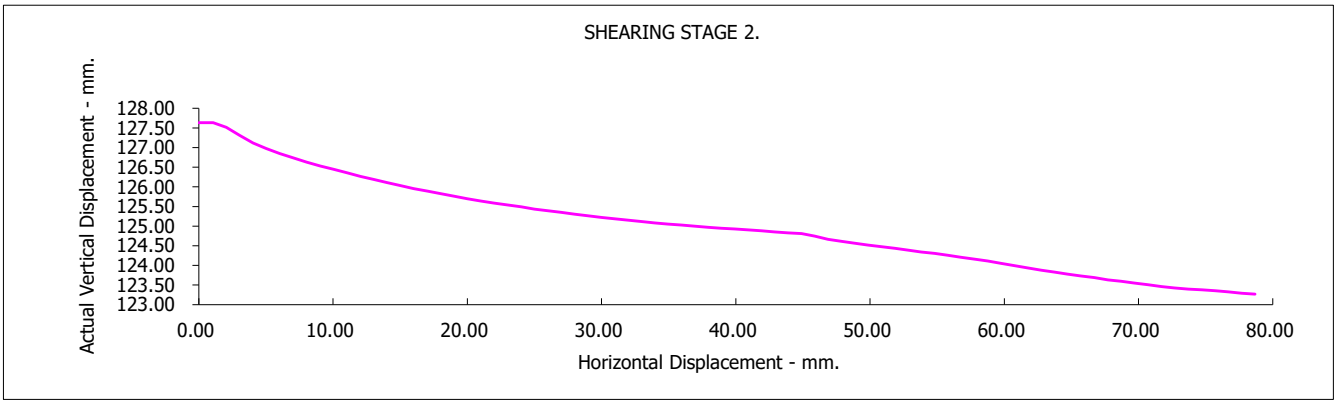
Figure.

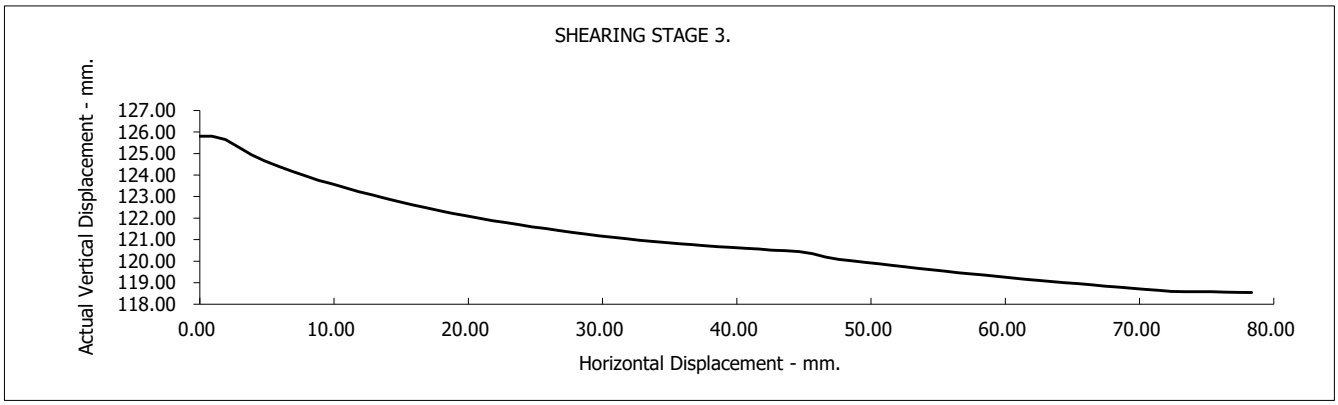
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

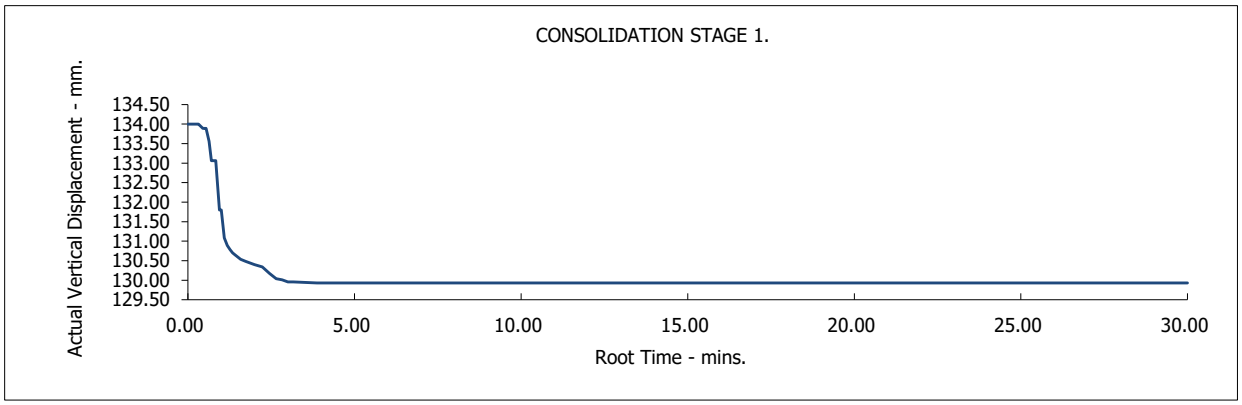
Client Ref Number: **14880RH**

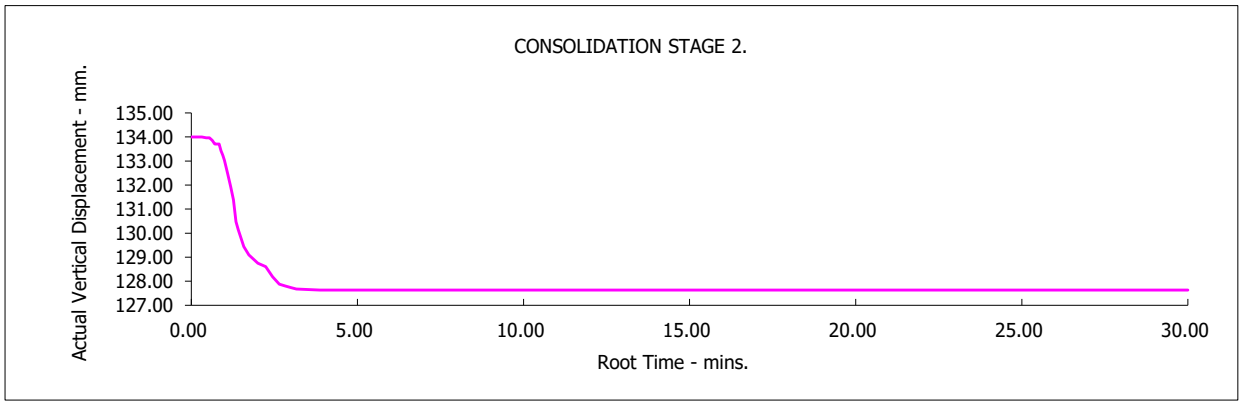
Figure.

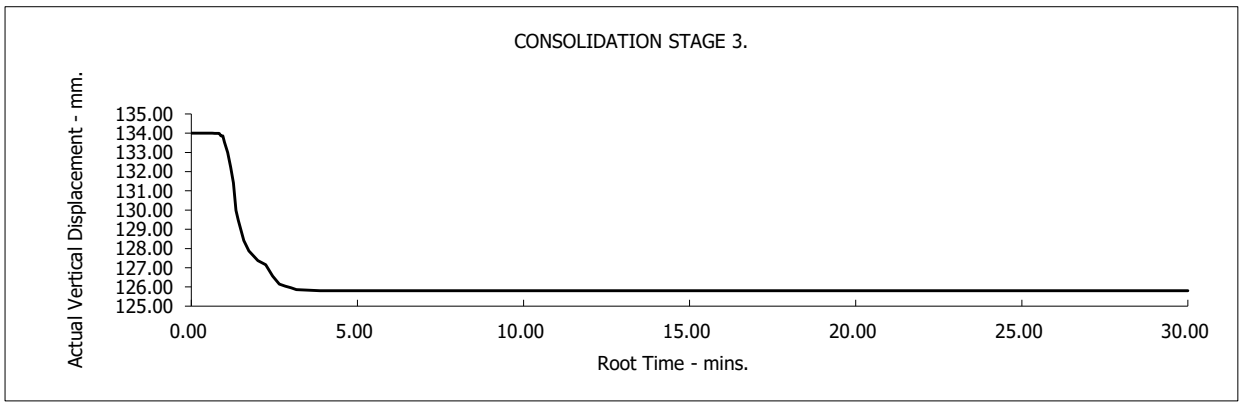
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S3 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S4	Depth from (m):	0.00
Sample Number :	4	Depth to (m):	0.00

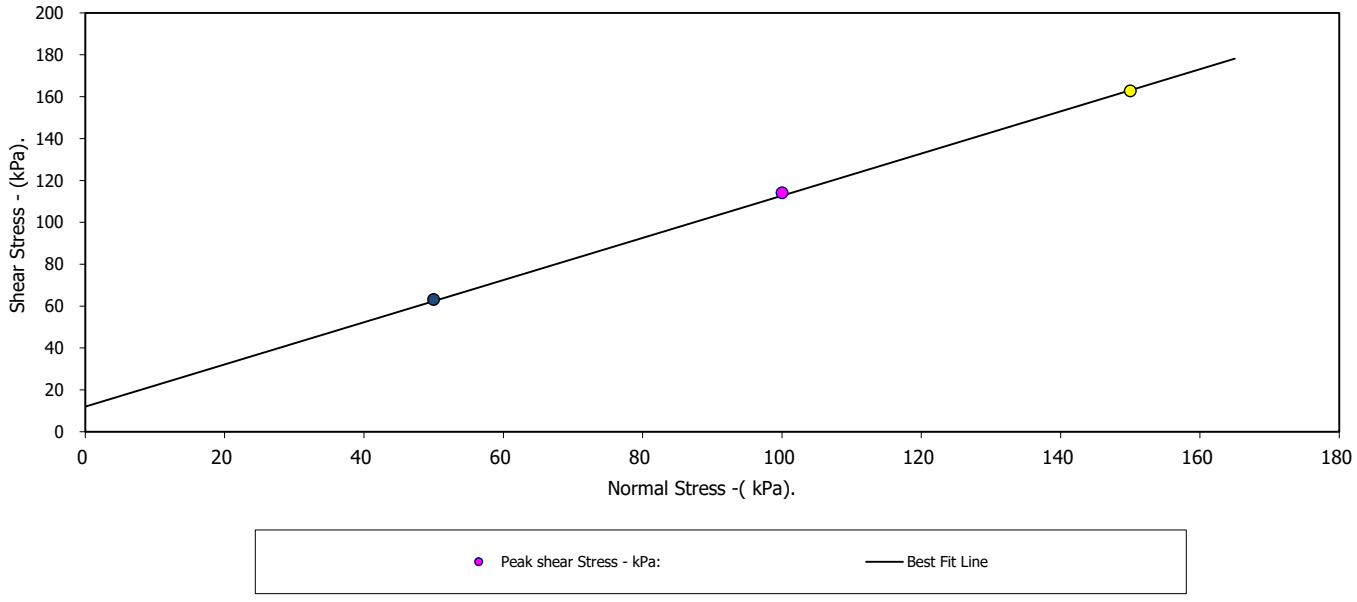
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	134.00	134.00	134.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	12	12	12
Bulk Density - Mg/m3:	1.59	1.59	1.59
Dry Density - Mg/m3:	1.43	1.43	1.43
Voids Ratio:	0.8575	0.8577	0.8575
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	130.29	129.03	127.07
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	53.12	52.66	56.20
Peak shear Stress - kPa:	63	114	163

PEAK	
Angle of Shearing Resistance:(θ)	**45.2**
Effective Cohesion - kPa:	**12**

FAILURE CONDITIONS



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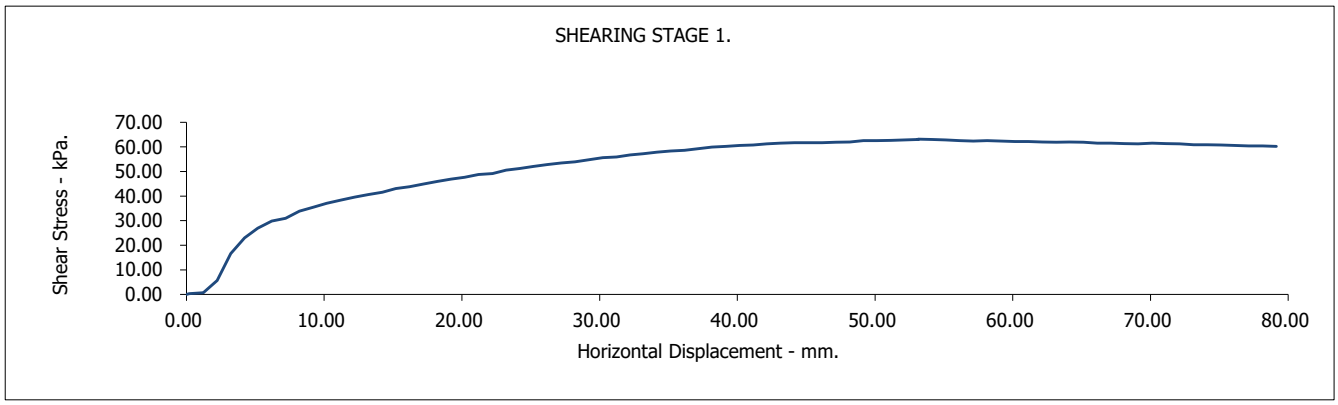
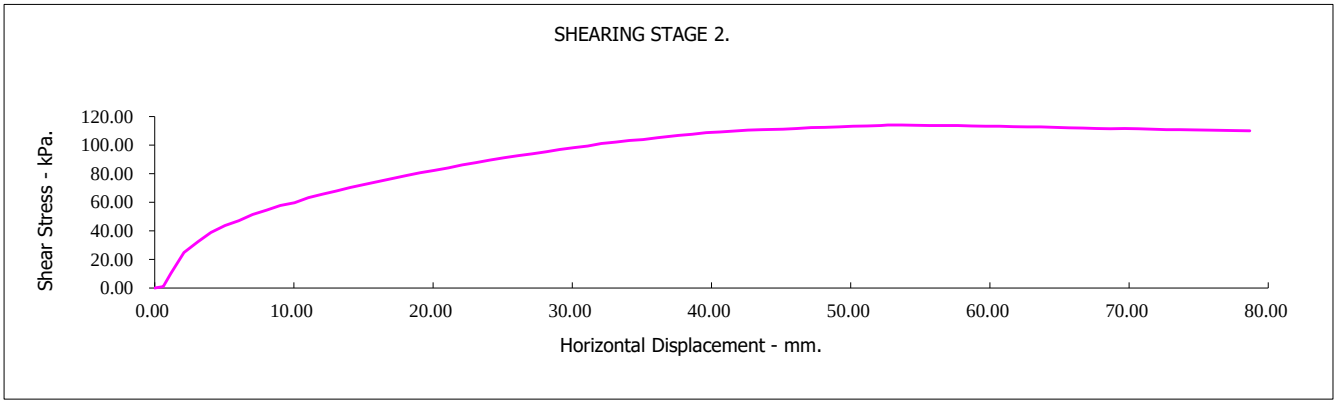
Buttington Quarry (B.Quarry)

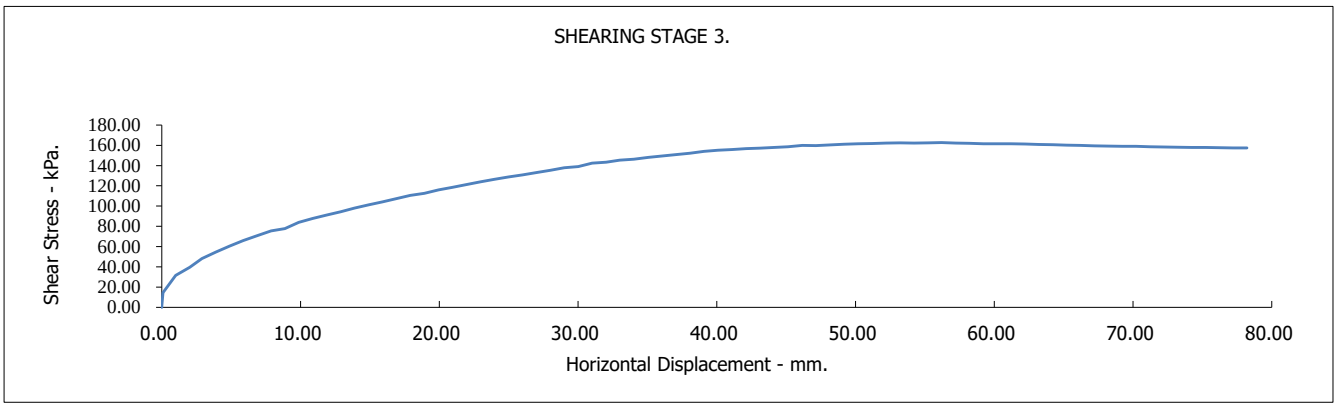
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

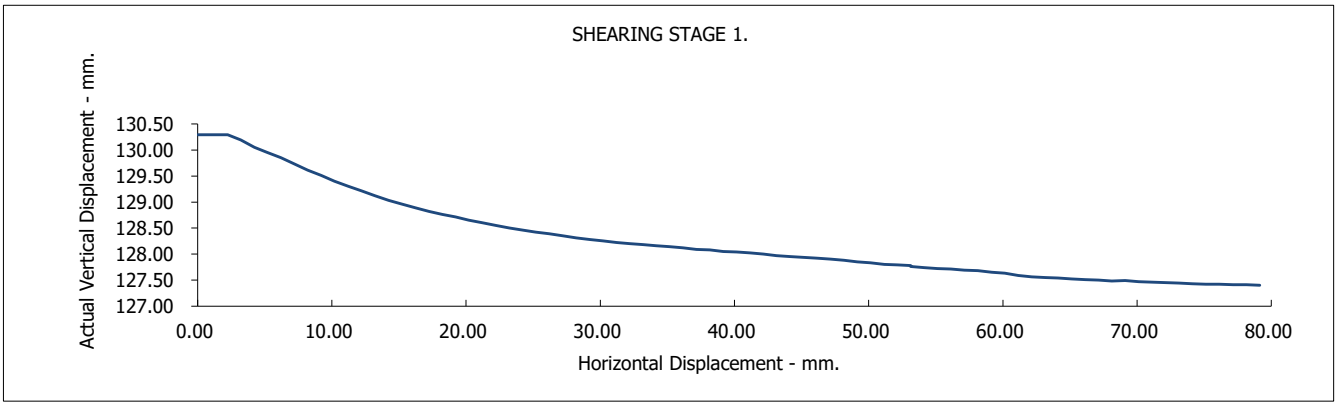
Client Ref Number: **14880RH**

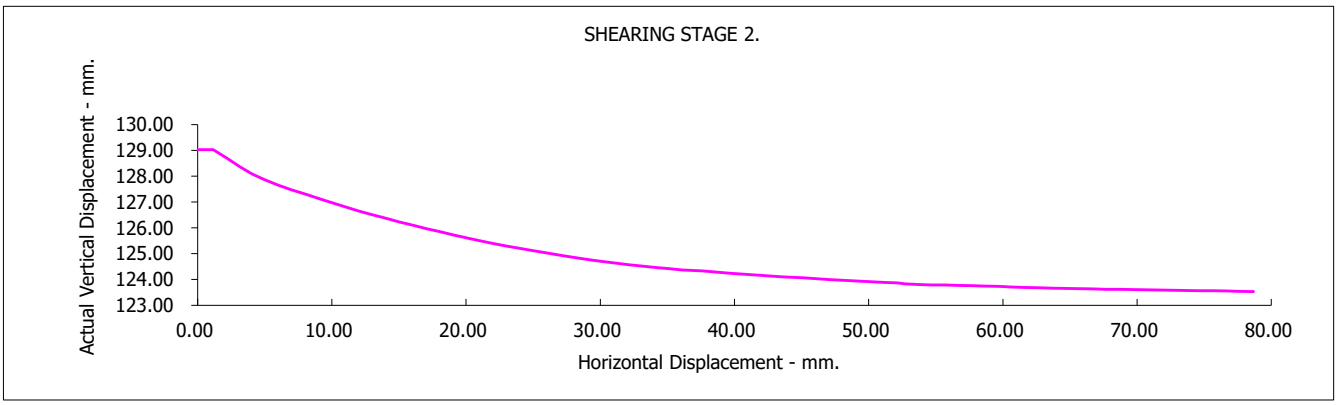
Figure.

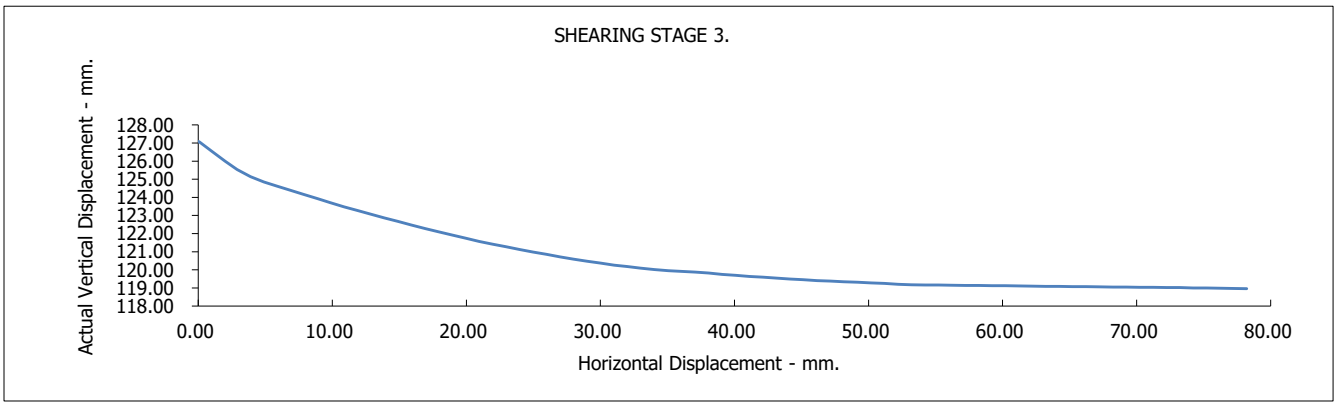
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

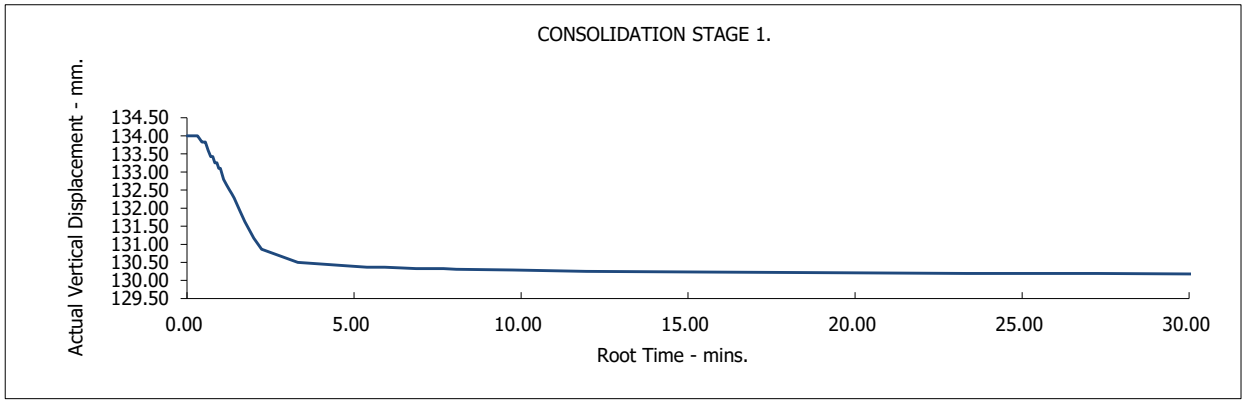
Client Ref Number: **14880RH**

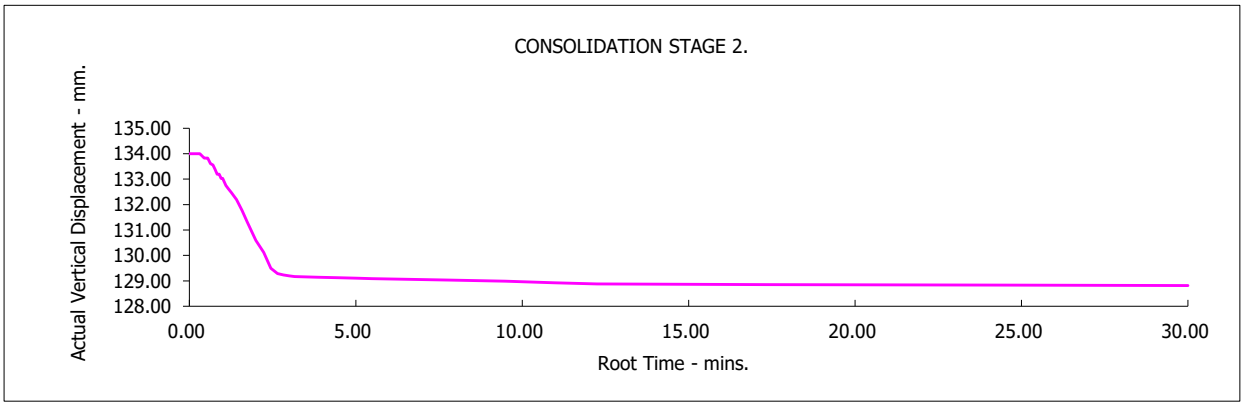
Figure.

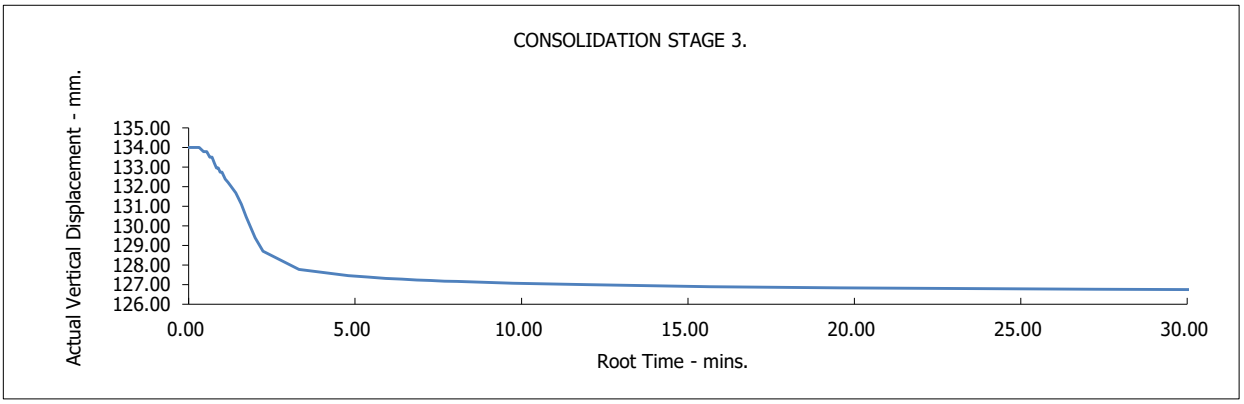
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S4 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S5	Depth from (m):	0.00
Sample Number :	5	Depth to (m):	0.00

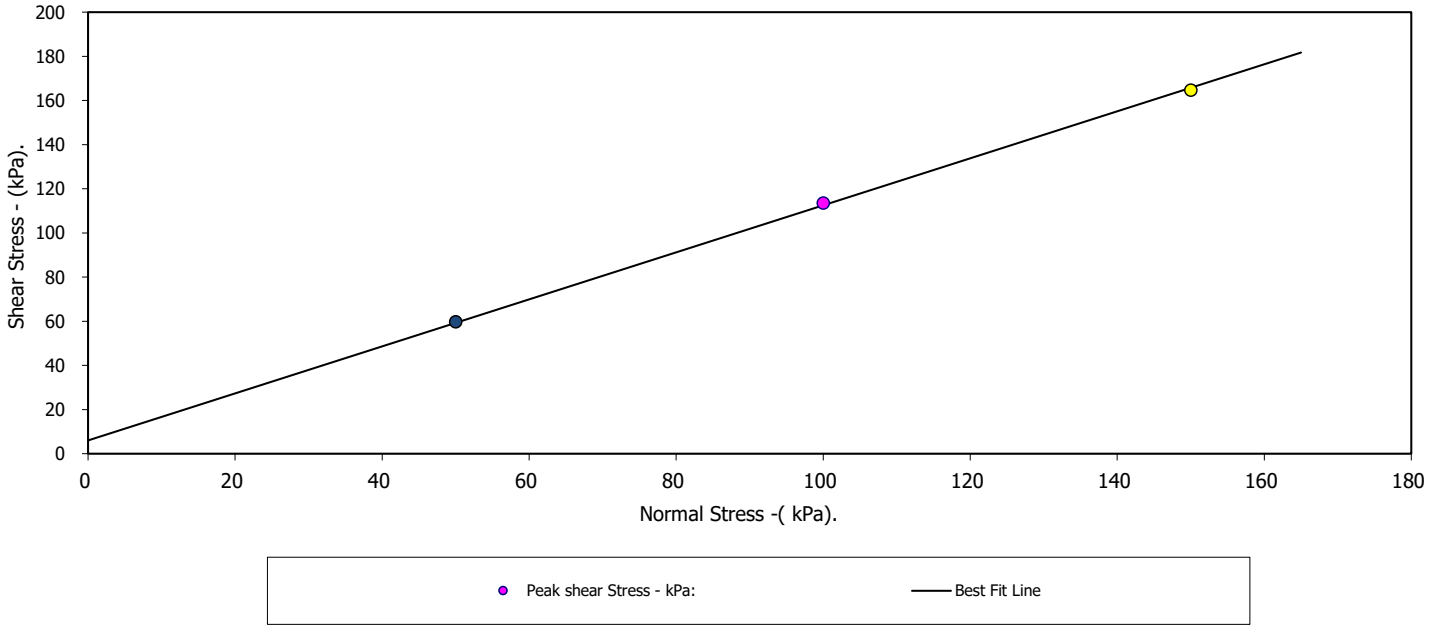
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown slightly clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	132.50	132.50	132.50
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	6	6	6
Bulk Density - Mg/m3:	1.65	1.65	1.65
Dry Density - Mg/m3:	1.55	1.55	1.55
Voids Ratio:	0.7053	0.7049	0.7050
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	128.00	126.20	124.88
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	60.01	61.02	61.02
Peak shear Stress - kPa:	60	113	165

PEAK	
Angle of Shearing Resistance:(θ)	**46.8**
Effective Cohesion - kPa:	**6**

FAILURE CONDITIONS



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Buttington Quarry (B.Quarry)

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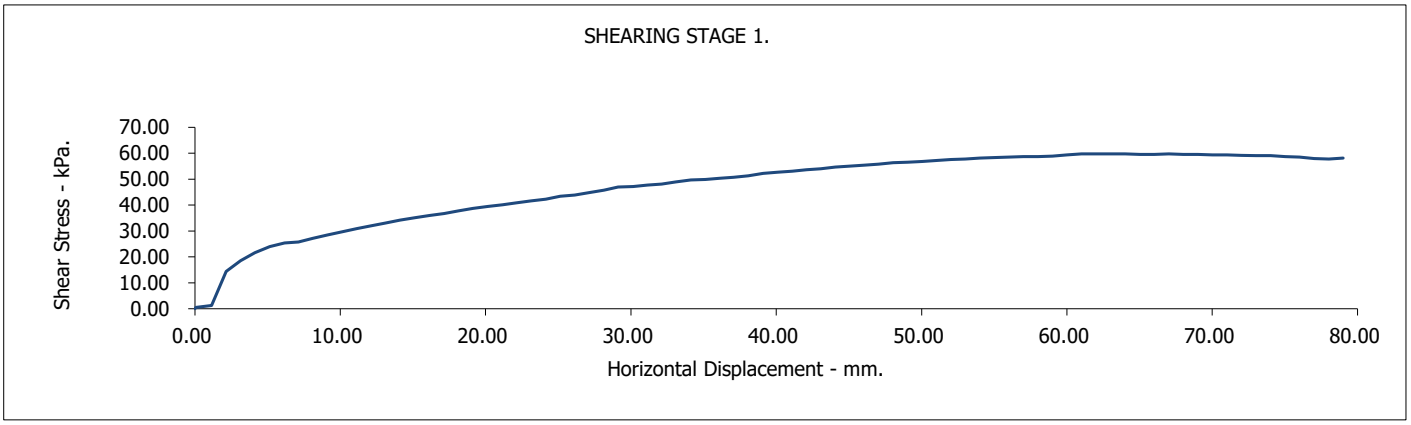
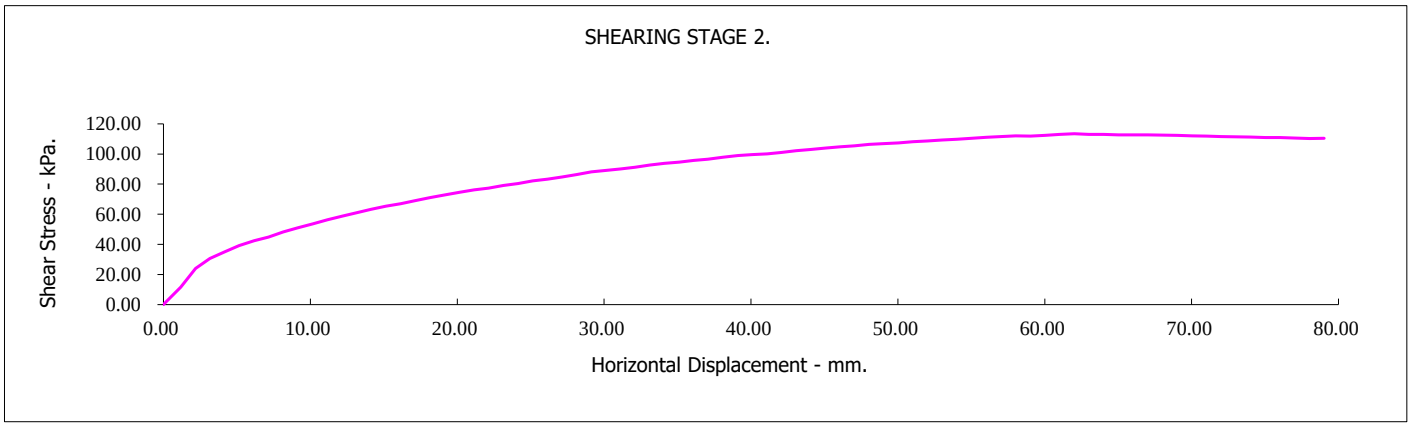
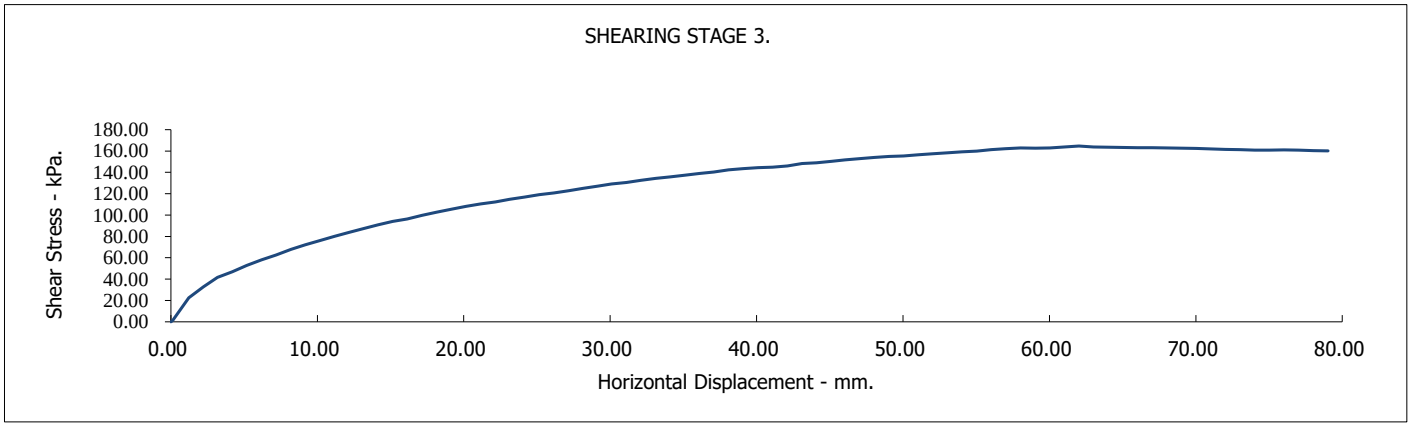
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

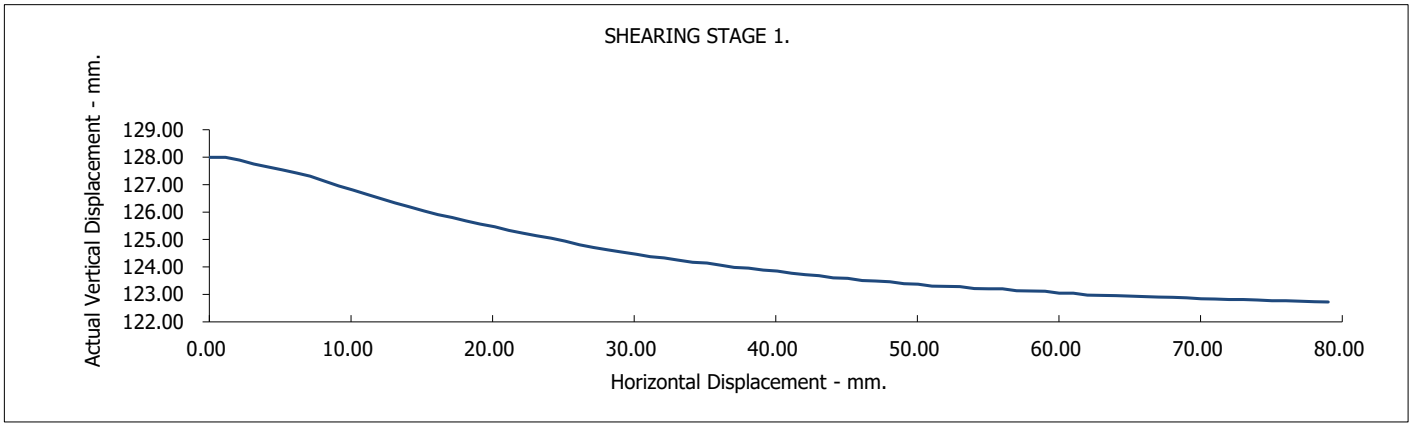
Client Ref Number: **14880RH**

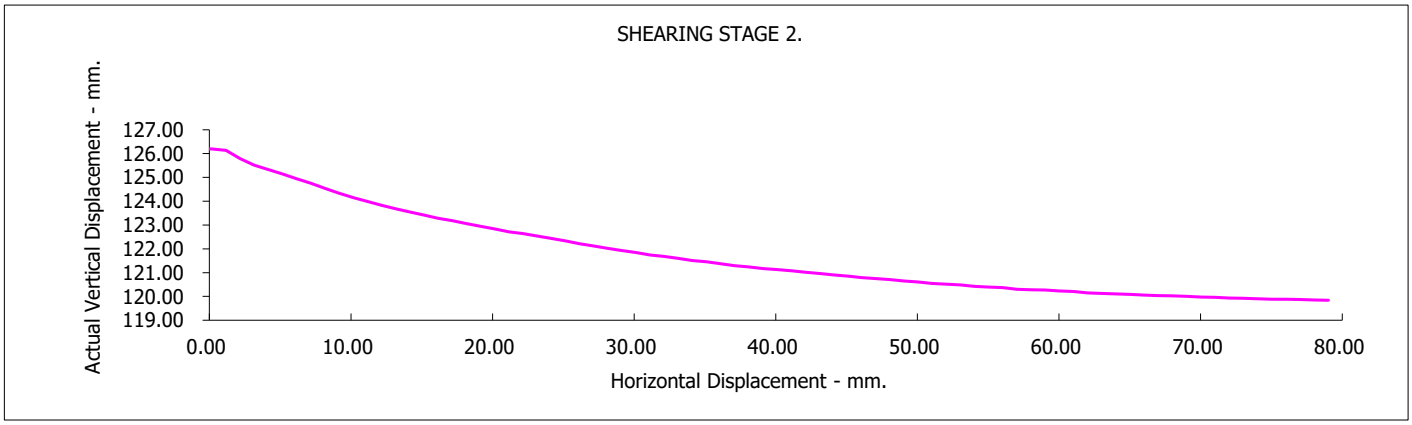
Figure.

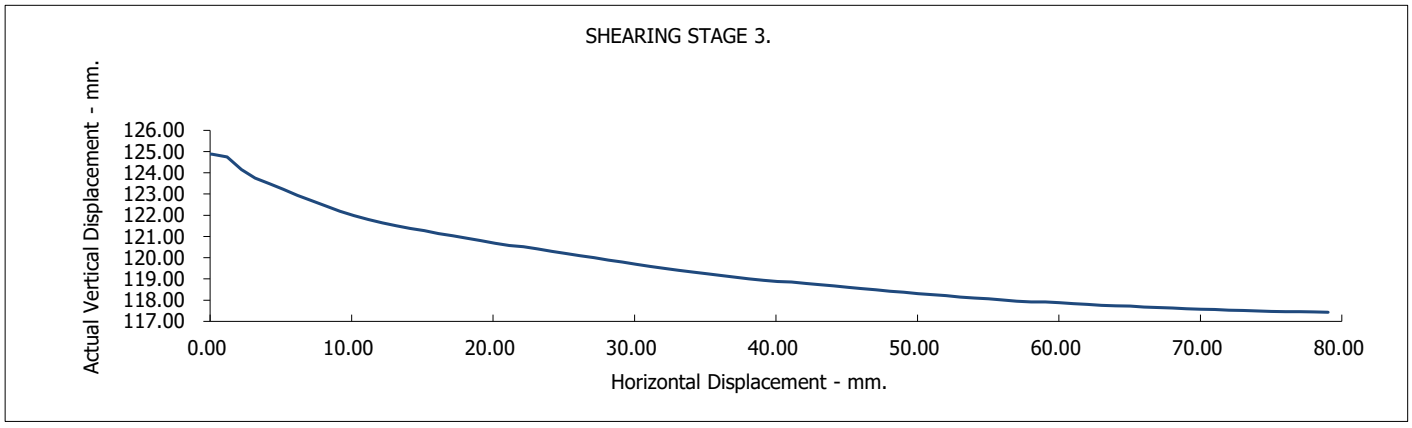
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

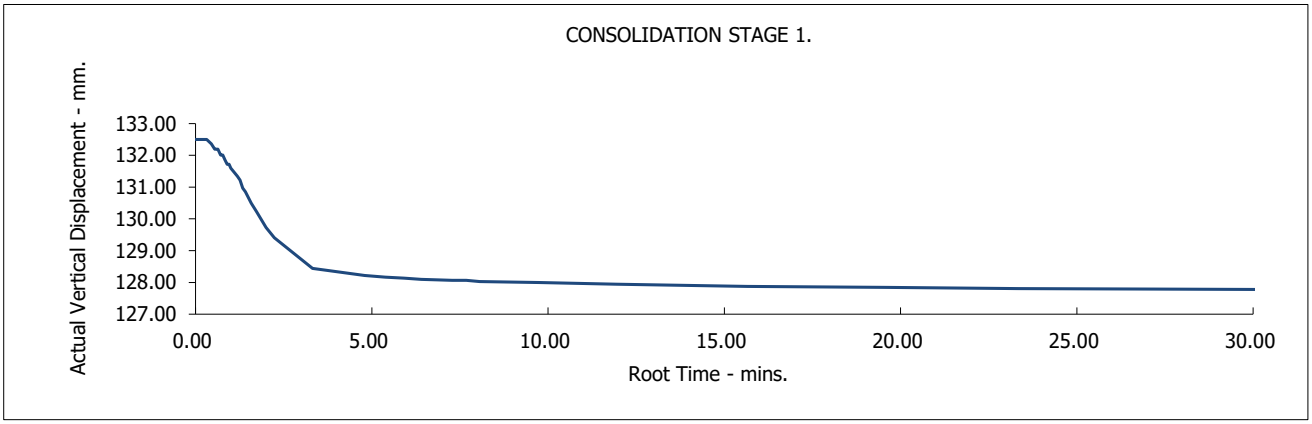
Client Ref Number: **14880RH**

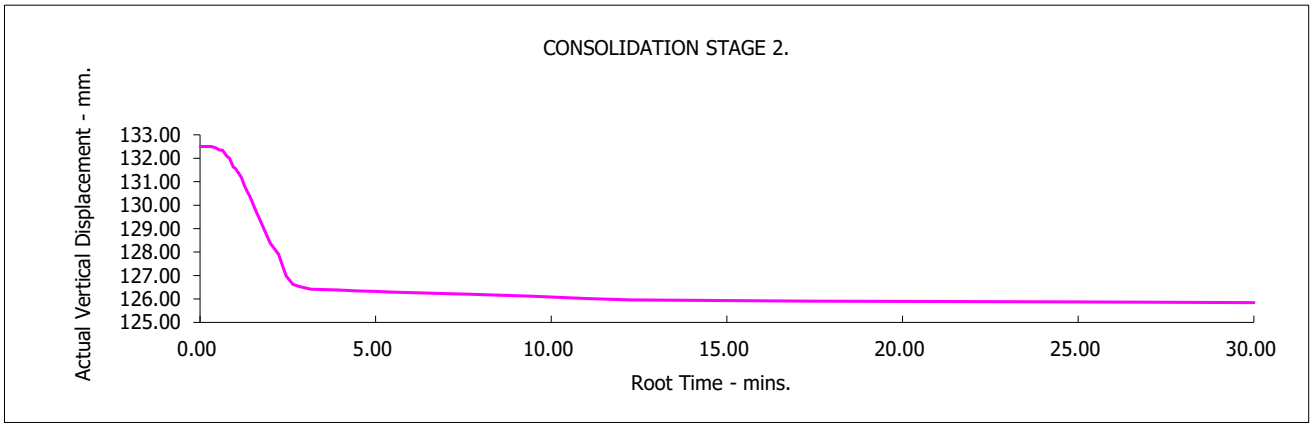
Figure.

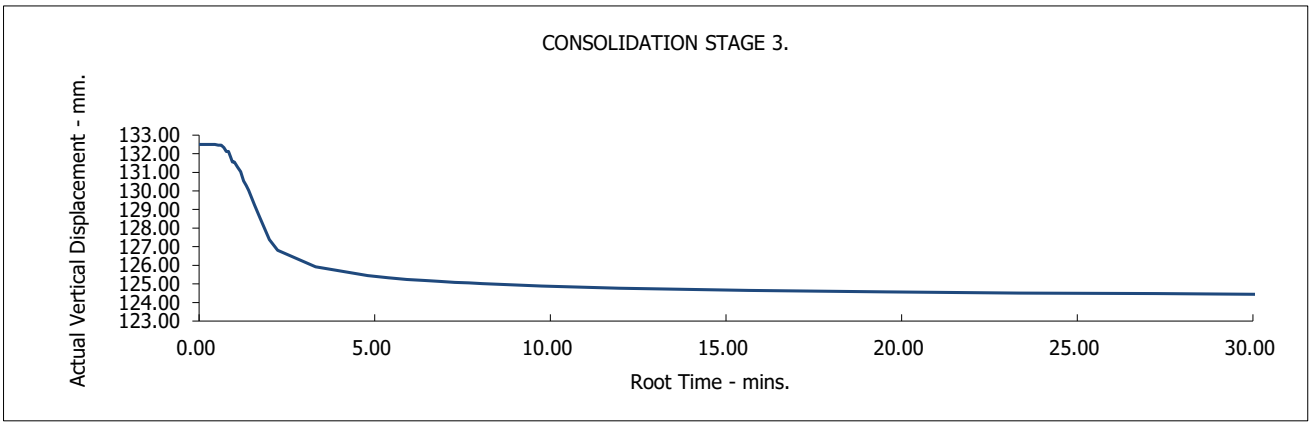
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S5 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

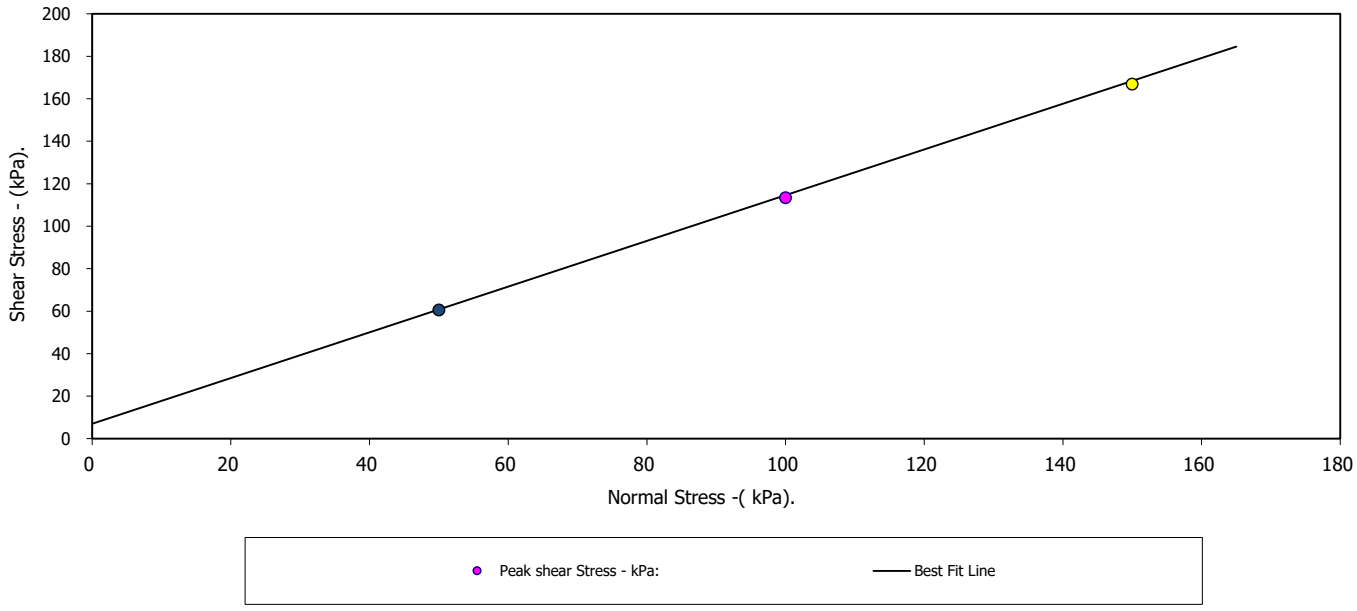
Borehole Number:	S6	Depth from (m):	0.00
Sample Number :	6	Depth to (m):	0.00

Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.
Sample Description: **Brown slightly clayey fine to medium GRAVEL**	

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	135.00	135.00	135.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	1.60	1.60	1.60
Dry Density - Mg/m3:	1.44	1.44	1.44
Voids Ratio:	0.8353	0.8351	0.8355
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	132.22	129.72	128.51
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	66.14	67.37	57.68
Peak shear Stress - kPa:	61	113	167

PEAK	
Angle of Shearing Resistance:(θ)	**47.1**
Effective Cohesion - kPa:	**7**

FAILURE CONDITIONS



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Buttington Quarry (B.Quarry)

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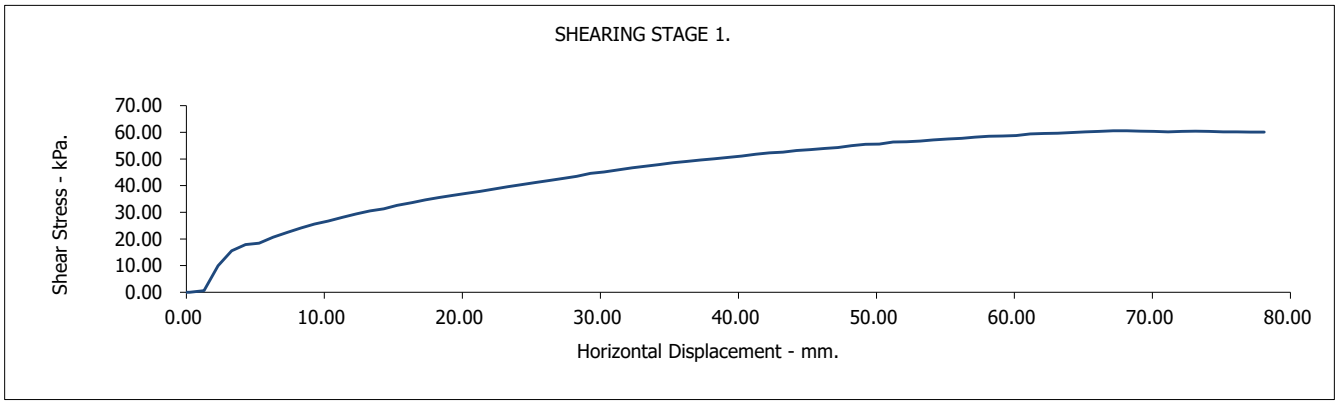
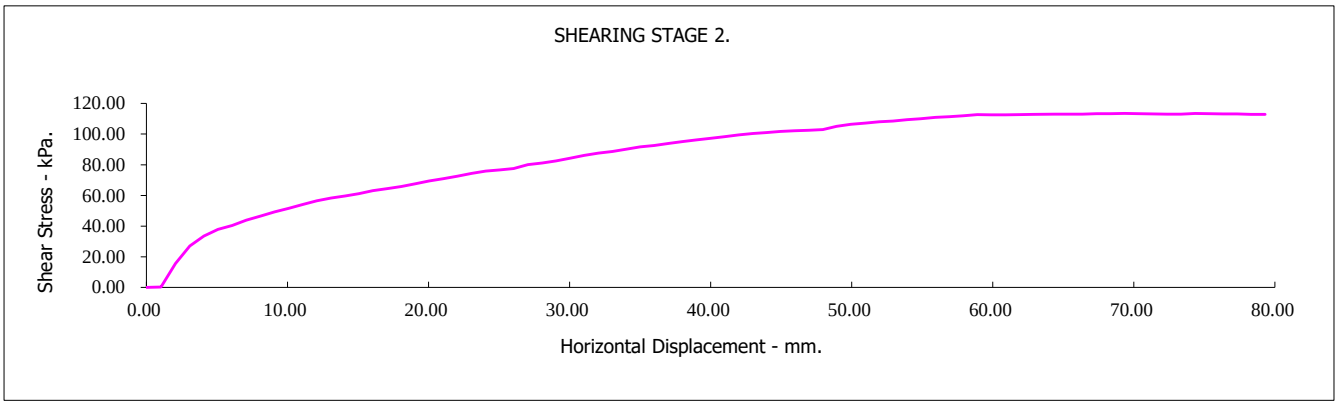
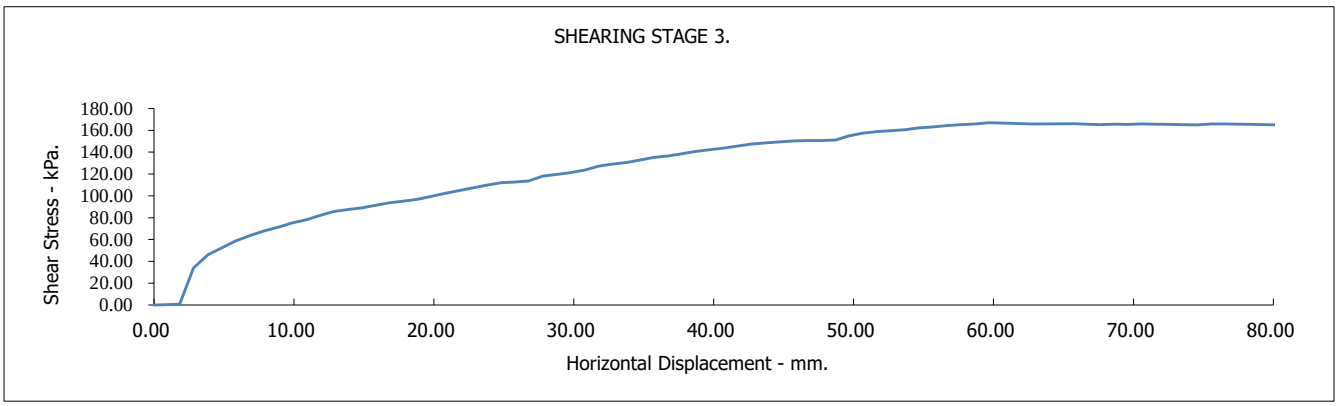
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

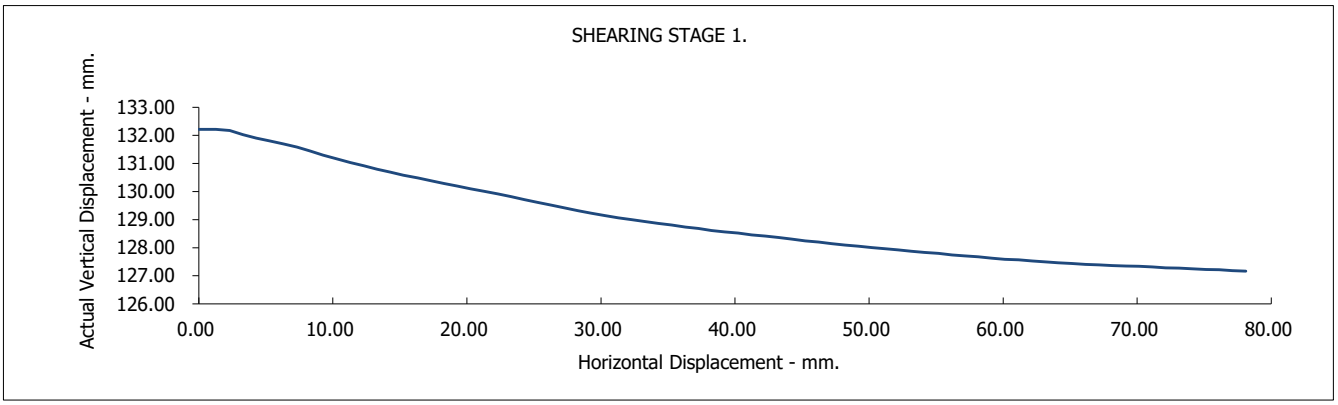
Client Ref Number: **14880RH**

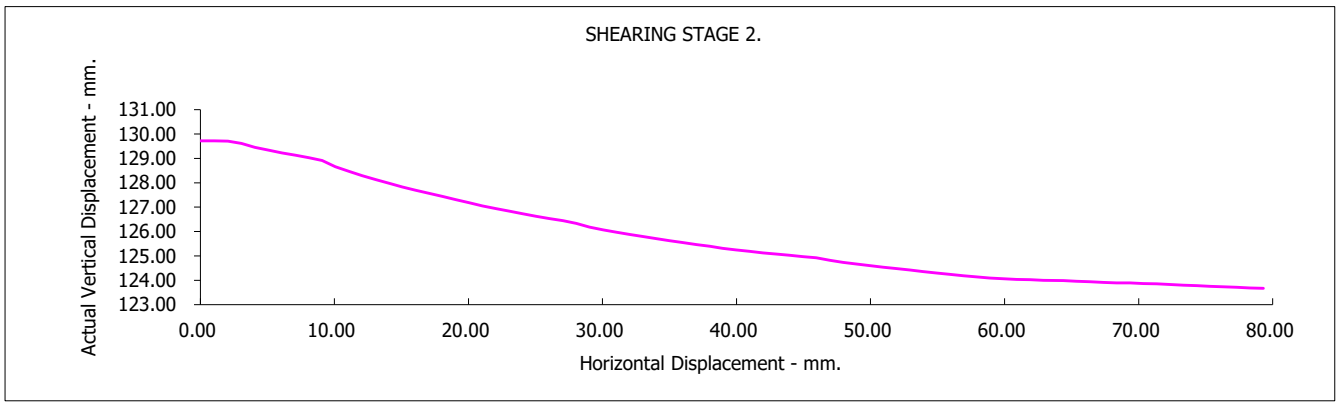
Figure.

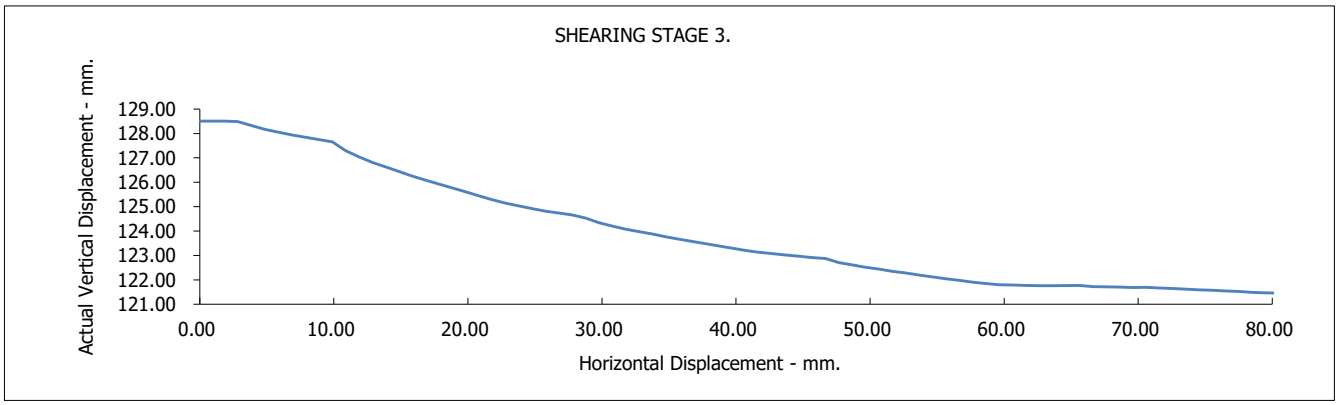
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

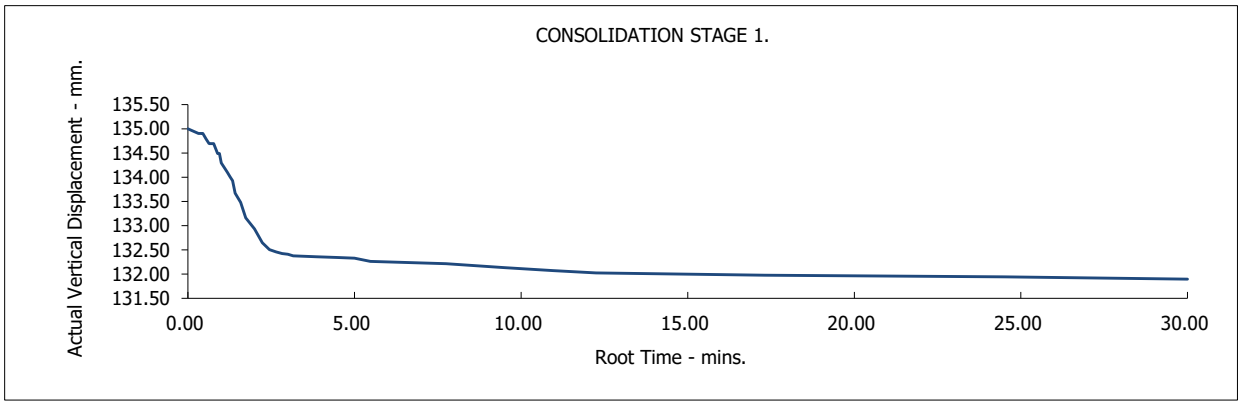
Client Ref Number: **14880RH**

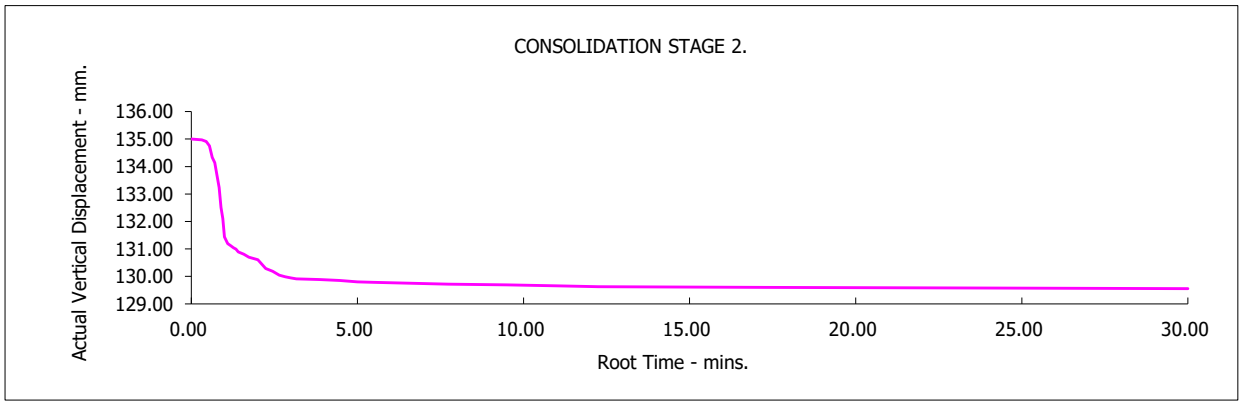
Figure.

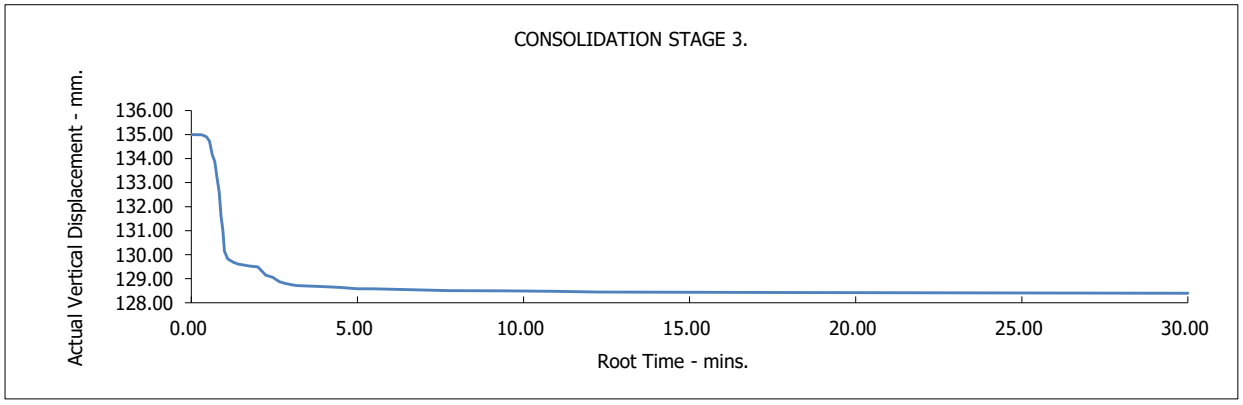
Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole/Sample Number: S6 Depth (m): 0.00







Buttington Quarry (B.Quarry)

Contract No.: **41501**

Client Ref Number: **14880RH**

Figure.

ANNEX D
TBMF Field Measurements

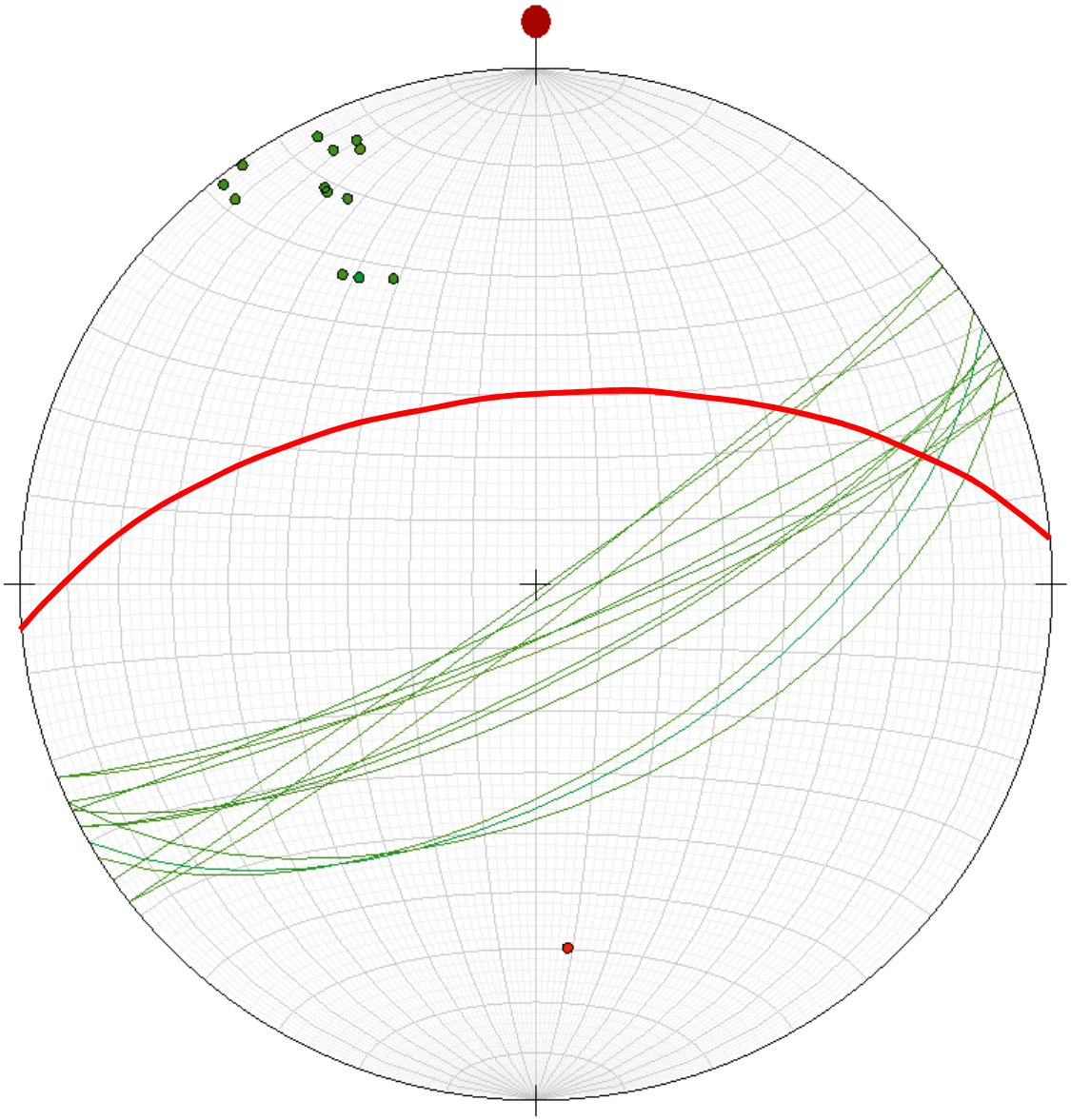
TBMF Field Measurements

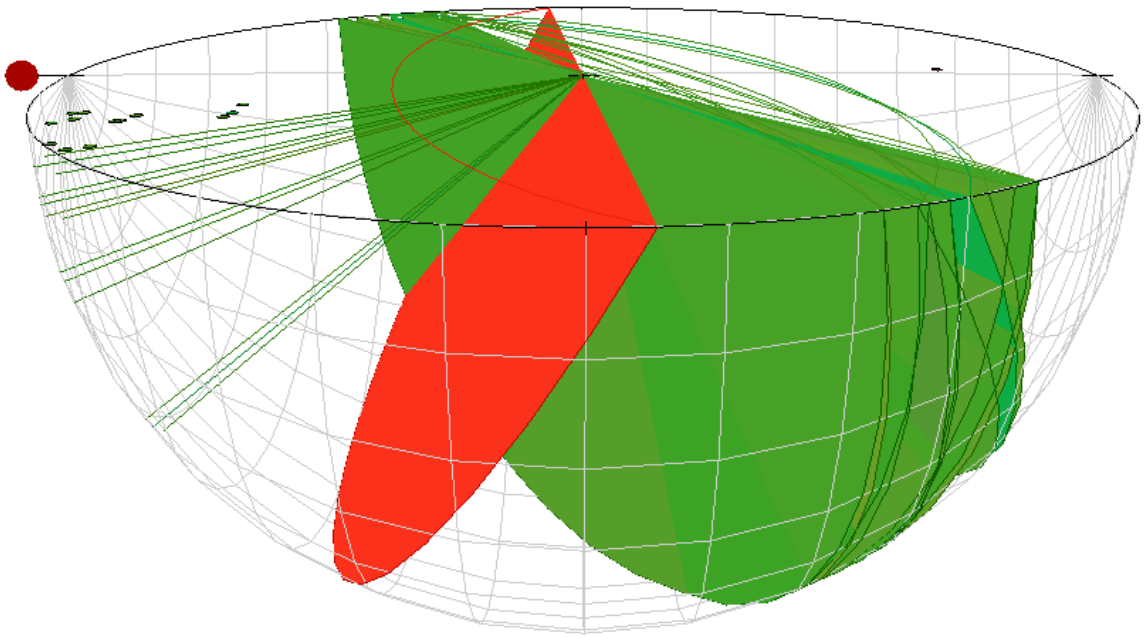
Bedding	Joints	
062/76	135/46	264/49
065/55	135/29	148/76
055/89	006/48	254/62
062/75	150/78	144/72
060/58	144/62	312/74
058/60	164/82	312/80
068/82	324/84	224/52
068/80	322/20	326/80
064/86	318/46	166/90
065/82	304/18	304/42
064/72	344/45	326/70
052/88	154/54	144/74
052/84	150/52	176/52
	352/54	160/86
	150/42	010/42
	162/70	

ANNEX E
Stereonets

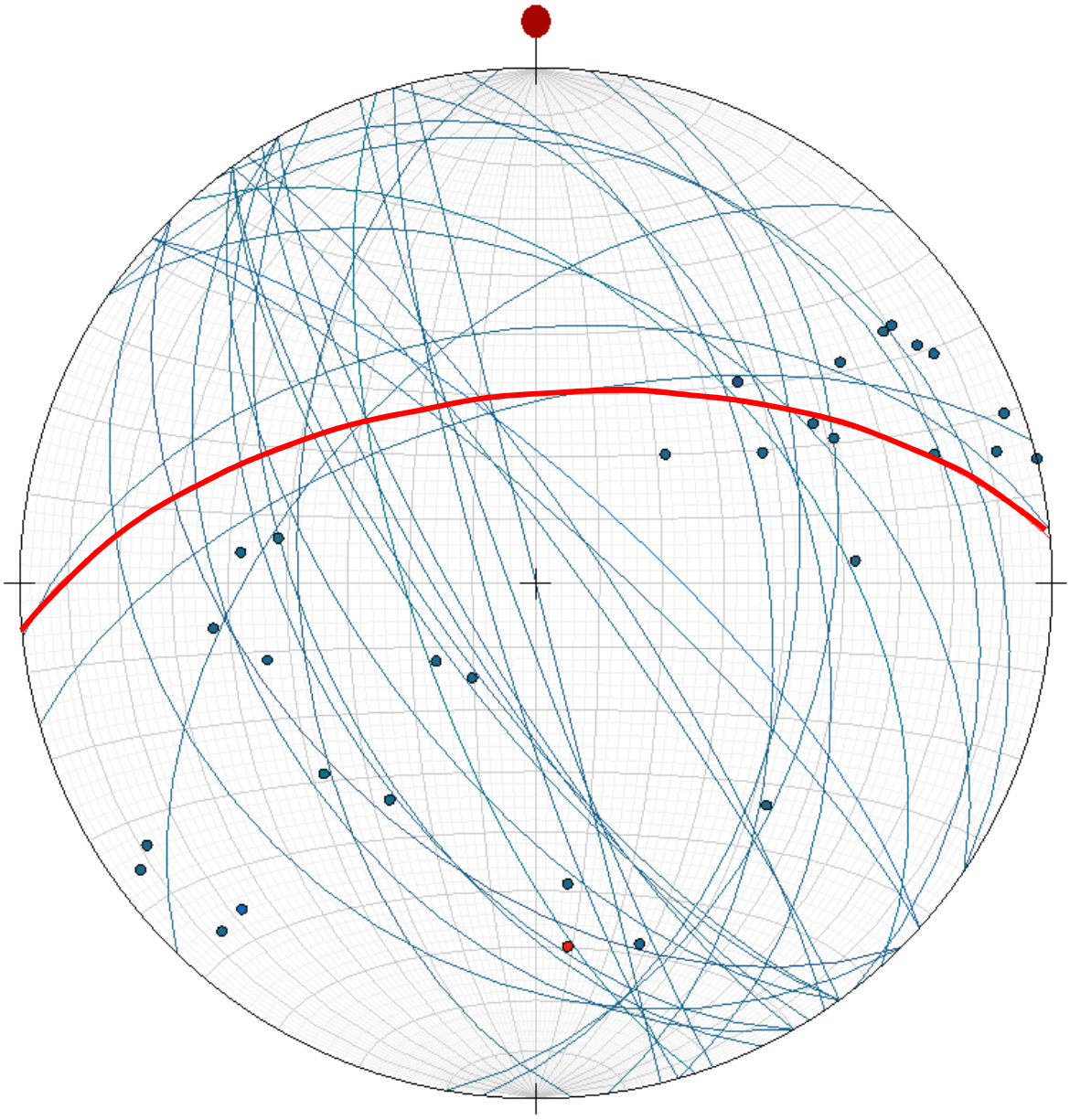
SLOPE CUT AT 265/60

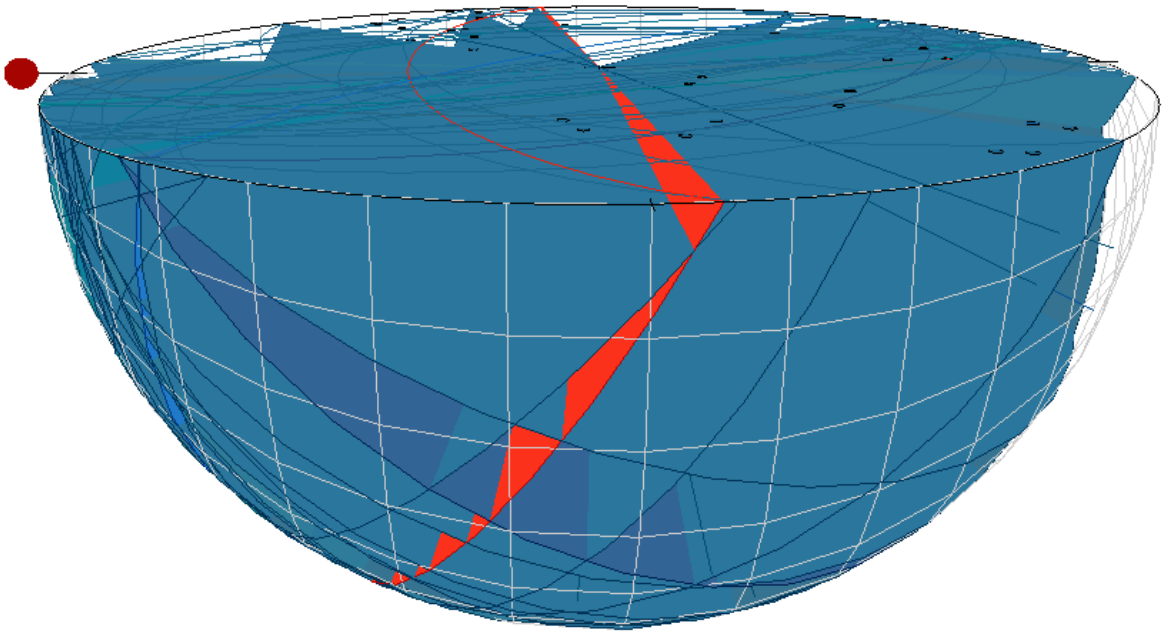
Bedding and proposed slope 265/60 orientation



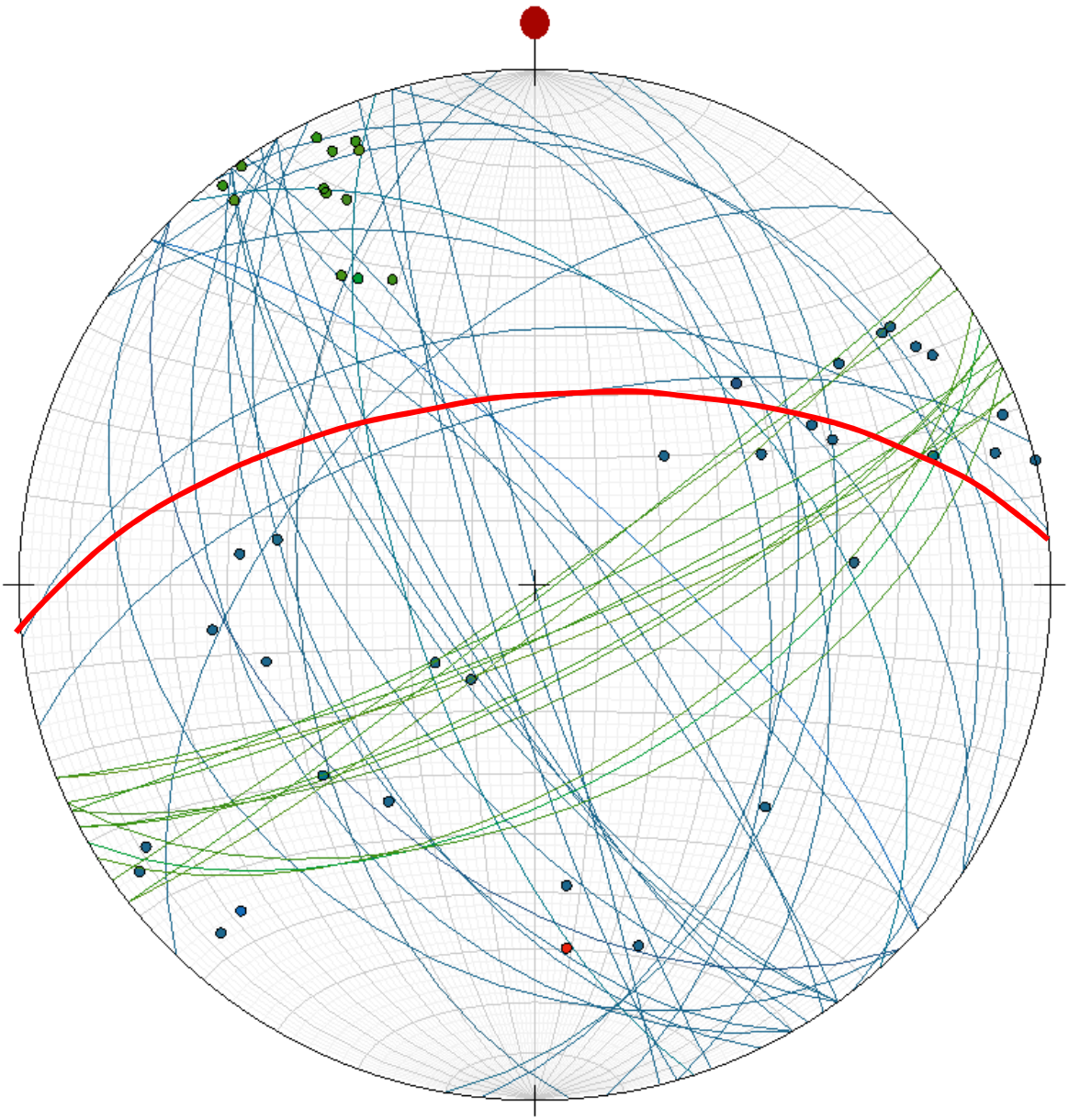


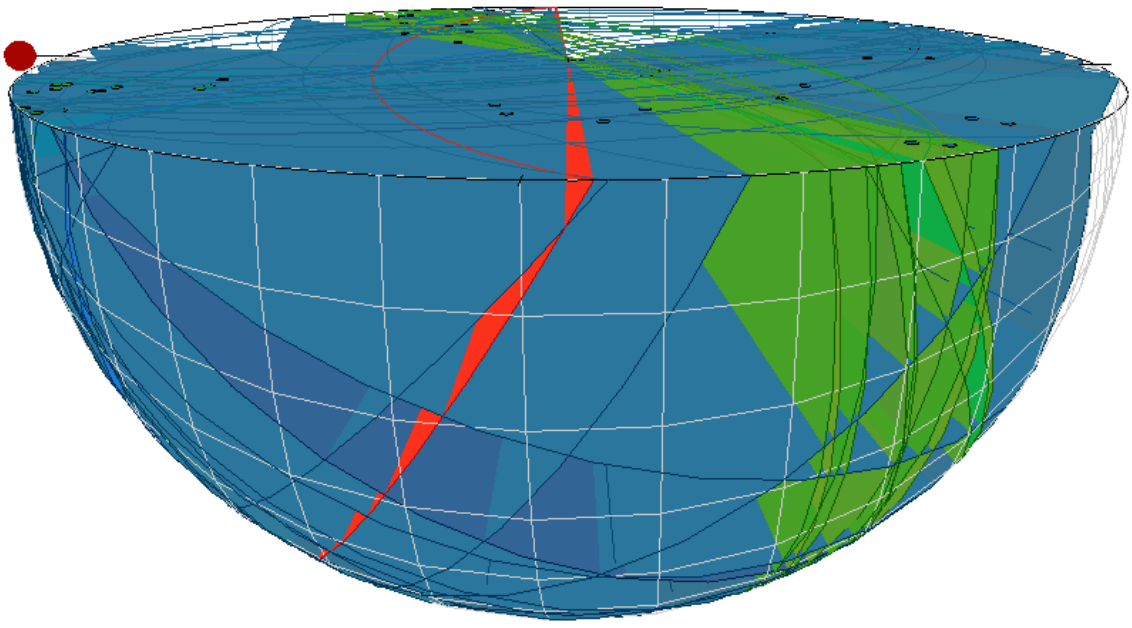
Fractures and proposed slope 265/60 orientation



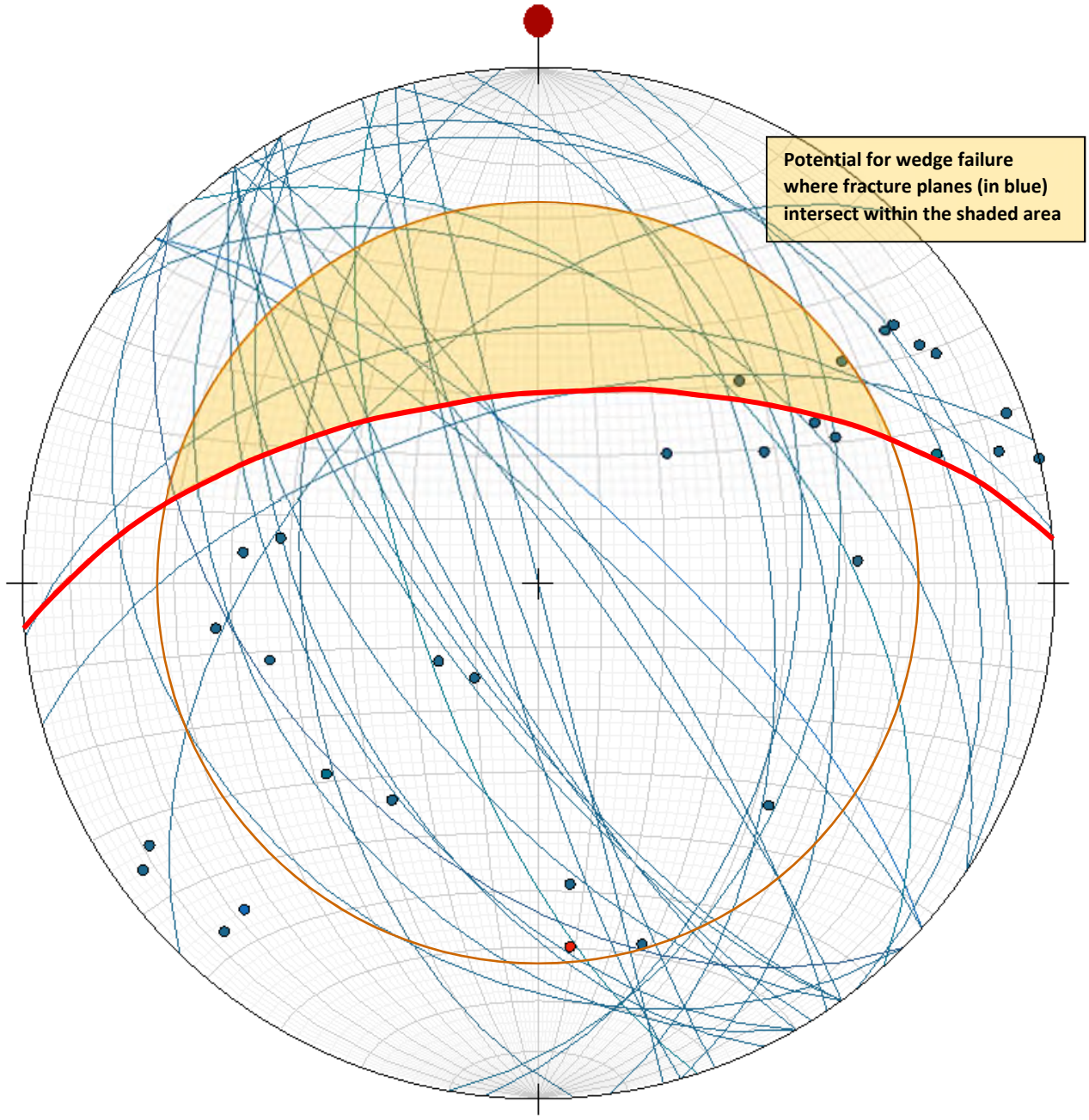


Bedding, Fractures and proposed slope 265/60 orientation

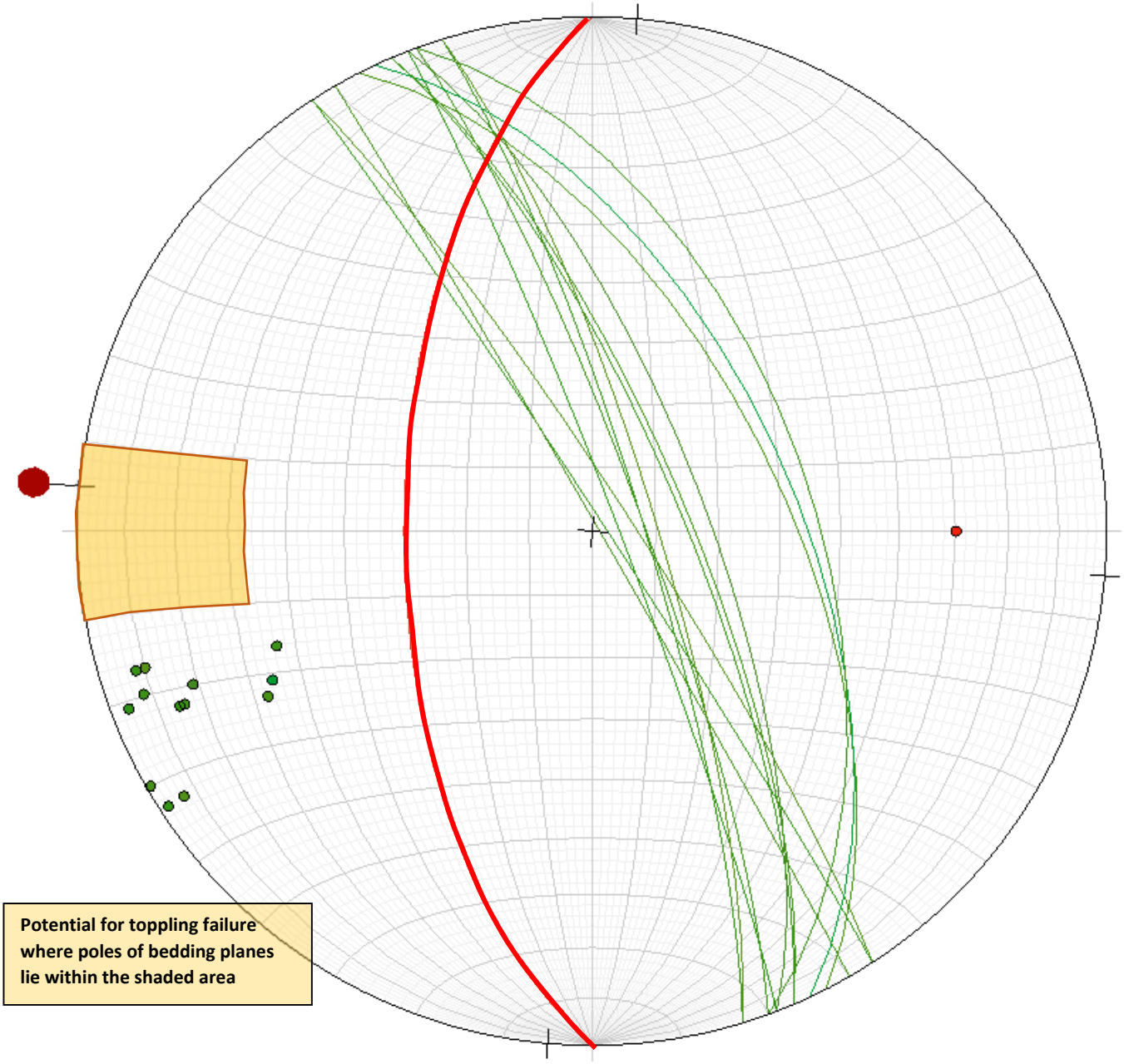




Wedge Failure



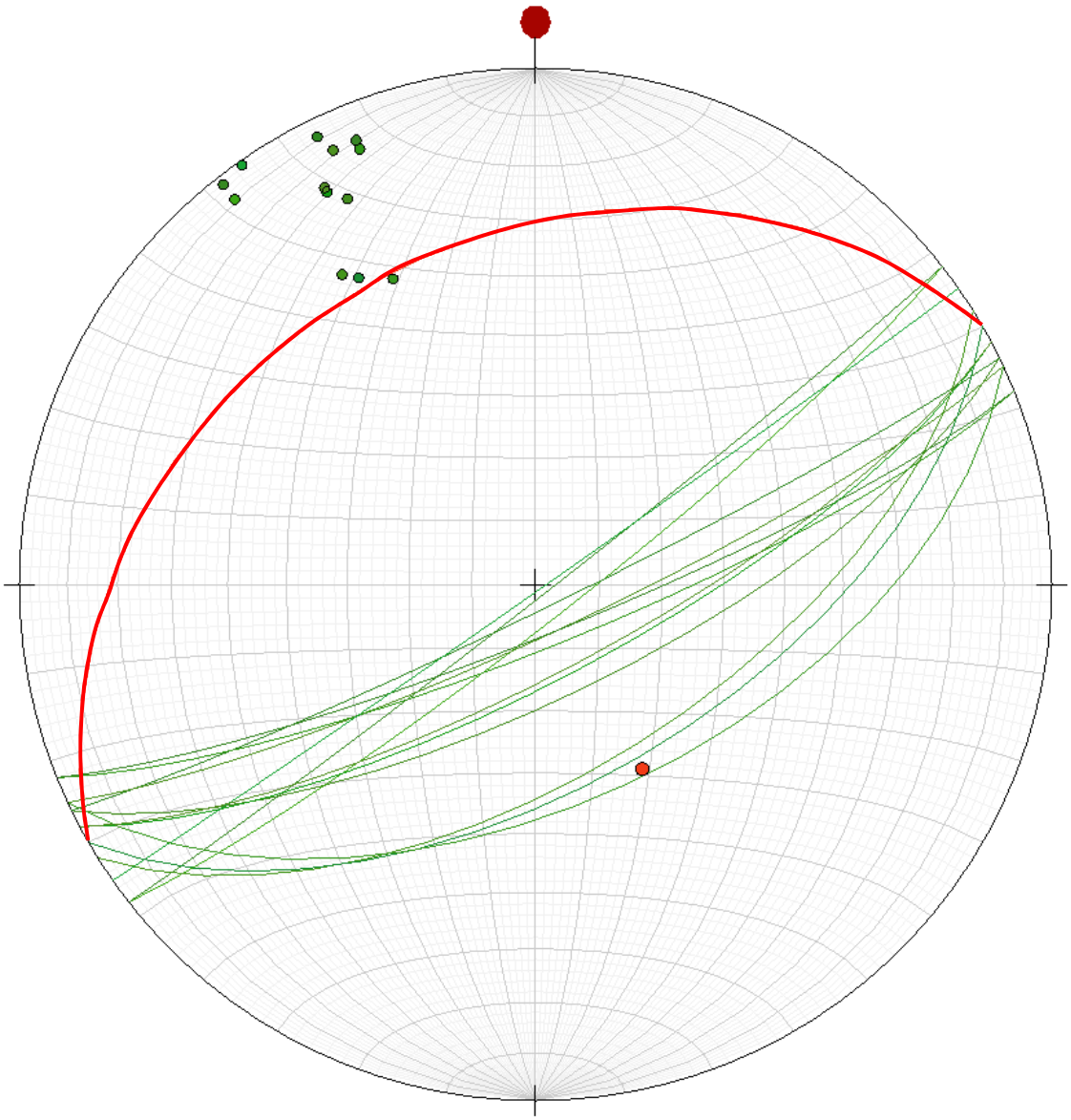
Toppling Failure

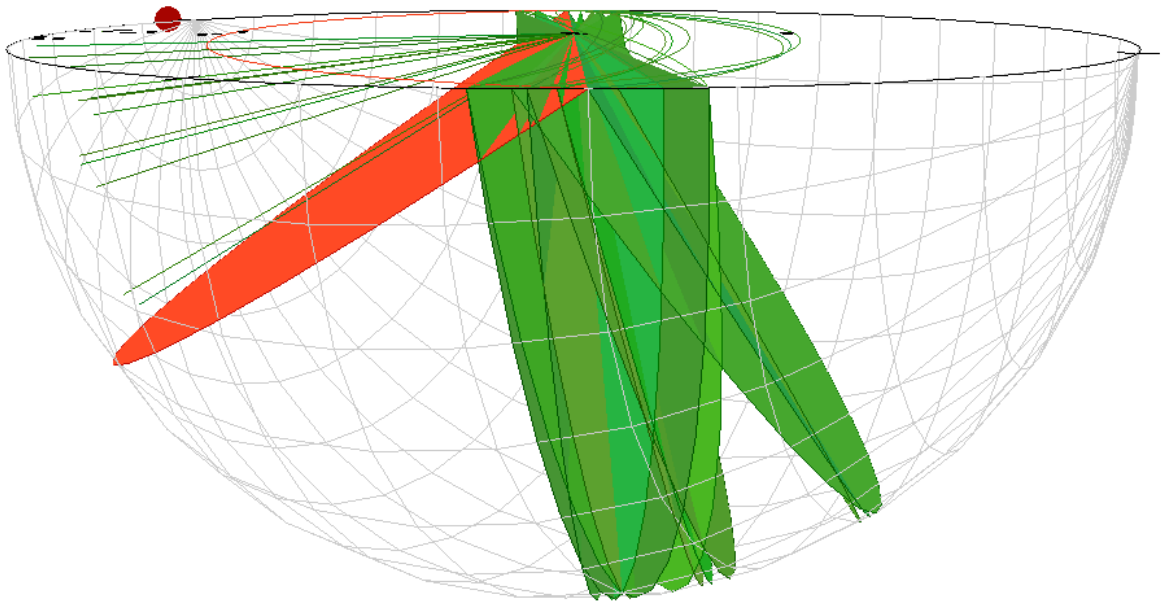


Potential for toppling failure where poles of bedding planes lie within the shaded area

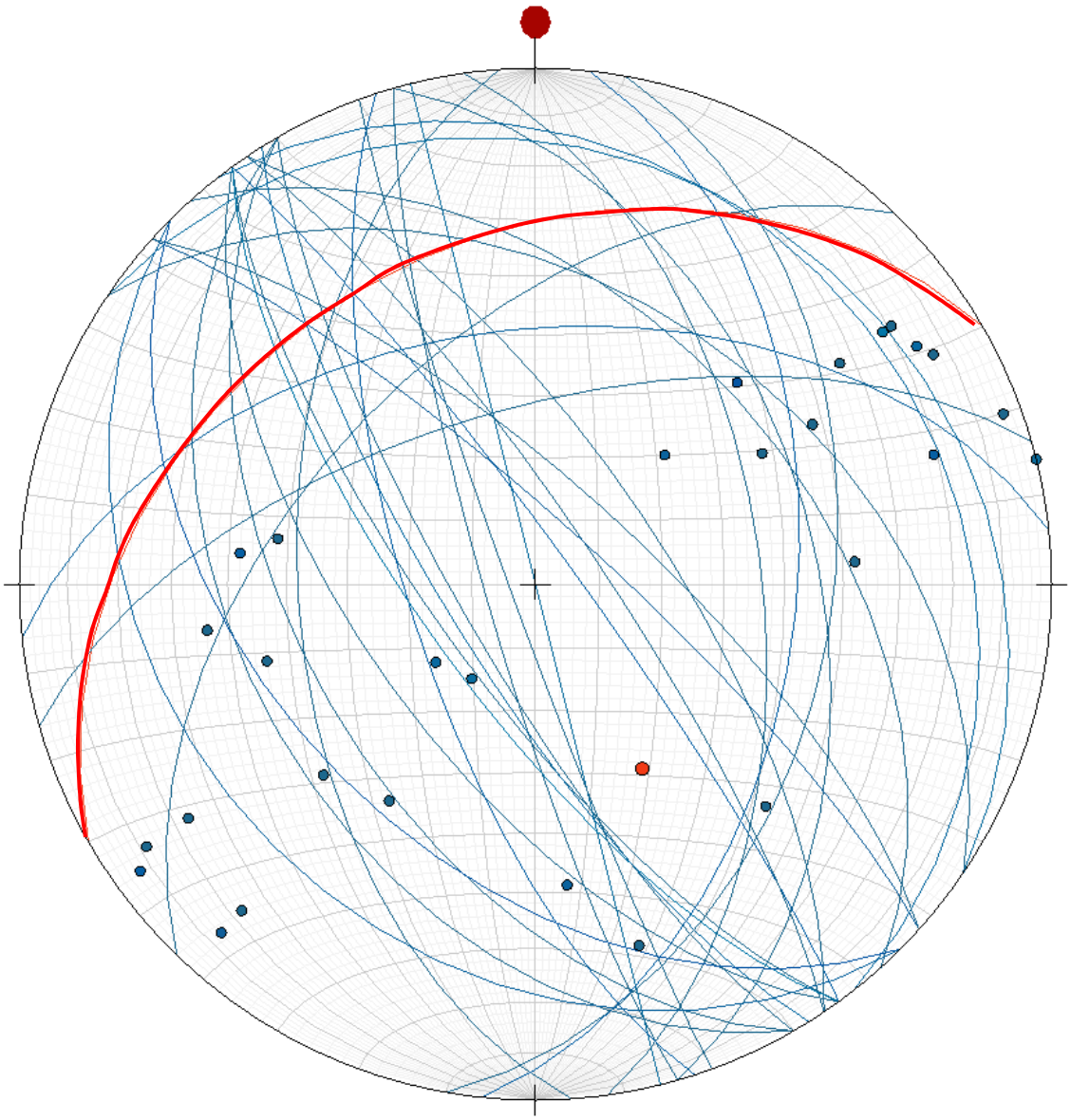
SLOPE CUT AT 240/34

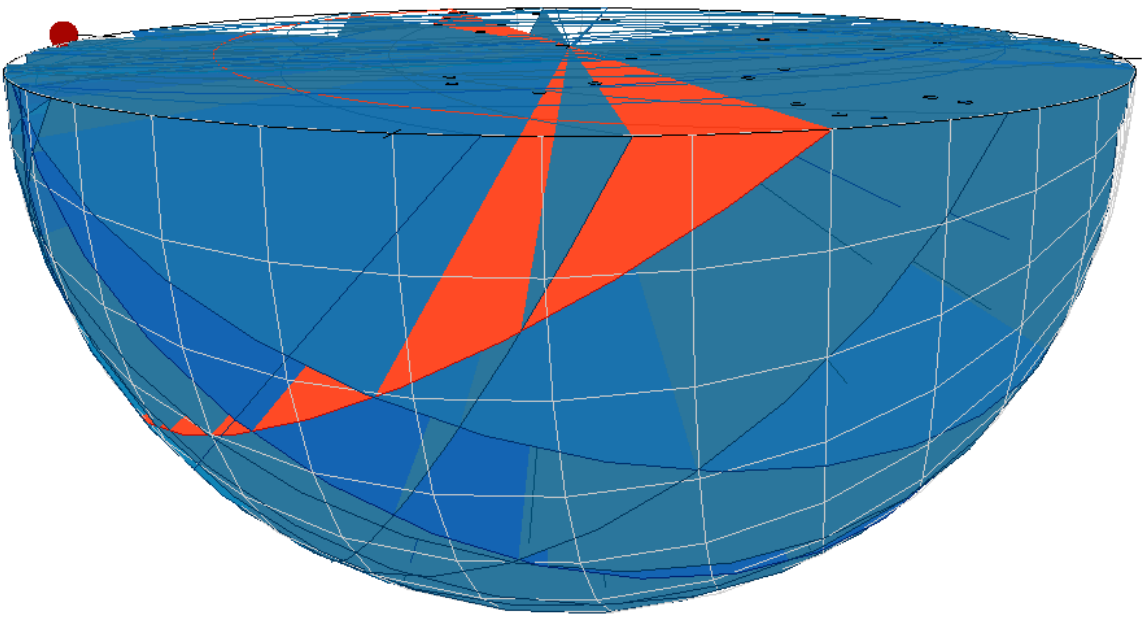
Bedding and proposed slope 240/34 orientation



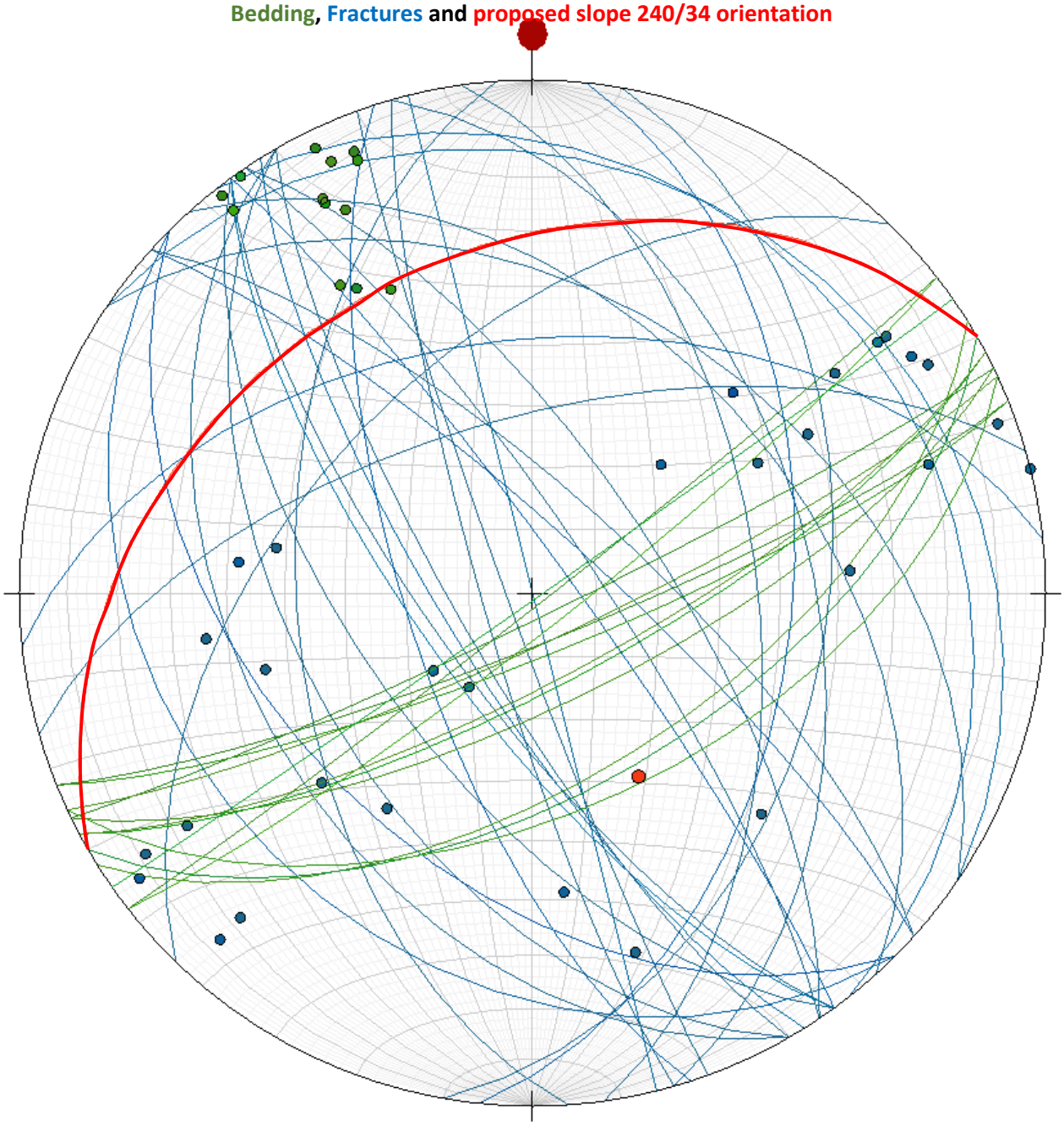


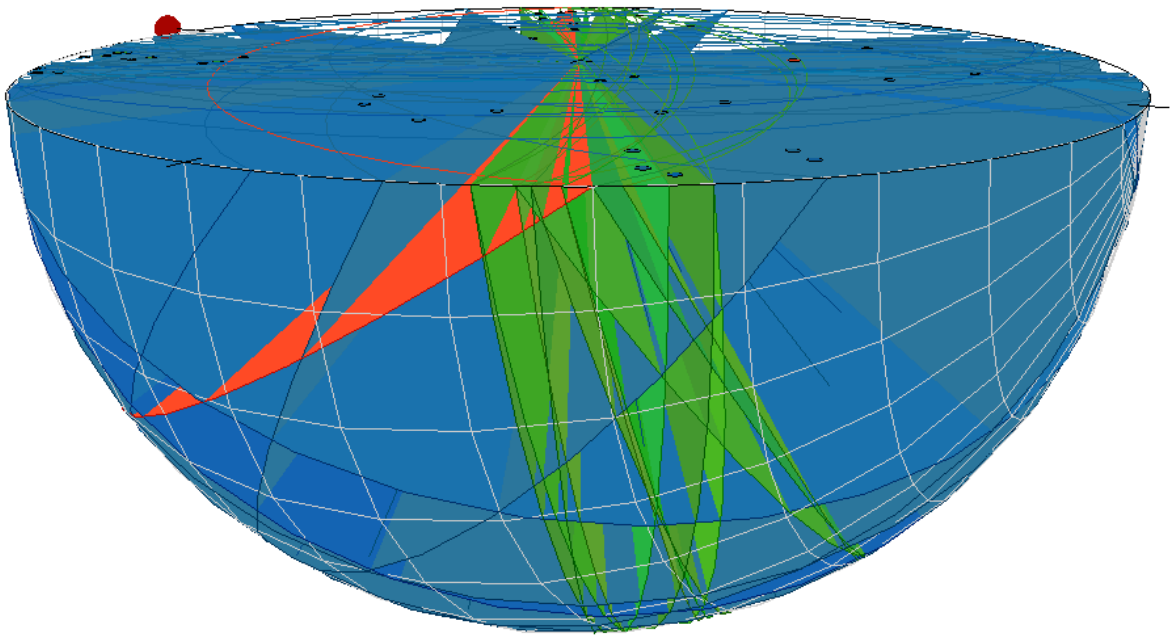
Fractures and proposed slope 240/34 orientation



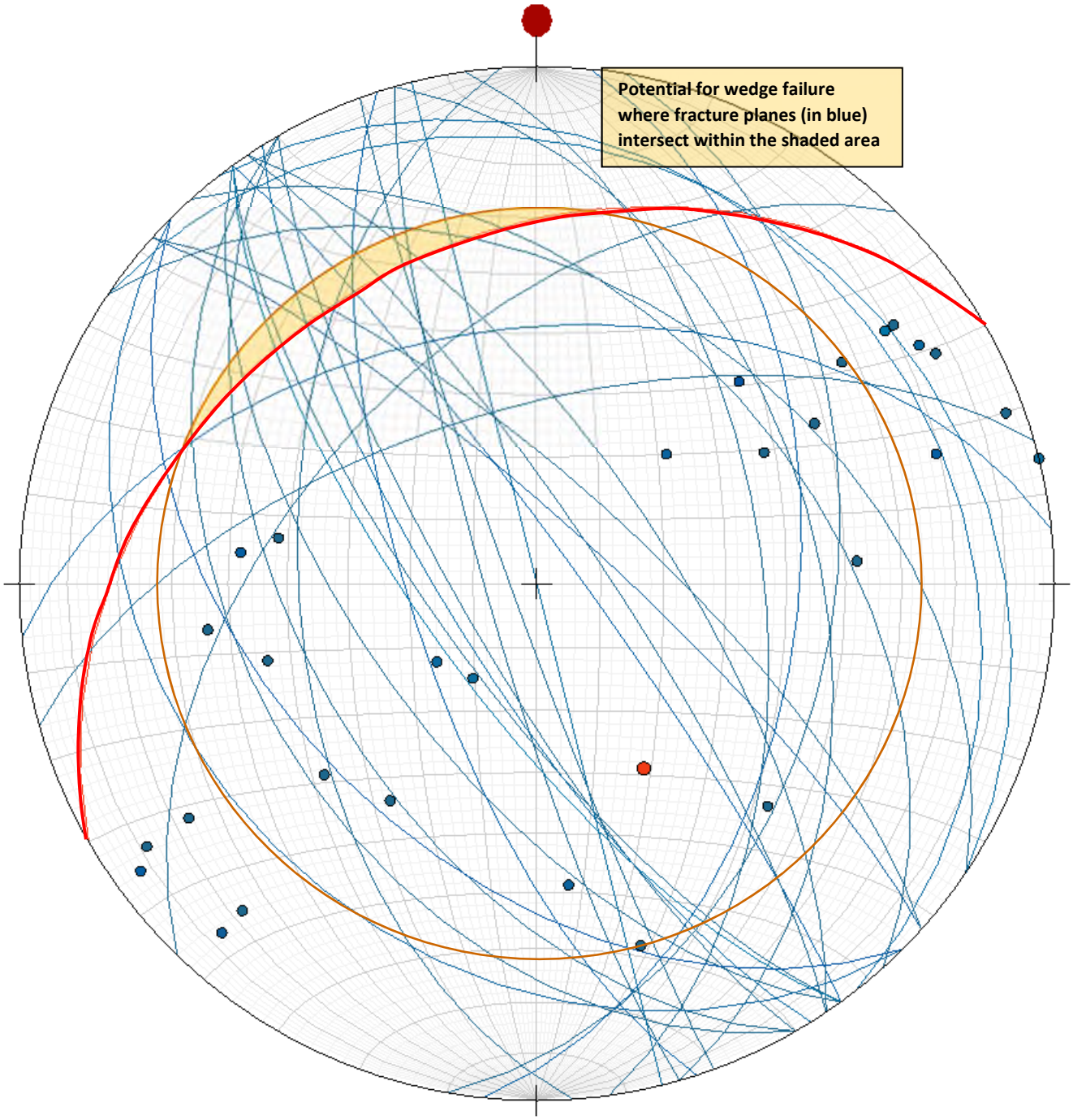


Bedding, Fractures and proposed slope 240/34 orientation

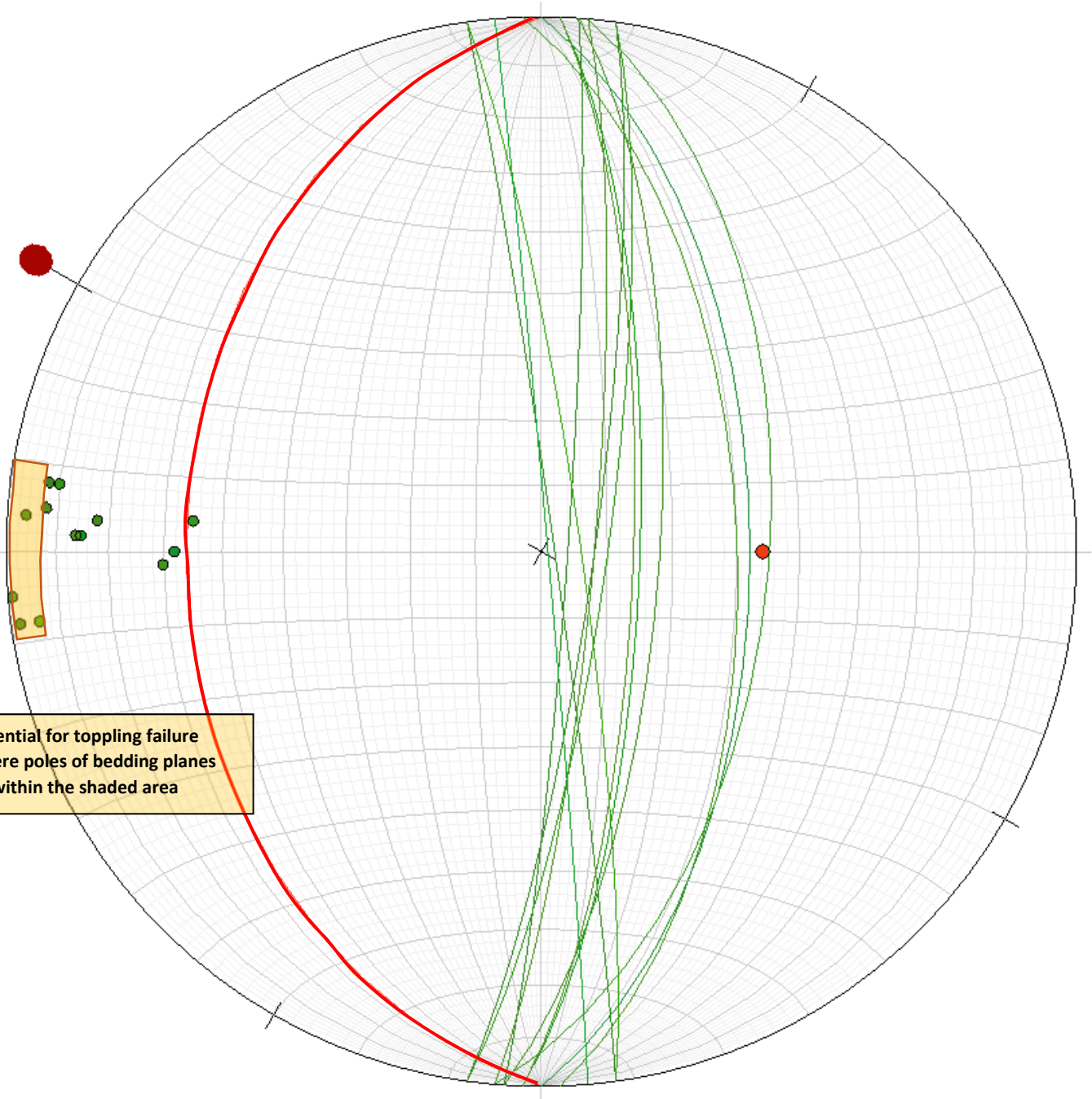




Wedge Failure



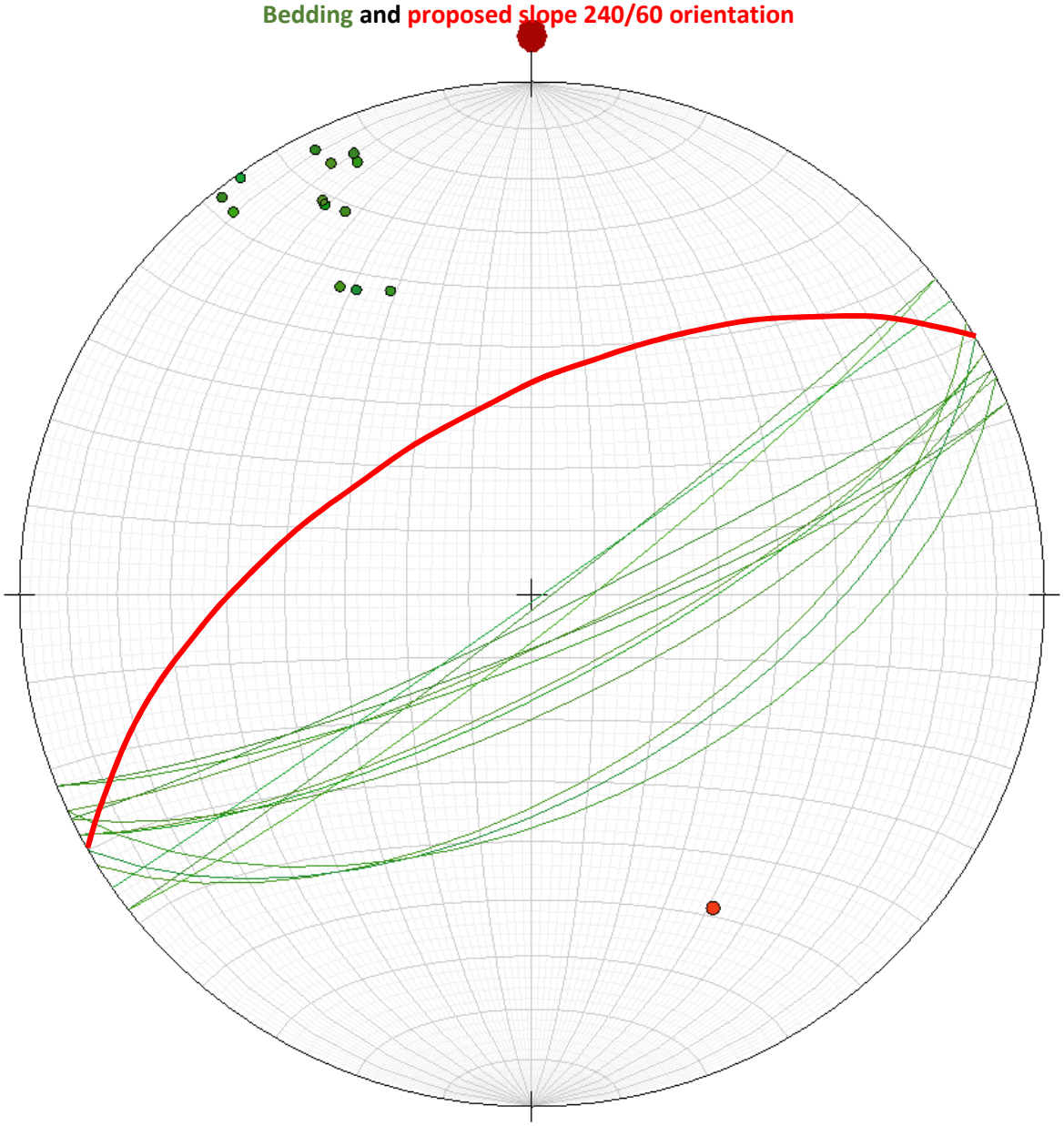
Toppling Failure

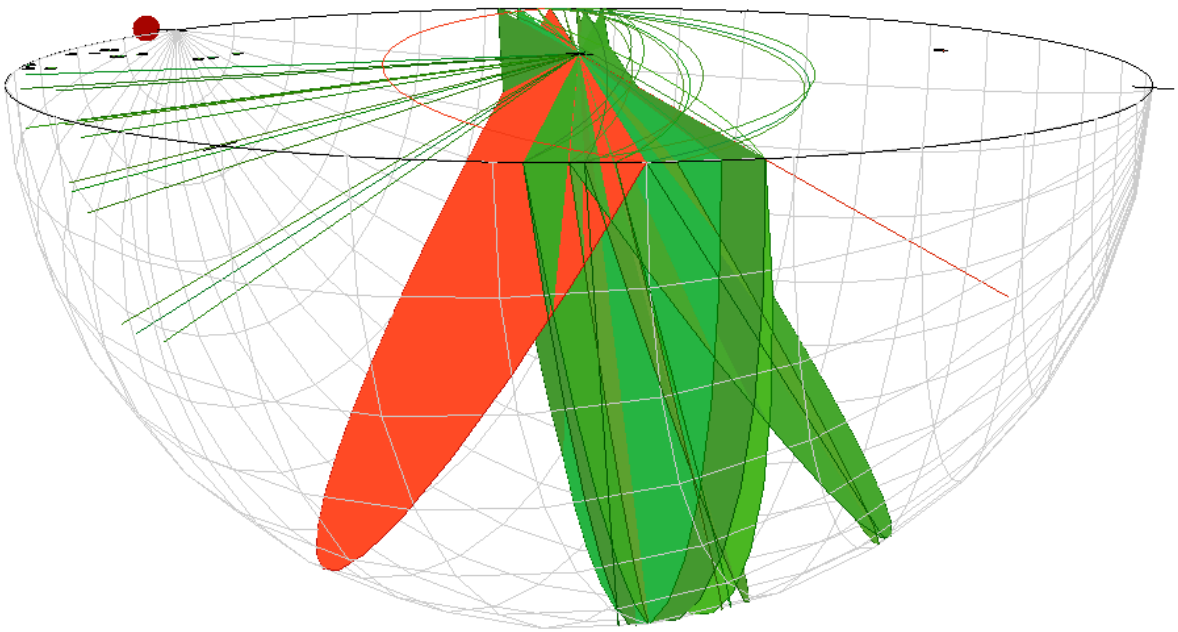


Potential for toppling failure where poles of bedding planes lie within the shaded area

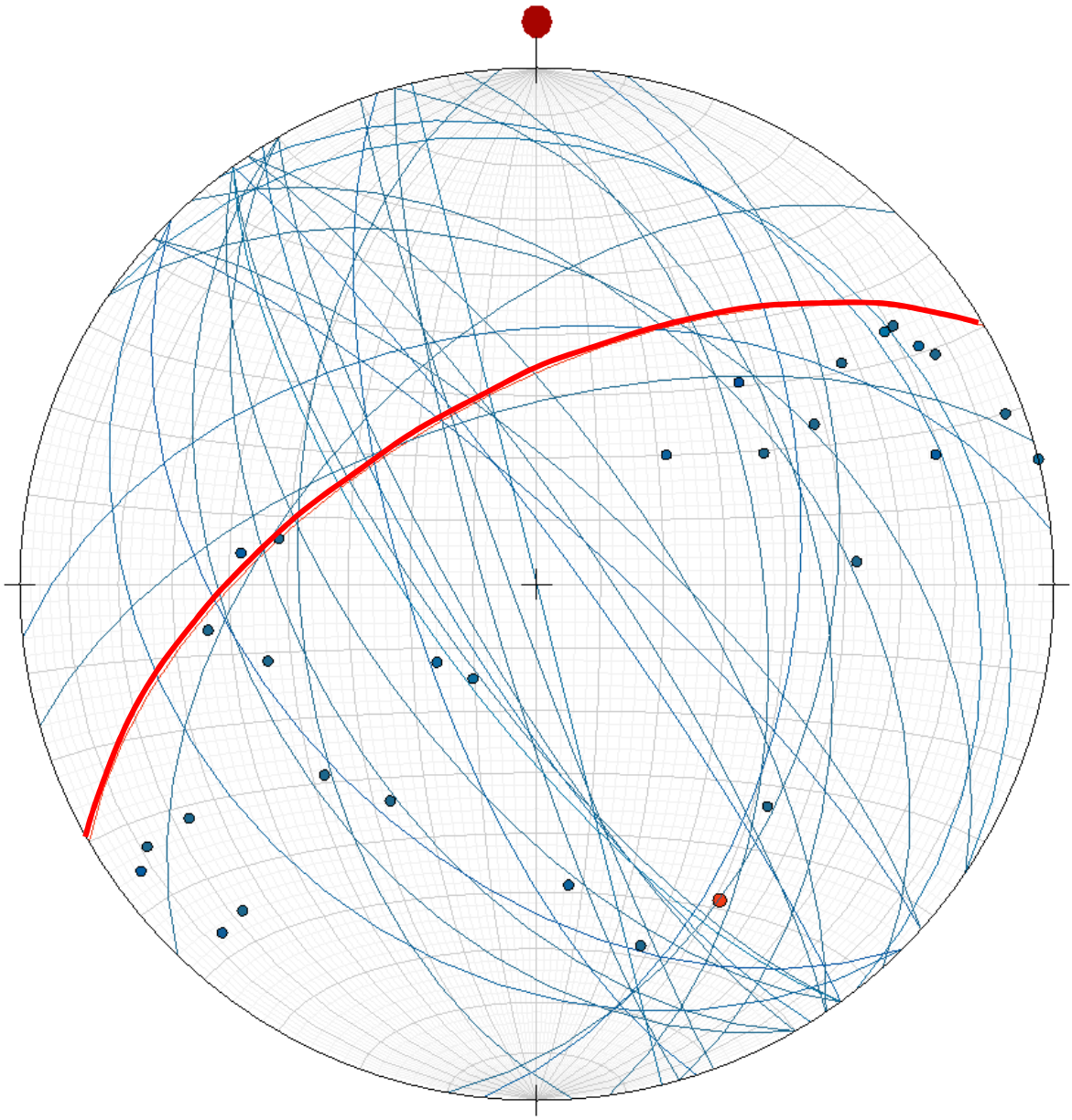
SLOPE CUT AT 240/60

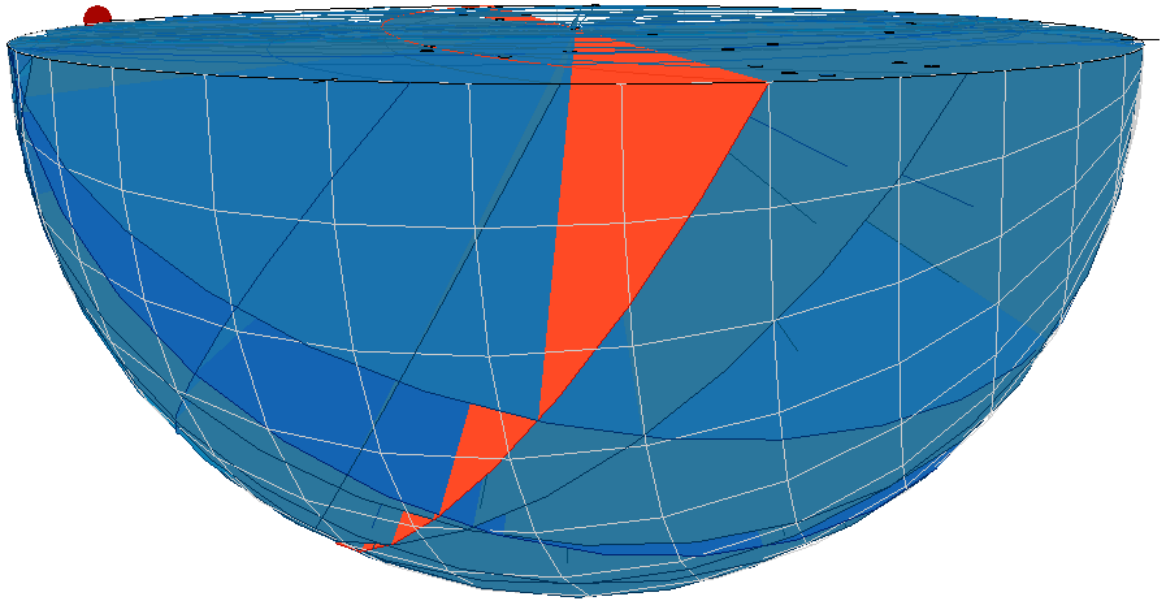
Bedding and proposed slope 240/60 orientation



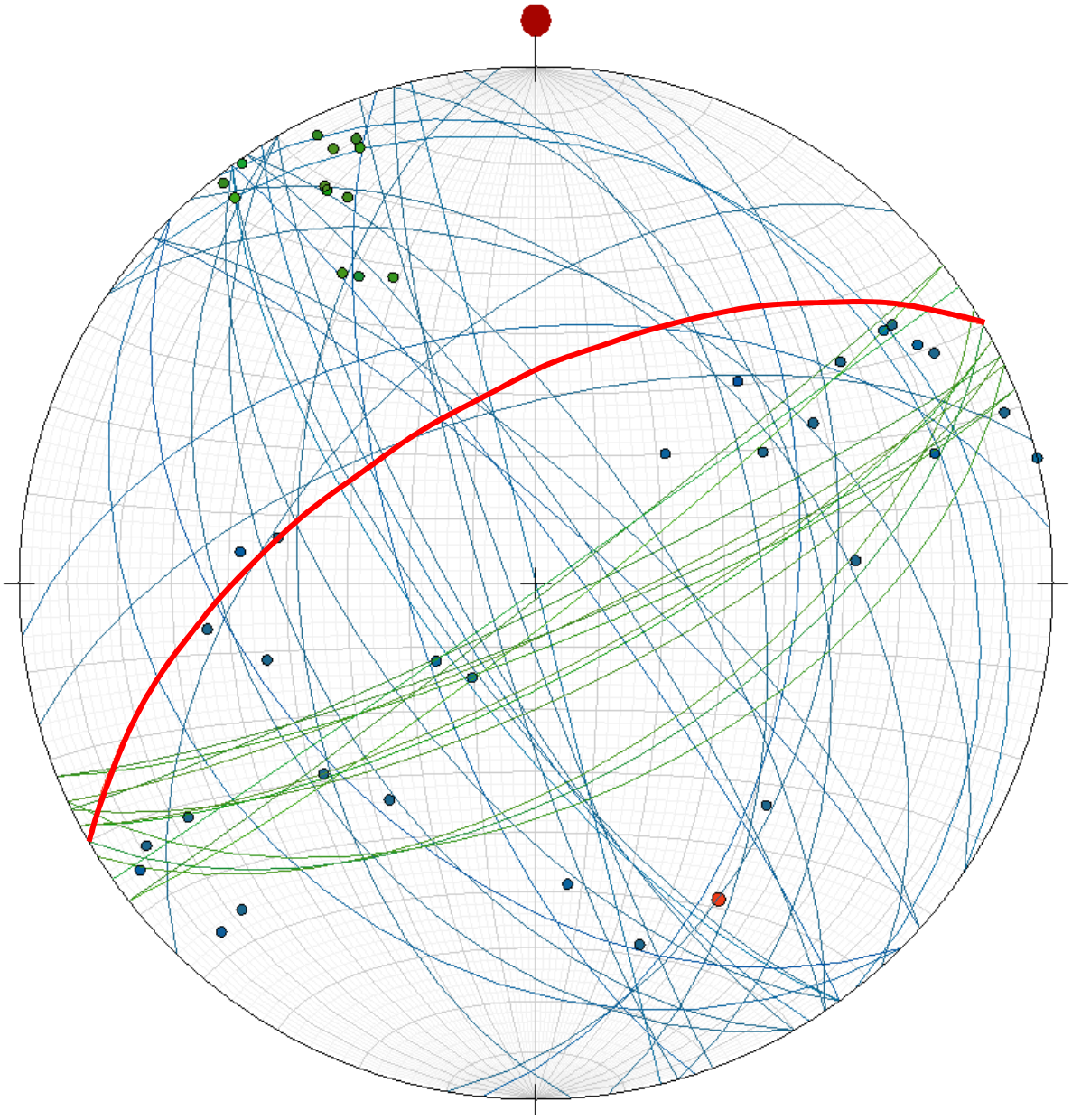


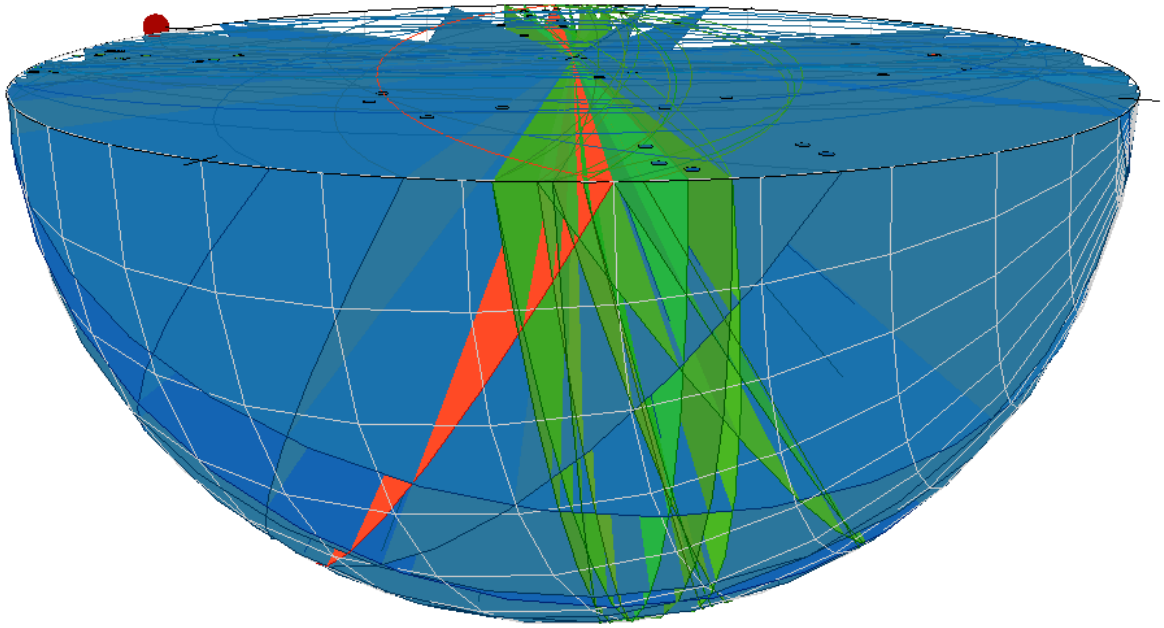
Fractures and proposed slope 240/60 orientation



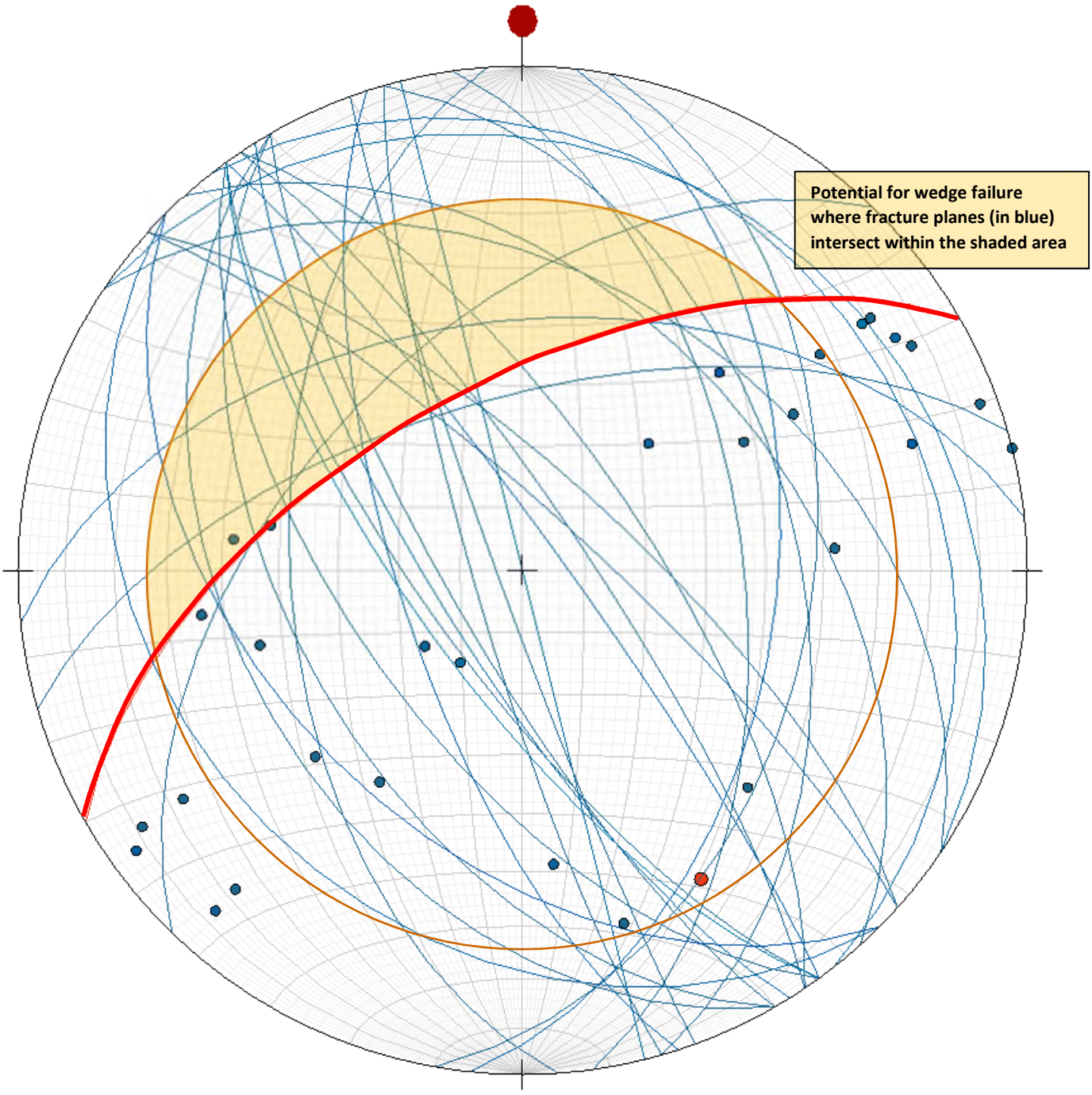


Bedding, Fractures and proposed slope 240/60 orientation

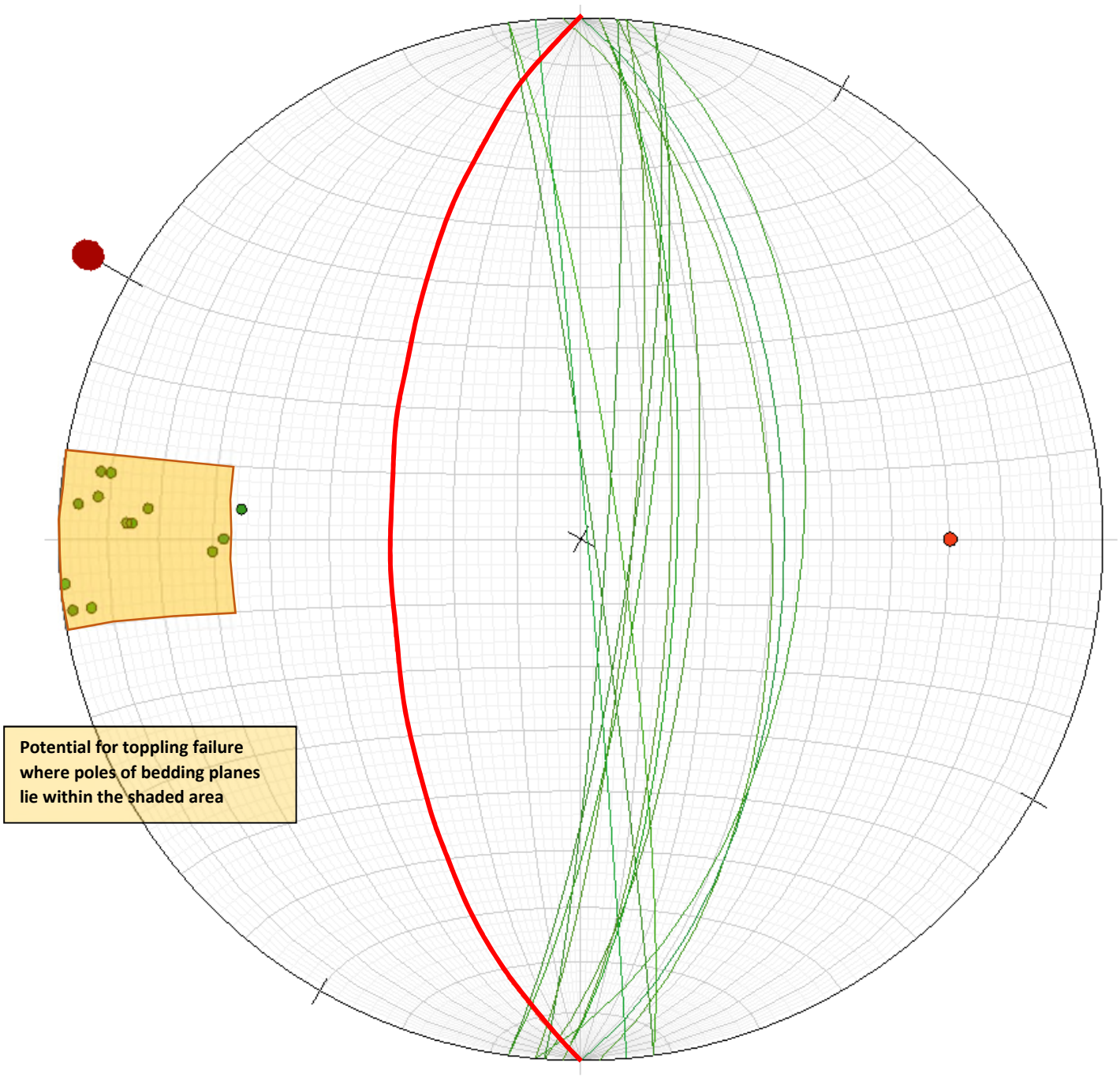




Wedge Failure



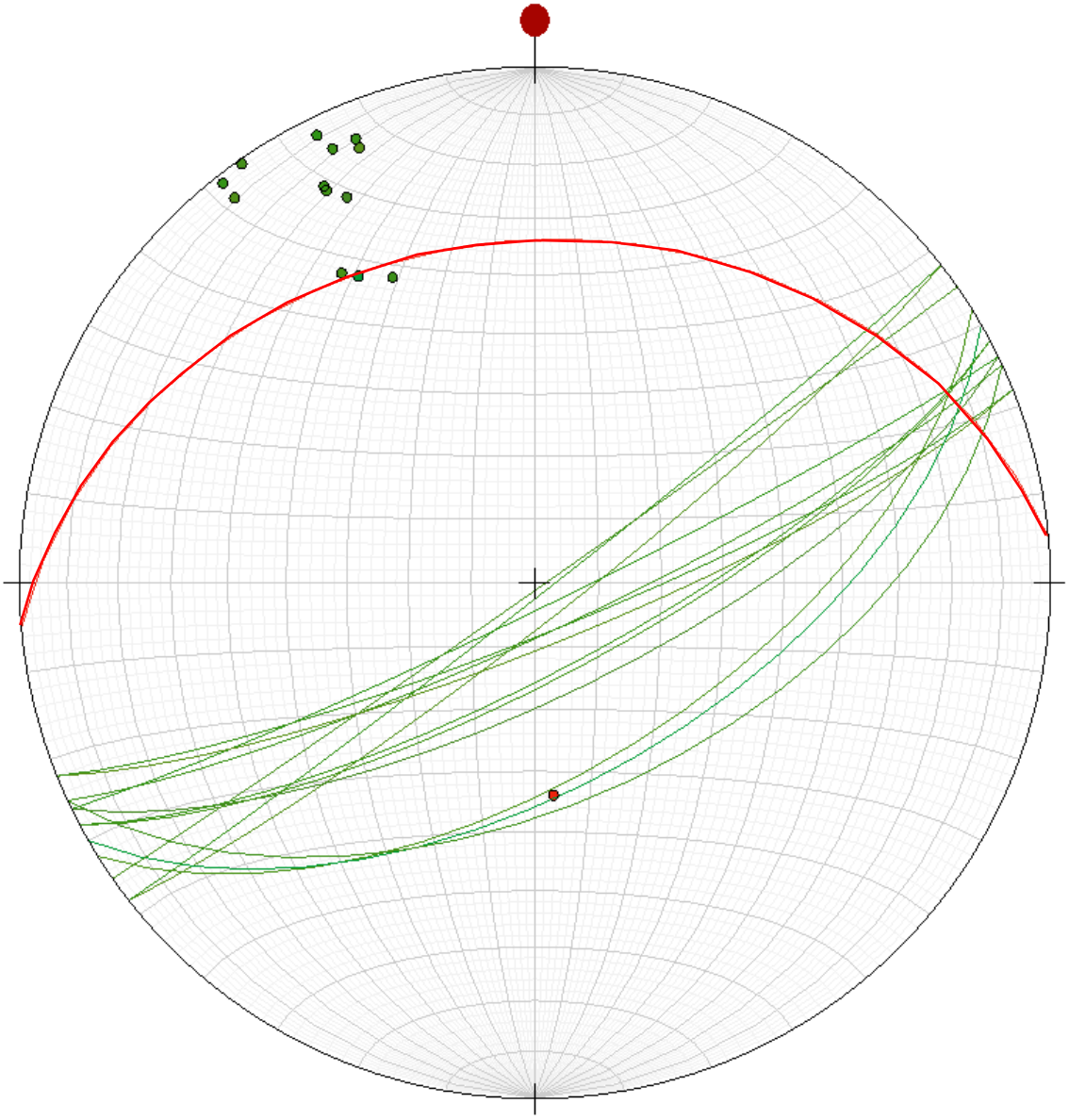
Toppling Failure

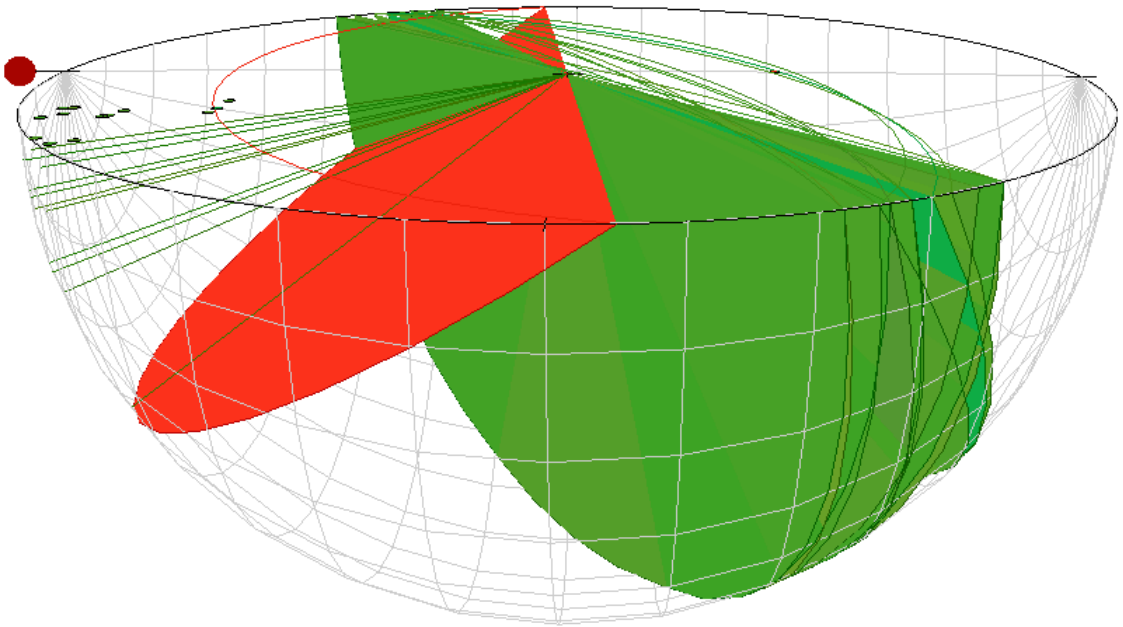


Potential for toppling failure where poles of bedding planes lie within the shaded area

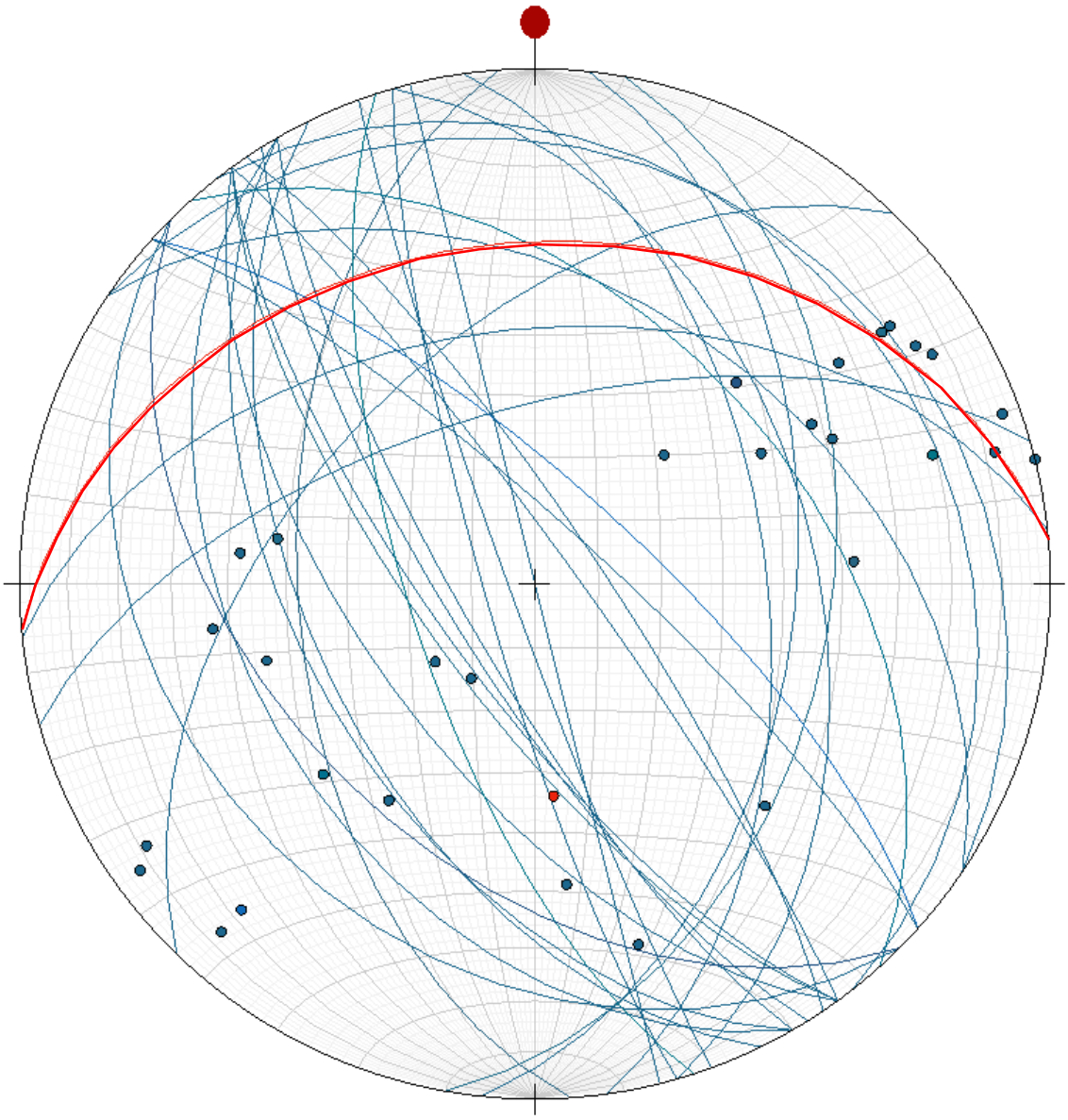
SLOPE CUT AT 265/34

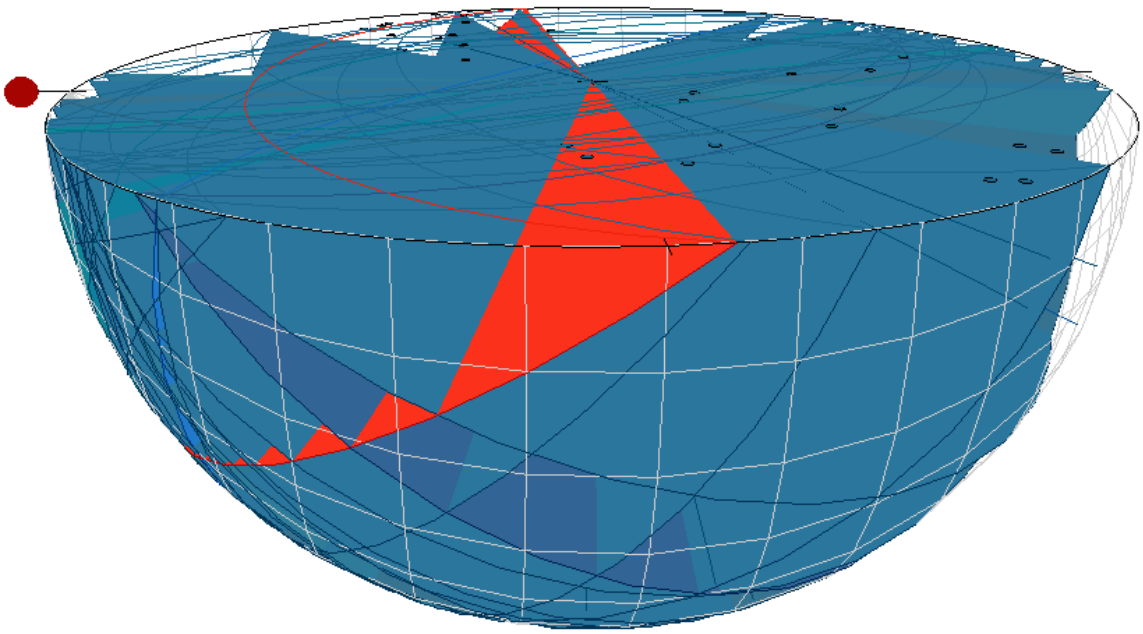
Bedding and proposed slope 265/34 orientation



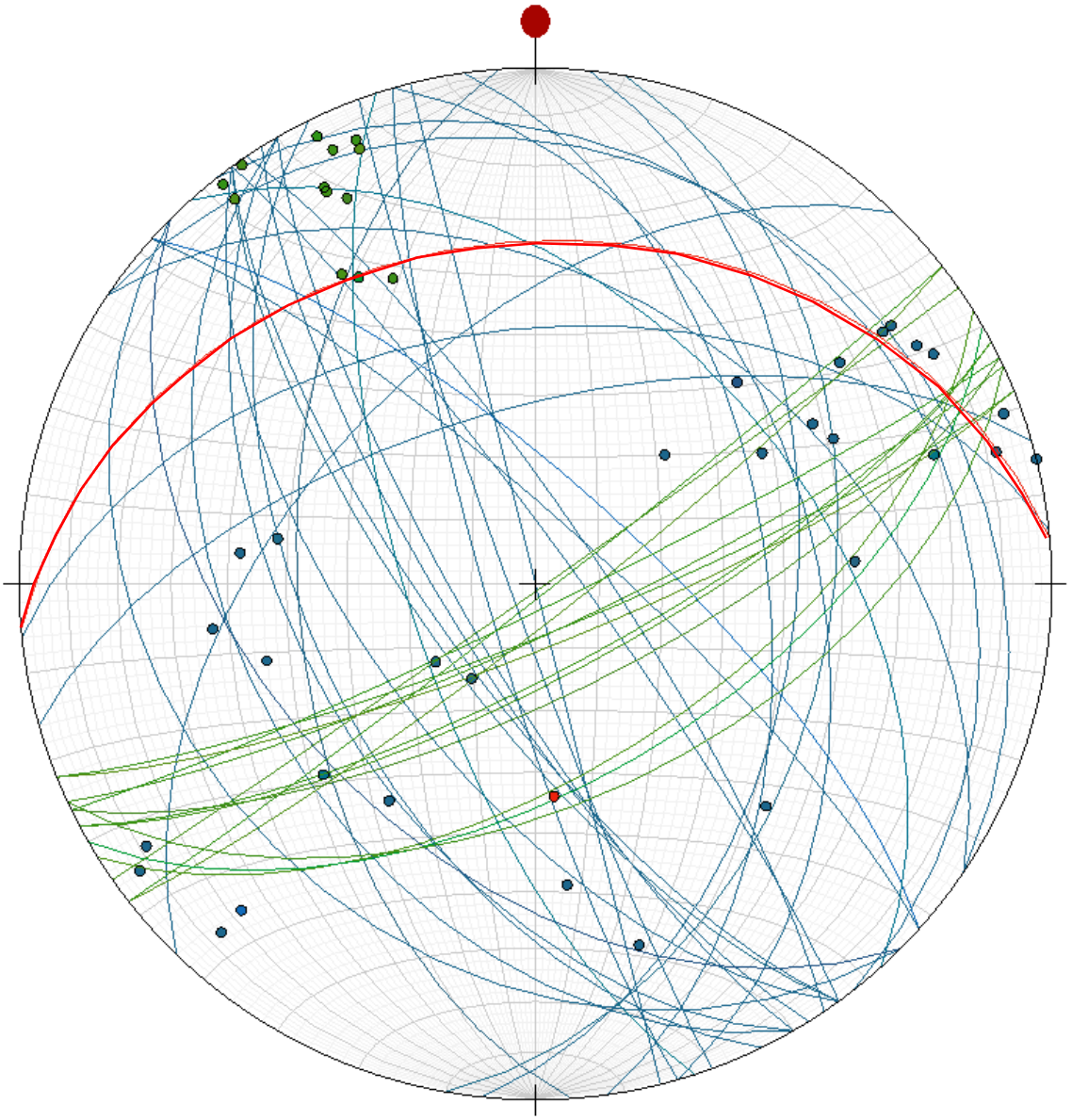


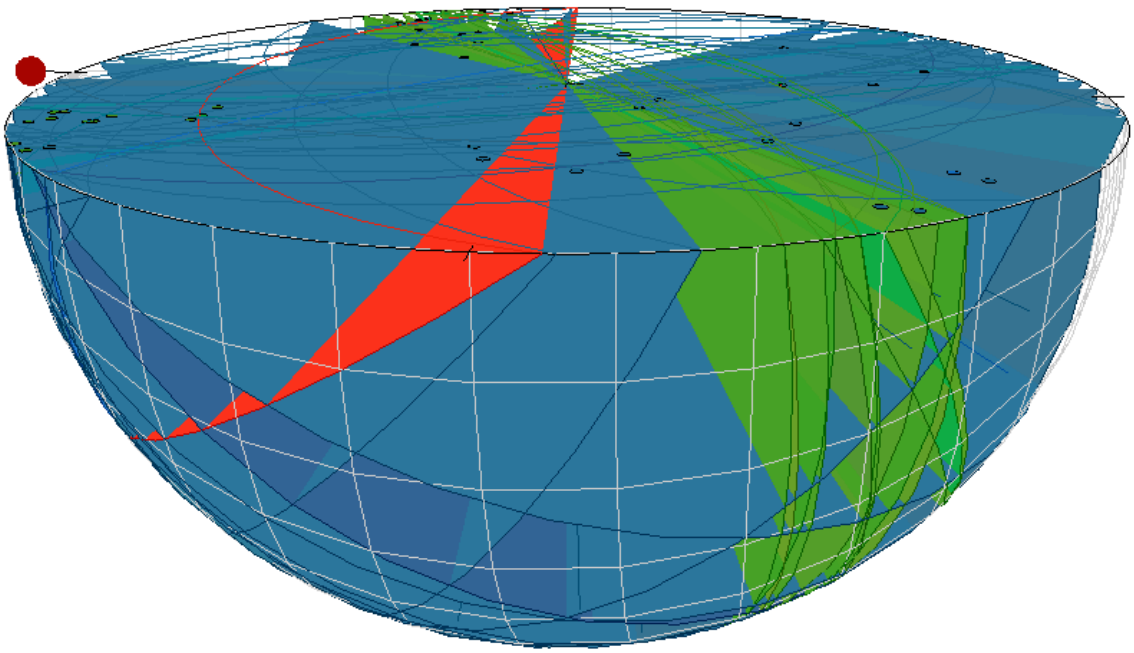
Fractures and proposed slope 265/34 orientation



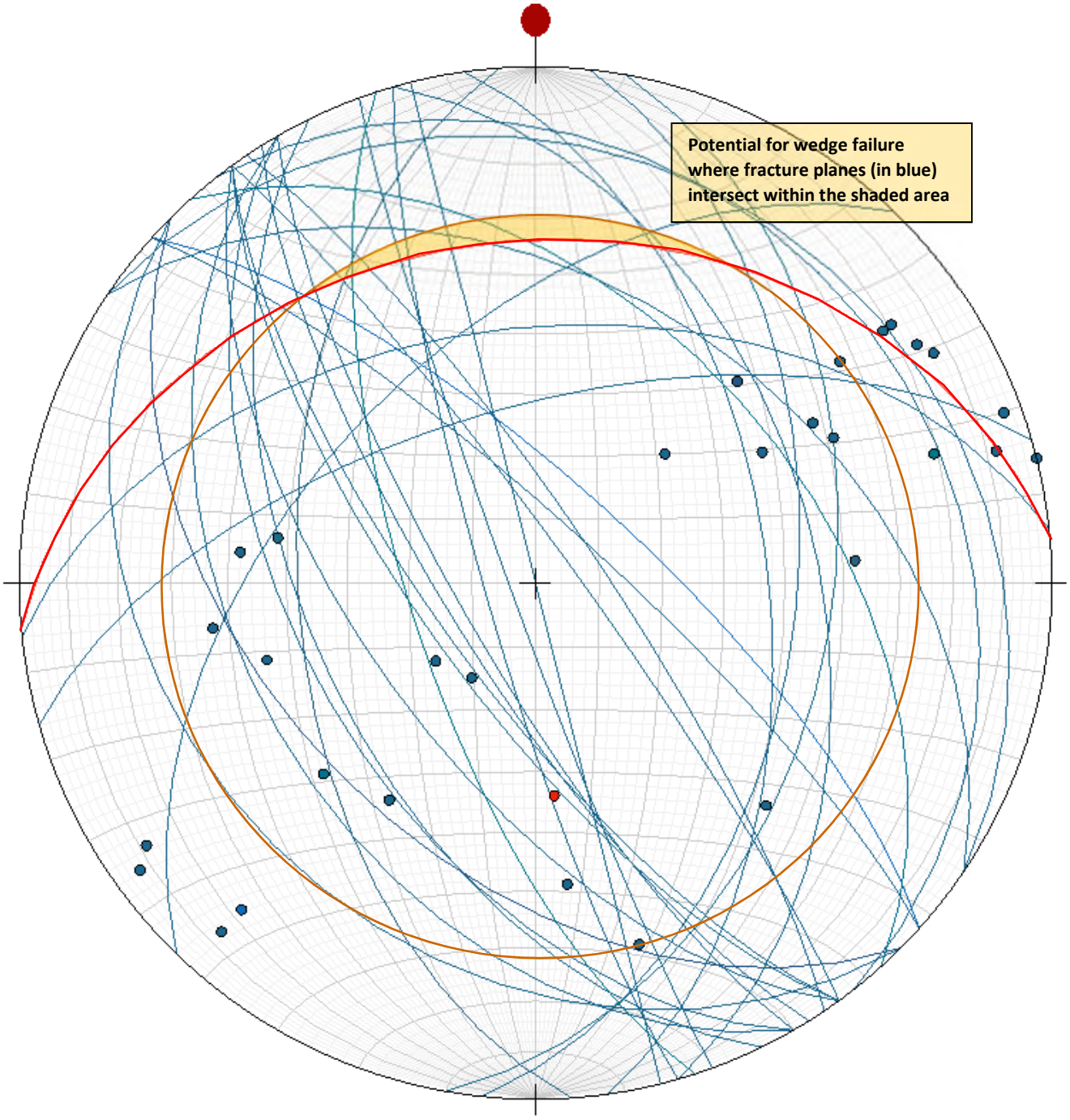


Bedding, Fractures and proposed slope 265/34 orientation

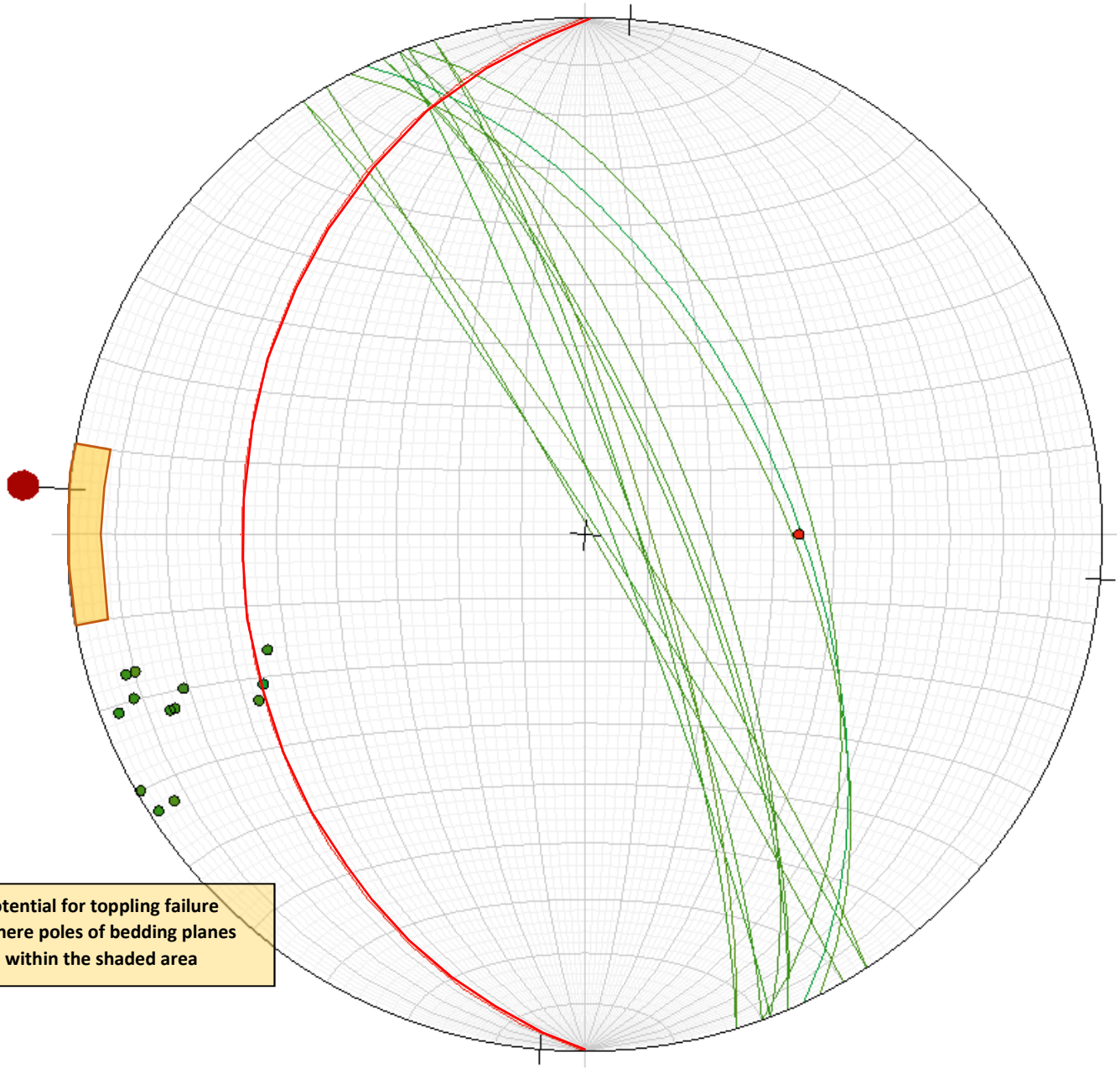




Wedge Failure



Toppling Failure



Potential for toppling failure where poles of bedding planes lie within the shaded area

ANNEX F
PSD and Slake Durability Test Results

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 41501

Client Ref:

Client PO: **14880RH**

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

Client **Terrafirma Wales Ltd**
5 Deryn Court
Wharfedale Road
Pentwyn
Cardiff
CF23 7HB

Contract Title: **Buttington Quarry (B.Quarry)**

For the attention of: **Ruth Howells**

Date Received: **06-11-2018**

Date Commenced: **06-11-2018**

Date Completed: **20-11-2018**

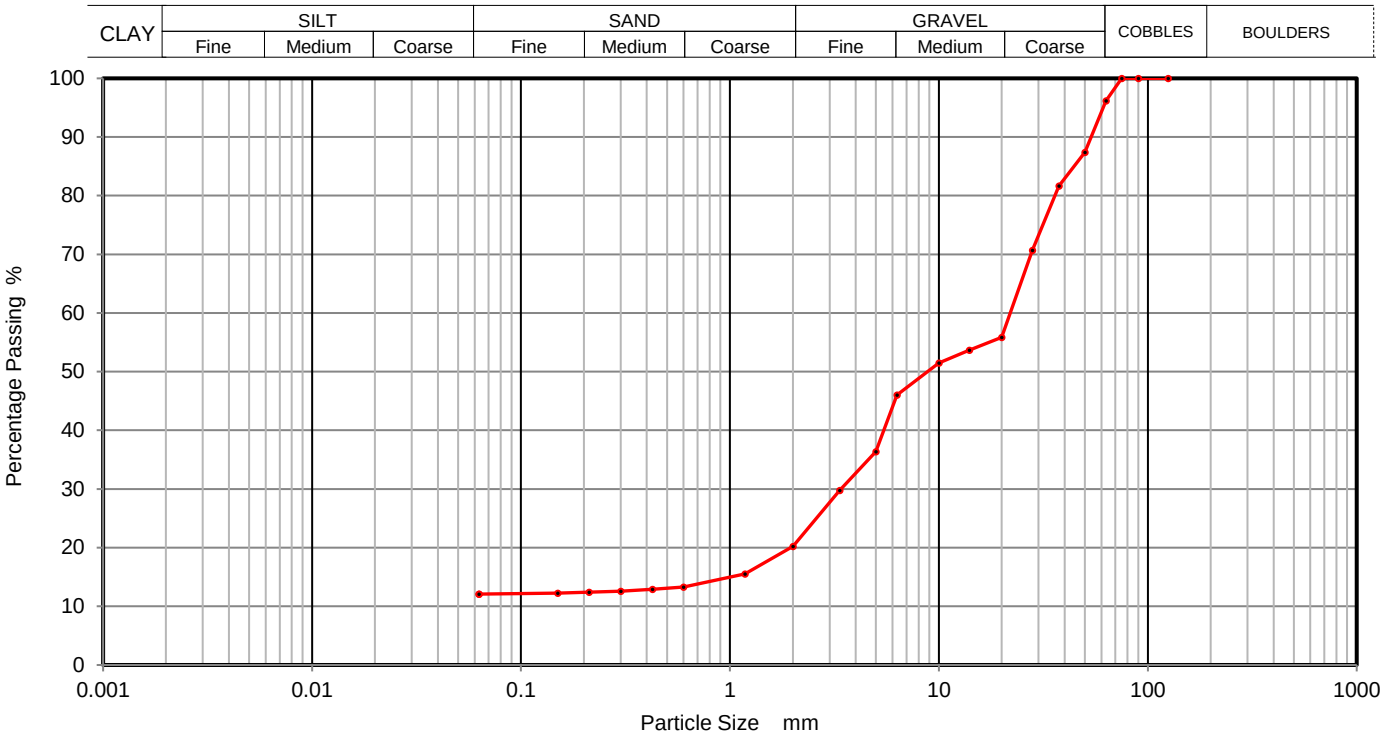
Test Description	Qty
Particle size Distribution (Aggregate) BS EN 933-1 - * UKAS	6
Determination of the slake durability index, two cycles. ISRM Suggested Method For Determining Slake Durability - @ Non Accredited Test	6
Large Shear Box 300mm Peak with 3 confining pressures includes remoulding BS 1377:1990 - Part 7 : 5 and Specification for Highway Works Vol.1 Clause 636 Part 2 - @ Non Accredited Test	6
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

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

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S1
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty clayey fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	96		
50	87		
37.5	82		
28	71		
20	56		
14	54		
10	51		
6.3	46		
5	36		
3.35	30		
2	20		
1.18	16		
0.6	13		
0.425	13		
0.3	13		
0.212	12		
0.15	12		
0.063	12		

Sample Proportions	% dry mass
Cobbles	4
Gravel	76
Sand	8
Silt and Clay	12

Grading Analysis	
Uniformity Coefficient	

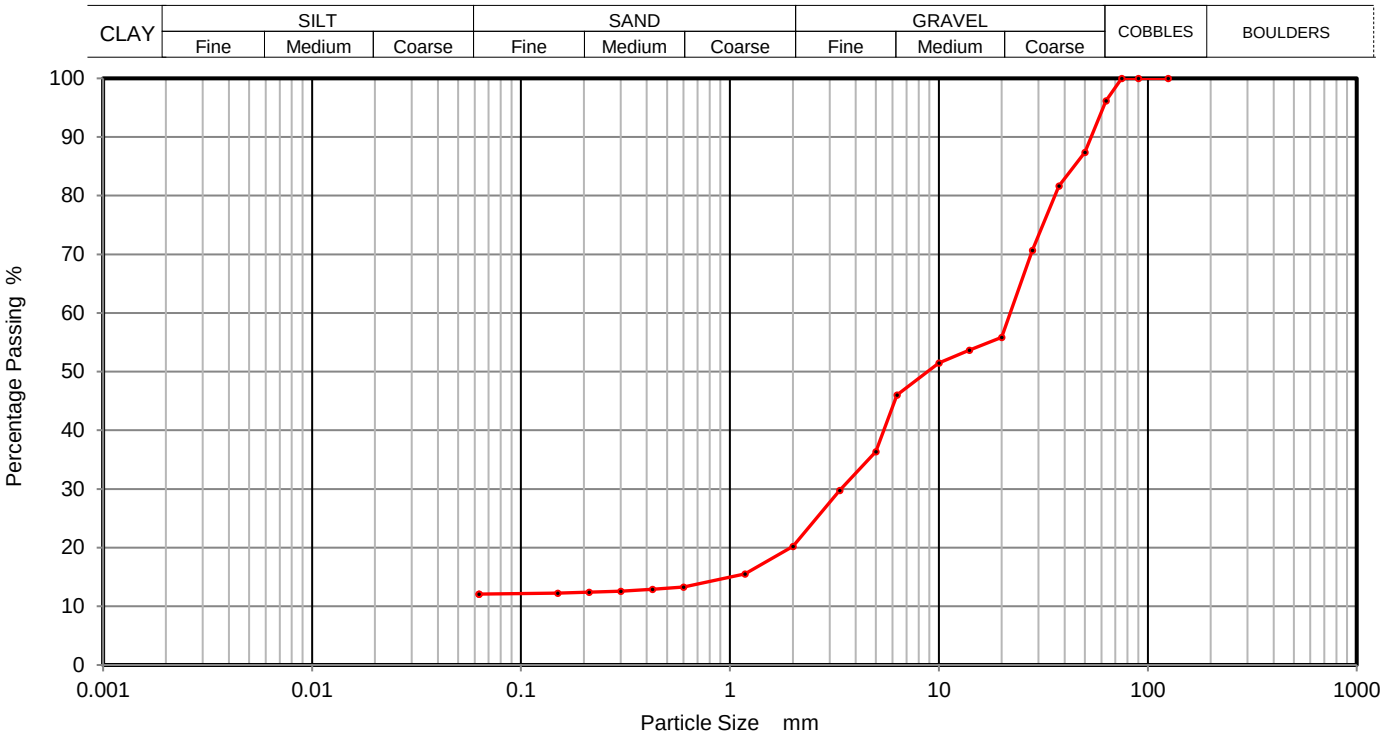
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S1
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty clayey fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	96		
50	87		
37.5	82		
28	71		
20	56		
14	54		
10	51		
6.3	46		
5	36		
3.35	30		
2	20		
1.18	16		
0.6	13		
0.425	13		
0.3	13		
0.212	12		
0.15	12		
0.063	12		

Sample Proportions	% dry mass
Cobbles	4
Gravel	76
Sand	8
Silt and Clay	12

Grading Analysis	
Uniformity Coefficient	

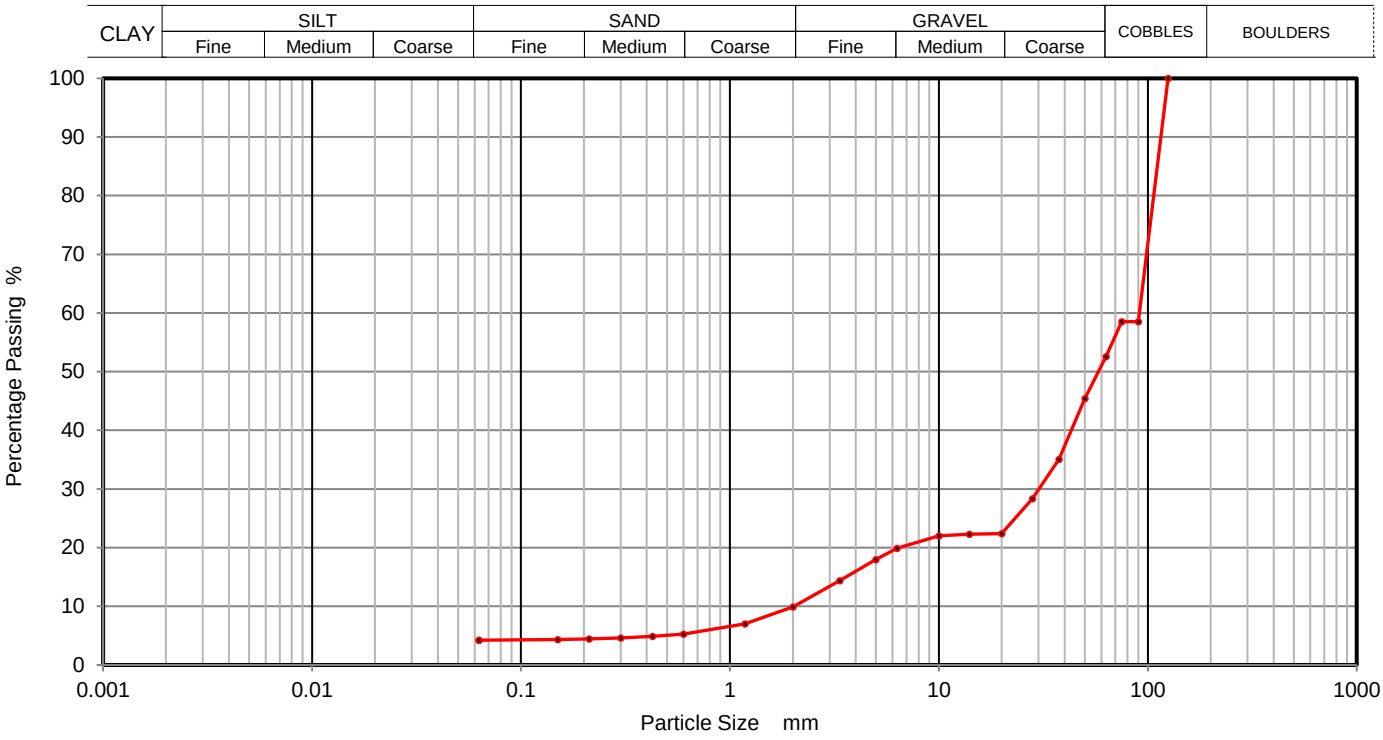
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S2
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown silty fine to medium slightly sandy fine to coarse GRAVEL with many cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	59	0.0060	
75	59	0.0019	
63	53		
50	45		
37.5	35		
28	28		
20	22		
14	22		
10	22		
6.3	20		
5	18		
3.35	14		
2	10		
1.18	7		
0.6	5		
0.425	5		
0.3	5		
0.212	4		
0.15	4		
0.063	4		

Sample Proportions	% dry mass
Cobbles	47
Gravel	43
Sand	6
Silt and Clay	4

Grading Analysis	
Uniformity Coefficient	

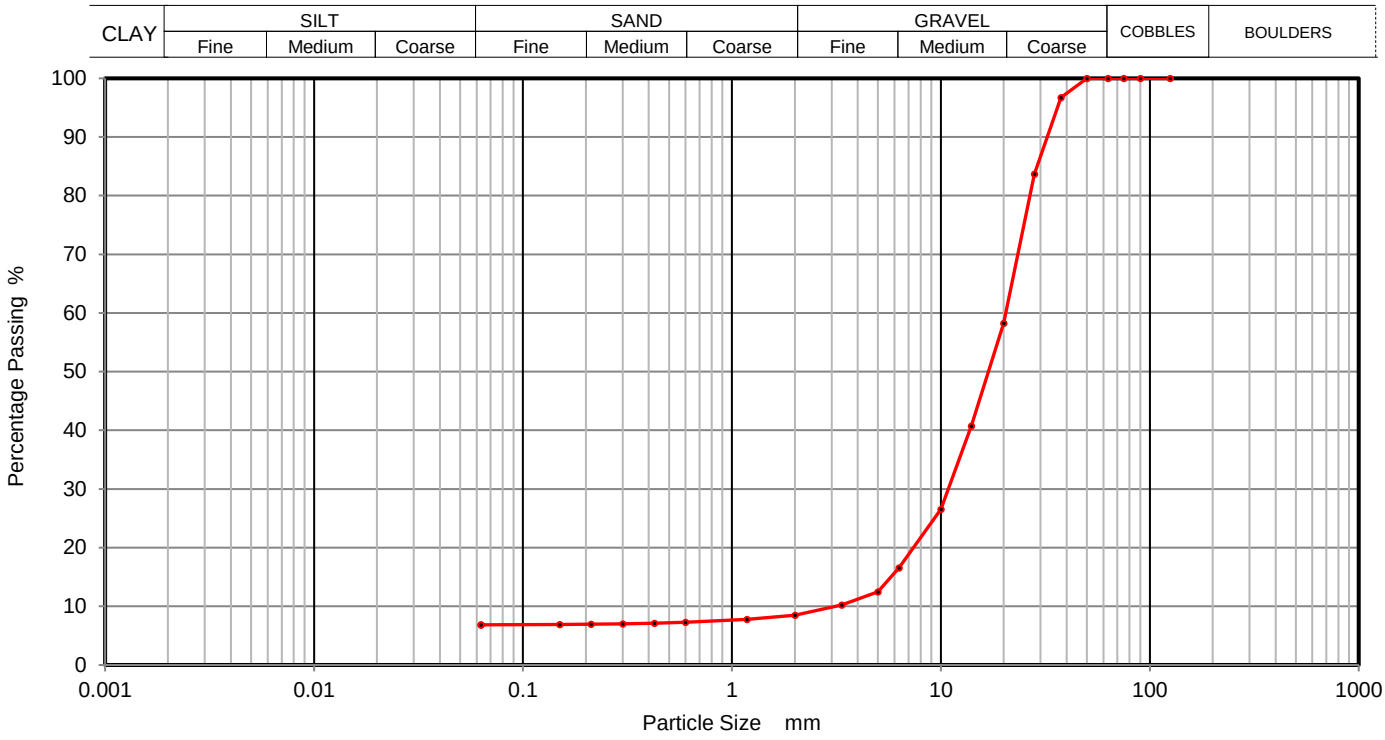
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S3
Site Name	Buttington Quarry (B.Quarry)	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	97		
28	84		
20	58		
14	41		
10	27		
6.3	17		
5	12		
3.35	10		
2	9		
1.18	8		
0.6	7		
0.425	7		
0.3	7		
0.212	7		
0.15	7		
0.063	7		

Sample Proportions	% dry mass
Cobbles	0
Gravel	91
Sand	2
Silt and Clay	7

Grading Analysis	
Uniformity Coefficient	

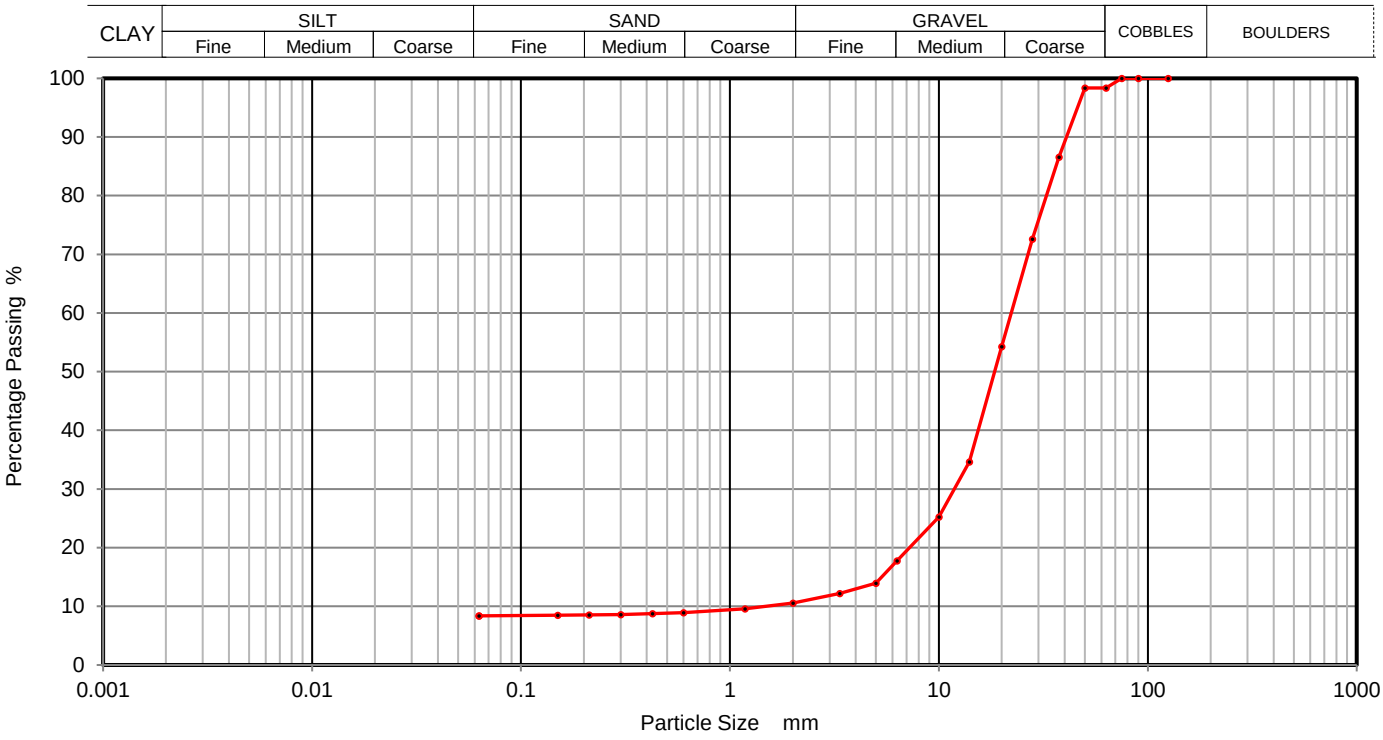
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S4
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	98		
50	98		
37.5	87		
28	73		
20	54		
14	35		
10	25		
6.3	18		
5	14		
3.35	12		
2	11		
1.18	10		
0.6	9		
0.425	9		
0.3	9		
0.212	9		
0.15	8		
0.063	8		

Sample Proportions	% dry mass
Cobbles	2
Gravel	87
Sand	3
Silt and Clay	8

Grading Analysis	
Uniformity Coefficient	

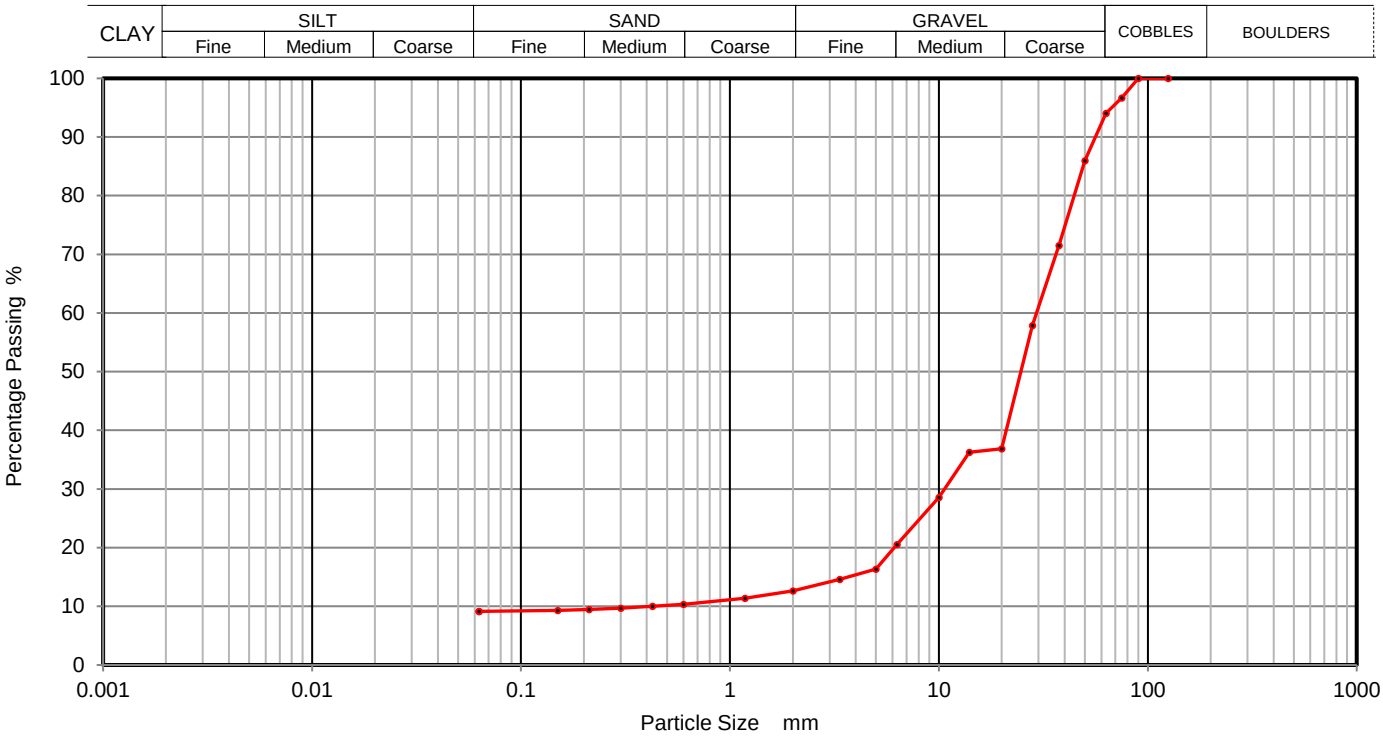
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S5
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	97	0.0019	
63	94		
50	86		
37.5	71		
28	58		
20	37		
14	36		
10	29		
6.3	21		
5	16		
3.35	15		
2	13		
1.18	11		
0.6	10		
0.425	10		
0.3	10		
0.212	9		
0.15	9		
0.063	9		

Sample Proportions	% dry mass
Cobbles	6
Gravel	81
Sand	4
Silt and Clay	9

Grading Analysis	
Uniformity Coefficient	

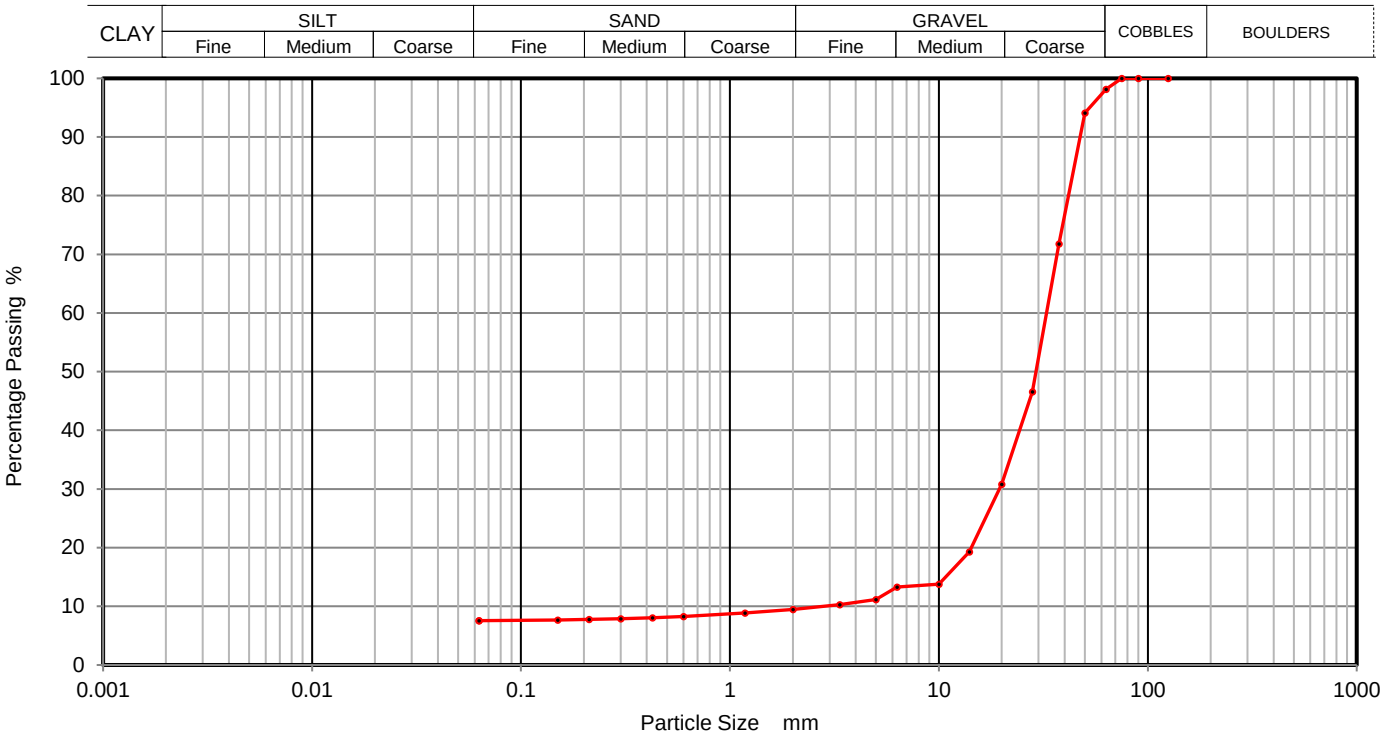
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	41501
		Borehole/Pit No.	S6
Site Name	**Buttington Quarry (B.Quarry)**	Sample No.	
Soil Description	Brown fine to medium slightly sandy silty fine to coarse GRAVEL with few cobbles.	Depth Top	
		Depth Base	
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	98		
50	94		
37.5	72		
28	47		
20	31		
14	19		
10	14		
6.3	13		
5	11		
3.35	10		
2	9		
1.18	9		
0.6	8		
0.425	8		
0.3	8		
0.212	8		
0.15	8		
0.063	8		

Sample Proportions	% dry mass
Cobbles	2
Gravel	89
Sand	1
Silt and Clay	8

Grading Analysis	
Uniformity Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	19/11/2018	Emma Sharp	
RO/MH	Approved	20/11/2018	Paul Evans	

UKAS TESTING 2788

Test Report: CONSOLIDATED DRAINED LARGE SHEARBOX TEST.

BS1377:Part 7:5 :1990.

Borehole Number:	S1	Depth from (m):	0.00
Sample Number :	1	Depth to (m):	0.00

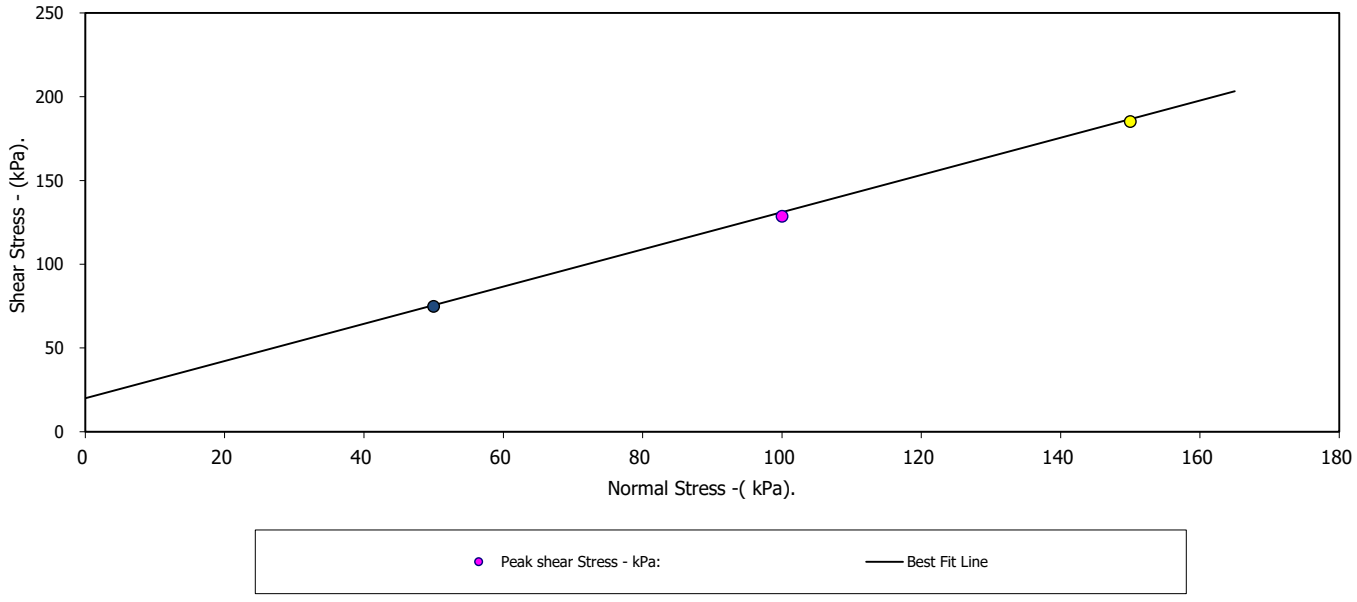
Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	At natural moisture content, Remoulded (Light Tamping) Material above 20mm removed.

Sample Description:
Brown clayey fine to medium GRAVEL

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	136.00	136.00	136.00
Length - mm:	300.00	300.00	300.00
Moisture Content - %:	10	10	10
Bulk Density - Mg/m3:	2.04	2.04	2.04
Dry Density - Mg/m3:	1.85	1.85	1.85
Voids Ratio:	0.4316	0.4317	0.4318
Normal Pressure- kPa	50	100	150
Consolidation			
Consolidated Height - mm:	133.03	131.54	129.77
Shear			
Rate of Strain (mm/min)	0.667	0.667	0.667
Strain at peak shear stress (%)	58.55	60.41	63.30
Peak shear Stress - kPa:	75	129	185

PEAK	
Angle of Shearing Resistance:(θ)	**48.0**
Effective Cohesion - kPa:	**20**

FAILURE CONDITIONS



D P Evans 20/11/18
Checked Pages 1-4 by: Date

D P Evans 20/11/18
Approved Pages 1-4 by: Date

Contract No.:
41501

Client Ref Number:
14880RH

Buttington Quarry (B.Quarry)

GSTL	Determination of Slake Durability Index ISRM Part 2.2	
Contract Number	41501	
Site Name	Buttington Quarry (B.Quarry)	
Nature of Slaking Fluid	Water at 20°C	
Date Tested	19/11/2018	

Hole Reference	Depth (m)			Slake First Cycle	Slake Second Cycle	Appearance Of Material Retained In The Drum	Appearance Of Material Passing Through The Drum
S1				87.79	75.84	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S2				88.18	74.93	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S3				95.84	92.97	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S4				92.52	88.10	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S5				93.77	89.44	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.
S6				91.14	88.01	10 Pieces of Subangular aggregate material with some pieces with ground corners and edges	Sub-angular to <2mm fragments to a sand/silt.

Key	Reported As
Slake First Cycle	%
Slake Second Cycle	%

Operators	Checked	19/11/2018	Wayne Honey	W. Honey
JD	Approved	20/11/2018	Ben Sharp	

Technical Appendix 13-3
Pre-Application Consultation and Response

Geotechnical Assessment

To	Mr Robin Williams	Date	28/10/2020
Project	Buttington EFW	Reference	1685
Subject	Preliminary Geotechnical Assessment of EIA v.1.0		

We have carried out a preliminary assessment of the EIA presented on the Broad Energy website. The review is primarily based on those chapters representing my area of expertise:

- Drawings for the Development;
- Environmental Statement - Chapter 4 Description of Project
- Environmental Statement - Chapter 13 - Geotechnical and Materials Management. The

following initial comments are provided for your consideration.

1. GEOLOGICAL SETTING

The proposed development site comprises a disused quarry, which exploited the Tarannon Mudstone for the production of brick. The quarry floor is at an elevation of c. 88-89mAD, with surrounding ground at c. 120mAD to the NW and SE. The Tarannon Mudstone is dipping at a very steep angle, and as such the quarry has a linear shape; the quarry floor is approx. 25m wide at its base and c.500m long; the Tarannon was fully extracted and the remaining sidewalls are formed of the bedrock above and below within the stratigraphic sequence.

The quarry is orientated NE-SW, the sidewalls to the NW comprises the Cefn Formation rock, at gradients of approximately 35°, and the SE sidewall comprises the Banwy and Trewern formation, which are at a steeper gradient.

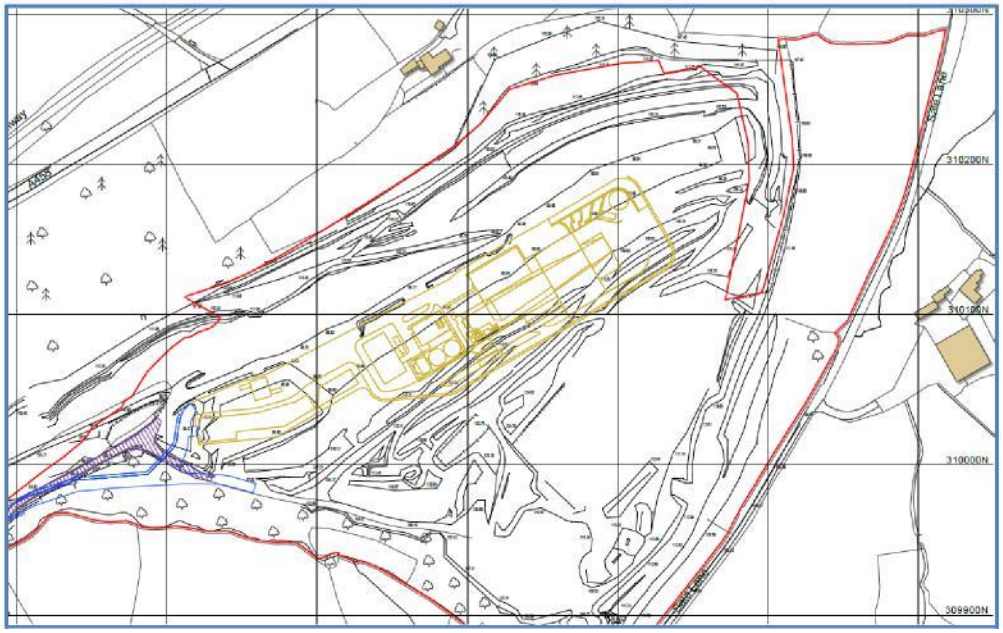
A geological SSSI is positioned at the Northern extent of the quarry, which is to be retained.

2. PROPOSED WORKS

The Drawings for the Development folder show good detail on the proposed plant, however there is very little, or no information on the relationship between the proposed structures and the existing quarry.

The plant is sat slightly above the quarry floor at c.90mAD, however very little context is provided in relation to its position relative to the proposed slopes is provided on the elevations, sections or plan views.

The Drawings (e.g. Drawing BT1180-D1) in Chapter 4 do however provide context (extract below), with a significant widening of c.25 - 30m of the quarry floor to accommodate the plant.



The best description of the proposed re-grading works is provided in Sections 4.4.15 to 4.4.24, which is summarised below:

- Existing quarry floor widened – although no dimension provided, drawings suggest 25-30m;
- NW quarry slope kept as existing, with 3m offset from toe for debris accumulation and erosion protection measures
- SE quarry face – steepened to 60° with 5m wide mid height berm. 3m offset provided. No dimensions or volumes provided. Rough calc by Daear suggests c.150,000 – 200,000m^3 of cutting;
- Excavated material shall be re-compacted into the void; however no details are provided.

3. REVIEW OF TECHNICAL APPENDICES TO CHAPTER 13

A brief preliminary appraisal of the two technical appendices presented in Chapter 13 follow:

1. Geotechnical and Geo-Environmental Site Investigation Report (Technical Appendix 13-1)
2. Slope Stability Assessment (Technical Appendix 13-2)

Geotechnical and Geo-Environmental Site Investigation Report (Technical Appendix 13-1)	
Section	**Comment**
8. Engineering Considerations	
8.1 Preparation of Site	No details on actual proposed works. All comments are generic.
8.2 Foundation & Floor Slabs	Recommendations based on raising the quarry floor level to 95mAD therefore not relevant to current plans, where the quarry floor remains at +90m. This is not considered a significant omission as foundations will be on rock, which will be superior to compacted fill.

Geotechnical and Geo-Environmental Site Investigation Report (Technical Appendix 13-1)	
Section	**Comment**
8.3 Excavation & Formations	No details on extent of actual proposed works, other than stating that excavations will require specialist equipment for excavating and breaking bedrock. The GI collected discontinuity data and qualitative rock strength was noted on the logs therefore it would have been possible to estimate the 'excavatability' of the rock, subdividing to 'digging', 'ripping' 'blasting' etc. by comparing the data to published charts. Recent excavation works for the quarried brick would be centred on removing the Tarannon mudstone, therefore there is limited experience in the removal of the Banwy and Trewern formation to the SE, which would need to be removed to accommodate the plant. No strength tests (point load or UCS) were carried out on the recovered rock core which would have been useful in determining ease of excavation.
8.4 Protection of Buried Concrete	No comment
8.5 Slopes	Cross reference made to 'Slope Stability Assessment' (TA13-2); see below for comments
9. **Earthworks**	
9.1 General	Bulk samples were obtained for testing. Para 3 states that they are representative samples of the three main strata. However, Para. 5 states that samples are representative of weathered materials that could be retrieved at or close to surface. The tested samples are therefore unlikely to be representative of the deeper rock mass, which will form the basis of the majority of the excavation works. No strength tests (point load or UCS) were carried out on the recovered rock core.
9.2 Slake Durability	These tests were based on near surface weathered samples not the deeper rock that will be recovered, therefore not particularly representative.
9.3 Grading Analysis	These test was based on near surface weathered samples not the deeper rock that will be recovered, therefore not particularly representative.
9.4 Compaction Specification	Guidance provided on earthworks specification for raising levels in quarry floor – Not particularly relevant if levels remain as per existing quarry floor level rather than raising to +95mAD. Assessment based on the tested near surface weathered samples, therefore not representative of what will actually be excavated.

Slope Stability Assessment (Technical Appendix 13-2)	
Section	**Comment**
Site Setting	Gradients of existing slopes not provided, however based on comment in S5.2, it is implied that all slopes are at gradients of c. 34° with significant weathering resulting in debris covering the lower half of the slopes. It is therefore not known if the 34° gradient relates to the lower slopes, the upper slopes or an average value of both.
5.2. Geo5 Slope Stability Assessment	Geotechnical parameters are provided in Table 5.1 for the bedrock and the scree; cohesion (c) = 20kPa & phi = 60° area assigned to the mudstone, which are considered quite unrealistic as stability will be dominated by fracture orientation. The values for the scree are considered realistic, although do not seem to be justified by anything over current scree gradients. Slope Stability Assessment with Geo5 software is not considered particularly useful as all it models is the scree slopes, which are clearly unstable, and the depth of the scree was not proven, therefore a realistic assessment of landslide risk or hazard cannot be made. The factors of safety reported are the minimum factors and represent extremely localised, very shallow failures. Consideration should have been given to the factor of safety of deeper slip circles, which would include larger landslides which have the potential to damage infrastructure or injury.
5.2.4.3	This section discusses the output of the Geo5. The test implies that a FoS of 1.0 indicates that the slope is stable; however, this is not the case as a FoS of 1 is right at the tipping point of failure. The fact that the FoS of deeper slip circles have not been analysed provides no assurance of the likelihood of more significant landslips occurring.

Slope Stability Assessment (Technical Appendix 13-2)	
Section	**Comment**
5.3 Stereonet assessment	It is not explained where the three proposed orientations (190°, 240° and 265°) for the slope have been obtained; presumably from a site development plan that was current at the time (but not included in the report.) – The proposed orientation of the current layout indicates that the 265° slope direction would be most relevant. The Statement *'The max. recommended Angle of cut for the mudstones is 60°' is* not considered to be accurate, the 60° value is based on a nominal phi value assigned to mudstones in BS6031; and is not a recommendation on stable cut angles. The fact that the current angles on site, in an active quarry suggest that stable long term angles are significantly shallower, and reflective of existing slope profiles as quarry operators do not generally take out overburden beyond the maximum possible stable angle. The discontinuity survey was carried out on surface exposures and collected 14 readings on bedding planes and 31 readings on joint sets. The dip (gradient)on the bedding varied between 55° and 89° and the dip direction varied between 052° and 068° (generally NE – ENE). There was significant variation in the joints, and no attempt had been made to group the readings into coherent joint sets. No consideration had been given to the faults identified on site.
5.3 Stereonet assessment cont.	No down-hole geophysics had been carried out to determine the insitu discontinuities in the area of the proposed cut slope, and it does not appear that the discontinuities from the boreholes had been compared to the field records.
5.3.1	It appears that planar failure has only been considered along bedding planes; it can occur along other continuous discontinuities
5.3.2	The statement that there is no risk of toppling failure at '265/60' is considered misleading, particularly as there is significant variation in the field measurements obtained for bedding planes and joint sets.
5.3.3	A high risk of wedge failure has been identified for slopes at 60°
5.3.4	The conclusions are very simplified, there is no discussion about the variability recorded in the bedding planes and joint sets and the limited number of readings for the size of the proposed slope. No consideration has been given to the faults and the likely influence of the fault on localised discontinuity patterns. No consideration has been given to the continued erosion/ravelling of the slope. No consideration has been given to the face that the quarry walls have been maintained at relatively shallow gradients; presumably due to experience of instability. I would have expected for a stereonet assessment to have presented a sensitivity analysis of possible slope gradients to determine the optimal, most cost effective profile rather than just concentrating on two potential slope angles It appears from comments in Chapter 4 that 60° gradients have been adopted by the developer in the proposed layout drawings.

Slope Stability Assessment (Technical Appendix 13-2)	
Section	**Comment**
6. Recommendation for Slope Stability	The fault is discussed in this section; geological inspection with dentition work is recommended, although impact on stereonet analysis is not considered.
6.1 NW face	This slope is retained at existing gradients. It is recommended that a 3m wide buffer zone and catchfence are constructed to allow for continued degradation and removal of weathered rock from the base
6.2 SE face	For 34° slopes the following measures are recommended: • 3m buffer and catch fence and • draped rock mesh over the face r It is not known why additional measures would be required compared to the NW face. For 60° Slope, the following measures recommended: • 5m buffer zone at base with catchfence and drainage; • 5m wide mid slope ledge with drainage; • Stabilisation of all face with appropriate ground anchors or soil nails/bolts, combined with rock netting and erosion control.
6.2 SE face cont.	No details of the stabilisation measures with ground anchors was provided, other than reference to the design being by specialist. No details on adopted stabilisation measured are provided in the EIA, over and above the 5m buffer zones. I am therefore uncertain if the magnitude of the stabilisation works has been appreciated by the developer. The new rock face will be in the order of 15,000m^2, which will need to be fully covered by rock mesh with, most likely a regular grid of rock anchors (possibly at 2-3m spacing and 6+m deep, although much deeper anchors would be required for deeper mass instability or complications associated with the faulting). Effective erosion protection will be very difficult to implement at such steep gradients using 'soft' facings, and without effective erosion control the ground anchor face plates will be undermined. Slope stabilisation measures for a slope of this size will result in substantial capital expenditure.
6.2.3	There is a brief discussion in this section about other possible slope gradients, but is limited to combining 34 and 60degree gradients. No consideration has been given to gradients where very expensive ground anchor stabilisation could be eliminated for the majority of the slopes.

4. DISCUSSION

There is a lack of clarity on the relationship between the proposed development and the existing site profiles.

Significant excavation is required. There are no details of the volumes generated, however rough estimates by Daear suggest that in excess of 150,000 – 200,000m^3 could be generated.

The EIA suggests strongly that the excavated material will be re-used on site, however it has not been detailed or quantified and based on current site levels and areas it is difficult to see how this will be achieved.

As such, no consideration appears to have been given to off-site disposal locations or costs. Associated traffic movements would also need to be considered.

No assessment of the method of extraction has been made, comments are qualitative and based on the previous extraction of the quarried Tarannon Mudstone rather than the adjacent bedrock, which will need to be removed.

Laboratory testing is focused on weathered near surface samples rather than the deeper rock mass which will be excavated.

Slope stability assessments have concentrated on the assessment and discussion of the suitability of either a 34^o or 60^o degree slope; no consideration of other slope gradients has been made.

The development is based on forming a 60^o cut slope in the new SE cut face. This will require extensive stabilisation measures to support it, with the entire face likely to require stabilization with ground anchors to prevent primarily wedge failures and toppling failures. No details of the likely stabilisation measures were provided in the geotechnical report, however, it is likely that a regular grid (say 2-3m spacing) of anchors will be required to depths of at least 5m, to prevent small to medium failures. However, if there are deeper / larger wedge failures or complications due to the faulting, much longer ground anchors may be needed locally. Further measures will also be required to prevent face degradation of the mudstone due to weathering/erosion, as there is a high risk that ground anchor face plates will be undermined in the medium to long term, resulting in them being redundant.

At this early stage I would recommend that the implications of the earthworks and stabilisation of the cut slopes are highlighted to the applicant as they have both planning and commercial implications.

Please contact me if you would like to discuss any element of this note.

terra firma
Geotechnical & Geoenvironmental Specialists
www.terrafirmawales.co.uk

Our Ref: GCL/14880/Stability

Your Ref:

Contact: Dr Gwyn C Lake

24th November 2020

ECL - For the attention of Sarah Burley

Dear Sarah

DAEAR GEO CONSULTING - GEOTECHNICAL ASSESSMENT

I confirm that I have studied the Daear Geo Consulting Geotechnical Assessment of our Chapter 13 Geotechnical Assessment of the EIA, which was based on our Slope Stability Report No 14880/SS and our Geotechnical and Geo-environmental Report No 18880/GGR and would comment as follows:

1. **Proposed Development -** At the time of production of our reports the final layout had yet to be decided, however, the layout has not changed since that time. Even had the layout changed, it does not affect the validity of our reports.

2. **Review of Technical Appendices to Chapter 13 - Engineering Considerations 8.1 -** Our comments are by necessity generic. The method of construction will be decided by the appointed main contractor and reviewed by ourselves.

3. **Review of Technical Appendices to Chapter 13 - Engineering Considerations 8.2** - Our recommendations are relevant regardless of the final level as the foundation recommendations are given for both engineered fill and bedrock.

4. **Review of Technical Appendices to Chapter 13 - Engineering Considerations 8.3 -** Excavation works will be carried out by the main contractor to the slope profiles provided at final design stage. It is not in Terra Firma's remit to determine the excavatability of the rock. This will be decided following site trials by the main contractor. It is untrue to say that no point load or Unconfined Compressive (UCS) tests have been undertaken. There have been 25 UCS tests and 33 Point Load Tests that are reported in 14880/GGR (presented as Technical Appendix 13-1 of this ES).

5. **Review of Technical Appendices to Chapter 13 - Engineering Considerations 9.1 –** Bulk samples were obtained for testing of the scree as it is the most unstable strata in the analysis. These samples do not represent the underlying weathered rock but were analysed to show their future susceptibility to further weathering. The test results do not represent the un-weathered rock but do show their lightly weathering properties once exposed to the elements. Once again UCS and point load tests have been carried out upon the un-weathered rock to characterise its strength. In addition, Rock Penetration Tests have also been carried during the drilling works to further categorise the strength of the in-situ rock.

6. **Review of Technical Appendices to Chapter 13 - Engineering Considerations 9.2 & 9.3 -** The grading analysis were intended to inform on the geotechnical properties of the scree as these materials were considered to be the most unstable. They are therefore considered to be relevant to the strata from which the samples were taken. Geotechnical tests such as grading analysis cannot be carried out on competent rock. Once again, the strength of the underlying un-weathered rock is given by the UCS and point load test results.

7. **Review of Technical Appendices to Chapter 13 - Engineering Considerations 9.4 -** A compaction specification has been provided to inform the Main Contractor should this be required. It has been assumed that the majority of the scree materials will be used for re-compaction and therefore the tests are relevant. Should the un-weathered bedrock be used then this will have to be crushed on site to the desired grading and therefore the compaction specification is again relevant.

8. **Slope Stability Analysis Site Setting –** The current angle of the lower (scree) slopes formed by natural weathering is 34°, as measured on cross-sections. The gradient of the upper slopes are variable, largely defined by exposed bedding, joint and fracture planes.

9. **Slope Stability Analysis Geo5 Slope Stability Assessment 5.2 –** The geotechnical parameters in the case of cohesion were taken to represent the strength of the rock mass as a whole while the phi angle was taken from published data of a stable cutting angle for the rock encountered and are therefore considered realistic. We agree that the stability will be influenced by fracture orientation, however a conceptual rock slope protection design has been carried out by Maccafferi to cater for such eventualities. With regards to deep seated landslides, analysis has shown no factors of safety within the rock mass that would cause concern.

10. **Slope Stability Analysis Geo5 Slope Stability Assessment 5.2.4.3 -** We do not infer that a FOS of 1 is stable. Section 5.2.3 states 'The minimum acceptable factor of safety applied is 1.3 to the model. Slopes with slip circles that have a factor of safety greater than 1.3 are considered sufficiently stable that a slip is unlikely to occur. Any slope with a factor of safety less that 1 is considered unstable. **The minimum acceptable factor of safety is 1.3.'** With regards to the Geo5 analysis deeper slip circles are analysed but only those with low factors of safety are reported.

11. **Slope Stability Analysis Geo5 Slope Stability Assessment 5.3 –** The three orientations used in the assessment were indeed those proposed for the new south-eastern and eastern quarry faces, which were derived based on the proposed footprint of the new development in the base of the quarry.

    There is no evidence that the stable long-term angles on site are or were shallower than 60 degrees. The upper part of the quarry slopes to the southeast are around 52 degrees at present. The original cut quarry slope angles are unknown given that weathering has occurred here to form scree slopes.

    Also, the primary risk from failure is along rock discontinuities rather than through direct shearing of the rock. The use of the 60 degree angle in the stereonets in most

instances presents potential worst case stability hazards, for which appropriate stabilisation measures have been considered.

An attempt was made to group joint sets but as stated in our report 'Numerous fractures and joints were also observed in the TBMF from different exposure locations. Fracture and joint planes were found to be variable in both orientation and dip and no dominant fracture groups could be deciphered'. However, all recorded joints were included in the stereonets to ensure complete assessment.

An in-situ geophysical survey was not undertaken given the wide area of study. Also due to the known many variable and inconsistent discontinuities the findings of a geophysical would have been very ambiguous.

12. **Slope Stability Analysis Geo5 Slope Stability Assessment 5.3.1 -** Agreed. the proposed rock slope stability design undertaken/to be undertaken by Maccafferi should includes provision for rock anchoring and should deal with this.

13. **Slope Stability Analysis Geo5 Slope Stability Assessment 5.3.2 -** The risk of toppling failure has been analysed from field data so the statement that this is misleading is purely conjectural. However, Section 5.3.2 of our report will be reviewed to confirm.

14. **Slope Stability Analysis Geo5 Slope Stability Assessment 5.3.3 -** Agreed.

15. **Slope Stability Analysis Geo5 Slope Stability Assessment 5.3.4 -** The recommendations given in our report are engineering based and are therefore simplified in respect to geology. However, consideration has been given to the variability of the bedding planes, joint sets and effect of faults on the overall stability of the cuttings by the use of slope protection to be designed in detail by Maccafferi which will be undertaken should planning be granted. Should anything untoward be encountered in the excavations then appropriate measures will be designed and installed to maintain stability. Consideration has been given to continued erosion by the use of netting and catch trenches and fences at the vase of the cutting. I cannot comment on the reason the current slope angles are at relatively shallow gradients as this is pure conjecture. We have not undertaken a sensitivity analysis on the most cost effective profile but have given two alternative proposals, one which we feel would be the most cost effective and the other that would involve greater stabilisation works. In addition, it should be noted that the 60^{o} slopes also provide for a larger area for future development use and therefore do not sterilise an area zoned in the Local Development Plan as employment land.
16. **Slope Stability Analysis Geo5 Slope Stability Assessment 6.0** – This section deals in the main with a brief discussion about the recommended remedial measures and associated likely cost of such works including the use of ground anchors, netting etc. I have no comment to make other than to confirm that cost estimates of the works were beyond the scope of TFW's brief and are not material planning considerations. The required netting, rock anchoring etc to deal with geological anomalies will be designed by Maccafferi who have provided conceptual designs and cost estimates.

In conclusion, I confirm that our recommendations are valid and that no other input is required by ourselves at this stage

Yours sincerely
for: Terra Firma (Wales) Ltd

Dr Gwyn C Lake