



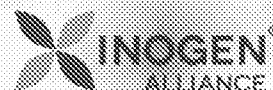
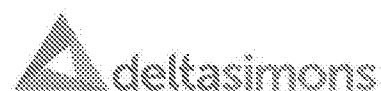
Preliminary Geo-Environmental Risk Assessment

Bognor Regis, Oldlands Farm PO22 6NN

Presented to Lysander Associates

Issued: September 2021

Delta-Simons Project No. 20-1543.04



Report Details

Client	Lysander Associates
Report Title	Preliminary Geo-Environmental Risk Assessment
Site Address	Bognor Regis, Oldlands Farm, PO22 9NN
Project No.	20-1543.04
Delta-Simons Contact	David.Josling@deltasimons.com

Quality Assurance

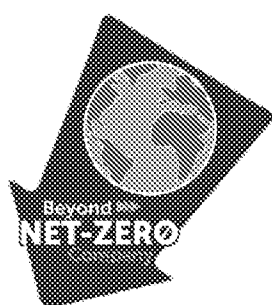
Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
5	Final	7 th September 2021	Updated to remove all references to the Development Drawing			
				Bethany Sleet Consultant	David Josling Associate	Simon Steele Associate Director

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Specialising in Environment, Health & Safety and Sustainability, Delta-Simons provide support and advice within the property development, asset management, corporate and industrial markets. Operating from across the UK we employ over 120 environmental professionals, bringing experience from across the private consultancy and public sector markets.

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Executive Summary

Brief	Delta-Simons was instructed by Lysander Associates to produce a Preliminary Geo-Environmental Risk Assessment for land at Oldlands Farm, Bognor Regis to support the submission of a planning application for the proposed development which comprises warehousing with associated access, car parking, van storage and landscaping.
Site Use & Surrounding Area	The Site currently comprises two plots of land to the north and south of the A259, comprising agricultural land. The Site is bounded to the north and west by agricultural land, a railway line to the east and a new commercial development to the south.
Environmental Setting	The eastern half of the Site is anticipated to be underlain by superficial deposits of Raised Marine Deposits consisting of clay, silt, sand and gravel with River Terrace Deposits containing sand, silt, and clay in the west. The underlying bedrock comprises undifferentiated chalks of the Lewis Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and the Portsdown Chalk Formation. The bedrock geology is classified as a Principal Aquifer. The superficial geologies are classed as Secondary A Aquifers. There are numerous drains on Site, especially in the east. These drains discharge into the Ryebank Rife / Lidsey Rife approximately 250 m to the east. Groundwater is expected to be shallow and to flow east towards the Lidsey Rife.
Contamination Potential Sources	Potential sources of contamination that have been identified at the Site include agricultural sources and potential sources from the A259 compound however recent ground investigations at the Site have not identified any elevated contaminants or ground gas regime set in the context of a commercial end use.
Contaminated Land Risk Associated with Ownership	There is considered to be a Low risk of enforcement action by the regulatory authorities under Part 2A of the Environmental Protection Act 1990, the Environmental Permitting (England and Wales) Regulations 2016 or the Environmental Damage Regulations 2015. The potential for legal action by surrounding landowners / Third Parties based on the potential for contamination to migrate off-Site (ongoing or historically) and result in private or statutory nuisance is considered to be Low.
Development Considerations	Widespread contamination is considered unlikely and the preliminary risk assessment has identified a Low risk of soil/groundwater contamination and hazardous ground gas at the Site. Potentially substantial geohazards have been identified associated with instability of cohesive sediments, shallow groundwater, flooding and solution features (such as chalk dissolution which will require further assessment).
Recommendations	No further ground investigation is considered necessary in relation to addressing the potential impacted associated with contamination however a watching brief should be maintained during construction works for unanticipated contamination. Intrusive investigation to inform foundation design should be undertaken include soakaway testing. Depending on the nature of the operation required to move material into the development, it may be necessary to submit a materials management plan in support of the proposed development scheme.
This is intended as a summary only. Further detail and the limitations of the assessment is provided within the main body of the Report.	

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1.0 Introduction

1.1 Appointment

Delta-Simons Environmental Consultants Limited (“Delta-Simons”) was instructed by Lysander Associates (the “Client”) to prepare a Preliminary (Geo-Environmental) Risk Assessment for land at Oldlands Farm, Bognor Regis PO22 9NN (the “Site”).

1.2 Context & Purpose

It is understood that the development will comprise the erection of a warehouse (Use Class B8) with ancillary office, associated vehicle parking, van storage, plant, ancillary structures, lighting, landscaping and infrastructure works. As part of the scheme it will be necessary to construct a Flood Compensation Area (FCA) to the north west of Felpham Relief Road and to rise levels within the development area using materials from the FCA and wider area.

The aim of this report is therefore to support the submission of a planning application for the proposed development. To that end this study assesses the likely environmental and geotechnical issues associated with soil and groundwater conditions that may affect the proposed development of the Site. This report is designed in general accordance with guidance on Land Contamination: Risk Management pages of the [GOV.UK](https://www.gov.uk/government/publications/national-planning-policy-framework-2019) web pages, the relevant requirements of the National Planning Policy Framework 2019 (NPPF) (paragraphs 170 & 178-180)¹ and the Planning Practice Guidance (Land Affected by Contamination)².

1.3 Scope of Works

- ▲ Review of the environmental setting of the Site, including the current use / status of the Site and surrounding area, and review of the geology, hydrogeology and hydrology;
- ▲ Review of the historical activities of the Site and surrounding area;
- ▲ Review of regulatory information relating to the Site;
- ▲ Review of the online planning records for the Site;
- ▲ Consult and review information from the Local Authority in relation to Part 2A of the 1990 Environmental Protection Act;
- ▲ Complete a Site reconnaissance by undertaking a visual inspection of readily accessible areas of the Site;
- ▲ Review of provided relevant third party reports relating to the Site or surrounding area;
- ▲ Develop an outline Conceptual Site Model and undertake a Preliminary Risk Assessment with respect to potential contamination focussed on the proposed land use;
- ▲ Identify potential contamination risks and / or liabilities associated with the proposed acquisition of the Site;
- ▲ Provide commentary on potential land contamination and geotechnical constraints in the context of the proposed development; and,

In completing this Assessment, Delta-Simons has utilised the following data sources and third party information:

- ▲ Current and Historical Ordnance Survey (OS) maps;
- ▲ British Geological Survey (BGS) data;
- ▲ Environment Agency (EA) online data;
- ▲ Coal Authority (CA) online data;
- ▲ A Landmark Envirocheck Report for the Site (ref. 257663936_1_1), dated September 2020 and report ref (277298819_1-1 dated 23rd April 2021);
- ▲ Historical Maps included as part of the Envirocheck Report; and

¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf

² <https://www.gov.uk/guidance/land-affected-by-contamination>

Information provided by Arun District Council.

1.4 Limitations

The standard limitations associated with this assessment are presented in Appendix A. In addition, there are the following specific limitations that apply to this assessment:

- Information The report includes a preliminary assessment for the potential for radon gas hazards and a detailed radon assessment falls outside of the scope of this report,
- Information A commentary has been provided regarding existing Site services in the context of assessing environmental and geotechnical issues, however a detailed review of all overhead or underground services is outside the scope of this assessment.

2.0 Site Context & Data Review

2.1 Site Information

Site Location		Site Layout	
Co-ordinates	Centred approximately at National Grid Reference 494570, 101850	Elevation	0 – 5.96 m AOD
		Area	18.9 Ha
Site Location	The Site is located in two parcels of land in the northern outskirts of Bognor Regis, approximately 3 km north-east from central Bognor Regis. The first parcel of land for development is approximately 30 m to the south-east of the A259 road. The second parcel of land which will be used as a flood compensation area plus additional materials for raising the development area levels is located 20m north of the A259 road. A Site location map is provided as Figure 1.		
Current Site Use	The main development area currently comprises undeveloped agricultural land with field boundaries and drains present crossing horizontally in an east-west direction. The Site is accessible from the A259, turning south-east onto an access road which grants entry to the Site. The FCA and wider area to the north is also set aside for arable use and is currently planted with crops comprising several large agricultural fields. An overhead electricity cable runs west to east along the southern section of the FCA broadly following the alignment of the Felpham Relief Road.		
Proposed Development Description	It is understood that the development will comprise the erection of a warehouse (Use Class B8) with ancillary office, associated vehicle parking, van storage, plant, ancillary structures, lighting, landscaping and infrastructure works in the southern parcel of land. Activities in the northern parcel of land will comprise the excavation of a Flood Compensation Area with suitable engineered materials transferred to the main development area in order to raise Site levels. Due to the shallow groundwater table, it is likely that insufficient material will be available to adequately raise levels and further excavation beyond the FCA will be required to provide a net mass balance for the development scheme. The resulting excavation within the FCA will then be backfilled with site won topsoil reinstating this area back to its original surfacing.		
Site Reconnaissance	Delta-Simons conducted a Site visit during February 2021. A series of Site photographs are presented as Appendix B, and pertinent information that was observed or reported on-Site is summarised as follows: ▲ The main development Site was predominantly undeveloped land containing drainage networks running along the south-south-western boundary and crossing roughly centrally across the Site extending towards the west. ▲ Delta-Simons did not observe any hazardous substances or petroleum products on Site. ▲ A small amount of fly tip waste was observed in the south-west of the Site. ▲ Boreholes were observed on-Site likely to be connected with Hydrock – Desk Study and Ground Investigation (Ref: C-06566-C/004) dated October 2018. ▲ A small stockpile of material was noted to be present in the south west corner of the Site, which based on visual appearances appears to comprise surplus materials left over from land raising activities associated with the development immediately to the south of the Site.		

	⚡ The parcel of land to the north was noted to comprise several large agricultural fields which were noted to be have been cropped at the time of the walkover. A small fence lines of semi mature trees is present in the south east corner. ⚡ No evidence of any contamination nor storage of bulk hazardous substances was noted at the adjacent properties during the Site reconnaissance. ⚡ The majority of the northern and eastern parts of the main development area were noted to be approximately 1.5- 2.0m lower than areas to the south and west. Where as the area to the north of the relief road was noted to gently slope in a northerly and easterly direction from a maximum elevation of 4.5m AOD reducing to 2.5m AOD. ⚡ A railway line is located along the eastern boundary.	
Current Surrounding Area	North	<i>Southern parcel of land</i> Access road and the A259 Road located on a flyover approximately 10m higher than the Site. <i>Northern parcel of land</i> Agricultural fields with several residential properties and large green houses beyond. A medium pressure gas mains is also noted to run along the northern edge of the area.
	East	Railway line which was noted to be partially raised above the Site.
	South	<i>Southern parcel of land</i> Rolls Royce warehouses – located on raised ground. Some evidence of localised failure/ deterioration to the embankment was noted with the fenceline noted to be partially leaning towards the Site. <i>Northern parcel of land</i> Access road and the A259 Road located on a flyover approximately 10m higher than the Site.
	West	<i>Southern parcel of land</i> Site access road with the A259 located on an embankment beyond. A series of 10no. culverts were noted to be present beneath the embankment. <i>Northern parcel of land</i> Cropped agricultural fields are present with the southern half of the western boundary noted to be at a reduced level which forms the FCA for the commercial area immediately to the south of the Site.
	The off Site railway line is considered to represent a potential source of low levels of organic contamination. Additionally, during the construction of the A259 there is a potential for the site to have been affected by construction works should the north area have been used as a laydown area. Lec Airfield is located approximately 450m south of the Site.	

2.2 Environmental Setting

Published Geology	From British Geological Survey mapping (1:50,000 Sheet Number 317/332, Chichester and Bognor), indicates the eastern half of the site to be underlain by superficial deposits of Raised Marine Deposits consisting of clay, silt, sand and gravel where as to the west. the superficial geology consists of River Terrace Deposits (undifferentiated) containing sand, silt, and clay. The underlying bedrock comprises undifferentiated chalks of the
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	Lewis Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and the Portsdown Chalk Formation.
Specific Ground Conditions	There are no BGS recorded boreholes on the Site or in the immediate vicinity of the Site. However, from the previous investigation conducted on the Site (Hydrock, October 2018) shows the geology encountered comprised the following generalised sequence: ⌘ Topsoil comprising dark brown gravelly slightly clayey sand to depths between 0.2 and 0.80 m below ground level (bgl); ⌘ Made Ground comprising variable dark brown to pink brown gravelly sand. Gravel of asphalt, concrete, brick, plastic and rope to depths of 0.30 m bgl – this was present on in one location (TP129) in the north-western edge of the development area; ⌘ Raised Marine Deposits comprising very soft light grey mottled orange gravelly sandy or silty clay, locally with plant remains and gravel of flint and chalk to depths between 0.90 and 5.80 m bgl; and ⌘ Undifferentiated chalks comprising structureless chalk of sandy gravelly silt and sandy gravel proven to 15 m bgl (base of the exploratory boreholes).
Hydrogeology	The bedrock geology of undifferentiated chalk is classified as a Principal Aquifer. The superficial geology of the Raised Marine Deposits and River Terrace Deposits are classed as Secondary A Aquifers. Monitoring data from the Hydrock, October 2018 investigation shows the groundwater table is standing at approximately 0.84 m to 1.2m bgl (0.16-0.7m AOD). Groundwater is expected to flow to the east, towards the Lidsey Rife river. There are no recorded groundwater abstractions within 1 km of the Site. The Site is not located within groundwater Source Protection Zone / protected area.
Hydrology	There are numerous drains on Site, especially in the east. These drains discharge into the Ryebank Rife / Lidsey Rife approximately 250 m to the east. ⌘ The Oldlands Farm Ditch runs along the south western boundary; and ⌘ The English Channel is approximately 2.3 km to the south of the Site. There are two surface water abstraction licenses at Lindsey Rife located 165m to the east of the Site for construction related dust suppression. The licenses were granted in 2015 and no date for cessation of abstraction has been provided.
Coal Mining	Reference to the Coal Authority on-line viewer indicates that the Site is not within a Coal Mining Reporting Area. Consequently, a Coal Mining Risk Assessment (CMRA) is unlikely to be required under the planning regime.
Radon Gas	The Site lies within an area where less than 1% of homes are above the National Radiological Protection Board (NRPB) recommended “action level” for radon. BRE211 (2015) indicates that no radon protective measures are necessary in the construction of new buildings at the Site.
Ecological Receptors	An Ecology Appraisal (Aluco Ecology, 2015) was carried out in 2015 for the main development area and recorded the presence of protected species in low numbers on Site. This included breeding and wintering bird assemblages with declining farm land species present, low use by a number of bat species, potential for water vole presence in the main watercourse and low populations of reptiles restricted to the field margins. It is understood that a separate ecological survey is being undertaken at the Site under a separate cover.

Environmental Sensitivity	The Site is considered to be of a moderate environmental sensitivity given the presence of the underlying Secondary A and Principal Aquifers and multiple ditches leading directly to the Ryebank Rife.
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2.3 Historical Use of the Site & Surrounding Area

Approach	The historical development of the Site and surrounding area has been assessed through a review of available historical OS maps and available online historical satellite imagery. A summary of the key historical Site uses and developments in the surrounding area is presented below. Copies of pertinent historical maps are included as Appendix C.
Historical Features On-Site	Historical sources dating back to 1876 show the southern parcel to comprise agricultural land until present day with no previous development besides the earthworks which took place pre 2017. The northern parcel was noted to have a similar history comprising agricultural land with the construction of overhead electricity cables along the southern part of the plot by 1974 with no further significant changes visible on available mapping, noting the construction of a FCA to the west of the plot ~2017. The surrounding area was also agricultural land up until 2012 when the A259 road began construction. By 2015 light industrial development had occurred at land south of the Site. Potential sources of on-site contamination could arise from agricultural sources including pesticides and herbicides. During the construction of the A259 land south west of the Site was used as a compound (2012-2015) creating potential on site sources of contamination.
Potentially Contaminative Historical Features Off-Site	Potential historical sources of contamination included within historical mapping include: ▲ Construction activities associated with the construction of the A259 to the west and north and the commercial units to the south; and ▲ Industrial/ trading estate to the south.

2.4 Environmental Database Review

Approach	The Landmark Envirocheck® Report provides a database of environmental information held by various statutory bodies including the EA, Local Authority (LA), Health & Safety Executive (HSE) and Public Health England amongst others. A full copy of the Envirocheck® Report is provided in Appendix D and the most relevant information is summarised below.
Features On-Site	The Landmark Envirocheck® Report lists no on-Site features.

Potentially Contaminative Features Off-Site	Relevant entries included within the Landmark Envirocheck® Report include: ⚡ Three surrendered discharge consent operated by Hochtief (UK) Construction Ltd for trade process water discharge to the Lidsey Rife are listed approximately 10 m to the north; and 125 and 180 m to the east of the Site. All were surrendered on 22nd August 2016; ⚡ Two surface water abstractions are listed approximately 165 m to the east of the Site operated by Hochtief UK Construction Ltd for dust suppression use, the start dates of the abstractions were noted from June 2014; ⚡ Multiple active and inactive contemporary trade directory entries within the wider area of the Site, the closest of these being an inactive entry approximately 274m to the north west for Wyvern Waste Service Ltd waste disposal services. Further entries include those for; industrial and commercial machinery suppliers, commercial vehicle servicing, repairs, parts and accessories, refrigeration equipment manufacture and distribution, paint and coatings spraying, domestic door manufacture, tool design manufacturers, builders merchants, window film manufacture and dealers and telecommunications equipment and systems suppliers; ⚡ A small area of infilled land is located 100m to the north east; ⚡ One historical landfill approximately 685 m to the south of the Site for deposited wastes including inert and industrial waste and liquid sludge. The license is held by LEC Refrigeration Limited with a last recorded input date of 31st December 1970. LEC Refrigeration Limited were noted to have a second entry approximately 820 m to the south of the Site (thought to be referring to the same landfill) was noted to accept excavated natural materials and foundry sand. The maximum input rate was not recorded, and the license lapse date recorded as 22nd March 1982; and ⚡ Potentially contaminative historical sources (not included within the landmark Envirocheck® Report) identified in the surrounding area include the railway line adjacent to the east of the Site, this dates back to 1876 and the disused airfield approximately 450m southeast of the site.
Implications for Land Contamination Risk	Potential sources of contamination that have been identified at the Site include agricultural sources and potential sources from the A259 compound. Potential off-Site sources of contamination have been identified that will be considered in the preliminary risk assessment.

2.5 Planning Review/Regulatory Enquiries

On-line Planning Portal	Arun District Council	Date Accessed	March 2021
Subject Property Findings	Several applications have been identified for the Site. The applications pertinent to this assessment are summarised below: ⚡ AL/58/15/OUT - Hybrid Application 1: Full planning application for earth works to facilitate flood compensation area & 2-Outline application (all matters reserved) for up to 20,453 sq m of B2 General Industrial Floorspace together with B8 warehousing & distribution floorspace. The application was conditionally approved on 20/04/16. Conditions within the decision notice were related to flooding, drainage and ecology Conditions relating to contaminated land were condition 34 relating to measures to deal with unexpected contamination. Condition 40 also set out that the developer must ensure that their proposal, both during construction and after completion of works on site, does not: - Encroach onto Network		

	Rail land - Affect the safety, operation or integrity of the company's railway and its infrastructure - Undermine its support zone - Damage the company infrastructure - Place additional load on cuttings - Adversely affect any land or structure - Over-sail or encroach upon the air-space of any Network Rail land - Cause to obstruct or interfere with any works or proposed works or Network Further to the application, AL/44/18/RES relates to a planning application for all reserved matters following outline conditions consent for AL/58/15/OUT (as amended by subsequent variation for conditions 11, 12 and 37) these conditions were not related to contaminated land.
Adjacent and Surrounding Property Findings	Several applications have been identified for the surrounding area. The applications pertinent to this assessment are summarised below: - BE/61/13/ v- hybrid application, 1: Full planning application for Access and road and Flood compensation area. 2: Outline application for 33116 sq m of mixed commercial and industrial uses, comprising A1, A3, A5, B1, B2 and B8, with associated works and landscaping. The application was noted as conditionally approved on 19/03/2014. Conditions within the decision notice were related to flooding, drainage and ecology. Condition 7 related to the requirement of a remediation strategy including a desk study, site investigation and verification plan. Condition 8 related to the requirement of a verification report demonstrating the completion of remediation. Condition 9 related to contamination not previously identified should be found, a remediation strategy should be approved by the local planning authority. - BE/73/14/PL – Planning application for the erection of 2 No. detached industrial/distribution units (B1(c)/B2/B8) including access & servicing arrangements, car parking, landscaping & associated flood compensation area. This application is a departure from the development plan. The application was noted as conditionally approved on 28/08/2014. The application related to a development adjacent to the south of the Site (now Rolls Royce warehouse). Conditions were within the decision notice related to flooding, drainage, and ecology. Condition 9 related to the requirement of a verification report demonstrating completion of works set out in the approved remediation strategy, including monitoring / sampling results and an approved verification plan demonstrating remediation had been met. Condition 21 also sets out the need to deal with unanticipated contamination with Conditions 22 setting out that piling should not be undertaken without permission from the regulatory authorities. Documents submitted with the application included desk study, ecological and archaeological reports. No phase 2 or remediation documents were noted. - BE/126/19/PL – Planning application for the erection of a 1410 square meter metres discount convenience retail food store (Use Class A1) & parking, landscaping & other associated works. The application was recorded as approved from 18/03/2020. The application related to a development approximately 100 m to the south-west of the Site. Conditions within the decision notice related to flooding and drainage and ecology. Condition 16 relating to contaminated land stated that is discovered during development, the Local Planning Authority should be informed and a method statement detailing how the unsuspected contamination would be dealt with must be prepared and submitted. It was also stated that should no contamination be found a statement recording such should be submitted.
Relevant Environmental Authority	No Contaminated Land Register Entries or Notices for the Site are listed in the Envirocheck® report.

2.6 Previous Reports

List of Reports	Delta-Simons has been provided with the following reports relating to the Site: ▲ Development Archaeology Services Ltd – Archaeological Assessment dated May 2015; ▲ Aluco Ecology Ltd – Ecological Appraisal (Ref: 1218) dated May 2015; ▲ Hydrock – Desk Study and Ground Investigation (Ref: C-06566-C/001) dated October 2017; and ▲ Hydrock – Desk Study and Ground Investigation (Ref: C-06566-C/004) dated August 2018. As part of this assessment, It has been assumed that the Client has full reliance upon the contents of both Hydrock Reports. Should reliance not be available then further assessment may necessary to assess the veracity of the information provided.
Key Findings	Archaeological Assessment: The assessment concluded that the possible presence of archaeology should not be considered as an overriding constraint to development. It was recommended that consultation be carried out with requirements for additional investigation outlined in planning condition BE/61/13 (discussed in section 2.5 above). Ecological Appraisal: The survey summarises existing baseline data for the Site (known as Ph 2) and provides several options for mitigation and biodiversity gain for a proposed development scheme, including further surveys for specific protected groups. Hydrock 2017 and updated 2018 Report Desk Study and Ground Investigation: From the walkover it was stated that topography slopes gently west to east. The site was noted to be divided into four fields, separated by drainage ditches oriented northwest to southeast and in use (at time of reporting) as arable agriculture (wheat). A stockpile mound of spoil was left at the south of the Site from previous excavations within Made Ground. Site investigation: The presence of potential Made Ground at the Site and wider area was considered to be a low to moderate ground gas hazard while the sensitivity of the development was considered as low (commercial). During the first visit methane levels at 0.7 %v/v with a gas flow of 4.9 l/hr were encountered in BH03 (off-Site to the southwest). However, during subsequent visits the concentration of methane, and the flow, had decreased significantly. Whilst risks to construction workers were not generally discussed in that report, it was recommended that all contractors and maintenance workers should be made aware of the possible presence of carbon dioxide and should take all necessary health and safety precautions when working in trenches or confined spaces. Soil leachate and ground water were sent for laboratory testing for a number of contaminants, these being general inorganics, total phenols, speciated PAHs, total PAHs, metals (arsenic, boron, chromium (III, hexavalent), beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium and zinc), BTEX (benzene, toluene, ethylbenzene and xylene), TPHs and pesticide and herbicide. Slight exceedances of boron were recorded in the topsoil when compared to adopted screening criteria for plant life. The report concluded that for the Site and wider area (known as Phase 2) there was no significant risk to human health, plant growth or controlled waters and that there was a low risk (CS1) from ground gases (subject to on-going monitoring at time of reporting). Geotechnical: Soil from excavations was considered to be suitable for reuse as general fill but would likely require further testing and specification. Due to the high groundwater table during the investigation, infiltration rate testing was not undertaken and as such soakaway drainage was not considered feasible. Raising sight levels was

	considered to generate significant consolidation settlement from the Raised Marine and River Terrace Deposits, both of which are compressible. The report recommended that a piled foundation should be designed to extend through the Raised Marine and River Terrace Deposits and carry their load into the chalk strata. The depth of competent strata increases to the east of the Site. The report recommended that the access road would likely need to be constructed on a piled load transfer platform. Preloading and surcharging was not considered suitable for the preparation of subgrade to support a ground bearing floor slab due to long term creep settlement, floor slab supported on piles or ground bearing design following ground improvement was recommended instead. Within Phase 2, a CBR of less than ~3% was recommended.
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3.0 Conceptual Site Model

3.1 Introduction

A Conceptual Site Model (CSM) represents the relationships between contaminant sources, pathways and receptors, to support the identification and assessment of Possible Contaminant Linkages (PPL).

3.2 Potential Contamination Sources

Identified potential contamination sources are presented in the following table:

Reference	Source	Location	Dates Present	Potential Associated Contaminants of Concern
S1	Pesticides and Herbicides	Site-wide	1876 to present	Pesticides and Herbicides
S2	Construction activities e.g. heavy machinery	South west	2012	Metals and metalloids, PAH and Petroleum hydrocarbons
S3	Made Ground	Southwest	2012	Metals and metalloids, TPH and PAHs, carbon dioxide and methane
S4	Raised Marine Deposits	Site Wide	-	Carbon dioxide and methane
S5	Railway Line(off Site)	East	1876 to present	PAH and Petroleum hydrocarbons

* Based on UK Department of the Environment Industry Profiles

3.3 Potential Receptors

Relevant potential receptors are considered to include:

- ▲ R1 - Construction workers.
- ▲ R2 - Third parties during construction (adjacent Site users and adjacent residents).
- ▲ R3 - Future Site users and maintenance workers.
- ▲ R4 - The Ryebank Rife and Lidsey Rife water courses.
- ▲ R5 - The underlying Secondary A and Principal Aquifers.
- ▲ R6 - The Built Environment (new buildings and infrastructure / utilities).

3.4 Potential Pathways

The potential pathways are considered to be as follows:

- ▲ P1 - Direct contact, ingestion or inhalation of soil bound contaminants / dust during or following redevelopment.
- ▲ P2 - Inhalation of organic vapours associated with contamination.
- ▲ P3 - Migration of ground gas / vapours into on-site buildings causing asphyxiation or risk of explosion.
- ▲ P4 - Leaching of contamination into groundwater followed by migration of groundwater to the wider groundwater environment or discharge to surface waters.

- ⚡ P5 - Direct contact between aggressive ground conditions and new infrastructure.

Contaminant Linkage Assessment					
Source(s)	Pathway(s)	Receptor(s)	Risk Rating	Justification & Mitigation (if required)	Requires Investigation
S1 Pesticides and Herbicides S2 Construction activities e.g. heavy machinery S3 Potential On-Site Made Ground	P1, P2, P3, P4, P5	R1, R2, R3, R4, R5, R6	Low	Based on the findings of the previous ground investigation no elevated contaminations (except boron) have been identified in the shallow soils and groundwater. The results of gas monitoring have characterised the gassing regime at the Site as CS1. Based on the current and historical use of the Site for use as an agricultural field combined with the more recent use partially for the construction of the adjacent A279 the risk assessment has not identified any significant sources to be present. Should localised areas of elevated contaminants be present then risks to users of the Site will be mitigated by the nature of the development with risks to construction workers mitigated by the adoption of a safe working procedures good standards of personal hygiene and appropriate levels of personal protective equipment (PPE) No specific gas protection measures are considered necessary within the development however a watching brief should be maintained throughout the works for unanticipated contamination.	N
S4 Railway line	P1, P2, P3, P4	R1, R2, R3, R4, R5	Low	The adjacent railway line is unlikely to have a significant detrimental impact upon the site and no further assessment is considered necessary.	N

4.0 Preliminary Ground Engineering Appraisal

4.1 Preliminary Ground Model

Based on the available information, it is anticipated that the Site is likely underlain by a sequence of Topsoil with limited Made Ground towards the northwest and south west. This is underlain largely by Raised Marine Deposits with River Terrace Deposits towards the west. Bedrock consists of undifferentiated chalks of the Lewis Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and the Portsdown Chalk Formation. Groundwater is expected to be shallow.

4.2 Plausible Geohazards

The geohazards listed below have been identified to follow guidance presented in the HE document CD622 'Managing Geotechnical Risk' (2019) which aims to identify and manage the geotechnical risks associated with a scheme throughout its lifespan, from planning to construction to maintenance.

The following geohazards are considered to be substantial ground related risks associated with the proposed development.

- ⚠ Instability of cohesive sediments.
- ⚠ Shallow groundwater.
- ⚠ Flooding.
- ⚠ Risk of chalk dissolution creating natural cavities.

Potential solutions and further steps to address the aforementioned issues are discussed in Section 5.

5.0 Development Considerations

5.1 Potential Remediation Requirements & Solutions

Soils	The risk of the Site requiring widespread remediation to protect end users is considered to be low. Spoil left from previous excavations within Made Ground may be suitable for re-use as general fill. The underlying River Marine Deposits and River Terrace Deposits similarly should be suitable for re-use as general fill, all of which is subject to further testing and specification. It should be noted that soils extracted below the groundwater level are likely to be saturated and may require drying or extensive modification to enable the material to be suitable for reuse. Chalk deposits are likely to degrade during periods of poor weather and may become unsuitable for use.
Groundwater	Significant widespread groundwater contamination is not anticipated. Ground water is expected to be very shallow and to flow to the east, towards the Lidsey Rife river. Monitoring data from the Hydrock, October 2018 investigation shows the groundwater table is standing at approximately 0.84 m to 1.2m bgl.
Ground Gas	Previous reports concluded that for the Site and wider area there was no significant risks to human health, plant growth or controlled waters and that there was a low risk (CS1) from ground gases.
Building Fabric & Services	Widespread contamination at the Site is considered unlikely. A drinking water pipeline assessment may be required following soils chemical results. Aggressive ground chemistry may attack buried concrete and therefore there may be a requirement for protection measures to be put in place at the Site.

5.2 Geotechnical Considerations

Instability of Cohesive Sediments	The Raised Marine Deposits are cohesive in nature, the River Terrace Deposits are only partially cohesive. Both deposits are expected to be compressible. The Raised Marine Deposits are usually considered to be highly compressible, however the River Terrace Deposits are potentially compressible (dependent on composition). Formations are likely to be subject to excessive and differential settlement when loaded during ground raising activities. Due to the potential for shallow groundwater, infilled materials may be prone to further creep settlement over time.
Shallow Groundwater	Can generate difficulties when excavating, further discussion in the Groundworks section below. The Site was noted to be flooded during the winter period which may preclude construction activities during this period.
Flooding	The EA Flood Map for Planning indicates that the Site is situated partially within Flood Zone 2 and Flood Zone 3, with a small section in the west of the Site within Flood Zone 1. Fluvial flooding could potentially occur if Lidsey Rife overtopped its banks / defences during or following an extreme rainfall event. The Site is also located within a Flood Warning and Alert Area, due to its proximity to the tidally influenced Lidsey Rife. There is a moderate risk of fluvial flooding at the Site. Water levels reach a maximum of 1.40 m AOD in the 1 in 200 year flood event. A formal Flood Risk Assessment is required to fully assess the level of land raising and floodplain compensatory and mitigation measures required which will reduce the risk to low during the 1 in 100 year plus CC and therefore the equivalent 1 in 200 year flood events.

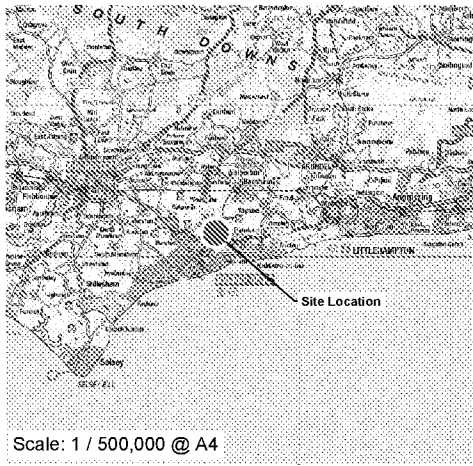
Solution Features	Undifferentiated chalk is found underlying the Site and surrounding area, the risk of chalk dissolution has been recorded as low in a previous report however an area of weaker chalk to a greater depth has been identified in the east of the Site. There are no recorded dissolution features in close proximity to the Site and in the absence of any natural or recorded man made cavities the risks posed by these features are considered to be low.
Foundations	Due to the poor load bearing features of the Raised Marine and River Terrace Deposits, together with the high groundwater table, it is suggested that shallow foundation will not be appropriate for development on Site, however piled foundation would be suitable. Recommendations contained within the Hydrock report suggest piled foundation should be designed to extend through the Raised Marine and River Terrace Deposits and carry their load in the chalk strata. Skin friction or a combination of skin friction and end bearing methods are suggested. The depth of competent chalk is noted to increase towards the east of the Site. Further investigation to beyond the toe of the proposed pile is recommended to provide information for specialist piling contractor design. Due to the potential for settlement following loading by engineered fill combined with the depths likely to be stressed by imposed loads it is likely that a suspended floor slab will be adopted at the Site.
Earthworks	It is understood that materials from the FCA and wider area are proposed to be used to raise Site levels. Delta Simons are currently undertaking a ground investigation to assess the suitability of these materials for use as engineered fill along with the requirement to modify the moisture content of the materials. Depending on the time of year and nature of material it may be necessary modify and improve the structural performance of the material.
Groundworks	During a previous site investigation instability of excavation faces was recorded during trial pitting. This occurred in the Raised Marine Deposits and within very shallow soils. Due to this, throughout construction, temporary trench support or battering of excavation sides when excavations are left open and where man entry is required will be necessary. Site groundwater levels are shallow. It has been suggested that sump pumping may not be sufficient enough to cope with anticipated flows and alternative methods of dewatering will be required. Groundwater levels will fluctuate seasonally and timing of construction will govern the degree of ground water control required.
External Works	California Bearing Ratio testing will be required to determine road construction thickness. Consideration will need to be given for the potential for differential settlement to affect road surfaces and services and appropriately mitigated within the design. Due to the potential for movement between structures and services areas further consideration may need to be given to the use of ground improvement in areas outside of the main structure to accommodate differential movements.

6.0 Conclusions & Recommendations

6.1 Land Contamination

Contamination Risks Associated with Ownership (Current Use)	There is considered to be a Low risk of enforcement action by the regulatory authorities under Part 2A of the Environmental Protection Act, the Water Resources Act or the Environmental Damage Regulations, whilst the Site remains in its current use. The potential for legal action by surrounding landowners / Third Parties based on the potential for contamination to migrate off-Site (ongoing or historically) is considered to be Low .
Potential Contaminated Land Development Risks	Widespread contamination is considered unlikely and the preliminary risk assessment has identified a Low risk of soil/groundwater contamination and hazardous ground gas at the Site.
Plausible Geotechnical Development Risks	⚠ Due to instability of cohesive sediments the underlying Raised Marine and River Terrace Deposits maybe subject to excess and differential settlement when a load is applied. ⚠ Shallow groundwater and the potential flood risk at the Site may create difficulties during and post development. ⚠ Absence and suitability of material to be used for engineered fill along with the potential requirement to improve material for use as engineered fill.
Recommendations	No further ground investigation is considered necessary in relation to addressing the potential impacts associated with contamination however a watching brief should be maintained during construction works. Details of the watching brief are included as Appendix E. Intrusive investigation to inform foundation design should be undertaken include soakaway testing. Depending on the nature of the operation required to move material into the development, it may be necessary to submit a materials management plan in support of the proposed development scheme.

Figure 1 – Site Location Map



LEGEND

 Site Boundary



Scale: 1 / 10,000 @ A4

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TITLE:
 Site Location Map
 Oldlands Farm
 Bognor Regis

DRAWN BY:	NW	SCALE:	To Scale@A4
CHECKED BY:	DJ	REVISION:	2
DATE:	2nd June 2021		

PROJECT NO:	20-1543.04
FIGURE NO:	1

Appendix A – Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B – Site Photographs

Site Photographs



Photograph 1 --View beneath flyover looking north east



Photograph 2 --View from north of the site looking towards Rolls Royce facility with Site noted to be flooded.



Photograph 3 --View south east from western edge of the Site



Photograph 4 --View East across saturated ground



Photograph 5 –View south west from west of the Site



Photograph 6 – Flooded access onto railway line along southern boundary of the Site



Photograph 7 –Stockpile of soil in south west of the Site.



Photograph 8 –View along northern boundary of the Site

Appendix C – Selected Historical Maps

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		Minor Roads		
	Sunken Road		Raised Road		
	Road over Railway		Railway over River		
	Railway over Road		Level Crossing		
	Road over River or Canal		Road over Stream		
	County Boundary (Geographical)				
	County & Civil Parish Boundary				
	Administrative County & Civil Parish Boundary				
	County Borough Boundary (England)				
	County Burgh Boundary (Scotland)				
	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
	Bracken		Heath
	Marsh		Reeds
	Building		Glasshouse
	Sloping Masonry		Pylon
	Cutting		Embankment
	Road Under		Road Over
	Level Crossing		Foot Bridge
	Standard Gauge Multiple Track		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
	Civil Parish		
	Boundary Post or Stone		Police Station
	Church		Post Office
	Club House		Public Convenience
	Fire Engine Station		Public House
	Foot Bridge		Signal Box
	Fountain		Spring
	Guide Post		Telephone Call Box
	Mile Post		Telephone Call Post
	Mile Stone		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
	Mean high water (springs)		Mean low water (springs)
	Telephone line (where shown)		Electricity transmission line (with poles)
	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

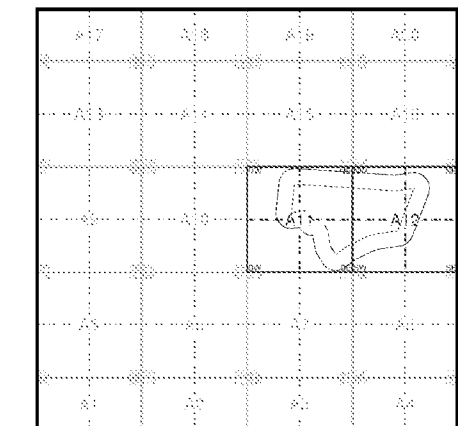
Envirocheck

LANDMARK INFORMATION GROUP

Historical Mapping & Photography included:

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Sussex	1:10,560	1879 - 1880	2
Sussex	1:10,560	1899	3
Sussex	1:10,560	1914	4
Sussex	1:10,560	1934	5
Sussex	1:10,560	1938 - 1950	6
Historical Aerial Photography	1:10,560	1947	7
Sussex	1:10,560	1951	8
Ordnance Survey Plan	1:10,000	1961 - 1962	9
Ordnance Survey Plan	1:10,000	1967	10
Ordnance Survey Plan	1:10,000	1979	11
Ordnance Survey Plan	1:10,000	1980	12
Ordnance Survey Plan	1:10,000	1992 - 1993	13
10K Raster Mapping	1:10,000	2000	14
10K Raster Mapping	1:10,000	2006	15
VectorMap Local	1:10,000	2021	16

Historical Map - Slice A



Order Details

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 Customer Ref: 20-1543.04
 National Grid Reference: 494170, 102160
 Slice: A
 Site Area (Ha): 20.47
 Search Buffer (m): 1000

Site Details

1 Oldlands Farm Cottages, Steyning Way, BOGNOR REGIS, PO22 9NN

Landmark
 INFORMATION GROUP

Tel: 0844 844 9852
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk

Sussex

Published 1879 - 1880

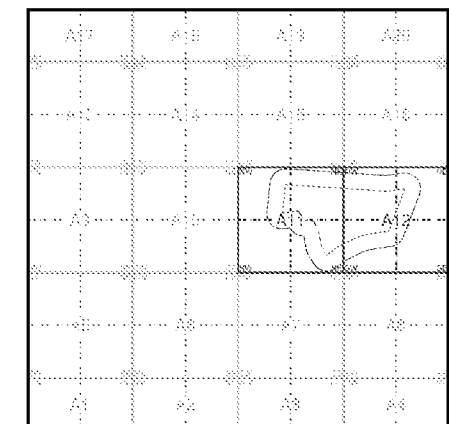
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Map Name(s) and Date(s)

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07400	1879	1:10,560

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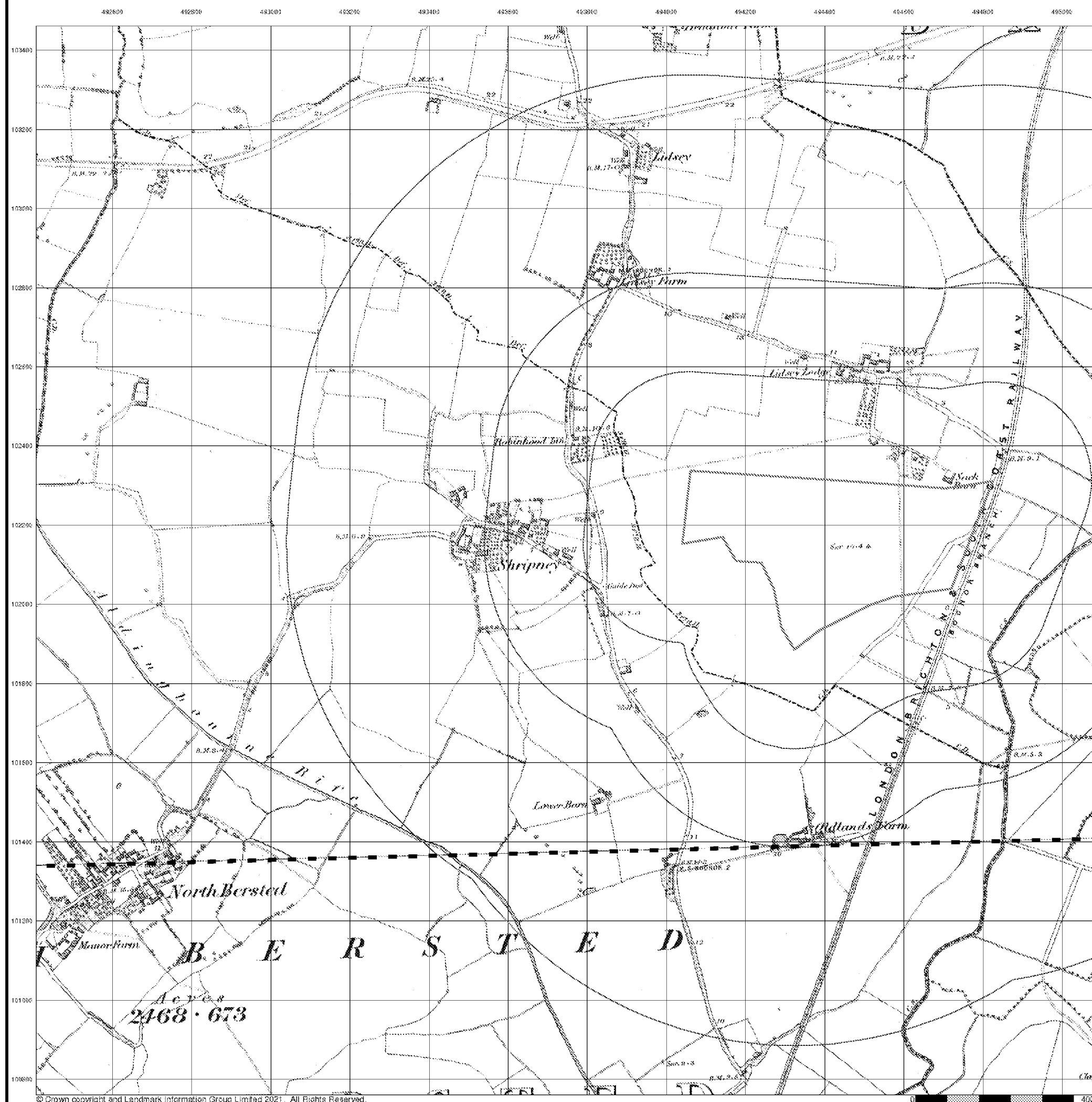


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 PO22 9NN



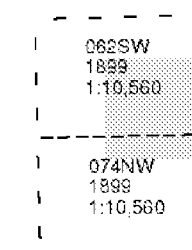
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Published 1899

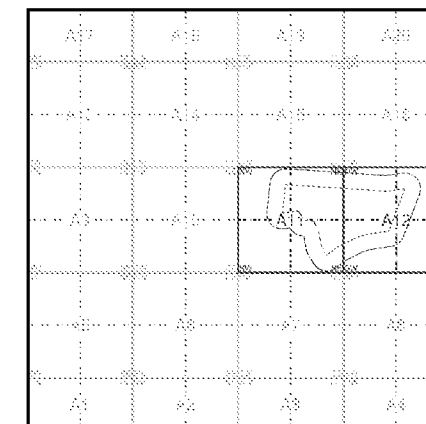
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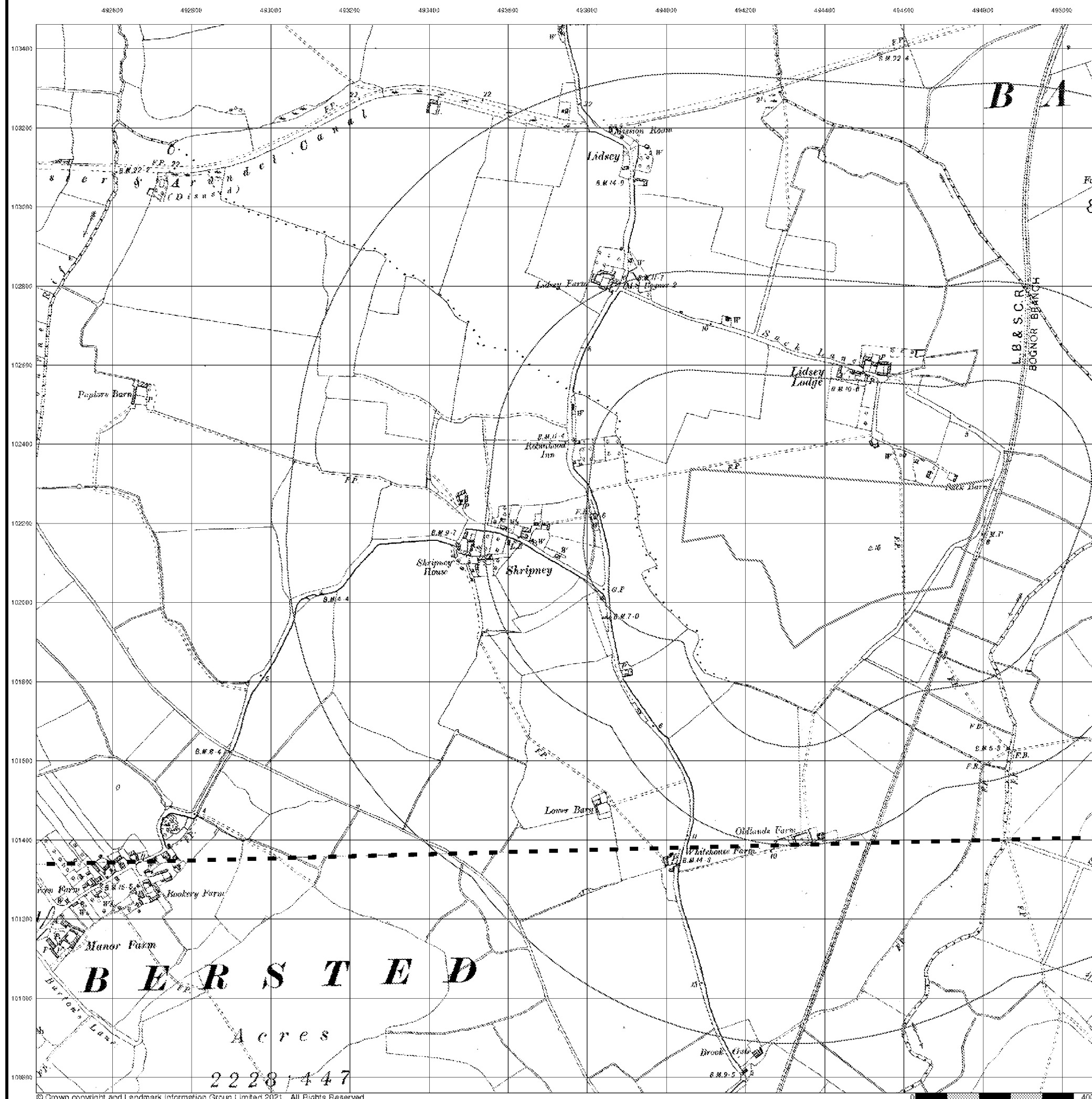


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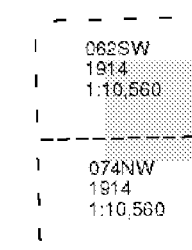
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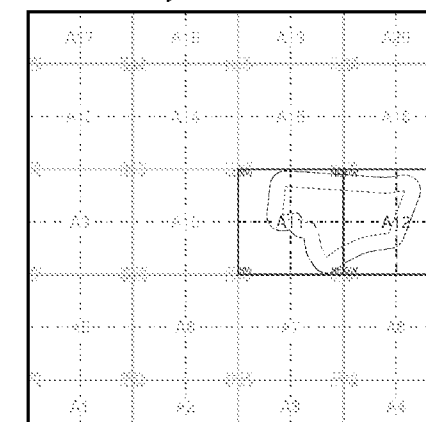
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Map Name(s) and Date(s)



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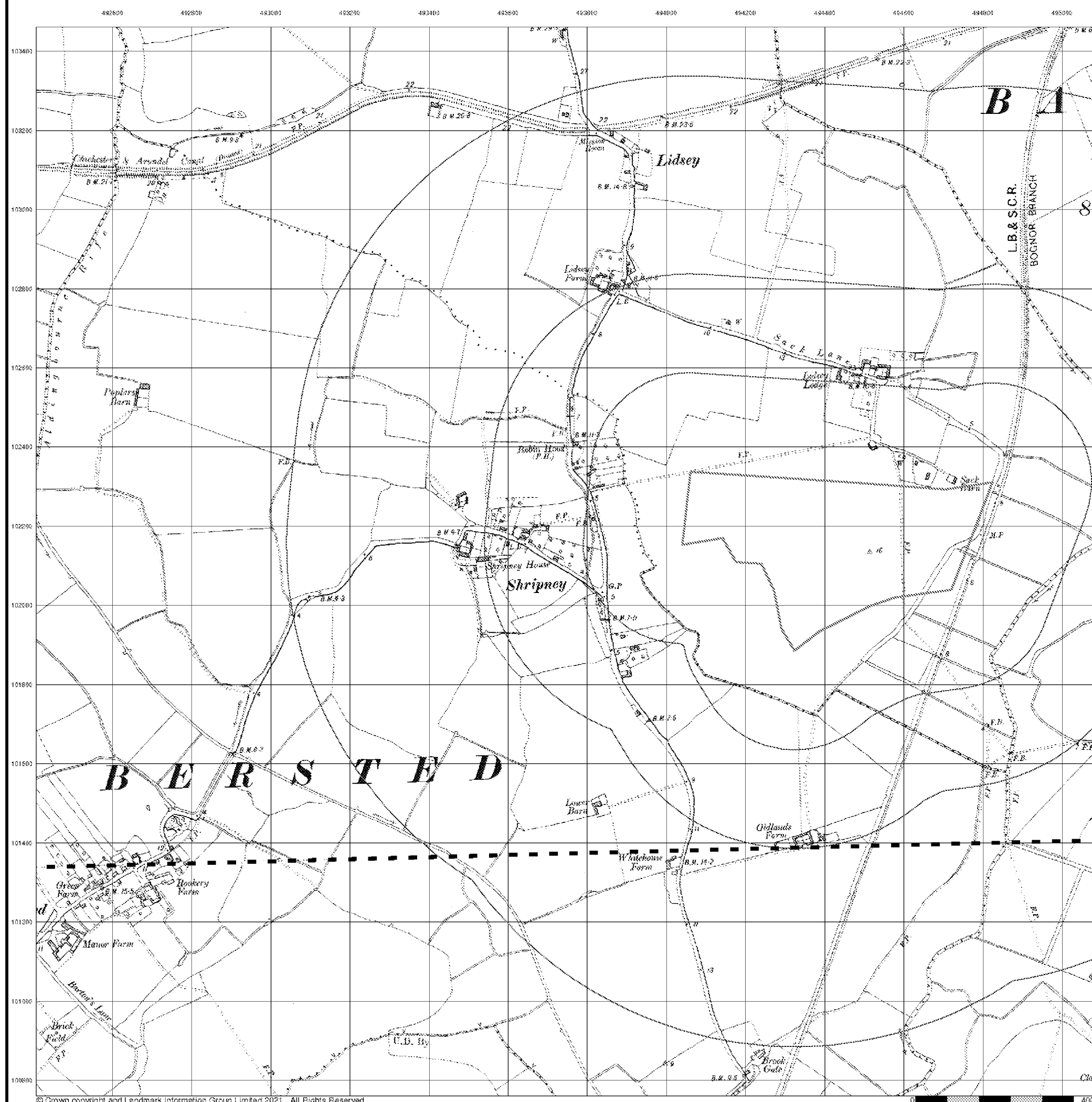


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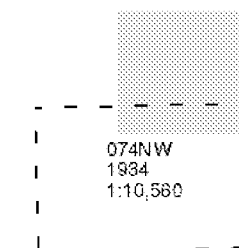
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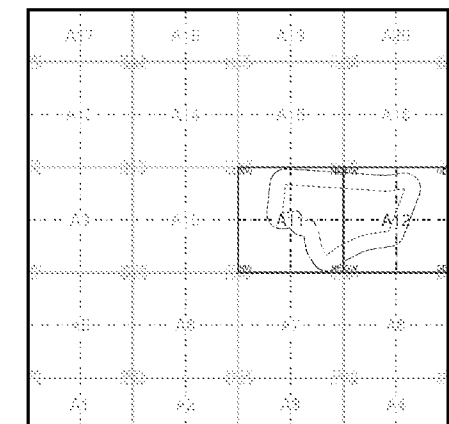
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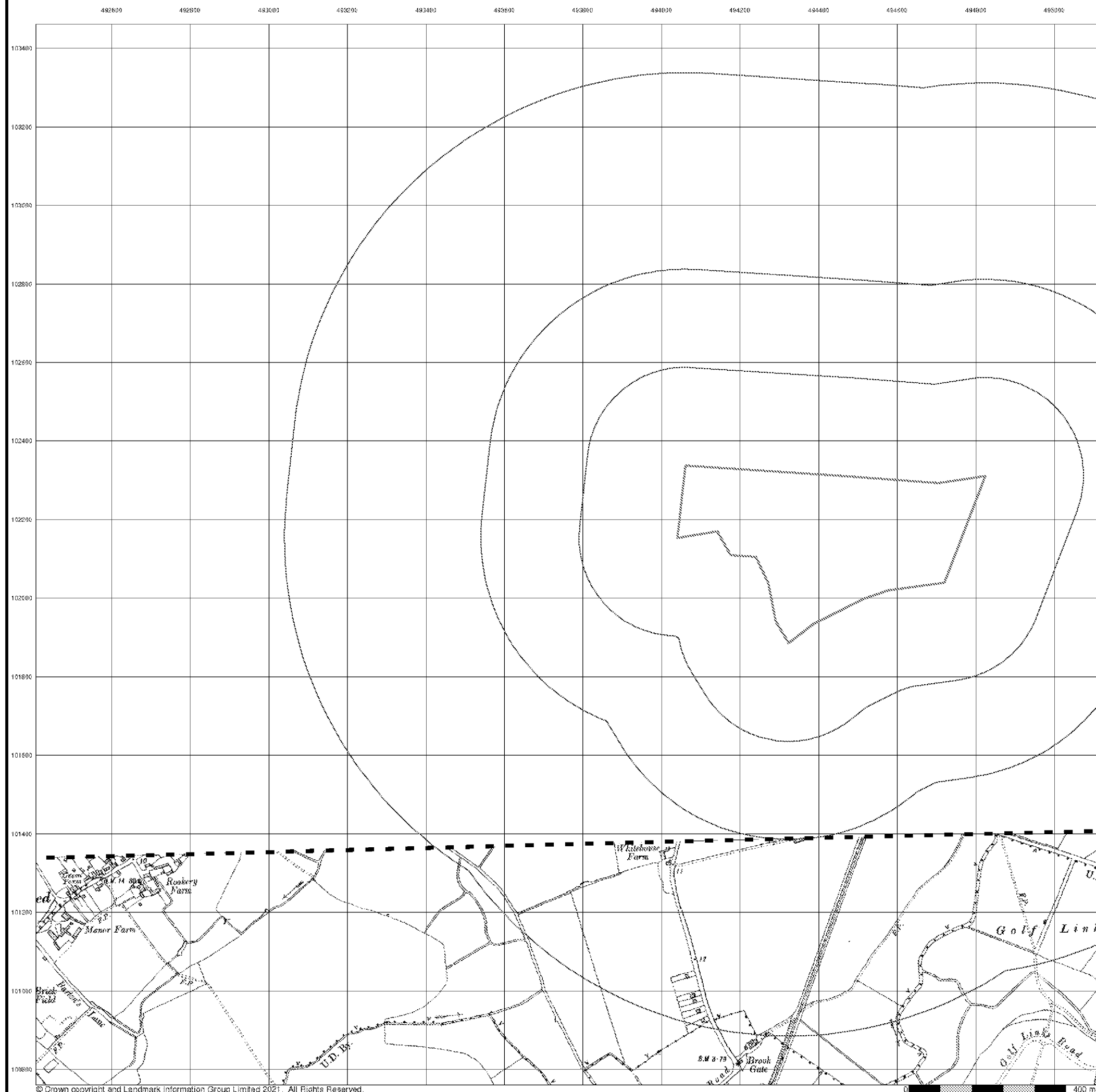


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PO22 9NN



Sussex

Published 1938 - 1950

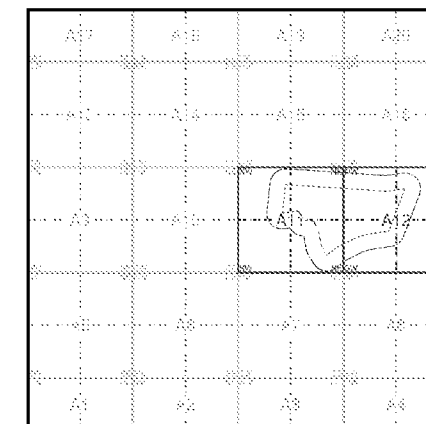
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Map Name(s) and Date(s)

062SW
1938
1:10,560
074NW
1950
1:10,560

Historical Map - Slice A

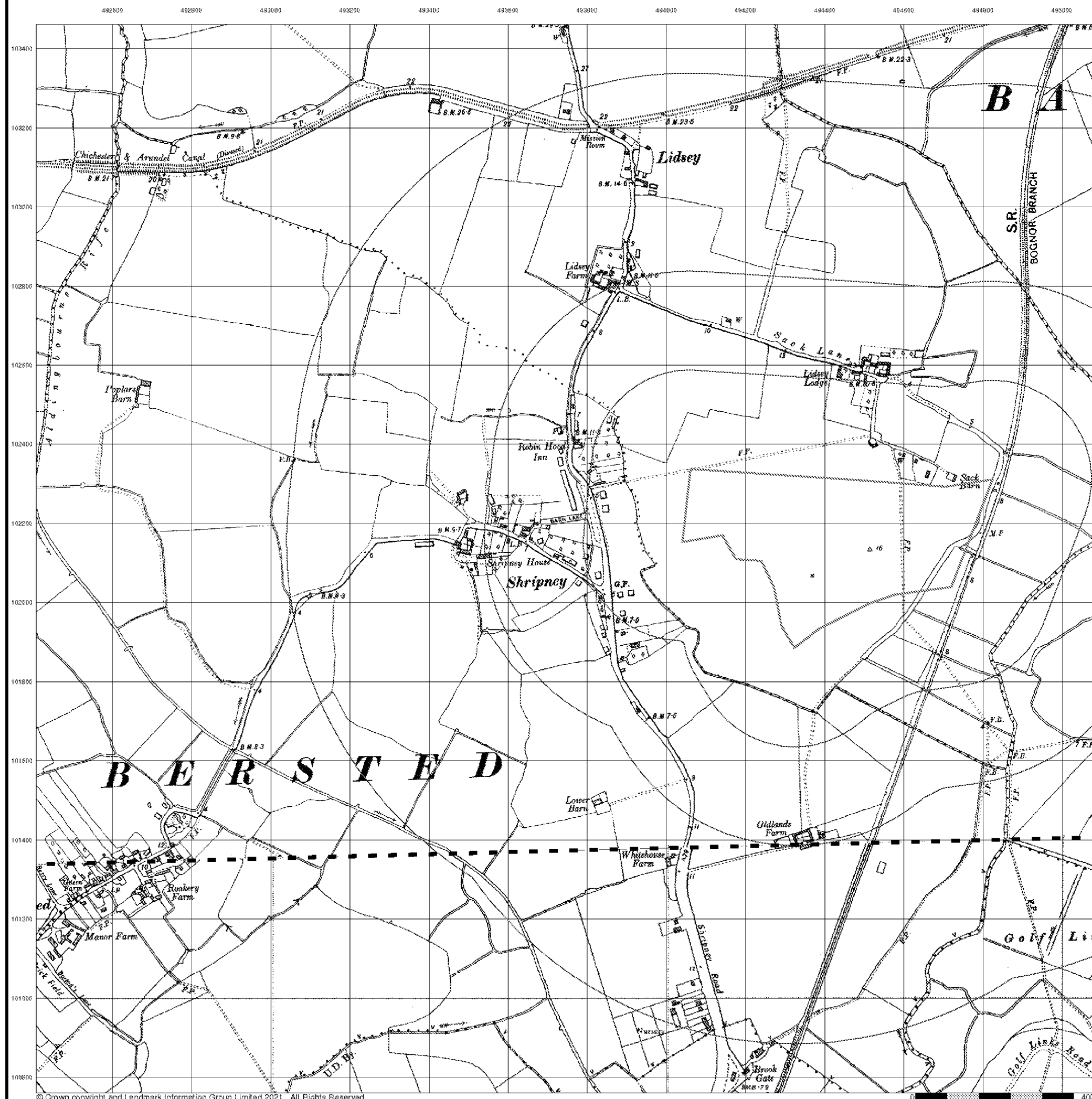


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 PO22 9NN





Historical Aerial Photography

Published 1947

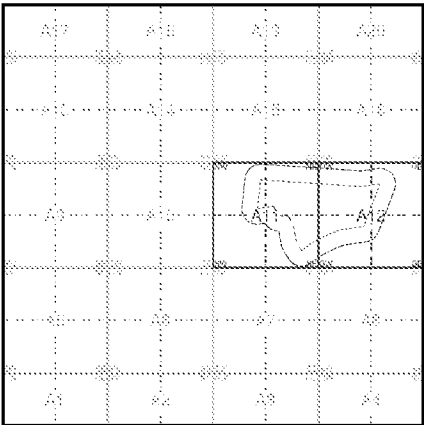
Source map scale - 1:10,560

The Historical Aerial Photos were produced by the Ordnance Survey at a scale of 1:1,250 and 1:10,560 from Air Force photography. They were produced between 1944 and 1951 as an interim measure, pending preparation of conventional mapping, due to post war resource shortages. New security measures in the 1950's meant that every photograph was re-checked for potentially unsafe information with security sites replaced by fake fields or clouds. The original editions were withdrawn and only later made available after a period of fifty years although due to the accuracy of the editing, without viewing both revisions it is not easy to spot the edits. Where available Landmark have included both revisions.

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Map Name(s) and Date(s)

Historical Aerial Photography - Slice A



Order Details

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