

DENTON HOMES LIMITED

BRADBURY HOTEL, STATION ROAD, EAST PRESTON

SITE INVESTIGATION REPORT

The Granary
White Hall Farm
Long Itchington
Warwickshire
CV47 9PU

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1. INTRODUCTION

Denton Homes Limited proposes to redevelop a site off Station Road, East Preston, West Sussex. Currently, the site is occupied by a recently vacant hotel property with associated grounds and tarmac-surfaced car parking facilities. It is understood the proposed development comprises nine, two-storey houses together with access road pavements, driveways and private gardens.

Crossfield Consulting Limited has been commissioned to undertake an investigation of the site to identify potential constraints to redevelopment relating to the ground conditions and including a risk-based environmental assessment and recommendations for remediation works, foundations, road pavement design and general construction advice in the context of the above development proposals.

This report presents the information obtained from a desk study and ground investigation. Sections 2 to 5 of the report, together with the associated Figures and Appendices, provides a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007.

A risk-based assessment of potential contamination is included in Section 7 of the report. This assessment makes reference to the desk study, ground investigation information and a Conceptual Site Model. It is considered that the report complies with National Planning Policy Framework and is in general accordance with guidance published by the Environment Agency and the NHBC.

The report also includes information required to form a Geotechnical Design Report as defined in BS EN 1997-1:2004, and the salient information, assessments and recommendations are presented in Sections 9 to 15 of the report, together with the associated Figures and Appendices.

It is considered that the report is suitable for submission in support of a planning application and the report is appropriate to assist in an appraisal of development solutions and costs, together with the preparation of engineering designs for the development. The report also complies with the published guidance relating to the requirements of a Building Control authority.

2. THE SITE

2.1 Location

The site is located to the south of Roadstone By-Pass Road (A259), approximately 0.5 km to the northwest of East Preston village centre, as shown on Figure 1. The National Grid Reference for the site is TQ 0650 0264. The site is situated within a residential area and houses are present to the north and south. Station Road is located along the western boundary with Langmead Recreational Park directly adjacent to the eastern site boundary, as shown on Figure 2.

2.2 Site Description

The following site description is based on the topographical survey, presented a Figure 3, together with any pertinent observations made during the site investigation works in October 2014.

The site is a rectangular plot of land, with an area of approximately 0.23 ha as shown of Figure 2. The site is relatively flat and comprises a two-storey hotel property with several modern extensions, a conservatory and associated outbuildings. The hotel occupies the northern and central part of the site. Paved areas are located around the periphery of the hotel building. No evidence of oil heating tanks were observed during the site investigation works.

The western part of the site consists of tarmac-covered car parking facilities. The southern part of the site is occupied by the hotel grounds comprising soft landscaping with mature trees. The western site boundary is marked by a brick wall, bushes and some trees.

2.3 Site History

The site history has been researched with reference to old editions of the County Series and National Grid Ordnance Survey Plans obtained from GroundSure. Extracts from a selection of these plans are presented in Appendix I. The plans indicate the following development has taken place on and around the site.

The earliest plan, dated 1878, shows the site as undeveloped land within a field. The western site boundary lies adjacent to a road. The general surrounding area was largely agricultural. A church, with a grave yard, is shown approximately 100 m south of the site.

The map dated 1898 continues to show the site as undeveloped and within a field. However, five small areas of woodland are shown within the field in close proximity to the site.

The County Series map of 1932 shows development had occurred on site. Two buildings are shown and are likely to have been of residential use. A similar residential property is shown immediately south of the site boundary. Approximately 100 m north of the site, extensive residential development had occurred. However, the immediate surroundings of the site remained as fields.

The map dated 1943 shows there had been no changes on site by this time. To the west, there had been development of new residential properties and construction of a new road, known as 'Hurst Road'.

By 1959, the map refers to the site name as 'Ruxley' and the site was used as a surgery. Due to the change in shape and size of the property by this time, it is evident that the property had undergone some extension. Further residential development had taken place to the north of the site. The road to the west is referred to as 'Station Road'.

By 1968-1970, the site was referred to as 'Honeywood House' and by the 1984-1989 map, the property was shown to have been extended towards the east and, within the southwestern corner, a rectangular outbuilding is shown.

There are no more significant changes shown on the historical maps with the site area. According to an online source (<http://www.eastprestonvillage.co.uk/news.php>), it is understood that Bradbury Hotel moved to the site in 2000. With reference to photographs extracted from the internet, it appears the hotel has recently become vacant and the frontage is now secured with wooden hoarding.

3. PUBLISHED GEOLOGY

Geological map data published by the British Geological Survey (BGS) online and in print, on 1:50,000 scale Sheet No.317/322 (Chichester/Bognor) indicate the site is underlain by superficial deposits consisting of River Terrace Deposits. These deposits typically comprise clays, silts and sands.

The solid geology underlying the superficial deposits comprise strata of the New Pit Chalk Formation of Cretaceous Age.

4. DESK STUDY ENQUIRIES

Enquiries were made to the Groundsure Environmental and Geological Databases and the British Geological Survey (BGS) regarding the site and surrounding area. Information obtained from these enquiries is presented in Appendix II and summarised below.

There is a record of a dry cleaning company, Kingfisher Cleaners, which holds a current Local Authority Type B permit and lies approximately 234 m to the north of the site. There is a record of Oakhurst Gardens holding a permit for the discharge of surface water into a freshwater river and lies approximately 233 m to the west of the site. A pollution incident is recorded approximately 145 m to the north of the site. This relates to gas and fuel oils and was recorded as having a minor impact on land and air quality.

There are no current or historical landfill sites recorded within 250 m of the site. There are no other waste handling facilities within a similar search radius.

The closest “industrial” land use to the site lies approximately 195 m to the north and relates to the presence of an electricity sub-station. An industrial estate is located 227 m to the north.

There are no petrol or fuel sites recorded within close proximity to the site location.

Hydrogeological information indicates that the superficial deposits (River Terrace Deposits) on site are recorded as a Secondary (A) Aquifer. The bedrock geology (New Pit Chalk Formation) is shown to be a Principal Aquifer. There are no groundwater Source Protection Zones (SPZ) or potable water groundwater abstraction licences within close proximity to the site location.

Hydrological information indicates that there are no watercourses within the immediate vicinity of the site. The proposed development is not located on an indicative floodplain, as defined by the Environment Agency.

There are no designated environmentally sensitive sites or property classifications within the site or the immediate surrounding area.

The GroundSure Geological Database indicates that there is no recorded artificial ground beneath the site and there are no recorded surface or underground workings beneath the property. The closest surface ground workings are located to the south of the site and relate to the use of the grave yard. With respect to the mining of chalk, the area is designated as ‘rare’ for such works. There are no other records relating to mining. There are no recorded natural cavities or solution features at, or in close proximity to the site.

BGS borehole records that are located within close proximity to the site have been obtained from the online borehole search facility of the British Geological Survey website. The closest historical borehole indicates that the area is underlain by sands and gravels of the River Terrace Deposits, with a thickness of approximately 9 m, overlying chalk.

The BRE Document BR211 – Radon: *Guidance on Protective Measures for New Building* (2015) indicates that the site is not within an area where radon precautions are required in new buildings. This is confirmed in the GroundSure EnviroInsight report and with reference to the data on the Public Health England (UK Radon) website.

5. GROUND CONDITIONS AND GEOLOGICAL MODEL

5.1 Ground Investigation

Details of the rationale and scope of the ground investigation and laboratory testing undertaken in 2014, together with exploratory hole logs, monitoring, in situ and laboratory test results, are given in Appendix III. The investigation has identified the presence of the following, below the site.

5.2 Buried Foundations and Services

Buried foundations and services were not encountered during the ground investigation but foundations and services associated with the existing hotel buildings should be anticipated beneath the site.

5.3 Strata Encountered

Made Ground

Tarmac surfacing, between 0.1 m and 0.15 m thick, is present across the car parking surfaces in the western part of the site and is underlain by Made Ground materials, comprising sand and gravel materials which acted as a sub-base, to a maximum of 0.5 m depth. One of the locations encountered ironmongery within the Made Ground.

In the soft landscaped areas of the site, an average thickness of 0.1 m of topsoil, comprising grass into dark brown slightly sandy, slightly gravelly silt with rootlets is present. The topsoil materials are underlain by Made Ground materials, to an average depth of 0.65 m (maximum of 1.2 m; total thickness unproven in one location) consisting of firm consistency light brown slightly sandy, slightly gravelly clay. Gravel fragments typically comprise flint, brick, pottery and coal. Rare ashy deposits were also observed. No other visual or olfactory evidence of contamination was noted.

River Terrace Deposits

Below the Made Ground materials across the site, predominantly orange brown, generally firm and firm to stiff consistency, slightly sandy, slightly gravelly clay is present. Two of the exploratory holes extended through the clay into dense orange brown slightly clayey sand and gravel and clayey sandy gravel from 2.2 m and 3.2 m depth retrospectively.

Standard Penetration Tests (SPT) undertaken within these strata recorded 'N' values of between 4 and 23 above 2 m depth in the western area of the site, increasing to between 22 and 50 below 2 m depth within the more granular material. Windowless samples refused at depths of between 3 m and 4 m due to the dense nature of the gravel / sand and gravel.

5.4 Groundwater

Groundwater was not encountered during the ground investigation.

The groundwater conditions are based on observations made at the time of the fieldwork. It should be noted that groundwater levels may vary due to seasonal and other effects.

6. PROPOSED DEVELOPMENT

The proposed development, presented as Figure 4, is understood to comprise the following:

- Nine, two-storey houses, of conventional construction with load bearing brick/block walls.
- Private access driveways and paved footpaths surrounding the houses.
- Areas of private gardens associated with each property.

7. ASSESSMENT OF POTENTIAL CONTAMINATION AND GROUND GASES

7.1 Assessment Criteria

Assessment of potential contamination and ground gases has been undertaken using a risk assessment based approach, as recommended within the Environmental Protection Act (1990), CLR11 (2004) CLEA Model (2004-2009), BS 10175:2011+A1:2013, CIRIA C552 (2001) and NHBC R&D Report 66 (2008). This approach considers the likely source of contamination, given the history and location of the site, and the possible migration pathways by which these potentially hazardous substances may reach likely receptors, such as end users of the site, controlled waters or the wider environment, in the context of the proposed development.

Part IIA of the Environmental Protection Act (1990) states that

“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) significant pollution of controlled waters is being caused or there is significant possibility of such pollution being caused;”

All risk assessments carried out as part of this investigation have been carried out with respect to the definition of “contaminated land” within Part IIA of the Environmental Protection Act (1990) and have considered the site both before and on completion of the development. The basis of the risk assessment is the Conceptual Site Model, which is derived from the desk study and initial information and identifies potential pollutant linkages that could affect receptors relevant to the site and the wider environment. The Conceptual Site Model is presented in Table 1.

Based on the model, a ground investigation was designed to obtain relevant information to assess further the identified pollutant linkages. Where relevant this included the recovery of representative samples and subsequent analytical laboratory testing. The rationale for the sampling and testing is set out in Appendix III. The results of the analytical testing are presented in Appendix III and summarised in Table 2. On the basis of the conceptual site model and the results of the analytical laboratory testing an assessment of the identified pollutant linkages is presented in Table 3.

7.2 Potential Sources of Contamination

Available information suggests that, historically, the site has been associated with residential usage and, more recently, has operated as a hotel with a number of buildings and car parking. Due to the age of residential development, it is likely that the houses were heated by coal fires. Therefore, it is possible that ashy wastes associated with the fires may have been deposited around the property. Ashy wastes may be associated with toxic and phytotoxic metals and polyaromatic hydrocarbons (PAHs). There is no evidence to suggest that the hotel has been heated by oil-powered plant and no oil storage tanks were observed at the site.

Ground conditions at the site comprise a limited thickness of Made Ground underlain by firm and firm to stiff consistency, sandy, gravelly clays and dense clayey, sandy gravel and sands and gravels of the River Terrace Deposits. No visual or olfactory evidence of significant contamination was observed during the ground investigation. No off-site sources of potential mobile contaminants were observed during the ground investigation.

Analytical laboratory testing was undertaken on the Made Ground materials encountered at the site. With respect to end users, Table 1 summaries that data and compares them to generic assessment criteria (GAC) relevant to the protection of human health. The majority of the priority contaminants are present at levels below the GAC. However, locally, lead is elevated above the GAC for residential with plant uptake end use. The risks to end users, and other human health considerations, are assessed further in Section 7.3.1.

The site has not been associated with past fuel and/or chemical storage and as such the site does not pose a risk to buried structures or services. Analytical laboratory testing indicates that the near-neutral soil conditions, with respect to sulphates, should not pose a risk to buried structures within the proposed development. Further assessment is presented in Section 7.3.2.

Based on available information, no elevated concentrations of phytotoxic metals were identified within the shallow soils. However, given the absence/limited amount of topsoil currently present at the site, a suitable thickness of topsoil/subsoil will be required to provide a suitable growing medium within the private gardens. Further assessment is presented in Section 7.3.3.

Low concentrations of metals and polyaromatic hydrocarbons have been recorded at the site. The risks to controlled waters are considered to be low as solubility and, hence, mobility of the potential contaminants is low at typical soil temperature and pH. Further assessment is presented in Section 7.3.4.

No putrescible material has been identified as the site and there are no recorded landfills within influencing distance. The site is not within an area where precautions against the ingress of radon gas are required in new buildings. Therefore, it is considered that there are no sources of hazardous ground gases at the site and ground gas protection is not required for the proposed development.

7.3 Pollutant Linkages – Solids and Liquids

Based on the Conceptual Site Model, consideration is given below to identified pollutant linkages and a risk evaluation is undertaken of each possible source-pathway-receptor linkage that may occur at the site. The risk evaluation considers the potential consequences and probability of occurrence in accordance with CIRIA C552 (2001). Where risks are identified as “negligible”, then by implication such risks are within normally accepted levels for the proposed development, and the further reduction of such risks by remediation works is considered unnecessary. Where risks are identified that are “low” as defined in CIRIA C552 (2001), or worse, then consideration is given to the management of the identified risks, with appropriate recommended actions that may include engineering solutions / remediation works as described in the following sections.

7.3.1 Human Health

A possible pollutant linkage to site end users through, dermal contact, ingestion and inhalation of material impacted by lead has been identified within the Made Ground encountered in the northeast area of the site. Locally, the recorded concentration of lead is above the GAC and C4SL for a residential with plant uptake end use.

With respect to end users, the large area of the site that will be covered by buildings and road pavements will ensure that there are effective barriers between the end users and the existing ground across much of the

site. However, there are areas of proposed private gardens. Within these locations, there are potential exposure pathways following development. Within the private gardens, direct dermal contact may be applicable as resident will be able to dig or cultivate the areas. Root activity and earth worm activity may also mix the existing ground with topsoil materials, thereby returning impacted soils to the surface, if limited thicknesses of topsoil are placed. As the gardens could be cultivated by end users, a recommended capping layer thickness (to comprise topsoil and/or subsoil) of 600 mm should be provided, in accordance with the research information provided in BR465 (2004).

Given that high concentrations of lead have only been identified at one location, it is recommended that when unrestricted access is available, supplementary investigation be undertaken within garden areas and additional samples of near-surface materials be taken and tested for potential contaminants. Following this investigation it may be possible to limit the areas requiring a capping layer.

Groundworkers involved in the construction of the new development may be exposed to the potential contaminants identified above. However, it is extremely unlikely that concentrations of potential contaminants would be sufficiently high to exceed short-term exposure limits. Notwithstanding this, it is recommended that appropriate personal protective equipment (PPE) be worn and high level of personal hygiene be maintained by groundworkers. To minimise soils at the site becoming airborne and moving beyond the site boundaries during earth moving works, it is recommended that appropriate soil dampening equipment be maintained on site during dry periods to minimise dust generation.

7.3.2 Durability of Buried Structures and Services

In view of the low soluble sulphate content and near-neutral soil conditions, there are no special precautions required for the protection of good quality buried foundation concrete. Based on guidance within *BRE Special Digest 1* (2005), the specified DC Class of concrete for buried structures and foundations should be suitable for an ACEC site classification of AC-1.

The site has not been associated with past fuel and/or chemical storage and there are no such storage facilities in close proximity. Therefore, the site would not be considered to be 'brownfield' under the definition provided by UKWIR (2010) with respect to the assessment of ground for water supply pipes. Based on the guidance provided by UKWIR, conventional plastic materials can be used for potable water supply pipes without any requirements for specific testing.

It should be noted that individual water companies may have in-house requirements for the assessment of ground conditions for potable water supply pipes and these requirements may be in addition to, or may contradict, the guidance provided by UKWIR. Therefore, it is recommended that the relevant water supply company be consulted prior to finalising the potable water supply design.

7.3.3 Landscape and Garden Areas

Concentrations of phytotoxic compounds are below those levels considered a risk to healthy plant growth (see BS 3882:2007 for requirements for topsoil). Therefore, it is considered that the existing soils do not represent a specific risk to plant growth in private gardens. However, it is considered unlikely that the Made Ground present across the site contains sufficient nutrients to support healthy plant growth and it is recommended that topsoil be imported as a growing medium in proposed private gardens. The capping layer proposed in Section 7.3.1 should be suitable to act as a growing medium.

7.3.4 Controlled Waters

The superficial strata (River Terrace Deposits) overlying the site are classified as a 'Secondary A aquifer'. The solid strata (New Pit Chalk Formation) beneath the site are classified as a 'Principal' aquifer. There are no groundwater source protection zones or potable water groundwater abstraction licences within close proximity to the site location. There are no surface water features in close proximity to the site.

Low concentrations of toxic metals and PAHs have been noted within shallow soils. Metals, at typical soil temperatures and the recorded pH values are of low solubility, whilst PAHs, particularly when associated with ash and clinker, have limited mobility in the water environment. Therefore, it is considered unlikely that potential contaminants would be mobilised for the shallow soils into controlled waters.

On the basis of the above, it is considered that there are no unacceptable risks to controlled waters associated with the ground conditions at the site.

7.4 Recommended Remedial Works

On the basis of the available information, it is considered that no remedial works should be required at this site to permit development.

With respect to construction-related remediation, it is recommended that allowance be made to import topsoil/subsoil materials to provide a suitable capping layer within proposed private gardens over the northeast area of the site. A 600 mm thick capping layer is recommended within areas of proposed gardens. The area requiring remediation should be finalised following supplementary investigation.

The above work should be undertaken in accordance with a suitable Remediation Implementation Plan that details the work to be undertaken and relevant acceptability criteria such that a Remediation Verification Report can be produced to provide a record of the completed work.

7.5 Potential Liabilities

Based on the available data, it is considered there should be no environmental liabilities associated with site ownership. There should be no change following development.

8. ASSESSMENT OF MINING, QUARRYING AND OVERALL GROUND STABILITY

The site is not within an area of recorded underground coal mining or other such mineral extraction and there is no evidence of quarrying activities at, or in close proximity to, the proposed development. Therefore, it is considered that the proposed development should not be constrained by issues of ground stability associated with mining or quarrying.

Chalk strata can be dissolved by water and solution features can fill with loose superficial deposits. Such deposits can be susceptible to collapse settlement (if loads are applied) or to inundation settlement (if large volumes of water are introduced to the superficial materials). However, based on geological database information, it appears that the site is not within an area where solution features have been recorded on or within close proximity to the site. No potentially anomalous ground conditions, indicative solution features were encountered during the ground investigation. However, if anomalous ground conditions are identified during construction works, it is recommended that the advice of a geotechnical engineer be obtained to assess the particular ground conditions. Notwithstanding this, and based on the available information, it is considered that risks to the proposed development from solution features are very low.

With reference to published information provided by the British Geological Survey, and in the context of the low sensitivity of the proposed structure to very minor background seismic events recorded in the UK, it is considered that the foundation solution should not be constrained by potential ground vibrations from natural sources and that more detailed assessment is not necessary.

9. FOUNDATION RECOMMENDATIONS

9.1 Design Approach

In compliance with the requirements of the National Annex of BS EN 1997-1:2004 the geotechnical design assessment is based on Design Approach 1 (as defined in BS EN 1997-1:2004). As the structural loads for the proposed building are well defined, uncertainty and risks of potential unfavourable conditions (or deviations from characteristic values) are primarily associated with the ground conditions.

Consideration is given to the assessment of ultimate limit state (ULS) conditions, where full collapse or failure conditions are considered, and relevant design information is presented in Appendix IV in this regard. In addition, the assessment considers serviceability limit states (SLS), to ensure that the recommended design parameters are compatible with an acceptably low risk of serviceability criteria being exceeded during the standard design life of the structure. It is noted that the SLS has a greater influence on the design parameters in comparison to ULS conditions and this is considered in the following assessment.

9.2 Proposed Structural Loadings and Serviceability Criteria

Details of imposed foundation loads (i.e. actions imposed by the building structure) and serviceability limit values are not currently available for the proposed structures. The geotechnical assessment presented in the report has considered generic values for the proposed development type, which is considered appropriate for the appraisal of engineering solutions and preliminary design, and these are listed below:

Preliminary Values, for appraisal purposes:

Maximum Imposed Load on Foundations: 125 kN/m run (two-storey house)

Serviceability Limit Values (associated with above action)

Maximum Total Settlement: 25 mm

Maximum Deflection: 1/1000

9.3 Geotechnical Category of Proposed Structures

In view of the nature of the proposed structures, comprising two-storey houses, of conventional construction with load bearing brick/block walls and with reference to the indicated ground conditions, as outlined in Section 5, it is considered that the development is compatible with Geotechnical Category 2, as defined in BS EN 1997-1:2004, and the necessary information relating to the Ground Investigation and Geotechnical Design Reports has been obtained and assessed on this basis.

9.4 Assessment of Foundation Solutions

With reference to the recorded ground conditions and corresponding Geological Model presented in Section 5, characteristic values relating to the geotechnical properties of the strata within influencing distance of the proposed structures are presented in Appendix IV. Salient elements of the geotechnical model are outlined below.

Ground conditions at the site comprise a limited thickness of Made Ground underlain by firm and firm to stiff consistency, sandy, gravelly clays and dense, clayey sandy gravel and clayey sand and gravel (River Terrace Deposits). New Pit Chalk strata are present at depth beneath the River Terrace Deposits but were not encountered during the investigation.

Based on the recorded ground conditions, it is considered that conventional spread foundations, placed in the River Terrace Deposits should be appropriate to support the proposed development. Whilst disturbance to the near-surface soils will occur over a large portion of the site during demolition and clearance of the existing structures it is considered unlikely that this disturbance will result in any requirement for special foundations. However, beneath specific areas of the site, deepened trench fill foundations may be required.

9.5 Recommended Foundation Design Parameters

On the basis of the foregoing assessment and the details presented in Appendix IV, it is considered that strip / trench fill foundations provides the most appropriate foundation solution for the proposed structure. On the basis of the ground conditions and structures described in the report, the recommended parameters for the foundation design are as follows:

<i>Foundation Strata :</i>	River Terrace Deposits comprising firm to stiff consistency slightly sandy slightly gravelly clay and dense clayey sandy gravel and clayey sand and gravel.
<i>Foundation Depth :</i>	Minimum 0.90 m, deepened within influence of trees, or through Made Ground
<i>Foundation Width/Size:</i>	Up to 2.0 m
<i>Nett Allowable Bearing Pressure:</i>	125 kN/m ²

It is considered that total settlement of foundations designed on the above basis should be less than the normal serviceability limit state for this development (i.e. total settlements of 25 mm) as outlined in the assessment presented in Appendix IV.

Laboratory testing results indicate the clayey horizons at the site comprise “low / medium volume change” potential soils, as defined in NHBC Standards (2016). Within the influence of existing or proposed trees, suitable foundation precautions should be adopted, as outlined in NHBC Standards (2016).

Based on guidance published within BRE Special Digest 1 (2005), the specified DC Class of concrete for buried structures and foundations should be suitable for an ACEC site classification of AC-1.

9.6 Floor Slab Recommendations

Due to the disturbance of the shallow strata likely to occur over the majority of the site during demolition and site clearance works, suspended floor slabs are recommended for the proposed development. Additionally, due to the recorded low / medium volume change potential of the clayey horizons at the site, a 250 mm void is also required in the influence of trees as outlined in NHBC Standards (2016).

9.7 General Construction Advice

All formations should be cleaned, and subsequently inspected by a suitably qualified engineer prior to placing concrete. Should any soft, compressible or otherwise unsuitable materials be encountered they should be removed and replaced by blinding concrete.

Foundation concrete, or alternatively, a blinding concrete, should be placed immediately after excavations and inspection in order to protect the formation against softening and disturbance.

Generally, all formations should be placed wholly within the same material type, unless specific geotechnical inspection and assessment have been undertaken.

Care should be taken to ensure that any drains encountered are carefully and satisfactorily blocked to prevent water seepage through the drains and into any excavations.

10. TEMPORARY WORKS

Conventional plant is considered appropriate for shallow excavation works at this site. However, the use of hydraulic breakers may be required to break up any remaining foundations and buried concrete following demolition of the existing structures.

Shallow excavations may remain stable in the short term. However, instability may occur in excavations left open for extended periods of time. Support should be provided, or the sides battered back, in any excavations requiring man entry.

Groundwater was not encountered during the ground investigation. In the unlikely event that perched water seepages are encountered in excavations they should be adequately controlled by pumping from screened sumps.

11. ASSESSMENT OF SOAKAWAY DRAINAGE

Based on the recorded ground conditions, comprising of low permeability clays to depths of up to 3.2 m, it is considered that soakaway drainage will be unlikely to be suitable for the proposed development. Therefore, it is recommended that an alternative method of drainage be identified for the site.

12. ROAD PAVEMENTS

Based on an examination of the soils present at the site and the guidance of TRRL Report LR1132 and the Highways Agency Interim Advice Note 73/06 (Rev. 1), it is considered that an equilibrium design CBR value of 4% may be used for road pavement design. It is considered that the material at shallow depth should be regarded as frost susceptible.

13. ASSESSMENT OF MATERIALS FOR WASTE DISPOSAL

There should be no environmental requirement to remove materials from site to permit development. Therefore, excavated material should be retained and reused on site where possible.

The near surface Made Ground materials encountered beneath the site are likely to be classified as either “non-hazardous” or “inert” waste if taken off site. Additional waste classification testing will be required if these materials are to be removed from site.

The underlying natural strata should be classified as “inert” waste is taken off site. As these materials comprise in situ natural strata, no analytical testing should be required on these materials to confirm waste classification.

Landfill tax would be payable on any materials removed from site and taken to landfill. However, inert waste may also be taken to a facility that is exempt under the Environmental Permitting regulations, subject to specific exemption requirements.

14. RECOMMENDATIONS FOR SUPPLEMENTARY GROUND INVESTIGATIONS

It is recommended that an allowance be made for a supplementary ground investigation, following site purchase and demolition of the existing properties, to confirm the shallow ground conditions prior to construction, the requirement for any capping layer in private garden areas and to assess the stability of excavations and to confirm waste classification. This supplementary ground investigation would utilise trial pits.

15. RECOMMENDED SUPERVISION AND MONITORING

In compliance with the requirements in BS EN 1997-1:2004 and BE EN 1997-2:2007, construction and workmanship of the engineering solutions recommended in this report shall be supervised. In particular, issues listed in Section 9.7 General Construction Advice shall be considered in the implementation of the works and design of any necessary temporary works set out in Section 10.

In relation to the foundation solution and ground floor slab recommendations in Section 9, the following supervision and monitoring is recommended.

- Inspections of formation strata in excavations for strip/trench fill footings

16. SUMMARY

Denton Homes Limited proposes to redevelop the Bradbury Hotel located on Station Road, East Preston, West Sussex for residential purposes. Currently, the site is occupied by a vacant hotel property with associated grounds and tarmac-surfaced car parking facilities. The proposed development is understood to comprise nine, two storey houses with associated access driveways and private gardens.

Ground conditions at the site comprise a limited thickness of Made Ground underlain by firm and firm to stiff consistency, sandy, gravelly clays and dense, clayey sandy gravel and clayey sand and gravel (River Terrace Deposits). The New Pit Chalk Formation is present beneath the River Terrace Deposits but were not encountered during the site investigation. Shallow groundwater was not encountered.

Lead has been recorded at one location within the shallow Made Ground material at a concentration above the generic assessment criteria (GAC) and C4SL for residential with plant uptake. Allowance should be made for the placement of a 600 mm thick topsoil/subsoil capping layer within proposed garden areas. Given that a high concentration of lead has only been identified at one location, it is recommended that, when unrestricted access is available, supplementary investigation be undertaken within soft landscaping areas and additional samples of near-surface materials be taken and tested for potential contaminants. Following this investigation it may be possible to limit the areas requiring a capping layer.

Based on recorded ground conditions, it is considered that conventional spread foundations, placed in the River Terrace Deposits should be appropriate to support the proposed development. Suspended ground floor slabs are recommended.

On the basis of the recorded ground conditions, it is considered that soakaway drainage will not be feasible for the proposed development, and that alternative forms of surface water drainage should be identified.

It is recommended a supplementary ground investigation, utilising trial pits, be undertaken following site purchase and demolition of the existing structures.

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GENERAL NOTES

1. This report is provided in the context of the stated development proposals and should not be used in a different context.
2. The accuracy of map extracts cannot be guaranteed and it should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.
3. Any borehole data from the British Geological Survey sources are included on the following basis: "The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation.
4. Where any data supplied by the Client or by other external sources, including previous site investigation data, have been used it has been assumed that the information is correct unless otherwise stated. No responsibility can be accepted by Crossfield Consulting Limited for inaccuracies within the data supplied by others.
5. Exploratory hole locations provided in the report are generally established by tape measurement from existing features or boundaries. Hole locations are not accurately surveyed and ground levels at these locations are not obtained unless specifically requested.
6. Any assessments made in this report are based on the ground conditions indicated by the trial pits and/or boreholes, together with the results of any field or laboratory testing undertaken and, where appropriate, other relevant site data which may have been obtained for the site. Variations in ground conditions may occur between exploratory hole locations and there may be special conditions appertaining to the site which have not been revealed by the investigation and which have not been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available.
7. The report is provided for the sole use by the Client or its assignees and is confidential to the Client's professional advisers. No responsibility whatsoever for the contents of this report will be accepted to any person other than the Client or its assignees.
8. New information, improved practices and legislation may necessitate an alteration to the report in whole, or in part, after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to Crossfield Consulting Limited for re-assessment and, if necessary, re-appraisal.

TABLES

TABLE 1

CONCEPTUAL SITE MODEL

Potential Contaminant Source	Potential Pathway	Receptors and Assessed Pollutant Linkage
Solids <i>On Site source:</i> <i>Toxic metals:</i> Potential source from ashy Made Ground <i>Phytotoxic metals:</i> Potential source from ashy Made Ground <i>Polyaromatic Hydrocarbons:</i> Potential source from ashy Made Ground <i>Off-site source:</i> No evidence of realistic source of mobile contaminants Liquids No source identified Ground Gases <i>Landfill Gas:</i> No source identified <i>Radon Gas:</i> No significant source <i>Grave Yard:</i> Relic source where there is negligible potential for gas flow mechanisms to occur – No source	Movement of Solids Direct dermal contact, ingestion of soil and inhalation of dust are all viable pathways during construction and in any proposed garden and landscaped areas following construction. New building and hardstanding will provide effective barrier to negate dermal, ingestion and inhalation pathways following development. Release into Liquid Phase Metal solubility generally low at typical soil temperature and pH. Low possibility of metal uptake by plants. Polyaromatic hydrocarbons are typically of low solubility. Therefore, limited potential for release into liquid/aqueous phase. Movement of Liquids Not applicable (no source) Movement of Ground Gases Not applicable (no source)	Human Health <i>Construction workers:</i> Potential pollutant linkage <i>Site users after development:</i> Potential pollutant linkage <i>Neighbouring properties:</i> Potential pollutant linkage Buried Structures & Services <i>Plastic (pipes):</i> No pollutant linkage Landscape Areas Potential pollutant linkage Controlled Waters (Water Environment) <i>Groundwater:</i> Secondary (A) and principal aquifers, no source protection zone - No pollutant linkage <i>Surface Water:</i> No pollutant linkage Human Health (Ground Gases) No pollutant linkage

NOTES

1. The above conceptual model is based on CIRIA C552 (2001) and BS 10175:2011+A1:2013.
2. The Conceptual Site Model is prepared from available desk study information. Where a site walkover or ground investigation identifies information that was not known at the desk study stage, such information is used to modify the Model.
3. Where a pollutant linkage is identified, any subsequent ground investigation is designed to obtain relevant information to assess the pollutant linkage. See Table 3 for a summary of pollutant linkage assessments.

TABLE 2
(Page 1 of 2)

SUMMARY OF ANALYTICAL TEST DATA: SOILS
POTENTIAL RISKS TO HUMAN HEALTH: PRIVATE GARDENS

Determinand	Units	No of Tests	Concentration (mg/kg)		Generic Assessment Criteria (mg/kg) Residential With Plant Uptake		Category 4 Screening Level (mg/kg) Residential With Plant Uptake	
			Min	Max	Value	No>GAC	Value	No>C4SL
Arsenic	mg/kg	5	2.0	11	37 ¹	0	37 ⁴	0
Cadmium	mg/kg	5	<0.2	0.5	11 ¹	0	26 ⁴	0
Chromium (Total) ⁵	mg/kg	5	11	26	910 ¹	0	-	-
Chromium (VI)	mg/kg	5	<4.0	<4.0	6 ¹	0	21 ⁴	0
Lead	mg/kg	5	2.6	400	120 ²	1	200 ⁴	1
Inorganic Mercury	mg/kg	5	<0.3	<0.3	40 ¹	0	-	-
Nickel	mg/kg	5	7.5	19	130 ¹	0	-	-
Selenium	mg/kg	5	<1.0	<1.0	250 ¹	0	-	-
Copper	mg/kg	5	7.4	32	2400 ¹	0	-	-
Zinc	mg/kg	5	15	150	3700 ¹	0	-	-
Boron	mg/kg	5	0.7	1.5	290 ¹	0	-	-
Phenols	mg/kg	5	<1.0	<1.0	120 ¹	0	-	-
pH	-	10	7.9	10.5	-	-	-	-
Total Organic Carbon	%	5	<0.1	1.3	-	-	-	-
Petroleum Hydrocarbons								
Aliphatics C ₅ – C ₆	mg/kg	5	<0.1	<0.1	42 ¹	0	-	-
Aliphatics C ₆ – C ₈	mg/kg	5	<0.1	<0.1	100 ¹	0	-	-
Aliphatics C ₈ – C ₁₀	mg/kg	5	<0.1	<0.1	27 ¹	0	-	-
Aliphatics C ₁₀ – C ₁₂	mg/kg	5	<1.0	<1.0	130 ¹	0	-	-
Aliphatics C ₁₂ – C ₁₆	mg/kg	5	<2.0	<2.0	1100 ¹	0	-	-
Aliphatics C ₁₆ – C ₃₅	mg/kg	5	<8.0	<8.0	65,000 ¹	0	-	-
Aromatics C ₆ – C ₇	mg/kg	5	<0.1	<0.1	70 ¹	0	-	-
Aromatics C ₇ – C ₈	mg/kg	5	<0.1	<0.1	130 ¹	0	-	-
Aromatics C ₈ – C ₁₀	mg/kg	5	<0.1	<0.1	34 ¹	0	-	-
Aromatics C ₁₀ – C ₁₂	mg/kg	5	<1.0	<1.0	74 ¹	0	-	-
Aromatics C ₁₂ – C ₁₆	mg/kg	5	<2.0	<2.0	140 ¹	0	-	-
Aromatics C ₁₆ – C ₂₁	mg/kg	5	<10	<10	260 ¹	0	-	-
Aromatics C ₂₁ – C ₃₅	mg/kg	5	<10	31	1100 ¹	0	-	-
VOCs								
Benzene	mg/kg	5	<0.001	<0.001	0.087 ¹	0	0.87 ⁴	0
Toluene	mg/kg	5	<0.001	<0.001	130 ¹	0	-	-
Ethylbenzene	mg/kg	5	<0.001	<0.001	47 ¹	0	-	-
Xylene	mg/kg	5	<0.001	<0.001	56 ¹	0	-	-
MTBE	mg/kg	5	<0.001	<0.001	49 ³	0	-	-

TABLE 2
(Page 2 of 2)

Determinand	Units	No of Tests	Concentration (mg/kg)		Generic Assessment Criteria (mg/kg) Residential With Plant Uptake		Category 4 Screening Level (mg/kg) Residential With Plant Uptake	
			Min	Max	Value	No>GAC	Value	No>C4SL
PAHs								
Naphthalene	mg/kg	5	<0.05	<0.05	2.3 ¹	0	-	-
Acenaphthylene	mg/kg	5	<0.10	<0.10	170 ¹	0	-	-
Acenaphthene	mg/kg	5	<0.10	<0.10	210 ¹	0	-	-
Fluorene	mg/kg	5	<0.10	<0.10	170 ¹	0	-	-
Phenanthrene	mg/kg	5	<0.10	0.60	95 ¹	0	-	-
Anthracene	mg/kg	5	<0.10	0.19	2400 ¹	0	-	-
Fluoranthene	mg/kg	5	<0.10	2.30	280 ¹	0	-	-
Pyrene	mg/kg	5	<0.10	2.20	620 ¹	0	-	-
Benz(a)anthracene	mg/kg	5	<0.10	1.60	7.2 ¹	0	-	-
Chrysene	mg/kg	5	<0.05	2.60	15 ¹	0	-	-
Benzo(b)fluoranthene	mg/kg	5	<0.10	1.40	2.6 ¹	0	-	-
Benzo(k)fluoranthene	mg/kg	5	<0.10	1.50	99 ¹	0	-	-
Benzo(a)pyrene	mg/kg	5	<0.10	1.50	2.2 ¹	0	5 ⁴	0
Indeno(123cd)pyrene	mg/kg	5	<0.10	0.47	27 ¹	0	-	-
Dibenzo(ah)anthracene	mg/kg	5	<0.10	<0.10	0.24 ¹	0	-	-
Benzo(ghi)perylene	mg/kg	5	<0.05	<0.05	320 ¹	0	-	-

NOTES

1. Suitable for Use Level (S4UL) published by LQM/CIEH, 2015 – Residential With Plant Uptake landuse. S4UL assumptions comprise 1% soil organic matter, soil pH of 7 and sandy loam soil type. S4ULs are copyright © Land Quality Management Limited reproduced with permission; Publication Number S4UL3133.
2. Generic assessment criteria (GAC) for lead calculated using CLEA Software version 1.06 (Environment Agency, 2009) with a lead intake based on a target blood level of 3.5 µg/dL. Other model assumptions comprise 1% soil organic matter, soil pH of 7 and sandy loam soil type.
3. Soil GAC for Human Health Risk Assessment produced by CL:AIRE (2010) – Residential With Plant Uptake. Assumption of 1% soil organic matter.
4. Category 4 Screening Level (C4SL), Department for Environment Food and Rural Affairs (March 2014)
5. In the absence of desk study or historical map evidence indicating a potential source of chromium (VI) usage at or in the near vicinity of the site (and confirmed by laboratory testing), total chromium concentrations have been compared to the GAC for chromium (III).

TABLE 3

ASSESSMENT OF POLLUTANT LINKAGES

NOTES:

- Pollutant linkage validity assessed following qualitative or semi-quantitative risk assessment.
- Pollutant linkage assessed following detailed quantitative risk assessment or assuming the recommended remediation or mitigation measures are in place

		Consequence (C)			
		Severe	Medium	Mild	Minor
Probability (P)	High likelihood (HL)	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely (L)	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low likelihood (LL)	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely (UL)	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

All terminology in accordance with the definitions provided in CIRIA C552 (2001)

Pollutant Linkage			Assessment of Pollutant Linkage following Ground Investigation	Pollutant Linkage Valid? ¹	Risk Rating			Quantitative Risk Assessment	Recommended Remediation/Mitigation (See Section 7 for further details)	Recommended Work Verified?	Pollutant Linkage Valid? ²
Source	Pathway	Receptor			C	P	Risk				
Toxic metals PAHs	Ingestion (dust) Other pathways not applicable	End Users	Lead concentrations locally elevated above GAC	Yes No	Med n/a	LL n/a	Mod/Low n/a	Locally, lead is elevated above GAC and C4SL for residential with plant uptake.	Recommended 600 mm topsoil/subsoil capping layer be implemented in proposed private gardens, to act as barrier between potential contaminants and site end users. Supplementary investigation recommended to define the extent of capping layer required.	To be confirmed during construction phase	No
Heavy metals, PAHs	Dermal contact, Ingestion	Construction workers	All tests below concentrations considered to be a short-term (acute) risk. No further assessment required	No No	n/a n/a	n/a n/a	n/a n/a	Not applicable	Not applicable but standard personal protective equipment is recommended as good practice	Not applicable at this stage	No
Heavy metals, PAHs	Dermal contact (dust), Ingestion (dust)	Neighbours/general public	Lead concentrations locally elevated above GAC	Yes No	Med n/a	LL n/a	Mod/Low n/a	No, GAC conditions considered to represent likely exposure pathways and risk receptor groups	Conventional dust control to be used during construction.	To be confirmed during construction phase	No
Phytotoxic metals	Plant uptake	Landscape plantings	Phytotoxic metals not present at concentrations considered a risk to healthy plant growth based on BS 3882:2007	No	n/a	n/a	n/a	Not applicable	Not applicable	Not applicable	No

FIGURES

FIGURE 1



SITE LOCATION PLAN

Scale 1: 50,000

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FIGURE 2

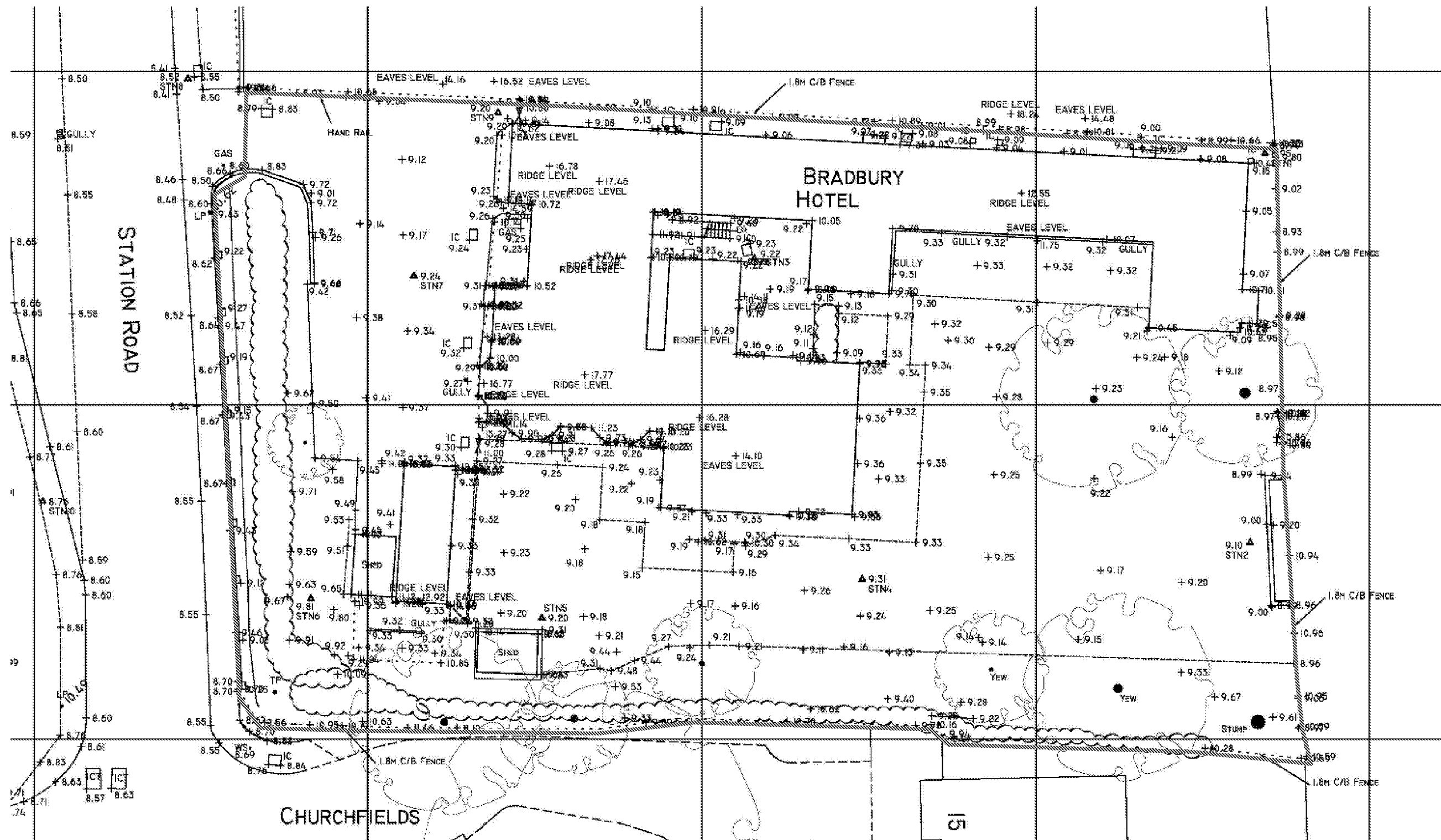


SITE PLAN

Scale 1:1250

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FIGURE 3



TOPOGRAPHICAL SITE SURVEY

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PROPOSED DEVELOPMENT PLAN

Scale 1:250

Plan based on drawing provided by the client, Denton Homes Limited.

APPENDIX I

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Hotel, Station Road, Eat
Preston, BN16 3AJ

Client Ref: EMS_271584_366260

Report Ref: EMS-271584_366260

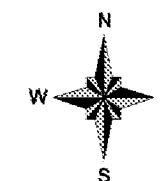
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Map date: 1878

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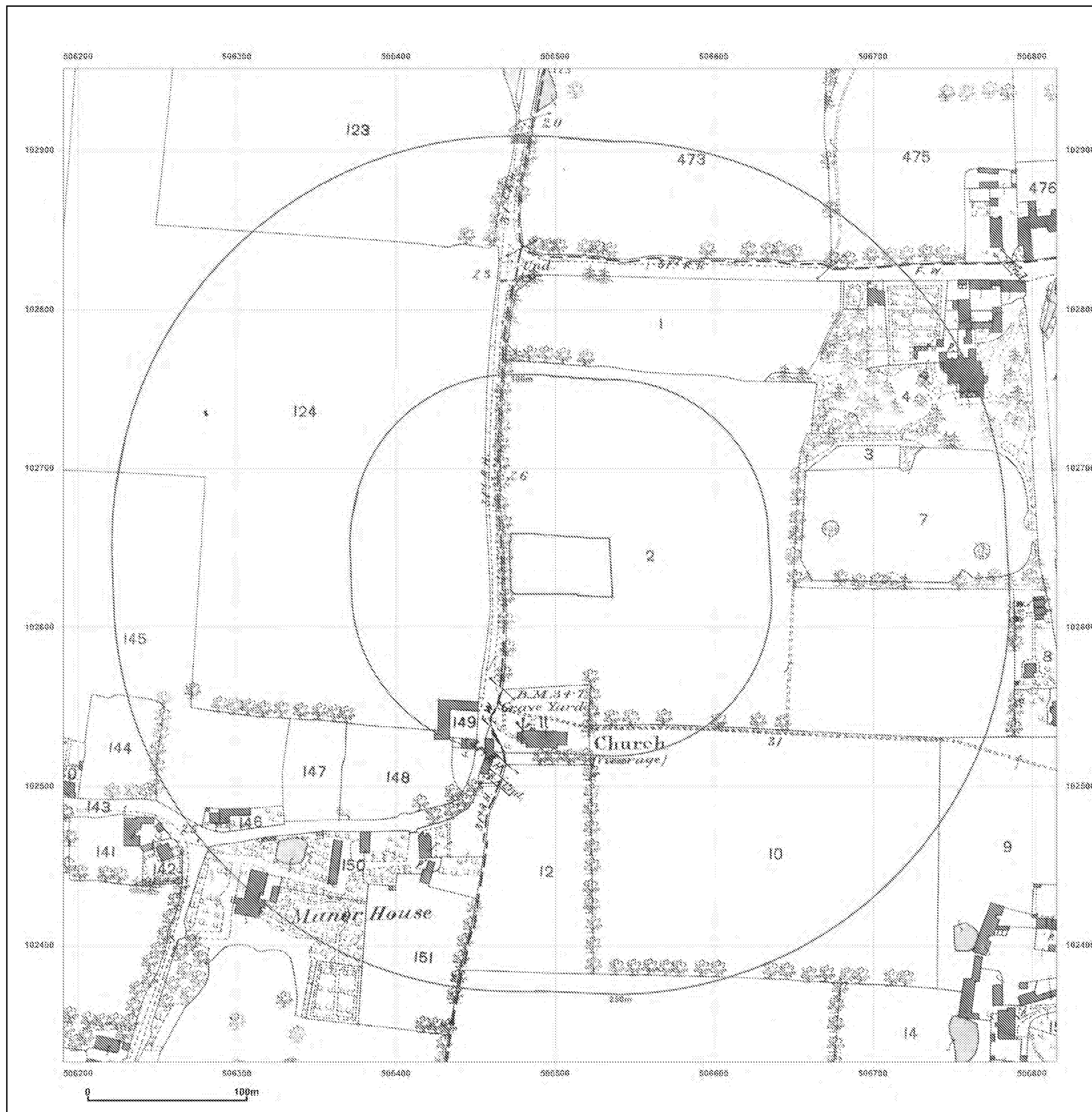


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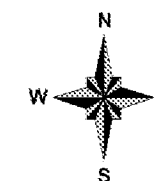
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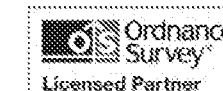


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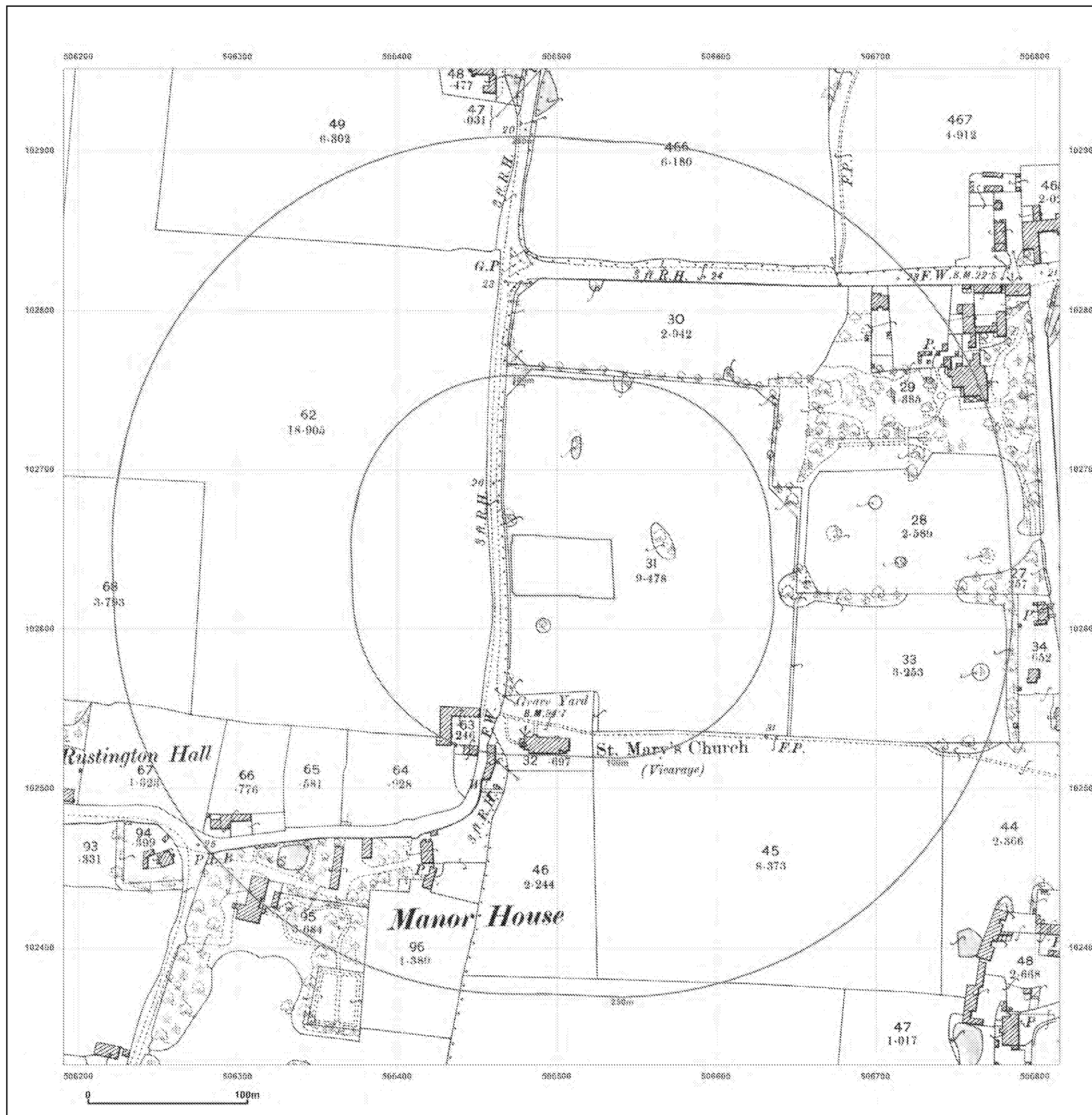


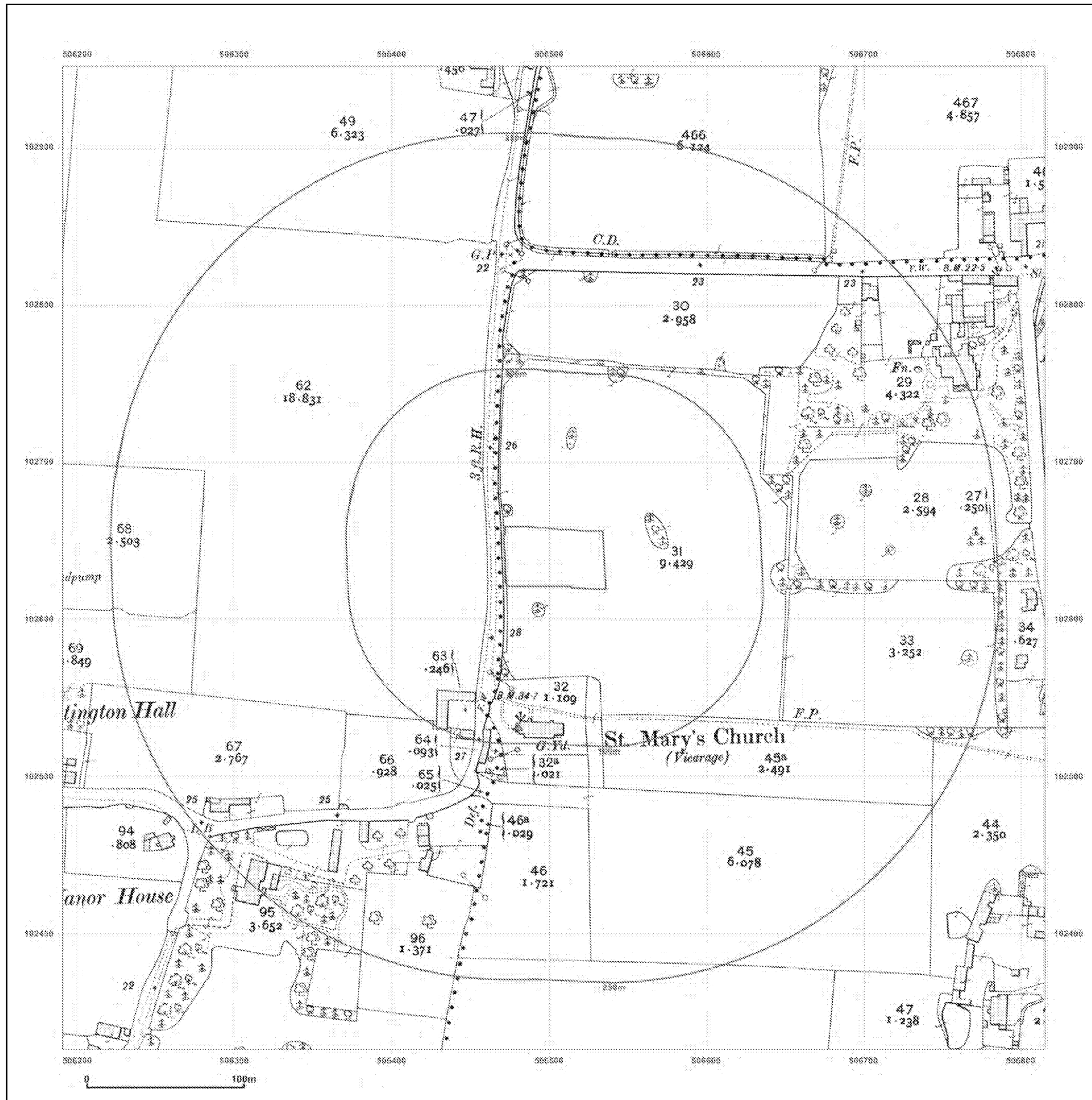
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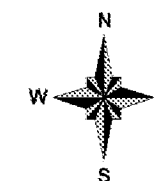
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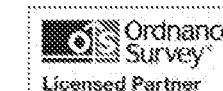


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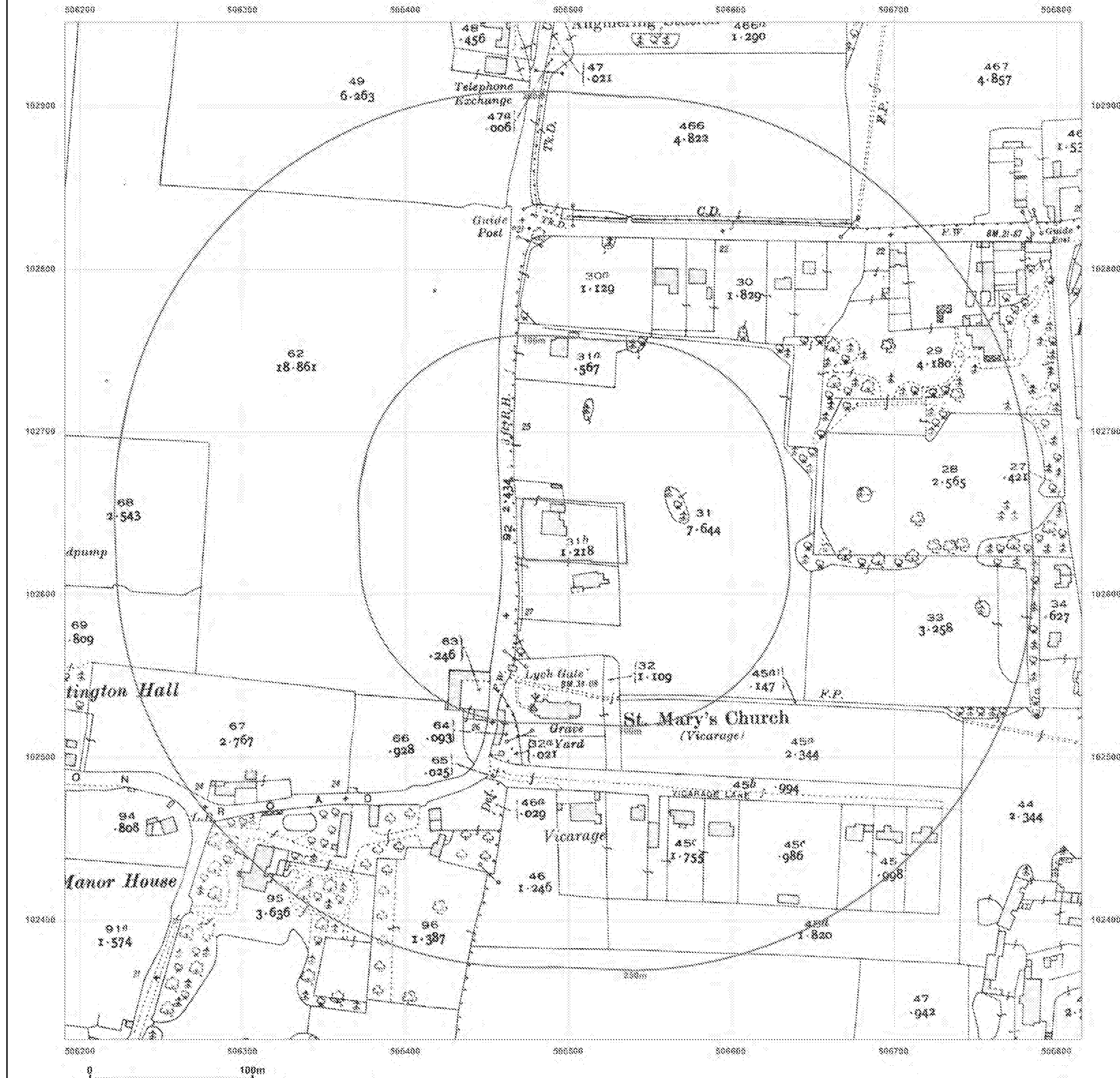
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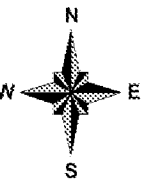
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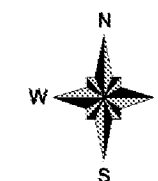
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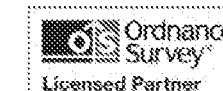


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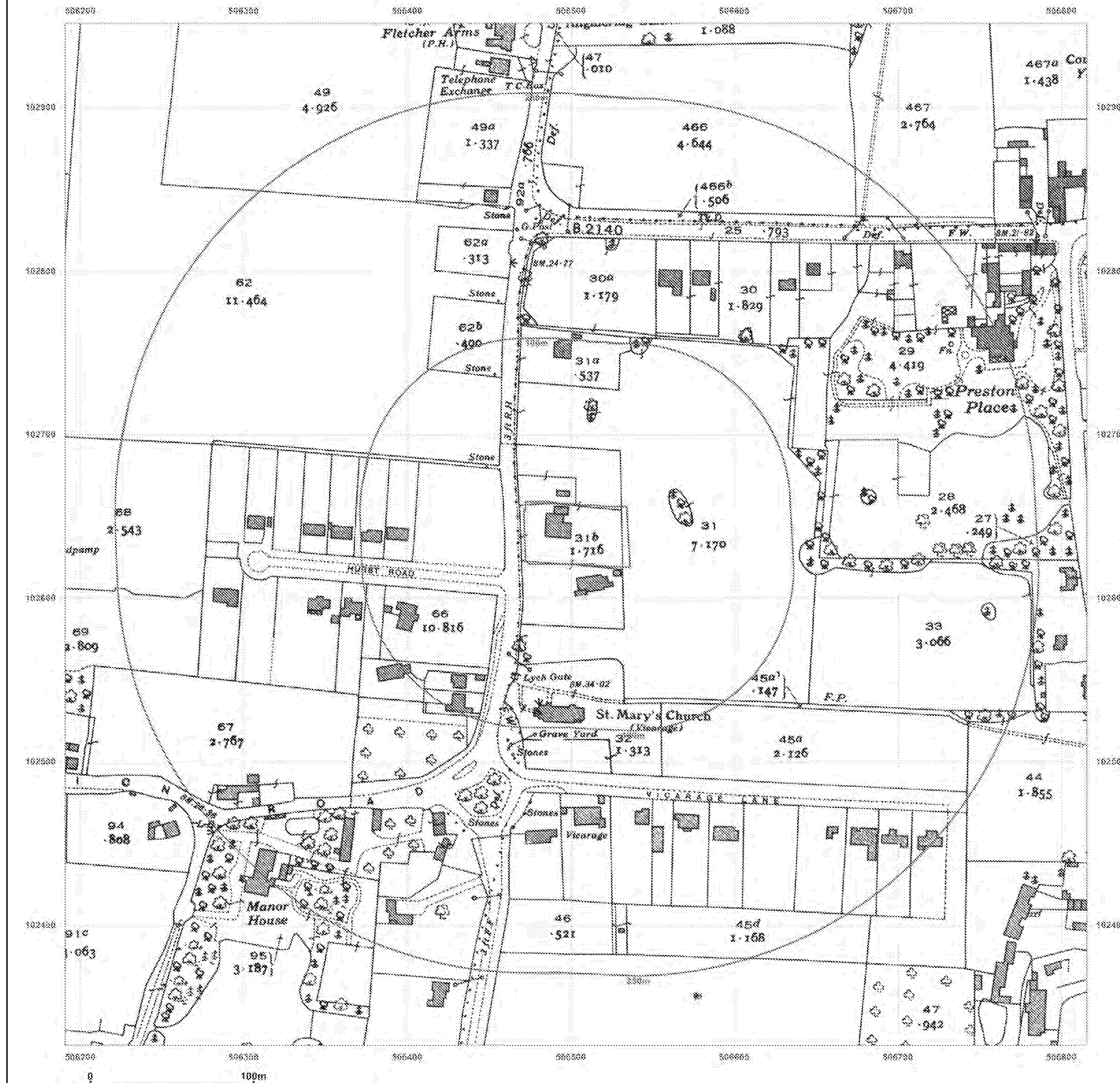


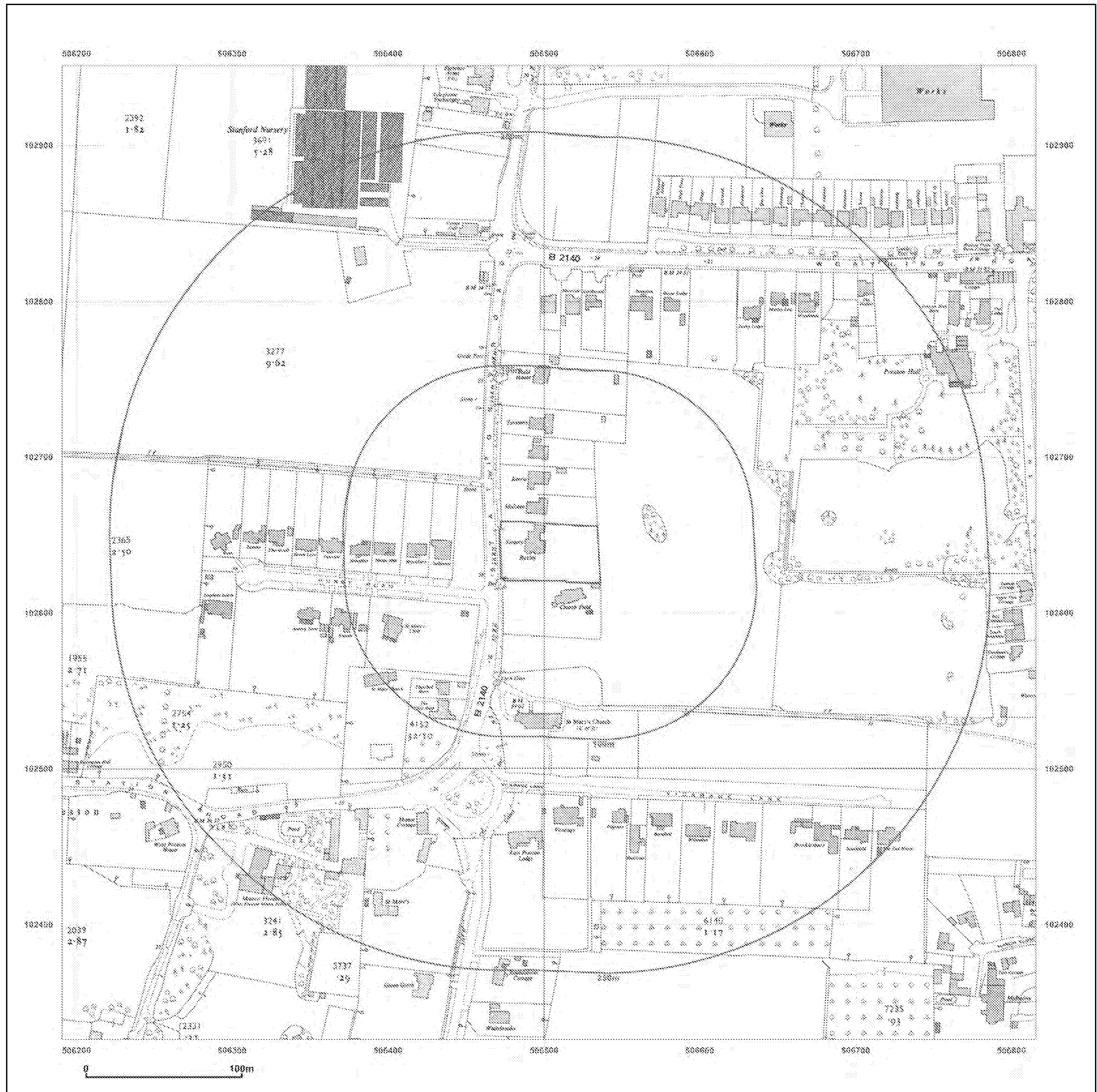
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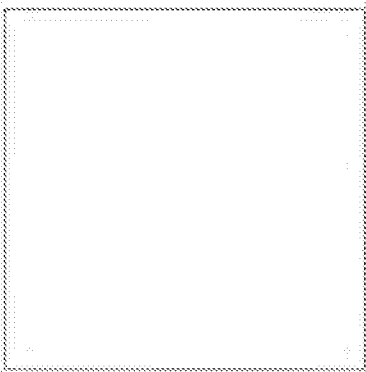
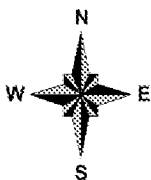
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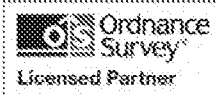


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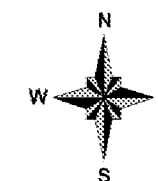
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Printed at: 1:2,000

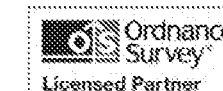


Surveyed 1958 Revised 1968 Edition N/A Copyright 1970 Levelled 1968	Surveyed 1967 Revised 1967 Edition N/A Copyright 1968 Levelled 1968
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Site Details:

CCL02593, Bradbury
Hotel, Station Road, Eat
Preston, BN16 3AJ

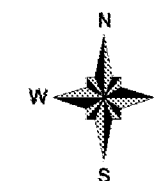
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Report Ref: EMS-271584_366260
Grid Ref: 506503, 102639

Map Name: National Grid

Map date: 1984-1989

Scale: 1:1,250

Printed at: 1:2,000



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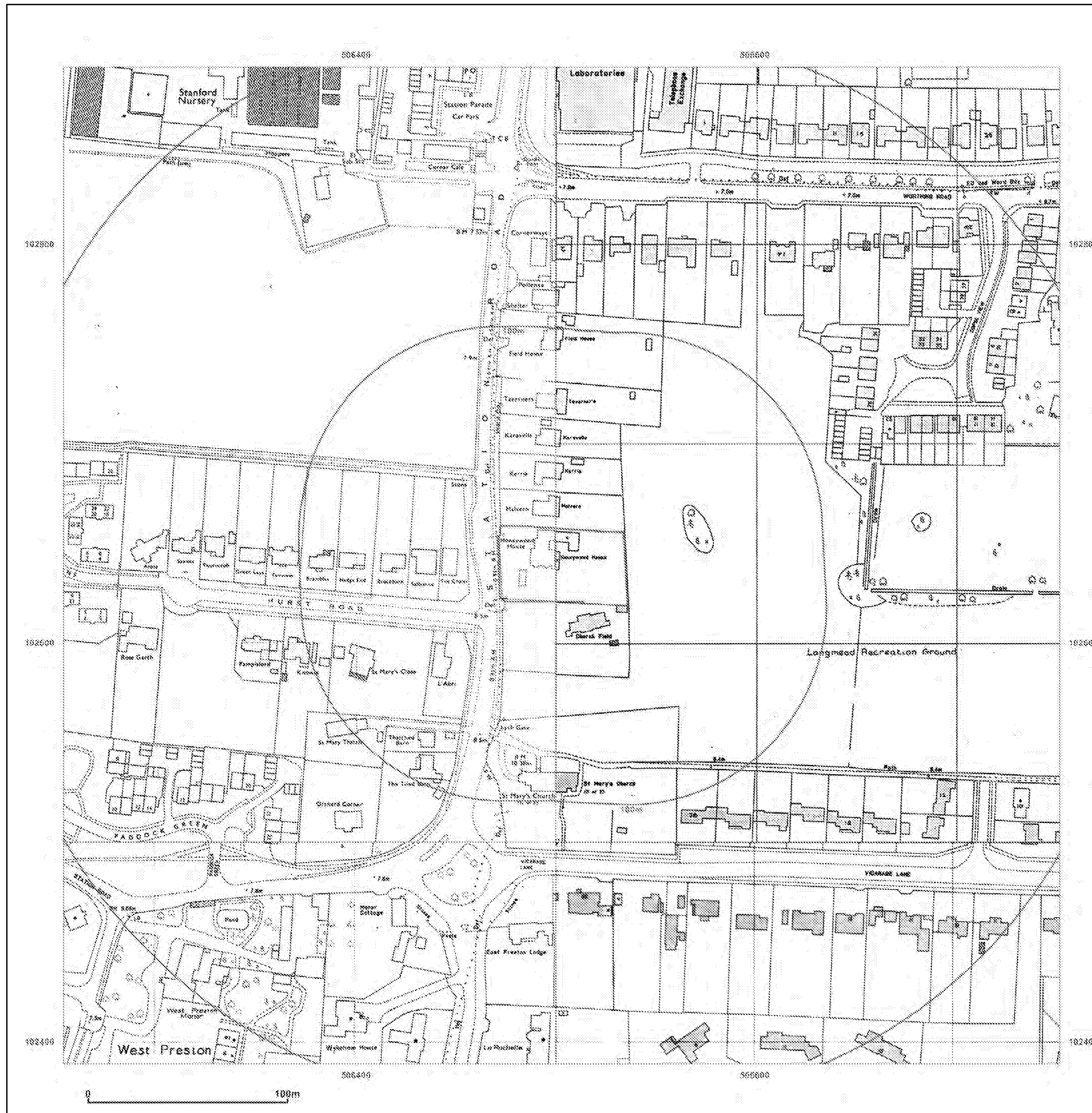


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Client Ref: EMS_271584_366260

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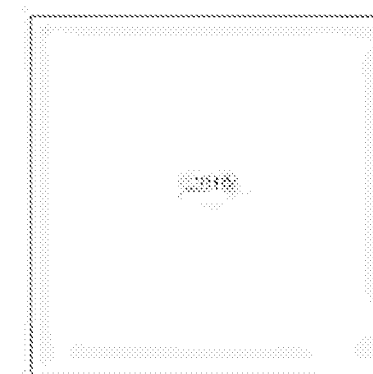
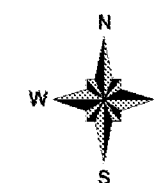
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Map Name: National Grid

Map date: 2014

Scale: 1:10,000

Printed at: 1:10,000



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