

Report type:	Site Appraisal
Site:	Calder Vale Business Park, Simonstone Lane, Burnley
Clients Agent:	The Alan Johnston Partnership
Ref:	GRM/P5467/F.1
Date:	May 2011

Site Appraisal for
Calder Vale Business Park, Simonstone
Lane, Burnley

SUMMARY OF RECOMMENDATIONS

Where further assessment is required it is indicated with a "Y" in the right hand column		
Proposed Development	New build industrial / commercial units.	N
CONTAMINATION ASSESSMENT - REMEDIATION / WASTE DISPOSAL		
End Users	None required – hard standing over all development area.	N
Site Workers	None - other than enforcement of PPE.	N
Construction Materials	Upgraded water pipes will be required.	N
Groundwater	None.	N
Surface Water	None.	N
Waste Disposal (may include soils, asbestos, oil drums, chemical containers, etc)	Client has a duty of care to ensure that all waste is disposed appropriately to a licensed landfill. The landfill receiving the waste may request additional 'WAC' testing analysis. Waste characterisation can only be confirmed by the landfill site.	
GEOTECHNICAL ASSESSMENT – FOUNDATIONS		
Ground Treatment Required	Excavation and re-compact beneath proposed buildings. Working platform for piling rigs. Possible drill and grout program dependant upon finding of rotary drilling program.	Y
Main Bearing Strata	Glacial Till.	N
Nett Allowable Bearing Pressure	Variable depending on depth, minimum 110kN/m ² .	Y
Tree Influence	Low.	N
Volume Change Potential	Low.	N
Likely Foundation Types	Pad and Piles.	Y
Likely Foundation Depth Range	0.9m to 3.0m for pads. Estimated to be between 10-15m - to be confirmed by specialist piling contractor when loads are known.	N
Excavation Hazards	Sub-structures; obstructions in made ground; shallow perched groundwater.	N
Floor Slab Types	Generally ground bearing.	N
Gas Protection Requirements Radon and/or Landfill	Gas monitoring on-going – currently gas protection against methane and carbon dioxide is required. No radon protection required.	Y
GEOTECHNICAL ASSESSMENT - GENERAL		
Slope Stability Risk	Low.	N
Soakaways Potential	Not suitable.	N
New Access Roads	Observational CBRs: made ground: <2%, natural clay: 2-5%.	Y
Buried Concrete Class	DS - 1; AC- 1.	N
Retaining Walls	Small existing. Possible future.	N
Other Comments	Assume drill and grout program to stabilise shallow coal workings. Ecological Survey – badger set.	Y

This summary is based on the full report that provides the detailed assessment of the ground risks affecting the development and how to manage them. It should not be used in isolation.

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1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Limited (GRM) has been appointed by The Alan Johnston Partnership (Client's Agent) on behalf of Fort Vale Engineering Ltd (Client) to undertake a Phase II Site Appraisal on land off Simonstone Lane, Simonstone, near Burnley. A desk study assessment (Phase I) for the site area has previously been carried out by GRM (GRM/P5467/DS.1), dated April 2011.

The Client proposes to redevelop the site with a number of industrial/commercial properties and associated areas of hard standing; as such the scheme does not include many areas of soft landscaping. A plan of the proposed development is presented in Appendix A.

A rotary drilling program is currently on-going at the site to determine the risk posed to the development from shallow coal / unrecorded shallow mine workings. A separate letter report will be produced detailing the findings of rotary drilling program. All recommendations and conclusions contained within this report are subject to revision depending on the findings of the rotary drilling program.

The Client has not made GRM aware any specific potential development hazards but has provided copies of the following reports:

- Phillips UK, Simonstone Glass Factory – Environmental Audit and Site Investigation, Wardell Armstrong, Report Ref LE02424/01, dated April 2001.
- LG Phillips, Simonstone Site – Desk Study, Bullen Consultants, Report Ref HMC/104B101/Re01, dated September 2004.
- LG Phillips, Simonstone Site – Ground Investigation, Bullen Consultants, Report Ref AA/104B101/01/A, dated June 2005.
- Proposed New Building, Fort Vale Engineering, Calder Works, Simonstone Lane, Burnley, BB12 7NL – Desk Study, Worms Eye Geotechnical, Report Ref GGC/DL/fortvaleBB12 7NL/dsk07, dated January 2007.
- Proposed Corporate HQ, Fort Vale Engineering, Calder Works, Simonstone Lane, Burnley, BB12 7NL – Intrusive Report, Worms Eye Geotechnical, Report Ref GGC/DL/fortvaleBB12 7NL/intr07, dated February 2007.
- Proposed Corporate HQ, Fort Vale Engineering, Calder Works, Simonstone Lane, Burnley, BB12 7NL – Gas Issues, Worms Eye Geotechnical, Report Ref DL/lw/let.07, dated June 2007.
- Proposed Steel Store, Fort Vale Engineering, Calder Works, Simonstone Lane, Burnley, BB12 7NL – Desk Study, Worms Eye Geotechnical, Report Ref GGC/DL/fortvaleBB12 7NL/dsk07, dated October 2007.
- Fort Vale Engineering, Simonstone – Preliminary Ground Conditions Summary Report, AECOM Environment, Report Ref 60161156, dated February 2011.

This site appraisal is intended to provide information that will assist decision making by identifying and recommending solutions to ground engineering and contamination issues.

GRM Standard Limitations of Reporting are provided on the back cover of this report.

Significant Features identified by Client's Agent:
None

1.2 OBJECTIVES OF THE SITE APPRAISAL

The Client's specific requirements were to undertake a site appraisal investigation in accordance with the supplied quotation.

The principal aims of the Phase II Site Appraisal are as follows:

- a) Obtain information about the soil and groundwater conditions within the area of the site.
- b) Determine the possible ground related geotechnical and contamination hazards within the site boundaries that may affect the proposed development.
- c) Provide preliminary development recommendations.
- d) Provide advice on further works required for the cost-effective reduction of risks to the development and procedures likely to satisfy regulators.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 SUMMARY PHASE I DESK STUDY AND SITE OBSERVATIONS

- The site is located to the west of Simonstone Lane 500m south of the centre of Simonstone Village, approximately 7km west of Burnley town centre. The National Grid Reference (NGR) for the approximate centre of the site is SD773334. Site Location and Boundary Plans are provided in Appendix B.
- The site covers an area of approximately 10ha hectares and comprises an irregular shaped plot.
- The site generally slopes gently down to the south. The central area (where the majority of the former buildings were present) has been built up to form a flat terrace, which results in a small slope (approximately 1.5m high) at its edge. In addition, some of the soft landscaping in the north eastern corner of the site is also raised.
- The southern site area contains the main existing production building (metal fabrication), two connected office buildings and associated storage areas. Where buildings are not present, this area of the site is covered with a mixture of tarmacadam, concrete and soft ground (demolition waste). The central, northern and eastern areas of the site are mostly post demolition land; with the former structures being demolished to ground level (the concrete floor slabs and substructures are still visible). The sub-structures are associated with some fairly large buildings and structures (i.e. six storey buildings and chimneys) and so are likely to be significant in size. The north western part of this area contains some metal clad storage sheds and a gas compound, whereas the far northern and eastern parts contain soft landscaping. GRM have been made aware of the presence of former tanks (now removed) in the south eastern corner of the main former structure. A fairly large stockpile of demolition waste is present to the south of the position of the main former structure. Where concrete floor slabs and substructures are not present, these areas of the site are covered by soft ground (grass and made ground), tarmacadam (access roads) and paving. The western area of the site is rough scrubland, which contains some large stockpiles of demolition waste. A brook flows south just beyond the western boundary and a badger set was noted along side it.
- The earliest available map (1891/1892) shows the site to be mainly undeveloped and forming part of three large fields. A property 'Meadow Top' is present in the northern area of the site. The northern site boundary is formed by a railway line, a brook (later named Simonstone Brook) forms part of the western boundary, the remainder of the western boundary and the southern boundary are not formed by any physical feature. The eastern boundary is formed by a road (later recorded as Simonstone Lane). The area surrounding the site is predominately undeveloped. The brook on the eastern boundary flows to the south west in to the River Calder, which at its nearest point is present 200m from the site. The map for 1912 shows Calder Colliery directly to the south of the site with what appear to be spoil heaps crossing the boundary on to the southern site area, the colliery site is shown to include shafts, chimneys and tanks. Further to the south Altham Bridge Pumping Station is shown, this complex includes tanks and chimneys. The colliery spoil heaps have extended on to site on the map for 1931. The colliery is shown to be disused from 1959 onwards and the pumping station is no longer labelled. The first industrial building is shown on site from 1959 onwards, initially only a large

building (at the approximate location of the current building) is shown; however, by the map for 1975 a larger building is shown to occupy the northern area, two chimneys are shown to form part of this structure and a tank farm is present in the north east of the site. The map for 1983 shows two water features in the western site area. No further significant changes are shown to the site until the most recent map for 2011 on which the buildings in the northern site area have been demolished (as noted during the walkover). With the exception of a works, later named business park, which was developed to the east of the site in the 1960s the area surrounding the site, has remained largely undeveloped. Copies of the relevant OS Historical maps are presented in Appendix C.

- The site is reported to be underlain by superficial Glacial Till and Alluvium. The Alluvium is illustrated adjacent to Simonstone Brook in the western section of the site and on the southern area where it is associated with the River Calder. The Glacial Till is likely to comprise gravelly clay and the Alluvium is likely to comprise a mixture of clays, silts, sands and gravels.
- The solid geology is indicated as the Pennine Lower Coal Measures Formation (generally mudstone, siltstone and sandstone and subordinate coal seams). The Arley Mine Coal Seam is shown to sub-crop below the south western section of the site. The local dip is not shown on the geological map but given the local stratigraphy it is assumed to dip to the southwest and as such the Arley Seam should not be present under the majority of the site; however, the geological map only reports an inferred location for the sub-crop and as such the Arley Seam could be present under a greater proportion of the site. No faults are shown to affect the site.
- Previous ground investigations indicate that the ground conditions comprise variable made ground to depths of up to 5m below existing ground level (begl), soft alluvial clay to depths of up to 6m begl, stiff glacial clay to depths of up to 14m (begl) overlying mudstone.
- The Environment Agency has classified the Alluvium and Pennine Lower Coal Measures below the site as Secondary A aquifers (formerly minor aquifer) and the Glacial Till as Unproductive strata. A copy of the relevant environmental data is presented in Appendix D.
- The site is not recorded to be within a groundwater protection zone; however, a potable groundwater abstraction is present 86m south of the site at Altham Bridge. There are a further two abstractions (process water) located 317m south of the site. At this stage the nearest abstraction point is considered a potential receptor.
- The previous investigations have encountered water strikes at depths of <5m in the made ground, 3-5m in the Alluvium and 13m-14.5m in the Glacial Till.
- Simonstone Brook forms part of the western boundary, and flows to south and joins the River Calder, which at its nearest point, is present 200m south of the site. There are four surface abstraction licenses within 1km of the site; these are located 975m from the site and as such are not considered to be potential receptors.
- The Coal Mining Report (presented in Appendix E) indicates that the site is in the likely zone of influence from workings in one seam of coal at 270m to 320m depth which was last worked in 1955; any ground movement from these coal workings should have stopped by now. The report does not highlight any shafts

near the site. The report does indicate that the site is in an area where the Coal Authority believes there is coal at or close to the surface which may have been worked at some time in the past. These comments relate to the Arley Mine Seam reported to sub-crop below the site. It is considered that the Arley Mine coal seam may sub-crop below the south western section of the site and as the local dip direction is to the south west it shouldn't be present below the majority of the site; however, probe drilling will be required to confirm this assessment.

- There are a number of records relating to environmental permits, incidents or registers within 500m of the site; the majority of these are off site and are considered not to pose a risk to it. There are two records of radioactive substances storage on site, this will have been low level material and as such is not considered to pose a risk. There are two recorded pollution incidents on site, both are considered not pose a significant risk.
- There are eleven records relating to waste sites within 1km of the site; these include off site land fills and waste transfer sites. A historical landfill is recorded on site; this is noted as receiving inert, industrial, liquid sludge waste and is centred on the former lagoons in the western section of the site.
- There are a number of entries relating to current land use within 250m of the site; these include the on site works and a number of low risk operations off site.
- A badger set was noted during the site walkover.
- No radon protection measures required.
- Potential contaminants of concern include metals, inorganics, speciated PAH, hydrocarbons. There is the potential that asbestos containing materials could have been mixed up with made ground, following the demolition works.
- Ground gas associated with any made ground has been highlighted as a potential hazard.

2.1 SUMMARY OF IDENTIFIED SIGNIFICANT FEATURES

Potential hazards have been identified in earlier sections and are now summarised in tabular form, with their consequences and possible risk management actions.

Potential Hazard	Potential Consequence	Action
Badger set	Protection zone	Ecological survey
Live services	Excavation hazard	Disconnection or diversion
Shallow coal	Drill and grout treatment	Ground investigation
Former structures and substructures	Deepened foundations, upgraded floor slabs	Ground investigation
Variable low strength soils (Alluvium)	Deepened foundations, upgraded floor slabs	Ground investigation
Shallow ground water	Excavation hazard / low bearing capacity, upgraded floor slabs	Ground investigation
Secondary A Aquifers	Potential receptor	Ground investigation, chemical analysis and risk assessment
Simonstone Brook and River Calder	Potential receptor	Ground investigation, chemical analysis and risk assessment
Past use, onsite made ground	Potential source of contamination and ground gas	Ground investigation, chemical analysis and risk assessment
Former landfill (sludge beds)	Potential source of contamination and ground gas	Ground investigation, chemical analysis and risk assessment
Colliery spoil tip	Potential source of contamination and ground gas	Ground investigation, chemical analysis and risk assessment

2.2 PHASE I CONCEPTUAL MODEL

HUMAN HEALTH			
Potential Source	Potential Pathway	Potential Receptor	Potential Solution
Contaminated made ground associated with former use.	Indoor and outdoor inhalation of soil dust, ingestion and dermal contact with contaminated soil and soil dust (reduced by lack of soft landscaping).	End users and construction workers.	Capping of soft landscaped areas.
Ground gas associated with onsite made ground and natural strata.	Inhalation.	End users of the completed development.	Basic gas protection measures.

CONTROLLED WATERS			
Contaminated made ground associated with former use.	Infiltration (pathway reduced post construction).	Secondary A Aquifer and surface water features.	Source removal.

CONSTRUCTION MATERIALS			
Contaminated made ground associated with former use.	Migration of contamination through leaks and joints, degradation of pipe materials.	Water pipes.	Upgraded water pipes.
Acidic ground conditions and/or elevated levels of sulphate.	Direct Contact.	Buried concrete.	Appropriate concrete specification.
Ground gas associated with onsite made ground and natural strata.	Migration in to building.	Buildings.	Basic gas protection measures.

3 PHASE II GROUND INVESTIGATION

3.1 FIELDWORK

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection, past ground investigation information and the proposed development layout. All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

This report encompasses the combination of window sampling and cable percussive drilling undertaken during the period 11th to 17th April. Rotary open- hole drilling to determine the presence and effect of shallow coal seams and / or unrecorded old mine workings beneath the site is currently on-going and a separate letter report will be issued detailing the findings.

A total of twenty five exploratory holes were undertaken; comprising fifteen window samples holes, drilled to a maximum depth of 5m begl, and ten cable percussive boreholes to a maximum depth of 12.3m. The Exploratory Hole Location Plan and Exploratory Hole Logs are presented in Appendix F and Appendix G respectively.

The window sampling was conducted on the 12th and 13th April and the cable percussive drilling between the 11th and 17th April 2011 with groundwater/gas monitoring visits continuing after that period.

Samples not used for testing will be stored for a month after issue of this report and then disposed of, unless the client requests in writing that they be kept.

3.2 MONITORING INSTALLATIONS

The gas monitoring programme has been designed to broadly comply with the recommendations outlined in CIRIA Report C665 'Assessing risks posed by hazardous ground gas to buildings' (2007).

As the proposed land use is classed as low sensitivity (commercial / industrial) eight gas monitoring standpipes have been installed across the site (WS2, WS4, WS10, WS12, WS13, WS15 and BH9 and BH10). The 35mm standpipes have been installed in window sampling boreholes targeted at the made ground and natural strata. 50mm standpipes have been installed in the cable percussive holes targeted at the deeper groundwater strikes.

As the gas hazard is considered low (limited made ground), the monitoring program would normally comprise six visits over three months. Therefore, only an initial assessment of the local gas regime has been undertaken at this stage and further

visits will be required to complete the monitoring program. A separate gas addendum letter report will be issued following the completion of the full monitoring program.

The post fieldwork monitoring has been designed to identify and assess the groundwater and gas regimes below the site. The gas monitoring has been undertaken using an LMSxi Multifunction Gas Analyser. The results are presented in Appendix H.

3.3 PROVEN GROUND

The following ground conditions were encountered during the investigation fieldwork:

- Re-laid Topsoil
- Made ground
- Alluvium
- Glacial Till
- Weathered Coal Measures
- Coal Measures

3.3.1 Re-laid Topsoil

The re-laid topsoil material was encountered in six exploratory holes (WS1, WS13, WS14, WS15, BH1 and BH10). The material encountered generally comprised a brown and locally mottled orange-brown silty slightly sandy clay with rare fine to medium subangular gravel including quartz and sandstone. The re-laid topsoil thickness was approximately 0.25m.

3.3.2 Made Ground

Types of Made ground

Three types of made ground were observed:

Made ground A generally comprised a red-brown and brown slightly silty fine to coarse sand and fine to coarse angular to subangular gravel including brick and concrete. Where present the material ranged in thickness from 0.5m to 2.9m, with an average thickness of approximately 1m.

Made ground B generally comprised a grey-brown clayey sandy fine to coarse angular gravel including limestone and occasionally concrete. Where present the material ranged in thickness from 1.3m to 2.3m, with an average thickness of 1.7m.

Made ground C varied from a grey silty fine to medium sand to a grey-brown silty very finely laminated clay. Where present the material ranged in thickness from 2.7m to 3.3m, with an average thickness of 2.0m.

Possible Sources of Made Ground

Made ground A generally comprised material representative of demolition rubble and is considered likely to have been generated by on-site activities. Made ground B comprises a sub-base type material and is considered likely to have been imported

for the purposes of creating a suitable sub-grade beneath areas of hard standing and made ground C is considered likely to have been generated as a waste material from on-site industrial processes.

Distribution of Made Ground Types

Made ground A, had the widest distribution of the made ground types and was observed in eighteen of the exploratory holes. The made ground was generally confined to the northern three-quarters of the site and largely within the footprint of the former buildings. WS12, located in the south western site area, was also within the footprint of a former building. The made ground material was found to overlie natural strata.

Made ground B was observed to have a restricted distribution and was encountered in WS11 and BH8 & BH9. All of the aforementioned exploratory holes were located in the south western site area and within the tarmac surfaced storage area of the existing factory.

Made ground C was observed to have a restricted distribution and was encountered only within WS13 and WS14 both located close to the central western site boundary. From the nature of the material it is considered likely that the made ground is the product of former settlement lagoons in the area.

3.3.3 Alluvium

The alluvial deposits varied from a grey-brown clayey, silty fine to medium organic SAND to a grey-brown sandy silty organic CLAY. The alluvial deposits were restricted to the western third of the site, corresponding to the presence of the adjacent, off-site, water courses (Simonstone Brook / River Calder). Where present the material ranged in thickness from 0.1m to 3.25m, with an average thickness of 1.7m. Strengths varied from very loose to loose (granular) and from soft to firm (cohesive).

3.3.4 Glacial Till

The Glacial Till was generally encountered as a dark brown silty slightly sandy CLAY with much fine to coarse subrounded to subangular gravel including sandstone, granitic material and mudstone. Strengths varied from firm to hard, but were generally stiff.

In WS1 (1.6m-2.1m), WS2 (0.9m-1.0m), WS10 (1.8m-2.6m), BH1(0.2m-4.0m), BH4 (2.9m-3.9m), BH8 (2.9m-7.1m), BH9 (2.7m-6.8m) and BH10 (6.4m-12.2m) the Glacial Till was observed to be granular in nature. Strengths within the granular material varied from medium dense to very dense, but were generally dense.

The Glacial Till was observed in seventeen of the exploratory holes and varied in thickness from 0.5m to 7.9m, with an average thickness of 4.2m.

3.3.5 Weathered Coal Measures

These deposits were encountered within three of the cable percussive holes: BH3, BH9 and BH10 and generally comprised a stiff to hard clay, although in BH10 a

dense brown slightly sandy fine to coarse subangular GRAVEL of sandstone was observed.

3.3.6 Solid Strata

Strata representative of the Coal Measures strata were encountered in four of the cable percussive holes: BH3, BH4, BH6 and BH10 and comprised a strong fine to medium grained SANDSTONE.

3.4 GROUNDWATER

3.4.1 Groundwater Initial Observations

Within the window sample holes evidence of groundwater was observed by virtue of the soils being wet or damp. However, the exploratory technique used was rapid and may have masked small water seepages. In addition, groundwater was struck in a number of the cable percussive boreholes. A summary table of the initial water observations is presented below.

Exploratory Hole Number	Depth (m) to water
WS1	Wet at 0.9
WS4	Damp at 2.4
WS5	Damp at 1.6
WS10	Wet at 2.0
WS11	Wet at 2.3
WS12	Wet at 2.2
WS13	Wet at 1.0
WS14	Wet at 1.0
BH3	Strike at 3.6
BH4	Strike at 4.9
BH6	Strike at 1.9
BH7	Strike at 2.7
BH8	Strike at 2.7
BH9	Strike at 2.8 & 12.0
BH10	Strike at 1.5, 8.1 and 10.9

3.4.2 Groundwater Monitoring Observations

The results of monitoring are reported in Appendix H. In summary standing water was encountered between 0.9m and 12m (monitoring on going).

3.4.3 Groundwater Regime

The water encountered within the window sample holes and at shallow depth (<10.9m) in the cable percussive boreholes during the investigation is considered to be from perched volumes either at the made ground / natural interface or within the Alluvium or Glacial Till and not representative of the regional groundwater table.

The water strikes recorded in BH9 and BH10 at 12.0m and 10.9m respectively are considered likely to be representative of the regional groundwater table.

The Glacial Till deposits encountered across the site has been proven to be largely cohesive in nature although inconsistent granular horizons have been observed as listed in Section 3.3.4. The groundwater in the Secondary A aquifer (Lower Pennine Coal Measures) is considered unlikely to be in hydraulic continuity with the observed perched water due to the presence of the considerable thickness of natural cohesive material (Glacial Till) acting as an aquiclude.

Long term monitoring of groundwater levels has not been conducted as part of this investigation and interpreted levels are approximate and will be dependent on seasonal variations.

3.5 CONTAMINATION OBSERVATIONS

Traditional indicators of soils contamination (ash and clinker) were not observed during the fieldworks or detailed logging and no visual or olfactory evidence of potential contamination was encountered during the fieldwork and monitoring.

3.6 GROUND GAS

3.6.1 Landfill Type Gases and Vapours

The potential sources of ground gas are reported in the desk study and the rationale for the number of gas standpipes and the length of the monitoring programme is discussed in section 3.2. Gas monitoring is currently on-going and a complete assessment of the ground gas regime will be reported at a later date. The gas monitoring results to date, are presented in Appendix H.

In summary methane of up to 6.1%v/v, carbon dioxide of up to 5.5%v/v and oxygen as low as 3.4%v/v has been recorded. No flow was recorded during the monitoring completed to date. The results suggest that the gas being generated is likely to come from the made ground. See section 4.2.5 for an analysis of the results.

3.6.2 Radon Gas

The desk study risk assessment determined that no radon protection measures are required. Observations during fieldwork confirm that this assessment should not be altered.

3.7 SUMMARY OF FIELDWORK OBSERVATIONS

The fieldwork has revealed/confirmed the following potential hazards, receptors and sources that were not identified during the desk study, but which should be included when assessing the site.

Significant Features identified during fieldwork

Deep made ground – geotechnical hazard (deepened foundations)
Soft made ground / alluvial deposits – geotechnical hazard (deepened foundations)
Variable ground - geotechnical hazard (deepened foundations)
Shallow perched water - geotechnical hazard (reduced bearing capacity in granular soils)

3.8 LABORATORY ANALYSES AND MONITORING RATIONALE

3.8.1 Chemical Laboratory Analysis

Chemical laboratory analyses were selected to provide the parameters necessary to make an initial assessment of potentially contaminated soils and/or waters, for the budgetary design of the development. The choice of contamination testing was based on the Phase I assessment, identified past use of the site and site observations. In summary the chemical analysis comprised:

- Fifteen samples for a general screening suite (metals, inorganics and speciated PAH).
- Fourteen samples for TPHCWG.
- Fifteen samples for potential asbestos fibres.
- Nine samples for soil leachate.

Various other potential contaminants identified in earlier work have been ruled out of the testing suites. These include:

- VOCs and SVOCs as no tell tale odours were detected.
- PCB's as no potential source has been identified.

pH and water soluble sulphate testing was conducted as part of the chemical analysis suite to determine how aggressive the ground and/or waters are to buried concrete.

The chemical laboratory analysis results are presented in Appendix I.

3.8.2 Geotechnical Laboratory Testing

Geotechnical soils testing has been undertaken as part of the ground investigation including the following:

- Seven Atterberg Limits (PI) classification
- Eight pH and water soluble sulphate testing
- Two Undrained Triaxial tests

Geotechnical laboratory tests were selected to provide the parameters necessary for the budgetary design of the development including foundations and infrastructure. Geotechnical laboratory test results are presented in Appendix J.

4 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH

4.1 INTRODUCTION

The Client proposes to redevelop the site with a number of industrial/commercial properties and associated areas of hard standing.

Various sources of contamination have been put forward in earlier text and summarised in the initial conceptual model. The material on site identified as being the most likely to be contaminated is the made ground.

Representative samples of all strata and those considered to be potentially contaminated by virtue of the desk study and/or based on site observations were collected for further examination and/or potential testing.

Guidance contained in the Environment Agency's CLEA Report has been used to assess the risks posed to human health. For this assessment it is considered that the default Tier 1 Assessment Criteria (TAC) for 'commercial and industrial' land use is appropriate when assessing the risks posed to human health.

The TAC used by GRM include Soil Guideline Values (SGV) published by the EA, values calculated by GRM using the CLEA v1.06 risk assessment and values and chemical data developed by LQM/CIEH. The TAC used in the assessment of the site is presented in Appendix K.

To assess the risks posed by ground gases such as radon, carbon dioxide and methane, the relevant current guidance has been used. For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (BR211: 2007)'. See Sections 2.0 and 3.6.2 of this report. For methane and carbon dioxide the primary guidance document used to determine if protection measures are required is CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings' (2007). This uses Gas Screening Values (GSVs), which are gas concentrations multiplied by borehole flow rate, along with additional limiting factors (such as maximum methane concentrations) to classify the gas regime of a site.

The guidance document includes two methods of characterising a site. The main method 'Situation A' is based on work by Wilson and Card and is used for all types of development except low rise housing that meets the assumptions of 'Situation B'. The 'Situation B' method proposed by Boyle and Witherington for the NHBC assumes all properties have pre-cast suspended floors (beam and block) with ventilated underfloor voids.

For this site, as the development is not low rise housing, the risk from ground gases has been assessed using 'Situation A'.

4.2 RISK TO END USERS

The chemical analysis test results on soils are presented in Appendix I.

Three separate types of made have been identified during the ground investigation.

- Made ground A generally comprised a red-brown and brown slightly silty fine to coarse sand and fine to coarse angular to subangular gravel including brick and concrete.
- Made ground B generally comprised a grey-brown clayey sandy fine to coarse angular gravel including limestone and occasionally concrete.
- Made ground C varied from a grey silty fine to medium sand to a grey-brown silty very finely laminated clay.

Sufficient samples have been analysed to categorize the site.

4.2.1 Analysis of Soil Contamination Data

All of the contaminants tested for had concentrations below the relevant TAC for industrial/commercial developments. No remedial works are considered to be necessary.

4.2.2 Analysis of Petroleum Hydrocarbon Contamination Data

Evidence of petroleum hydrocarbon contamination was not observed in the exploratory holes. However, fourteen samples of the made ground were tested for banded TPH as a precautionary measure so that the risk to end users could be assessed.

The sample analysis did not reveal elevated concentrations of petroleum hydrocarbons in excess of the relevant TAC for industrial/commercial development. It is therefore considered that there is no significant risk posed to end-users from petroleum hydrocarbons.

4.2.3 Analysis of Asbestos Contamination Data

Given the industrial heritage of the site fifteen samples of the made ground were analysed for the presence of asbestos fibres. None of the samples analysed reported the presence of asbestos fibres. It is therefore considered that there is no significant risk posed to end-users from asbestos fibres.

4.2.4 Radon

Radon gas assessments have been made in earlier sections. There is deemed to be no significant hazard posed by this gas. Accordingly, it is considered that no radon protection measures are required for the development.

4.2.5 Harmful Soil and Landfill Gases

The gas monitoring results are summarised in section 3.6.1 and are presented in full in Appendix H. As discussed in section 4.1 the site is being assessed using 'Situation A' as described in CIRIA C665.

To produce a positive result a default flow rate of 0.1l/hr has been used in the following assessment.

Using the default flow rate of 0.1l/hr and the maximum methane concentration of 6.1%v/v, a GSV of 0.0061l/hr has been calculated for methane. Using the same flow rate the maximum carbon dioxide concentration of 5.5%v/v equates to a GSV of 0.0055l/hr. These levels would normally fall in to 'Characteristic Situation 1' as the GSV is <0.07l/hr; however, as the level of methane is >1% and carbon dioxide is >5% the site has been assessed as 'Characteristic Situation 2' as outlined in table 8.5 of CIRIA C659.

Therefore, based on the information obtained to date it is considered that gas protection measures are required for the proposed development. See section 8.1.5 for recommended gas protection measures.

Gas monitoring is currently on-going at the site and a complete assessment of the ground gas regime will be reported at a later date. Further gas monitoring will be required by the Local Authority to confirm that the recommended gas precautions are adequate.

4.2.6 Summary of Risk to End Users

In summary, based on the proposed industrial/commercial end use of the site, the risk to end users from soil contamination is considered to be negligible.

At this stage there is considered to be a moderate risk posed to the development from landfill type ground gases (i.e. methane/carbon dioxide). However, further gas monitoring will be required to confirm this assessment to satisfy the Local Authority.

4.3 RISK TO SITE WORKERS

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

As the proposed development entails demolition and dismantling of existing structures on the site such works must be conducted to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any further demolition. Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

5 QUANTITATIVE RISK ASSESSMENT - CONTROLLED WATERS

5.1 INTRODUCTION

When assessing the risk to Controlled Waters, leachate and groundwater testing is normally carried out. The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the soil leachate test results.

The most sensitive receptors are considered to be the Simonstone Brook forming part of the sites western boundary and the River Calder, located beyond the southern site boundary, and, therefore, the EQS are the most appropriate for this site. However, the risk to the underlying Secondary A aquifers (Alluvium and Lower Pennine Coal Measures) have also been considered. Initial Tier 1 screening values are presented in Appendix K.

5.2 ASSESSMENT OF THE CHEMICAL ANALYSIS RESULTS

Recorded concentrations of almost all contaminants are below the EQS thresholds. However, the following were recorded at levels in excess of the relevant EQS:

Arsenic - Recorded concentrations of 24.9µg/l in WS4 at 0.6m-0.7m, 12.6µg/l in BH4 at 0.5m-1.0m, 56.4µg/l in BH7 at 0.5m-1.0m and 17.4µg/l in BH10 at 2.0m-2.45m exceed the EQS of 10µg/l.

Mercury - Recorded concentration of 3.6µg/l in BH10 at 2.0m-2.45m exceeds the EQS of 1µg/l.

Benzo(a)pyrene - Recorded concentration of 0.02µg/l in WS1 at 0.05m-0.15m exceeds the EQS of 0.01µg/l.

Combined PAHs - Recorded concentration of 0.18µg/l in WS1 at 0.05m-0.15m and 0.16µg/l in WS14 at 0.05m-0.15m exceed the EQS of 0.1µg/l.

There is the potential for contaminants to migrate towards the identified surface receptors through over-land flow. However, it is considered that such migration would only occur during periods of heavy rainfall resulting in the mass flow of water. It is considered that this would dilute any potential contamination to a sufficient level to not pose a risk to the identified receptors. The underlying geology (Glacial Till) has been proven to be predominately cohesive in nature and so it is considered highly unlikely that a clearly identifiable and consistent pathway between the site and the underlying Secondary A aquifers will exist.

5.3 SUMMARY OF RISK TO CONTROLLED WATERS

The risk to the Simonstone Brook and the Secondary A aquifers (Alluvium and Pennine Lower Coal Measures) is assessed as very low as is the risk to the identified groundwater abstraction point, located 86m to the south. Remediation should not be required to protect them from the levels of contaminants present.

6 QUANTITATIVE RISK ASSESSMENT - CONSTRUCTION MATERIALS

6.1 INTRODUCTION

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010 (extract included in Appendix K), for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

6.2 WATER SUPPLY PIPES

Locally, the recorded concentrations of pH (WS1 at 0.05m-0.1m) and petroleum hydrocarbons (WS4 at 0.6m-0.7m and WS15 at 0.9m-1.0m) exceed the acceptable levels listed in the WRAS documentation. Contaminant concentrations recorded are such that plastic MDPE water supply pipes may not be acceptable to the water supply company. Other options such as metal (copper) pipes or Durapipe Protecta-Line System or similar, may be required.

The local water supply company should be contacted to determine its exact requirements in respect of the levels of contamination encountered.

6.3 BURIED CONCRETE

Based on the results of the pH and water soluble sulphate testing and a review of the strata encountered, in accordance with the requirements of BRE Special Digest 1 (2005), the Design Sulphate Class for the site should be assumed as DS-1 and the ACEC Class as AC-1. For unreinforced trench-fill foundations with a width of greater than 450mm, the classifications above equate to a concrete designated as GEN1 in BS8500 and RC35 for reinforced foundations.

Sulphate and pH results are presented in Appendices I and J.

7 PHASE II CONCEPTUAL MODEL

7.1 SOURCE – PATHWAY – RECEPTOR

The intrusive investigation has revealed that the made ground / natural soils across the site are not significantly contaminated with toxic metals, PAH or Petroleum Hydrocarbons. Gas monitoring is currently on-going and elevated concentrations of methane and carbon dioxide have been recorded. No evidence of asbestos fibres mixed with the underlying soils has been identified on the site.

Development proposals have been confirmed as including the new build of a number of industrial / commercial units together with associated parking/servicing areas. No areas of soft landscaping are currently indicated.

The primary human health receptors are end users of the completed development and construction workers. The pathways of concern include dermal contact with contaminated soil and soil dust, the ingestion of contaminated soil and soil dust, indoor and outdoor inhalation of ground gas and soil vapours.

For controlled waters the identified receptors include the Simonstone Brook, the River Calder together with the Secondary A aquifers (Alluvium and Lower Pennine Coal Measures) below the site. Soil leachate test results have identified minor amounts of leachable contaminants. However, the near surface soils are cohesive in nature and will severely restrict the migration of any contamination.

The concentrations of pH and petroleum hydrocarbons compounds exceed the threshold for water pipes. Specifications for buried concrete have been made in light of the reported pH and water soluble sulphate concentrations.

Considering the above, it is considered that the site poses a low risk to end users, controlled waters and construction materials.

The pollutant linkage model is illustrated in detail on the following page.

7.2 POLLUTANT LINKAGE MODEL

HUMAN HEALTH			
Potential Source	Potential Pathway	Potential Receptor	Potential Solution
None.	Indoor and outdoor inhalation of soil dust, ingestion and dermal contact with contaminated soil and soil dust (reduced by lack of soft landscaping).	End users and construction workers.	None required.
Ground gas associated with onsite made ground and natural strata.	Inhalation.	End users of the completed development.	Gas protection measures required. Level of precaution to be confirmed following completion of monitoring program.

CONTROLLED WATERS			
Contaminated made ground associated with former use.	Infiltration (pathway reduced post construction).	Secondary A Aquifer and surface water features.	None required.

CONSTRUCTION MATERIALS			
Contaminated made ground associated with former use.	Migration of contamination through leaks and joints, degradation of pipe materials.	Water pipes.	Upgraded water pipes.
Acidic ground conditions and/or elevated levels of sulphate.	Direct Contact.	Buried concrete.	Appropriate concrete specification.
Ground gas associated with onsite made ground and natural strata.	Migration in to building.	Buildings.	Gas protection measures.

8 REMEDIATION

8.1 RECOMMENDED RISK REDUCTION AND REMEDIAL MEASURES

8.1.1 Protection of End Users

Based on the recorded levels of contamination across the site and the proposed cover of hard standing no specific remediation will be required (as no pathway will be present).

8.1.2 Protection of Site Workers

The risk to site workers from the soil contamination is low. No remedial measures are required. However, the use of suitable PPE should be enforced during the ground works stage of construction and suitable precautions should be taken during the removal of any asbestos containing materials.

8.1.3 Protection of Controlled Waters

No remediation is required to protect controlled waters (surface or aquifer).

8.1.4 Protection of Construction Materials

Upgraded water pipes are likely to be required. The use of the appropriate concrete specification is recommended.

8.1.5 Remedial Actions for Overall Ground Gas Hazard

Gas monitoring is currently on-going at the site and a complete assessment of the ground gas regime will be reported at a later date. However, an initial assessment of the local gas regime, based on the concentrations recorded to date, is given in section 5.2.3. The site has been classified as 'Characteristic Situation 2' (Situation A); therefore, basic gas protection measures are required.

Based on the available data, suitable gas protection measures would include a reinforced cast in situ floor slab, 2000 gauge damp proof membrane, underfloor venting (pipes) and sealed joints/service entries.

No radon protection measures will be required.

8.2 POST REMEDIATION VALIDATION

Given that the site surface will be exclusively given over to hardstanding, no post remediation validation is anticipated. If subsoil/topsoil is to be imported for future areas of soft landscaping with an existing test certificate, then it is recommended that this be forwarded to GRM to ensure that the material is suitable for use. The test certificate should be for the same suite of contaminants as the GRM soils testing suite, details of which are presented in Appendix I.

8.3 REMEDIATION METHOD STATEMENT

A Remediation Method Statement should not be required. Following your review of this document, we would recommend that a copy of it be forwarded to the Local Authority for comment and approval, prior to commencing development of the site. The Local Authority may choose to include other consultees as part of the planning process (such as the Environment Agency). Consultation should be undertaken at the earliest possible opportunity to avoid abortive or delayed works.

8.4 DISPOSAL AND CLASSIFICATION

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The analysis results presented in Appendix I should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous which is considered unlikely for this site, then the site will need to be registered with the Environment Agency prior to the movement of the waste. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. Likewise making the site as volume neutral as possible will reduce the costs of development.

8.5 SITE WASTE MANAGEMENT PLANS

Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

SWMPs will be a legal requirement for all projects with an overall development cost of over £300k from the 6th April 2008. GRM can assist in the production of SWMPs which comply with the Code of Practice and identify best environmental disposal options when dealing with waste.

9 GEOTECHNICAL ASSESSMENT

9.1 INTRODUCTION

The client has indicated that the proposed development includes the construction of approximately eight new build industrial / commercial units, a new test facility, together with an extension to the existing Fort Vale Engineering Production building. In addition to the new units up to four new service yards and associated car parking areas are proposed.

The finished levels of the proposed development have not been provided by the client. Therefore, for the purposes of this assessment, it is assumed that finished levels will not vary appreciably from the existing ground levels. It has been assumed that any works will not compromise existing foundations or ground stability.

Should the development proposals or finished levels be different from those assumed then the comments/recommendations below may require revising.

9.2 MINING RISK ASSESSMENT

A drilling program comprising twenty rotary boreholes is currently on-going at the site. A letter report detailing the findings will be issued upon completion of the drilling and may entail some revision of the recommendations / conclusions contained in this report.

9.3 ENGINEERING GROUND TREATMENT

The near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should be taken to avoid this, as excessive disturbance may entail more onerous floor slab design, road cap thickness and increased amounts of off site disposal etc.

The near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known. It should be noted that a working platform will be required for the piling works.

The presence of shallow coal / unrecorded shallow mine workings is currently being assessed. At this stage and based on the available geological information the risk posed by shallow coal / old workings is considered to be low to moderate.

9.4 EXCAVATION CONDITIONS

Excavation of the materials encountered during the ground investigation should be achieved using conventional hydraulic excavation techniques. A breaker or similar plant may be required where hardstanding or existing foundations are encountered.

No trial pit stability observations are available. However, based on the results of the window sampling and cable percussive boreholes and observation of similar soils seen on other sites, it is likely that excavations will be generally stable in the short term. Some materials such as granular soils (alluvial deposits) and made ground are

liable to collapse without warning. This situation is likely to be exacerbated by water ingress.

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground, soft and very soft clays and granular soils. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

The observed groundwater conditions suggest that simple dewatering techniques (e.g. sump pumping) will be needed to control water ingress in shallow excavations. The use of full dewatering systems (e.g. well pointing) may be necessary to dewater deeper excavations. Care should be taken to ensure that dewatering does not lead to settlement of soils below existing structures or services on or off-site.

If contaminated water enters excavations it should be removed and transported to an appropriate treatment facility by a suitably licensed carrier before construction begins.

9.5 EXISTING STRUCTURES / SUBSTRUCTURES

There are existing structures on site including the existing Production Building located in the central southern site area and a series of large storage bays along the north western boundary. If encountered and where practical, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There are existing structures and/or infrastructure in close proximity to the proposed development. Foundations or excavations close to existing underground services may require designing to protect the integrity of these structures and features.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing roads and services that are to be retained.

9.6 TREE INFLUENCE ON FOUNDATIONS

The soils (both Glacial Till and Alluvium) below the site are of low volume change potential (see Appendix J). As a result deepening of foundations within the influence of trees will be required, in accordance with, for example, NHBC Standards Chapter 4.2 'Building near trees'.

Heave precautions will be required where the foundations lie within the heave zone of trees as defined in, for example, NHBC Standards Chapter 4.2. Foundations should be remote from the direct action of tree roots, and should not be constructed so close to trees as to significantly damage their root systems.

It is recommended that conventional foundations deeper than 2.5m are designed by an Engineer or a deeper foundation technique such as piling is used. Such design can not be started until a tree survey and proposed site levels are available and could involve detailed desiccation testing to prove safe foundation depths. However, at this stage it is estimated that 10% of the site will have deepened foundations due to trees.

9.7 FOUNDATIONS

Foundations must not be founded in made ground, soft natural strata, all of which should be fully penetrated by all new foundations.

Based on the available Schematic Master Plan (Drawing No. 40020 / SK04 P1, dated 2010) it is anticipated that for Building 1, 2 and the proposed Test Facility the most appropriate foundation solution will be piled foundations and for buildings 3, 4, 5, 6, 7 and 8 the most likely foundation solution will be pad foundations.

Triaxial testing of two samples of the natural cohesive material has indicated undrained shear strengths of between 32kPa and 36kPa (kN/m²) at depths of 4.0m and 10.7m (Appendix J).

Building 1 – The presence of deep soft to very soft made ground has been proven in this area of the site. Due to the potential for shear failure these strata are not considered to be suitable for pad foundations. The penetration of these unsuitable strata to bear on deeper more competent strata would lead to foundations in some cases in excess of 4.5m bgl, through potentially unstable ground.

It is considered that piled foundations will be the most cost effective solution in this area of the proposed development. A specialist piling contractor should confirm the suitability of the ground and advise on the most appropriate pile type and column length. It should be noted that a working platform will be required by the piling contractor.

Building 2 – The natural cohesive material (Alluvium) encountered at anticipated foundation depth (2.4m-3.5m) was generally firm. If the material beneath the entire

footprint of the building is found to be consistently firm then a square pad foundation of 1.5m side dimension, a nett allowable bearing pressure of at least 110kN/m² (locally 150kN/m²) should be available on the these soils.

It should be noted that the alluvial deposits encountered during the investigation were variable in terms of thickness (0.1m-3.3m) and strength (very soft to firm / very loose to loose). If the alluvium encountered beneath the buildings footprint is variable then it is recommended that the foundations should fully penetrate this material to encounter the cohesive Glacial Till at anticipated depths of approximately 3.5m begl. GRM consider that further GI will suggest that this building is piled.

If penetration of the alluvial deposits is required it is recommended that piled foundations will be the most cost effective foundation solution for Building 2. A specialist piling contractor should confirm the suitability of the ground and advise on the pile type and column length. It should be noted that a working platform will be required by the piling contractor.

Furture Extension & Test Facility - The presence of deep soft to very soft natural strata (Alluvium) has been proven in this area of the site. These strata are not considered to be suitable for pad foundations. The penetration of these unsuitable strata to bear on deeper more competent strata would lead to foundations in some cases in excess of 4m begl, through potentially unstable ground.

It is recommended that piled foundations will be the most cost effective foundation solution in this part of the site. A specialist piling contractor should confirm the suitability of the ground and advise on the pile type and column length. It should be noted that a working platform will be required by the piling contractor.

If piles are used in cohesive strata where trees are/have been present, then the use of heave precautions will be required.

Buildings 3 & 4 - The natural cohesive materials encountered at anticipated foundation depth (approximately 3.0m) were generally firm. For a square pad foundation of 1.5m side dimension, a nett allowable bearing pressure of at least 110kN/m² should be available on the cohesive soils. For high point/column loads piling may be necessary.

Building 5 – The natural cohesive material encountered at anticipated foundation depth (between 1.0m and 2.9m) was generally firm. For a square pad foundation of 1.5m side dimension, a nett allowable bearing pressure of at least 110kN/m² should be available on the cohesive soils. For high point/column loads piling may be necessary.

Building 6 – The natural cohesive material encountered at anticipated foundation depth (between 1.0m and 1.7m) was at least stiff. For a square pad foundation of 1.5m side dimension, a nett allowable bearing pressure of at least 150kN/m² should be available on the cohesive soils. For high point/column loads piling may be necessary.

Building 7 – The natural cohesive / granular materials encountered at anticipated foundation depth (between 2.1m and 3.0m) were generally firm (cohesive) or medium

dense (granular). For a square pad foundation of 1.5m side dimension, a nett allowable bearing pressure of at least 110kN/m² should be available on the these soils. For high point/column loads piling may be necessary.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a structure then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (piles).

Building 8 - The natural cohesive / granular materials encountered at anticipated foundation depth (1.0m-2.0m) were at least firm (cohesive) / medium dense (granular). For a square pad foundation of 1.5m side dimension, a nett allowable bearing pressure of at least 110kN/m² (locally 150kNm²) should be available on the these soils. For high point/column loads piling may be necessary.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a structure then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (piles).

Once the development plan and levels have been finalised, consideration should be given to the most appropriate foundation solution, taking into account removal of old substructures, stability of the strata and proximity to boundaries/services/roads/ existing structures.

9.8 FLOOR SLABS

At present ground levels in excess of 600mm of unsuitable material/made ground will be present below a significant proportion of the site. As the proposed structures cover large areas and at least one is anticipated to have a heavily loaded floor (Building 1, the proposed foundry), it is likely to be more practical and cost-effective to carry out a ground treatment program (e.g. excavate and re-compact) followed by the construction of ground-bearing floor slabs or suspended floors supported by piles.

Old substructures should be removed to at least 0.5m below any new floor slabs to prevent the formation of 'hard spots'.

Gas protection measures are required for the proposed development. These could comprise cast in situ floor slabs with a granular venting layer/pipework dependant on the depth of unsuitable material. Accordingly, it is recommended that allowance be made for such floors through the development. See section 8.1.5 for full details of the required gas precautions. It should be noted that further monitoring is required to complete the gas monitoring program.

No radon protection measures are required.

9.9 SLOPE STABILITY AND RETAINING STRUCTURES

- The site generally slopes gently down to the south. The central area (where the majority of the former buildings were present) has been built up to form a flat terrace, which results in a small slope (approximately 1.5m high) at its edge. In addition, some of the soft landscaping in the north eastern corner of the site is also raised.
- Grading of the site, cut and fill operations, removal of trees/vegetation from existing slopes, interference with drainage around existing slopes or the cutting of the toe or surcharging of the crest of existing slopes may cause instability and failure to occur.

The present gradients on site are likely to be adjusted by minor earthworks. Future ground profiles may require earth retaining structures, for which further advice may be required when more information is available.

9.10 SOAKAWAY DRAINAGE

The natural cohesive stratum is considered unlikely to be suitable for a soakaway drainage system. It is considered likely that reuse of the existing site drainage system will prove most cost effective.

9.11 NEW ACCESS ROADS

Site observations suggest that the existing untreated Made Ground should be assumed to have a CBR value of less than 2% and that the natural cohesive materials will have CBR values of between 3% and 5%, when suitably drained.

Proof rolling and the improvement of soft spots may result in increased CBR.

Site observations should be confirmed by in situ or laboratory testing in accordance with the adopting Local Authority's preference.

9.12 BURIED CONCRETE

Based on the recorded water soluble sulphate and pH levels in the soils below the site and assuming mobile groundwater conditions, in accordance with requirements of BRE Special Digest 1 (2005), 'Concrete in Aggressive Ground', the Design Sulphate Class for buried concrete at the site should be assumed as DS-1 and the ACEC Class as AC-1. For trench-fill foundations with a thickness of greater than 450mm, the classifications above equate to a concrete designated as GEN1 in BS8500.

The results of the water soluble sulphate and pH testing of are presented in Appendices I and J.

10 **FURTHER INVESTIGATION**

Some further investigation, to determine more accurately the effect of some of the identified hazards on the development, is recommended. This includes the following:

- Gas monitoring will continue after submission of this document. Subsequently, an addendum letter report will be issued to confirm the ground gas risk assessment.
- A copy of this report should be submitted to the Planning Department of the Local Authority/Local Authority EHO for review, if planning conditions exist for this site.
- A rotary drilling program is presently on-going to assess the shallow mining hazard. A letter report will be issued following completion of the drilling program.

11 **CONCLUSIONS**

This Site Appraisal has shown the site is suitable for the proposed development, assuming compliance with all the recommendations contained within this report.

See 'Summary of Recommendations' table at the beginning of the report.

Document prepared by	 Paul Wardle MA BSc (Geologist)
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When required in-house geological, geotechnical, environmental, structural and civil staff helped to produce this document.	

NOTES ON LIMITATIONS

11.1.1 General

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

- a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and
- b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and, if warranted, to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as tentative only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The number of sampling points and methods of sampling and testing do not preclude the existence of localised "hotspots" of contamination where concentrations may be significantly higher than those actually encountered.

The risk assessment and opinions provided, inter alia, take in to consideration currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects. The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

The risk assessment and opinion provided, inter alia, take into consideration currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

A P P E N D I X A



DO NOT SCALE
NOTES:

1 Building Number



GRM Development Solutions Ltd
Laurus House, First Ave, Centrum 100,
Burton-on-Trent, Staffordshire
Tel: 01283 551 249 Fax: 01283 211 968
mail@grm-uk.com www.grm-uk.com

CLIENT:

**Fort Vale Engineering Ltd c/o
The Alan Johnston Partnership**

PROJECT:

**Calder Vale Business Park,
Simonstone, Burnley**

TITLE:

Proposed Development Plan

SCALE@SIZE :

NTS

ISSUE:

FINAL

DESIGN/DRAWN :

CRS

DATE:

04/2011

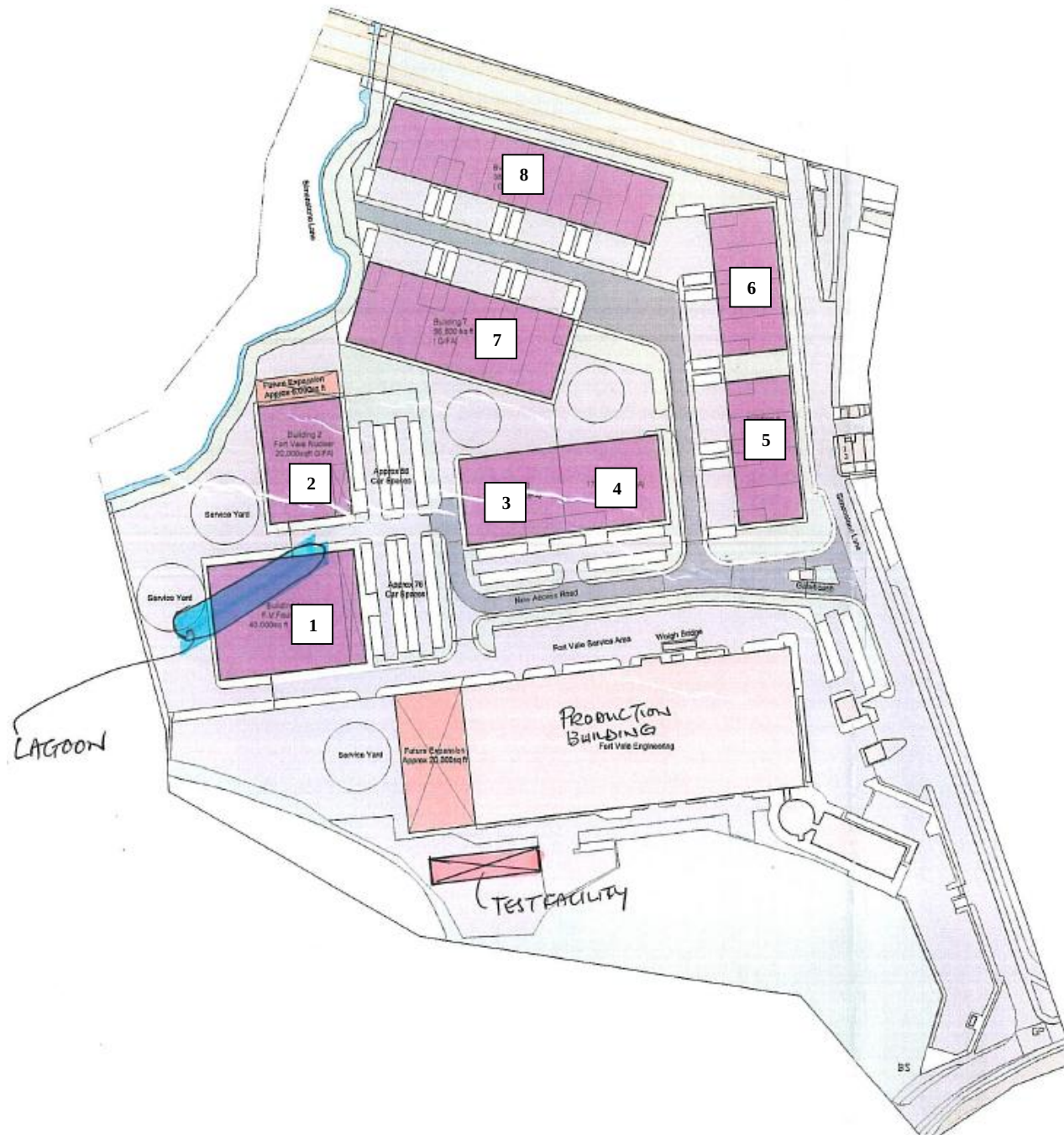
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P5467

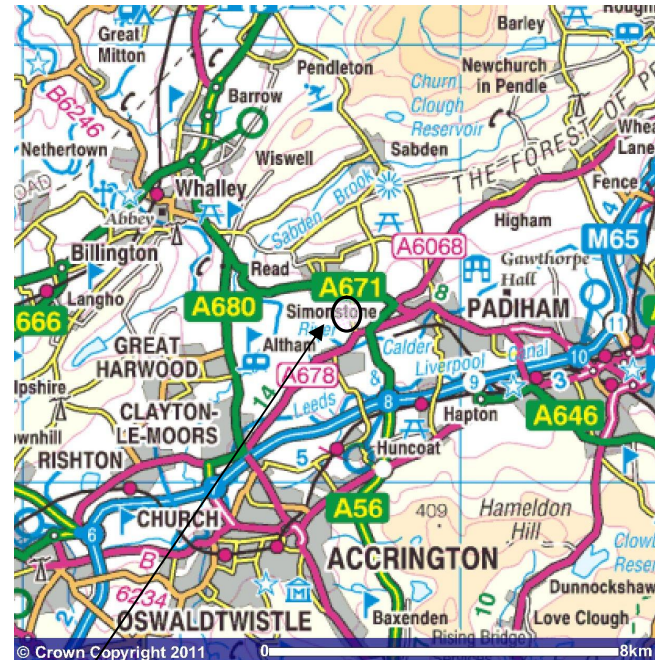
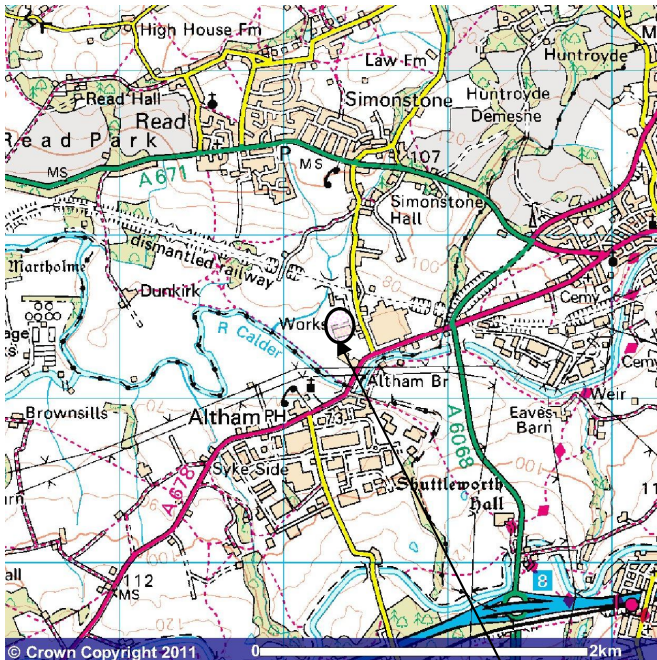
DRAWING No:

Figure 1

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A P P E N D I X B



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○ Approx Site Location



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 Laurus House, First Ave, Centrum 100,
 Burton-on-Trent, Staffordshire
 Tel: 01283 551 249 Fax: 01283 211 968
mail@grm-uk.com www.grm-uk.com

CLIENT:

**Fort Vale Engineering Ltd c/o
 The Alan Johnston Partnership**

PROJECT:

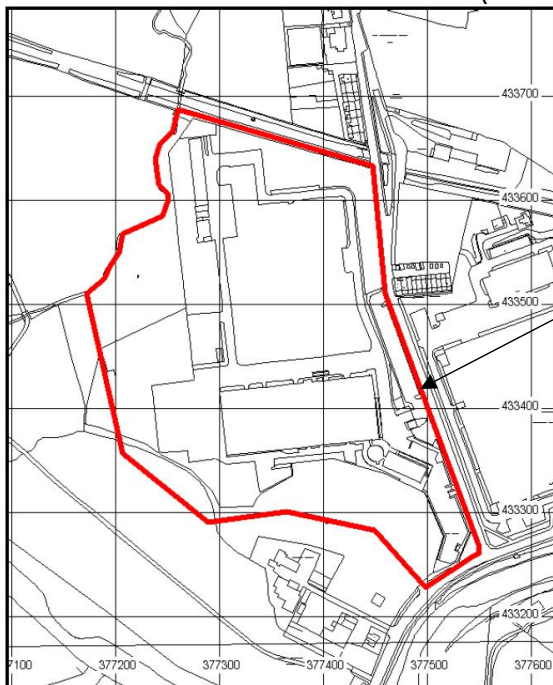
**Calder Vale Business Park,
 Simonstone, Burnley**

TITLE:

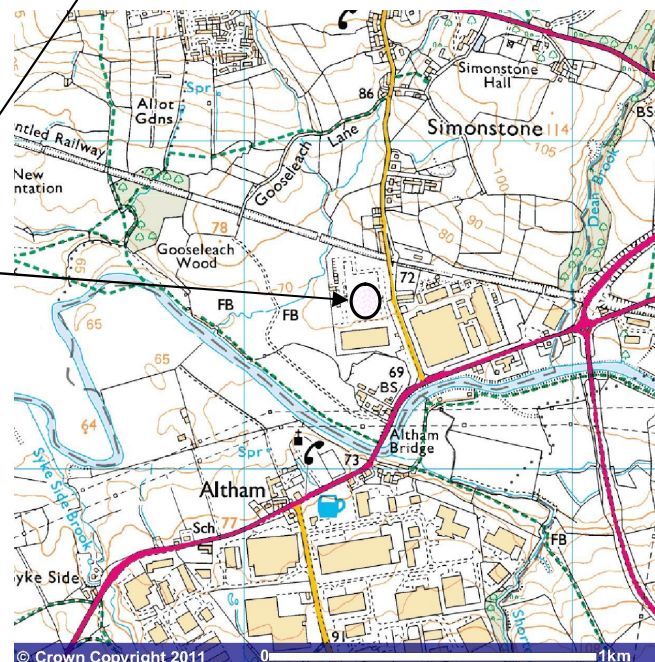
**Site Location and Boundary
 Plan**

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
CRS	04/2011
PROJECT No:	DRAWING No:
P5467	Figure 2

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SITE



A P P E N D I X C

Site Details:

Calder Vale Business
Park, Simonsite Lane, Burnley

Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

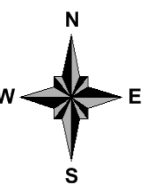
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Map Name: MasterMap

Map date: 2011

Scale: 1:2,500

Printed at: 1:2,500



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Site Details:

Calder Vale Business
Park, Simonsite Lane, Burnley

Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

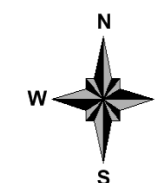
Grid Ref: 377354, 433457

Map Name: National Grid

Map date: 1993

Scale: 1:2,500

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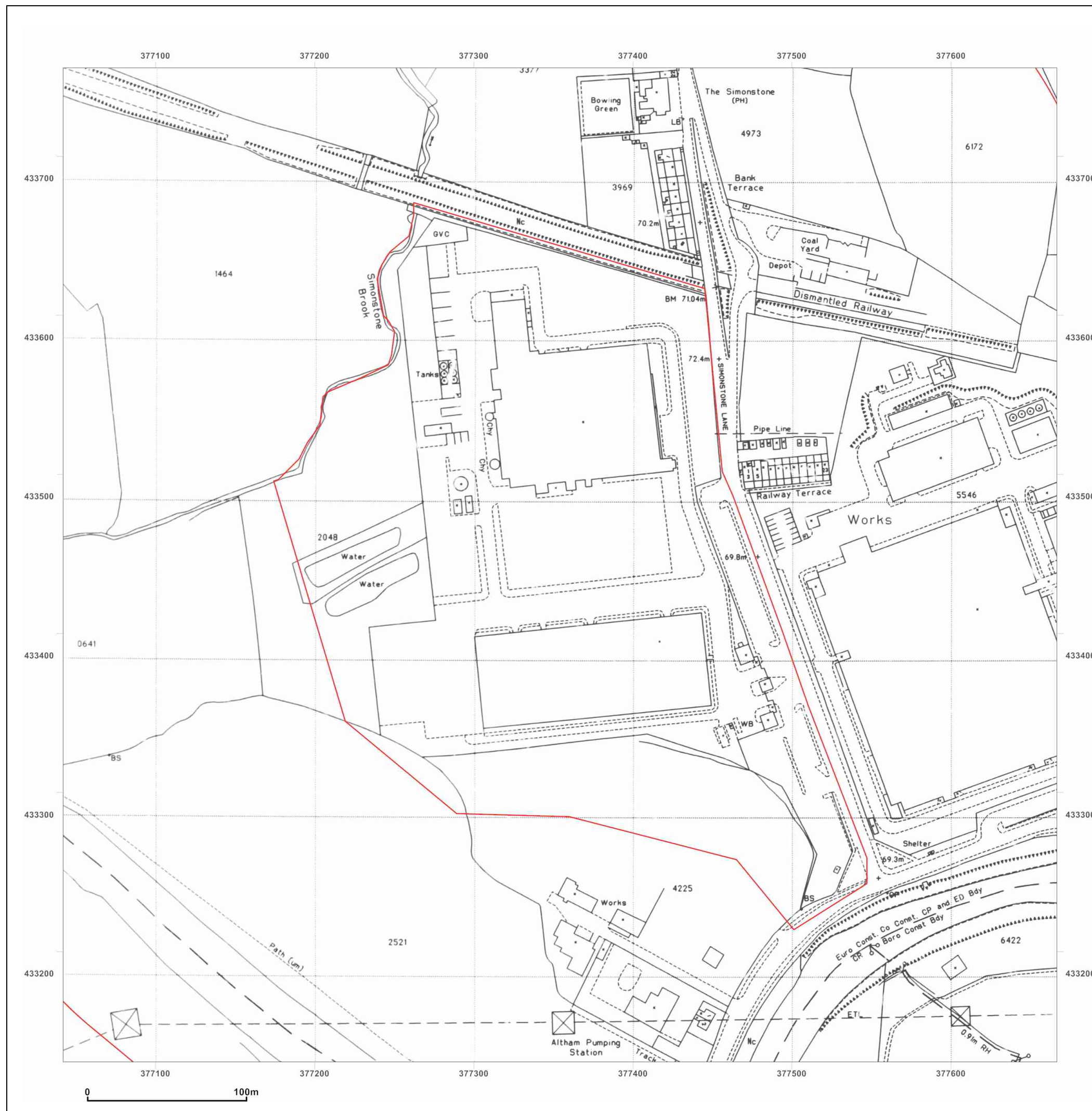


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Site Details:

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Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

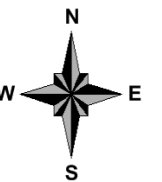
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Map Name: National Grid

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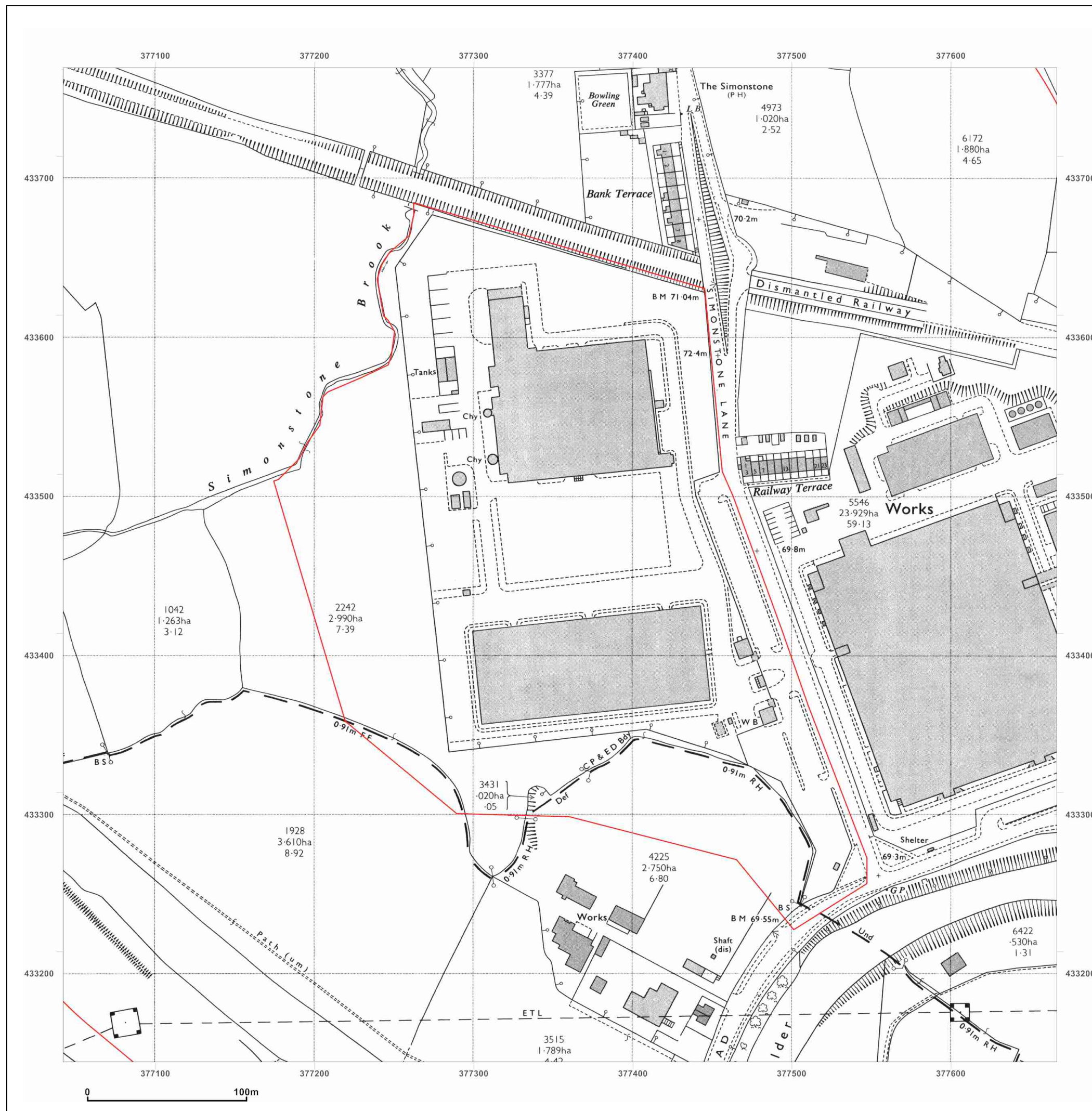


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Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

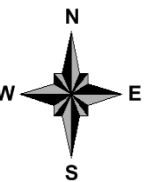
Grid Ref: 377354, 433457

Map Name: National Grid

Map date: 1959

Scale: 1:2,500

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Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

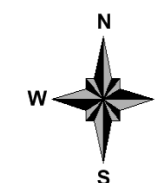
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Map Name: County Series

Map date: 1931

Scale: 1:2,500

Printed at: 1:2,500



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Revised 1931
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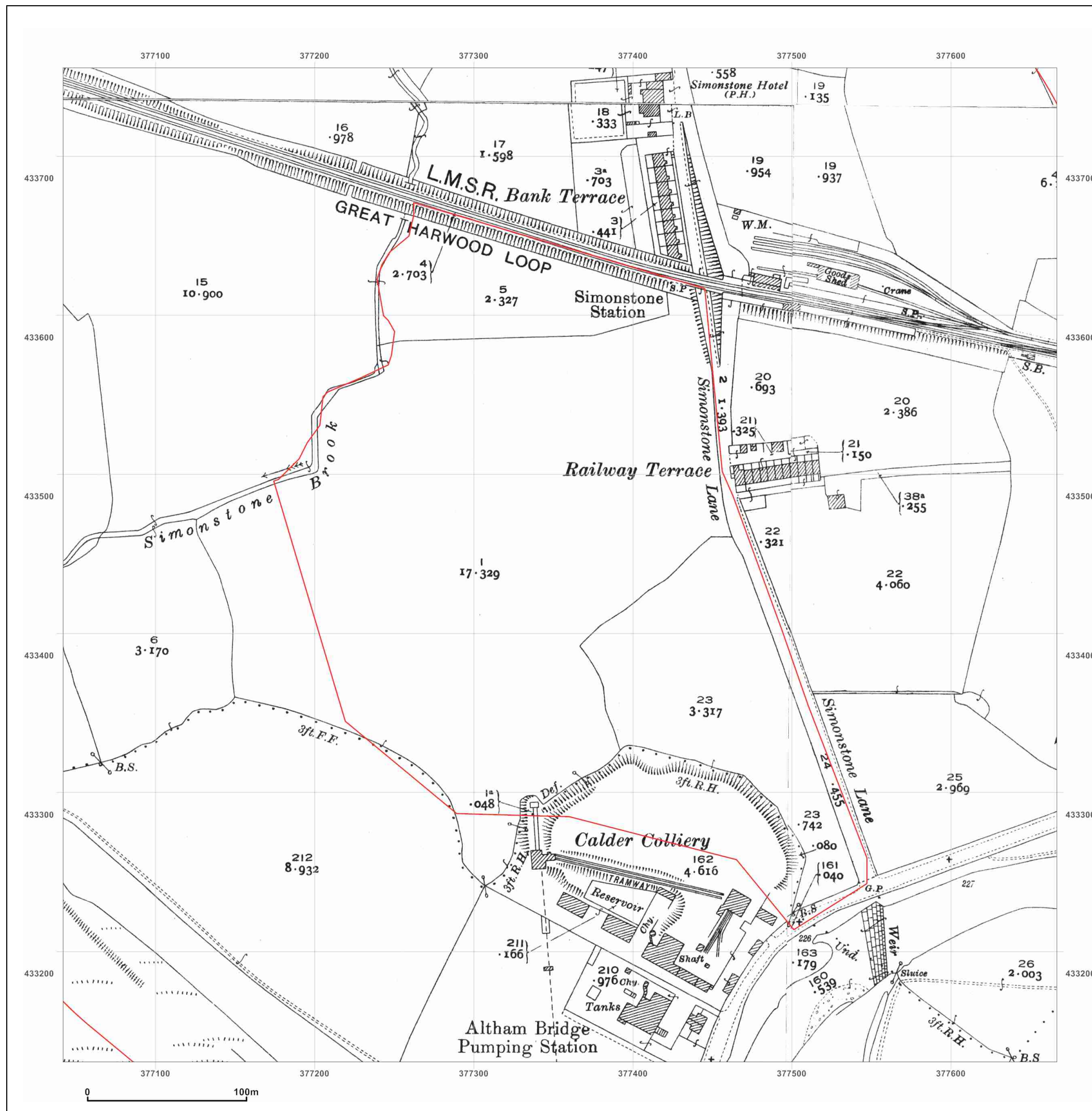


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Site Details:

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Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

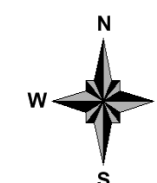
Grid Ref: 377354, 433457

Map Name: County Series

Map date: 1912

Scale: 1:2,500

Printed at: 1:2,500



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Revised 1912
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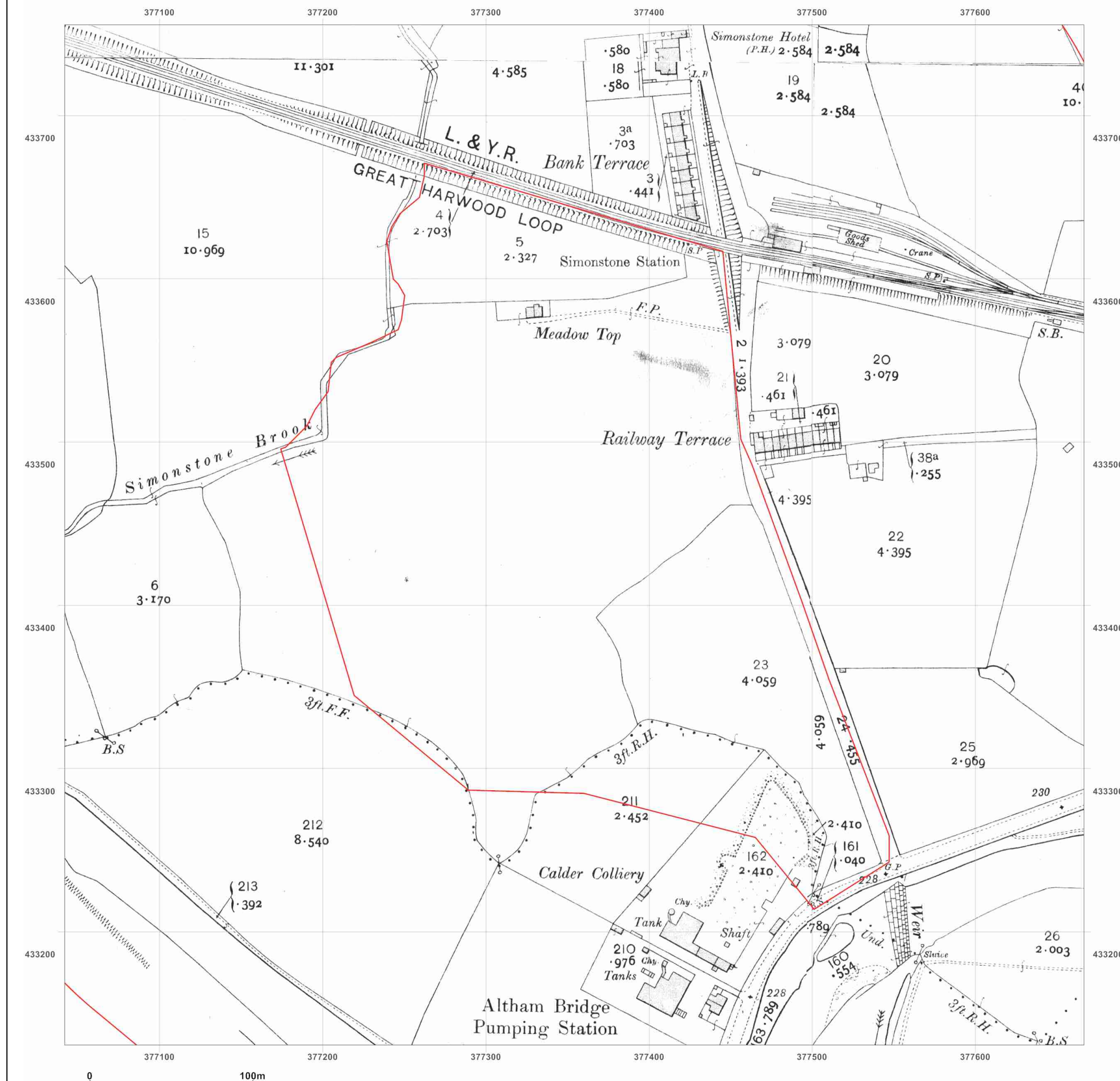


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Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

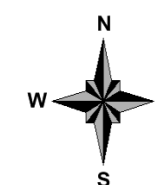
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Map Name: County Series

Map date: 1891-1892

Scale: 1:2,500

Printed at: 1:2,500



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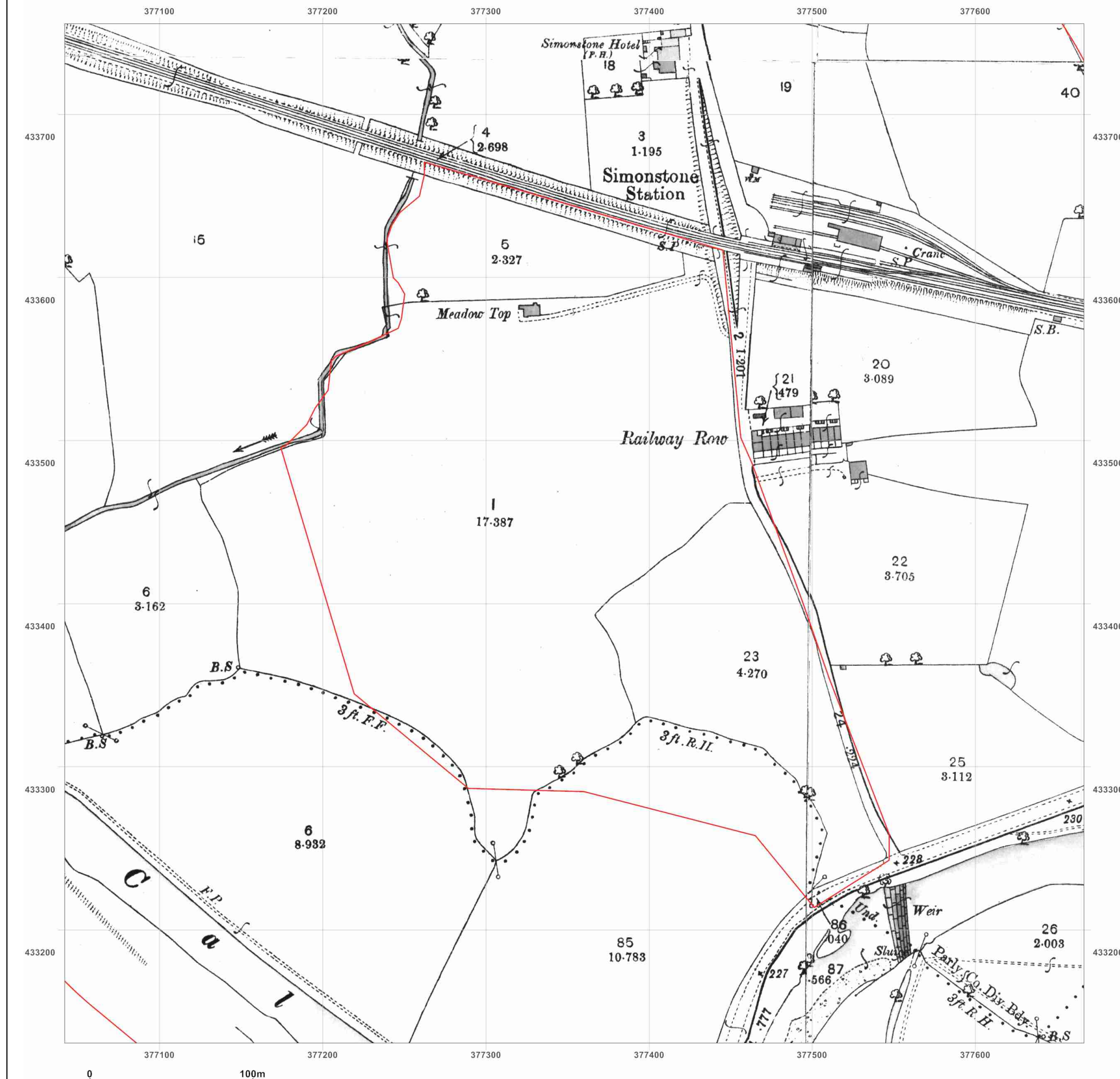


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Client Ref: EMS_124171_165883
Report Ref: EMS-124171_165883
Grid Ref: 377354, 433457

Map Name: National Grid

Map date: 2011

Scale: 1:10,000

Printed at: 1:10,000



2011



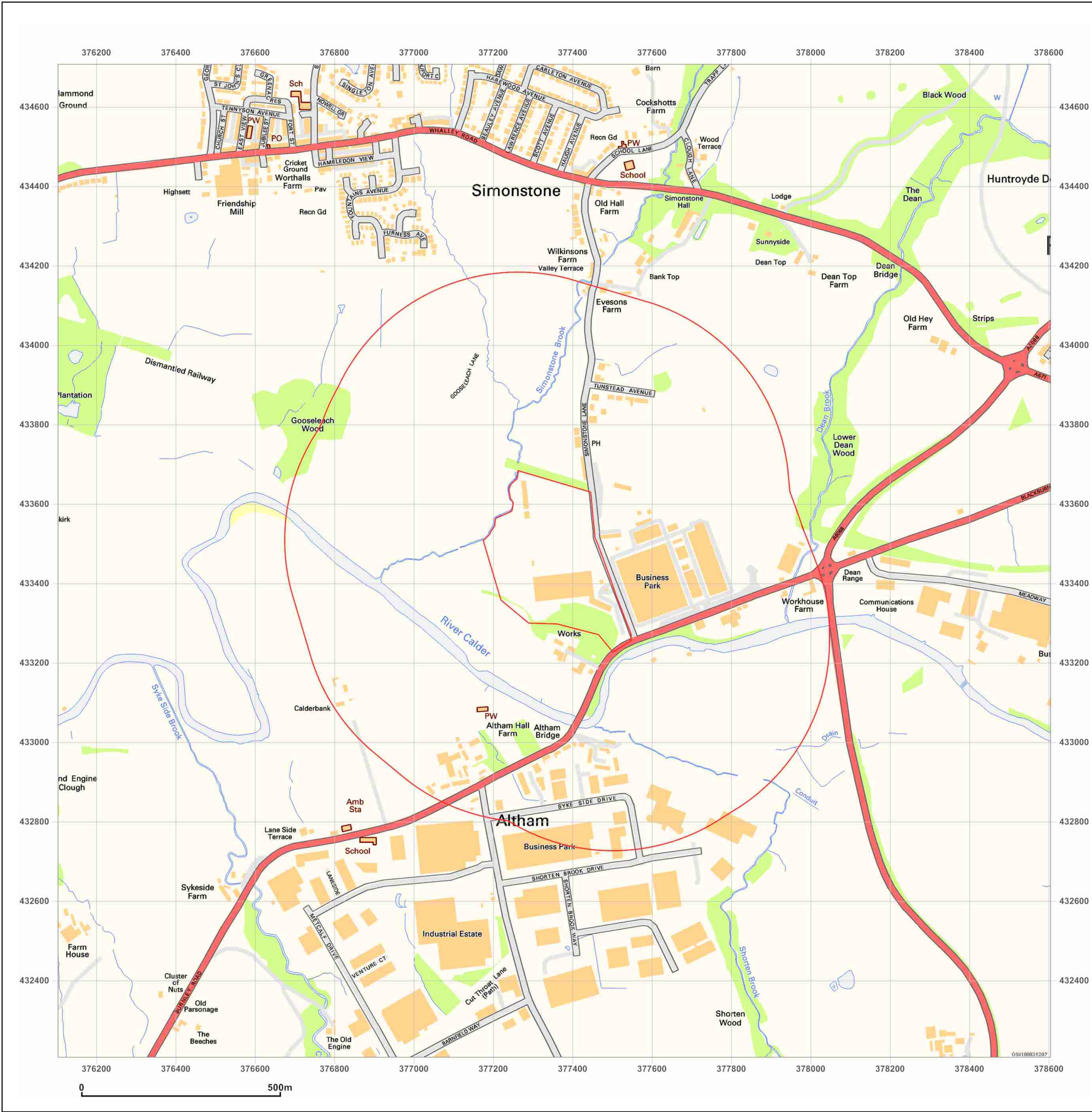
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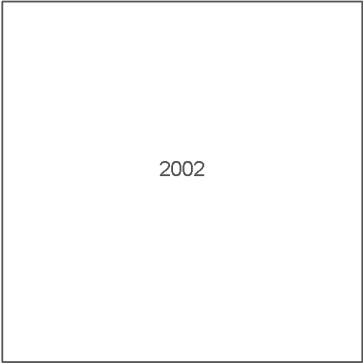
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Report Ref: EMS-124171_165883
Grid Ref: 377354, 433457

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Map date: 2002

Scale: 1:10,000

Printed at: 1:10,000



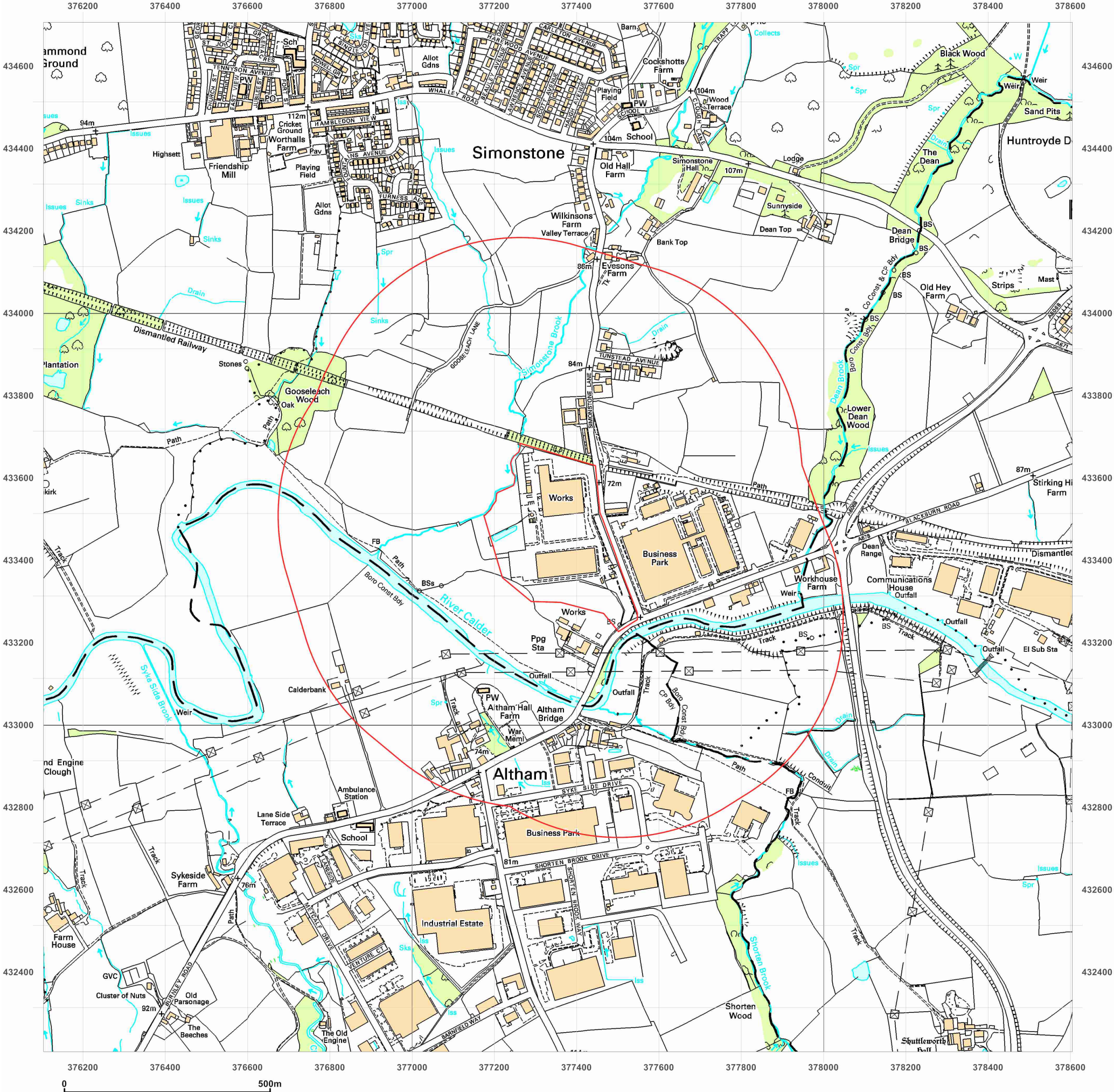
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Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

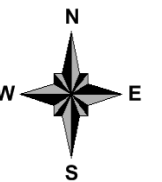
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Map Name: National Grid

Map date: 1991

Scale: 1:10,000

Printed at: 1:10,000



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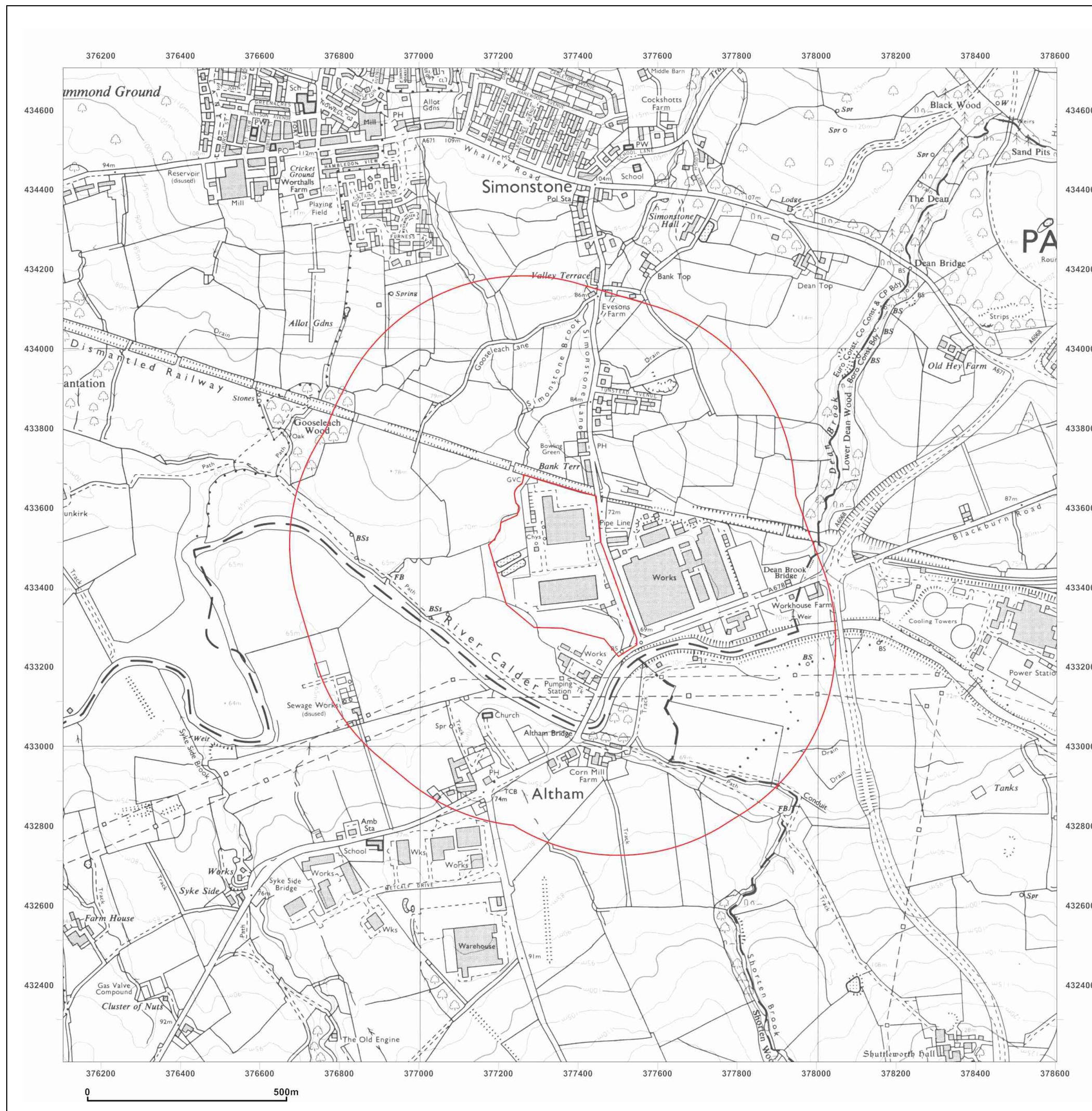


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Client Ref: EMS_124171_165883
Report Ref: EMS-124171_165883
Grid Ref: 377354, 433457

Map Name: National Grid

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Client Ref: EMS_124171_165883
Report Ref: EMS-124171_165883
Grid Ref: 377354, 433457

Map Name: National Grid

Map date: 1977

Scale: 1:10,000

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Client Ref: EMS_124171_165883
Report Ref: EMS-124171_165883
Grid Ref: 377354, 433457

Map Name: Provisional

Map date: 1965

Scale: 1:10,560

Printed at: 1:10,560



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Client Ref: EMS_124171_165883
Report Ref: EMS-124171_165883
Grid Ref: 377354, 433457

Map Name: Provisional

Map date: 1950

Scale: 1:10,560

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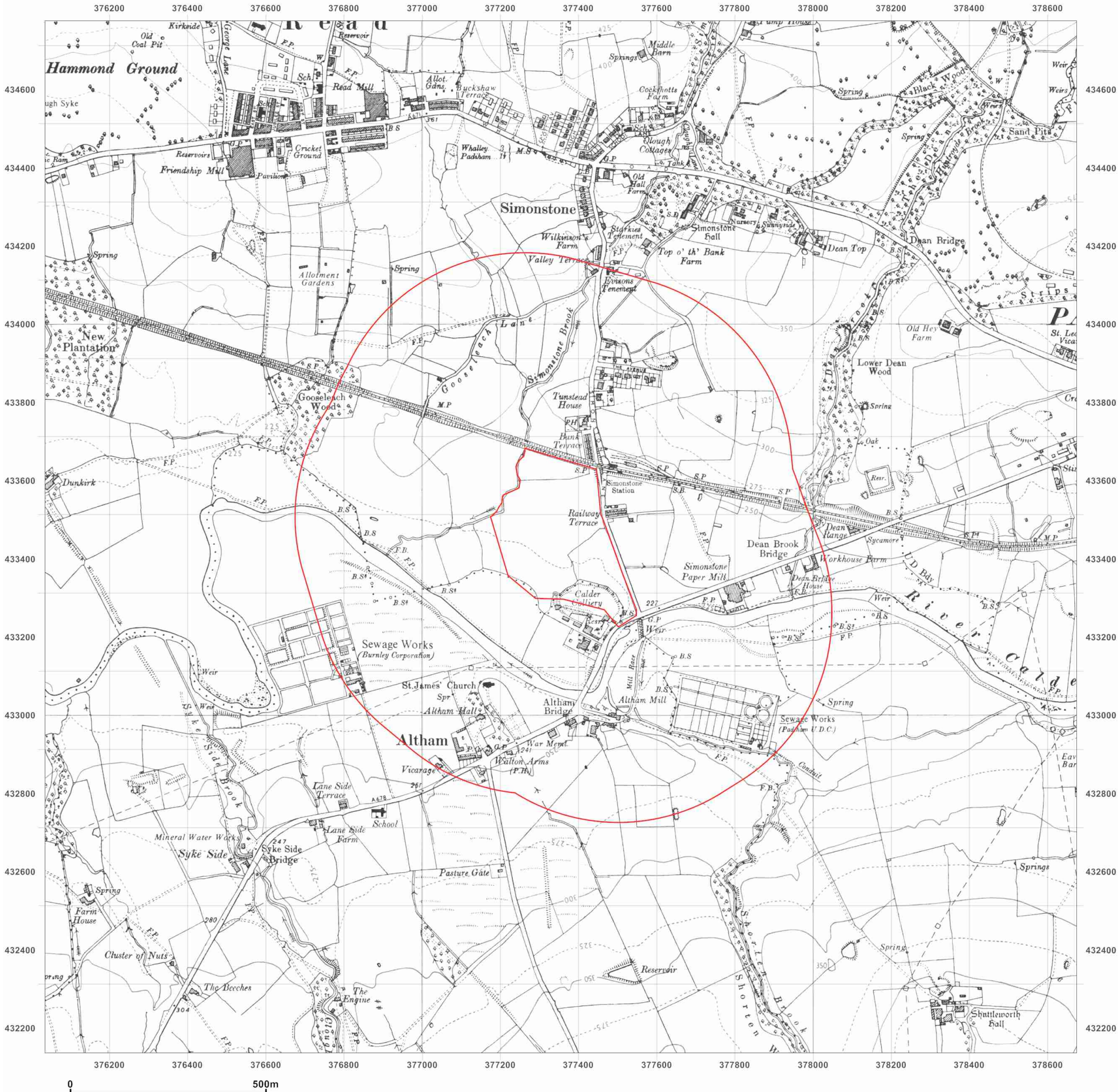


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Client Ref: EMS_124171_165883

Report Ref: EMS-124171_165883

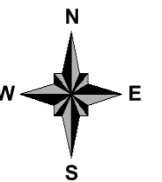
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Map Name: County Series

Map date: 1938

Scale: 1:10,560

Printed at: 1:10,560



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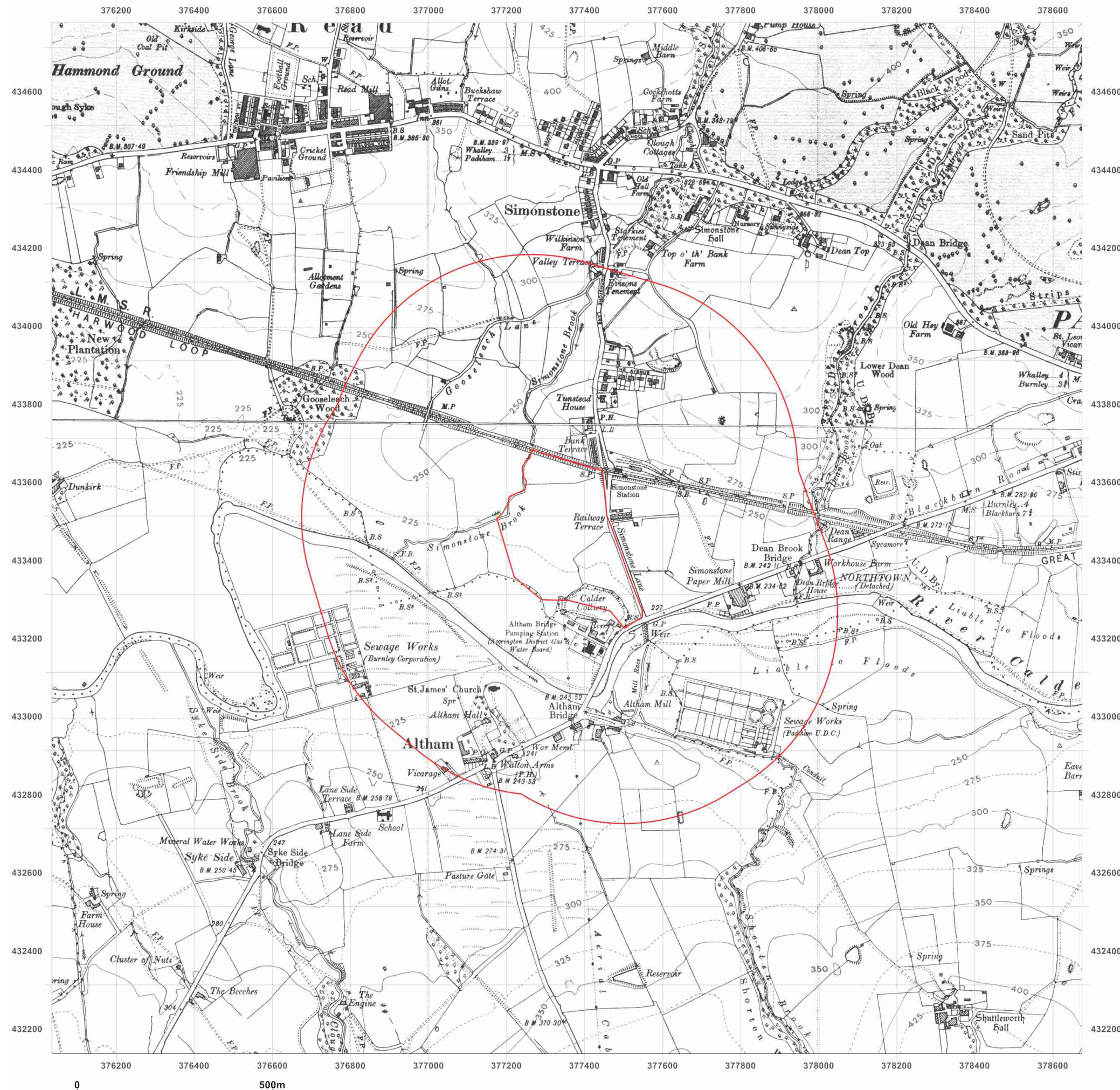


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Client Ref: EMS_124171_165883
Report Ref: EMS-124171_165883
Grid Ref: 377354, 433457

Map Name: County Series

Map date: 1929

Scale: 1:10,560

Printed at: 1:10,560



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Surveyed 1844
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Edition NA
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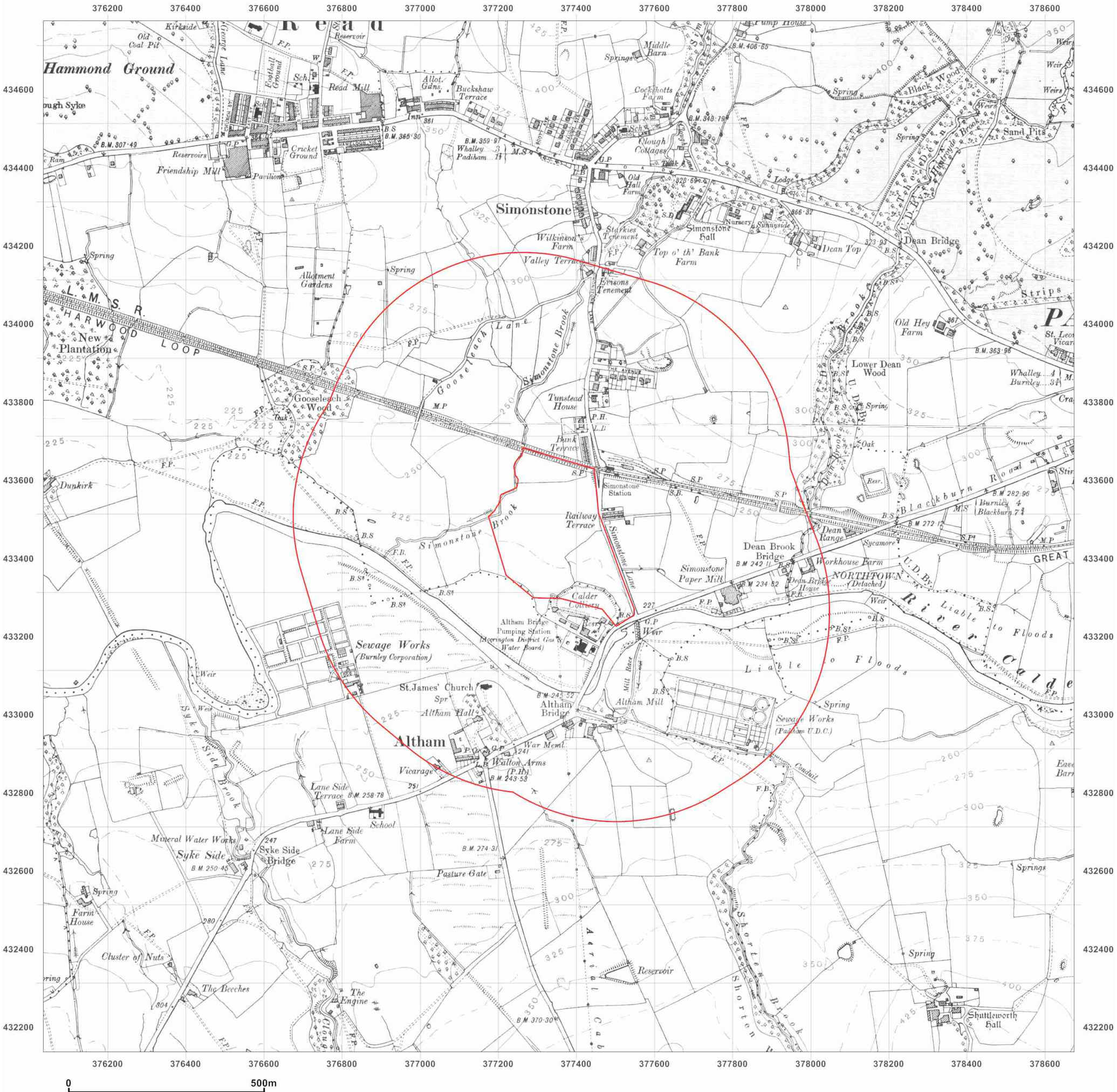


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Site Details:

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Client Ref: EMS_124171_165883
Report Ref: EMS-124171_165883
Grid Ref: 377354, 433457

Map Name: County Series

Map date: 1909-1910

Scale: 1:10,560

Printed at: 1:10,560



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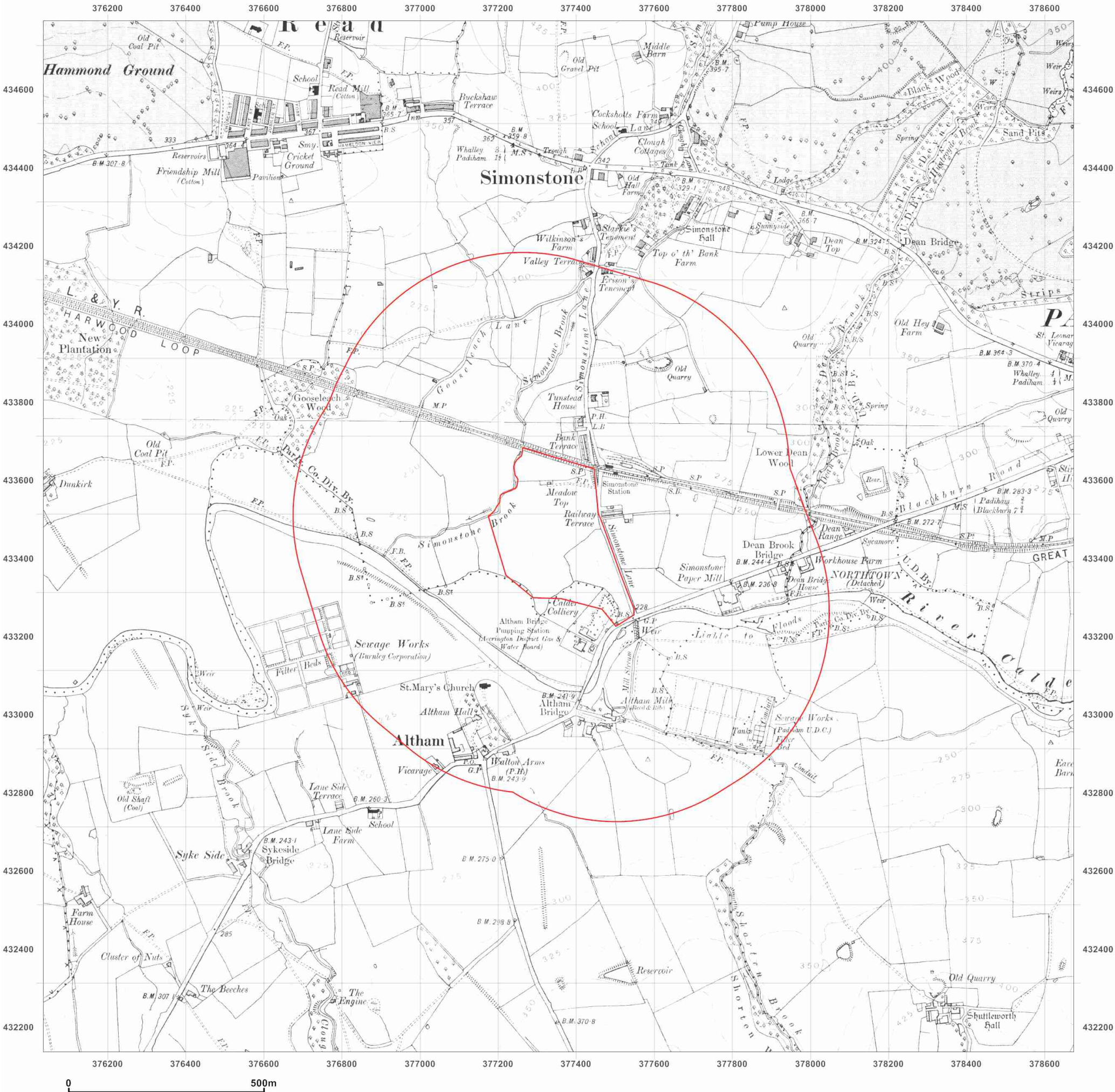


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A P P E N D I X D



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Your Reference:	EMS_124171_165885
Report Date:	Mar 28, 2011
Report Delivery Method:	Email - pdf
Client Email:	sales@emapsite.com

GroundSure EnviroInsight

Address: Calder Vale Business Park, Simonsite Lane, Burnley

Dear Sir/Madam,

Thank you for placing your order with emapsite. Please find enclosed the GroundSure EnviroInsight as requested

If you would like further assistance regarding this report then please contact the emapsite customer services team on 0118 9736883 quoting the above report reference number.

Yours faithfully,

emapsite customer services team

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GroundSure EnviroInsight

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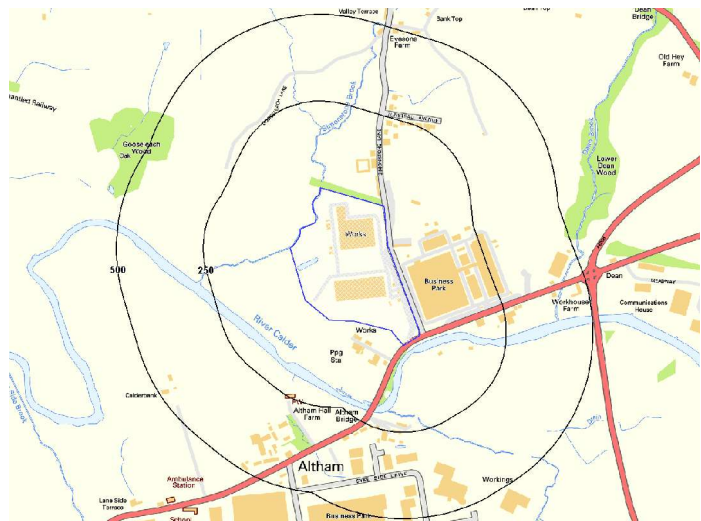
Address: Calder Vale Business Park, Simonsite Lane, Burnley

Date: Mar 28, 2011

GroundSure Reference: EMS-124171_165885

Your Reference: EMS_124171_165885

Client: EmapSite



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Aerial Photograph of Study Site



Site Name: Calder Vale Business Park, Simonsite Lane, Burnley
Grid Reference: 377354,433457
Size of Site: 9.91 ha

Aerial photography supplied by Getmapping PLC.
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Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Report Section	Number of records found within (X) m of the study site boundary					
1. Environmental Permits, Incidents and Registers	on-site	0-50	51-250	251-500	501-1000	1000-1500
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations						
Records of historic IPC Authorisations	0	0	1	0	-	-
Records of Part A(1) and IPPC Authorised Activities	0	0	0	0	-	-
Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0	-	-
Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0	-	-
Records of List 1 Dangerous Substances Inventory sites	0	0	0	0	-	-
Records of List 2 Dangerous Substances Inventory sites	0	0	0	0	-	-
Records of Part A(2) and Part B Activities and Enforcements	0	0	1	0	-	-
Records of Category 3 or 4 Radioactive Substances Authorisations	2	0	0	2	-	-
Records of Licensed Discharge Consents	0	0	1	0	-	-
Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0		
1.2 Records of COMAH and NIHHS sites	0	0	0	0	-	-
1.3 Environment Agency Recorded Pollution Incidents						
National Incidents Recording System, List 2	0	0	2	-	-	-
National Incidents Recording System, List 1	1	0	0	-	-	-
1.4 Sites Determined as Contaminated Land under Part IIA EPA 1990	0	0	0	0	-	-
2. Landfill and Other Waste Sites	on-site	0-50	51-250	251-500	501-1000	1000-1500
2.1 Landfill Sites						
Environment Agency Registered Landfill Sites	0	0	0	0	0	-
Landfill Data – Operational Landfill Sites	0	0	0	1	0	-
Environment Agency Historic Landfill Sites	1	0	1	2	1	3
Landfill Data – Non-Operational Landfill Sites	1	0	0	0	2	-
BGS/DoE Landfill Site Survey	0	0	0	0	0	1
GroundSure Local Authority Landfill Sites Data	0	0	0	0	0	0
2.2 Landfill and Other Waste Sites Findings						
Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Environment Agency Licensed Waste Sites	0	0	0	0	2	0

3. Current Land Uses	on-site	0-50	51-250	251-500	501-1000	1000-1500
3.1 Current Industrial Sites Data	4	1	18	-	-	-
3.2 Records of Petrol and Fuel Sites	0	0	0	0	-	-
3.3 Underground High Pressure Oil and Gas Pipelines	0	0	0	0	-	-

4. Geology	Description
4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site? *	No
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site? *	Yes
4.3 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
Source: Scale: 1:50,000 BGS Sheet 068	

* This includes an automatically generated 50m buffer zone around the site.

5. Hydrogeology and Hydrology	on-site	0-50	51-250	251-500	501-1000	1001-2000
5.1 Are there any records of Productive Strata in the Superficial Geology within 500m of the study site?				Yes		
5.2 Are there any records of Productive Strata in the Bedrock Geology within 500m of the study site?				Yes		
5.3 Groundwater Abstraction Licences (within 1000m of the study site).	0	0	1	2	0	-
5.4 Surface Water Abstraction Licences (within 1000m of the study site).	0	0	0	0	4	-
5.5 Potable Water Abstraction Licences (within 2000m of the study site).	0	0	1	0	0	0
5.6 Are there any Source Protection Zones within 500m of the study site?					No	
5.7 River Quality	on-site	0-50	51-250	251-500	501-1000	1001-1500
Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	Yes	No	No	Yes
5.8 Detailed River Network entries within 500m of the site	1	1	9	11	-	-
5.9 Surface water features within 250m of the study site	Yes	Yes	Yes	-	-	-

6. Flooding	
6.1 Are there any Environment Agency indicative Zone 2 floodplains within 250m of the study site?	Yes
6.2 Are there any Environment Agency indicative Zone 3 floodplains within 250m of the study site?	Yes
6.3 Are there any Flood Defences within 250m of the study site?	Yes
6.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.5 Are there any areas used for Flood Storage within 250m of the study site?	No
6.6 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	High
6.7 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Moderately Low

7. Designated Environmentally Sensitive Sites	on-site	0-50	51-250	251-500	501-1000	1001-1500
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	-	-
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	-	-

7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	-	-
7.3 Records of Local Nature Reserves (LNR)	0	0	0	0	-	-
7.4 Records of Special Areas of Conservation (SAC)	0	0	0	0	-	-
7.5 Records of Special Protection Areas (SPA)	0	0	0	0	-	-
7.6 Records of Ramsar sites	0	0	0	0	-	-
7.7 Records of World Heritage Sites	0	0	0	0	-	-
7.8 Records of Environmentally Sensitive Areas	0	0	0	0	-	-
7.9 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	-	-
7.10 Records of National Parks	0	0	0	0	-	-
7.11 Records of Nitrate Sensitive Areas	0	0	0	0	-	-
7.12 Records of Nitrate Vulnerable Zones	1	0	0	0	-	-

8. Natural Hazards

8.1 What is the maximum risk of natural ground subsidence? Moderate

9. Mining

9.1 Are there any coal mining areas within 75m of the study site? Yes

9.2 What is the risk of subsidence relating to shallow mining within 150m of the study site? Low-Moderate

9.3 Are there any brine affected areas within 75m of the study site? No

Using this Report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between GroundSure and the Client. The document contains the following sections:

1. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

2. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

3. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure underground oil and gas pipelines.

4. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

5. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

6. Flooding

Provides information on surface water flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

7. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites. These searches are conducted using radii of up to 500m.

8. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence.

9. Mining

Provides information on areas of coal and shallow mining.

10. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, GroundSure provide a free Technical Helpline (08444 159000) for further information and guidance.

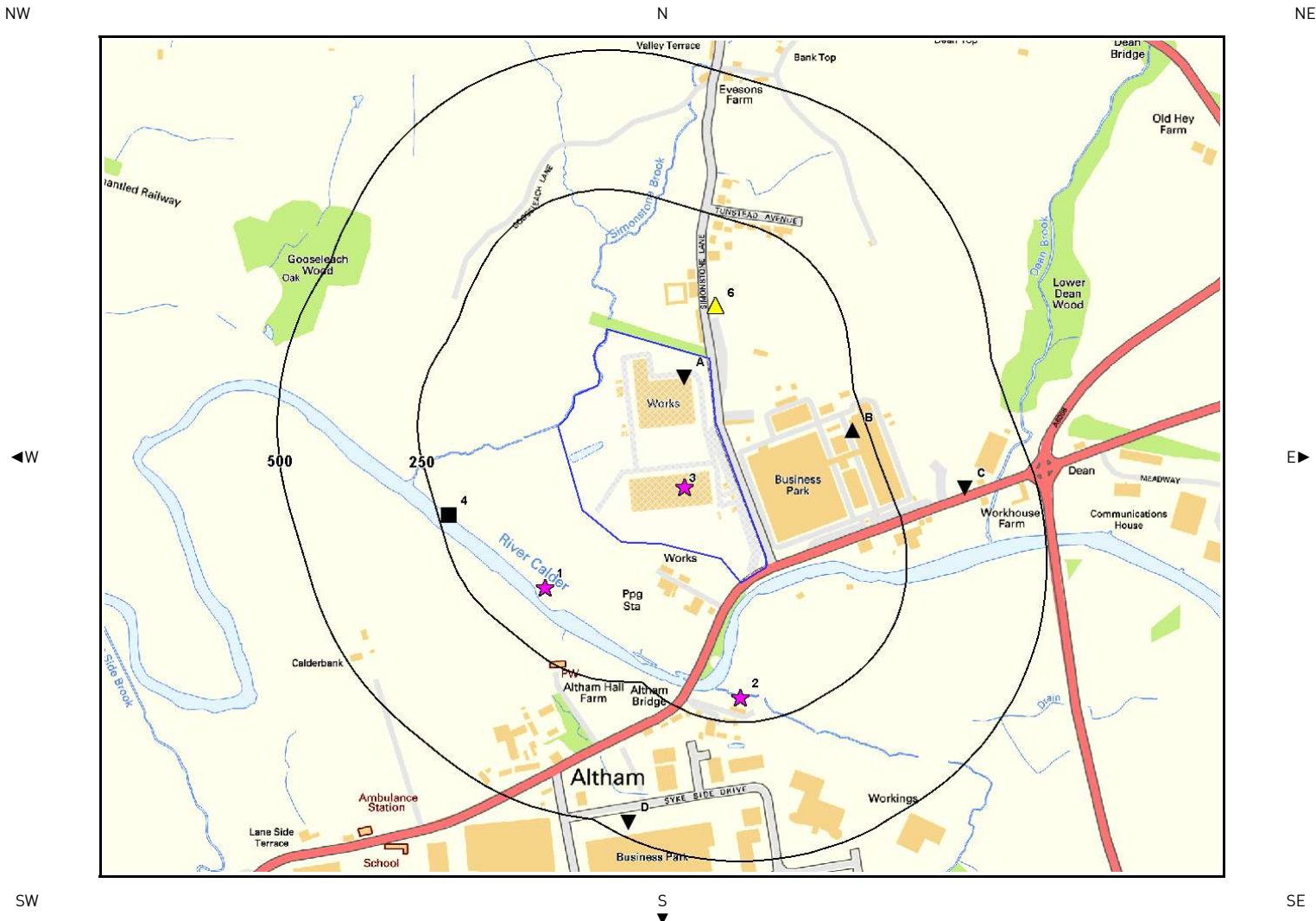
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

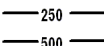
1. Environmental Permits, Incidents and Registers Map



Authorisations, Incidents and Registers Legend



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- | | | |
|--|---|--|
|  Site Outline |  Recorded Pollution Incident |  RAS 3 & 4 Authorisations |
|  Search Buffers (m) |  Dangerous Substances (List 1) |  Part A(1) Authorised Processes and Historic IPC Authorisations |
| |  Dangerous Substances (List 2) |  Part A(2) and Part B Authorised Processes |
| |  Water Industry Referrals |  COMAH / NIHHS Sites |
| |  Licenced Discharge Consents |  Sites Determined as Contaminated Land |
| |  Red List Discharge Consents |  Hazardous Substance Consents and Enforcements |

1.Environmental Permits, Incidents and Registers

1.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency and Local Authorities reveal the following information:

Records of historic IPC Authorisations within 500m of the study site: 1

The following IPC Authorisations are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance	Direction	NGR	Details
11B	223.0	E	377700, 433500	Operator: Rwe Npower Plc Address: Padiham Power Station, Blackburn Road, Padiham, Burnley, Lancashire, BB12 7NH Process: Combustion Processes Permit Number: AA2461 Original Permit Number: IPCAIRAPP Date Approved: 8-4-1993 Effective Date: 8-4-1993 Status: Surrendered

Records of Part A(1) and IPPC Authorised Activities within 500m of the study site: 0

Database searched and no data found.

Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site: 0

Database searched and no data found.

Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site: 0

Database searched and no data found.

Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site: 0

Database searched and no data found.

Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site: 0

Database searched and no data found.

Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site: 1

The following Part A(2) and Part B Activities are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance	Direction	NGR	Details
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6	92.0	N	380300, 432000	Address: Lg. Philips Displays, Glass Factory, Simonstone Lane, Simonstone, Burnley, Bb12 7nf Process: Glass Manufacturing Process Status: Ceased Permit Type: Part B	Enforcement: Data requested, not received. Date of Enforcement: Data requested, not received. Comment: Data requested, not received.
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Records of Category 3 or 4 Radioactive Substance Licences within 500m of the study site:

4

The following RAS Licence (3 or 4) records are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance [m]	Direction	Address	Operator	Type	Permission Number	Dates	Status
12A	0.0	On Site	Philips Semiconductors Ltd, Simonstone Tvp g Factory , Burnley, Lancashire, BB12 7NJ	Philips Semicon ductors Ltd	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	AM9055	Date of Approval: 1 7-2-1992 0:00:00 Effective from: 17- 2-1992 0:00:00 Last date of update: 20 03-12-01	Revoked/ cancelled
13A	0.0	On Site	Philips Semiconductors Ltd, Simonstone Tvp g Factory , Burnley, Lancashire, BB12 7NJ	Philips Semicon ductors Ltd	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	AM9055	Date of Approval: 3 1-3-1991 0:00:00 Effective from: 31- 3-1991 0:00:00 Last date of update: 20 03-12-01	Supersed ed By Variation
14C	375.0	E	Mullard Colour Tubes, Blackburn Road, Simonstone, Burnley, Lancashire, BB12 7NJ	Mullard Colour Tubes	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	AQ0114	Date of Approval: 1 -4-1991 0:00:00 Effective from: 1-4- 1991 0:00:00 Last date of update: 20 03-12-01	Revoked/ cancelled
15D	473.0	SW	Jas Broadley Ltd, Unit B Gec Site, Blackburn Road, Clayton Le Moors, Accrington,	Jas Broadley Ltd	Keeping And Use Of Radioactive Materials (was Rsa60 Section 1).	AQ3148	Date of Approval: 1 -4-1991 0:00:00 Effective from: 1-4- 1991 0:00:00 Last date of update: 20 03-12-01	Revoked/ cancelled

Records of Licensed Discharge Consents within 500m of the study site:

1

The following Licensed Discharge Consents records are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance	Direction	NGR	Details
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