Preliminary Environmental Risk Assessment

The Stag Brewery, Mortlake

July 2020

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Executive Summary

Objectives

Update the February 2018 Preliminary Environmental Risk Assessment for ground contamination risks at the proposed residential-led mixed used development of the Stag Brewery, Mortlake, SW14 7ET (the "Site"). This update is based on a revised development proposal.

Site Setting

Current Use	The Stag Brewery ceased operations in late 2015 and decommissioning of brewery infrastructure was undertaken subsequently. Stripping of the Site has since commenced with removal of the majority of brewing equipment and tanks underway at the time of the walkover. A sports field and clubhouse are located in the west.
History	Brewery use since the 15th Century, which expanded to occupy the majority of the eastern half of the Site by 1896 and the whole Site except for the playing fields by 1974. Brewery activities ceased on the Site in December 2015.
Geology	Up to 2.7m Made Ground, then 1.7 – 5.4m of superficial deposits (Alluvium and Kempton Park Gravel Member). Alluvium is sporadically absent across the Site. Beneath this is approximately 73m London Clay Formation, followed by 15 – 20m of Lambeth Group, 5 – 10m Thanet Formation and the Chalk Group at depth.
Controlled Waters	The Alluvium and Kempton Park Gravel Member contain a Secondary A Aquifer, with the London Clay Formation classified as an Unproductive Stratum. The Lambeth Group and Thanet Formation are Secondary A Aquifers. The Chalk Group is a Principal Aquifer.
Consultation	A Groundsure Enviro Insight dataset was commissioned for the Site. Information was also requested from the London Borough of Richmond upon Thames Environmental Health, Building Control and Planning Departments in 2018.

Preliminary Conceptual Model

The following potential pollutant linkages have been identified for the Site:

- Potential exposure of construction workers and the general public during the Works to contaminated soils, groundwater, airborne dust and run-off from stockpiled soils or exposed shallow ground;
- Potential for construction workers to encounter UXO during basement excavation;
- Potential risks to exposed shallow groundwater from introduction of new potential sources of contamination during the Works;
- Potential mobilisation of contamination via historical abstraction wells leading into the Chalk Group Principal Aquifer;
- Potential risks to shallow groundwater and the River Thames due to surface run-off from stockpiled materials via the drainage system discharging to the River Thames, or mobilisation of ground contamination by rainfall infiltration after removal of hardstanding during demolition, and introduction of new sources of contamination during the Works;
- Potential exposure of future occupants and visitors of the proposed redevelopment to residual ground contamination via soft landscaping; and
- Potential exposure of buried structures and services to ground and groundwater contamination, leading to chemical attack.

Conclusions

Given the proposed end use, the overall risk rating for the Site is assessed as **Medium**. The recommendations of this report outline preliminary remedial and mitigation measures that require confirmation through additional works. However, once successfully implemented the risks are anticipated to be **Low**. Therefore the NPPF requirement that on completion the Site can no longer be captured under the Part IIA regime is expected to be met.

Recommendations

The following actions are recommended to address the potentially unacceptable risks identified:

- Further ground investigation should be completed targeting soils and groundwater in the areas where basements are now not proposed as part of development works and residual soils will remain in-situ, to confirm findings of the previous Aecom investigation;
- Geotechnical investigation as part of design works for the development should include sampling and testing of soils to assess the risk posed by chemical attack;
- An environment watching brief should be undertaken throughout ground works, with additional environmental sampling undertaken where visual or olfactory contamination is suspected within the Made Ground or Kempton Park Gravel Member;
- A detailed UXO desk study should be undertaken by a suitably qualified Explosive Ordnance Disposal (EOD) Engineer to assess the risk posed by UXO beneath the Site. The recommendations of this assessment should be followed during construction works;
- A Construction Environmental Management Plan (CEMP) should be developed for the Site, detailing measures to minimise the potential risk to the River Thames and shallow Secondary A aquifer during the demolition and construction works;
- During the Works, appropriate measures for managing materials, chemicals and waste should be utilised. Measures should also be taken to prevent run-off from stockpiled soils reaching the River Thames, and to supress the generation of dust;
- Following removal of hardstanding across the Site post-demolition, an attempt should be made to locate the historical abstraction wells and decommission them if necessary;
- Construction workers should be provided with and use personal protective equipment (PPE), respiratory protective equipment (RPE) and informed of good hygiene measures as protection against direct contact with contaminated Made Ground, contaminated groundwater or ground gas / vapours;
- Concrete used in construction, and any new water pipes installed as part of the redevelopment works should be appropriately protected against chemical attack from potential contamination in Made Ground, shallow soils and shallow groundwater underlying the Site; and
- Private gardens at the Development should be planted using an appropriate thickness of imported, certified clean cover material.

1. Introduction

1.1 Objectives

Waterman Infrastructure & Environment Limited ("Waterman") was instructed by Reselton Properties Limited to prepare an updated Preliminary Environmental Risk Assessment (PERA) for ground contamination at the Former Stag Brewery Site in Mortlake within the London Borough of Richmond Upon Thames (LBRuT).

This document is an update of a previous PERA completed by Waterman in February 2018 (*report reference WIE10667-101-R-3.3.1*) and accounts for the changes to the proposed development design including those made in May 2019). The purpose of this updated PERA is to support further amendments to the proposed development.

1.2 Proposed Development

The redevelopment (hereafter referred to as the 'Development') involves demolition of all structures on-Site except the former listed malthouse structure and facades of the former hotel and bottling building. A new mixed use development will be constructed, providing homes (including affordable homes), complementary commercial uses, community facilities, a new secondary school alongside new open and green spaces throughout. Associated highway improvements are also anticipated, which include potential highway works at Chalkers Corner. A large single-level basement will underlie the majority of the eastern part of the Site (east of Ship Lane), with a sub-basement under the cinema building (Building 01). A smaller single-level basement will be constructed in the western part of the Site (west of Ship Lane).

Three planning applications have been submitted in for the development, as follows:

Application A

"Hybrid application to include the demolition of existing buildings to allow for the comprehensive phased redevelopment of the Site:

Planning permission is sought in detail for works to the east side of Ship Lane which comprise:

- Demolition of existing buildings (except The Maltings and the façade of the Bottling Plant and former Hotel), walls, associated structures, site clearance and groundworks;
- Alterations and extensions to existing buildings and erection of buildings varying in height from 3 to 10 storeys plus a single storey basement;
- Residential apartments;
- Flexible use floorspace for:
    i. Retail, financial and professional services, café/restaurant and drinking establishment uses
    ii. Offices
    iii. Non-residential institutions and community use
    iv. Boathouse
- Hotel / public house with accommodation;
- Cinema;
- Offices;
- New pedestrian, vehicle and cycle accesses and internal routes, and associated highway works;
- Provision of on-site cycle, vehicle and service parking at surface and basement level;

- Provision of public open space, amenity and play space and landscaping;
- Flood defence and towpath works; and
- Installation of plant and energy centres.

Planning permission is sought in outline with all matters reserved for works to the west of Ship Lane which comprise:

- The erection of a single storey basement and buildings varying in height from 3 to 8 storeys
- Residential development
- Provision of on-site cycle, vehicle and service parking
- Provision of public open space, amenity and play space and landscaping
- New pedestrian, vehicle and cycle accesses and internal routes, and associated highway works."

Applications B and C

No amendments are proposed to the description of development for Applications B and C.

1.3 Regulatory Context

The National Planning Policy Framework (NPPF) 2019 sets out Government planning policy for England and how this is expected to be applied to development. Paragraph 118 of Section 11 – Making effective use of land and paragraphs 170, 178, 179 and 183 of Section 15 – Conserving and enhancing the natural environment of the NPPF relate to contaminated land matters and state the following:

118. Planning policies and decisions should:

> *c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land;*

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and*
>
> *f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.*

178. Planning policies and decisions should ensure that:

> *a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);*
>
> *b) after remediation, as a minimum, land should not be capable of being determined as contaminated*

land under Part IIA of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

179. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

183. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

In order to assess the contamination status of the Site, with respect to the proposed end use, it is necessary to assess whether the Site could potentially be classified as "Contaminated Land", as defined in Part IIA of the Environmental Protection Act 1990 and Contaminated Land Statutory Guidance 2012. This is assessed by the identification and assessment of potential pollutant linkages. The linkage between the potential sources and potential receptors identified needs to be established and evaluated.

To fall within this definition, it is necessary that, as a result of the condition of the land, substances may be present in, on or under the land such that:

a) significant harm is being caused or there is a significant possibility of such harm being caused; or

b) significant pollution of controlled waters is being caused, or there is significant possibility of such pollution being caused.

It should be noted that DEFRA has advised (Ref. Section 4, DEFRA Contaminated Land Statutory Guidance 2012) Local Authorities that land should not be designated as "Contaminated Land" where:

a) the relevant substance(s) are already present in controlled waters;

b) entry into controlled waters of the substance(s) from land has ceased; and

c) it is not likely that that further entry will take place.

These exclusions do not necessarily preclude regulatory action under the Environmental Permitting (England and Wales) Regulations 2016, which make it a criminal offence to cause or knowingly permit a water discharge of any poisonous, noxious or polluting matter to controlled waters. In England and Wales, under The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009, a works notice may be served by the regulator requiring appropriate investigation and clean-up.

1.4 Constraints

The information contained in this report is based on a review of available historical, geological and hydrogeological sources, consultation with the regulatory authorities, previous ground investigation reports and observations made on-Site during inspections on 14 July 2016 and 17 July 2019.

Waterman has endeavoured to assess all information provided to them during this investigation but makes no guarantees or warranties as to the accuracy or completeness of this information.

The scope of this ground investigation includes an assessment of the presence of asbestos containing materials in the ground at the Site but not within buildings or structures or below ground structures (basements, buried service ducts and the like).

Access was not available to part of the workshop at the eastern section of the Site, due to stripping works in progress at the time of the walkover.

The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the Site.

2. Methodology

This Preliminary Environmental Risk Assessment has been undertaken in general accordance with the Model Procedures for Management of Land Contamination (Contaminated Land Report 11 – Environment Agency, September 2004).

The report includes the following:

- collation of available documentary information;
- a Site reconnaissance;
- hazard identification;
- formulation of a Preliminary Conceptual Model for the Site;
- hazard assessment for the identification of potentially unacceptable risks; and
- recommendations for further action.

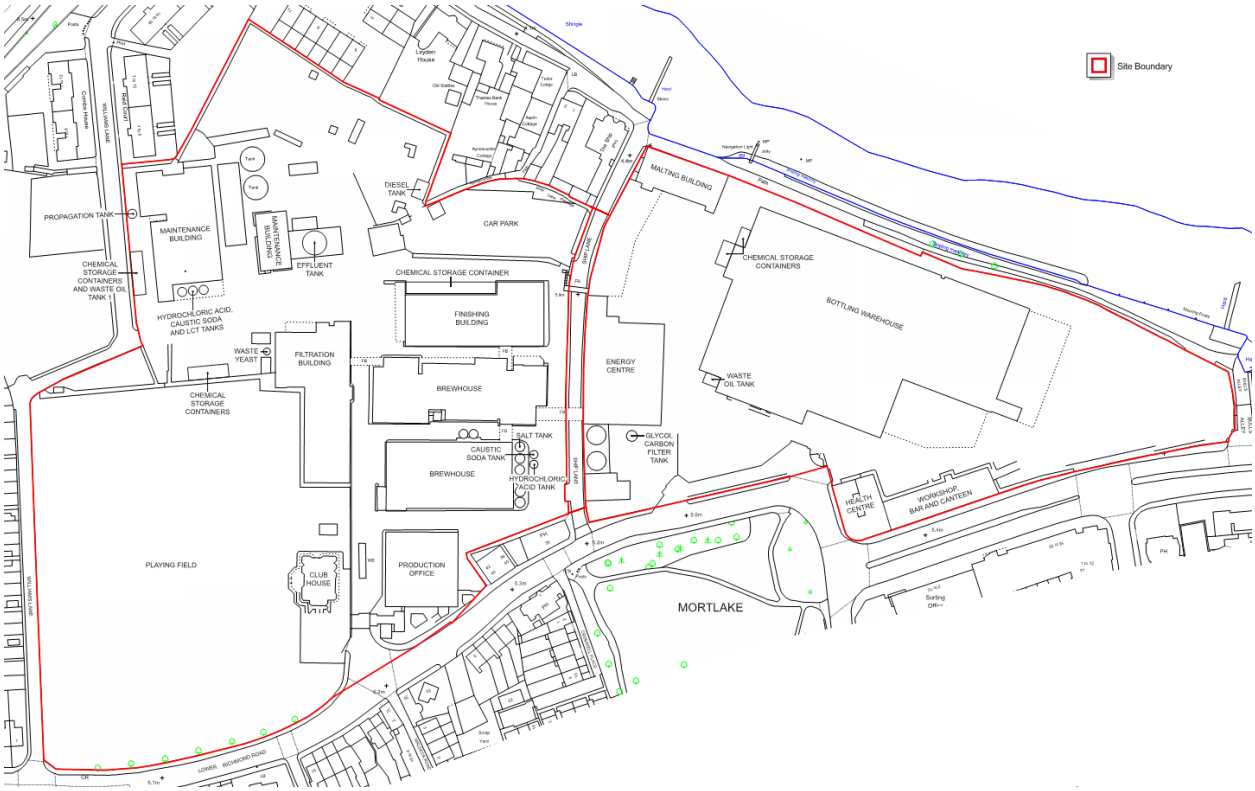
3. Hazard Identification

3.1 Site Description and Reconnaissance

The Site is located at National Grid Reference 520360, 175990, in Mortlake, south-west London. The Site comprises two adjacent land plots bisected by Ship Lane, an 'East Site' and a 'West Site'. The East Site is entirely occupied by brewery buildings, and the West Site is occupied by further brewery buildings in the north and east, and a playing field in the southwest. Thames Water sewers pass beneath the Site, however these have been decommissioned by backfilling at the Site boundary.

At the time of the walkover in July 2019 works to strip out brewery infrastructure from the buildings and external areas such as tanks and electrical cabinets were in progress. Partial demolition of some buildings had been completed to facilitate removal of larger tanks and other equipment.

Figure 1: Site Layout (pre-demolition works)



Source: 2016 Pre-demolition Site Plan

East Site

The East Site is occupied by five main buildings: the Maltings; Bottling Warehouse; hotel/health centre, workshop, bar and canteen; and Energy Centre. These buildings are surrounded by hardstanding. All buildings have been internally stripped out except the power house, where removal of electrical infrastructure was in progress at the time of the walkover.

The Maltings is located at the northwest corner of the Site and is seven storeys with a single storey basement. This building has been internally stripped and is empty, however was not assessed during the walkover due to structural instability.

The centre of the Site is occupied by a large Bottling Warehouse, with a double-height ceiling at the work

floor and a two-storey office integrated along the western side of the building. The warehouse and offices have been completely stripped internally, and all plant and machinery has been removed. A 3,350 litre waste oil tank and pipework was formerly located in the south-west corner of the Site, however this has since been removed. The drainage runs surrounding this former tank remain in place. An outdoor area of the building in the west of the Site under a canopy was in use for general waste storage, with two empty drip trays, pallets of building materials, metal containers and small mobile equipment stored here.

The former hotel/health centre, workshop, bar and canteen are located in a single two-storey building at the southern edge of the Site. This building is internally subdivided into a medical room in the western end, and canteen with food cellar, workshop and a bar to the east. Above the workshop, bar and canteen are a series of meeting rooms. All rooms in these buildings had been or are in the process of being internally stripped out. Access was not available to part of the workshop due to stripping works in progress at the time of the walkover.

The Energy Centre is a three-storey building with rooftop access in the west of the Site. The ground floor contains pipework for ammonia tanks which have been removed, and large boiler tanks which remain in place. Two large water tanks and associated pipework are present at first floor level, along with a series of glycol tanks. An electrical substation and electrical cabinets are located at the second floor and were being stripped out at the time of the walkover. The third floor leads to rooftop access. Four air conditioning units are located at the rooftop, still in place at the time of the walkover. A series of glycerol carbon filter tanks located on the outside of the building to the north were removed during the walkover. A further 4,700 litres glycol carbon filter tank and pipework are located in south-west.

Potentially contaminative activities and features identified during the walkover are detailed in Table 1.

Table 1: Summary of Potentially Contaminative Activities on East Site

Potential Issue	Description	Condition
Above ground Storage Tanks (and fuel lines)	Glycerol carbon filter tank and pipework in south-west corner of the Site, approximately 4,700 litre capacity.	Appeared in good condition with no damage, corrosion or staining. Certified as decommissioned.
	Two glycol tanks and pipework at 2nd floor within energy centre, estimated capacity 10,500 litre each.	Appeared in good condition with no damage, corrosion or staining. Not known if they were empty.
	Two small glycol tanks in north of the Site, unknown volume	Tanks were undergoing removal at the time of the inspection.
	Former waste oil tank of 3,350 litre capacity	Tank and pipework removed, no evidence for staining to hardstanding
Drainage	Drainage at the East Site is combined. It is not known if there is an interceptor.	Hardstanding appeared to be in good condition, drains were clear with no evidence for overflowing. Drainage around former oil tank appeared clean with no evidence of staining or leaks from this tank.
Hazardous Materials	Two metal chemical storage containers located outside western face of warehouse.	Containers were empty, contained empty spill trays at base.
Solid and Liquid Waste Storage	Waste oil tank formerly present at south-western corner of bottling warehouse, approximately 3,350 litre capacity.	Tank and pipework removed, no staining evident on ground at former location.

West Site

The West Site comprises the seven main buildings surrounded by hardstanding: the Production Office Building (also referred to as POB); two Brewhouses; a Finishing Building; a Filtration Building; and two

Maintenance Buildings (also referred to as packaging and processing buildings). The brewery is adjacent to a sports field in the west of the Site, which has a two-storey clubhouse. Some trees are set in hardstanding at the northern and eastern boundary of the West Site.

The Production Office is a four-storey building with a single-level basement. Two large water tanks are situated within this basement, along with pumping infrastructure and a diesel generator with 800 litre supply tank. The above-ground floors contain meeting rooms, which have been completely stripped internally.

The Brewhouse Buildings and Finishing Building are adjacent three-storey and four-storey blocks in the east of the Site. Stripping out of these buildings was in progress at the time of the walkover, with partial demolition of the brewhouses and finishing building undertaken above ground level to facilitate removal of the large brewery tanks and other infrastructure. A former chemical storage area is located along the north of the finishing building, with six hazardous gas cylinder storage bays. These bays were formerly listed as containing nitrogen, compressed air, helium, hydrogen and acetylene. l

The Filtration Building is a part three, part four storey building in the centre of the Site. The main section of the building is occupied by brewing infrastructure such as tanks and pipework, with an office complex on all floors at the northern end. The ground floor and first floor of the filtration building are disused offices which have been cleared out. At the second floor of the Filtration building is a set of offices and a small laboratory for product testing. At the time of the walkover soft-stripping out process was in progress.

The Maintenance Buildings are located in the northwest corner of the Site. Both are single storey, and are used for storage of pump equipment, parts and tools. Access was not available to the either Maintenance building due to hoarding blocking the entrances. Externally, three former chemical tanks and equipment present in the south of the buildings have been removed. A former large, outdoor effluent tank to the east of the eastern maintenance building has been dismantled, although the base remains in place.

A 6,750 litre mobile diesel storage tank is located in the north of the Site on hardstanding. The current volume of fuel in this tank was not known. No staining or evidence for any leaks from this tank was evident.

Adjacent to the brewery to the west is a large, open playing field, with a two-storey clubhouse at the western boundary. Access was not available to this clubhouse at the time of the walkover.

Potentially contaminative activities and features identified during the walkover are detailed in Table 2.

Table 2: Summary of Potentially Contaminative Activities on West Site

Potential Issue	Description	Condition
Above ground Storage Tanks (and fuel lines)	Diesel tank against northern boundary, estimated capacity 6,750 litres.	Appeared in good condition, certified as decommissioned.
Drainage	Drainage at the West Site is combined. It is not known if there is an interceptor.	Hardstanding appeared to be in good condition, drains were clear with no evidence for overflowing.
Hazardous Materials	6no hazardous gas cylinder storage bays, marked for nitrogen, compressed air, helium, hydrogen and acetylene.	Storage bays were empty.
	Diesel generator and pipework in basement of production offices, supplied by 800 litre diesel tank on raised platform.	Appeared in good condition with no damage, corrosion or staining. Tank certified as decommissioned.

3.1.1 Licences and Consents

The following Pollution, Prevention and Control licenses, discharge consents, licensed waste management facilities and registered radioactive substances are now covered by Environmental Permits;

- Integrated Pollution, Prevention and Controls (IPPC): Environmental Permit for a Part A(1) Activity
- Local Authority IPPC (LA-IPPC): Environmental Permit for a Part A(2) Activity
- Local Authority Pollution, Prevention and Controls (LAPPC): Environmental Permit for a Part B Activity
- Licensed Waste Management Facilities: Environmental Permit for waste activities
- Registered Radioactive Substances: Environmental Permit relating to radioactive substances
- Discharge Consents: Environmental Permit for discharges to groundwater/surface water

The Groundsure Enviro Insight dataset obtained for the Site identified the following licences and consents registered to the property:

- Two Integrated Pollution Prevention and Control applications, registered to The Stag Brewery. The earlier of these were registered in November 2005 and relates to treating of raw materials for food processes (brewing). The later of these applications was for surrender of the permit upon closure of the brewery and was submitted in March 2015. A surrender notice was issued by the EA in June 2016.

A Site Location Plan and Site Layout Plan are presented as Appendix A. A selection of photographs taken during the site inspection is presented as Appendix B.

3.1.2 Site Surroundings

A summary of the current surrounding land uses, including relevant licences and consents, is shown in Table 3.

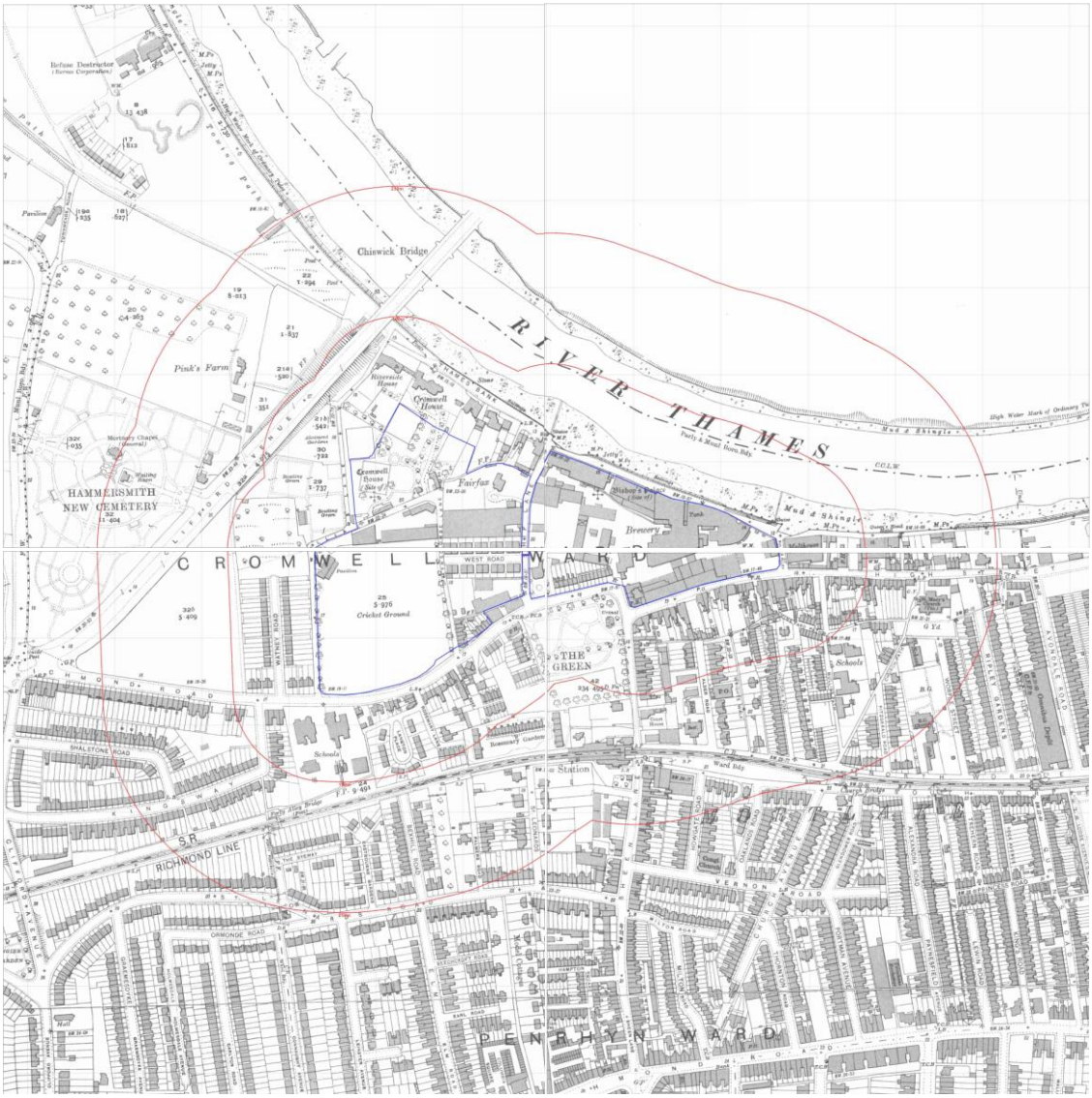
Table 3: Summary of Surrounding Land Uses

Location	Description
North	The River Thames. Four historical landfills, the closest 126m northwest, named Dukes Meadow and accepting waste between 1945 and 1950. The further four landfills are between 233m and 419m north, and where recorded accepted inert and industrial waste. These landfills closed between 1934 and 1935. Single active licensed waste management facility, 467m northwest and managing household, commercial and industrial waste. This site is also a Registered Waste Transfer Site. Single Environmental Permit 241m northwest, registered to a crematorium.
East	Residences. Two Environmental Permits, closest 73m south-east registered to a dry cleaner. Further entry 852m west is also for a dry cleaner.
South	Mortlake High Street, commercial premises and residences. Former scrapyard 16m southeast Four Environmental Permits, the closest 245m south and registered to a petrol filling station. Further entry 498m south for a dry cleaner.
West	Williams Lane, residences. Single Environmental Permit 457m west registered to a petrol filling station.

There are no recorded Environmental Permits relating to handling of Local Authority Pollution Prevention and Controls, radioactive substances or explosives, Control of Major Accident Hazards (COMAH), or Notifications of Installations Handling Hazardous Substances (NIHHS) within 1km of the Site.

3.2 History

Figure 2: Historical Site Use



Source: Groundsure Enviro Insight Report Historical Mapping Data

A review of historical maps obtained from the Groundsure Enviro Insight has been undertaken. Table 4 summarises the relevant information.

Table 4: Site History

Source	Site [a]	Surroundings [a]
Surrey, Middlesex, Maps 1868*, 1870*, 1871*, 1896 (1:2,500) London Map 1895 (1:1,056) Surrey Maps 1873*, 1871-1874 (1:10,560)	A ***brewery*** occupies the eastern half of the Site. The western half of the Site is playing fields.	***Smithy*** directly adjacent to the Site to the east. ***Railway station*** and ***railway lines*** 150m to the south. Majority of the area surrounding the Site is residential, playing fields and a farm.

Source	Site [a]	Surroundings [a]
London Maps 1896 (1:2,500), 1896, 1898-1899 (1:10,560)	No significant changes.	***Coal wharf*** 100m east. ***Drainage works*** 750m northwest.
Insurance Plans (1907) 1:480 Surrey Maps 1913, 1914-1915*, 1919* (1;2,500), 1920 (1:10,560)	No significant changes.	***Bus garage*** present 300m southeast. ***Clay works*** 500m west. ***Electricity works*** 350m east. ***Electricity works*** 350m east are no longer present. ***Sewage works*** adjacent to ***drainage works*** 700m northwest.
Surrey Maps 1933, 1938* (1:10,560) Surrey Maps 1934-1935 (1;2,500), 1933 (1:10,560)	Large, unnamed commercial structures have been built in the western half of the Site.	***Incinerator*** 500m northwest Further warehouses have been built 100m-350m east.
OS Plan 1940-1958 (1:10,000) Historical Aerial Photography 1946 (1;1,250)	No significant changes.	***Incinerator*** is now a ***works***.
OS Plans 1952-1953 (1;2,500) OS Plan 1952-1960 (1;1,250) OS Plan 1953-1961, 1968* (1:2,500) Additional SIMs 1952-1953* (1:2,500)	Large commercial structure in the western part of the Site is listed as a ***garage***.	***Engine works*** 20m south ***Garages*** 40m and 140m south. The ***coal wharf*** 100m east is now a ***foundry***. ***Corporation depot*** 420m east. ***Coal bunker*** 350m east.
Additional SIMs 1953-1961*, 1952-1977 (1:2,500)	No significant changes.	The ***smithy, foundry*** and ***coal bunker*** are no longer listed. ***Electrical substations*** are listed 60m southeast, 400m southeast, 120m south and 240m south of the Site.
OS Plan 1974*, 1961-1978* (1:1,250) 1962-1966, 1966-1967*, 1975-1976* (1:10,000) Additional SIMs 1965-1978* (1:1,250)	Structures in the western half of the Site have been demolished or reduced in size. The ***garage*** is no longer listed. Six ***tanks*** are present in the southern half of the Site.	The ***corporation depot*** and ***works*** are no longer listed.
Additional SIMs 1978-1988*, 1987*, (1:1,250) London Map 1985 (1:25,000) National Grid Data 1991 (1:1,250)	No significant changes.	The ***engine works*** has expanded with additional buildings. The ***garage*** 40m south is no longer listed. A ***scrap yard*** is present 40m south.
National Grid Data 1991-1992*, 1991-1994, 1992-1995* (1:1,250) OS Plan 1992* (1:10,000)	Two large ***tanks*** in the northwest corner of the Site, and three smaller ***tanks*** in the west of the Site.	***Bus depot*** is no longer present.
Raster mapping 1999, 2006 (1:10,000)	No significant changes	The ***engine works*** and ***scrap yard*** are no longer listed.

Source	Site [a]	Surroundings [a]
Historic Aerial Photography 1999 1:1,250)		
Vector Map 2016 (1:10,000)		

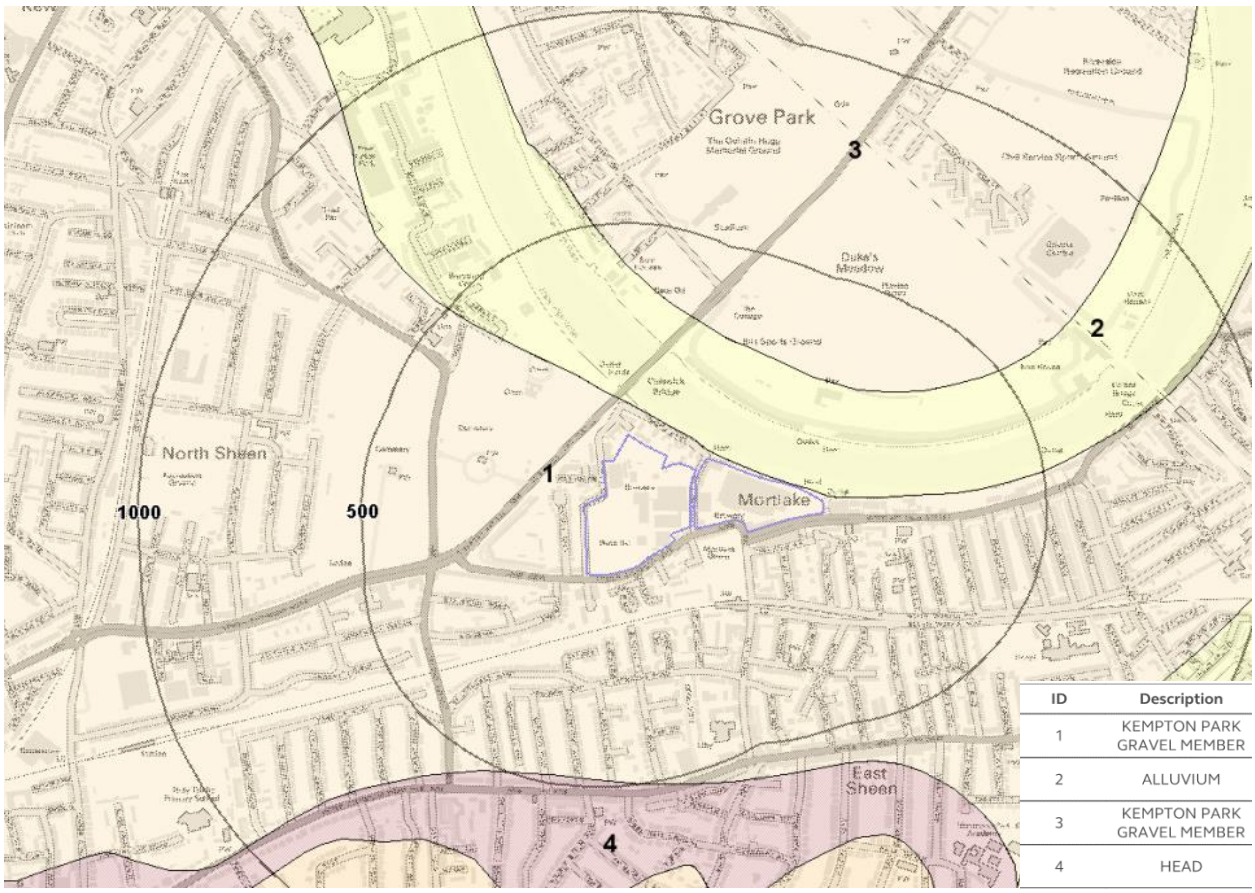
[a] potentially contaminative uses are shown in bold italics.

* maps do not have entire coverage of the Site or surrounding area.

3.3 Geology

The geology beneath the Site has been established from previous ground investigations by Dames and Moore (1995), CRA (2003) and Aecom (2015), alongside British Geological Survey 1:50,000 map sheet 270 (South London, Solid and Drift Edition), BGS borehole records TQ27/NW-596 and TQ27/NW-597, and the BGS website (accessed online 21/08/2019). The results are outlined in Figure 3.

Figure 3: Geology



Source: Groundsure Geo Insight Report

A summary of the geology is provided in Table 5.

Table 5: Site Geology

Stratum	Area Covered	Estimated Thickness	Typical Description
Made Ground	Whole Site	0.4 – 2.7	Predominantly coarse sand and gravel, including pieces of brick and minor amounts of black clinker.
Alluvium	Sporadic across Site	0.3 – 1.5	Soft brown grey slightly gravelly clay.
Kempton Park Gravel Member	Whole Site	1.4 – 3.9	Clayey, silty sand with varying gravel content with areas of soft, brown, sandy clay.
London Clay Formation	Whole Site	73	Stiff grey to brown clay, with occasional pockets of silt and sand.
Lambeth Group	Whole Site	15 – 20	Clay, some silty or sandy, with sands and gravels.
Thanet Formation	Whole Site	5 – 10	Fine grained sand that can be clayey and glauconitic. Flints at the base of the formation.
Chalk Group	Whole Site	Not proven	Chalk and flints.

BGS mapping does not indicate Alluvium is present beneath the Site. However, ground investigations found it is sporadically present in some areas at both the eastern and western sections of the Site.

3.3.1 Ground Stability

BGS map data does not identify any structural, geomorphological or geochemical features on or near to the Site. The Groundsure Geo Insight report for the Site records a moderate potential risk of shrinking or swelling clay ground stability hazards at the northern half of the Site, with the remainder of the Site assessed as negligible risk.

The Site is not in an area that could be affected by coal or metalliferous mining activity.

3.3.2 Unexploded Ordnance

There is a risk unexploded bombs, anti-aircraft projectiles and/or incendiary bombs fell unnoticed and unrecorded within the Site boundary. The Preliminary Unexploded Ordnance Risk Assessment (Ref. 501990) for the Site produced by Groundsure (Appendix C), identifies an overall medium risk classification for the Site. Historical records indicate during WWII the LBRuT sustained a high density of bombing and bomb risk maps have identified several high explosive bombs as having fallen on parts of the Site.

3.3.3 Ground Gas and Vapours

Radon

Radon is a colourless and odourless radioactive gas, formed from the decay of naturally occurring uranium within soils and rocks. The radioactive elements formed by the decay of radon may be inhaled, entering the lungs, and potentially leading to localised damage, and lung cancer.

Current Building Regulations, endorsed by Public Health England (PHE) detail that all new buildings or extensions require radon protective measures where the development is in an area of high radon.

Information recovered from the Landmark Report, BGS, and PHE indicate the Site is not in an area of high radon levels. Correspondingly, no radon protective measures are required at the proposed development.

In 2009 the Health Protection Agency ((HPA), now Public Health England) recommended that radon protection measures be built into all new occupied buildings in the UK, whether or not they were situated in radon sensitive area as identified by British Geological Survey (BGS) maps. The Building Regulations Advisory Committee supported the HPA's proposal. However the then Government rejected this recommendation and the current Building Regulations (2013) do not include it.

This approach should be confirmed with the Building Control Officer.

Ground Gas

There are four registered landfills within 500m of the Site. These landfills are all located to the north, and are separated from the Site by the River Thames. This is likely to prevent the migration of ground contamination, ground gas and vapours from these landfills to the Site.

The potential for ground gas has been further assessed according to the Waterman Ground Gas Assessment Tool, with results reproduced in Appendix C. Following assessment, the Site is considered a very low risk for ground gas issues. Based on the sensitivity of the end-use receptor, no further ground gas investigation or assessment is required.

Vapours

Land uses with the potential to result in ground contamination with vapour risks have been identified on-Site, including diesel and waste oil tanks. These tanks were all formerly located in buildings or on hardstanding, reducing the potential for any leaks or spills to reach the underlying soils. All tanks have been decommissioned and are no longer in use, mitigating their potential to cause future contamination before or during redevelopment.

The Groundsure dataset does not record any pollution incidents relating to oils or fuels within 500m of the Site.

Based on the above there is no significant vapour risk to the Site.

3.4 Controlled Waters

3.4.1 Surface Waters

The nearest surface water to the Site is the River Thames, directly adjacent to the north. The Ecological Potential of the River Thames has been assessed as 'Moderate' under the Water Framework Directive.

There are no surface water abstractions within 1km of the Site. The closest is 1.3km northeast, drawing water from the River Thames to supply a lake/pond.

There are five recorded active Environmental Permits for discharges to surface water within a 1km radius of the Site. The closest of these is located 763m northwest, operated by Thames Water for discharge of public sewage overflow to the River Thames. The further four are also for sewage overflows. On-Site sewer records indicate that some areas of the Site currently drain to the Thames Water surface water sewer network, ultimately discharging to the River Thames.

The Environment Agency (EA) records a single pollution incident to surface water from the Site, involving a spill of unknown chemicals at Stag Brewery. The spill was recorded as a Category 3 (minor incident). A further two Category 2 (significant incident) spills are recorded at Ship Lane, which runs between the East Site and the West Site, involving miscellaneous chemicals and unknown chemicals. These spills likely originated from the Site.

The EA provides the following further information relating to these incidents:

- Pollutant Incident 17/04/1996 at Stag Brewery involved a spillage of yeast on-site, which had a minimal impact to the tidal Thames.
- Pollutant Incident 02/07/1994 at Ship Lane was a discharge of brown foaming trade effluent discharged directly to the River Thames from a surface water outfall due to incorrect plumbing. A CCTV survey was undertaken and the situation rectified. A local effect to the tidal Thames was recorded.
- Pollutant Incident 24/05/1989 at Ship Lane was a discharge of contaminated water to the River Thames. The cause was identified as a broken sewer on-Site allowing effluent to enter surface water drainage. The discharge was stopped on discovery and the sewer repaired.

Environmental Incident Reports provided for the Site to Aecom referred to 15 spill incidents during operation of the brewery between 2009 and 2015. These included spills to drainage of brewing substances (wort, beer, grain, yeast and sugar) and mechanical fluids (lubricant, hydraulic oil, oxafoam, diesel and unidentified substances). Whether the spills were cleaned up, or the clean-up methodology used for each spill is not recorded.

Six pollution incidents to surface waters are recorded within 1km of the Site. The closest of these occurred 475m northwest, involved a miscellaneous spill of oils to the River Thames and was a Category 2 (significant incident). The further pollution incidents involved oils, sewage and miscellaneous chemicals, with three classed as Category 3 and two classed as Category 2.

3.4.2 Flood Risk

According to EA indicative flooding data, the north-east of the Site is located within a Zone 2 flood risk area. The remainder of the Site is within a Zone 3a flood risk area, however a flood risk assessment for the Site by Hydro-Logic Services in October 2019 states the Site is not within Flood Zone 3b (functional flood plain).

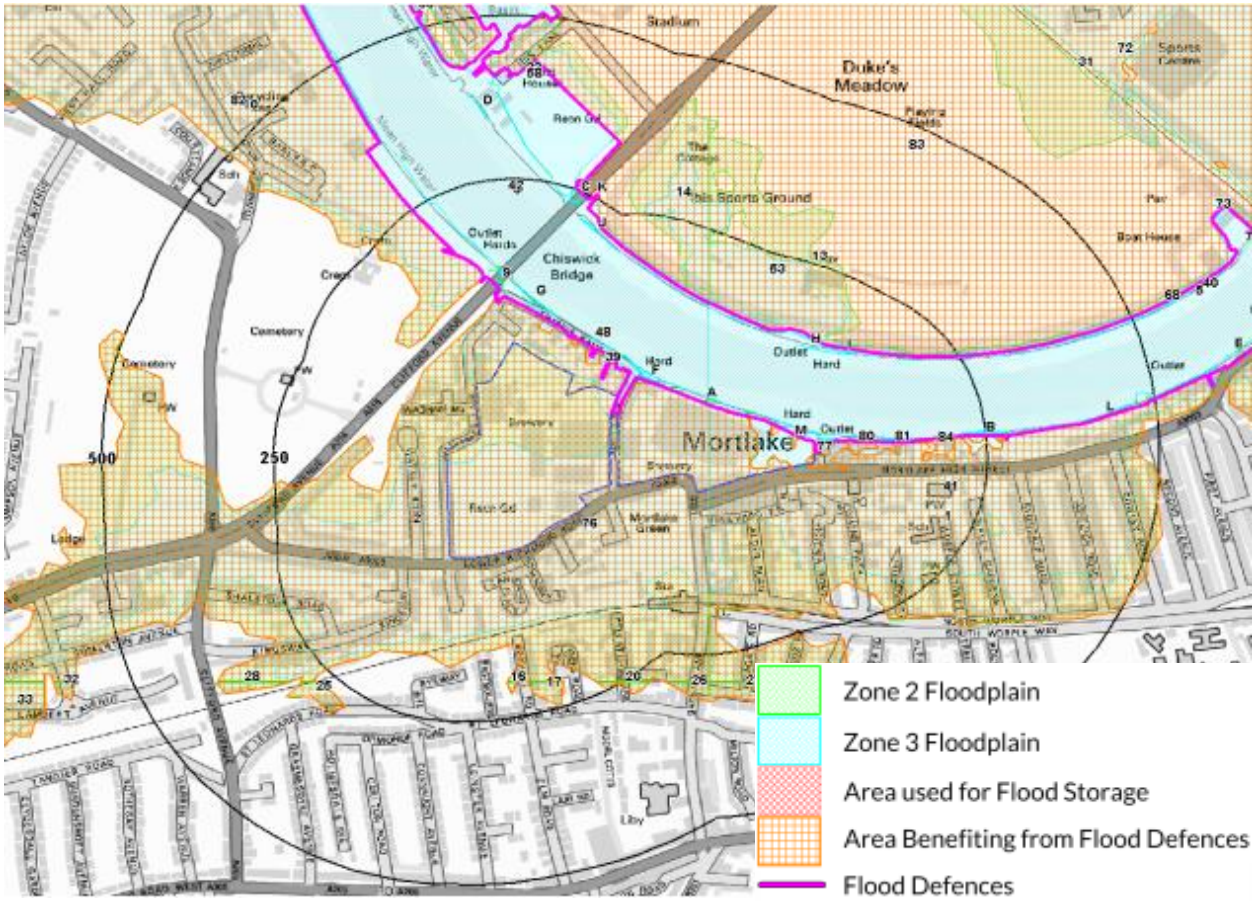
Mapping data indicates the Site is in an area benefitting from flood defences. In consideration of this, the Groundsure dataset reports the risk of flooding from rivers and the sea as low.

BGS data also indicates the Site is in an area at risk of groundwater flooding to surface level.

During a previous walkover of the Site by Waterman in 2016, Ship Lane and the off-site footpath to the north of the brewery were flooded.

The risk of flooding from rivers or seas is shown in Figure 4.

Figure 4: Flood Risk Zones



Source: Groundsure Enviro Insight

3.4.3 Groundwater

According to EA online data, the geological deposits underlying the Site are classified as per Table 6.

Table 6: Summary of Hydrogeological Properties of the Main Geological Strata

Stratum	EA Classification	Hydrogeological Significance
Made Ground	Not classified	Likely to be sufficiently permeable to allow the migration of surface water to underlying strata.
Superficial Deposits (Alluvium and Kempton Park Gravel Member)	Secondary A Aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These strata are likely to be in hydraulic continuity with the adjacent River Thames.
London Clay Formation	Unproductive Stratum	Rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.
Lambeth Group	Secondary A Aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Thanet Formation	Secondary A Aquifer	
Chalk Group	Principal Aquifer	Layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage.

The Site is not located within a groundwater Source Protection Zone. Based on available information, it is anticipated that shallow groundwater in the Alluvium and Kempton Park Gravel Member is in hydraulic continuity with the tidal River Thames directly adjacent to the Site.

There are two recorded historical groundwater abstractions within the Site boundary, references TQ27/NW-596 and TQ27/NW-597. These wells were drilled in 1836, extended to 101m and 121m below ground level in 1858 and abstracted groundwater from the Chalk Group Aquifer. Details of abstraction volumes were not recorded.

A further two groundwater abstractions are recorded within a 1km radius of the Site. The closest of these is located 228m north at Dukes Meadow Golf Club, drawing 8,000 litres of groundwater per year from the Chalk Group aquifer for irrigation of the playing green. The further abstraction is located 663m northeast, also for irrigation purposes at Dukes Meadow Golf Club and drawing a further 5,000 litres per year.

There are no Environmental Permits for discharges to groundwater recorded within 1km of the Site.

3.5 Ecological Systems

The Groundsure dataset identified the non-statutory River Thames and Tidal Tributaries Site of Metropolitan Importance (SMI) for Nature Conservation located adjacent to the north of the Site.

3.6 Consultations

The agencies and individuals which have been contacted and/or their records reviewed during the course of this study are listed in Table 7.

Table 7: List of Parties Consulted During this Study

Organisation	Consultee	Response
London Borough of Richmond upon Thames		
Environmental Health	Simon Makoni	Response received July 2016.
Planning	-	Contacted June 2019, no response was received.
Building Control	-	Contacted June 2019, no response was received.
Environment Agency		
Enquiries Unit	Karen Rigg	Response received 10/09/2016.

3.6.1 Environmental Health

The Environmental Health Department reported they held records of potentially contaminative land uses in proximity to the Site between 1899 and 2016. These included the brewery on-Site alongside electrical substations, foundries, metal recycling centres, petrol filling stations and ordnance works within the surrounding 500m.

LBRuT did not hold records of any contaminated land ground investigations or remediation having taken place at the Site.

3.6.2 Planning Department

A search of the LBRuT's planning portal (accessed online August 2019) identified multiple planning applications for the Site between 1977 and 2019. The majority of these related to tree works such as

pruning and branch clearing. Several applications were for minor changes to building layouts such as extensions, upgrades or erection of display hoardings.

A planning application is recorded for construction of the Bottling Warehouse at the East Site (reference 95/1625/FUL. This application was approved in July 1995, with no conditions relating to contaminated land. Four further applications are recorded for minor variations to this planning permission.

3.6.3 Environment Agency

Information has been requested from the EA with regard to pollution incidents, in their response they identified the following;

- Pollutant Incident 17/04/1996 involved a spillage of yeast on-site, which had a minimal impact to the tidal Thames.
- Pollutant Incident 02/07/1994 was a discharge of brown foaming trade effluent discharged directly to the River Thames from a surface water outfall due to incorrect plumbing. A CCTV survey was undertaken and the situation rectified. A local effect to the tidal Thames was recorded.
- Pollutant Incident 24/05/1989 was a discharge of contaminated water to the River Thames. The cause was identified as a broken sewer on-Site allowing effluent to enter surface water drainage. The discharge was stopped on discovery and the sewer repaired.

4. Previous Environmental Assessments

The following environmental reports were provided with respect to the Site.

Table 8: List of Previous Environmental Assessments and Documents Reviewed

Author	Title	Reference and Date
Aecom	Stag Brewery: Phase 1 Environmental Site Assessment	47074683; July 2015
Aecom	Stag Brewery, Mortlake: Phase 2 Environmental Site Assessment Report	47075502; September 2015
Aecom	Stag Brewery, Mortlake: Groundwater Sampling Point Decommissioning Report	60473952; February 2016
Bale Group	Tank Decommissioning Certificates	December 2015 to January 2016
Waterman	Environmental Risk Assessment: The Former Stag Brewery East Site, Mortlake, London	WIE10667-101-R-4.2.1 RJM; February 2018

Stag Brewery, Mortlake: Phase 1 Environmental Site Assessment, July 2015

This desk study report was undertaken in July 2015. The objective of the report was to identify potential risks, liabilities and constraints to future developments. The study area comprised all brewery buildings on-Site, and the adjacent playing fields. At the time of the survey, the brewery was disused although twelve tanks were still present. These were identified as holding gas oil (x2), waste oil (x2), slat-lube, diesel (x2), hydrochloric acid, brine, caustic soda, and spent KG slurry (x2).

The desk study reviewed environmental, geological, hydrogeological data, and information from a number of previous reports for the Site, listed below:

- Dames & Moore Environmental Assessment (1995);
- CRA Baseline Soil and Groundwater Investigation (2003);
- SPMP Groundwater Monitoring Reports (2003 – 2012) and Review Report (2008);
- The asbestos risk register for the Site, drainage survey, environmental incident reports and periodic environmental inspections undertaken while the Site was in active use were also reviewed.

The Dames & Moore and CRA reports included intrusive ground investigation, with soil and groundwater sampling at a total of eighteen exploratory holes drilled to between 2.5m and 7.9m below ground level (bgl). Six monitoring wells were installed by Dames & Moore, and seven by CRA. CRA also undertook monitoring at four of the Dames & Moore wells during their investigation, bringing the total for their study to eleven.

Geology encountered during the ground investigations comprised Made Ground, then Alluvium which was found to be sporadic across the Site, and not present in many locations. Beneath this was Kempton Park Gravel Member, then London Clay Formation to maximum depth drilled. Groundwater was encountered at between 4 to 5.5m bgl within the Kempton Park Gravel Member. Locally perched groundwater was encountered at 1.2m to 2.6m bgl, due to the presence of underground voids. Groundwater was interpreted to generally flow towards the east / north-east, likely influenced by tidal cycles of the nearby River Thames.

Soil samples from the Made Ground, Alluvium and Kempton Park Gravel Member were analysed as part of both ground investigations for a range of organic and inorganic contaminants including metals, VOCs and SVOCs, and TPH. The Dames & Moore study found no exceedances of Dutch Intervention Values (DIV; applicable as soil guidance values in 1995 but superseded since) were detected. In groundwater, a

single exceedance of chromium and copper above DIV was recorded in one borehole, but this was not considered to be representative of the water body as a whole.

The CRA results showed no exceedances of DIV within soil samples. In groundwater, concentrations of TPH of 51ug/l and 1,114ug/l were recorded in two boreholes, in the vicinity of the fuel oil tanks.

Dames & Moore concluded that, given the lack of evidence of significant soil or groundwater contamination at the Site, the risk to off-Site groundwater receptors was low. The CRA report concurred but noted that a potential pollution pathway existed between the tanks holding caustic soda and acid, and groundwater beneath the Site via downward migration through damaged hardstanding.

Groundwater from these wells was monitored and sampled for laboratory analytical testing on a further three occasions in December 2005, April 2007 and November 2012 as part of a Site Protection & Monitoring Programme (SPMP). Results of this monitoring found that when compared against relevant Environment Quality Standards (EQS), Environmental Standards for Discharge to Surface Waters, Drinking Water Quality Standards (DWS) or WHO guidelines for drinking water some exceedances for metals, hydrocarbons and ammoniacal nitrogen. However, this was not thought to represent widespread groundwater contamination at the Site.

Neither the Dames & Moore nor the CRA study included ground gas or vapour monitoring at the Site.

The Environmental Incident Reports provided for the Site referred to 15 spill incidents during operation of the brewery between 2009 and 2015. These included spills to drainage of brewing substances (wort, beer, grain, yeast and sugar) and mechanical fluids (lubricant, hydraulic oil, oxafoam, diesel and unidentified substances).

The Aecom desk study concluded that sources on-Site were the brewery and chemicals stored for brewing operations, effluent management and historical chemical releases. Identified pathways for potential migration of any contamination were vertical and lateral transport through shallow soils, volatisation of ground contamination resulting in vapours, and direct contact between ground contamination and human receptors. Potential receptors included construction workers, future Site residents, off-Site residents and controlled waters beneath and adjacent to the Site. The risk posed by potential contamination was assessed as low due to the low levels of contamination identified by past ground investigations. However, the report recommended further ground investigation be done to confirm no localised areas of contamination were present in areas where historically intensive industrial processes were identified.

Stag Brewery, Mortlake: Phase 2 Environmental Site Assessment Report, September 2015

Aecom conducted an intrusive ground investigation between 20 and 28 August 2015. Twenty-eight boreholes were drilled to a maximum depth of 5m bgl to collect soil samples, and three deep boreholes were drilled to between 6m and 7.6m to allow for groundwater sampling.

Exploratory hole locations were distributed across both the eastern and western areas of the Site, and targeted areas where the potential for localised contamination was identified in the earlier Phase 1 report. These included heavy oil storage tanks in three locations around the Site, storage areas in the northwest, the tanker cleaning pad and waste storage areas in the west, the area of a suspected historical drain leak, chemical storage areas in the west and southwest, vehicle maintenance area in the east, electrical substation, slurry tanks and engineering workshop. The remaining locations were chosen to provide general Site coverage. The geology and groundwater depths encountered during the investigation was generally consistent with that described in geology section of this report, although the thickness of Made Ground was found to be greater than that logged by the 2003 CRA study.

In addition to the new exploratory holes, the 13 existing groundwater wells from previous ground investigations were reconditioned via desilting and pumping. Groundwater level monitoring and sampling was then undertaken at all 16 installations.

Soil samples from the Made Ground, Alluvium and Kempton Park Gravel Member were analysed for organic and inorganic contaminants including metals, polyaromatic hydrocarbons (PAH), volatile and semi-volatile organic compounds (VOCs and SVOCs), speciated total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), pH and asbestos. Results were compared against Aecom Generic Assessment Criteria for three end-use scenarios based on the anticipated development layout: residential land with gardens, residential land without gardens and commercial land.

Soil results

Results of soil testing for 37 samples collected found that levels of arsenic exceeded GAC for a residential end-use with or without private gardens in a single location. Levels of lead exceeded GAC for commercial end-use in one location, residential end-use without private gardens in two locations and human health with private gardens in six locations. Three exceedances of coal tar above residential GAC without private gardens were also identified. Asbestos was detected in eight samples across the Site, however this was quantified at levels less than 0.1%.

Soil sampling and testing indicated that overall contamination across the Site did not represent an unacceptable risk to human health, regardless of the end use scenario.

Groundwater results

Groundwater samples from the Kempton Park Gravel Member shallow aquifer were tested for metals, ammoniacal nitrogen, nitrate, phosphate, sulphate, VOCs and SVOCs, TPH and pH. The results were contrasted against UK Drinking Water Standards (DWS), or Environmental Quality Standards (EQS).

During recovery of groundwater samples, no measurable free phase product, oily sheen or staining was observed and no hydrocarbon odours or significantly elevated PID readings were detected. Groundwater results found some elevated levels of metals above DWS and EQS. Three samples contained elevations of TPH, and a single sample contained phenol above EQS. The average ammoniacal nitrogen concentration from groundwater samples marginally exceeded the DWS. However, the measured concentrations were variable and in many cases were only slightly above GAC.

Ground Gas and Vapour Monitoring

Aecom did not undertake any ground gas or vapour monitoring at the installed monitoring wells, as this was not within the scope of their investigation.

The report concluded that soils and groundwater at the Site did not contain contaminant concentrations that represented a significant environmental risk to human health or controlled waters. No environmental improvement works were considered necessary at the Site.

Stag Brewery, Mortlake: Groundwater Sampling Point Decommissioning Report

The sixteen groundwater monitoring wells drilled as part of previous investigations at the Site were decommissioned by Aecom in February 2016, as part of the closure of the brewery on-Site and surrender of Environmental Permits. Works involved filling the entire standpipe and screened section of each well with low permeability backfill (slurry) and securing the metal cover in place at the surface.

The report concluded that the sampling points had been successfully decommissioned and no pathway for any future surface contamination to reach groundwater or subsurface soils via the wells existed.

Bale Group: Tank Decommissioning Certificates

Bale Group undertook tank decommissioning and cleaning works at the Site between 2 December 2015 and 21 January 2016. The following tanks still present at the Site were drained, cleaned, degassed and tested as free of CO_2, H_2S, LEL and pH with a calibrated handheld gas detector:

East Site

- Glycol carbon filter tank in southwest corner of the Site.
- Waste oil tank 2 located outside southwestern corner of the warehouse.

West Site

- Diesel generator tank in Production Office basement.
- Diesel tank against northern boundary.
- Hydrochloric acid tank, bund and pipework at east side of Brewing Building.
- Caustic soda tank, bund and pipework at east side of Brewing Building.
- Effluent tank on raised platform in centre of northern part of the Site
- Waste oil tank 1 located against western boundary wall, approximately 3,350 litres capacity.

Environmental Risk Assessment: The Former Stag Brewery East Site, Mortlake, London, February 2018

Waterman undertook a ground investigation at the section of the Site east of Ship Lane between 3-27 October 2016. The scope included two boreholes drilled to 30m bgl, ten window sampler holes to 5.5m bgl. Monitoring wells were installed in both boreholes and window sampler holes.

Boreholes were located at opposing ends of the Site to provide the widest possible range of geotechnical conditions and variance over the total area. Four window sampler holes were situated targeting potentially contaminative former activities at the brewery, with the remainder located to provide a spread of exploratory holes across the available Site area. Monitoring wells were installed in eight of the window sample holes, and both boreholes to enable ground gas and vapour monitoring, and groundwater monitoring and sampling.

Soil samples were collected from arisings every 0.5m in the Made Ground, and every 1.0m in the natural material. Samples collected were analysed for a range of inorganic and hydrocarbon contaminants including metals, total petroleum hydrocarbons (TPH), polyaromatic hydrocarbons (PAHs) volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Samples of shallow strata were also submitted for Waste Acceptance Criteria testing. Groundwater samples were collected from all monitoring wells, and screened for metals, TPH, PAHs, VOCs and SVOCs.

Soil results

No metal contamination was identified above residential assessment criteria. TPH exceedances were recorded across three sampling locations in the western half of the Site, close to historical tank bases and the decommissioned waste oil tank. Asbestos was not visually identified during the ground investigation works. Following laboratory microscopic analysis and quantification, chrysotile asbestos as fibre bundles was identified in some Made Ground samples.

Groundwater results

Groundwater samples from the Kempton Park Gravel Formation identified iron, nickel and zinc contamination at BH1, in the southwest of the Site. No elevated levels of organic contamination were identified

Ground Gas and Vapour Monitoring

A single preliminary round of ground gas and vapour monitoring was completed at the Site. Based on the highest methane or carbon dioxide concentration recorded of 4% v/v and the peak flow rate of +0.4 l/hr, the Site was classified as very low risk for ground gas issues. Based on soil and groundwater sampling, and follow-up monitoring the Site was not considered at significant risk of vapour ingress.

The report concluded that whilst significant ground contamination was not identified, further investigation in areas of the Site not accessible at the time of the study was needed to confirm the ground conditions.

5. Hazard Assessment and Preliminary Conceptual Model

Contaminants of concern are presented within Table 9. The Preliminary Conceptual Model for the Site is presented in Table 10 and graphically in Figure 3 of Appendix A.

The risk rating included in Table 10 has been assessed qualitatively using the criteria given in Appendix E and the potential receptors identified using the criteria given in Appendix F.

5.1 Contaminants of Concern

Contaminants of concern identified at the Site are summarised in Table 9.

Table 9: Contaminants of Concern

Source	Associated Contaminants
On-Site (current)	
Electrical substations	Metals, PCBs, transformer oils
On-Site (historic)	
Brewery	Diesel, waste oil, lubricant oils, hydrochloric acid, caustic soda, slurry, asbestos
Off-Site (current)	
Garages and petrol filling stations	Metals and metalloids, fuels, TPH, PAH, organic solvents, asbestos
Off-Site (historic)	
Landfill	Clinker, brick, slate, pottery, mortar, wood, chert, concrete, metal, glass, flint, asbestos, ground gas and vapours
Incinerator	Ash and clinker, metals and metalloids, glass, flint, asbestos
Smithy	Metals and metalloids, organic solvents, asbestos
Coal depot	Metals and metalloids, sulphates, sulphides, cyanides
Electricity works and electrical substations	Metals and metalloids, PCBs, bitumen, detergents, organic solvents, TPH, mineral oil, asbestos

Table 10: Preliminary Conceptual Model for the Site

Receptor	Potential Sources	Pathways	Risk	Justification / Mitigation	Residual Risk
Human Health					
Future Site Users	Contamination in Made Ground and shallow soils from on-Site and adjacent off-Site land uses. Contamination in perched groundwater, and the shallow Secondary A Aquifer in the Alluvium and Kempton Park Gravel Member.	Dermal contact and inhalation of dust from contaminated soils. Ingestion of contamination via plant uptake in private gardens.	Low	The brewery has been decommissioned, with all known contamination sources removed. Therefore, it is unlikely that any contamination will arise from the remaining buildings and plant. Historically, ground contamination may have occurred during operation of the brewery or close to the Site from nearby activities such as the coal depot, garages or electrical substations. Previous ground investigations between 1995 and 2015 found some organic and inorganic contamination is present in Made Ground beneath the Site, when compared against relevant assessment criteria. However, in the majority of samples targeted at potential contamination hotspots as part of the Aecom investigation, no significant contamination elevations were identified. Where elevated levels were encountered, it is not thought to represent a significant contamination risk to future Site users in either a residential or commercial end-use scenario. A basement is proposed beneath the eastern Site, with a smaller basement beneath the western section. This will excavate out and remove a significant volume of Made Ground from the Site, lowering the potential for residual contamination to remain beneath the completed development. Additionally, the extent of hardstanding and use of appropriate thicknesses of imported clean topsoil in private gardens and soft landscaping at the completed development will prevent future Site users' exposure to ground contamination. Further ground investigation should be completed targeting soils and groundwater in the areas outside of proposed basements, where residual soils will remain in-situ to confirm findings of the previous Aecom investigation.	Low

Receptor	Potential Sources	Pathways	Risk	Justification / Mitigation	Residual Risk
	Ground gas arising from Made Ground and Alluvium and vapours from hydrocarbon contamination in shallow groundwater.	Accumulation in confined spaces, leading to inhalation.	Low	Geological information for the Site from previous ground investigations indicates approximately 0.7m – 4.2m Made Ground and Alluvium beneath the majority of the Site. Due to this limited thickness present, the time elapsed since the material was emplaced, and considering basement excavation will remove a significant volume of this material, it is not considered likely to represent a ground gas risk to the future development. Previous ground investigations found that soil and groundwater samples did not indicate extensive hydrocarbon contamination in soils, or in groundwater from the Secondary A Aquifer. As the proposed basements will remove most of this Made Ground at the eastern area, and a significant volume from the western area, the risk of vapours arising from residual soils and causing impacts to the completed development is assessed to be low. Groundwater sampling by Aecom in 2015 did not detect visual or olfactory evidence for hydrocarbon contamination. Three samples contained minor elevations of TPH, and a single sample recorded phenol above EQS. However this was not identified as sufficient to represent a vapour source. This should be confirmed by soil and groundwater sampling as part of additional ground investigation outside the proposed basement areas.	Low
Off-Site residents/users	Contamination in Made Ground and shallow soils.	Windborne, potentially contaminated construction dust. Runoff from stockpiled soils.	Medium	A Construction Environmental Monitoring Plan (CEMP) should be prepared for the works, including measures to minimise runoff from stockpiled soils, manage groundwater in excavations and suppress the generation of dust. Construction materials brought on-Site as part of works will be appropriately stored to prevent spills and leaks. This should prevent potentially contaminated material reaching off-Site residents.	Low
Construction Workers	Contamination in Made Ground, shallow soils, and shallow groundwater.	Dermal contact and ingestion. Dust inhalation. Ground gas and vapour Accumulation in trenches and confined spaces, leading to inhalation followed by asphyxiation and risk of explosion.	Medium	Construction workers will be provided with personal protective equipment (PPE) and respiratory protective equipment (RPE) where appropriate. Workers should be aware of good hygiene measures as protection against direct contact with contaminated Made Ground, contaminated groundwater, ground gas, vapours and dust inhalation. Works will be undertaken in accordance with the Control of Asbestos Regulations 2012.	Low

Receptor	Potential Sources	Pathways	Risk	Justification / Mitigation	Residual Risk
Property					
Future on-Site structures	Contamination in Made Ground, shallow soils, and shallow groundwater.	Direct contact with building foundations and buried services leading to chemical attack.	Medium	Geotechnical investigation as part of design works for the development should include sampling and testing of soils to assess the risk posed by chemical attack. If required, appropriately designed buried concrete and barrier water supply pipes should be used at the development.	Low
	Ground gas and vapours.	Accumulation in confined spaces, leading to risk of explosion.	Low	Identified geology and hydrogeology at the Site, alongside findings of previous ground investigations indicates there is not a significant risk of ground gas or vapours impacting the completed development. Soil and groundwater sampling as part of further ground investigation should confirm this.	Low
Off-Site structures	Contamination in Made Ground, shallow soils, and shallow groundwater.	Direct contact with building foundations and buried services leading to chemical attack.	Low	No significant contamination elevations were identified in soils and groundwater during previous investigations at the Site. Where elevated levels were encountered, it was not thought to represent a significant contamination risk to off-site structures.	Low
Ecological Receptors					
Soft landscaping	Contamination in Made Ground, shallow soils, and shallow groundwater.	Direct contact of roots.	Low	All soft landscaping at the completed development should be situated in an appropriate thickness of imported, certified clean cover material. This would prevent plants at the completed development contacting any ground contamination beneath the Site.	Low
River Thames SMI for Nature Conservation	Contamination in Made Ground, shallow soils, and shallow groundwater.	Windborne, potentially contaminated construction dust. Runoff from stockpiled soils.	Medium	A CEMP should be prepared for the demolition and construction works on-Site, detailing measures to minimise the potential risk to the SMI for nature conservation on the opposite bank of the waters from stockpiled soils during below-ground works such as basement excavation. Construction materials brought on-Site as part of works will be appropriately stored to prevent spills and leaks. This should prevent potentially contaminated material reaching the River Thames.	Low
Controlled Waters					
The River Thames	Contamination in Made Ground, shallow soils, and	Migration through granular deposits and via sewer	Medium	Previous ground investigations found that soil and groundwater samples did not indicate extensive contamination present beneath the Site. Therefore, the potential for contamination mobilisation is assessed as low.	Low

Receptor	Potential Sources	Pathways	Risk	Justification / Mitigation	Residual Risk
	shallow groundwater.	bedding materials to the River Thames. Runoff from stockpiled soils.		On-Site sewer records indicate that some areas of the Site currently drain to the Thames Water surface water sewer network, ultimately discharging to the River Thames. Measures should be undertaken during demolition and construction works to minimise runoff from stockpiled soils, and prevent contamination reaching the River Thames via Site drainage. This should prevent potentially contaminated material reaching the River Thames.	
	Construction materials stored on-Site as part of development works.	Spills to ground, and the River Thames.	Medium	A CEMP should be prepared for the demolition and construction works on-Site, detailing measures to minimise the potential risk to controlled waters. Construction materials brought on-Site as part of works should be appropriately stored to prevent spills and leaks. This should prevent potentially contaminated material reaching the River Thames.	Low
Shallow Secondary A aquifer in the Alluvium and Kempton Park Gravel Member	Contamination in Made Ground and shallow soils.	Remobilisation of contamination by rainfall infiltration following removal of hardstanding during construction works.	Low	The CEMP should include measures to minimise rainwater infiltration to exposed ground, or the potential for construction spills during the demolition and construction works. Rainwater infiltration via soft landscaping and private gardens is possible at the completed Development. However, this is likely to be limited as the majority of the Site will be covered by buildings and hardstanding, and underlain by basements. Previous ground investigations did not identify significant contamination in Made Ground or shallow soils , and there are unlikely to be significant impacts from any mobilisation.	Low
Deep Secondary A aquifers in the Lambeth Group and Thanet Formation Principal Aquifer in the Chalk Group	Contamination in shallow groundwater.	Migration via historical abstraction wells.	Medium	The Site is underlain by about 73m of London Clay Formation, which is considered to present an impermeable barrier against the migration of contaminants to the deep Secondary A and Principal Aquifers. The proposed development will comprise mid-rise buildings, whose foundations will not penetrate this layer. Two redundant historical abstraction wells are recorded on-Site, which could act as a pathway for contamination migration to the Principal Aquifer in the Chalk Group. Before commencing excavation works these should be located and decommissioned.	Low

6. Conclusions

Given the proposed end use the overall risk rating for the Site is assessed as **medium**.

Potential Risks

The following potential pollutant linkages have been identified for the Site:

- Potential exposure of construction workers and the general public during the Works to contaminated soils, groundwater, airborne dust and run-off from stockpiled soils or exposed shallow ground;
- Potential for construction workers to encounter UXO during basement excavation;
- Potential risks to exposed shallow groundwater from introduction of new potential sources of contamination during the Works;
- Potential mobilisation of contamination via historical abstraction wells leading into the Chalk Group Principal Aquifer;
- Potential risks to shallow groundwater and the River Thames due to surface run-off from stockpiled materials via the drainage system discharging to the River Thames, or mobilisation of ground contamination by rainfall infiltration after removal of hardstanding during demolition, and introduction of new sources of contamination during the Works;
- Potential exposure of future occupants and visitors of the proposed redevelopment to residual ground contamination via soft landscaping; and
- Potential exposure of buried structures and services to ground and groundwater contamination, leading to chemical attack.

The recommendations of this report outline preliminary remedial and mitigation measures that require confirmation through additional works. However, once successfully implemented the risks are anticipated to be **low**. Therefore the NPPF requirement that on completion the Site can no longer be captured under the Part IIA regime is expected to be met.

7. Recommendations

The following actions are recommended to address the potentially unacceptable risks identified:

- Further ground investigation should be completed targeting soils and groundwater in the areas where basements are not proposed as part of development works and residual soils will remain in-situ, to confirm findings of the previous Aecom investigation;
- Geotechnical investigation as part of design works for the development should include sampling and testing of soils to assess the risk posed by chemical attack;
- An environment watching brief should be undertaken throughout ground works, with additional environmental sampling undertaken where visual or olfactory contamination is suspected within the Made Ground or Kempton Park Gravel Member;
- A detailed UXO desk study should be undertaken by a suitably qualified Explosive Ordnance Disposal (EOD) Engineer to assess the risk posed by UXO beneath the Site. The recommendations of this assessment should be followed during construction works;
- A Construction Environmental Management Plan (CEMP) should be developed for the Site, detailing measures to minimise the potential risk to the River Thames and shallow Secondary A aquifer during the demolition and construction works;
- During the Works, appropriate measures for managing materials, chemicals and waste should be utilised. Measures should also be taken to prevent run-off from stockpiled soils reaching the River Thames, and to supress the generation of dust;
- Following removal of hardstanding across the Site post-demolition, an attempt should be made to locate the historical abstraction wells and decommission them if necessary;
- Construction workers should be provided with and use personal protective equipment (PPE), respiratory protective equipment (RPE) and informed of good hygiene measures as protection against direct contact with contaminated Made Ground, contaminated groundwater or ground gas / vapours;
- Concrete used in construction, and any new water pipes installed as part of the redevelopment works should be appropriately protected against chemical attack from potential contamination in Made Ground, shallow soils and shallow groundwater underlying the Site; and
- Private gardens at the Development should be planted using an appropriate thickness of imported, certified clean cover material.

GLOSSARY

For the purpose of this report, the following terms and definitions apply (see BS 10175:2001).

Accuracy	Level of agreement between true value and observed value.
Conceptual Exposure model	Textual and or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process. **Note 1:** The conceptual exposure model is initially derived from the information obtained by the preliminary investigation. This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of the field investigation can provide additional data that can be used to further refine the conceptual model.
Contamination	Presence of a substance which is in, on or under land, and which has the potential to cause significant harm or to cause significant pollution of controlled water. **Note 1:** There is no assumption in this definition that harm results from the presence of the contamination. **Note 2:** Naturally enhanced concentrations of harmful substances can fall within this definition of contamination. **Note 3:** Contamination may relate to soils, groundwater or ground gas.
Controlled water	Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three mile limit of territorial waters. **Note 1:** See Section 104 of The Water Resources Act 1991.
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case humans, including property.
Hazard	Inherently dangerous quality of a substance, procedure or event.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
Precision	Level of agreement within a series of measurements of a parameter.
Receptor	Persons, living organisms, ecological systems, controlled water, atmosphere, structures and utilities that could be adversely affected by the contaminant(s).
Risk	Probability of the occurrence, magnitude and consequences of an unwanted adverse effect on a receptor.
Risk assessment	Process of establishing, to the extent possible, the existence, nature and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
Soil	Upper layer of the earth's crust composed of mineral parts, organic substance, water, air and living matter. **Note 1:** In accordance with BS 10175:2001 the term soil has the meaning ascribed to it through general use in civil engineering and includes topsoil and subsoil; deposits such as clays, silt, sand, gravel, cobbles, boulders and organic deposits such as peat; and material of natural or human origin (e.g. fills and deposited wastes). The term embraces all components of soil, including mineral matter, organic matter, soil gas and moisture, and living organisms.
Source	Location from which contamination is, or was, derived. **Note 1:** This could be the location of the highest soil or groundwater concentration of the contaminant(s).
Uncertainty	Parameter, associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurement.

APPENDICES

A. Site Plans

- **Site Location Plan**
- **Site Plan**
- **Conceptual Model**

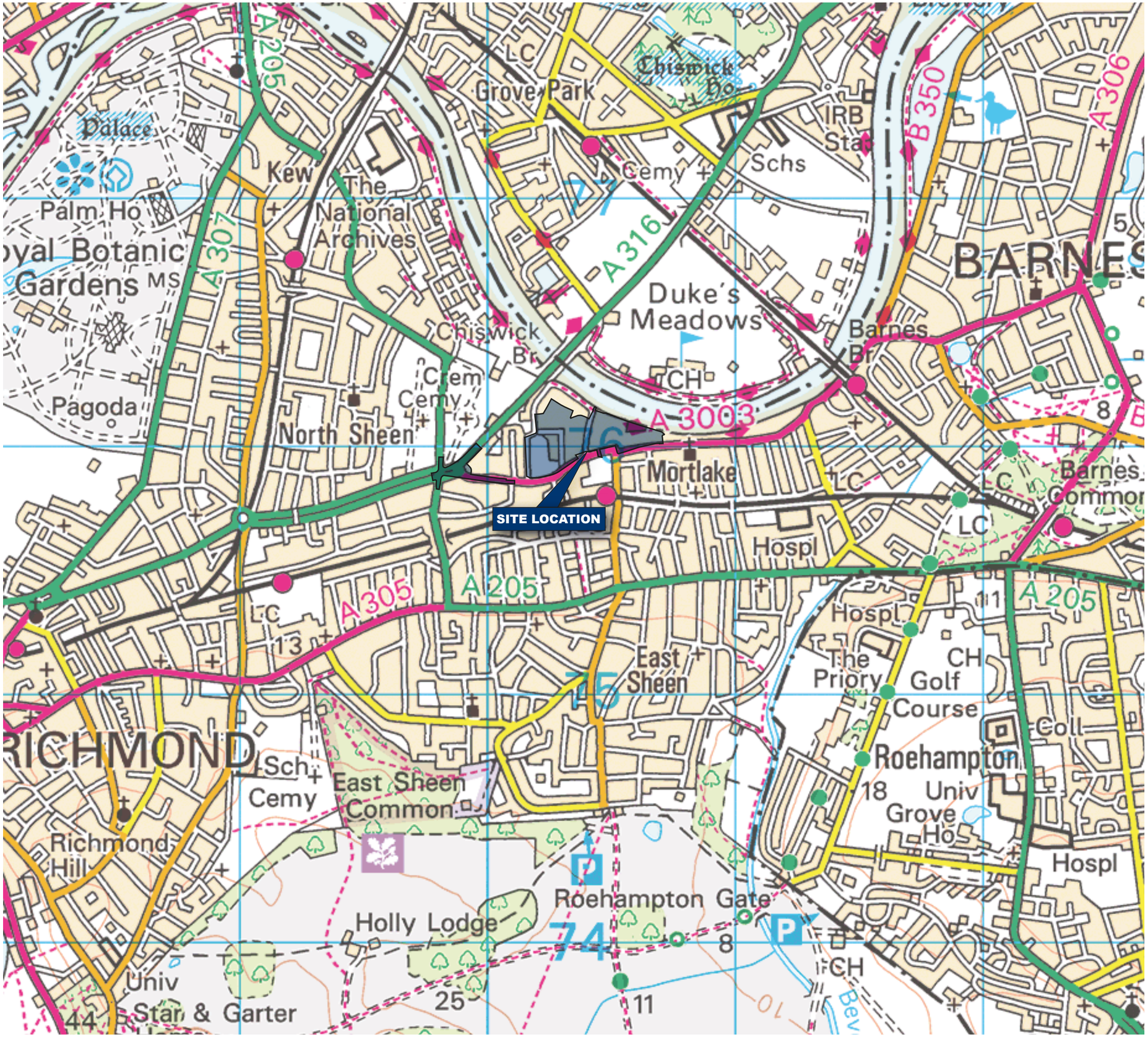


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Figure Ref	WIE15582-105_GR_PERA_A1A
Date	September 2019
File Location	\\s-lncs\wiel\projects\wie15582\105\graphics\pera\issued figures

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Site Boundary

PROPAGATION TANK
MAINTENANCE BUILDING
CHEMICAL STORAGE CONTAINERS AND WASTE OIL TANK 1
HYDROCHLORIC ACID, CAUSTIC SODA AND LCT TANKS
MAINTENANCE BUILDING
EFFLUENT TANK
DIESEL TANK
CAR PARK
CHEMICAL STORAGE CONTAINER
FINISHING BUILDING
FILTRATION BUILDING
WASTE YEAST
CHEMICAL STORAGE CONTAINERS
BREWHOUSE
SALT TANK
CAUSTIC SODA TANK
HYDROCHLORIC ACID TANK
POWERHOUSE
GLYCOL CARBON FILTER TANK
MALTING BUILDING
CHEMICAL STORAGE CONTAINERS
BOTTLING WAREHOUSE
WASTE OIL TANK
THE (FORMER) HOTEL
THE (FORMER) BOTTLING HALL
PLAYING FIELD
CLUB HOUSE
PRODUCTION OFFICE
MORTLAKE
WILLIAMS LANE
SHIP LANE
LOWER RICHMOND ROAD
CROMWELL PLACE
MEWS
THAMES BANK
Shingle
Leyden House
Old Stables
Thames Bank House
Tudor Lodge
Asplin Cottage
Aynescombe Cottage
The Ship (PH)
Hard
Sluice
Navigation Light
Jetty
Sloping masonry
Path
Mooring Posts
BALLS ALLEY
BOULS ALLEY
Combe House
Red Court
Sorting Office
Scrap Yard
Ward Bdy
WALDEGRAVE
PH
LB
CR
WB
FB
TCB
Posts

N

Project Details	WIE15582-105: Stag Brewery, Mortlake
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Figure Ref	WIE15582-105_GR_PERA_A2A
Date	September 2019
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SITE EXTENT

CONSTRUCTION WORKERS IN TRENCHES USING APPROPRIATE PPE / RPE

PERCHED GROUNDWATER

GROUND CONDITIONS OUTSIDE PROPOSED BASEMENTS CONFIRMED BY ADDITIONAL FURTHER GI

LIMITED MADE GROUND & ALLUVIUM THICKNESS NOT CONSIDERED SUFFICENT FOR GROUND GAS GENERATION

BASEMENTS REMOVE POTENTIALLY CONTAMINATED SHALLOW SOILS

SHIP LANE

CLEAN IMPORTED MATERIAL PREVENTS FUTURE SITE USERS CONTACTING CONTAMINATION VIA PLANT UPTAKE

BUILDING FOUNDATIONS APPROPRIATELY PROTECTED AGAINST CHEMICAL ATTACK

WINDBOURNE DUST PREVENTED BY DUST SUPRESSION

SOILS STOCKPILED DURING CONSTRUCTION WORKS

RUN-OFF PROVENTED BY APPROPRIATE CONSTRUCTION TECHNIQUES SET OUT IN CEMP

RIVER THAMES

SECONDARY A AQUIFER

BUILDING FOUNDATIONS NOT ANTICIPATED TO PENETRATE LONDON CLAY FORMATION PREVENTING PATHWAY FORMING TO DEEPER AQUIFERS

HISTORICAL ABSTRACTION WELL SEALED TO PREVENT GROUNDWATER MIGRATION

MADE GROUND AND ALLUVIUM

KEMPTON PARK GRAVEL MEMBER

LONDON CLAY FORMATION

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B. Site Photographs

- **2016 Site Visit (pre-demolition)**
- **2019 Site Visit (during demolition)**

Air conditioners at The Power House Roof

The (former) Bottling Hall

Brewery infrastructure in Brewhouse

Brewing vats in Brewhouse

The (former) Hotel cellar used as the staff canteen

Chemical stores at Packaging Warehouse

Condition of tank sumps

Decommissioned diesel tank in Production Office basement

Project Details	WIE15582-105: Stag Brewery, Mortlake
Figure Title	Figure B1: Site Photographs
Figure Ref	WIE15582-105_GR_PERA_B1A
Date	September 2019
File Location	\\s-lncs\wiel\projects\wie15582\105\graphics\pera\issued figures

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Site entrance at western area

Interior of eastern area bottling warehouse with stripout completed

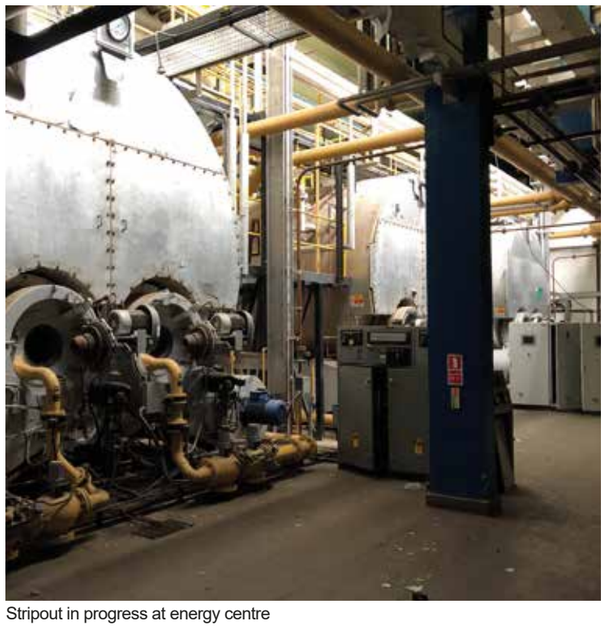
Stripout completed at eastern area canteen builidng

Malting Building retained at eastern Site

Empty chemical storage containers adjacent to bottlign warehouse

Waste stored under canopy to east of bottlign warehouse

Removal of tanks adjacent to energy centre in progress



Stripout in progress at energy centre

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Figure Ref	WIE15582-105_GR_PERA_B2A
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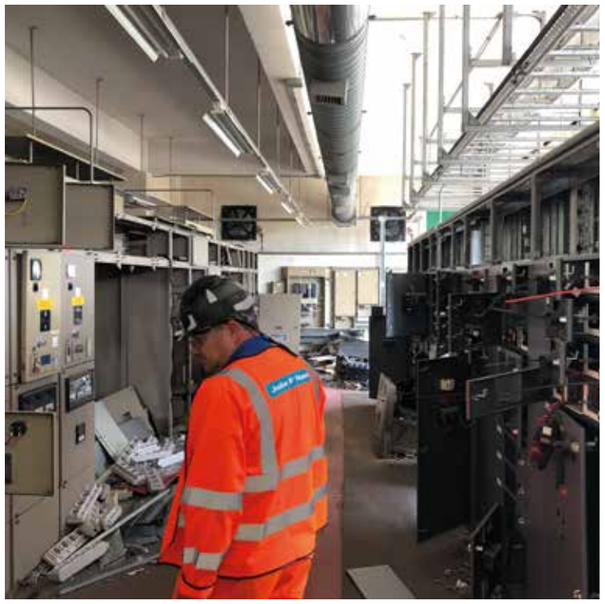
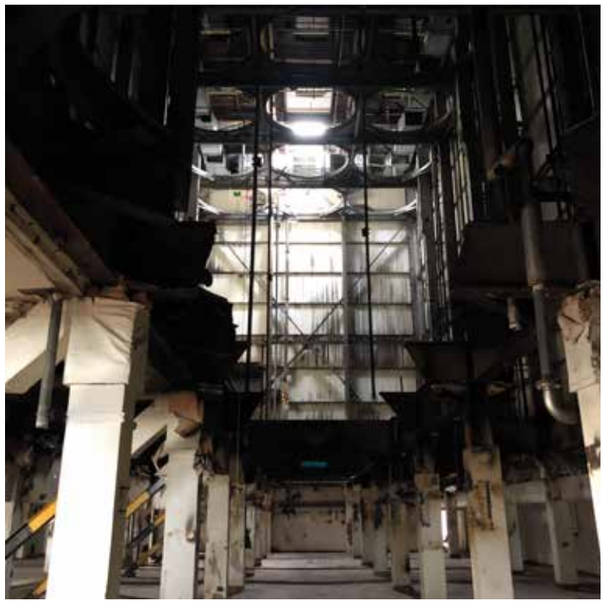


Stripout in progress at energy centre

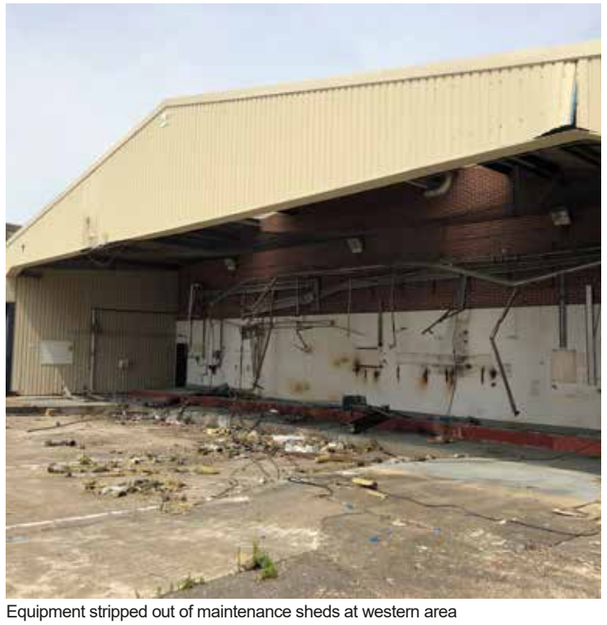
Air conditioners at roof of energy centre



Former tank holders at brewhouse in eastern area

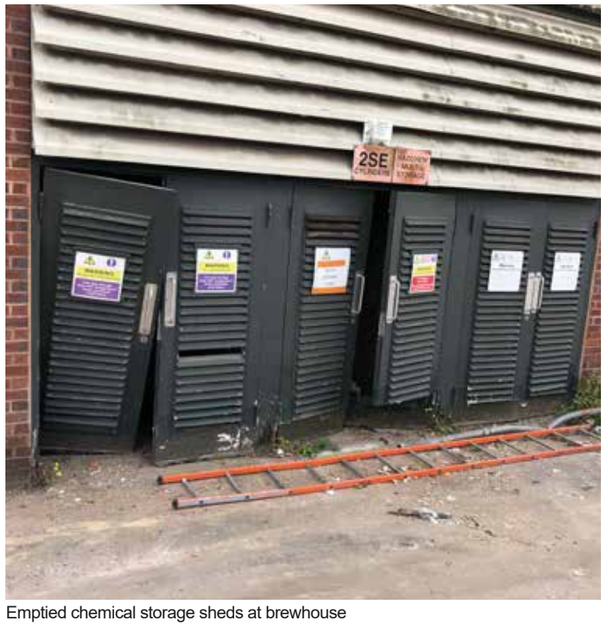
Diesel tank at north of eastern area

Former base for removed effluent tank



Equipment stripped out of maintenance sheds at western area

Further tanks in brewhouse awaiting removal



Emptied chemical storage sheds at brewhouse

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Date	September 2019
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C. Ground Gas Risk Assessment

Table C.1:Waterman Ground Gas Risk Assessment Tool

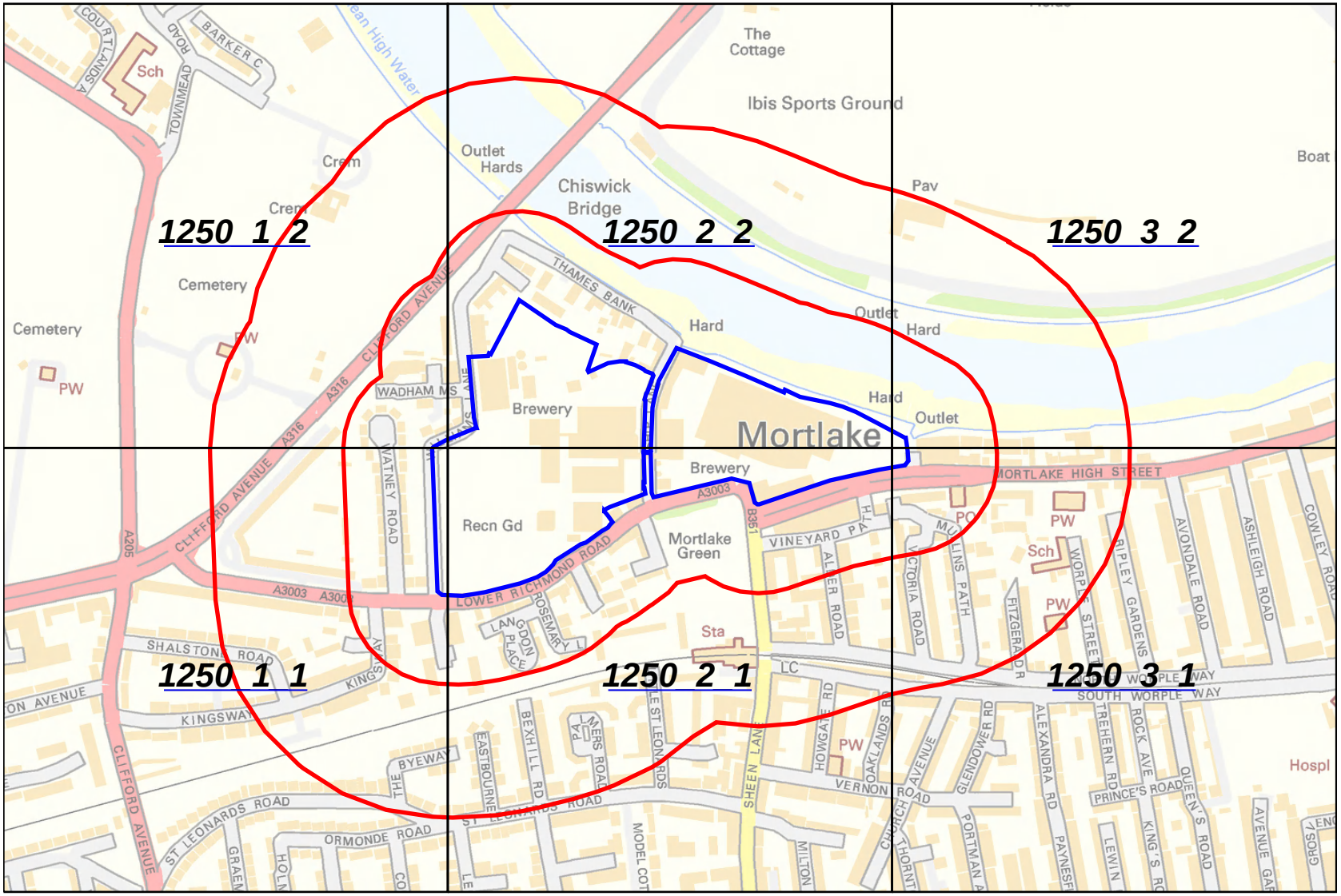
Parameter	Select parameter	Assessment score	Impact on ground gas risk to completed development	Reasoning	Supporting guidance and reference
Is there an existing Ground Investigation report for the Site?	Yes	0	*Review the GI information if available*	*An existing ground investigation may include information such as proven geology, groundwater levels and ground gas monitoring which allows for more accurate assessment of the ground gas regime.*	
Is the Site within 20m of an area of former coal mining or landfilling?	No	0	*Reduces risk*	*The absence of coal mining or landfills close to the Site removes a significant potential source of ground gas risk.*	The Coal Authority: Risk Based Approach to Development Management, Guidance for Developers (2017) [Section 2.2, Page 7] CL:AIRE: Research Bulletin RB17 A Pragmatic Approach to Ground Gas Risk Assessment (November 2012) [Section 3, Page 3] EPG: Ground Gas Information Sheet 3 Screening approach for landfill gas migration
Is the Site in an area at risk of radon?	No	0	*No impact on risk*	*The proposed development is unlikely to include any radon protective measures that could also mitigate ground gas risk*	Building Research Establishment: BRE 211 Radon - Guidance on protective measures for new buildings [Section 5 Page 6]
Primary soil type assessed	Made Ground with low organic content (i.e. bricks, demolition material, crushed concrete sub-base)	1	*No increase in risk*	*Where organic matter is unlikely to comprise a significant component of Made Ground the methane generation potential is relatively low as material such as brick, glass, concrete and demolition waste (except wood) does not putrefy.*	CL:AIRE: Research Bulletin RB17 A Pragmatic Approach to Ground Gas Risk Assessment (November 2012) [Section 3, Page 3] EPG: A pragmatic approach to ground gas risk assessment for the 21st Century (2011) [Page 2]
Secondary soil type assessed (if assessing multiple strata)	Alluvium	1	*No increase in risk*	*Although Alluvium may contain thin bands of peaty material, in general the majority constituent is silts and silty sands with limited potential for putrification and methane generation.*	CL:AIRE: Research Bulletin RB17 A Pragmatic Approach to Ground Gas Risk Assessment (November 2012) [Section 3, Page 3] EPG: A pragmatic approach to ground gas risk assessment for the 21st Century (2011) [Page 2]
Thickness of Made Ground (if present on-Site)	Under 5m (with average of less than 3m)	0	*Reduces risk*	*Made Ground of this volume is not likely to have sufficient organic material present to generate significant volumes of methane, unless it has a significantly high organic content. Also Made Ground of this thickness is likely to be accurately characterised by trial pitting alone, which will determine the gas risk.*	CL:AIRE: Research Bulletin RB17 A Pragmatic Approach to Ground Gas Risk Assessment (November 2012) [Section 3: Page 4]
Period since Made Ground emplaced (if present on-Site)	Not applicable	0	*Reduces risk*	*Absence of Made Ground reduces risk of petrogenic material beneath the Site*	CL:AIRE: Research Bulletin RB17 A Pragmatic Approach to Ground Gas Risk Assessment (November 2012) [Appendix A, Page 10]
Building type	Construction of new buildings	-3	*Reduces risk*	*Construction of new buildings offers an opportunity to incorporate gas protection measures directly into the strucure at the design stage, offering greater flexibility and reliability than retrofitting an existing structure.*	CIRIA: C665 Assessing Risks Posed by Hazardous Ground Gases to Buildings (2007) [Table 8.6, Page 90] British Standard: BS8485 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (2015) [Table 86 Page 90]
Development type	Type B: Residential (flats) or public buildings such as hospitals, schools, leisure centres, hotels etc	1	*Increases risk*	*Developments of this type are more likely to have active ventilation systems, but also more likely to contain sensitive receptors present within the structure for extended periods of time.*	British Standard: BS8485 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (2015) [Section 7, Page 21]
Ground floor slab construction details	Not known	0	*Does not reduce risk*	*Does not reduce risk*	CIRIA: C665 Assessing Risks Posed by Hazardous Ground Gases to Buildings (2007) [Table 8.6, Page 90] British Standard: BS8485 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (2015) [Section 7.2, Page 23]
Development includes a basement?	Yes, no specific ventilation	0	*Does not reduce risk*	*Where no specific air circulation has been designed into the development the potential for ground gas accumulation is increased.*	British Standard: BS8485 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (2015) [Annex A Page 36] CIEH: The Local Authority Guide to Ground Gas (September 2008) [Section 7 Page 101]
If a basement is present, is this structure in contact with groundwater-bearing strata?	Basement in contact with groundwater	-1	*Reduces risk*	*A basement is in contact with groundwater-bearing strata it is likely to be waterproofed, which may provide protection againt both dissolved methane in groundwater and in the unsaturated zone. This should be confirmed via as-built plans if available.*	EPG: Dissolved methane monitoring for ground gas risk assessment (September 2018) [Page 1]
Presence of off-Site sources with potential pathway to Site?	No	0	*Does not increase risk*	*Where no potential off-Site sources exist, or where there is no direct pathway for these gases to migrate to the Site no risk exists.*	

In consideration of the above details the development is considered to be at	**Very Low Risk**	**for ground gas issues.**
Based on the sensitivity of the end-use receptor	**no further ground gas investigation or assessment required.**	

When reviewing previous ground investigation results for a site, it should be noted gas concentrations from the well headspace are not necessarily representative of the ground gas regime due to the potential influences of a variety of factors. Caution should therefore be taken when relying solely on ground gas results from well headspace. Instead, as undertaken throughout contaminated land, a lines of evidence approach should be used whereby the results are interrogated along with the potential sources, proposed development use, geology, and hydrogeology at the site.

D. Consultation Information

- **Groundsure Enviro Insight Report**
- **Groundsure Geo Insight Report**
- **Groundsure Historical Mapping Information**



Groundsure INSIGHTS

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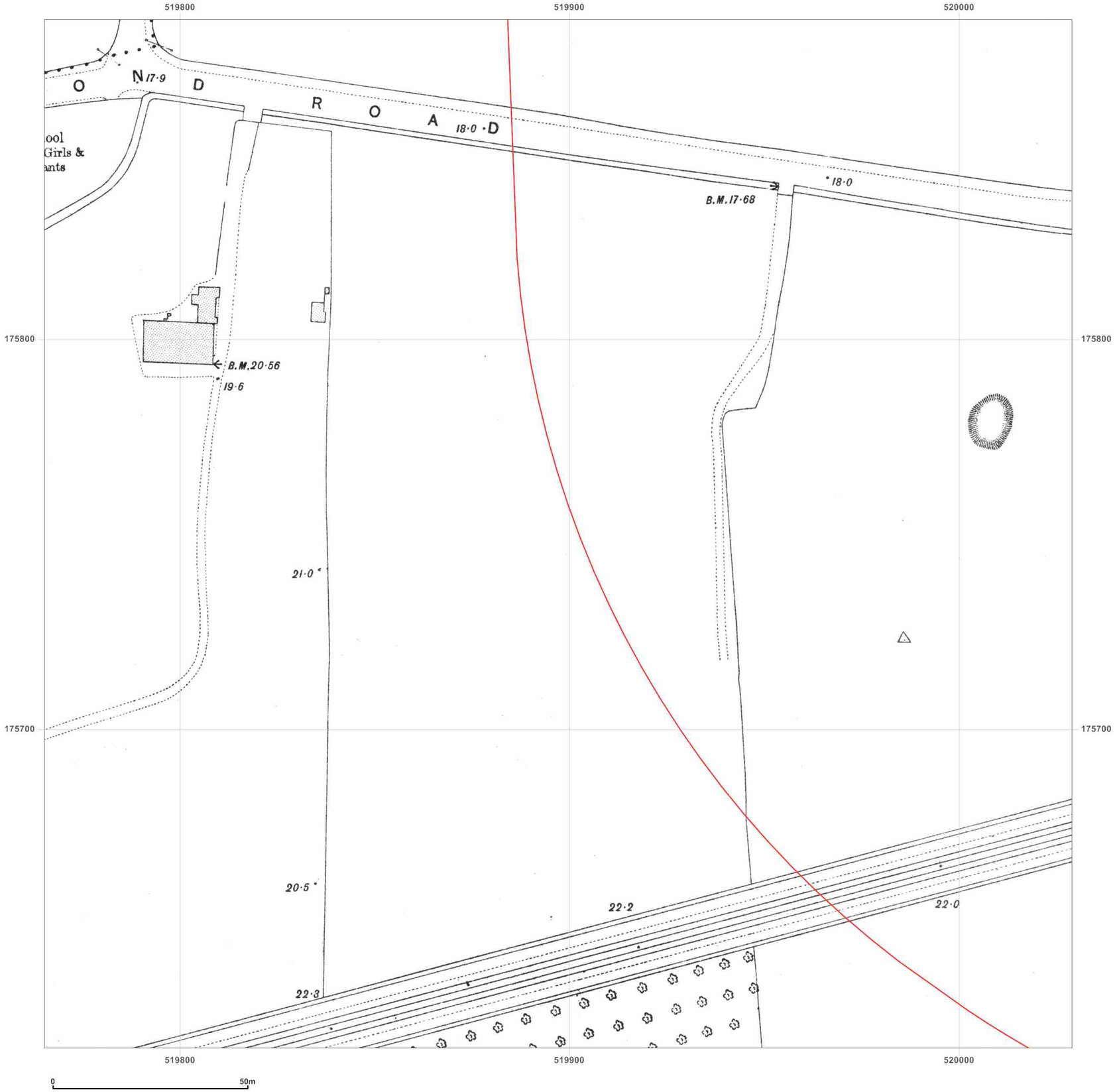
1:1250 Scale Grid Index



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Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: 1056 Scale Town Plan

Map date: **1896**

Scale: 1:1,056

Printed at: 1:1,056

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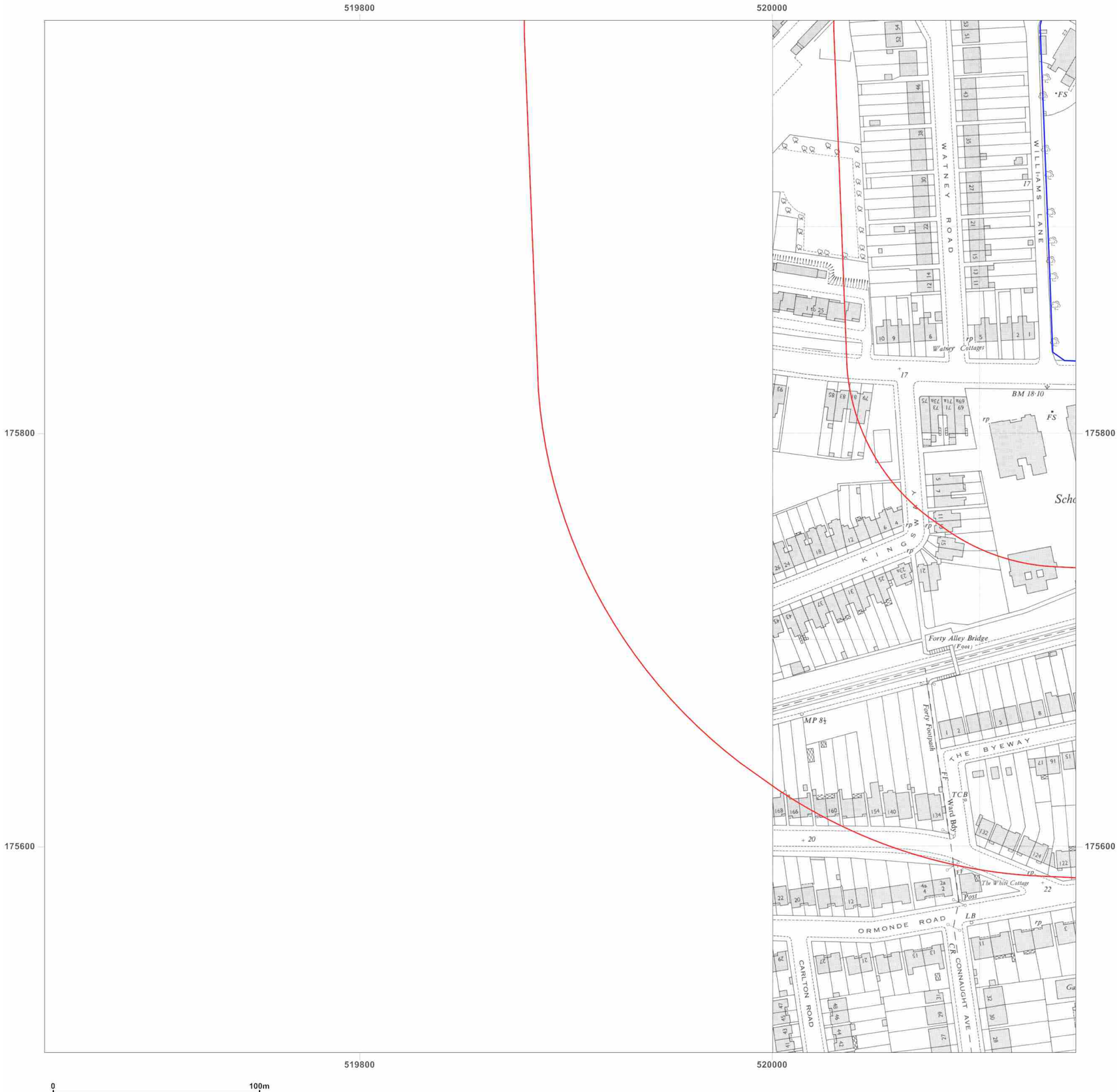
Surveyed 1893
Revised N/A
Edition 1896
Copyright N/A
Levelled N/A

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 18 July 2019

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



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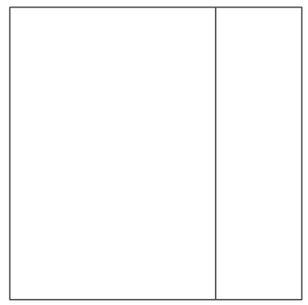

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Revised 1951
Edition N/A
Copyright N/A
Levelled 1932

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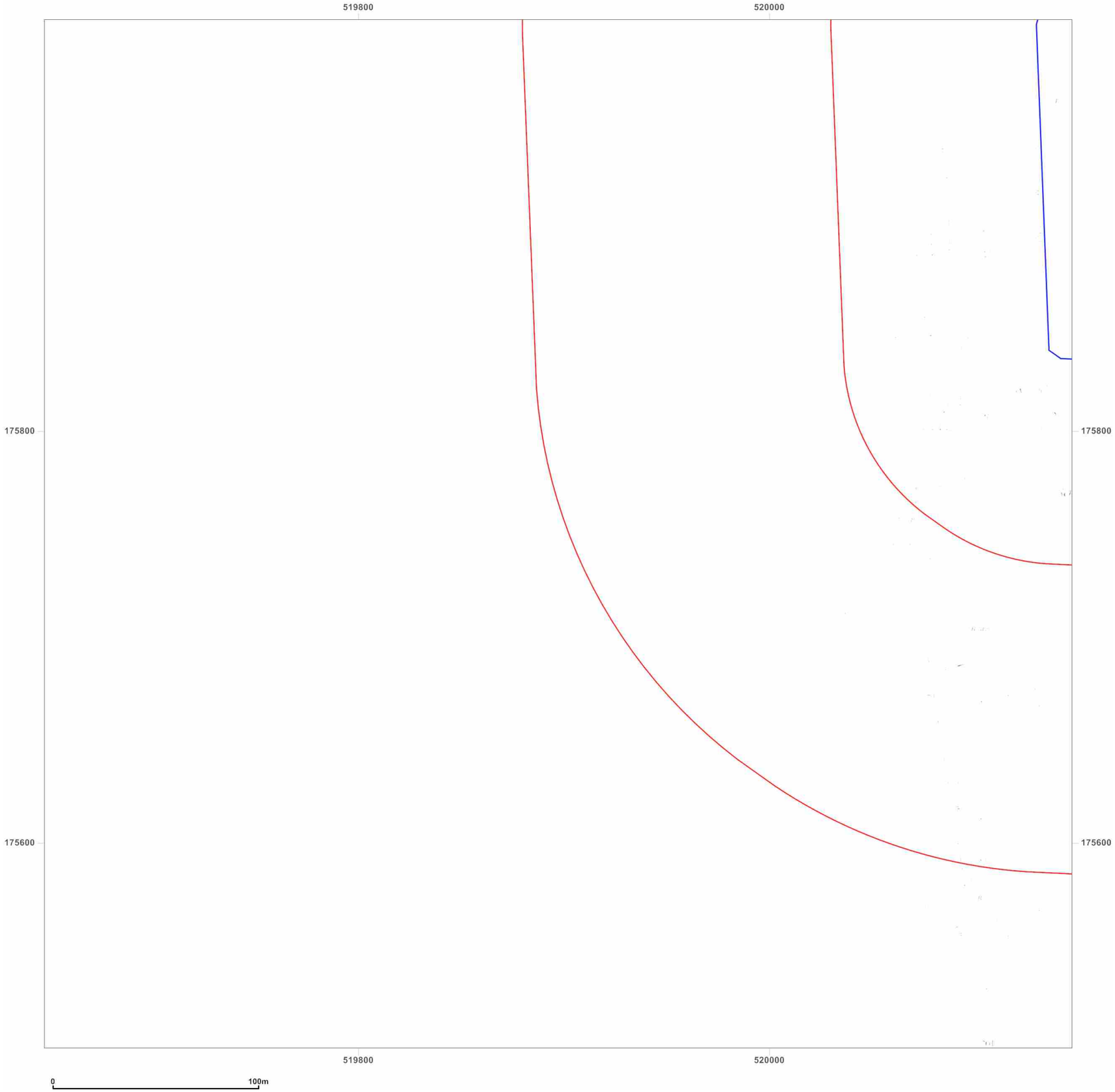

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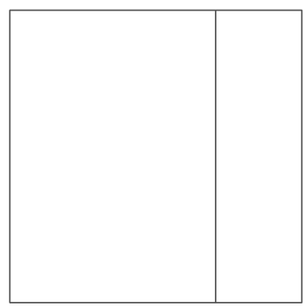

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Scale: 1:1,250

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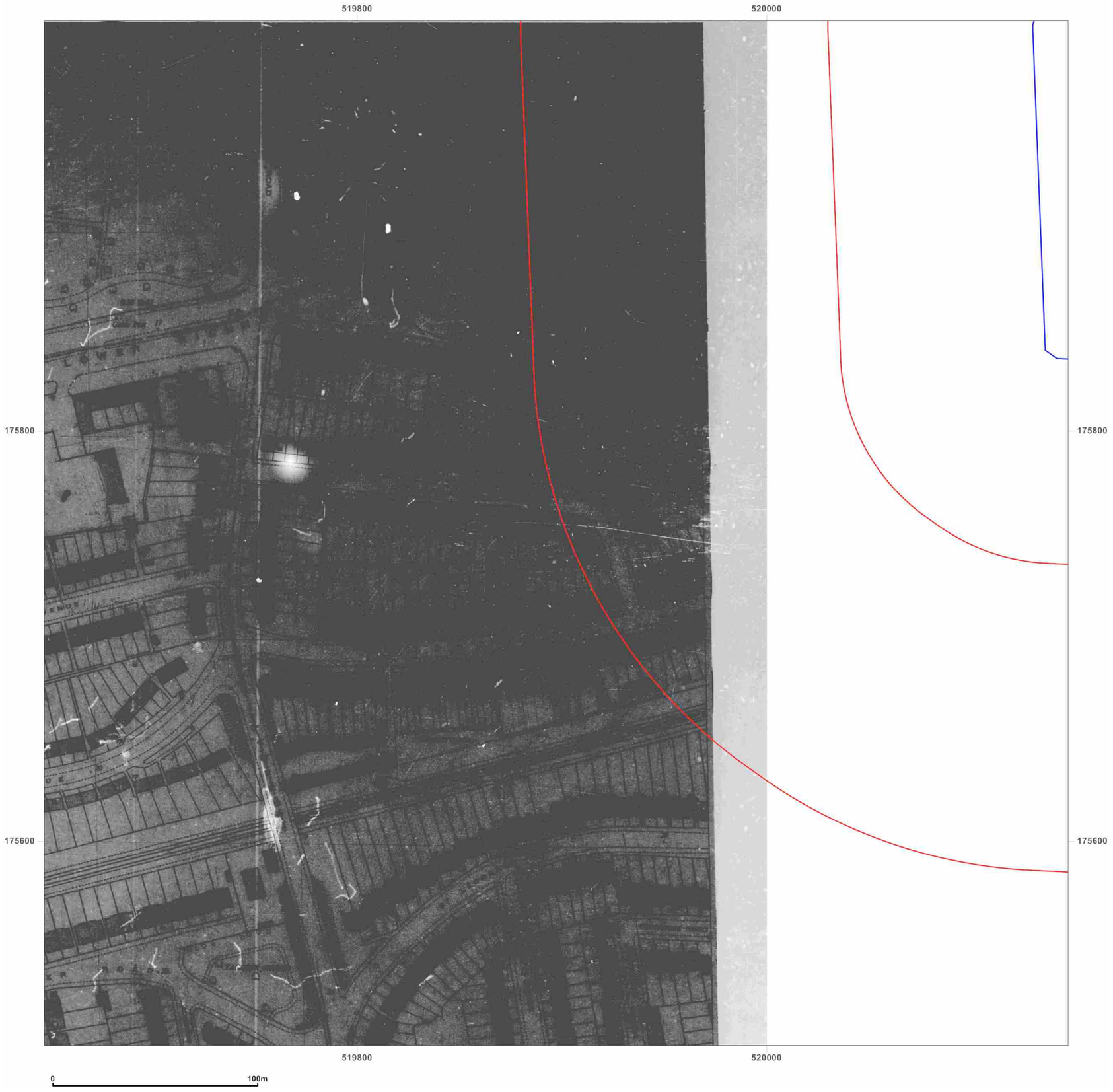

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Site Details:

THE STAG BREWERY, LOWER
RICHMOND ROAD, MORTLAKE,
LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1974**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Site Details:

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Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1978**

Scale: 1:1,250

Printed at: 1:2,000

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Waterman

Site Details:

THE STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1987-1988**

Scale: 1:1,250

Printed at: 1:2,000

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Surveyed N/A Revised N/A Edition N/A Copyright 1988 Levelled 1972	Surveyed 1973 Revised 1987 Edition N/A Copyright 1987 Levelled 1973

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Site Details:

THE STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1991**

Scale: 1:1,250

Printed at: 1:2,000

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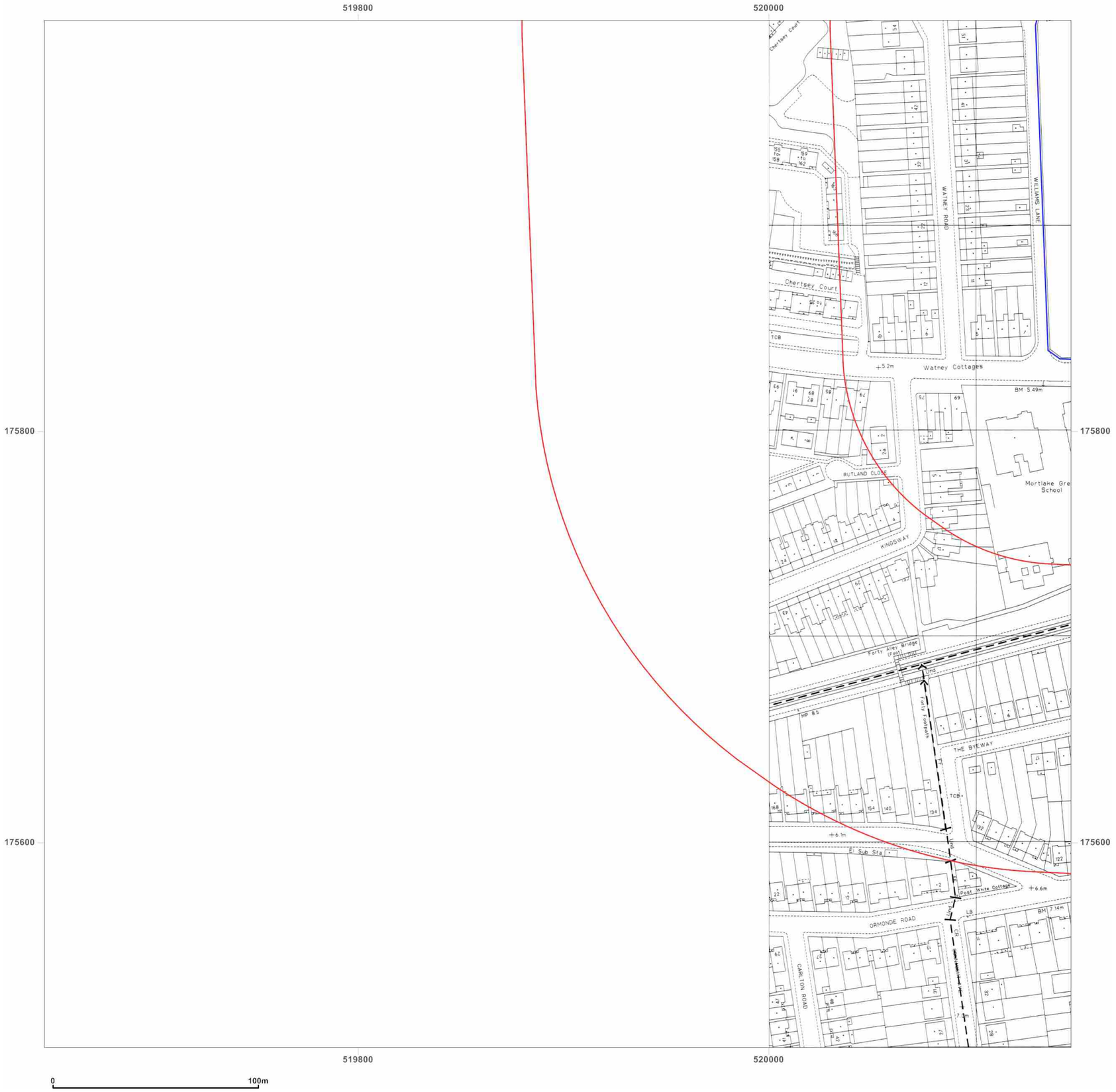

Site Details:

THE STAG BREWERY, LOWER
RICHMOND ROAD, MORTLAKE,
LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1991**

Scale: 1:1,250

Printed at: 1:2,000

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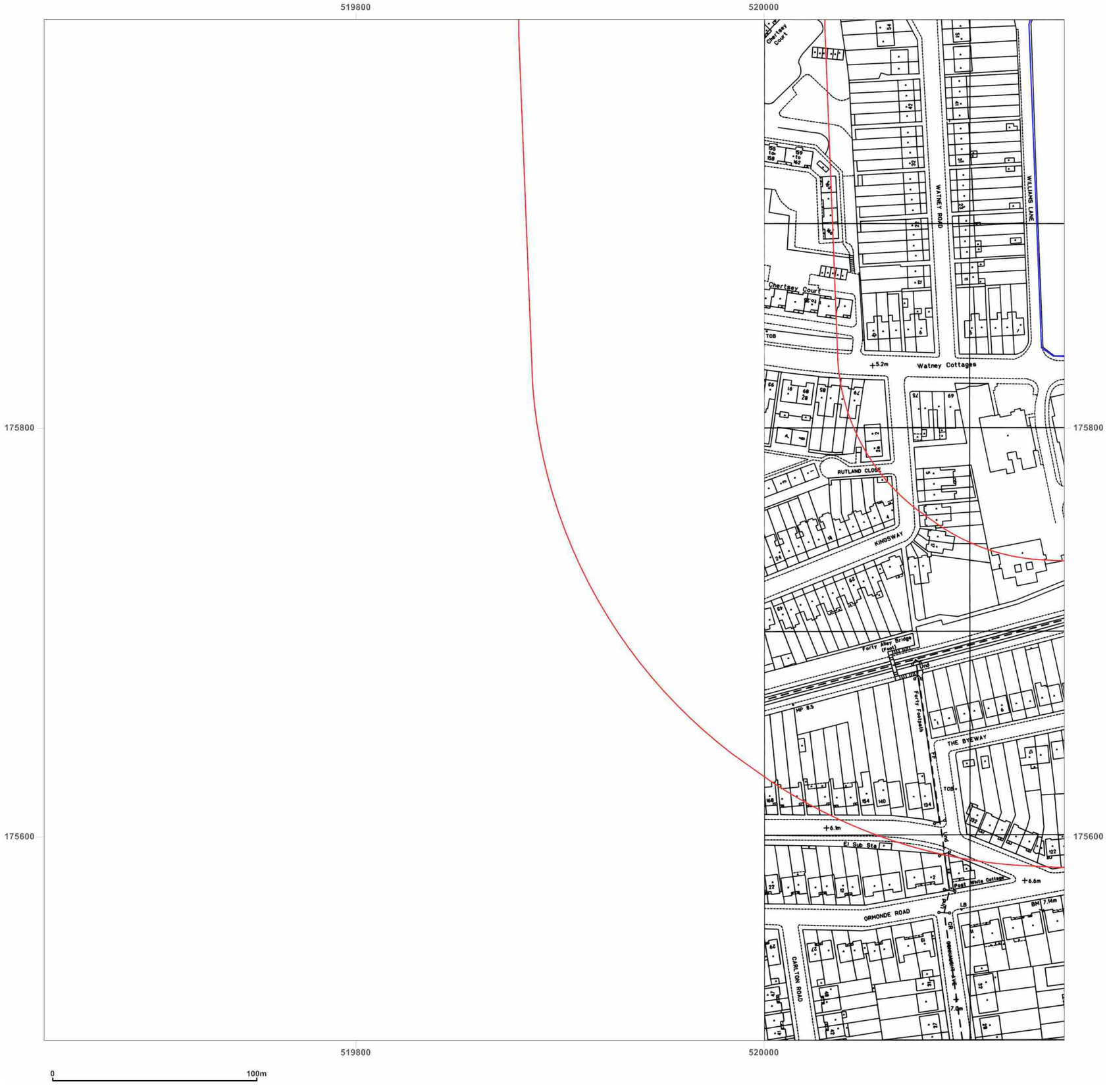

Site Details:

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Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1992**

Scale: 1:1,250

Printed at: 1:2,000

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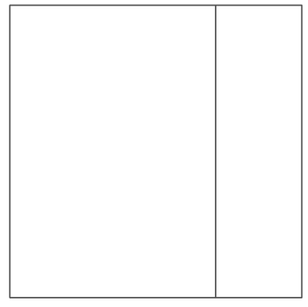

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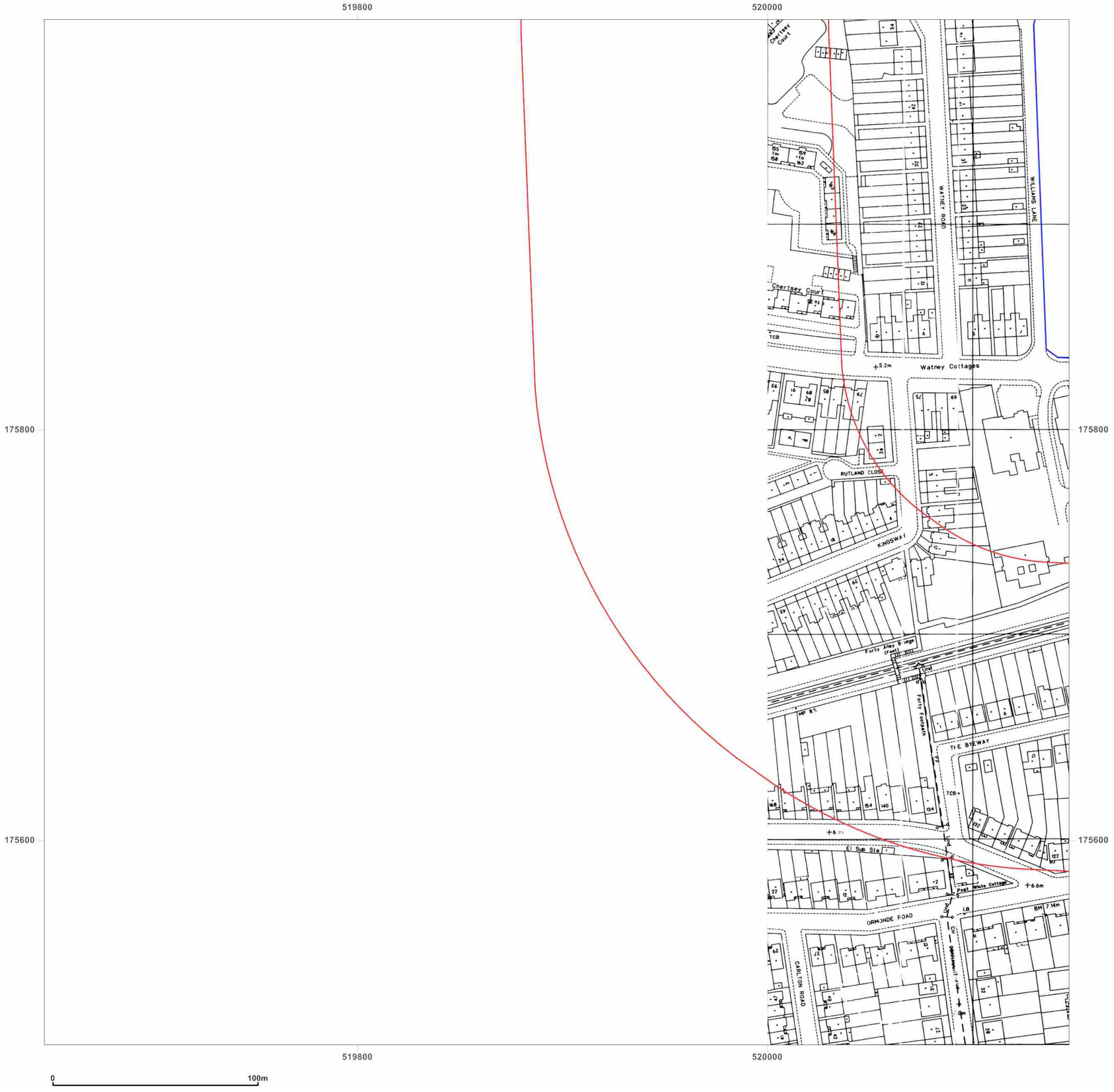

Site Details:

THE STAG BREWERY, LOWER
RICHMOND ROAD, MORTLAKE,
LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1992**

Scale: 1:1,250

Printed at: 1:2,000

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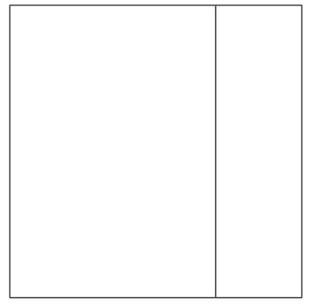

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Revised N/A
Edition N/A
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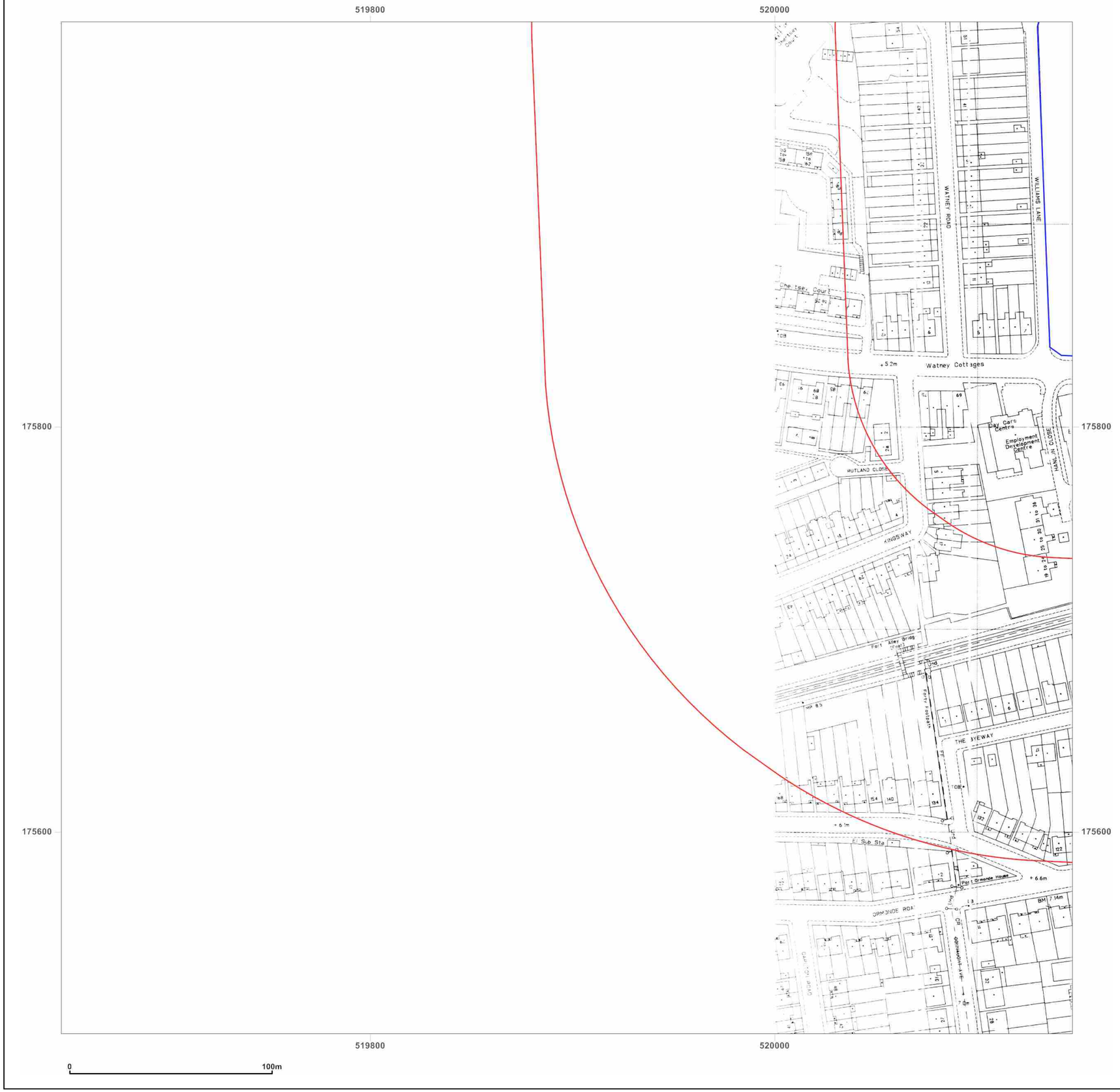

Site Details:

THE STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1995**

Scale: 1:1,250

Printed at: 1:2,000

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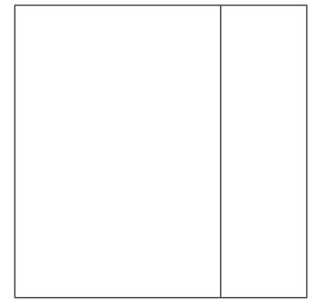

Surveyed N/A
Revised N/A
Edition N/A
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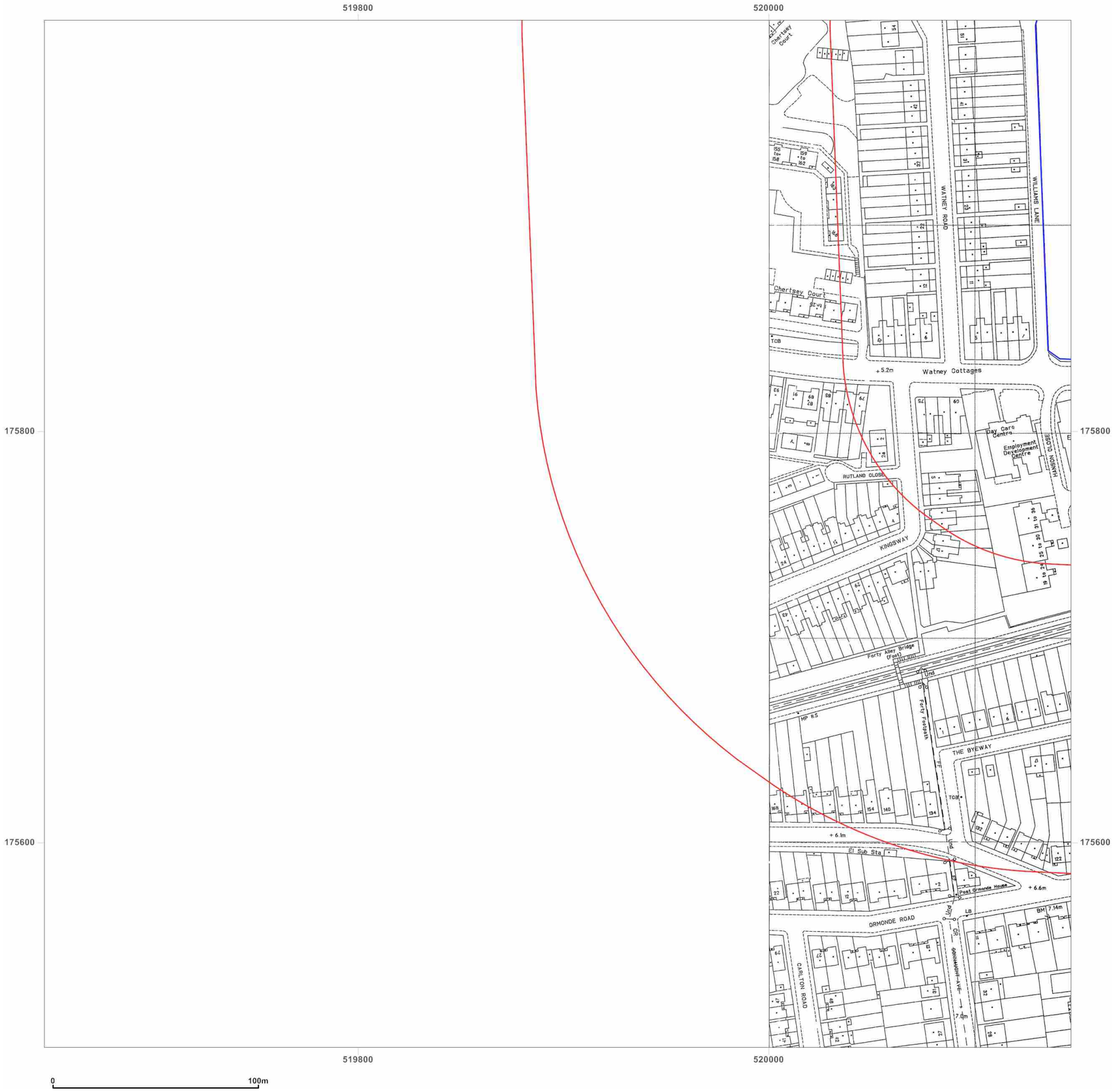

Waterman

Site Details:

THE STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_1
Grid Ref: 519897, 175750

Map Name: National Grid

Map date: **1995**

Scale: 1:1,250

Printed at: 1:2,000

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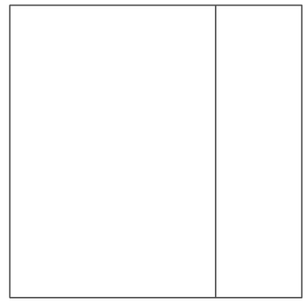

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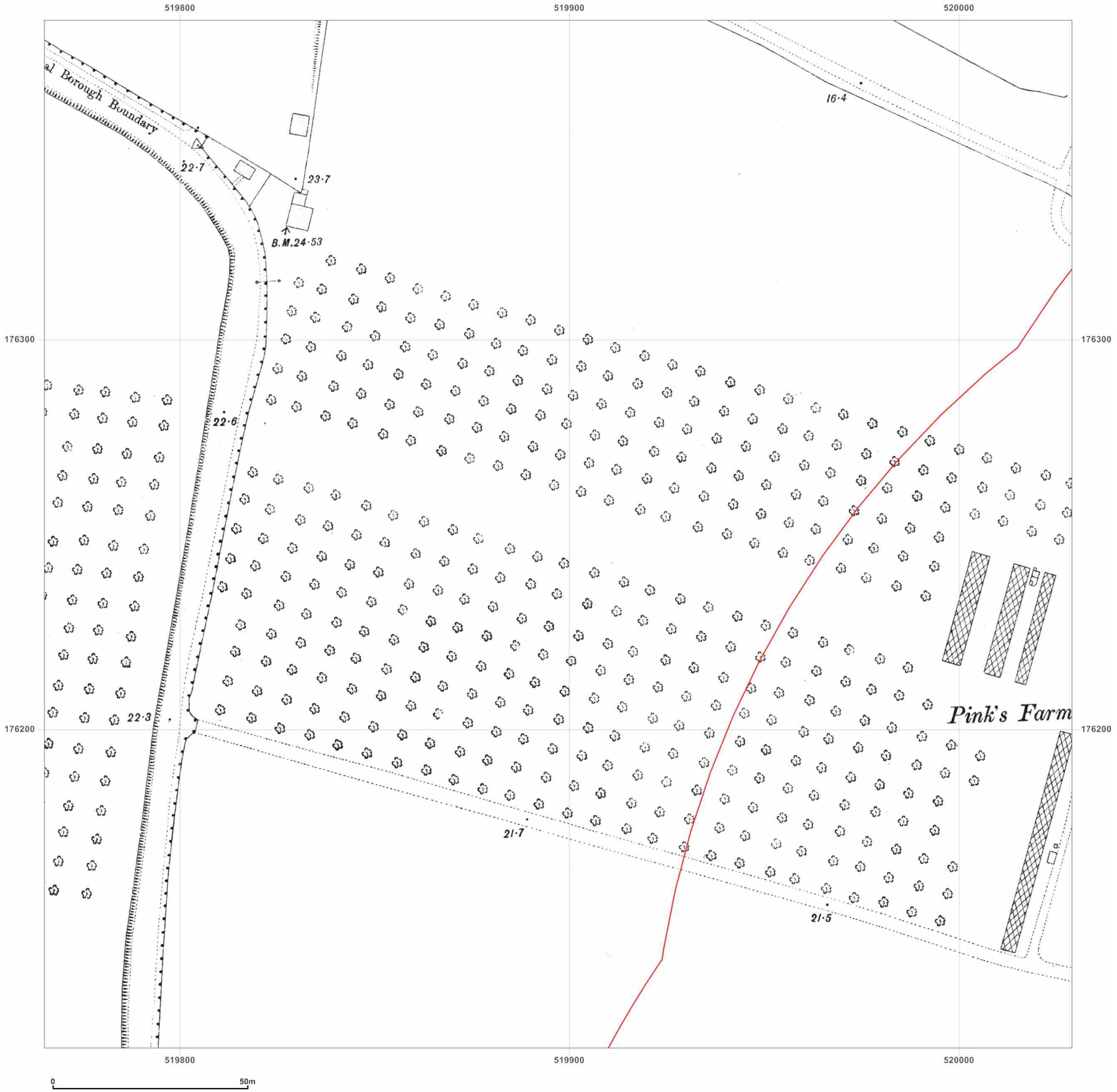

Site Details:

THE STAG BREWERY, LOWER
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LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: 1056 Scale Town Plan

Map date: **1896**

Scale: 1:1,056

Printed at: 1:1,056

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Site Details:

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LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: National Grid

Map date: **1951**

Scale: 1:1,250

Printed at: 1:2,000

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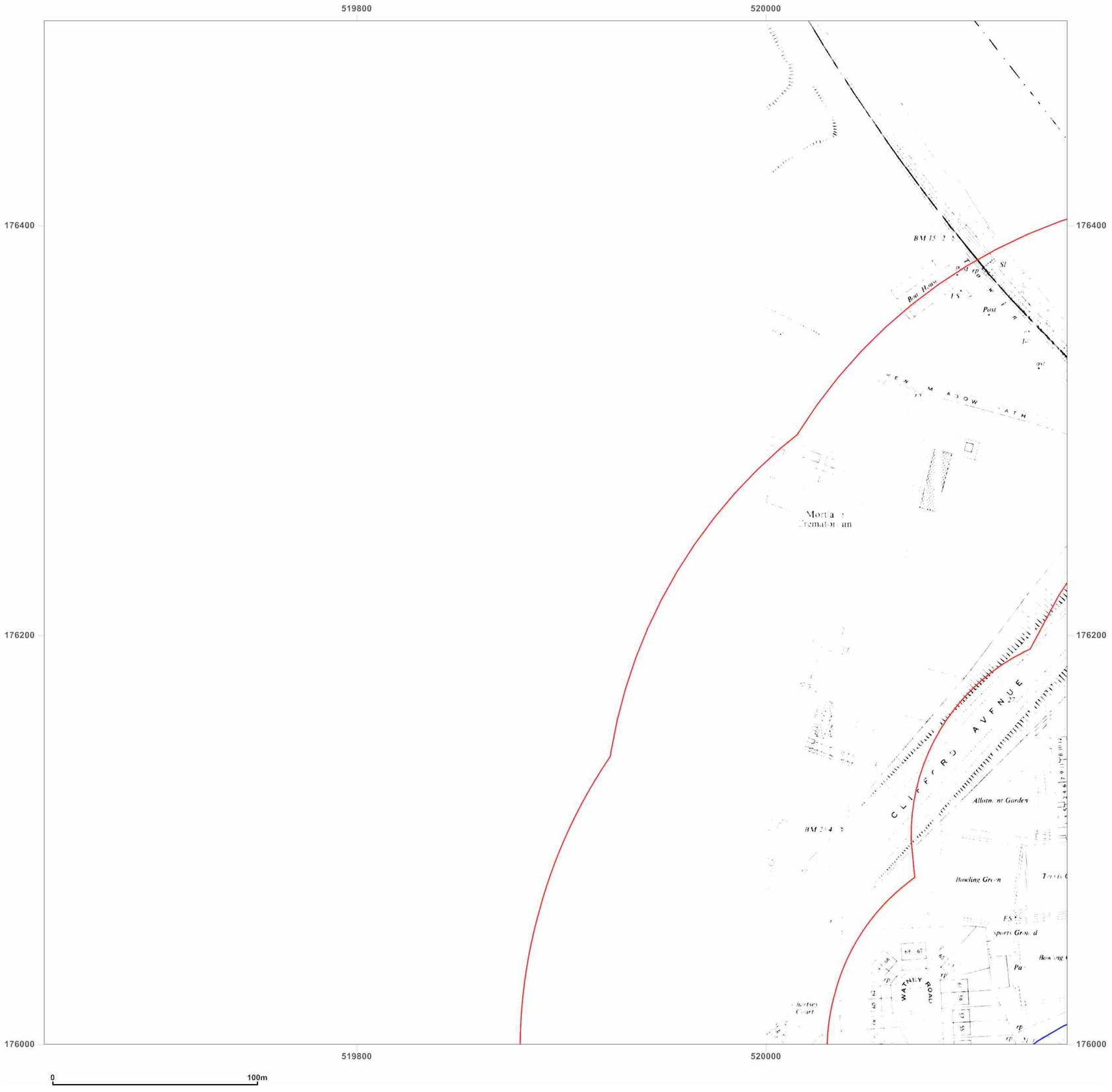

Site Details:

THE STAG BREWERY, LOWER
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LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: National Grid

Map date: **1952**

Scale: 1:1,250

Printed at: 1:2,000

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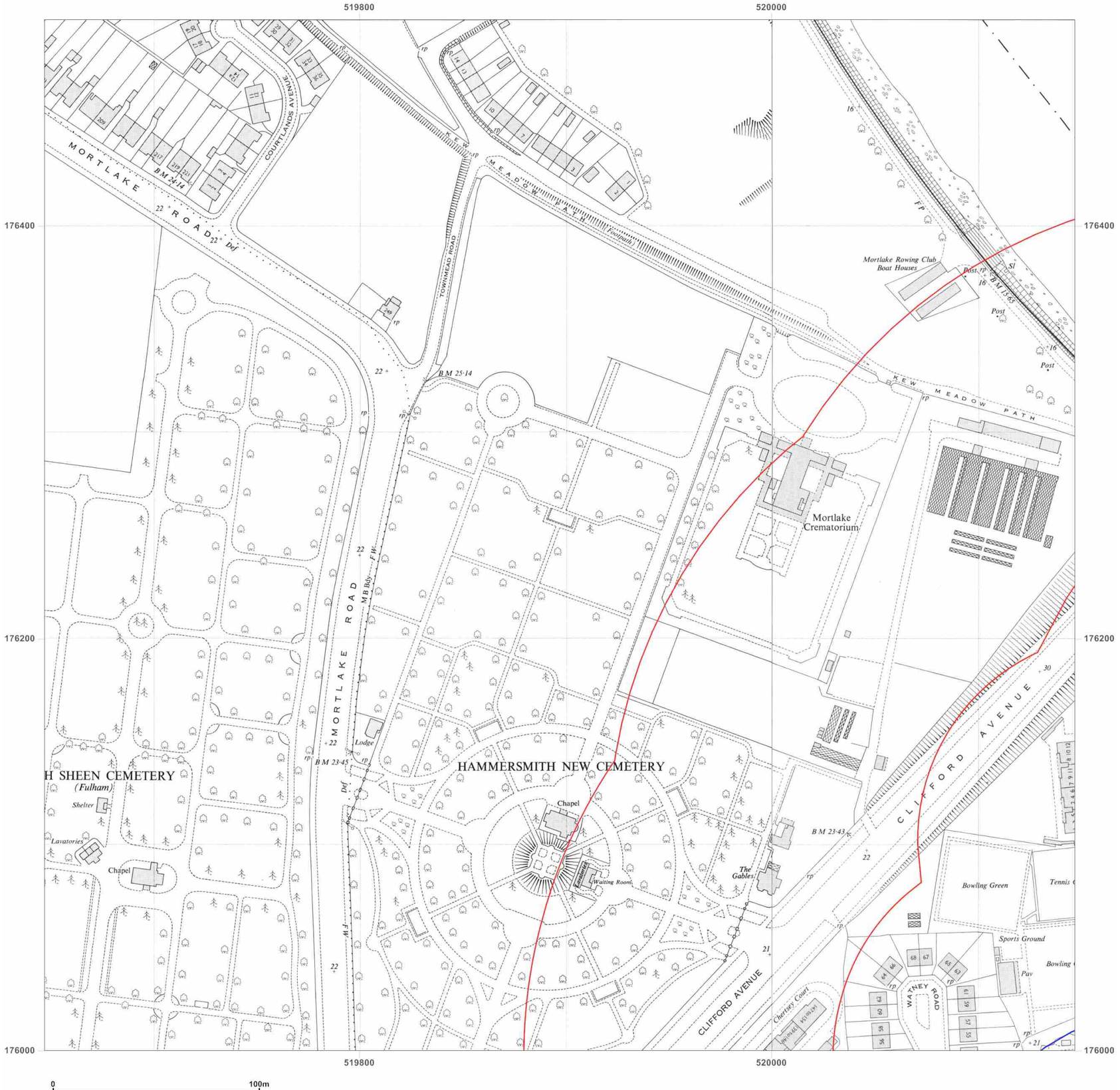

Site Details:

THE STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: National Grid

Map date: **1960**

Scale: 1:1,250

Printed at: 1:2,000

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Site Details:

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Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: National Grid

Map date: **1961**

Scale: 1:1,250

Printed at: 1:2,000

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Revised N/A
Edition N/A
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Production date: 18 July 2019

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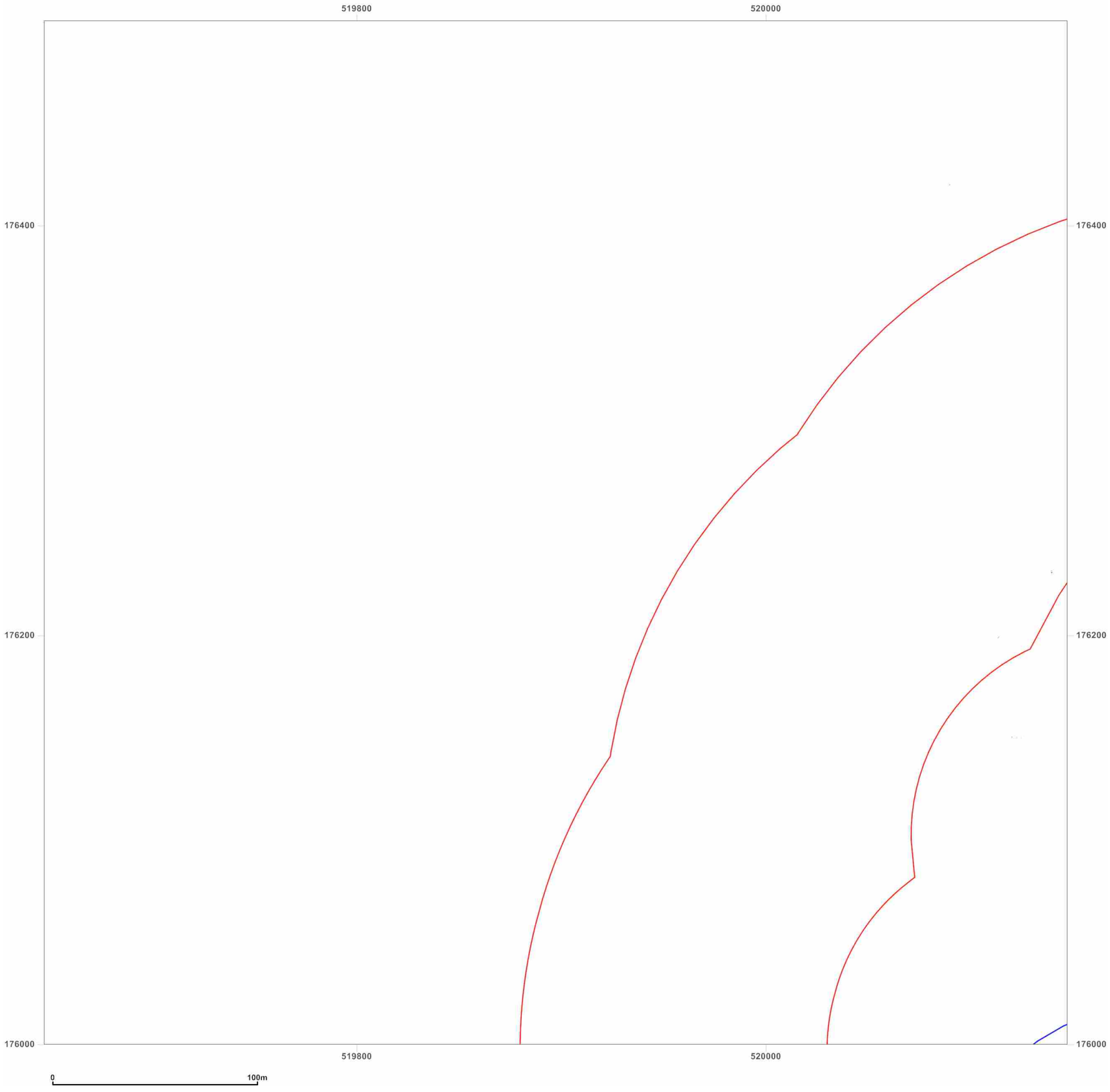

Site Details:

THE STAG BREWERY, LOWER
RICHMOND ROAD, MORTLAKE,
LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: National Grid

Map date: **1974**

Scale: 1:1,250

Printed at: 1:2,000

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Revised N/A
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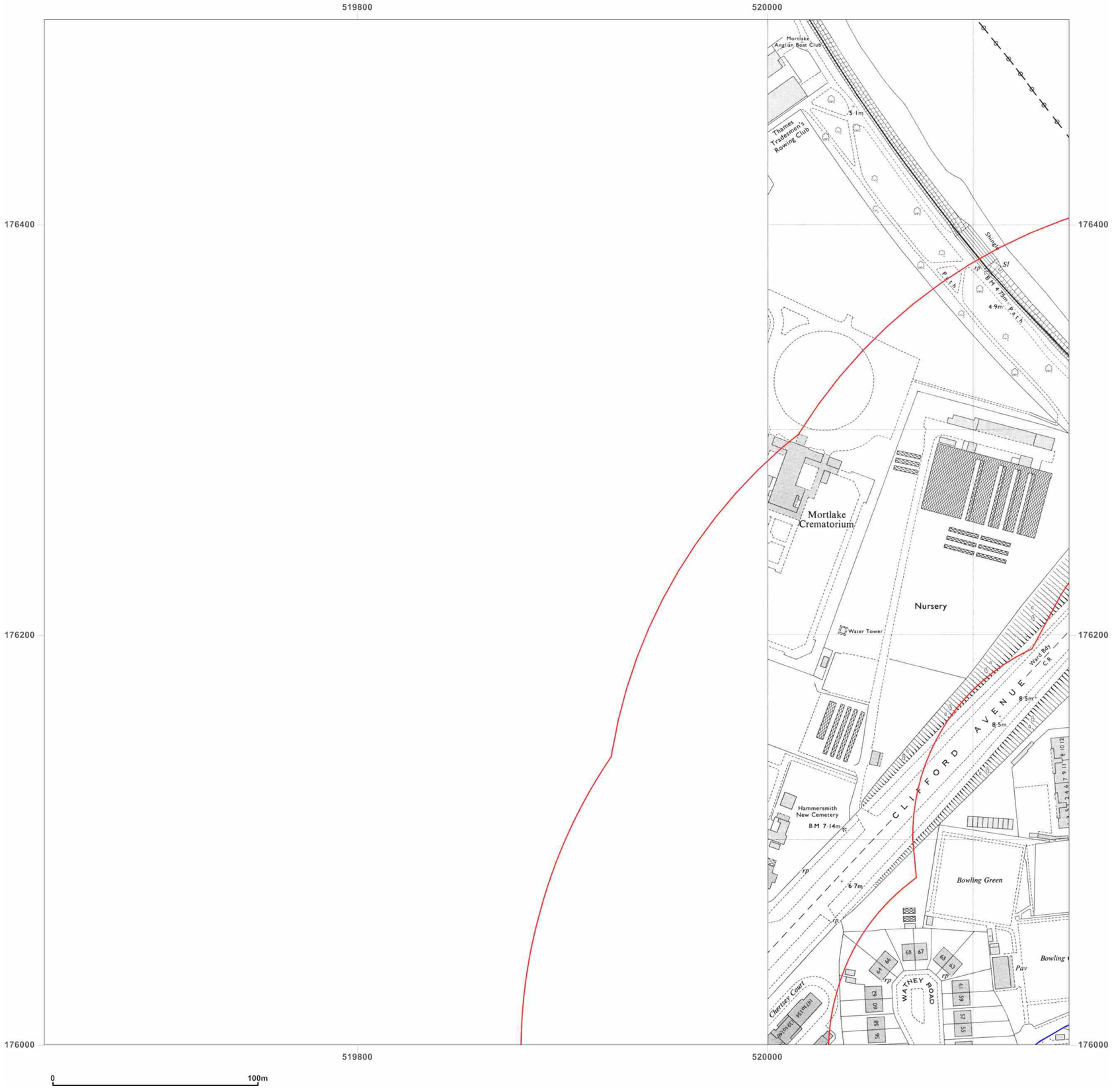

Site Details:

THE STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: National Grid

Map date: **1976**

Scale: 1:1,250

Printed at: 1:2,000

N
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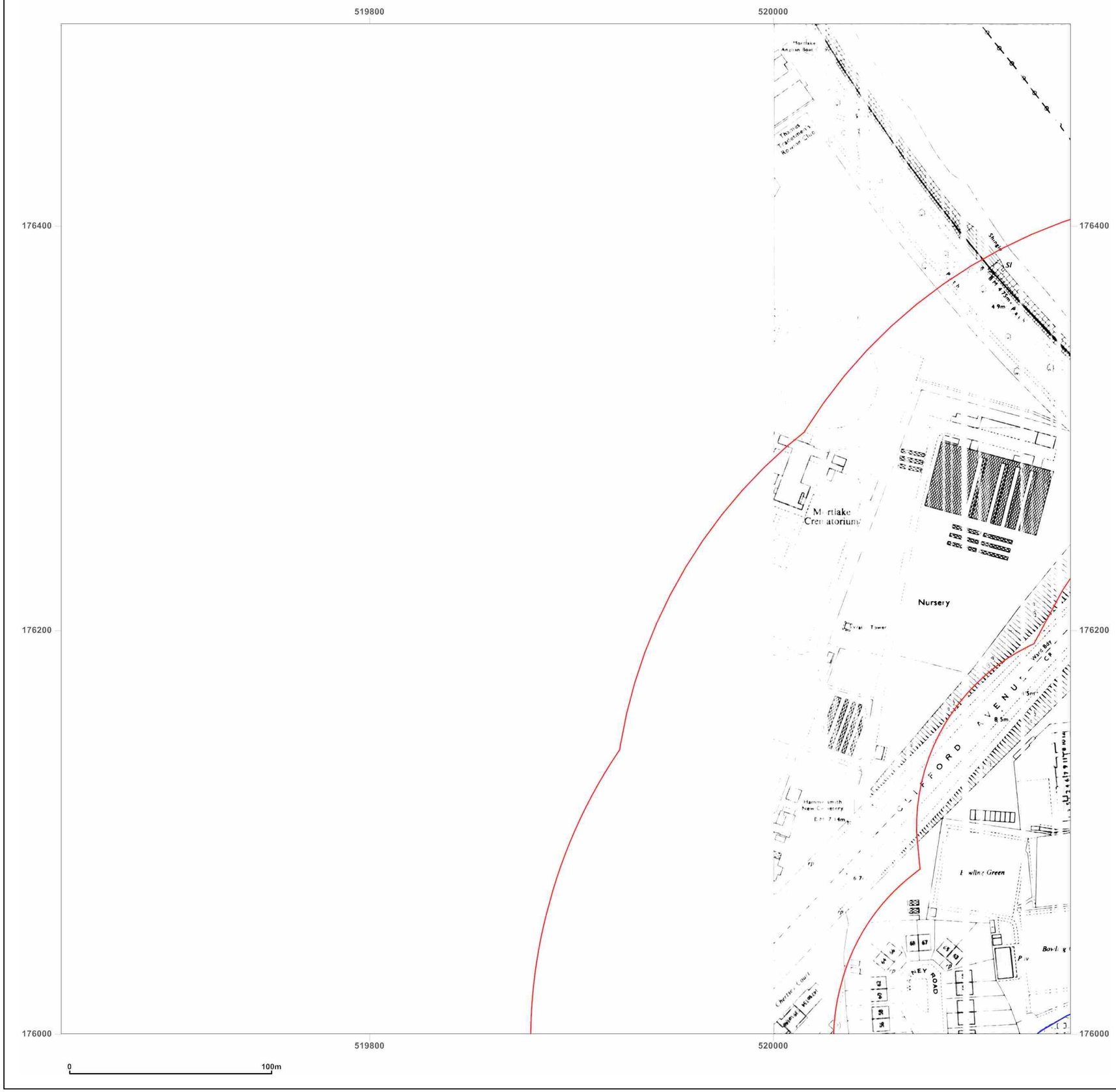

Site Details:

THE STAG BREWERY, LOWER RICHMOND ROAD, MORTLAKE, LONDON, SW14 7QR

Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: National Grid

Map date: **1977**

Scale: 1:1,250

Printed at: 1:2,000

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Revised N/A
Edition N/A
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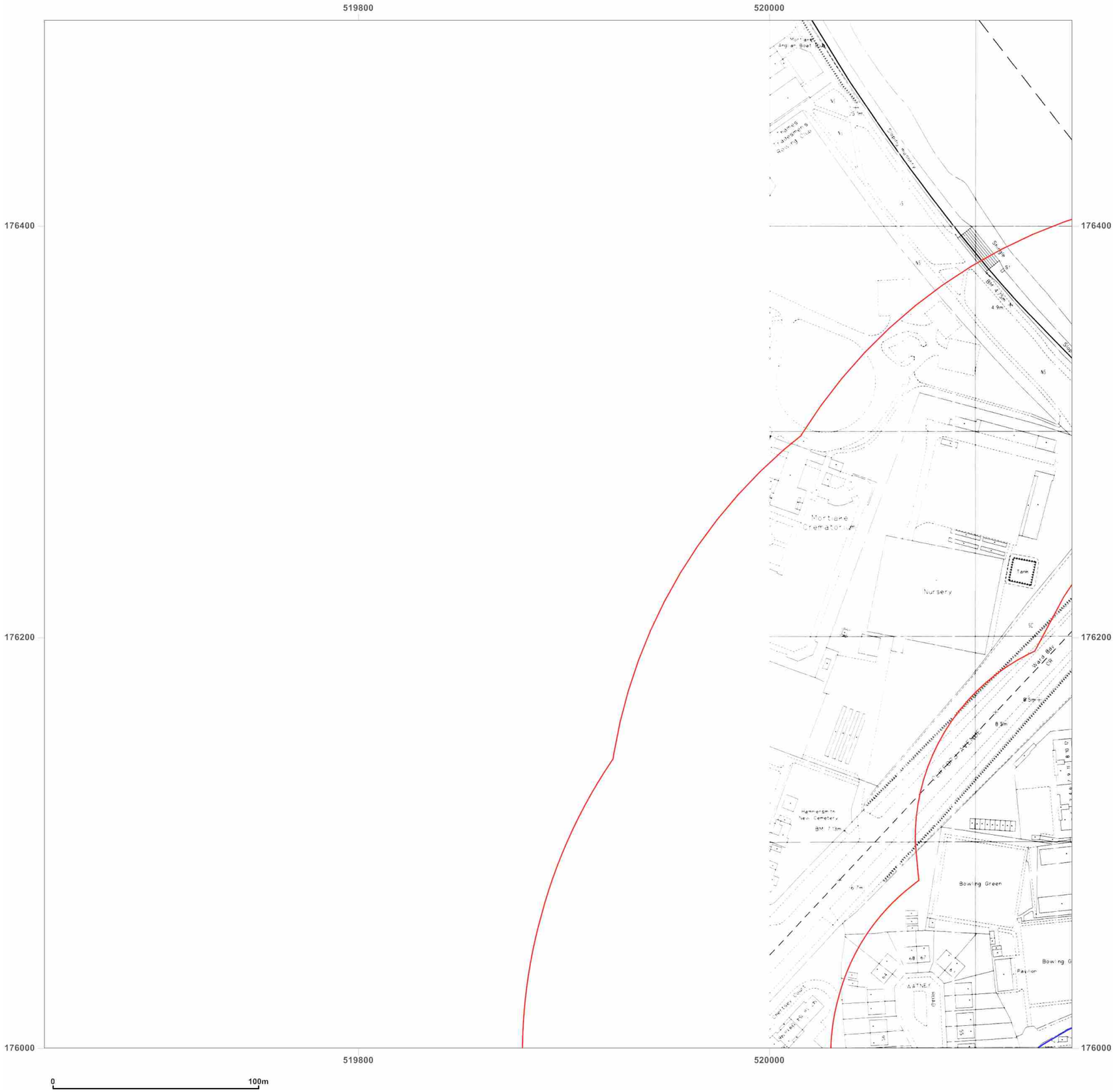

Site Details:

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Client Ref: WIE15582_Stag_Brewery_REQ99015
Report Ref: WTM1-6181570_1250scale_1_2
Grid Ref: 519897, 176250

Map Name: National Grid

Map date: **1991**

Scale: 1:1,250

Printed at: 1:2,000

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Edition N/A
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