that leachate tests undertaken as part of waste acceptance criteria analysis recorded concentrations beneath assessment criteria and noting that there are no potable groundwater abstractions were identified within 1km. Furthermore, no risks were reported from ground gases as the composition of Made Ground was considered to represent a very low gas generation potential and from vapours noting that no petroleum hydrocarbons in soil analysis. PBA noted that water supply pipes may come into contact with Made Ground and new water supply pipes will be required to be 'barrier pipes'.

Environment Agency (EA)

A response was received from the EA in September 2018 (as detailed within Appendix C). The following information was provided:

- No landfills were known to be located within 500m of the site (corroborating with information provided by the London Borough of Richmond and the Envirocheck Report);
- That they were not aware of any incidents relating to contaminated land within 500m of the site;
- That no sites designated under Part 2a were believed to be within close proximity of the site;
- That no groundwater level monitoring sites were positioned within 500m of the site and therefore neither information relating to local depth to groundwater nor flow direction was held;
- No records were held relating to water quality;
- A single groundwater abstraction borehole was noted in relation to spray irrigation use located at the Richmond Athletics Ground (c.970m to the north-west); and,
- In relation to the former Richmond Gas Works located adjacent and to the north-east of the site, no investigation records were held, however following note their database dated from 2001 detailed the following:

  "Groundwater contaminated with TPH, BTEX compounds and PAHs. Hotspots of heavy metals and PAHs. Remedial measures included the installation of a bentonite wall on the East & South of the site, excavation of 1.5m from across the site and the removal of buried structures. Groundwater remediation measures also include the removal of LNAPL and disposal off-site, groundwater treatment ex-situ and reinjection, and a period of monitoring to EA satisfaction."

Network Rail

Fairhurst contacted and met with representatives of Network Rail (30th August 2018) in order to discuss potential constraints to the site development posed by the railway lines to the north-west and the south of the site.

Network Rail confirmed their responsibility for the lines and also that they require access to the railway via the gate to the south-west of the site in order to reach signalling equipment. In relation to the proposed development, Network Rail was generally happy with the provisions for this access incorporated into the existing design. Although Network Rail would likely not have any objections to the scheme and were generally satisfied with the required distance from the proposed blocks to their boundary, it was considered that final site layout (particularly referencing blocks within the southern portion of the site) will require further consultation and approval with Network Rail.

Liaison with Network Rail is ongoing.

Transport for London

Transport for London have confirmed that the Overground route at this location is owned and managed by Network Rail and TfL only has running rights on this route. Furthermore, the District line is under TfL / London Underground ownership and management.

London Underground

London Underground have stated that their assets will not be affected by works on-site; although there are Network Rail assets close to the site.

London Overground

London Overground have stated that they have no assets within close proximity of the site.

4.0 PRELIMINARY CONCEPTUAL MODEL AND QUALITATIVE RISK ASSESSMENT

A preliminary conceptual model represents the characteristics of the site that show the possible relationship between contaminant sources, pathways and receptors. The following outline conceptual model is based on the findings of the PRA. The principles of environmental risk assessment are presented in Appendix F.

The significance of the presence of sources, pathways and receptors is considered by carrying out a risk assessment of all potential pollutant linkages. The assessment has been undertaken to inform on potential geo-environmental risks associated with the redevelopment of the site for a residential led end use development.

4.1 Source Characterisation

Potentially contaminative land uses (current and historic) identified as part of this PRA are detailed in Table 5 below.

It is considered that when the distance from a potential source to the site is more than 250m, the creation of a realistic source-pathway-receptor linkage (contaminant transfer) is unlikely. This is, unless the primary pathway of concern is the migration of ground gas (such as from a historic landfill site or backfilled quarry). Therefore, typically, potential sources more than 250m from the site are excluded from the risk assessment. Where sources are discounted for alternative reasons, due to the absence of a realistic source-pathway-receptor linkage, this is stated in Table 5.

Table 5 – Identified Potential Sources of Contamination

Source (Date first identified on historical mapping)	Location	Identified by	Discounted
		On-site	
Made Ground	On-site	Borehole records	No, nature and composition of fill material is unknown.
Current use of site as Homebase and pet store	On-site	Site walkover	Yes, no potential sources of contamination were identified during site walkover and shop use not considered to pose risk of contamination. Fly tipping was limited and noted to be of tyres, cushions, rubbish, plastics and turf and no contamination is anticipated from these sources. Area of paint storage was noted to be limited and not considered to present contamination source.
Former site use as car wash	On-site	Site walkover / Online aerial imagery	No, potential for chemicals to have been used.
Current site use as car parking and bus stand	On-site	Site walkover	No, potential for localised hotspots of contamination from spillages, interceptors and venting pipes identified in this area.
Historical uses including timber yard, crane, railway sidings, fuel depot, coal hoppers, electrical substation and power station	On-site	Historical maps / Council correspondence	No, potential for contamination to remain from historical sources.
Electrical substation	On-site (north-western corner and	Historical maps / Site walkover / Council correspondence	No, potential for historic and ongoing contamination from source.

	centre of western boundary)		
Asbestos containing materials in building fabrics	On-site	Historical maps / building age	Yes, it is considered that asbestos in building fabrics is unlikely to impact soil / groundwater. It is considered that an up to date asbestos survey will be undertaken prior to the demolition of existing structures. Asbestos may be present in soil from historic structures / Made Ground; however, this is covered in the Made Ground source detailed above.
Contemporary trade directory entry for electrical goods sales, manufacturers and wholesalers	On-site	Envirocheck report	Yes, no potential sources of contamination considered to be present associated with shop use.
Off-site			
Railway lines (1867 - present)	Bounding site to south and west	Historical maps / Site walkover / Council correspondence	No, potential for contamination to be present from source.
Richmond gas works and associated activities, including railway sidings, gas holders, tank etc (1867 - present) Later detailed as works / depot (1975 - 1990s)	Historically from 50m NE Present day 120m NE	Historical maps / Council correspondence	No, whilst source is likely down hydraulic gradient, potential for gas/groundwater impact to have had a widespread impact on groundwater quality in the area. Further, ground investigation is required to confirm hydraulic gradient.
Militia barracks and drill ground (1867 - 1894)	150-200m NW	Historical maps	Yes, noting that the source is considered to be down hydraulic gradient and the time passed since its presence.
Nursery (1867 - 1960)	200m NW	Historical maps	Yes, noting that the source is considered to be down hydraulic gradient and considered unlikely to be significant;
Laundry (1896 - 1898)	200m SW	Historical maps	No, source is up assumed hydraulic gradient of the site and relic contamination may remain from source, although unlikely given >100 years and likely volatile vapour nature of contaminants. Some detergents can be pervasive in the groundwater environment.
Corporation depot (1896 - 2004) Goods depot (1960 - 1970s). Later coach repair works (1970s - 1980s) and depot (late 1980s)	200m W	Historical maps / Council correspondence	No, source is up hydraulic gradient of the site and relic contamination may remain from source.
Nursery (1896 - 1913)	100m S	Historical maps	No, source is up hydraulic gradient of the site and relic contamination may remain from source, although given time passed since its presence (>100 years), this is considered unlikely.

Timber yard (1896 - 1913)	100m N	Historical maps	Yes, noting that the source is considered to be down hydraulic gradient and the time since present; therefore allowing for natural attenuation of contamination.
Smithy (1913)	200m E	Historical maps	Yes, noting that the source is considered to be down hydraulic gradient and the time since present; therefore allowing for natural attenuation of contamination.
3no garages (1960 - 1990s)	250m S	Historical maps	No, source is up hydraulic gradient of the site and relic contamination may remain from source.
3no works (1960 - 1990s). One of which is considered to be the car dealership / garage identified during the walkover 2no active car dealers positioned here	240-250m NE	Historical maps / Site walkover / CTDE	Yes, noting that the source is considered to be down hydraulic gradient and the time since present; therefore allowing for natural attenuation of contamination.
Warehouse buildings / works (1970s - present) Electrical substation (1970s - unspecified) Builders yard, identified as Travis Perkins during walkover (1970s - present) and 3no CTDE positioned at this location Tank (1970s - unspecified). CTDE for inactive tank cleaning and repair positioned here Additional CTDE for printers, aerosols, 2no optical goods, tyre dealers, powder coatings and domestic cleaning services positioned here	20 - 50m W	Historical maps / Site walkover Council correspondence / CTDE	No, potential for contamination to be remain associated with sources. Although, limited contamination considered to be present associated with ongoing Travis Perkins / builder's warehouse use.
F.A. Clover & Sons Ltd and Big Yellow Self Storage	20 - 50m W	Site walkover	Yes, no potential sources of contamination are considered associated with shop use.
Electrical substation (1960 - 1990s)	200m NW	Historical maps	Yes, noting that the source is considered to be down hydraulic gradient of the site.
Works (1975 - 1990s) Identified CDTE as inactive builders merchant, inactive distribution services and active carpet, curtain and upholstery cleaners	Adjacent SW	Historical maps / CTDE / Council correspondence	No, potential for contamination to be remain associated with source.
Coal hoppers (1970s - 1980s)	Adjacent N	Historical maps	No, potential for contamination to be remain associated with source.
Garage (petrol filling station) and works (1970s -	150m N	Historical maps / Site walkover /	Yes, noting that the source is considered to be down hydraulic

present) CTDE for inactive petrol filling station, inactive cable and wire equipment manufacturers and active and inactive garage services positioned here		CTDE	gradient of the site.
Electrical substation (1990s - unknown)	100m S	Historical maps	No, potential contamination present from source and it is positioned up hydraulic gradient of the site.
Petrol filling station (2000s - present)	200m NE	Historical maps / site walkover	Yes, noting that the source is considered to be down hydraulic gradient of the site.
Warehouse (light industrial: engines, building and general industrial to manufacture component parts for electrical and motor industries) (1978-2002)	20m S	Council correspondence	No, potential for contamination to be remain associated with source.
Classic car specialists	130m N	CTDE	Yes, source considered to be down hydraulic gradient.
Active garage services, active tyre dealers, inactive car customizing specialists, inactive and active distilleries, inactive pottery manufacturers and suppliers, active dry cleaners and inactive road haulage services	150-210m W / NW	CTDE	No, source is potentially up hydraulic gradient of the site.
Active clothing and fabrics manufacturers and inactive dairies	230-240m NE	CTDE	Yes, sources are considered to be down hydraulic gradient
Category 2 significant incident positioned 210m north-east, dated May 1989. Pollutant was unknown oils and no further information is provided Category 3 minor incident positioned 250m north-east, dated December 1991. Pollutant was unknown oils and no further information is provided		Envirocheck report	Yes, noting that the source is considered to be down hydraulic gradient of the site.

Contaminants of concern associated with the sources outlined above are listed in Table 6 below. Whilst they have been withdrawn, Department of Environment (DoE) industry profiles have been utilised for reference, where available. Figure 2a and 2b presents potential sources of contamination (on and off-site respectively), which are carried forwards to the conceptual site model.

Table 6 – Contaminants of Concern

Source	Contaminants of Concern
On-site	
Made Ground	Metals, PAH, asbestos, TPH, ground gas
Former car wash	Metals, PAH , TPH, VOC, SVOC
Car parking	Metals, TPH, SVOC, VOC PAH

Historical uses including timber yard, crane, railway sidings, fuel depot, coal hoppers, electrical substation and power station	Metals, PAH, asbestos, TPH, PCB, VOC, SVOC, phenols, pesticides
Electrical substation	PCB, TPH, PAH, metals, VOC, SVOC
Off-site	
Railway lines (1867 - present)	DoE industry profiles note the following potential contaminants in the vicinity of tracks: metals, VOC, PAH, pesticides
Richmond gas works and associated activities, including railway sidings, gas holders, tank etc (1867 - present) Later detailed as works / depot (1975 - 1990s)	Metals, TPH, PCB, PAH, VOC, SVOC, ammonia, phenols, cyanide (total), sulphates
Laundry (1896 - 1898)	VOC, solvents
Corporation depot (1896 - 2004) Goods depot (1960 - 1970s). Later coach repair works (1970s - 1980s) and depot (late 1980s)	Metals, TPH, VOC, SVOC, and PAH
Nursery (1896 - 1913)	Metals, pesticides
3no garages (1960 - 1990s)	Metals, TPH, VOC, SVOC, and PAH
Warehouse buildings / works (1970s - present) Electrical substation (1970s - unspecified) Builders yard, identified as Travis Perkins during walkover (1970s - present) and 3no CTDE positioned at this location Tank (1970s - unspecified). CTDE for inactive tank cleaning and repair positioned here Additional CTDE for printers, aerosols, 2no optical goods, tyre dealers, powder coatings and domestic cleaning services positioned here	Metals, PCB, PAH, TPH, VOC, SVOC
Works (1975 - 1990s) Identified CDTE as inactive builders merchant, inactive distribution services and active carpet, curtain and upholstery cleaners	PAH, TPH, VOC, SVOC, metal
Coal hoppers (1970s - 1980s)	Metal, PAH
Electrical substation (1990s - unknown)	Polychlorinated biphenyls, petroleum hydrocarbons, metals
Warehouse (light industrial: engines, building and general industrial to manufacture component parts for electrical and motor industries) (1978-2002)	PCB, PAH, TPH, VOC, SVOC, metal
Active garage services, active tyre dealers, inactive car customizing specialists, inactive and active distilleries, inactive pottery manufacturers and suppliers, active dry cleaners and inactive road haulage services	PAH, TPH, VOC, SVOC, metal

Metals and inorganic compounds including but not limited to As, B, Cd, Cr total, Cr VI and III, Cu, Hg, Ni, Pb, Se, Zn/ phenols, cyanide (free and total), asbestos and sulphates / VOC: volatile organic compounds / SVOC: semi volatile organic compounds / PAH: polycyclic aromatic hydrocarbons / TPH CWG: total petroleum hydrocarbons / PCB: polychlorinated biphenyls / Ground gas including but not limited to CO2, CH4, CO, H2S

4.2 Receptor Characterisation

The following receptors are identified at the site:

- Human health: future site workers and residents and off-site adjacent land users, including neighbours and members of the public;
- Building materials and below ground structures (foundations and services); and
- Controlled waters: the underlying Secondary A Aquifer (Kempton Park Gravel Member).

The River Thames is not considered a receptor to on-site contamination, noting the distance of this surface water feature to the site (>1.6km). Furthermore, the off-site pond positioned c.310m south is considered to likely be up hydraulic gradient and therefore not considered to be a receptor from on-site contamination. Three groundwater abstractions were identified during council liaison, and were noted to be positioned west and north-west of the site and at closest 920m from the site; therefore, these have been discounted as they are not considered to be in hydraulic connectivity with the site.

It is assumed that appropriate Health & Safety measures, based upon a qualitative environmental risk assessment of site conditions by the contractor will be adopted during any future below ground maintenance works. This is likely to include personal protective equipment (PPE). It is considered that these measures will adequately mitigate the risk to construction and future maintenance workers from potential sources of contamination. Therefore, future construction and maintenance workers are not discussed further as part of this risk assessment.

Pollution linkages have not been identified to ecology as a Part IIA and Non-Part IIA Receptor at this stage. However, this report does not purport to be making ecological recommendations, for which a specialist should be consulted.

4.3 Pathway Characterisation

The potential pathways by which receptors might be exposed to contaminants (sources) at the site can vary depending on the proposed or current land use (i.e. commercial or residential land use). The assessment has been based on a residential end use.

For humans, the following are considered plausible exposure pathways:

- Migration, accumulation and inhalation of soil gas / vapours via permeable soils and groundwater;
- Direct contact and ingestion / inhalation of contaminated soils in areas of soft landscaping; and
- Ingress of contaminants into conduits, contaminating drinking water supplies.

Noting that the proposed development is to include multi-storey apartment buildings and therefore assumed shared landscaping spaces, the consumption of home grown produce has been excluded from the assessment.

For building materials and below ground structures (including foundations and services), the following are considered plausible exposure pathways:

- Soil gas / vapour accumulation in confined spaces and voids within or beneath structures; and
- Direct contact of building fabric with contaminated soils.

For controlled waters, the following pathways may be present:

- Vertical leaching and migration of contaminants from the soil to groundwater; and
- Lateral migration of on-site groundwater off-site or from off-site groundwater on-site.

4.4 Pollutant Linkages

The significance of future potential pollutant linkages at the site is now qualitatively assessed by considering the magnitude of the hazard, and the possibility of the linkages occurring based on the observations made above and taking consideration of the continued commercial end use. Potential pollutant linkages are identified in Table 7.

Table 7 – Preliminary Qualitative Risk Assessment for Identified Sources of Contamination

Source	Potential contaminants	Potential Pathway (s)	Potential receptor (s)	Assessment	Potential Severity	Potential Probability	Risk Class
On-site sources	Metals, TPH, PAH, PCB, VOC, SVOC, sulphates, asbestos, pesticides	Direct contact with contaminated soils Direct ingestion / inhalation of contaminated soils Ingestion of contaminated water from drinking water supply pipes	Human health (on-site)	Development proposals include areas of soft landscaping. Residential end use is more sensitive than existing commercial. Possible that new drinking water supply pipes are to be laid.	Medium	Likely	Moderate
	Ground gases / VOC	Inhalation of accumulated soil ground gases or vapours Lateral migration of volatile compounds in groundwater	Human health (on and off site)	Potential for ground gases to be present attributable to Made Ground or the degradation of organic contamination. Furthermore, potential sources of VOC identified.	Severe	Low	Moderate
	Ground gases / VOC	Soil gas / vapour accumulation in confined spaces and voids within or beneath structures	Buildings and service conduits (on and off-site)	As above.	Severe	Low	Moderate
	Metals, TPH, PAH, PCB, VOC, SVOC, pesticides Sulphates in London Clay Formation	Direct contact of building fabric with contaminated soils	Buildings and service conduits (on and off-site)	Sources of contamination identified on-site and associated with historic uses which may result in aggressive chemical conditions within Made Ground. Soft landscaping associated with proposed development may increase vertical leaching of contamination. Plausible that proposed building foundations are positioned beneath the groundwater table.	Mild	Likely	Moderate / Low
	Metals, TPH, PAH, PCB, VOC, SVOC, asbestos, pesticides	Vertical leaching and migration of contaminants from the soil to groundwater Lateral migration of groundwater off-site	Secondary A Aquifer (on and off-site)	Soft landscaping associated with proposed development may increase vertical leaching of contamination. Whilst no abstractions / surface water features are identified, the resource potential of the Secondary A Aquifer should be considered. Shallow groundwater was encountered from 1.5m bgl within BGS borehole records in the Kempton Park Gravel Formation.	Medium	Likely	Moderate

Source	Potential contaminants	Potential Pathway (s)	Potential receptor (s)	Assessment	Potential Severity	Potential Probability	Risk Class
Off-site sources	Ground gases / VOC	Inhalation of accumulated soil ground gases or vapours Lateral migration of volatile compounds in groundwater	Human health (on-site)	Potential sources of ground gases identified and there is potential for these to migrate in the unsaturated zone onto site. Potential for VOCs to migrate in groundwater or via the unsaturated zone to beneath the site.	Severe	Low	Moderate
	Ground gases / VOC	Soil gas / vapour accumulation in confined spaces and voids within or beneath structures	Buildings and service conduits (on - site)	As above.	Severe	Low	Moderate
	Metals, TPH, PCB, PAH, VOC, SVOC, ammonia, cyanide (total), sulphates, pesticides	Contact with building structures and services with contaminated groundwater migrating onto site	Buildings and service conduits (on - site)	Plausible that proposed building foundations will be positioned beneath the groundwater table and therefore in contact with contaminated groundwater migrating onto site.	Mild	Likely	Moderate / Low
	Metals, TPH, PCB, PAH, VOC, SVOC, ammonia, cyanide (total), sulphates, pesticides	Vertical leaching and migration of contaminants from the soil to groundwater Lateral migration of off-site groundwater on-site	Secondary A Aquifer (on-site)	Potential for contaminated groundwater to be flowing onto site. No abstractions identified on-site; however, resource potential could be impacted.	Medium	Likely	Moderate

5.0 GEOTECHNICAL CONSIDERATIONS

The following geotechnical considerations are noted associated with the development.

Basement Development

- Consultation with LBRuT identifies that the basement development would be subject to Policy LP 11 from their local plan, which details: and

  A. The Council will resist subterranean and basement development of more than one storey below the existing ground level to residential properties or those which were previously in residential use.

  B. Proposals for subterranean and basement developments will be required to comply with the following:

     1. Extend to no more than a maximum of 50% of the existing garden land or more than half of any other undeveloped garden area (this excludes the footprint of the original building);
     2. Demonstrate the scheme safeguards the structural stability of the existing building, neighbouring buildings and other infrastructure, including related to the highway and transport; a Structural Impact Assessment will be required where a subterranean development or basement is added to, or adjacent to, a listed building.
     3. Use natural ventilation and lighting where habitable accommodation is provided;
     4. Include a minimum of 1 metre naturally draining permeable soil above any part of the basement beneath the garden area, together with a minimum 200mm drainage layer, and provide a satisfactory landscaping scheme;
     5. Demonstrate that the scheme will not increase or otherwise exacerbate flood risk on the site or beyond, in line with policy LP 21 Flood Risk and Sustainable Drainage;
     6. Demonstrate as part of a Construction Management Statement that the development will be designed and constructed so as to minimise the impact during construction and occupation stages (in line with the Local Environmental Impacts, Pollution and Land Contamination policy of this Plan);

  C. Proposals for subterranean and basement developments, including extensions, as well as lightwells and railings, will be assessed against the advice set out in the Council's SPDs relating to character and design as well as the relevant Village Planning Guidance and the forthcoming SPD on Basements and Subterranean Developments. Applicants will be expected to follow the Council's Good Practice Guide on Basement Developments.

- Furthermore, the LBRuT planning advice note 'Good Practice Guide on Basement Developments', May 2015Consultation with LBRuT identifies that the basement development would be subject to Policy LP 11 from their local plan, which details potential requirements including: contacting utilities, Network Rail and Transport for London to confirm that works will not interfere with their infrastructure; flood risk assessment taking consideration of groundwater and potential groundwater flooding; assessment of land stability; structural assessment taking consideration of ground conditions and groundwater, existing trees and infrastructure and drainage; site investigation; and assessment of ground movements.

On the basis of the foregoing, it is considered that a Basement Impact Assessment and/or Ground Movement Assessment may be required to confirm the absence of adverse impacts to existing offsite infrastructure assets or neighbouring structures, subject to the development details/design and liaison with TFL/LUL and/or Network Rail and the Local Planning Authority.

Below Ground Structures and Utilities

- Council correspondence notes that the site is within a National Grid safeguard zone (unknown if this relates to the former Richmond Gas Works) and a possible Southern Gas Network structure was identified in the south-eastern corner of the site. Furthermore, existing utilities are likely to be present on-site associated with the existing development, including the electrical substation. Existing services may require removal, capping and diversion associated with the development. Furthermore, it is recommended that full service plans are obtained in advance of any below ground investigation works;
- Relic foundations and structures may be present associated with the historic development of the site. Obstructions may need to be delineated and grubbed out as part of any future earthworks at the site; and
- As detailed in Section 3.6, the site is within a high risk area with respect to unexploded ordnance. It is recommended that a UXO specialist is contacted prior to any below ground works.

Foundation Appraisal

- There is the potential for aggressive sulphates in Made Ground and London Clay Formation, which may impact buried concrete and as such will require further consideration as part of any ground investigation;
- Trees are present bounding the site and pre-application consultation with LBRuT identifies that there are tree preservation orders at the site. It is considered probable that existing tree roots are present in the Kempton Park Gravel Formation and should this formation prove to be cohesive in nature the volume change potential should be considered where trees are to be removed or planted associated with the development;
- Structural loads are unknown at this stage. Noting proposed development heights of potentially up to 10 No. storeys (plus ground and basement floors), it is considered that loads may exceed traditional shallow foundations (i.e. pads and strips) and foundations may need to be piled. Following ground investigation consideration could be given to shallow foundations and raft basement slabs, dependent on settlement tolerances and the thickness and density of the Kempton Park Gravels;
- Based on BGS borehole records, it is considered that a piled foundation solution would extend into the London Clay Formation. Foundation design will be subject to structural loads and ground investigation findings.

Adjacent Railways

- District, Overground and National Rail tracks bound the site to the south and the west. It is likely that additional assessments will be required to confirm the potential impacts of development on these assets, including during ground investigation and future development.

Further Considerations

- Soakaways may be feasible within the granular Kempton Park Gravel Formation; however, given the potential for contamination identified, further risk assessments may be required to ensure that these do not result in increased mobilisation of potential contamination. Furthermore, BGS borehole logs have identified a groundwater table from c.1.5m bgl and the shallow depth to groundwater may preclude the use of soakaway drainage.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Geo-Environmental

This report has identified potential sources of contamination on-site, including those that predate the commercial building, including Made Ground, timber yards, electrical substations, car wash, coal hoppers, fuel depot, power station and car parking. Furthermore, off-site sources of contamination were identified, most notably the former Richmond Gas Works positioned to the north-east of the site beyond Manor Road.

Potential risks were assessed against sensitive receptors including human health, building structures and services and controlled waters as the underlying Kempton Park Gravel Member (Secondary A Aquifer).

Typically a moderate risk was identified to receptors associated with the proposed development. It is considered that contaminated land planning conditions will be included associated with the development and it is recommended that a ground investigation is undertaken to further quantify potential risks.

6.2 Geotechnical

Potential Geotechnical considerations identified including:

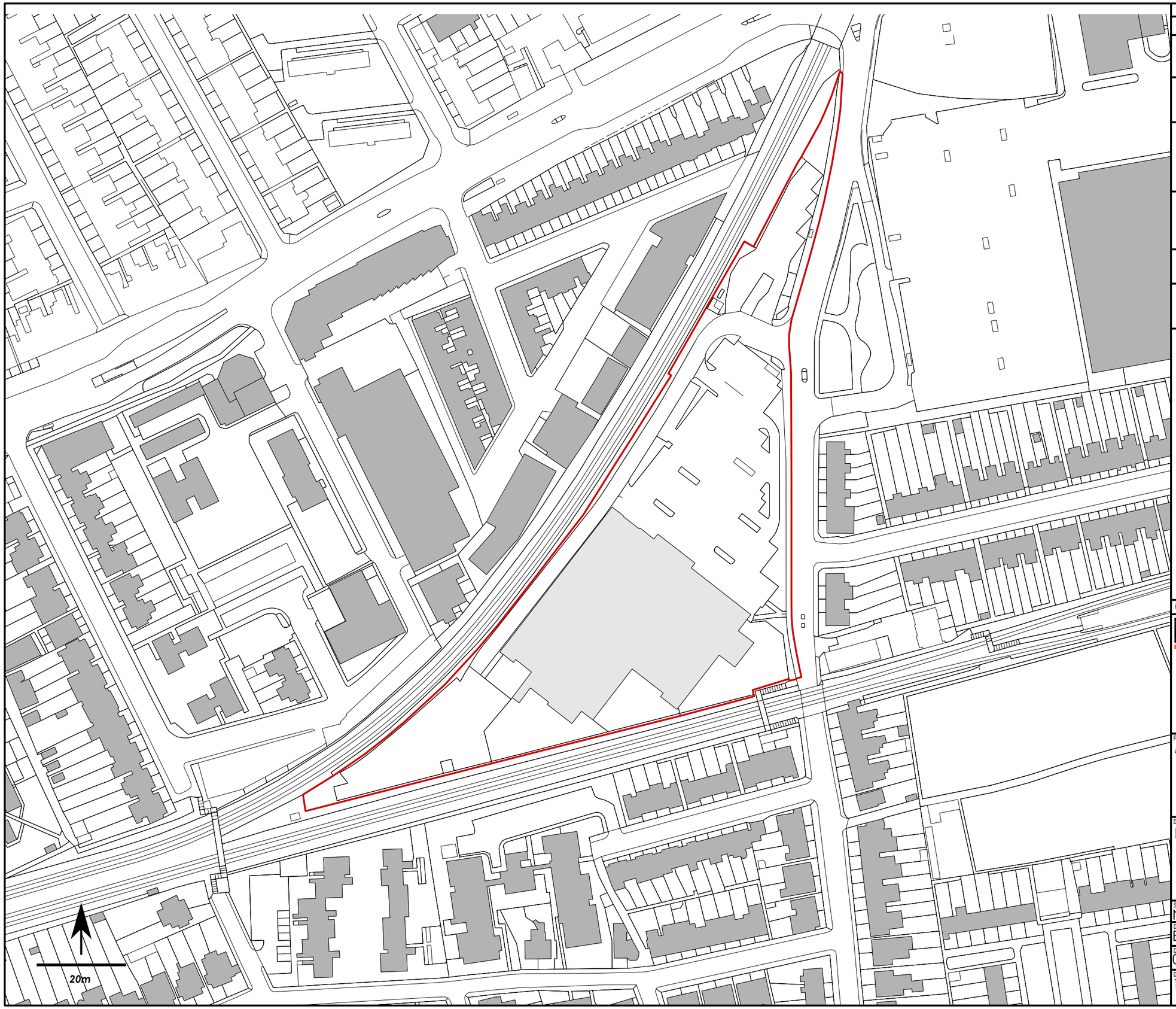
- Presence of railway lines adjacent to the south and west of the site. The development will require ongoing consultation with Network Rail following Fairhurst's initial meeting with regards to confirming absence of risk to their assets;
- It is noted that the site is within a National Grid safeguard zone and additional services are likely to be present associated with the development of the site. Existing services may require removal, capping and diversion associated with the development. Furthermore, it is recommended that full service plans are obtained in advance of any below ground investigation works;
- Structural loads are preliminary at this stage. Noting proposed development heights of up to 10 No. storeys (plus basement and ground floor), it is considered that loads may exceed traditional shallow foundations (i.e. pads and strips) and foundations may need to be piled. Based on BGS borehole records, it is considered that a piled foundation solution would extend into the London Clay Formation. Foundation design will be subject to structural loads and ground investigation findings; and
- The site is within a high risk area with respect to unexploded ordnance. A detailed assessment is currently being undertaken and the findings should be referred to prior to any below ground / excavation works.

6.3 Recommendations

It is recommended that an intrusive ground investigation is undertaken to further quantify Geo-Environmental and Geotechnical risks associated with the development. The above assessment is based on the proposed development plans included in Appendix A and the assessment should be revised if these are amended.

Figure 1

Site Location Plan



Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO.

CONSTRUCTION

DEMOLITION

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

Rev.	Date	Description	Drwn.	Chkd.	Appd.

FAIRHURST

135 Park Street
LONDON
SE1 9EA

Tel: 020 7828 8205
Fax: 084 4381 4412
Fairhurst.co.uk

Client:
Avanton

Project Title:
Manor Road, Richmond

Drawing Title:
Existing Site Layout
From Assael Drawing A3004 100

Scale at A3:	Status:	
Not to Scale	ISSUE	
Drawn: EY	Checked: AS	Approved: AS
Date: 04/12/18	Date: 05/12/18	Date: 05/12/18
Drawing No.: 126782 Figure 1		Revision: A

Figure 2

Potential Sources of Contamination

Legend

PotentialSourcesofContaminationOn-Site

- Former Car Wash
- Former Coal Hoppers
- Former Crane
- Former Depot
- Former Electrical Substation
- Former Fuel Depot
- Former Railway Sidings
- Made Ground, Former Timber Yard & Former Power Station (location unknown)
- Car Parking
- Electrical Substation
- Site Boundary

FAIRHURST
135 Park Street
LONDON
SE1 9EA

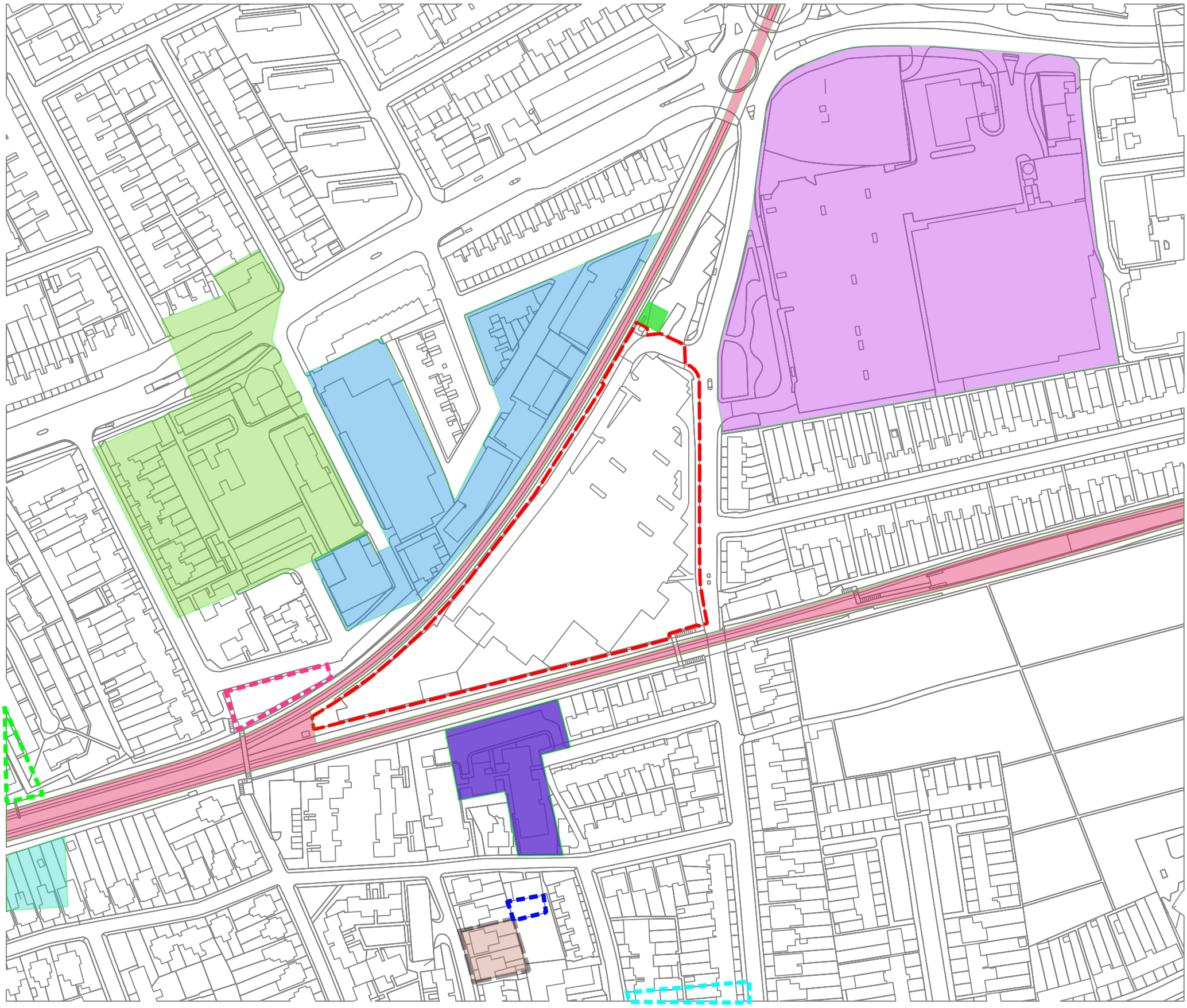
Tel: 020 7828 8205
Fairhurst.co.uk

Client:
Avanton Limited

Project Title:
Site off Manor Road, Richmond

Drawing Title:
Potential Sources of Contamination On-Site
126782

Scale at A1: NTS	Status: N/A	
Drawn: FS	Checked: CB	Approved: CB
Date: 10/08/2018	Date: 10/08/2018	Date: 10/08/2018
Drawing No.: Figure 2A		Revision: -



Legend

- Corporation & Goods Depots and Coach Repair Works
- Electrical Substation
- Former 3no Garages
- Former Coal Hoppers
- Former Laundry
- Former Light Industrial Warehouse
- Former Nursery
- Former Richmond Gas Works
- Former Warehouses, Works, Electrical Substation, Builders Yard, Tank and Various CTDE
- Former Works, Builders Merchant, Distribution Services & Carpet Cleaners
- Railway Lines
- Various CTDE
- Site Boundary

FAIRHURST
135 Park Street
LONDON
SE1 9EA

Tel: 020 7828 8205
Fairhurst.co.uk

Client:
Avanton Limited

Project Title:
Site off Manor Road, Richmond

Drawing Title:
Potential Sources of Contamination Off-Site
126782

Scale at A1: NTS	Status: N/A	
Drawn: FS	Checked: CB	Approved: CB
Date: 10/08/2018	Date: 10/08/2018	Date: 10/08/2018
Drawing No.: Figure 2B		Revision: -

APPENDIX A

Development Proposals

0m 10m 50m
5m 25m

N

General notes

All setting out must be checked on site
All levels must be checked on site and refer to Ordnance Datum Newlyn unless alternative Datum given
All fixings and weatherings must be checked on site
All dimensions must be checked on site
This drawing must not be scaled
This drawing must be read in conjunction with all other relevant drawings, specification clauses and current design risk register
This drawing must not be used for land transfer purposes
Calculated areas in accordance with Assael Architecture's Definition of Areas for Schedule of Areas
This drawing must not be used on site unless issued for construction
Subject to survey, consultation and approval from all statutory Authorities

Revision Status:
P=Preliminary
C=Contract

Drawing notes

Electronic file reference

Enter Source Filename ' Eg AA Title Block'

Status R:	Revision	Date	DRN	CHK	CDM
15	For Information	17/06/20	LP	HB	
16	For Information	01/07/20	MP	HB	
17	Design Freeze	17/07/20	TP	HB	

Key

Key	Studio	1 Bed	2B3P	2B4P	3 Bed
Market					
Shared Ownership					
London Affordable Rent					
London Living Rent					
Plant/Refuse/Bike Store					
Commercial					

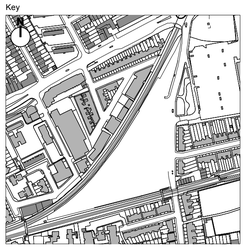
Purpose of information

The purpose of the information on this drawing is for:

- Planning ☐
- Information ☒
- Comment ☐
- Client approval ☐
- Construction ☐

All information on this drawing is not for construction unless it is marked for construction.

Key



Client

Avanton

Project title

A3004
Manor Road Richmond

Drawing title

GA Plans Proposed
First Floor

Scale @ A1 size: **1:500**

Date: **July '20**

Drawing N°

MNR-AA-ALL-01-DR-A-2001

Status & Revision

R17

Assael

Assael Architecture Limited
123 Upper Richmond Road
London SW15 2TL

+44 (0)20 7736 7744
info@assael.co.uk
www.assael.co.uk

APPENDIX B

Envirocheck Report

Historical Mapping Legends

Ordnance Survey County Series 1:10,560

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

Ordnance Survey Plan 1:10,000

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

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

1:10,000 Raster Mapping

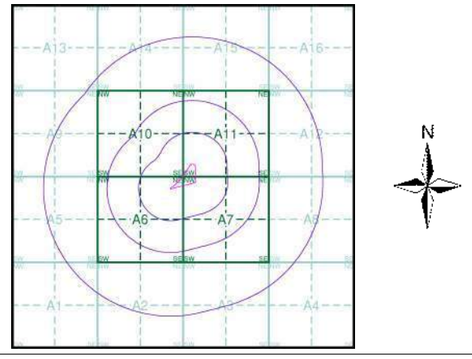
Gravel Pit
Refuse tip or slag heap
Rock
Rock (scattered)
Boulders
Boulders (scattered)
Shingle
Mud
Sand
Sand Pit
Slopes
Top of cliff
General detail
Underground detail
Overhead detail
Narrow gauge railway
Multi-track railway
Single track railway
County boundary (England only)
Civil, parish or community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

FAIRHURST

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Middlesex	1:10,560	1869 - 1873	3
Surrey	1:10,560	1871 - 1874	4
London	1:10,560	1896	5
Surrey	1:10,560	1898 - 1899	6
Middlesex	1:10,560	1920	7
Surrey	1:10,560	1920	8
London	1:10,560	1920	9
Surrey	1:10,560	1933	10
Surrey	1:10,560	1933	11
Middlesex	1:10,560	1935	12
Surrey	1:10,560	1938	13
Middlesex	1:10,560	1938	14
Surrey	1:10,560	1938	15
London	1:10,560	1938	16
Ordnance Survey Plan	1:10,000	1940 - 1950	17
Ordnance Survey Plan	1:10,000	1940 - 1958	18
Historical Aerial Photography	1:10,560	1948	19
Historical Aerial Photography	1:10,560	1948	20
Ordnance Survey Plan	1:10,000	1962 - 1966	21
Ordnance Survey Plan	1:10,000	1966 - 1967	22
Ordnance Survey Plan	1:10,000	1975 - 1976	23
London	1:25,000	1985	24
Ordnance Survey Plan	1:10,000	1988	25
Ordnance Survey Plan	1:10,000	1992	26
10K Raster Mapping	1:10,000	1999	27
10K Raster Mapping	1:10,000	2006	28
VectorMap Local	1:10,000	2017	29

Historical Map - Slice A



Order Details

Order Number: 142584674_1_1
Customer Ref: Homebase, Richmond
National Grid Reference: 518890, 175430
Slice: A
Site Area (Ha): 1.58
Search Buffer (m): 1000

Site Details

Homebase Ltd, 84, Manor Road, RICHMOND, TW9 1YB

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

Russian Military Mapping Legends

1:5,000 and 1:10,000 mapping

a. Not drawn to scale b. Drawn to scale

- Government and Administrative Buildings
- Military and Industrial Buildings
- Military and Communication Areas
- Subway Entrance
- Fireproof Building
- Prominent Fireproof Building
- Non-fireproof Building
- Non-fireproof Building (non-dwelling)
- Factory, mill, and flour mill, with chimneys
- Factory, mill, and flour mill, without chimneys
- Power Station, drawn to scale
- Hydroelectric Power Station
- Radio Station, drawn to scale
- Telephone Station, drawn to scale
- Abandoned Open-pit Mine or Quarry
- Open-pit Salt Mine
- Pit
- Oil Deposit or Well
- Oil Seepage
- Tailings Pile
- Fuel Storage Tanks
- Natural Gas Tank
- Bench Mark
- Drill Hole
- Burial Mound
- Triangulation Point on Burial Mound
- Single-track Railroad
- Double-track Railroad and Station Building
- Coniferous Forest
- Deciduous Forest
- Mixed Forest
- Lawns
- Citrus Orchard
- Wet Ground
- Scattered Vegetation

243,8 — Values for prominent elevations

186.0 — Numbers for spot elevations, depth soundings, contour lines, etc.

0,2 — Velocity of the current, width of river bed, depth of river

Fractional terms: length and capacity of bridges; depth of fords and condition of the river bottom; height of forest and the diameter of trees

Russian Alphabet (For reference and phonetic interpretation of map text)

А а (A)	З з (Z)	П п (P)	Ч ч (CH)
Б б (B)	И и (I)	Р р (R)	Ш ш (SH)
В в (V)	Й й (Y)	С с (S)	Щ щ (SHCH)
Г г (G)	К к (K)	Т т (T)	ъ (–)
Д д (D)	Л л (L)	У у (U)	ы (Y)
Е е (E)	М м (M)	Ф ф (F)	ь (')
Ё ё (YO)	Н н (N)	Х х (KH)	Э э (E)
Ж ж (ZH)	О о (O)	Ц ц (TS)	Ю ю (YU or IU)
			Я я (YA or IA)

1:25,000 mapping

a. Not drawn to scale b. Drawn to scale

- Government and Administrative Buildings
- Military and Industrial Buildings
- Military and Communication Areas
- Subway Entrance
- Partly Demolished Buildings
- Demolished Buildings
- Built-Up Area with Fireproof Buildings Predominant
- Built-Up Area with Non-Fireproof Buildings Predominant
- Individual Fireproof Building
- Prominent Industrial Building
- Individual Dwelling, Fireproof
- Ruins of an Individual Dwelling
- Factory or Mill Chimney
- Factory or Mill with Chimney
- Factory or Mill without Chimney
- Mine or Open Pit Mine
- Operating Shaft or Mine
- Non-Operating Shaft or Mine
- Salt Mine
- Tailings Pile
- Pit
- Stone Quarry
- Gas Pump or Service Station
- Fuel Storage or Natural Gas Tank
- Oil or Natural Gas Derrick
- Small Hydroelectric Power Station
- Power Station
- Transformer Station
- Cemetery
- Burial Mound (height in metres)
- Triangulation Point on Burial Mound
- Triangulation Point
- Bench Mark
- Bench Mark (monumented)
- Telegraph Office
- Telephone Station
- Radio Station
- Radio Tower
- Airfield or Seaplane Base
- Landing Strip
- Main Highway
- Highway under Construction
- Improved Dirt Road (former truck road)
- Double-track Railroad with First Class Station
- Dismantled Railroad
- Railroad Under Construction
- Shore Embankment
- River or Ditch with Embankment
- Direction and velocity of current
- Well
- Water Reservoir or Rain Water Pit
- Spring
- Isobath with value
- Heavy (Index) Contour Line
- Contour Line and Value
- Half Contour Line
- Spot Elevation Value
- Coniferous
- Deciduous
- Mixed
- Scrub

Key to Numbers on Mapping

TQ17_London

No.	Description
93	Factory (Gas)

FAIRHURST

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Middlesex	1:10,560	1869 - 1873	3
Surrey	1:10,560	1871 - 1874	4
London	1:10,560	1896	5
Surrey	1:10,560	1898 - 1899	6
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Surrey	1:10,560	1933	10
Surrey	1:10,560	1933	11
Middlesex	1:10,560	1935	12
Surrey	1:10,560	1938	13
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Ordnance Survey Plan	1:10,000	1966 - 1967	22
Ordnance Survey Plan	1:10,000	1975 - 1976	23
London	1:25,000	1985	24
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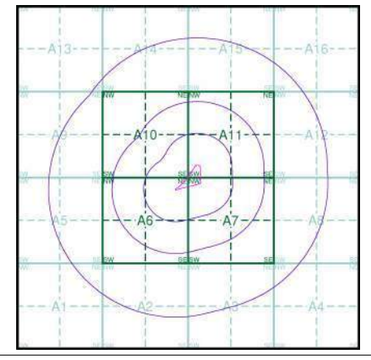
Ordnance Survey Plan	1:10,000	1992	26
10K Raster Mapping	1:10,000	1999	27
10K Raster Mapping	1:10,000	2006	28
VectorMap Local	1:10,000	2017	29

Russian Map - Slice A



Order Details

Order Number: 142584674_1_1
Customer Ref: Homebase, Richmond
National Grid Reference: 518890, 175430
Slice: A
Site Area (Ha): 1.58
Search Buffer (m): 1000

Site Details

Homebase Ltd, 84, Manor Road, RICHMOND, TW9 1YB

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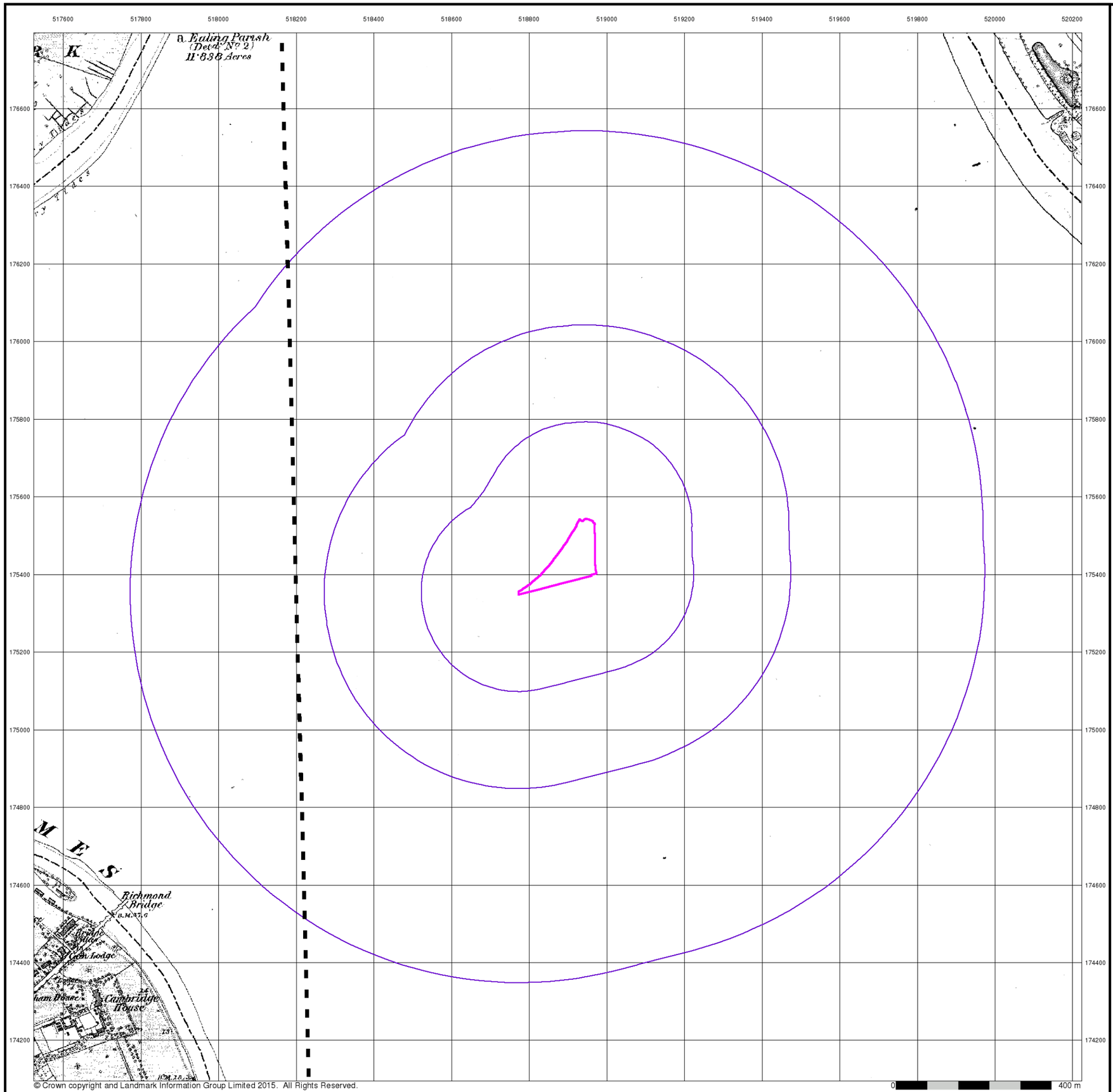
Web: www.envirocheck.co.uk



FAIRHURST

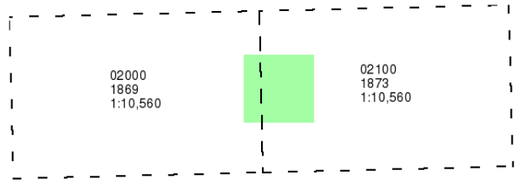
Middlesex

Published 1869 - 1873

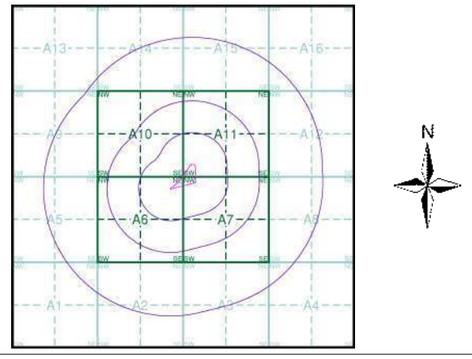
Source map scale - 1:10,560

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

Map Name(s) and Date(s)



Historical Map - Slice A



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Web: www.envirocheck.co.uk

FAIRHURST

Surrey

Published 1871 - 1874

Source map scale - 1:10,560

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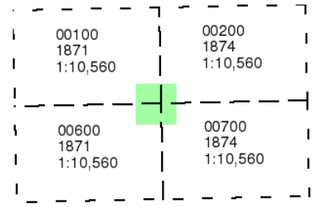
Map Name(s) and Date(s)



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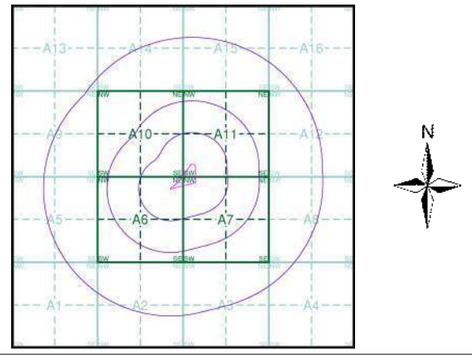

Order Details

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Customer Ref:	Homebase, Richmond
National Grid Reference:	518890, 175430
Slice:	A
Site Area (Ha):	1.58
Search Buffer (m):	1000

Site Details

Homebase Ltd, 84, Manor Road, RICHMOND, TW9 1YB

Landmark INFORMATION GROUP

Tel: 0844 844 9952
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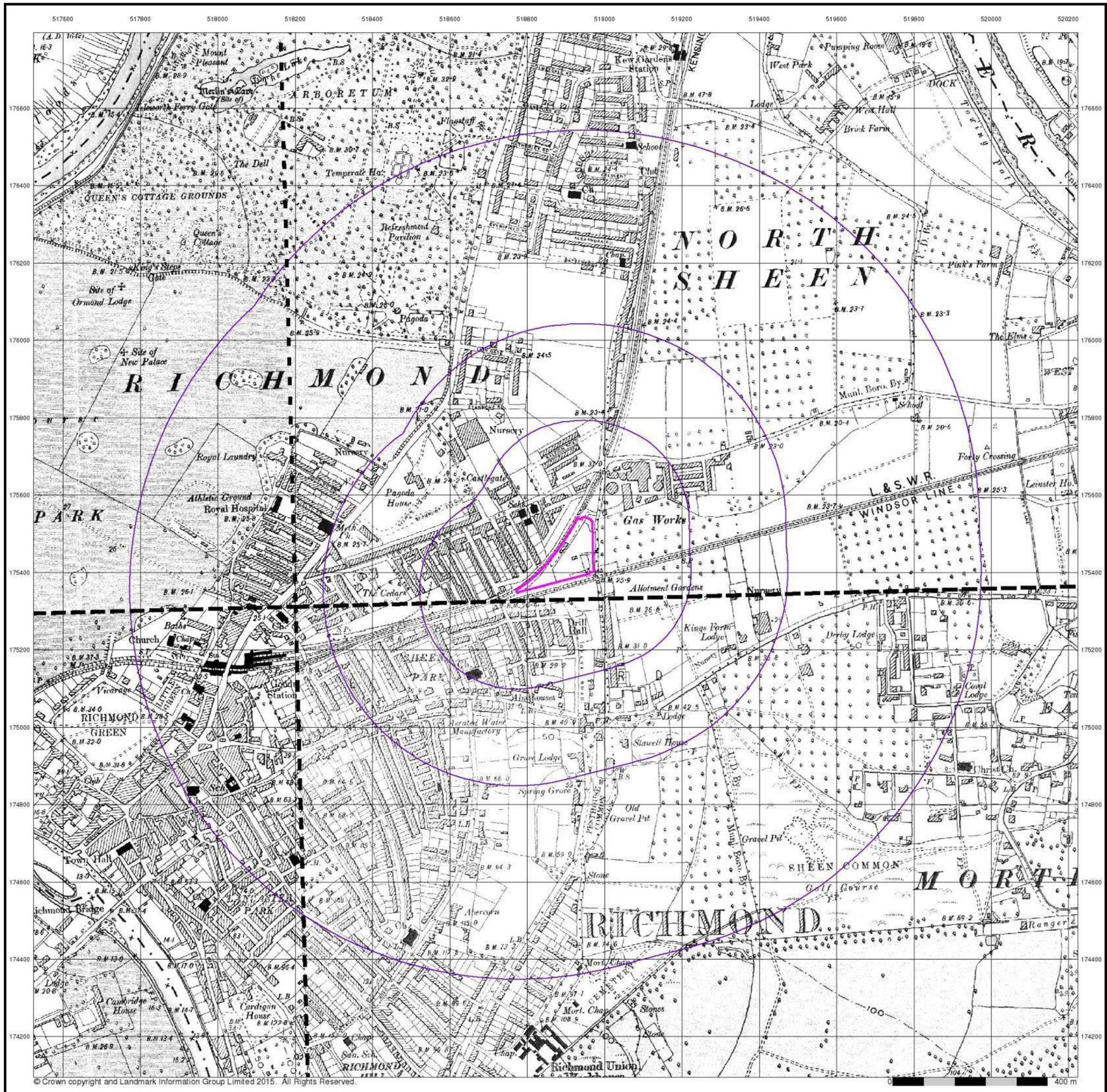


FAIRHURST

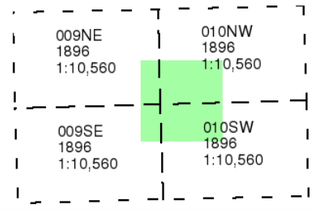
London

Published 1896

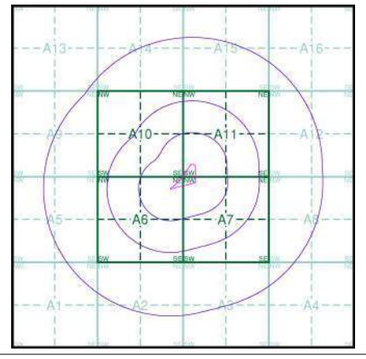
Source map scale - 1:10,560

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

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	142584674_1_1
Customer Ref:	Homebase, Richmond
National Grid Reference:	518890, 175430
Slice:	A
Site Area (Ha):	1.58
Search Buffer (m):	1000

Site Details

Homebase Ltd, 84, Manor Road, RICHMOND, TW9 1YB

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

FAIRHURST

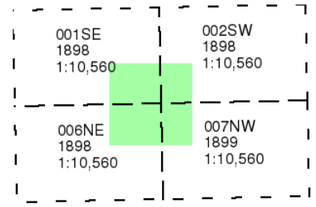
Surrey

Published 1898 - 1899

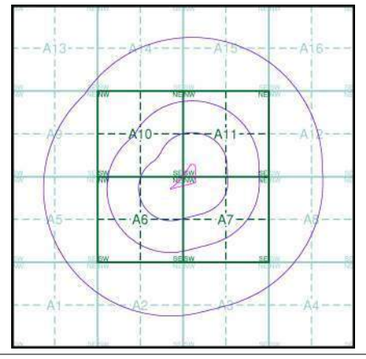
Source map scale - 1:10,560

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

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	142584674_1_1
Customer Ref:	Homebase, Richmond
National Grid Reference:	518890, 175430
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Site Area (Ha):	1.58
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Site Details

Homebase Ltd, 84, Manor Road, RICHMOND, TW9 1YB

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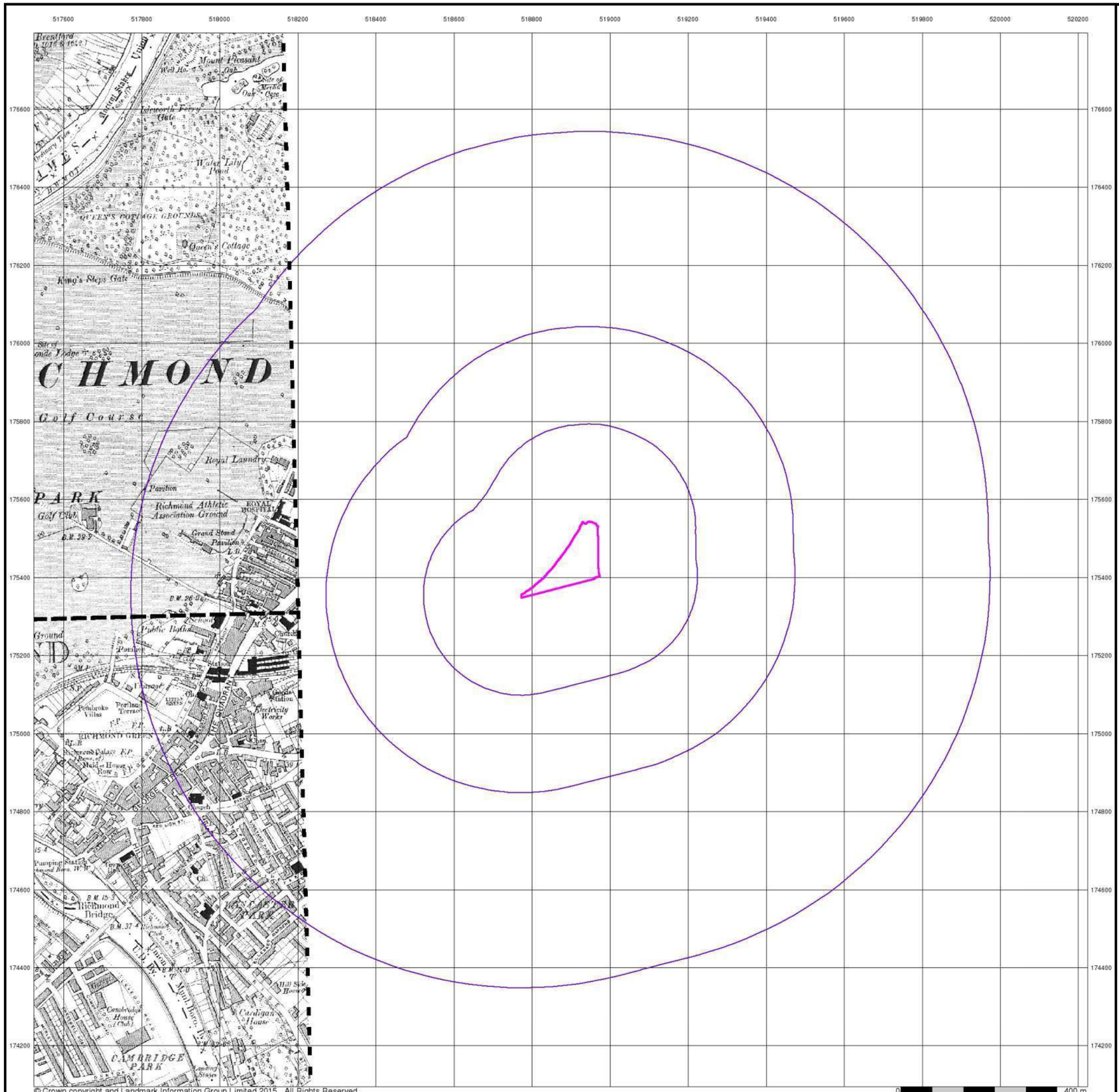


FAIRHURST

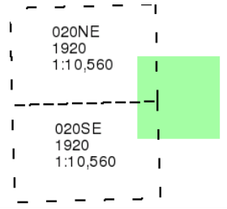
Middlesex

Published 1920

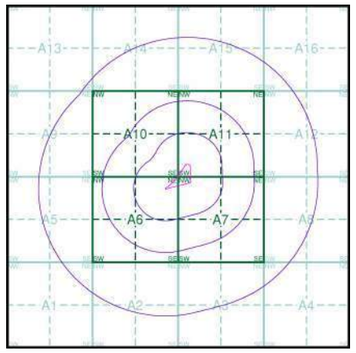
Source map scale - 1:10,560

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

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

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National Grid Reference:	518890, 175430
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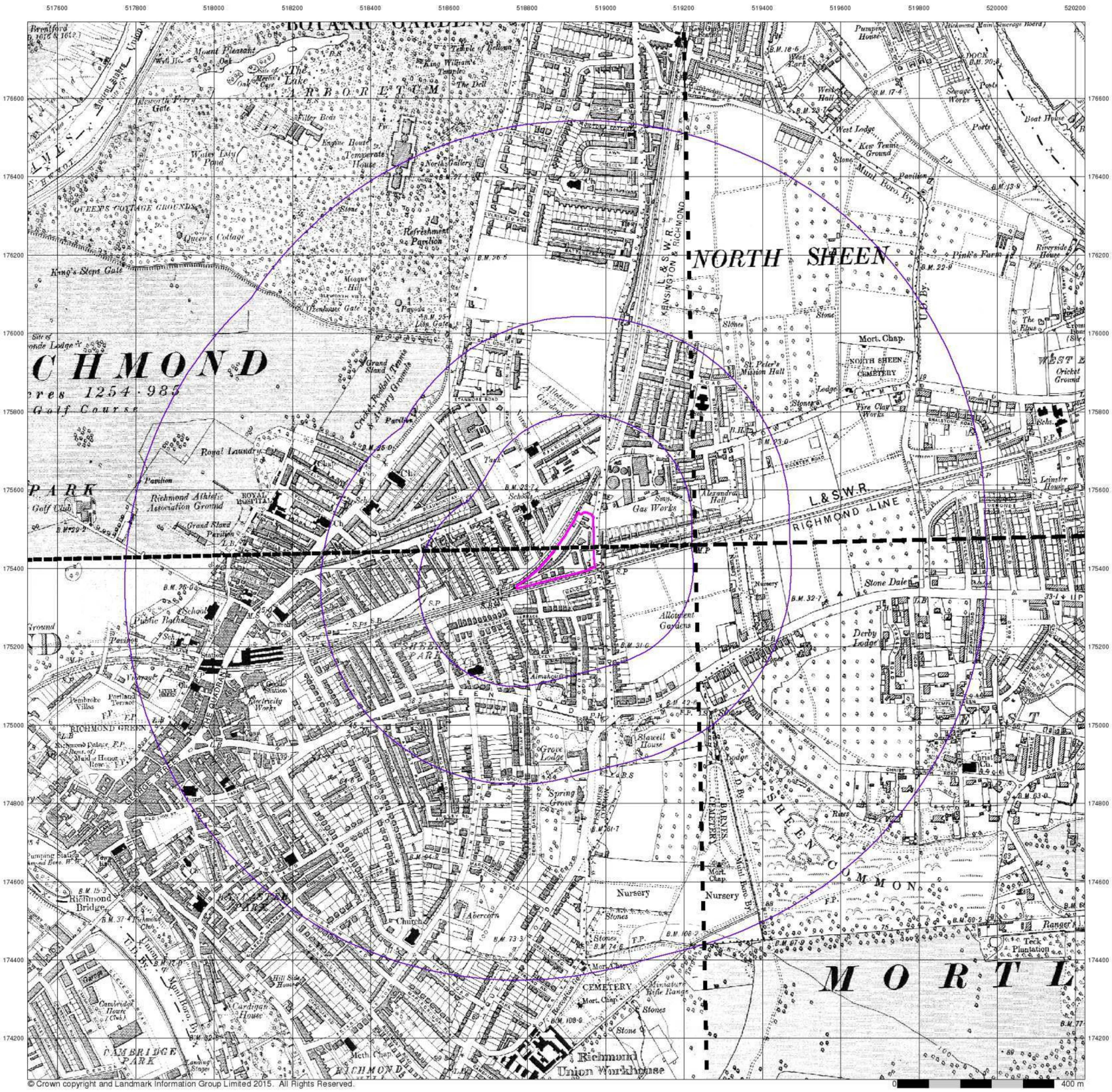
Site Area (Ha):	1.58
Search Buffer (m):	1000

Site Details

Homebase Ltd, 84, Manor Road, RICHMOND, TW9 1YB



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FAIRHURST

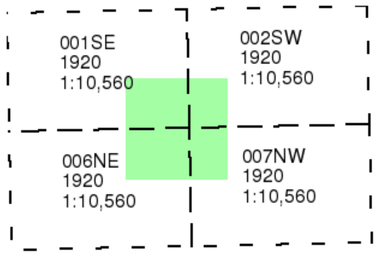
Surrey

Published 1920

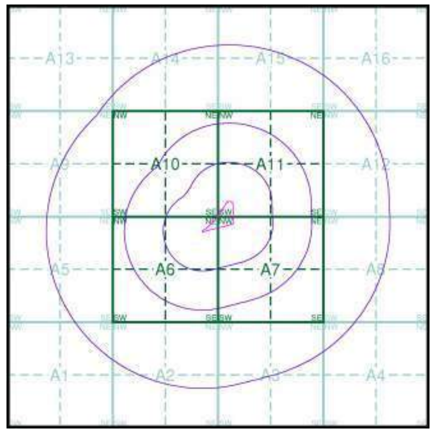
Source map scale - 1:10,560

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

Map Name(s) and Date(s)



Historical Map - Slice A



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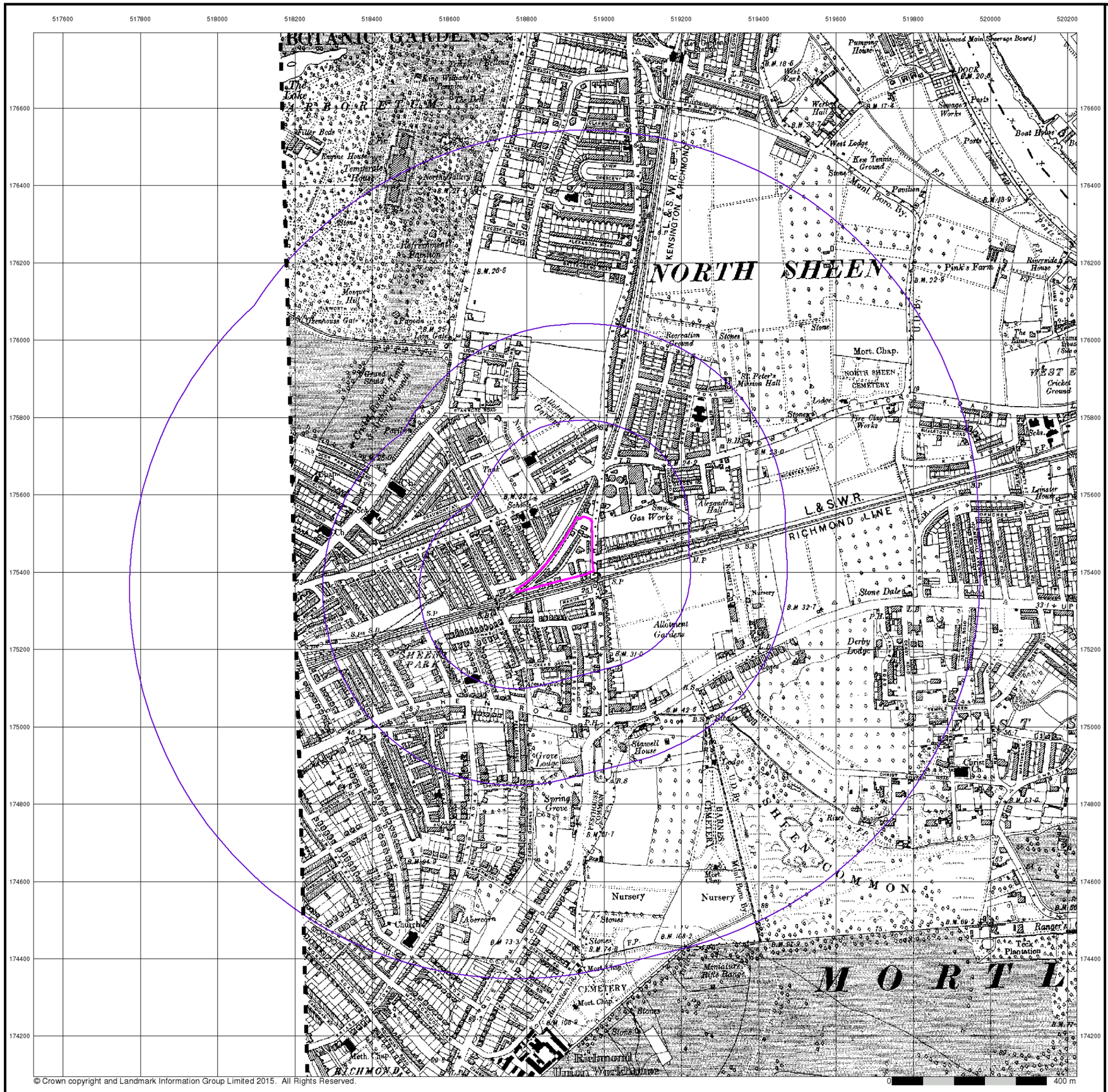
Web:	www.envirocheck.co.uk



FAIRHURST

London

Published 1920

Source map scale - 1:10,560

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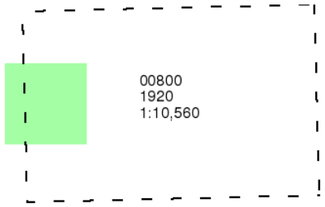
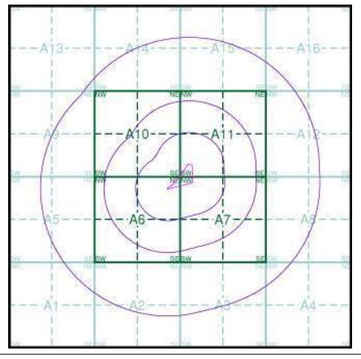


Historical Map - Slice A



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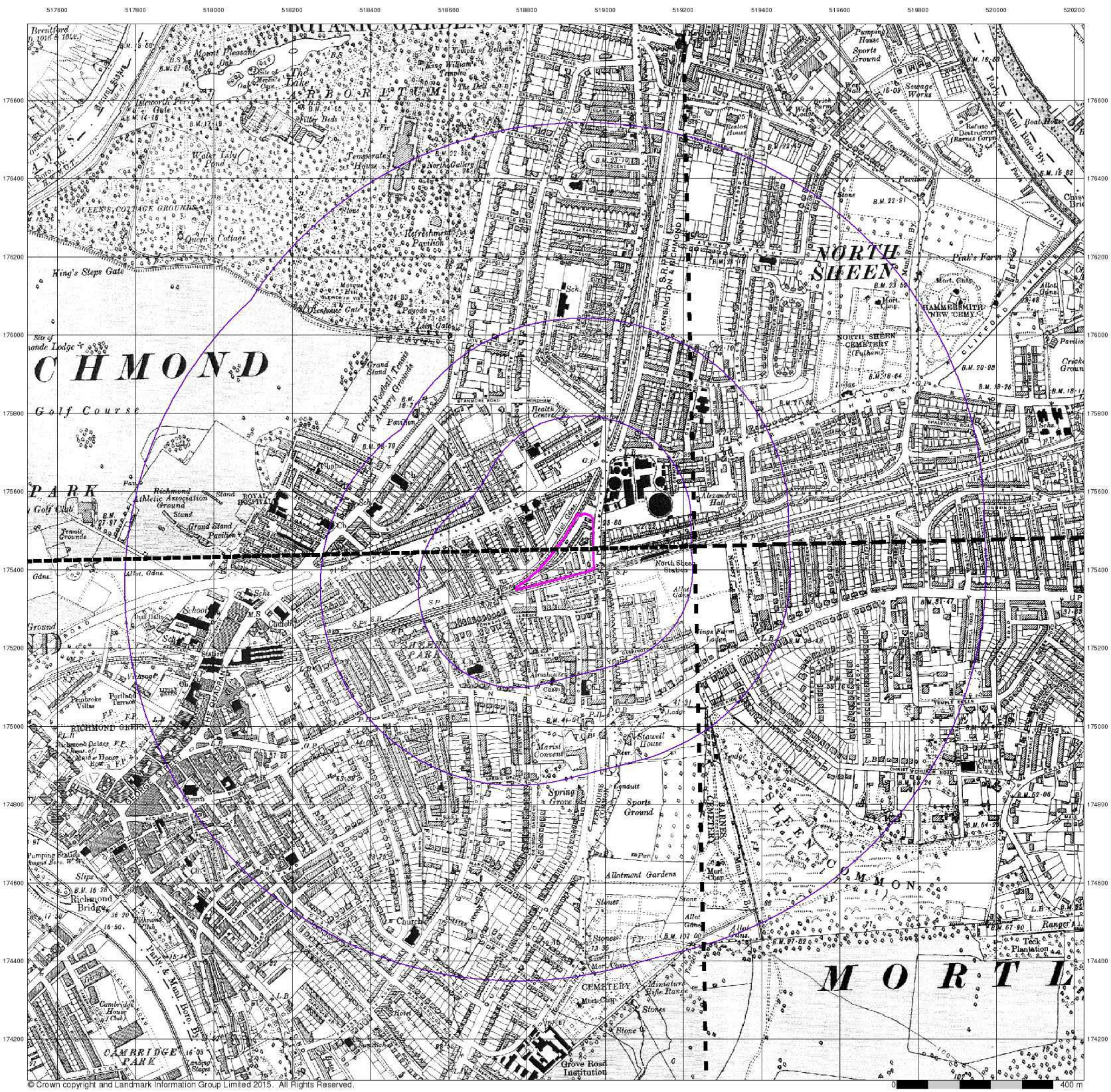

FAIRHURST

Surrey

Published 1933

Source map scale - 1:10,560

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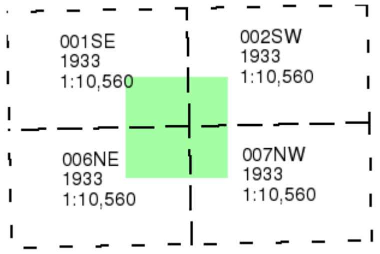
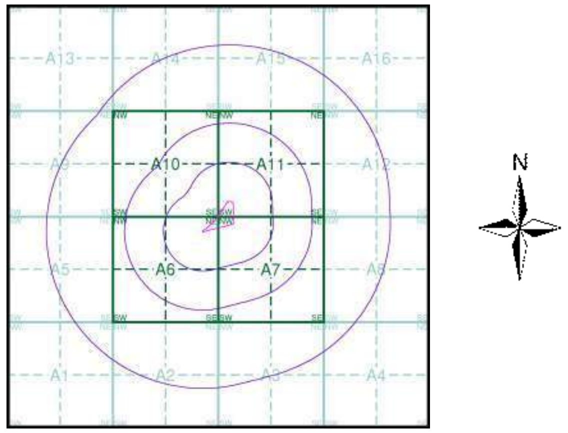


Historical Map - Slice A



Order Details

Order Number:	142584674_1_1
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Slice:	A
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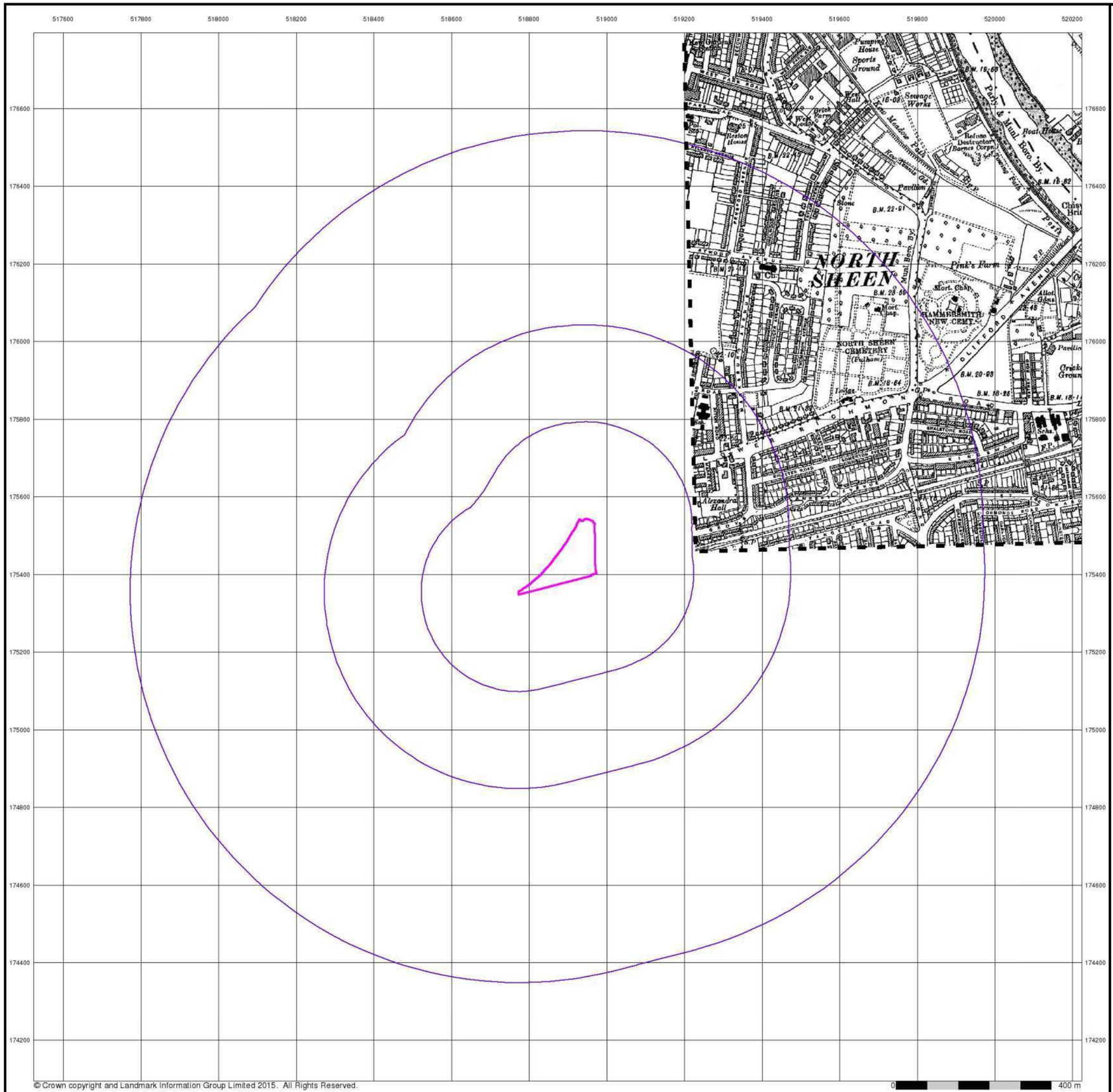

FAIRHURST

Surrey

Published 1933

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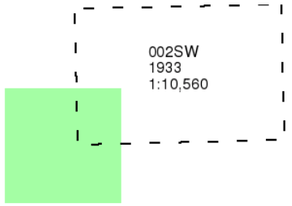

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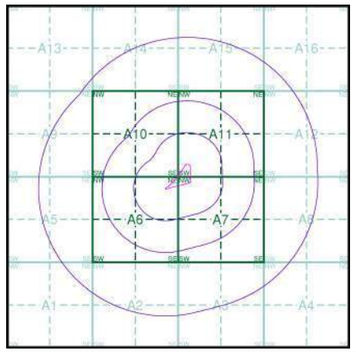

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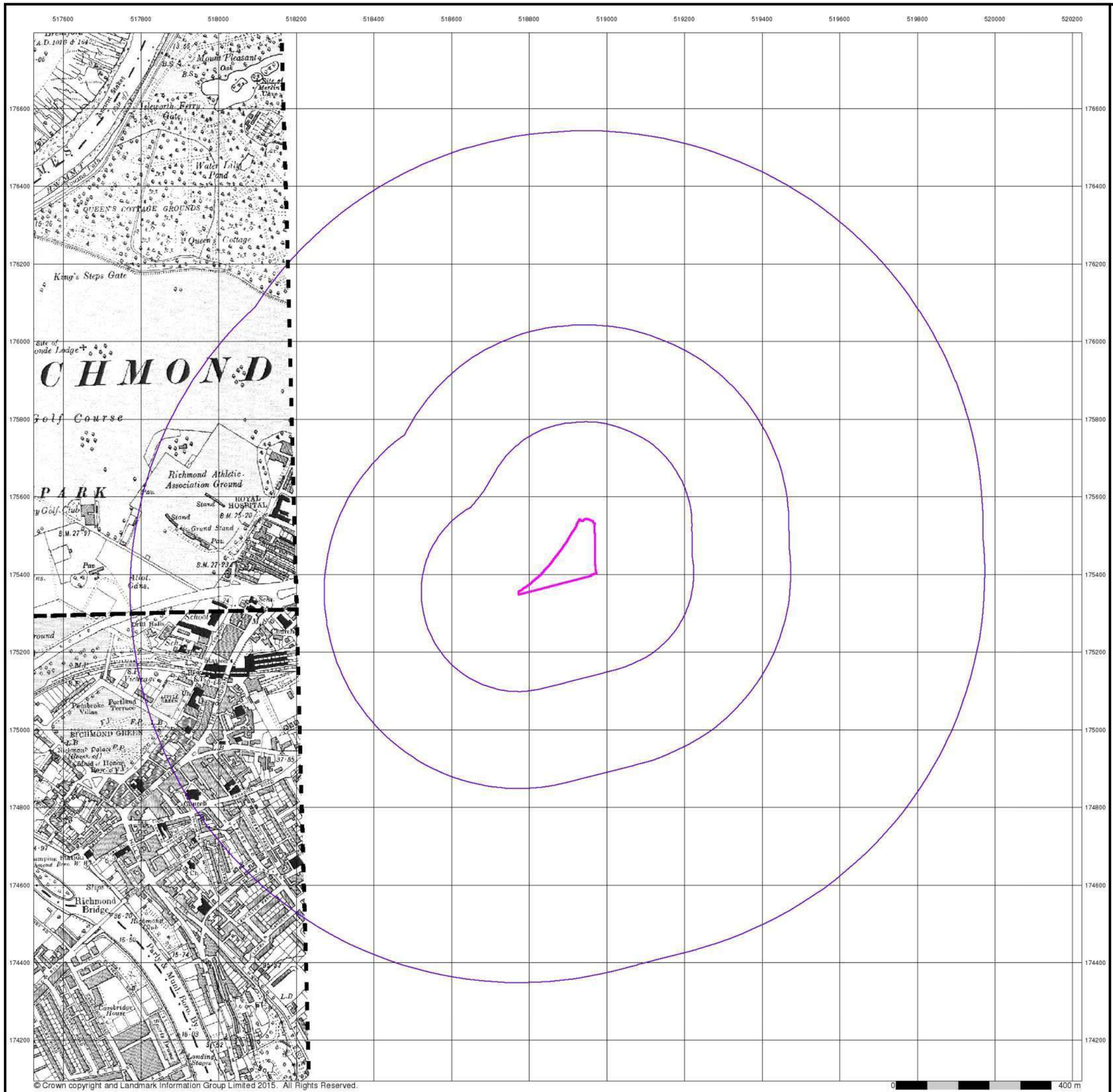

FAIRHURST

Middlesex

Published 1935

Source map scale - 1:10,560

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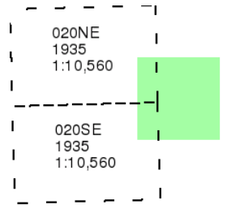
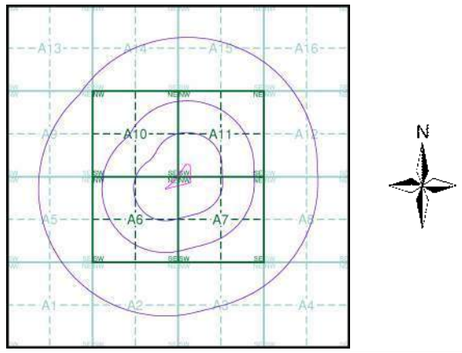


Historical Map - Slice A



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