

Appendix 16.1: Phase 1 Preliminary Risk Assessment

Date: September 2018

Preliminary Environmental Information Report

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume 6

Appendix 16.1

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Table of Contents

1. l	ntroduction1
1.1	Preamble1
1.2	2 Objectives 1
1.3	B Legislation and Guidance1
2. 8	Site Reconnaissance and Desk Study
2.1	Site Reconnaissance
2.2	2 Site History
2.3	8 Environmental Setting
2.4	Authorised Processes and Pollution Incidents7
3. C	Dutline Conceptual Site Model 10
3.1	Background10
3.2	Potential Pollutant Linkages
3.3	3 Outline Conceptual Site Model11
4. C	Conclusions and Recommendations
5. F	References
Anne	ex A – General Notes
	ex B – Part 2A (The Contaminated Land Regime)16
Anne	ex C – Historical Mapping

Summary

The purpose of this Phase 1 Preliminary Risk Assessment is to determine the potential for significant contamination to be present which could impact future site occupants and the wider environment, significantly constrain the proposed use of the site or affect the development process. It forms the technical basis for the baseline conditions section of Volume 3, Chapter 16: Geology, Hydrogeology and Ground Conditions.

Qualifications

This document has been prepared by Liz Holland, a Fellow of the Geological Society, who has nine years' experience working in the environmental sector, specialising in contaminated land assessments.

It has been checked by Jim Lightbown, a Chartered Environmentalist and Scientist of CIWEM, who has 15 years' experience working in the contaminated land sector, within consultancies and within a regulatory body.

List of Tables

Table 2.1: Historical Site Uses.	5
Table 2.2: Historical Neighbouring Site Uses.	
Table 2.3: Description of Geological Strata.	
Table 2.4: Licensed Groundwater Abstractions	7
Table 2.5: Landfills and Waste Sites.	8
Table 2.6: Environmental Permits.	8
Table 3.1: Outline CSM.	11

List of Figures

Figure 2.1: Main Development Site	2
Figure 2.2: General View of Zone C	
Figure 2.3: General view of Zone D	3
Figure 2.4: General View of Zone F1.	4
Figure 2.5: Area of Fly Tipping in Zone I.	4





1. Introduction

1.1 **Preamble**

1.1.1 This Phase 1 Preliminary Risk Assessment provides the technical basis for the Geology, Hydrogeology and Ground Conditions chapter, which is included at Volume 3, Chapter 16.

Objectives 1.2

- 1.2.1 The principal objectives of this assessment were as follows:
 - to assess potential sources of contamination at the site, associated with historical and current land uses both on site and in the surrounding area;
 - to review the environmental setting to assess the sensitivity of the surrounding ٠ area to contamination/pollution;
 - produce an outline Conceptual Site Model (CSM) detailing how any contamination may impact the identified receptors via pollutant linkages; and
 - recommendations for further investigation of potential pollutant linkages, where ٠ considered necessary.

1.3 Legislation and Guidance

- 1.3.1 This report has been produced in general accordance with:
 - Contaminated Land (England) Regulations 2006 (as amended); •
 - DEFRA Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012);
 - DEFRA and Environment Agency (2004) Contaminated Land Report 11 (CLR 11): Model Procedures for the Management of Land Contamination;
 - National Planning Policy Framework (2018);
 - CIRIA Document C665: Assessing Risks Posed by Hazardous Ground Gases to • Buildings;
 - British Standard requirements for the 'Investigation of potentially contaminated • sites - Code of practice' (ref. BS10175:2011+A1:2013);
 - British Standard requirements for the 'Code of practice for ground investigations' (ref. BS5930:2015); and

- British Standard requirements for the 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' (ref BS8485:2015).
- 1.3.2 Where appropriate, consideration has also been given to the following:
 - the potential for environmental liabilities to occur under other associated regimes, for example the Water Resources Act (1991) and the Environmental Damage Regulations (2009); and
 - key constraints on site redevelopment.
- 1.3.3 Details of the limitations of this type of assessment are described in Annex A.





Site Reconnaissance and Desk Study 2.

2.1 Site Reconnaissance

- 2.1.1 This section of the report is based upon observations made during a site visit carried out on 13 September 2018. The location and order limits are shown in Figure 1.2 in Volume 2, Chapter 2: Project Description.
- 2.1.2 The proposed development is located on land to the south west of Station Road near Tilbury, Essex, centred at National Grid Reference TQ662766. Land within the proposed order limits has been divided into zones (namely Zone A to Zone J). The main development site comprises Zone A.

The Site

2.1.3 Land within the order limits comprise a number of agricultural fields separated into the following zones.

Zone A

- 2.1.4 This zone comprised two irregularly shaped agricultural fields, located approximately 970m to the south of West Tilbury village and directly south of a railway line (London, Tilbury and Southend Railway known as the Tilbury Loop). The field in the north was cultivated and bordered by drainage ditches to the east, south and west. This field was generally flat with two electricity pylons located in the centre. The second field was located in the south of the site and appeared to have been left fallow, vegetated with long grass. The topography of the southern field was slightly undulating with two further electricity pylons, located in the centre. Drainage ditches were located to the east, south, west and north of the southern field with another drainage ditch cutting through the northeast corner. The drainage ditches were approximately 1.00m deep and heavily vegetated with shrubs and some small trees. The vegetation formed an approximately 1.50m wide border to either side of the drainage ditches. A grass track was located on the western edge of Zone A, providing vehicular access to the southern field, drainage ditches were located on either side of the track.
- 2.1.5 A photograph of the main development site in its current condition, is shown in Figure 2.1.



Figure 2.1: Main Development Site

Zone B

2.1.6 This zone comprised an existing National Grid Substation. Due to the operational nature of this area, Zone B was not accessed as part of the site walkover. Zone B was located to the south of Zone A beyond a drainage ditch.

Zone C

2.1.7 Zone C comprised a corridor of land located adjacent to the south of the railway line and to the north of Zone A. The corridor comprised a gravel track in the north with a metal fence separating the site from the railway line. The gravel track was raised approximately 0.50m above the adjacent cultivated agricultural field (located in the centre to south of the zone) which formed the majority of the Zone C area. Five electricity pylons were located within Zone C. Zone C was bisected by two drainage ditches in the east and centre running north to south across the site. The drainage ditches were culverted below the track and open within the field area. The ditches were heavily vegetated with weeds and shrubs. A mound of soil and a drain/manhole cover were noted adjacent to the eastern drainage ditch. The track extended along the entire length of Zone C providing access from Station Road. Two railway crossings were also located within Zone C in the centre and west of the area. The western railway crossing was for vehicles and livestock with the central crossing for pedestrians only. A locked metal gate was located at the end of the track, at station road. A photograph of Zone C is shown in Figure 2.2.





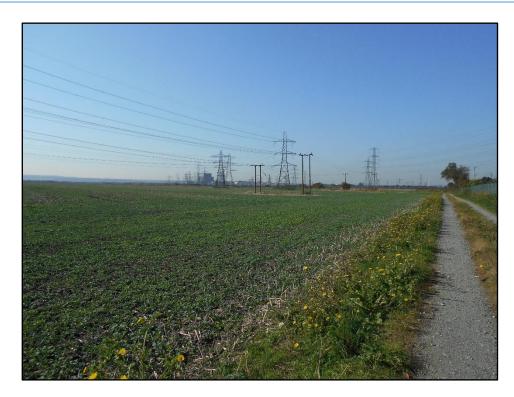


Figure 2.2: General View of Zone C.

Zone D

- 2.1.8 Zone D comprised two agricultural fields separated by Station Road (access to both fields was provided from Station Road) located approximately 1.25km southwest of West Tilbury. The borders of the fields adjacent to Station Road comprised trees and shrubs. The larger, irregularly shaped northern field appeared to have been recently ploughed and sloped slightly up from north to south. The smaller, rectangular southern field also appeared to have been recently ploughed. The topography of this field was generally flat and piles of hay bales were stored on the northern boundary. The southern field was not accessed, however there appeared to be a number of HGV trailers stored in its southeast corner.
- 2.1.9 A photograph of Zone D is shown in Figure 2.3.



Figure 2.3: General view of Zone D.

Zone E

2.1.10 Zone E was located adjacent to the southern field of Zone D and comprised a fallow agricultural field (vegetated with grass) with a generally flat topography. The area was accessed from Station Road to the northwest. The northern and western boundary of the area was demarcated by shrubs and trees.

Zone F1 and Zone F2

2.1.11 Zones F1 and F2 were located to the north of the railway line, extending from the edge of Grays town to the north of Zone C. Zone F1 comprised a roughly rectangular field and Zone F2 comprised part of field, both of which were located along the northern edge of the railway line. The railway line was raised approximately 0.50m above the fields. A drainage ditch was located along the western, northern and eastern edge of the field with a vegetated border comprising weeds, shrubs and reeds. The vegetated border was also raised slightly above the field level. The field comprised short grass (potentially recently cut) with a number of telegraph poles spanning its centre. A photograph of Zone F1 is shown in Figure 2.4.







Figure 2.4: General View of Zone F1.

Zone H

2.1.12 Zone H comprised sections of public highway and sections of a private road. Given this land use, a detailed assessment of this zone was not undertaken as part of the site reconnaissance.

Zone I

- Zone I comprised a field of long grass (approximately 0.50m tall) located to the north 2.1.13 of the railway line, adjacent to the east of Zone F and north of Zone C. Zone I was accessed via the vehicle railway crossing from Zone C or via a track leading to the east (likely towards Station Road). One electricity pylon and a number of telegraph poles were located across Zone I. Zone I extended to the north to Cooper Shaw Road. Fly tipping was noted within Zone I adjacent to the road and included three large possible HGV tyres and rubble. Zone I was again bound by drainage ditches and dense vegetation on its eastern, northern and western sides.
- 2.1.14 A photograph showing an area of fly tipping in Zone I is shown in Figure 2.5.



Figure 2.5: Area of Fly Tipping in Zone I.

Zone J

2.1.15 Zone J comprised a thin strip of land, crossing a number of fields. Access to this area was not available at the time of the site reconnaissance.

Summary

2.1.16 At the time of the site visit, the majority of the site (excluding Zone B) was in agricultural use predominantly as cultivated fields. Zone B comprised an active substation. Aside from the fly tipping located in Zone I no waste storage was noted on-site, nor was any chemical or oil storage observed. Access was not available to the HGV trailers stored in the southeast corner of Zone D. No buildings were noted on the accessed areas of the site. No visual evidence of contamination was identified during the site walkover.

Surrounding area

2.1.17 The site was located within a predominantly agricultural area. Agricultural fields were located adjacent to the site in all directions. East Tilbury village was located beyond the agricultural fields to the east of the site. East Tilbury included the Thames Industrial Park with industrial units visible from Zone D. A metal recycling works was located adjacent to the northwest of Zone D. Tilbury Power Station and Tilbury Sewage Treatment Works were located to the south of the site. Grays town was located to the west of the site with West Tilbury village located to the north.





2.2 **Site History**

Historical Map Review

2.2.1 The following review is based on past editions of readily available Ordnance Survey (OS) maps. These include scales of 1:1,250, 1:2,500 and 1:10,000 dated 1865 to 2014. Historical mapping is provided as Annex C. The imagery included within Annex C contains Ordnance Survey data (license 100035207) under © Crown copyright and database right (2018) and is replicated from Groundsure Report (Ref: RPS-5426520).

Table 2.1: Historical Site Uses.

On-site Land Use and Features	Dates
The majority of the site comprised undeveloped rural (likely agricultural) land traversed by a number of land drains. Waltom Common West Tilbury Marshes was indicated to be present in Zone A and Parsonage Common in Zone I. A large building and associated outbuildings were present in the west of Zone D, labelled as Gravelpit Farm.	c.1865 to c.1955
<i>Then</i> the larger building of Gravelpit Farm in Zone D was no longer indicated to be present. Electricity transmission lines with poles and pylons were shown within Zone A and Zone C.	c.1955 to c.1967
Then a works was indicated to be present in the south of Zone B.	c.1967 to c.1973
<i>Then</i> the electricity transmission lines running through Zone A and Zone C and the surrounding area were marked as ending in Zone B. In addition, a roughly rectangular outline was marked within Zone B.	c.1973 to c.2014
Then a road was shown to extend into Zone B.	c.2014 to Present

Table 2.2: Historical Neighbouring Site Uses.

Surrounding Land Uses (250m radius)	Orientation	Distance	Dates	
			From	То
Railway line	south, north	Adjacent	1865	Present
Old gravel pits <i>Then</i> old kiln and gravel pit (disused) <i>Then</i> brick works <i>Then</i> scrap yard, electricity substation and works <i>Then</i> industrial estate	south, north	Adjacent	1895 1923 1939 1961 1992	c.1923 c.1939 c.1961 c.1992 Present
Gravel pit <i>Then</i> potentially infilled	east	Adjacent	1923 1967	c.1967
Works	north	70m	1955	c.2002

Surrounding Land Lloss (250m rodius)	Orientation	Distance	Dates	
Surrounding Land Uses (250m radius)			From	То
Gravel pit <i>Then</i> gravel pit (disused)	north	80m	1922 1939	c.1939 c.1955
Works Then electricity substation	south	80m	1966 1991	c.1991 c.2010
Works with chimney and tanks	south	90m	1973	c.2002
Old gravel pit <i>Then</i> potentially infilled	northeast	100m	1895 1955	c.1955
Sewage Works Tanks	south	150m	1955	c.2010
Works <i>Then</i> extended onto Zone B <i>Then</i> Tilbury power station with tank	southwest	100m On site Adjacent	1955 1967 1973	c.1967 c.1973 Recent
Factory <i>Then</i> Thames Industrial Estate	northeast	250m	1939 1991	c.1991 Recent
Old chalk pit <i>Then</i> potentially infilled	southeast	250m	1895 1923	c.1923

Site Planning History

One relevant planning record has been readily obtained from Thurrock Council planning website. This relates to the proposed construction of a combined cycle gas power station with a generating capacity up to 2500 megawatts, open cycle gas turbines with a generating capacity up to 300MW and an energy storage facility on Tilbury Power Station site (18/00549/SCO). This site is located adjacent to the south and southeast of the application site. The decision made in May 2018 was that an EIA would be required.

2.3 **Environmental Setting**

Geology

2.3.1 Based on British Geological Survey (BGS) mapping (1:50,000-scale) and the Environment Agency (EA) Groundwater Vulnerability mapping (1:100,000-scale), the stratigraphic sequence and aquifer classifications beneath the site are indicated to be as follows:





Table 2.3: Description of Geological Strata.

Strata	Description & approximate thickness	Aquifer Classification
Artificial ground	Made Ground may be present beneath Zone B.	N/A
Head deposits are indicated to be present from group level across parts of Zones D & E. This stratum generally comprises clay, silt, sand and gravel. Like be a few metres in thickness.		Secondary Undifferentiated Aquifer
Alluvium (Zones A, B, C, F & I)	Alluvium is indicated to be present from ground level across Zones A, B, C, F & I. This stratum generally comprises clay, silt, sand and peat. Likely to be approximately 10 m to 15 m in thickness.	Secondary Undifferentiated Aquifer
Taplow Gravel Member (Zone D)	This stratum is indicated to be present from ground level beneath parts of Zone D. It generally comprises sand and gravel, likely to be a few metres in thickness beneath the site. This stratum is likely to be present beneath the Alluvium across Zones A, B, C, F & I.	Secondary A Aquifer
Lynch Hill Gravel Member (Zone D)	This stratum is indicated to be present from ground level beneath parts of Zone D. This stratum generally comprises sand and gravel likely to be a few metres in thickness beneath the site.	Secondary A Aquifer
Thanet Formation (Zones D & E)	This stratum generally comprises fine grained sand likely to be up to 30m in thickness beneath the site.	Secondary A Aquifer
White Chalk Subgroup (all zones)	This stratum generally comprises white chalk. Likely to be of significant thickness beneath the site.	Principal Aquifer

- 2.3.2 A BGS record of an historical borehole log (ref: TQ67NE285, located between Zone A and Zone B) indicates underlying ground conditions comprised topsoil to approximately 0.20m below ground level (bgl) with silty clay below to approximately 1.30m bgl. Alternating layers of organic silty clay with decaying vegetation and peat were encountered to a depth of approximately 16.80m bgl (interpreted by RPS as Alluvium). Layers of sand and gravel were identified below the clay to a depth of approximately 19.40m bgl (interpreted by RPS as the Taplow Gravel member). Chalk was noted to be present from approximately 19.40m bgl to the base of the borehole at approximately 20.10m bgl.
- 2.3.3 As indicated in Table 2.3, Made Ground may be present across parts of the site, in particular Zone B. No site investigation reports have been reviewed to verify this.

Hydrogeology

- 2.3.4 The majority of the site is indicated to be located above a Secondary Undifferentiated Aquifer relating to the Head and Alluvium deposits. These formations have varying characteristics in different locations.
- 2.3.5 Secondary A Aquifers relating to the Taplow Gravel Member, Lynch Hill Gravel Member and Thanet Formation are indicated to be located below Zones D and E (Thanet Formation only). These formations are formed of permeable layers capable of supporting water supplies at a local scale, in some cases forming an important source of base flow to rivers. The Taplow Gravel Member is indicated to be present beneath the Alluvium in Zones A, B, C, F & I.
- 2.3.6 A Principal Aquifer relating to the White Chalk Subgroup is indicated to be located below the superficial deposits (and Thanet Formation in Zone D and E) across the entire site. These formations provide a high level of water storage and may support water supply and / or river base flow on a strategic scale.
- 2.3.7 According to EA data, the majority of site, including the main development site (Zone A), is not located in a groundwater Source Protection Zone (SPZ). The north of Zone D and the north eastern corners of Zone E and Zone C are located within a groundwater SPZ 3 (Total Catchment). The total catchment is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.
- 2.3.8 Under the Water Framework Directive, the EA's local River Basin Management Plan classifies groundwater chemical guality within the Essex Gravel beneath Zone D and E of the site as 'poor' quality (as of 2016). Groundwater chemical quality (as of 2016) within the South Essex Thurrock Chalk located below Zones A, B, C, F and I was classified as having 'good' chemical quality, as was the South Essex Lower London Tertiaries located below Zone C and parts of Zone I. However, as part of the EA's response (ref: EA/2018/123138/01-L01, dated 5th September 2018) to the EIA Scoping Report, reference was made to the South Essex Thurrock Chalk groundwater body currently being at 'poor' status.
- 2.3.9 Information provided by the EA indicates that there are records of five active licensed groundwater abstractions within 2 km of the site. These are detailed in Table 2.4 below.





Table 2.4: Licensed Groundwater Abstractions.

License Holder	Approx. Distance and Direction	Source	Use
C H Cole & Sons	85m north west	Well West Tilbury	General farming & domestic use including spray irrigation
RWE Generation UK Plc	160m west	Borehole East Tilbury	Potable Water
C H Cole & Sons	225m north	Well West Tilbury	General farming and domestic use including spray irrigation
S Walsh & Son Ltd	575m northeast	Gravel pit at East Tilbury	Mineral Washing
Northumbrian Water Ltd	1,360m north	Well at Linford	Potable Water

Surface Water

- 2.3.10 Numerous drainage ditches are located on site and within the surrounding area. However, no watercourses which are classified within a River Basin Management Plan published by the EA under the European Water Framework Directive (2000) have been identified within 1km of the site.
- Information provided by the EA indicates that there is a record of one active licensed 2.3.11 surface water abstraction within 2km of the site. The license holder for the abstraction is C. H. Cole & Sons, for an abstraction recorded approximately 1,770m northwest of the site, from a ditch tributary of the River Thames for spray irrigation (storage) uses.

Fluvial / Tidal Flood Risk

2.3.12 According to the EA flood map, parts of the site are located within Flood Zone 3, with the annual probability of flooding classified as greater than 1 in 100 (1%). The floodplain appears to be associated with the River Thames, located over 1.5km to the south of the site. Much of the surrounding area is also within the projected floodplain of the River Thames. The site appears to benefit to an extent from flood defences (the level of protection afforded should be confirmed with the EA). Further information regarding Flood Risk is provided in Volume 3, Chapter 15: Hydrology and Flood Risk.

Ecologically Sensitive Sites

2.3.13 Natural England data indicates that there is one ecologically sensitive site, which constitutes an environmental receptor as defined within Table 1 of the Defra Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (2012), located within a 1km radius of the site. This relates to Mucking Flats and Marshes Site of Special Scientific Interest (SSSI) located approximately 770m to the east of Zone E.

Radon

2.3.14 According to the Indicative Atlas of Radon in England and Wales published by the Health Protection Agency (part of Public Health England) and the British Geological Survey, the site is located in an area where between 1% and 3% of properties are above the Action Level. However, no radon protection measures as described in publication BR211 by the Building Research Establishment are considered necessary.

Coal Authority

The Interactive Map Viewer on the Coal Authority website indicates that the site is not 2.3.15 located in a coal mining reporting area.

Non-Coal Mining

- The BGS has provided information regarding non-coal mining activities in the vicinity 2.3.16 of the site. These include:
 - Chalk: Small scale underground mining may have occurred; mine adits, shafts are at a level where they should be considered.
 - level where they need not be considered.

Authorised Processes and Pollution Incidents 2.4

Landfills and Waste Sites

2.4.1 Information provided by a number of sources (EA, BGS, Local Authority) shows that there are six recorded licensed or known historical landfill sites and four waste treatment / transfer sites recorded within 250m of the site. These are described within Table 2.5 below.



Appendix 16.1: Phase 1 Preliminary Risk Assessment Preliminary Environmental Information Report September 2018

and tunnels may be present. The potential for localised difficult ground conditions

Sand: Sporadic underground mining of restricted extent may have occurred. The potential for difficult ground conditions are unlikely and localised and are at a



Table 2.5: Landfills and Waste Sites.

Approx. Distance and Direction	License Details	Waste Type and Details	
Landfill Sites			
On site - east of Zone B	Tilbury Power Station 1963 to present day . Known as the Tilbury ash disposal site.	Industrial waste (factory curtilage) – pulverised fuel ash.	
Adjacent to Zone D	Leemans and Readman (known as Low Street Brickworks) – 1956 to 1977	Industrial, commercial (brickworks) Thurrock Council has record of a pit inspection from 28 July 1956 which notes that the filling of a pong had been done using waste foundry sand from the Readymetal Company. Condition 1 of THU/442/75 stated that no refuse other than refuse of the descriptions specified below shall be deposited on the site without the further consent of the Council and Thurrock Borough Council being first sought and obtained – clay, excavated materials, building site clearance materials and waste concrete blocks excluding liquid, toxic, putrescible and water soluble materials	
Adjacent to Zone D	Low Street – 1969 to 1976	Non-hazardous industrial and commercial	
Adjacent to Zone E	Aylett Gravel Limited (known as Princess Margaret Road landfill (Love Lane)) – 1934 to 1988	Inert, industrial, commercial	
10m north Zone E	Bata Gravel Pit	Not provided	
40m Zone D	Bowaters Farm – 1968 to unknown end date. Reclamation status – satisfactory	Inert (including decomposed refuse)	
30m south Zone B	National Power Plc - issued 1978	Inert	
185m southwest Zone B	East Tilbury Marshes (William Cory and Son Limited) – 1932 to 1991	Industrial, commercial, household, liquid sludge Thurrock Council has a record of this site being operated from 1979 until the mid-1990s. Waste types included household hazardous solids and liquids.	

Approx. Distance and Direction	License Details	Waste Type and Details
Scrap Yards & Waste Trai	nsfer / Treatment Sites	
10m south Zone B	RWE Npower Plc, Tilbury B Power Station – issued 2001	Industrial waste landfill (factory curtilage) – pulverised fuel ash
45m northwest Zone D	Lester Reclaim Spares Ltd, Unit 9, Station Road – issued 2004	End of life vehicle facility
50m southwest Zone D	J S Trucks Ltd, Low Street Brickworks, Station Road – issued 1998, effective 2004	Metal recycling site (vehicle dismantler)
100m northwest Zone D	Mayer Parry Recycling Ltd, Station Road – issued 1994, modified 2009	Metal recycling site

Environmental Permits

2.4.2 an Environmental Permit (under the Environmental Permitting Regulations 2010) within 500m of the subject site. These are outlined in Table 2.6 below:

Table 2.6: Environmental Permits.

License Holder	Approx. Distance and Direction	
Mayer Parry Recycling Limited	90m northwest	Recover waste
Stobart Biomass Products	365m southeast	Recover treatmer
RWE Generation UK Plc	420m south	Loading prior to t
RWE Generation UK Plc	420m south	Combus
RWE Generation UK Plc	420m south	Waste la
RWE Generation UK Plc	420m south	Recover involvinç

COMAH Sites

2.4.3 There are no records of any active operations under the Control of Major Accident Hazards (COMAH) Regulations 1999, located within 500 m of the site.

Appendix 16.1: Phase 1 Preliminary Risk Assessment Preliminary Environmental Information Report September 2018

EA and Local Authority data indicates that there are six active processes regulated by

Permitted Activity

ery and disposal of non-hazardous waste – metal

ery and disposal of non-hazardous waste - preent of waste for incineration

g, unloading, storing of pulverised fuel ash in bulk transportation

stion of any fuel.

landfilling excluding inert waste

ery and disposal of non-hazardous waste ng treatment of slags and ashes.



Pollution Incidents

2.4.4 Environment Agency data indicates that there are no records of 'major' or 'significant' pollution incidents within 500 m of the site.

Regulatory Consultations

- 2.4.5 The Contaminated Land Officer at Thurrock Council was consulted regarding any known contamination issues at the site. The Council advised the following:
 - Thurrock Council has implemented its Inspection Strategy for Contaminated • Land, as required by Part 2A of the Environmental Protection Act 1990. At this time, they have had no cause to inspect any land within 250 m of the site for contamination, applying this strategy.
 - No land within 250 m of the site has been declared as 'contaminated land' as defined by Part 2A of the Environmental Protection Act 1990. The zones have been assessed as Category 3 or 4 sites in their current use.
 - Thurrock Council Environmental Health has no records of pollution incidents at • the site or in the surrounding area.
- RPS notes that the Contaminated Land Statutory Guidance (2012) states that 2.4.6 "Categories 1 and 2 would encompass land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health. Categories 3 and 4 would encompass land which is not capable of being determined on such grounds." In addition, "Categories 1 and 2 would comprise cases where the authority considers that a significant possibility of significant pollution of controlled waters exists. Categories 3 and 4 would comprise cases where the authority considers that a significant possibility of such pollution does not exist."





Outline Conceptual Site Model 3.

Background 3.1

- 3.1.1 An outline conceptual site model (CSM) consists of an appraisal of the sourcepathway-receptor 'contaminant linkages' which is central to the approach used to determine the existence of 'contaminated land' according to the definition set out under Part 2A of the Environmental Protection Act 1990. For a risk to exist (under Part 2A), all three of the following components must be present to facilitate a potential 'pollutant linkage'.
 - Source referring to the source of contamination (Hazard).
 - Pathway for the contaminant to move/migrate to receptor(s).
 - Receptor (Target) that could be affected by the contaminant(s). •
- 3.1.2 Receptors include human beings, other living organisms, crops, controlled waters and buildings / structures. The National Planning Policy Framework, used to address contaminated land through the planning process, follows the same principles as those set out under Part 2A. Further details on the Part 2A regime are presented within Annex B.

Potential Pollutant Linkages 3.2

3.2.1 Each stage of the potential pollutant linkage sequence has been assessed individually on the basis of information obtained during the site reconnaissance and desk study exercise and are discussed in the following section.

Potential Contaminant Sources

On Site – Current

- 3.2.2 The majority of the site currently comprises agricultural land, which is not considered to represent a potentially significant source of contaminants of concern. However, agricultural land uses could represent a potential source of pesticides and herbicides.
- 3.2.3 The use of Zone B as a National Grid substation represents a potential source of contamination.
- 3.2.4 BGS mapping indicates that Made Ground may be present across Zone B. Where present this could represent a potential source of contaminants of concern and / or ground gas.

- 3.2.5 The presence of peat within the underlying Alluvium could represent a potential source of ground gas.
- 3.2.6 At the time of the site walkover, a minor amount of fly tipping was observed to be present within Zone I adjacent to the road. Given its small scale and the nature of the materials, this is not considered to represent a potentially significant source of contaminants of concern. Access was not available to the HGV trailers stored in the southeast corner of Zone D.

On Site – Historical

- 3.2.7 Historical maps indicate the majority of the site comprised undeveloped rural land (likely agricultural), which is not considered to represent a potential source of contamination.
- 3.2.8 The historical use of Zone B as a works (likely associated with Tilbury Power Station) from c.1967 could represent a potential source of contaminants of concern.

Off-site – Current

- 3.2.9 Current off-site potential sources of contaminants of concern include Tilbury Power Station and Tilbury Sewage Treatment Works located to the south of Zone B. A metal recycling site and associated industrial units located adjacent to the north of Zone D and East Tilbury Industrial Estate located approximately 130m northwest of Zone D. Two metal recycling / end of life vehicle waste sites are also recorded from 45m north west of Zone D.
- 3.2.10 A licensed landfill, accepting industrial waste, is recorded to the east of Zone B (potentially extending onto Zone B), representing a potential source of mobile contamination and ground gas.

Off-Site – Historical

- Potentially infilled gravel pits are located from adjacent to the north of the site. These 3.2.11 could represent potential sources of contaminants of concern and / or ground gas.
- 3.2.12 A brick works, then labelled as a scrap yard and subsequently an industrial estate was located adjacent to the north of the Gsite.
- 3.2.13 A number of historical landfills accepting industrial and commercial waste were recorded in the site vicinity (adjacent to Zone D, Zone E and from 30m south of Zone B) which could represent a potential source of contaminants of concern and ground gas.





Potential Pathways

- The main development site will be covered by buildings, structures and apparatus 3.2.14 comprising the gas engines, substations, battery storage, gas compound and attenuation area. In these areas, the risks to future on site human health receptors via the pathways of dermal contact and ingestion will be mitigated. However, in any areas of proposed soft landscaping, the pathways of dermal contact and ingestion could still be active. In addition, there would be potential for the airborne migration of soil/dust from these areas.
- 3.2.15 There is the potential for ground gas and volatile contaminants of concern in soil and/or groundwater (if present) beneath the site to impact future site users via the inhalation pathway in indoor areas. However, it is noted that the facility is not expected to have a full-time workforce on site during operation.
- 3.2.16 There is the potential for contaminants of concern (if present) beneath the site to migrate on or off-site via granular horizons of the Made Ground (if present) and the Head, Alluvium and Taplow Gravel Member deposits. These may impact off-site human heath receptors via the dermal contact, ingestion and vapour inhalation pathways.
- 3.2.17 The service corridors and/or subterranean infrastructure corridors could act as preferential pathways for the migration of any potential contaminants of concern.
- There is potential for any mobile contaminants of concern (if present) within shallow 3.2.18 soils to leach into the underlying Thanet Formation and White Chalk Subgroup. However, the likely significant thickness of Alluvium beneath the majority of the site will the potential for the vertical and/or lateral migration of any contaminants of concern.

Potential Receptors

- 3.2.19 Potential human health receptors include future site users and off-site human health receptors.
- 3.2.20 Providing construction workers adopt appropriate levels of hygiene and personal protective equipment, they are not considered to be at significant risk from potential contaminants of concern and have not been considered further.
- 3.2.21 Head deposits and Alluvium are indicated to be present from ground surface across the majority of the application site, including the main development site. These strata are classified as Secondary Undifferentiated Aquifers. Given this classification, they are not considered to represent potential controlled waters receptors.

- Parts of Zone D and Zone E are directly underlain by the Taplow Gravel Member or 3.2.22 Lynch Hill Gravel Member. These strata are classified as Secondary A Aquifers.
- 3.2.23 While the main development site is indicated to be underlain by the White Chalk Subgroup (a Principal Aquifer), the relatively thick, likely low permeability Alluvium will provide a high level of protection to the underlying groundwater within this aguifer. As such, the White Chalk Subgroup is not considered to represent a sensitive controlled waters receptor.
- 3.2.24 Numerous drainage ditches are located on site and within the surrounding area.
- 3.2.25 Mucking Flats and Marshes Site of SSSI is located approximately 770m east of Zone E. However, given that this feature is over 2.5km from the main development site, it is not considered to represent a potential receptor.

Outline Conceptual Site Model 3.3

3.3.1 An outline CSM has been developed on the basis of the site reconnaissance and desk study. The CSM is used to identify potential sources, pathways and receptors (i.e. potential pollutant linkages) on site and is summarised in the table below:

Potential Source	Contaminants of Concern	Via	Potential Pathways	Linkage Potentially Active?	Receptors
			Direct contact/ingestion	\checkmark	Future site
			Inhalation of volatiles	\checkmark	users
On site – current:) Metals, hydrocarbons, pesticides, herbicides and	Soil	Airborne migration of soil or dust	\checkmark	Off-site users
Agricultural land, National Grid substation (Zone B) and Made Ground			Leaching of mobile contaminants	✓ ✓	Taplow Gravel Member Secondary A Aquifer
On site – historical: Works (Zone B)					Lynch Hill Gravel Member Secondary A Aquifer
		Groundwa ter	Direct contact/ingestion	✓ ✓	Future site users Off-site users





Potential Source	Contaminants of Concern	Via	Potential Pathways	Linkage Potentially Active?	Receptors
			Inhalation of volatiles	✓ ✓	Future site users Off-site users
			Vertical and lateral migration in permeable strata	✓ ✓	Taplow Gravel Member Secondary A Aquifer Lynch Hill Gravel Member Secondary A Aquifer Drainage ditches
Off-site – current: Tilbury Power Station and Tilbury Sewage Treatment Works (located to the south of Zone B); a metal recycling site and associated industrial units located adjacent to the north of Zone D; East Tilbury Industrial Estate (north west of Zone D); two metal recycling / end of life	y Power Station ilbury Sewage ment Works ed to the south of B); a metal ling site and siated industrial located adjacent north of Zone D; Tilbury Industrial e (north west of D); two metal	water	Direct contact/ingestion	~	Future site users
vehicle waste sites north west of Zone D; licensed landfill, east of Zone B (potentially extending onto Zone B) Off site – historical: Potentially infilled gravel pits; historical landfills; and brick works, a scrap yard and an industrial estate	hydrocarbons	Groundwater	Inhalation of volatiles	~	Future site users
On and off-site: Landfills, potentially infilled gravel pits,	Carbon dioxide and methane	Ground Gas	Inhalation of ground gas	✓ ✓	Future site users Off-site users

Potential Source	Contaminants of Concern	Via	Potential Pathways	Linkage Potentially Active?	Receptors
Made Ground / natural strata (including peat deposits) or bio- degradation of contamination			Explosive risks	✓ ✓	Future site users Off-site users

The risk assessment is based upon the available information relating to the site. 3.3.2 Should ground conditions inconsistent with those outlined in this report be encountered RPS should be contacted to enable further assessment.





Conclusions and Recommendations 4.

- 4.1.1 The outline CSM produced upon completion of the desk study assessment has identified a limited number of potential pollutant linkages that may be active upon the redevelopment of the site, particularly in consideration of the main application site.
- 4.1.2 It is recommended that limited, targeted environmental sampling of soil, groundwater and ground gas is undertaken (focusing on the potentially infilled areas of ground, landfills and any peat layers within the Alluvium). This could be undertaken in conjunction with the geotechnical investigation that will likely be required to assess the geotechnical properties of strata underlying the site prior to redevelopment.
- 4.1.3 The BGS has provided information regarding non-coal mining associated with the site. It is reported that small scale underground mining may have occurred; mine adits, shafts and tunnels may be present. The potential for localised difficult ground conditions are at a level where they should be considered. Given this, an Interpretative Cavity Occurrence Assessment Report is recommended.





References 5.

British Standards Institution (2013) BS 10175 Investigation of Potentially Contaminated Sites (2011+A1:2013).

British Standards Institution (2015) BS 5930 Code of practice for ground investigations.

British Standards Institution (2015) BS 8485 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.

Construction Industry Research and Information Association (CIRIA) (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings (C665).

Defra and Environment Agency (2004) Contaminated Land Report 11(CLR 11): Model Procedures for the Management of Land Contamination.

Defra (2012) Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance.

Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework.





Annex A – General Notes

- 5.1.1 This report provides available factual data for the site obtained only from the sources described in the text and related to the site on the basis of the location information provided by the Client.
- 5.1.2 The desk study information is not necessarily exhaustive and further information relevant to the site may be available from other sources.
- 5.1.3 The accuracy of maps cannot be guaranteed and it should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.
- 5.1.4 No sampling or analysis has been undertaken in relation to this desk study.
- 5.1.5 Any borehole data from British Geological Survey sources is included on the basis that: "The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation".
- 5.1.6 Where any data supplied by the Client or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by RPS for inaccuracies in the data supplied by any other party.
- 5.1.7 This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a re-interpretation of the report in whole or in part after its original submission.
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Annex B – Part 2A (The Contaminated Land Regime)

Contaminated Land Definition

- 5.1.10 Under Section 57 of the Environmental Act 1995, Part 2A was inserted into the Environmental Protection Act 1990 to include provisions for the management of contaminated land.
- Subsequent regulations were first implemented in England in April 2000, Scotland in 5.1.11 July 2000 and Wales in July 2001¹, providing a definition of 'contaminated land' and setting out the nature of liabilities that can be incurred by owners of contaminated land and groundwater.
- 5.1.12 According to the Act, contaminated land is defined as 'any land which appears to the local authority in whose area the land is situated to be in such a condition, by reason of substances in, on or under the land that:
 - a) significant harm is being caused or there is a significant possibility of such harm being caused; or
 - b) significant pollution of controlled waters² is being caused or there is a significant possibility of such pollution being caused³
- 5.1.13 The guidance on determining whether a particular possibility is significant is based on the principles of risk assessment and in particular on considerations of the magnitude or consequences of the different types of significant harm caused. The term 'possibility of significant harm being caused' should be taken, as referring to a measure of the probability, or frequency, of the occurrence of circumstances that could lead to significant harm being caused.
- The following situations are defined where harm is to be regarded as significant: 5.1.14
 - i. Chronic or acute toxic effect, serious injury or death to humans

³ The definition was amended in 2012 by implementation of the Water Act 2003.



- ii. Irreversible or other adverse harm to the ecological system
- iii. Substantial damage to, or failure of, buildings
- Disease, other physical damage or death of livestock or crops iv.
- The pollution of controlled waters⁴. V.
- 5.1.15 With regard to radioactivity, contaminated land is defined as 'any land which appears to be in such a condition, by reason of substances in, on or under the land that harm is being caused, or there is a significant possibility of such harm being caused^b.

The Risk Assessment Methodology

5.1.16 Risk assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential risks to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected with the hazard via one or several exposure pathways (e.g. the pathway of direct contact). Risks are generally managed by isolating or removing the hazard, isolating the receptor, or by intercepting the exposure pathway. Without the three essential components of a source (hazard), pathway and receptor, there can be no risk. Thus, the mere presence of a hazard at a site does not mean that there will necessarily be attendant risks.

The Risk Assessment

- 5.1.17 By considering where a viable pathway exists which connects a source with a receptor, this assessment will identify where pollutant linkages may exist. A pollutant linkage is the term used by the DEFRA in their standard procedure on risk assessment. If there is no pollutant linkage, then there is no risk. Therefore, only where a viable pollutant linkage is established does this assessment go on to consider the level of risk. Risk should be based on a consideration of both:
 - The likelihood of an event (probability) takes into account both the presence of the hazard and receptor and the integrity of the pathway.
 - severity of the hazard and the sensitivity of the receptor.

For further information please see the Contaminated Land section on the DEFRA website (www.defra.gov.uk).

The severity of the potential consequence - takes into account both the potential



¹ In England by The Contaminated Land (England) Regulations 2000, updated by The Contaminated Land (England) (Amendment) Regulations 2012; in Scotland by The Contaminated Land (Scotland) Regulations 2000, updated by the Contaminated Land (Scotland) Regulations 2005; and in Wales by The Contaminated Land (Wales) Regulations 2001, updated by the Contaminated Land (Wales) Regulations 2006.

² In Scotland the term "controlled water" has been updated to "water environment" under the Contaminated Land (Scotland) Regulations 2005 in line with the Water Environment and Water Services (Scotland) Act 2003.

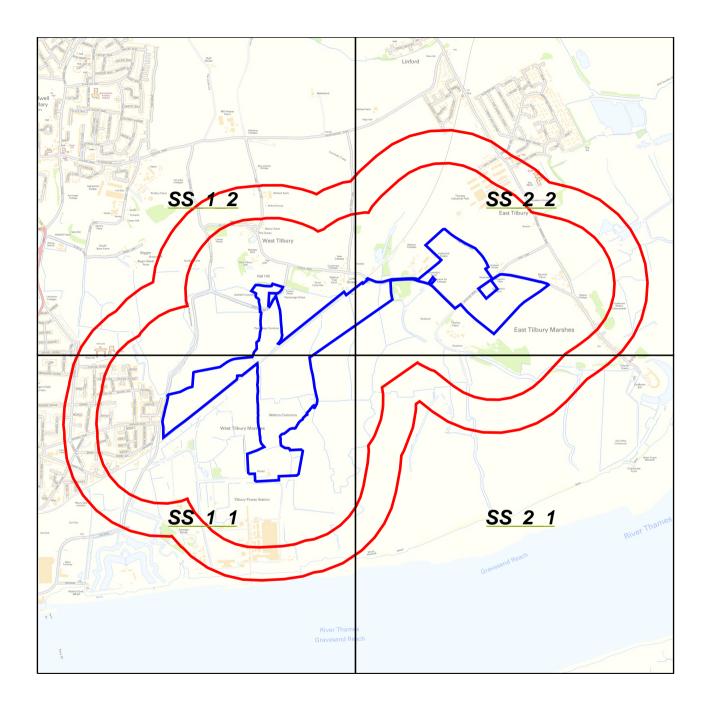
⁴ Groundwater in this context does not include waters within underground strata but above the saturated zone.

⁵ The Radioactive Contaminated Land (Modification of Enactments) (England) Regulations 2006 and Contaminated Land (Wales) Regulations 2006.

Annex C – Historical Mapping

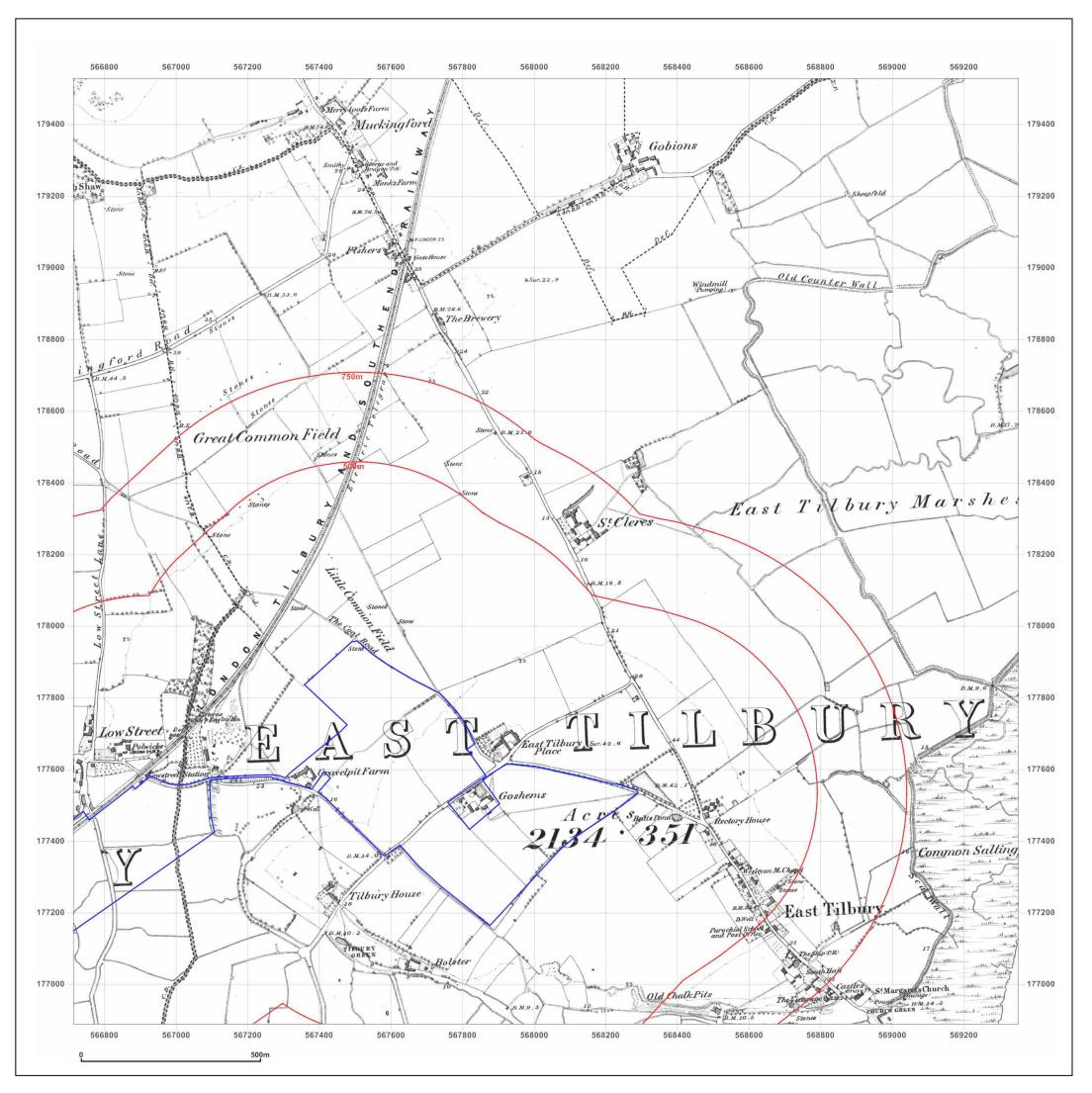






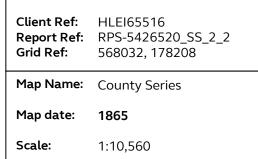


Small Scale Grid Index

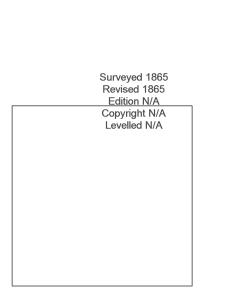




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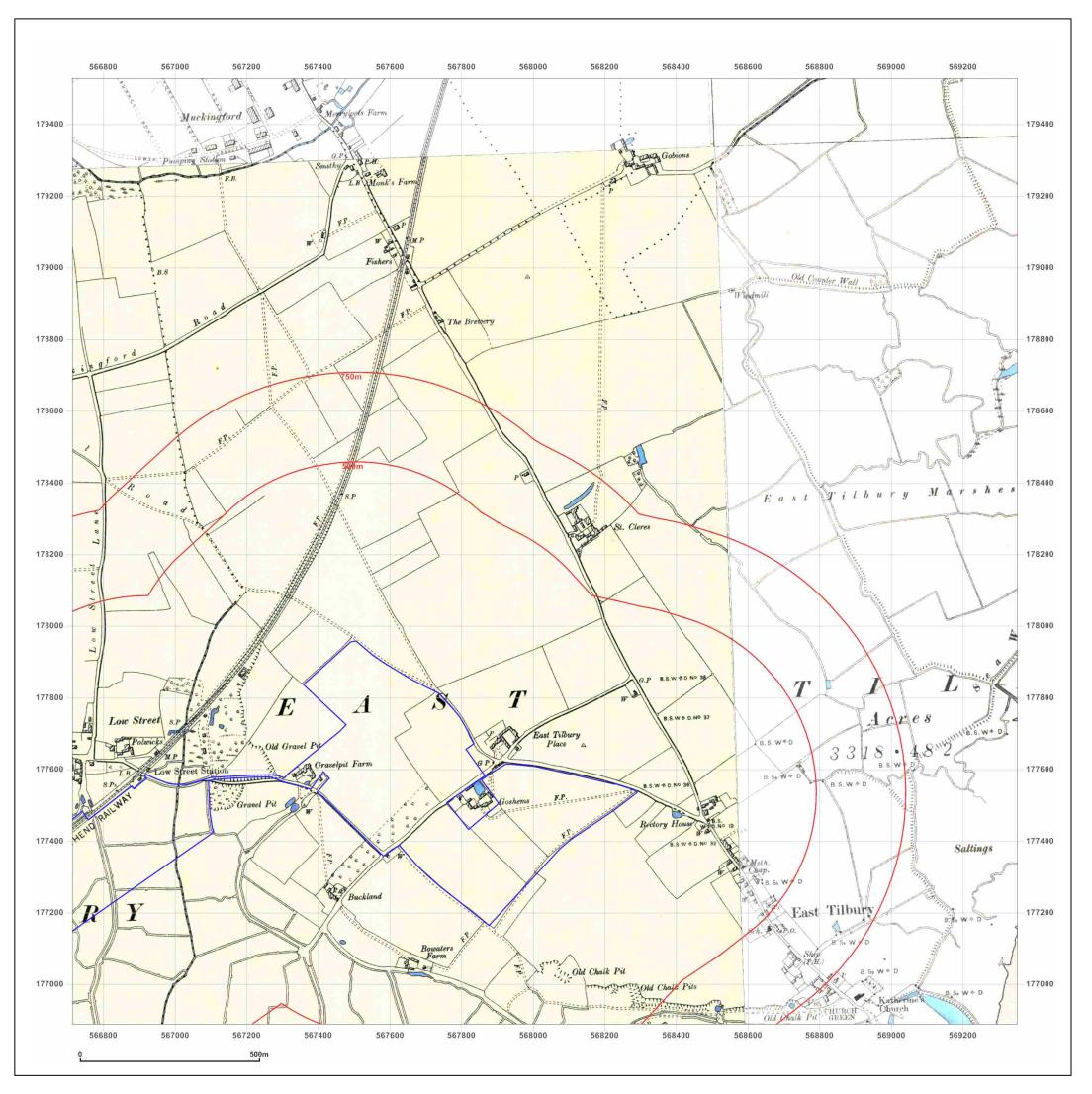
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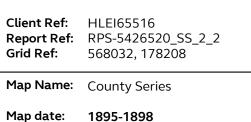
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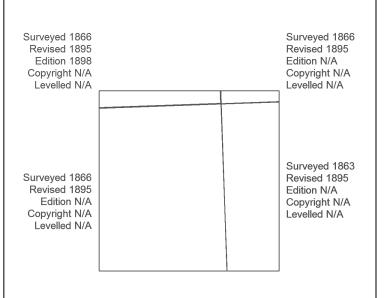
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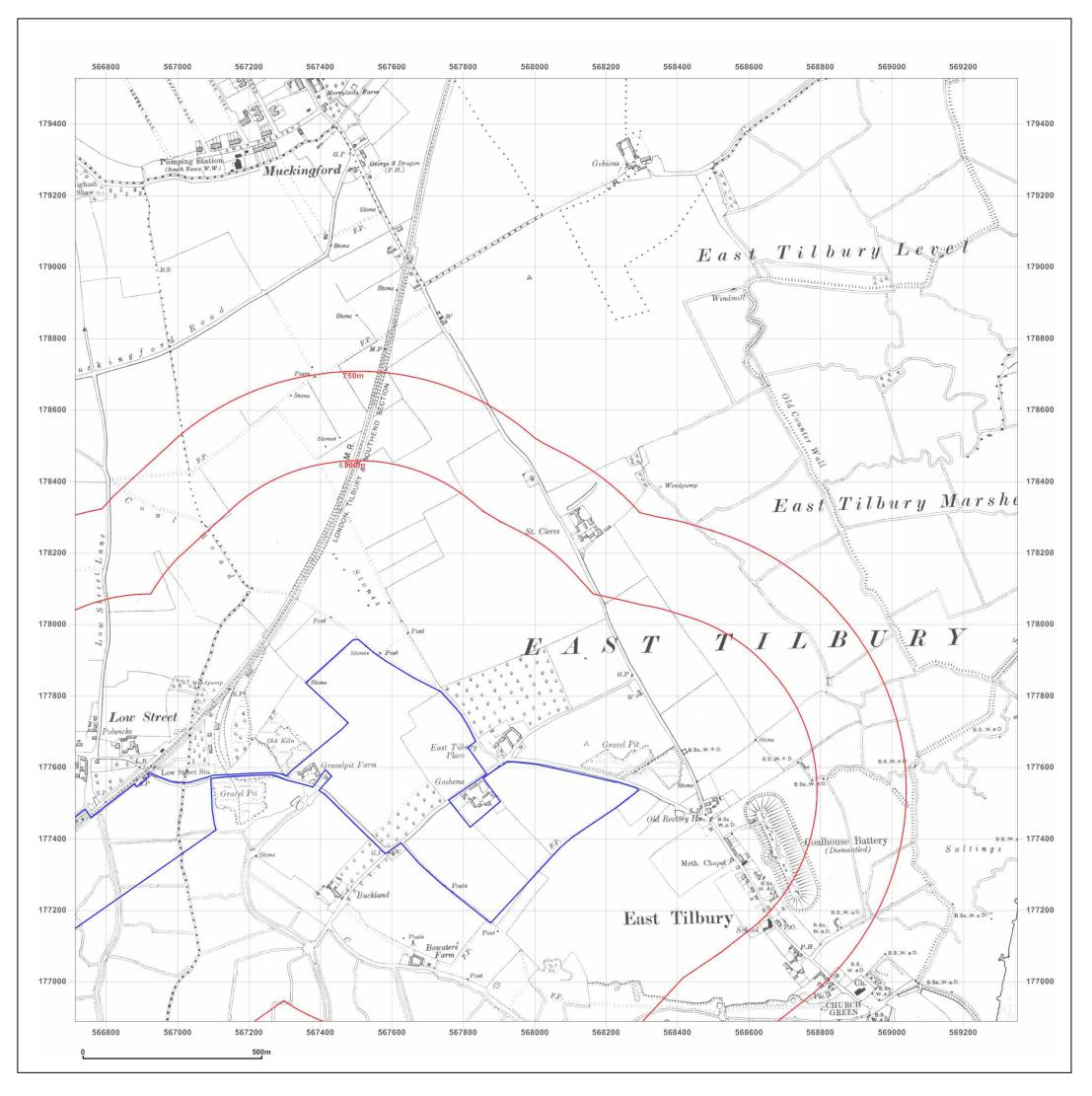
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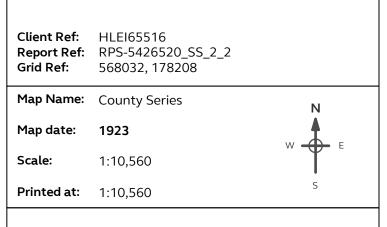
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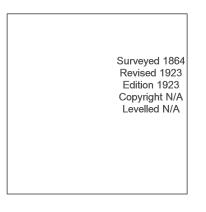
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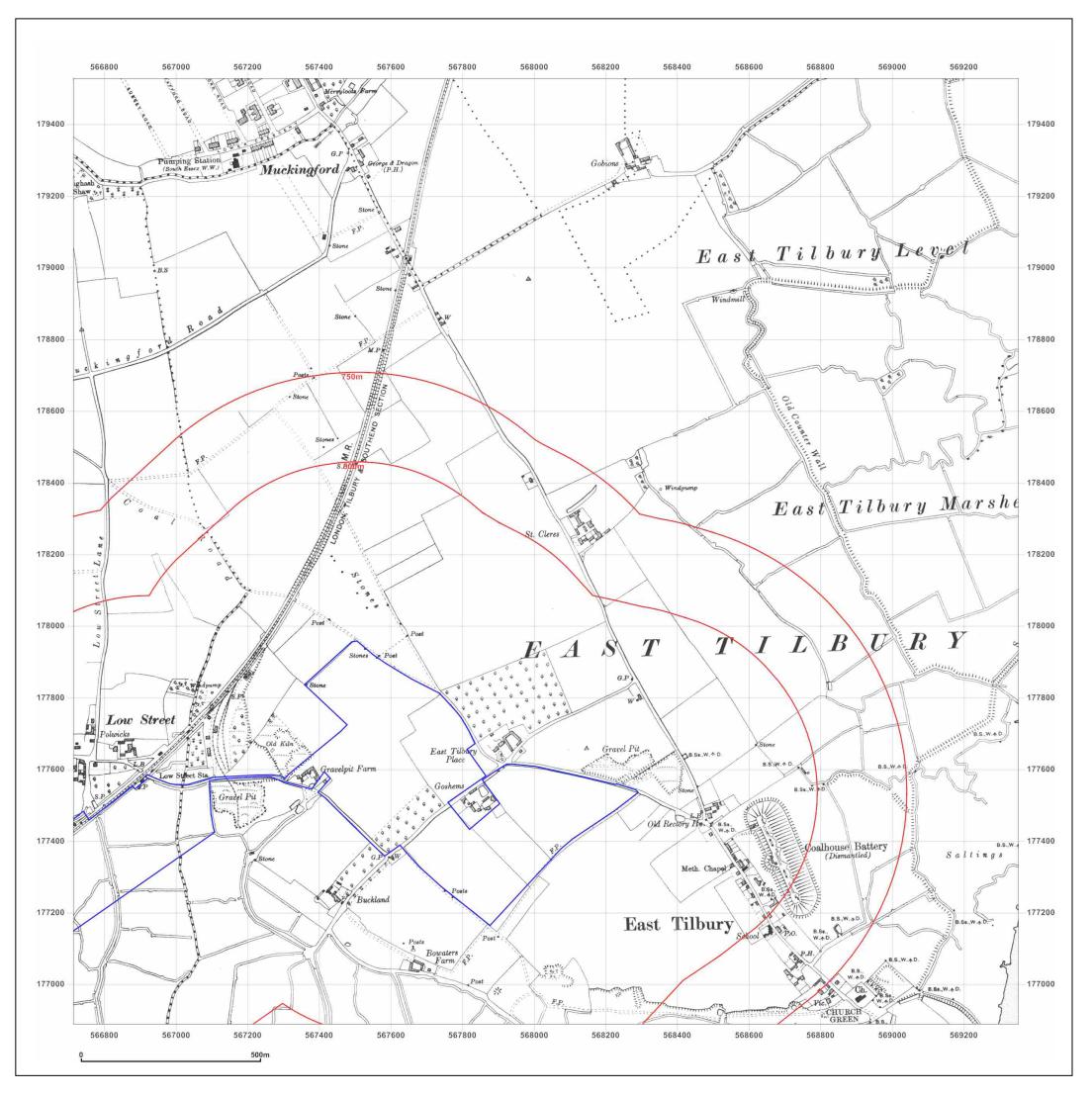




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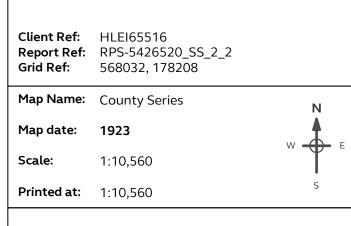
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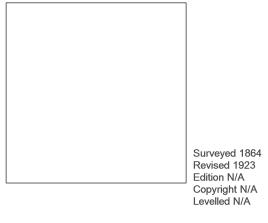
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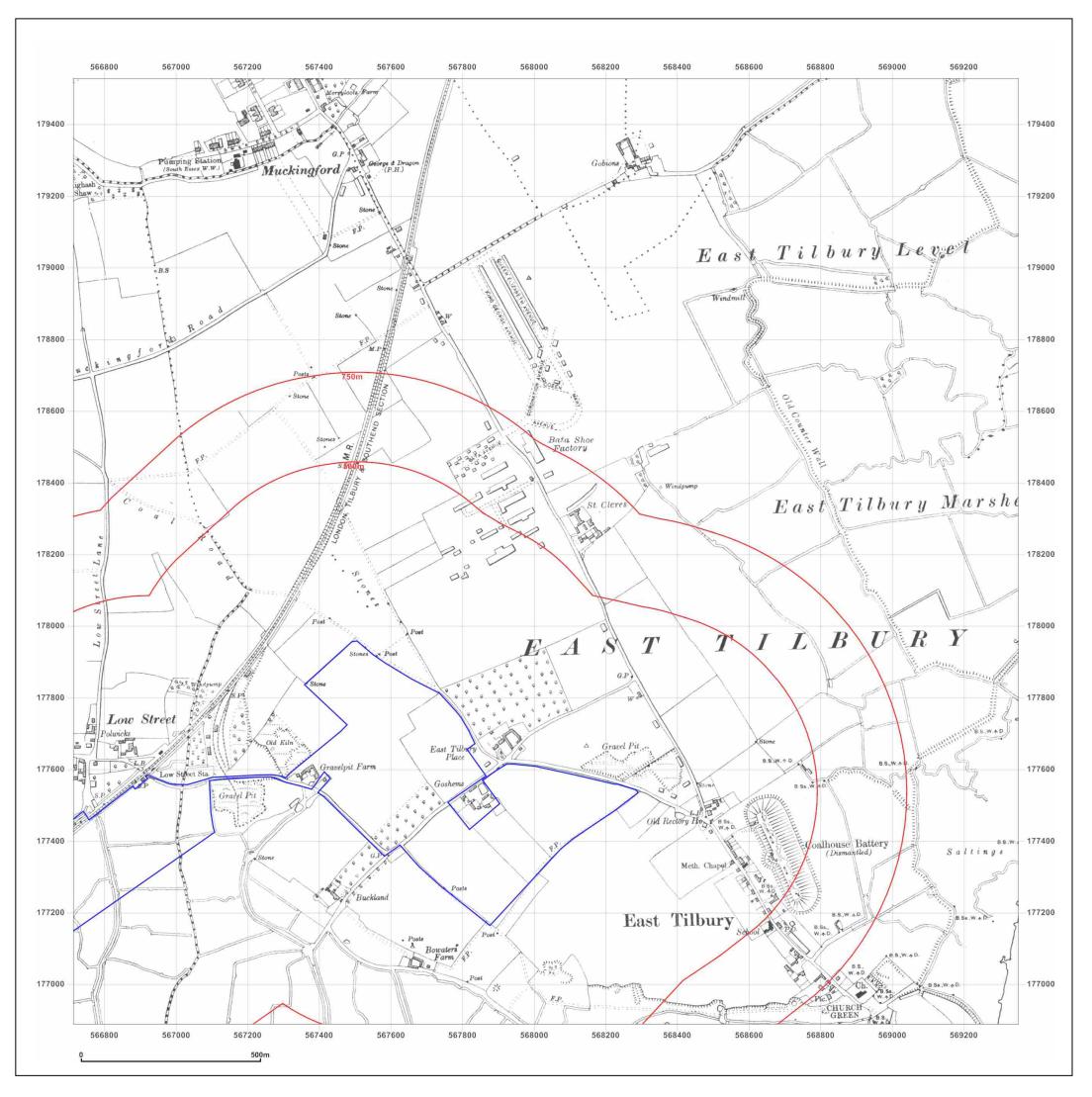




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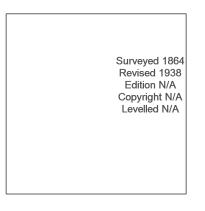
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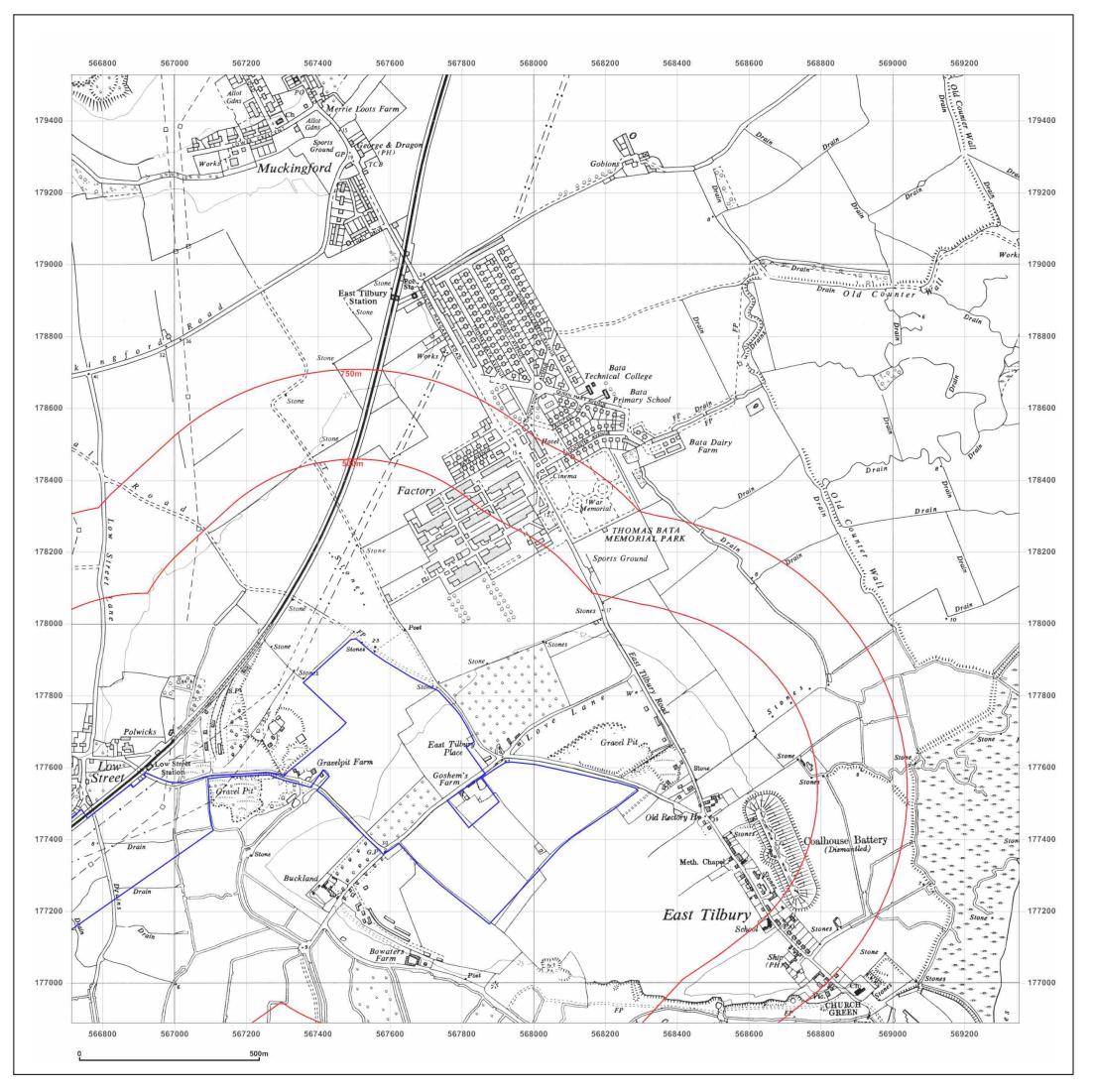




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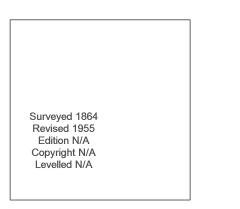
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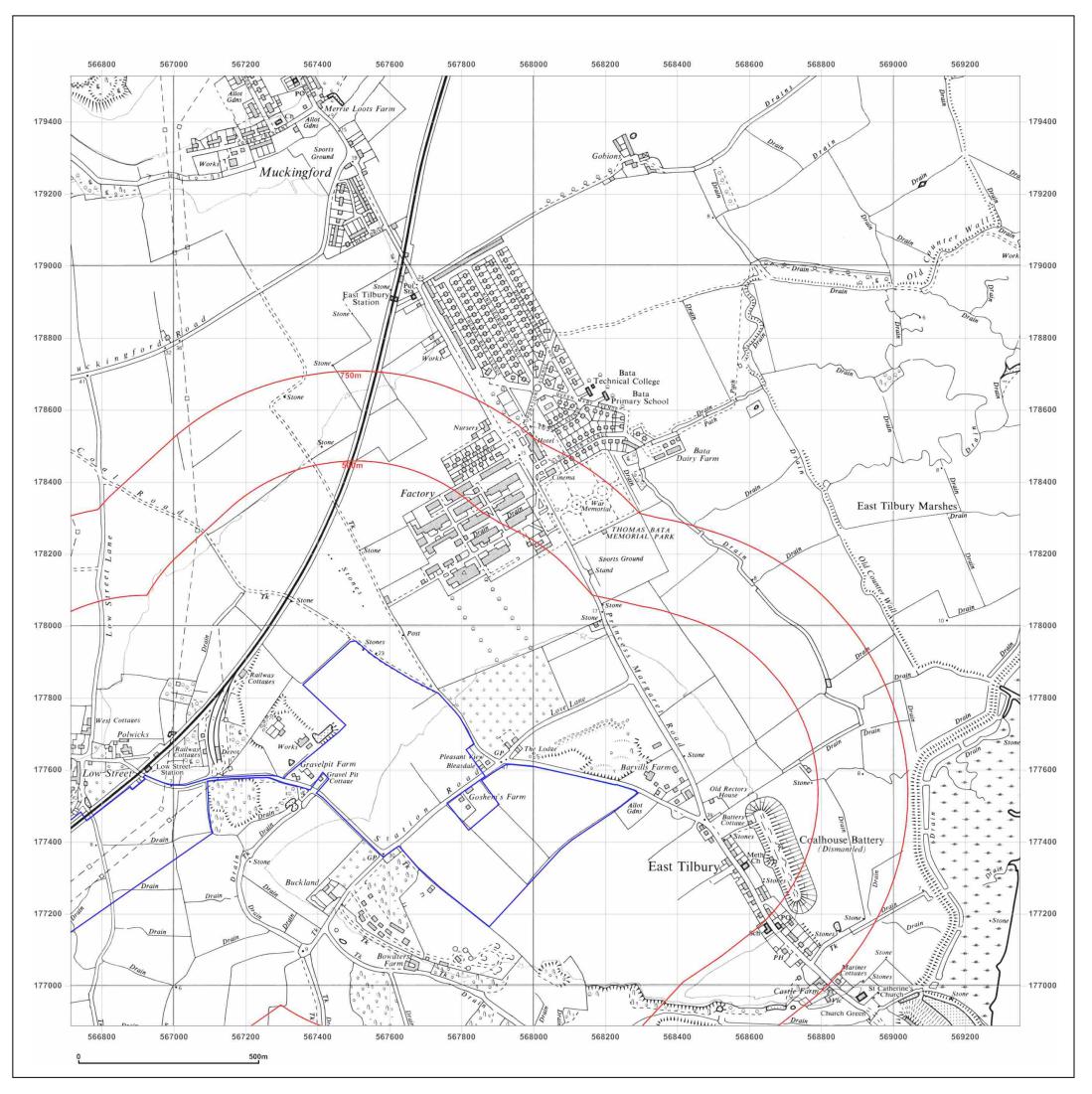




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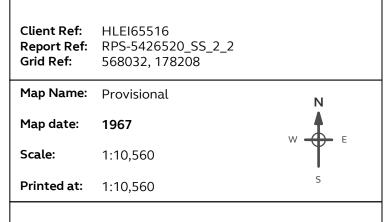
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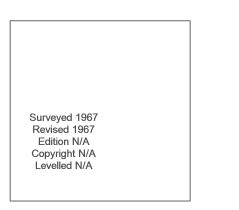
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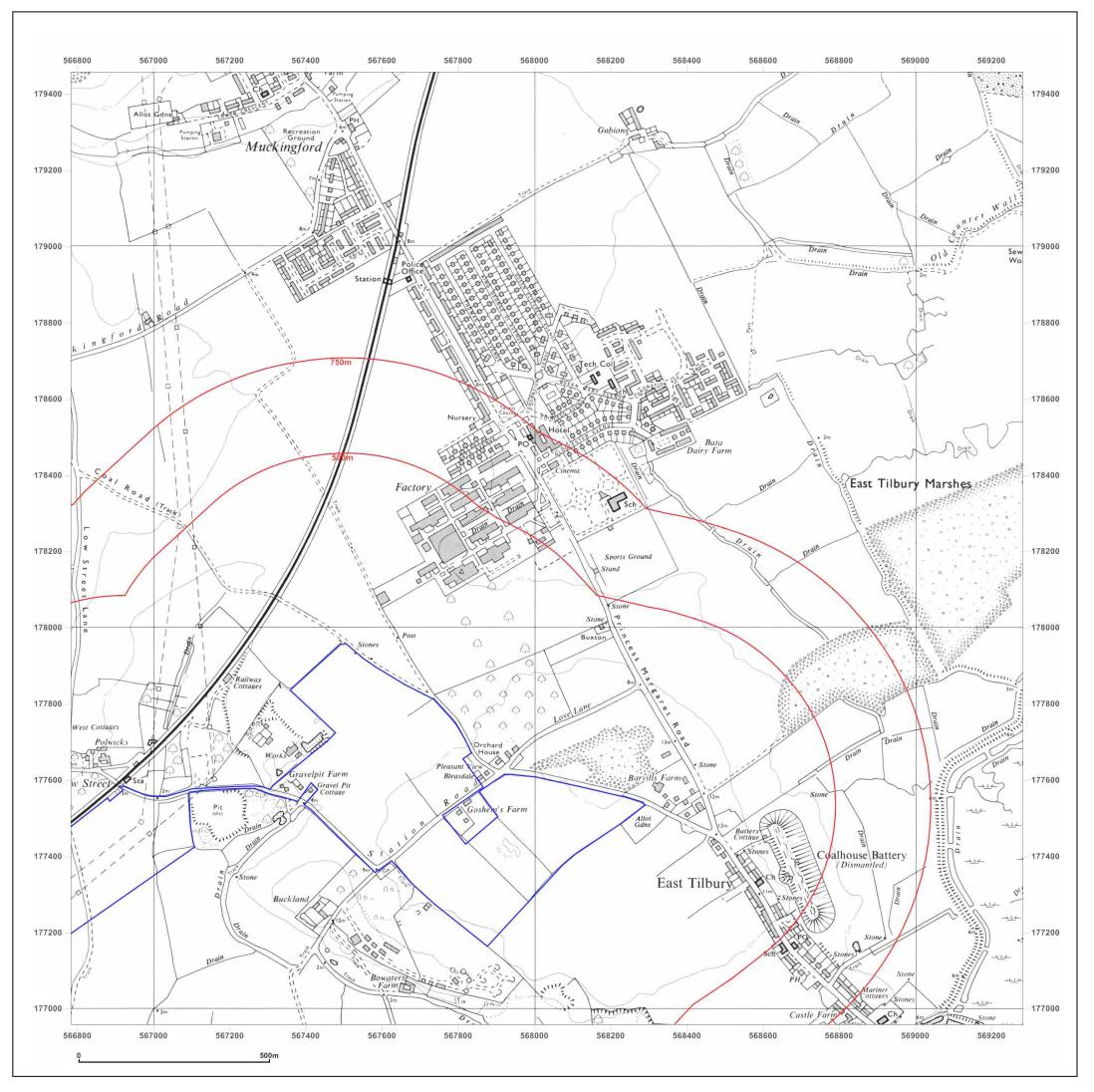




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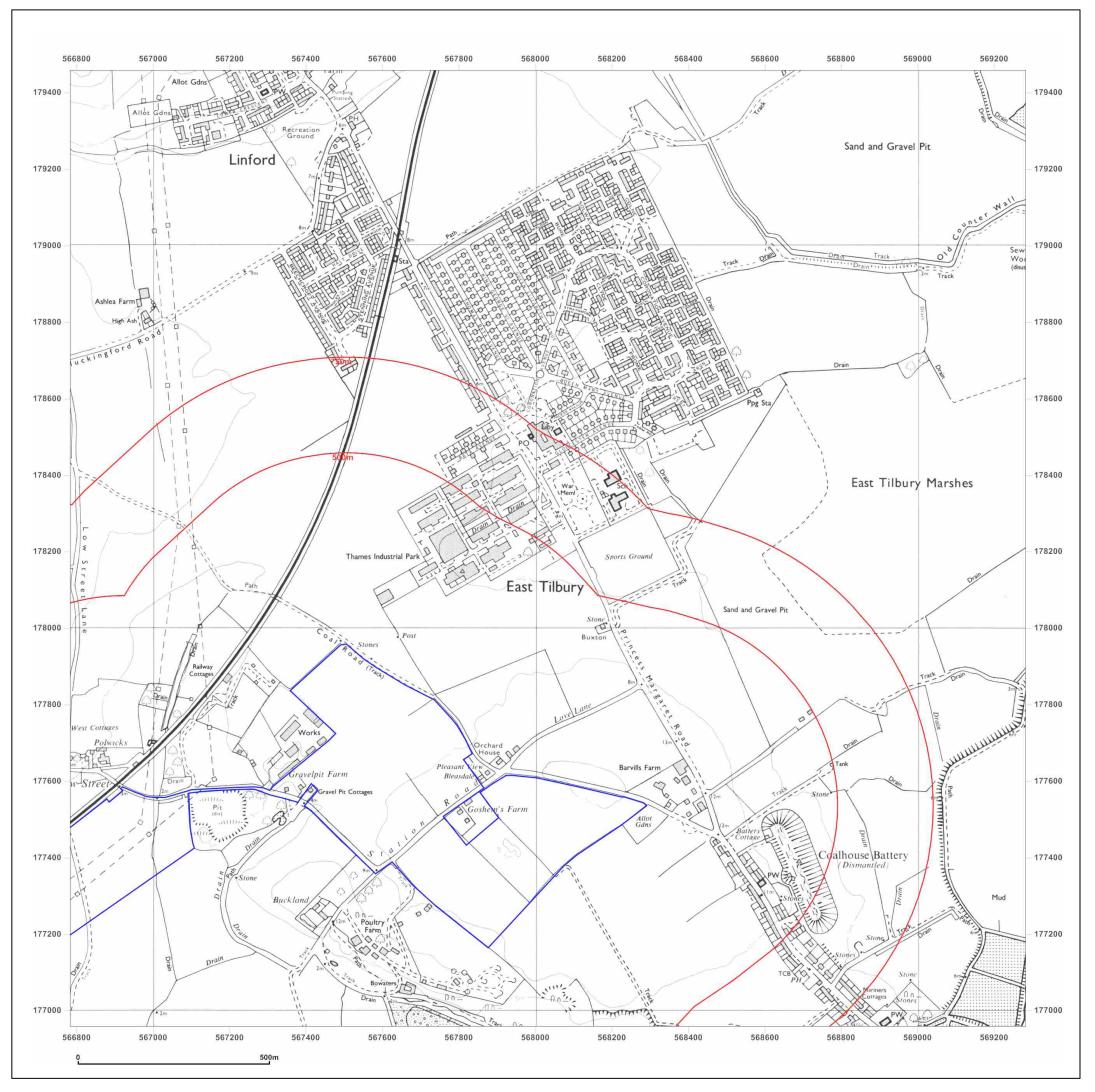
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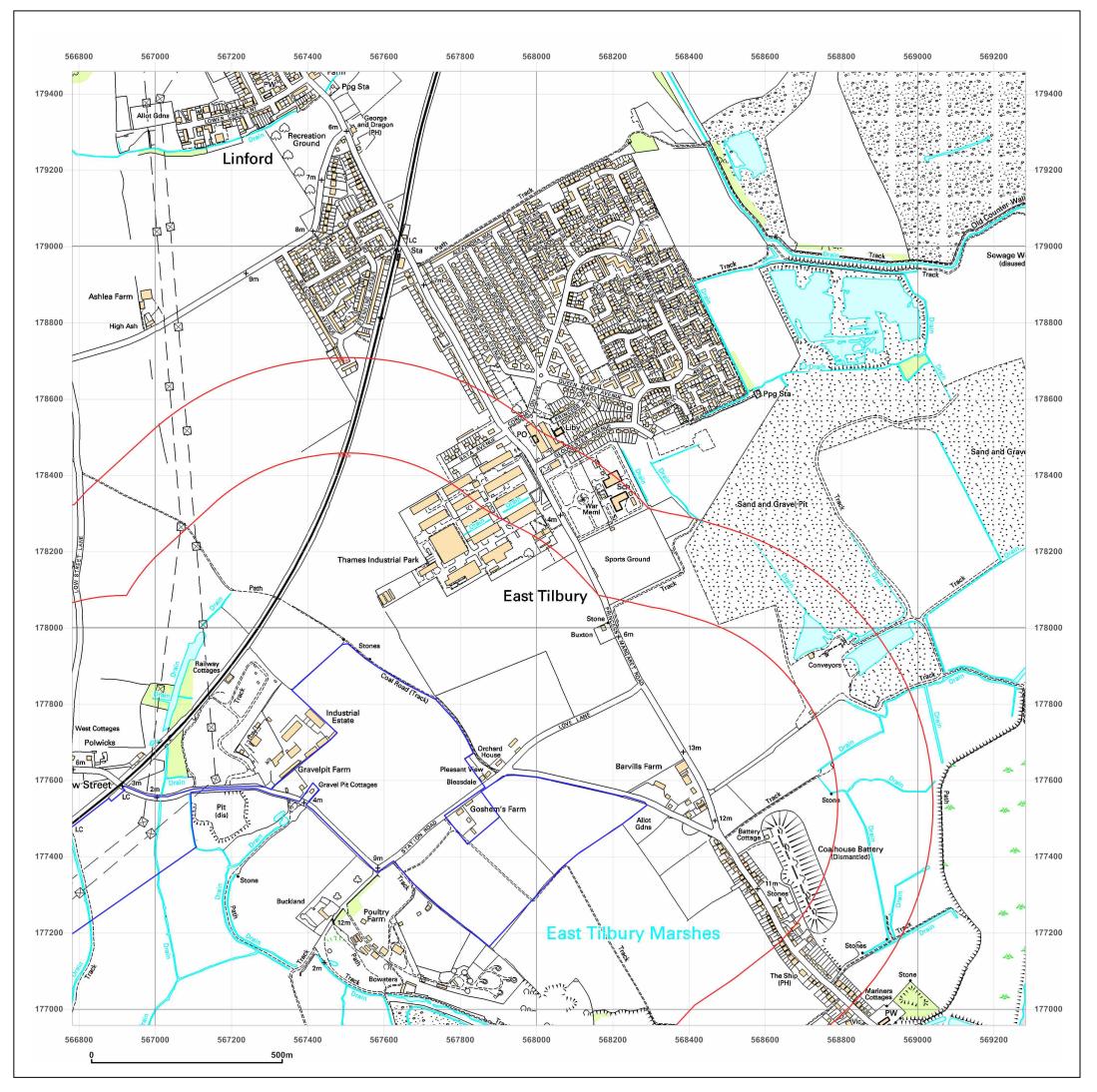
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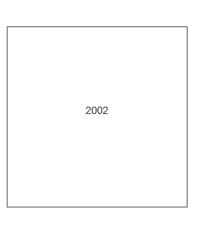




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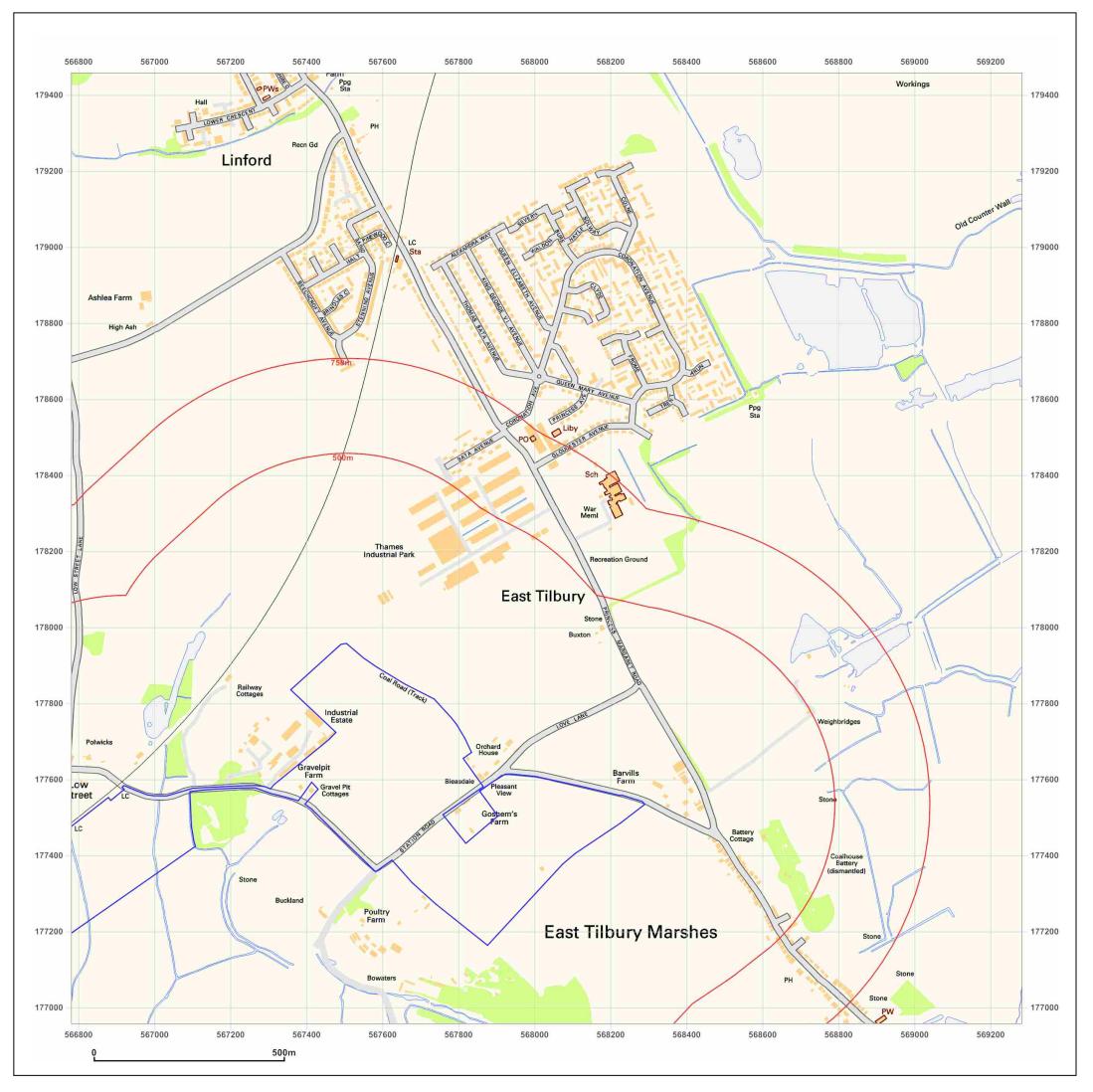
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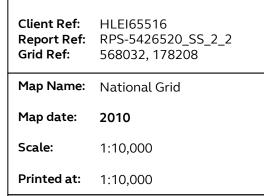
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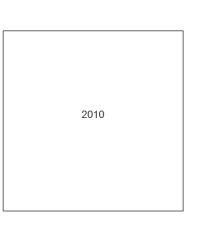
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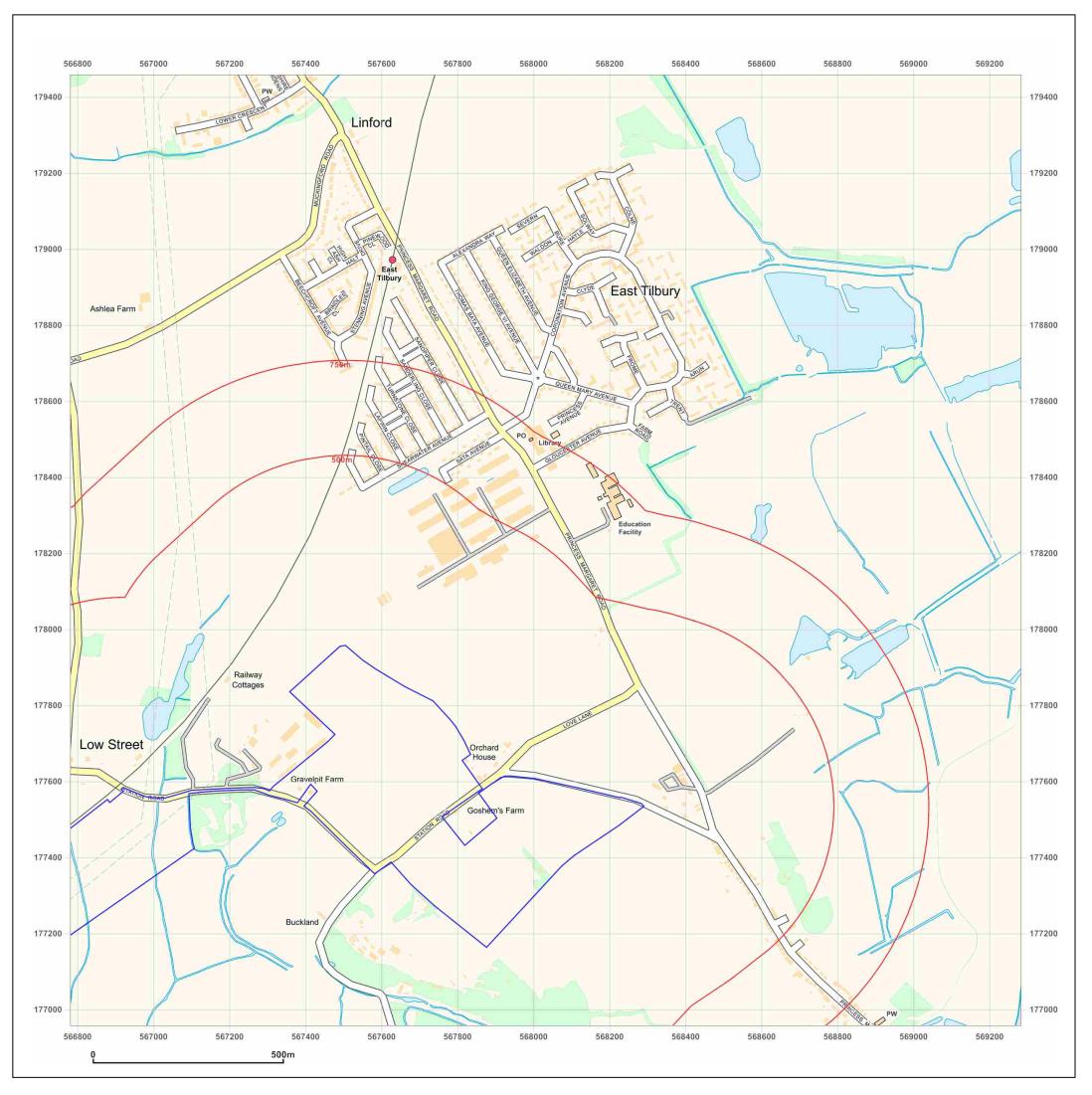
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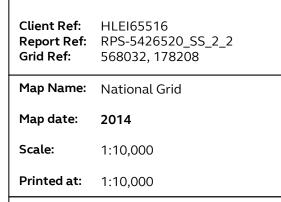
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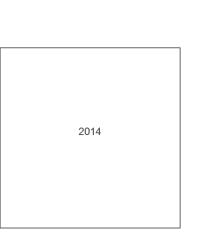
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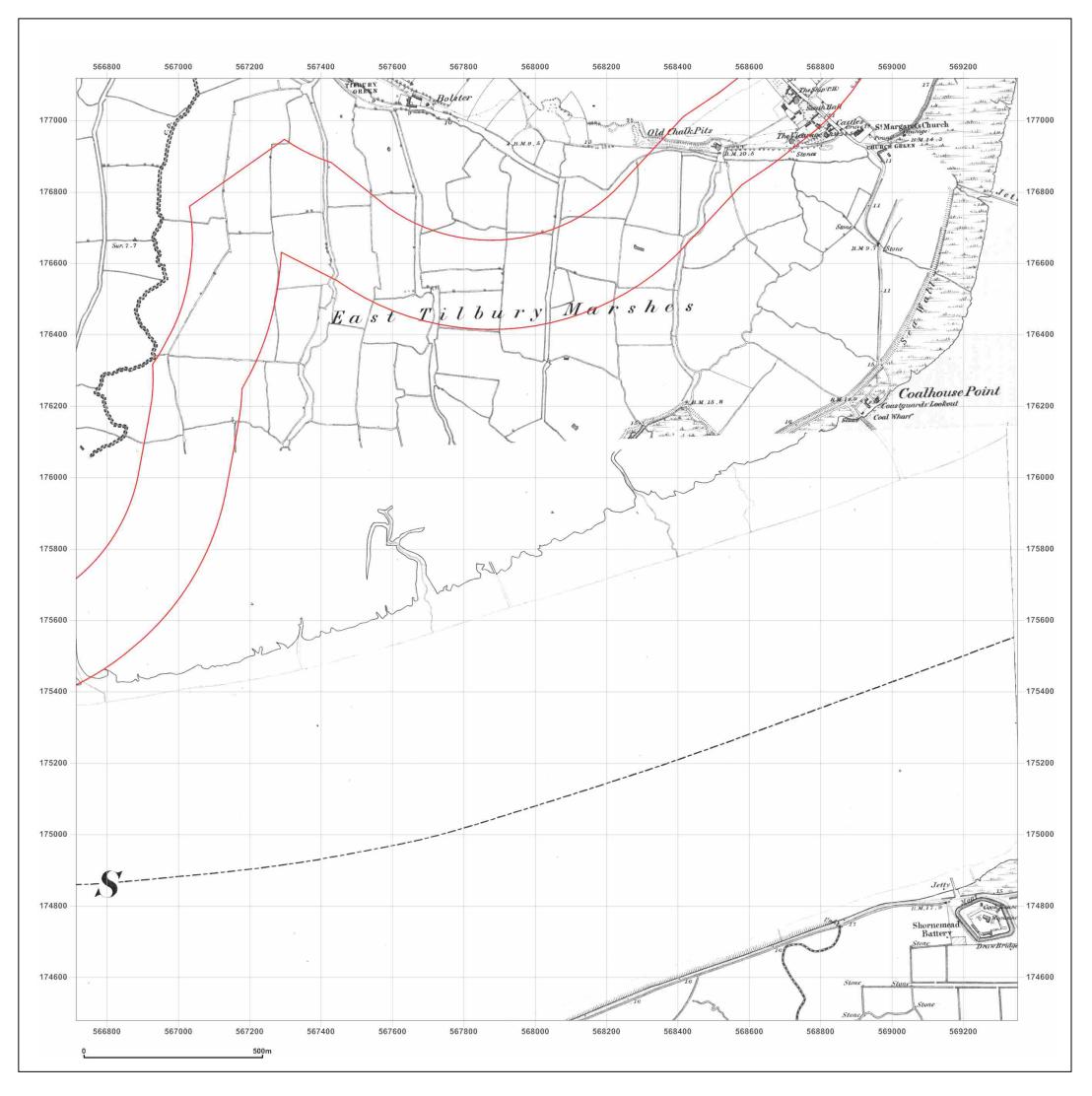
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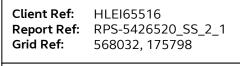
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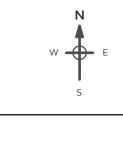


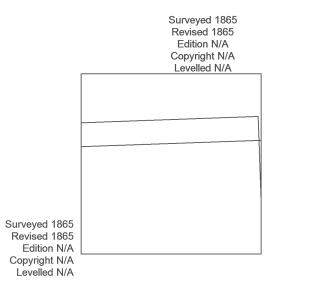
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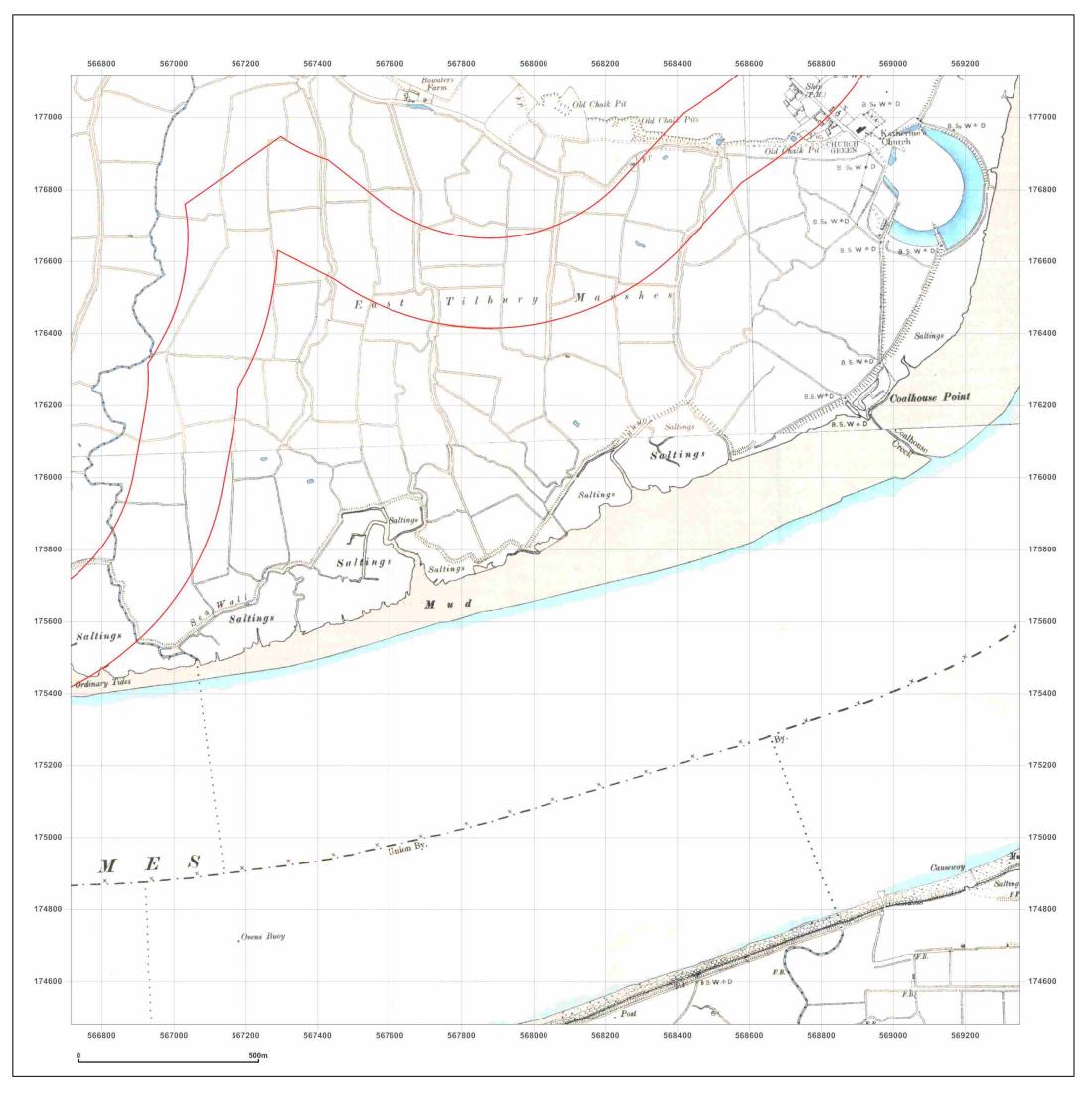




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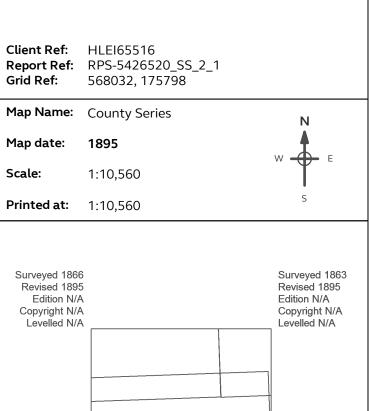
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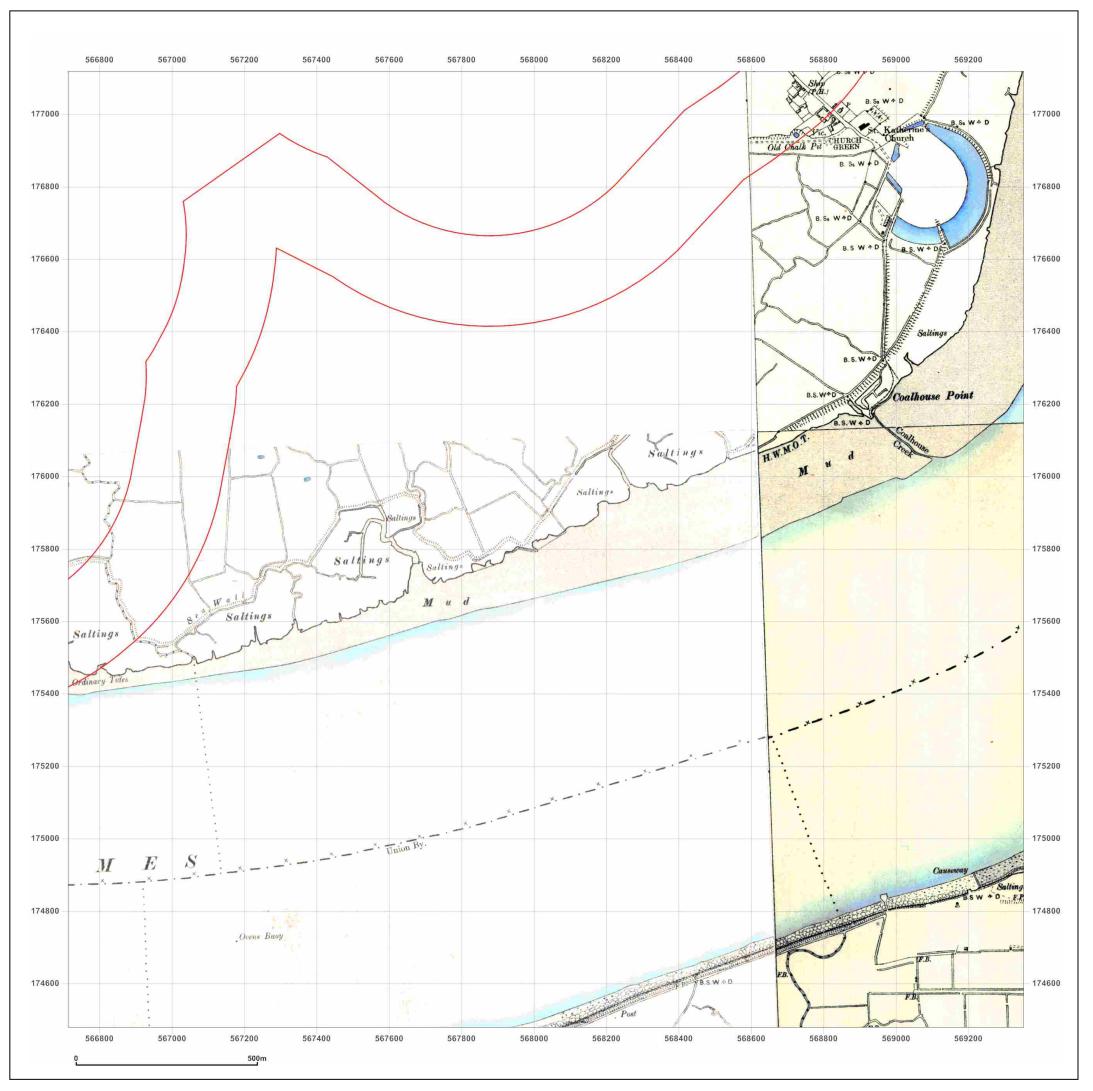
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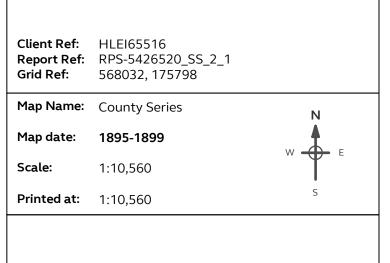
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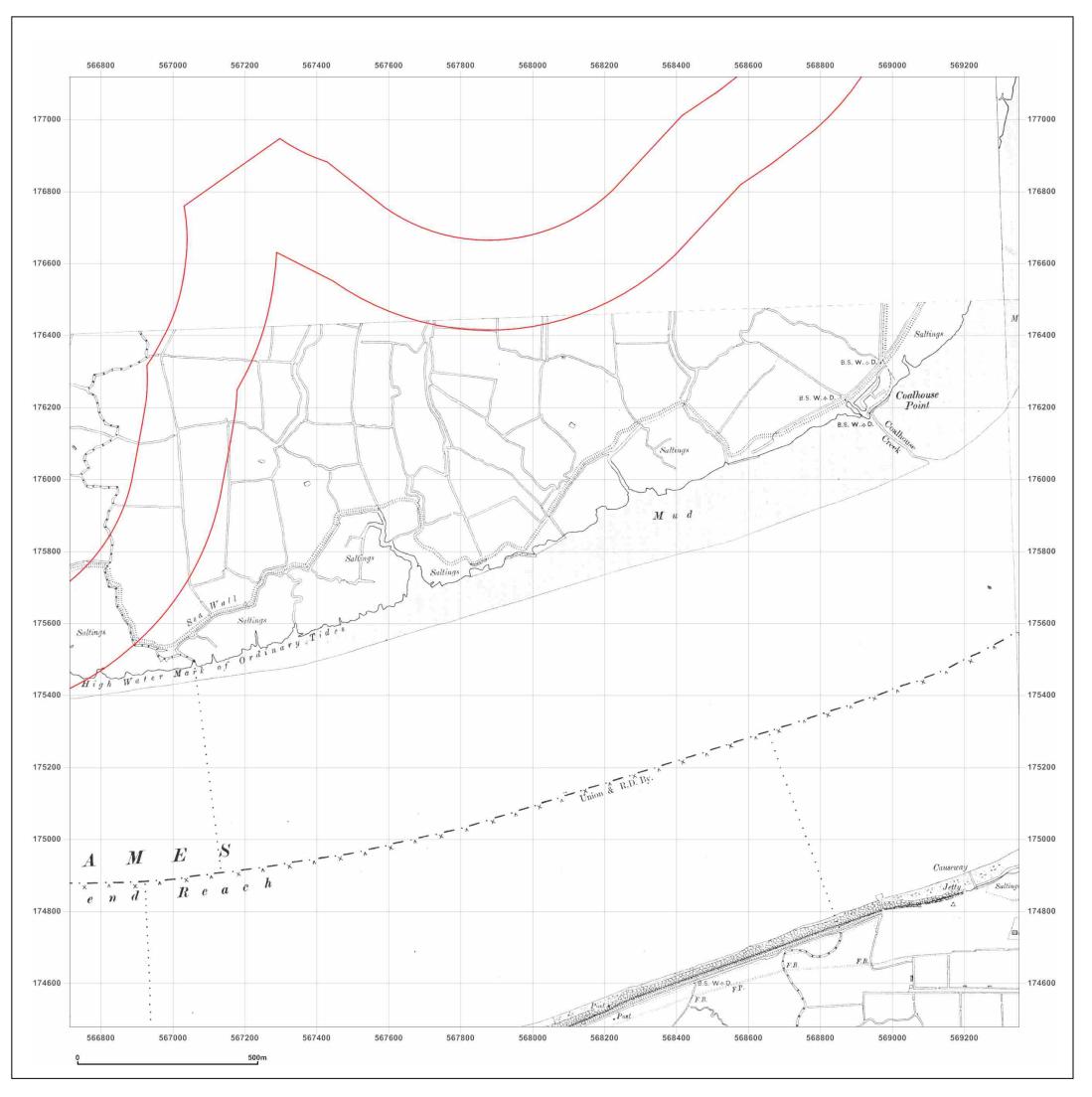
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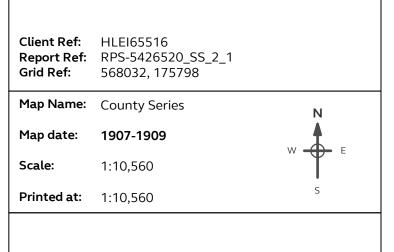
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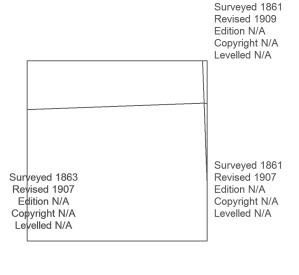
Production date: 13 September 2018





THURROCK FGP, TILBURY



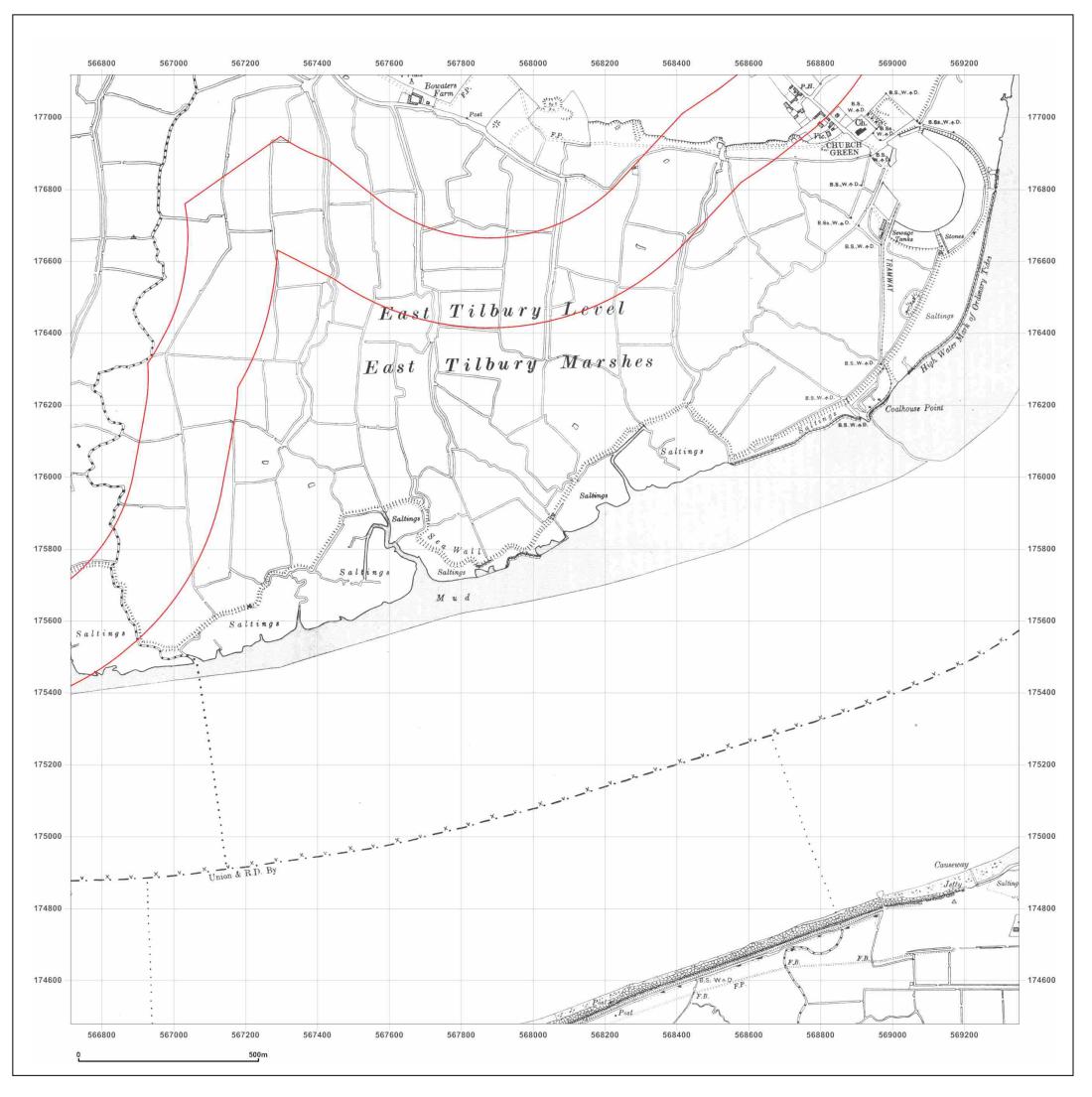




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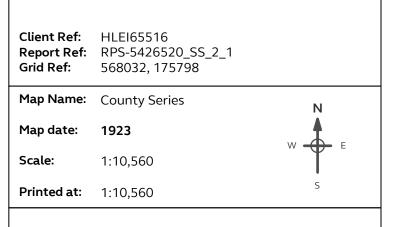
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Production date: 13 September 2018





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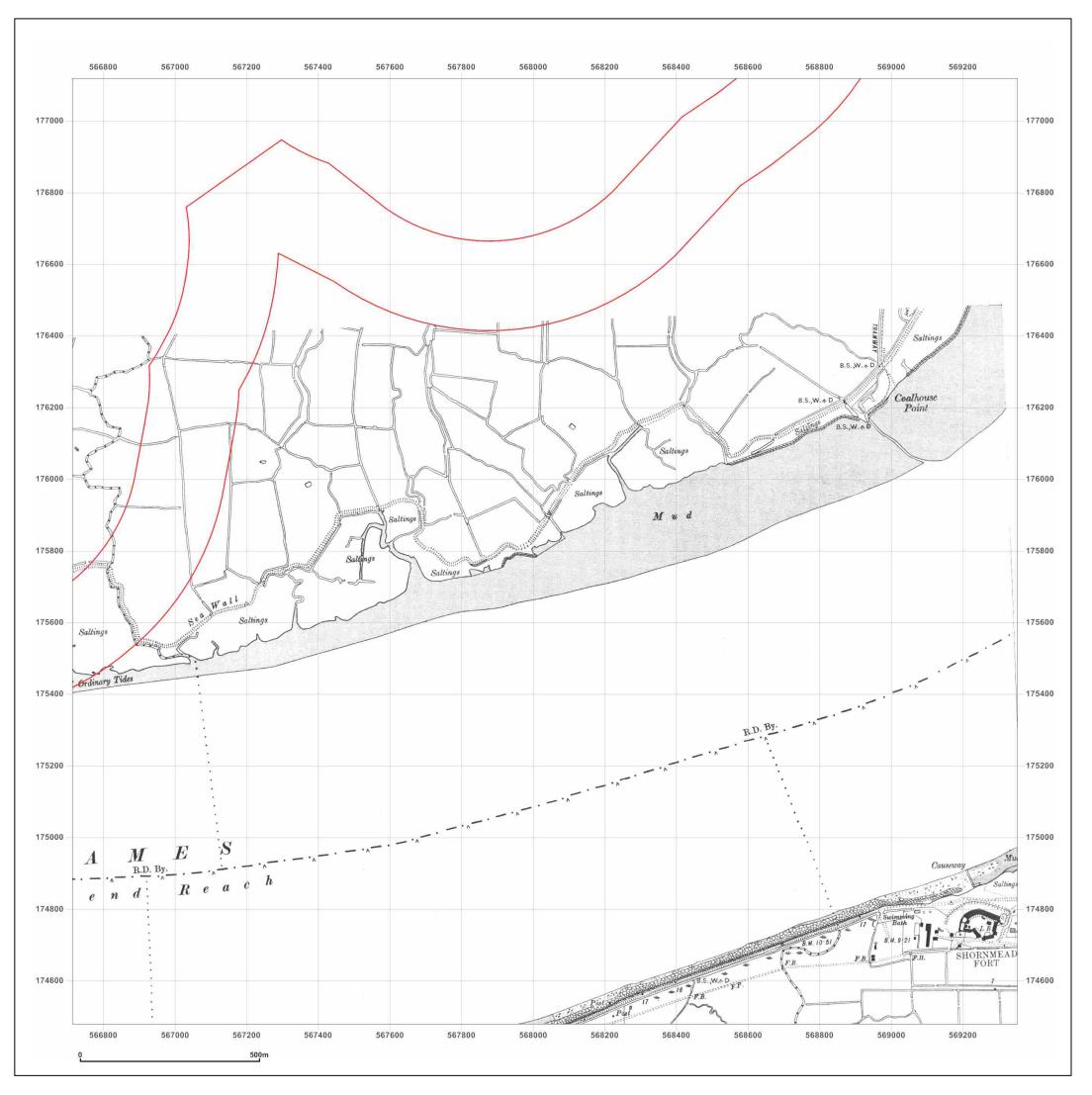
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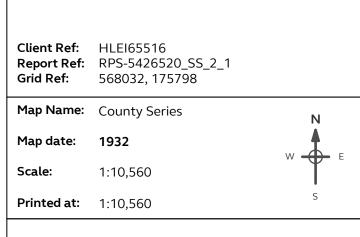
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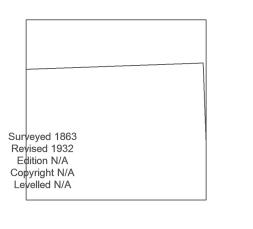
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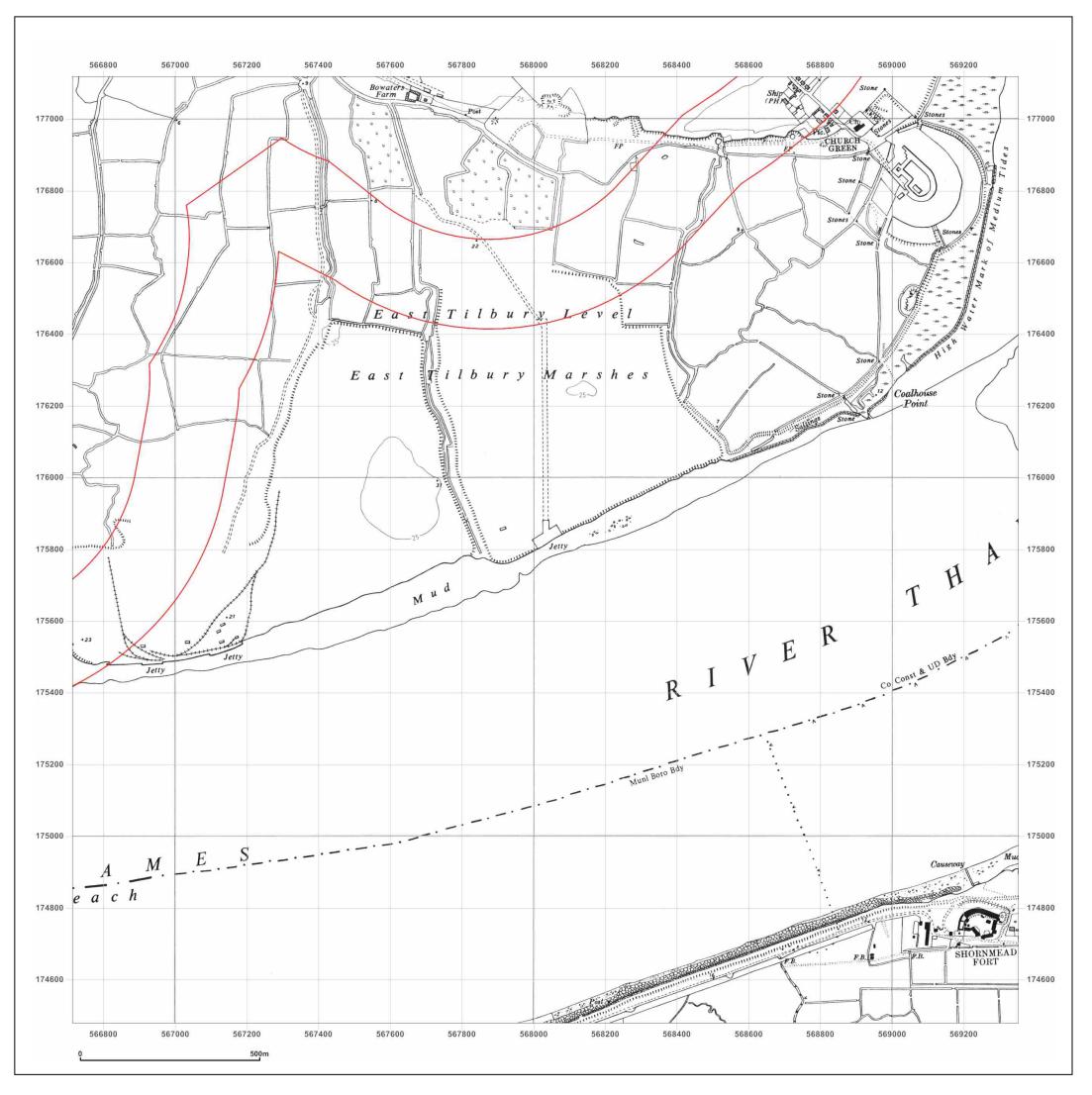




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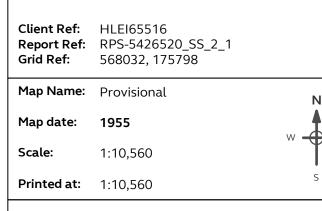
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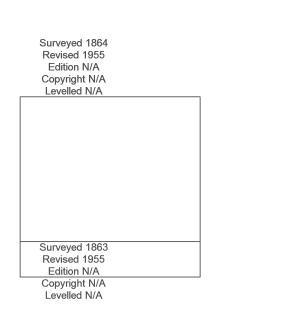
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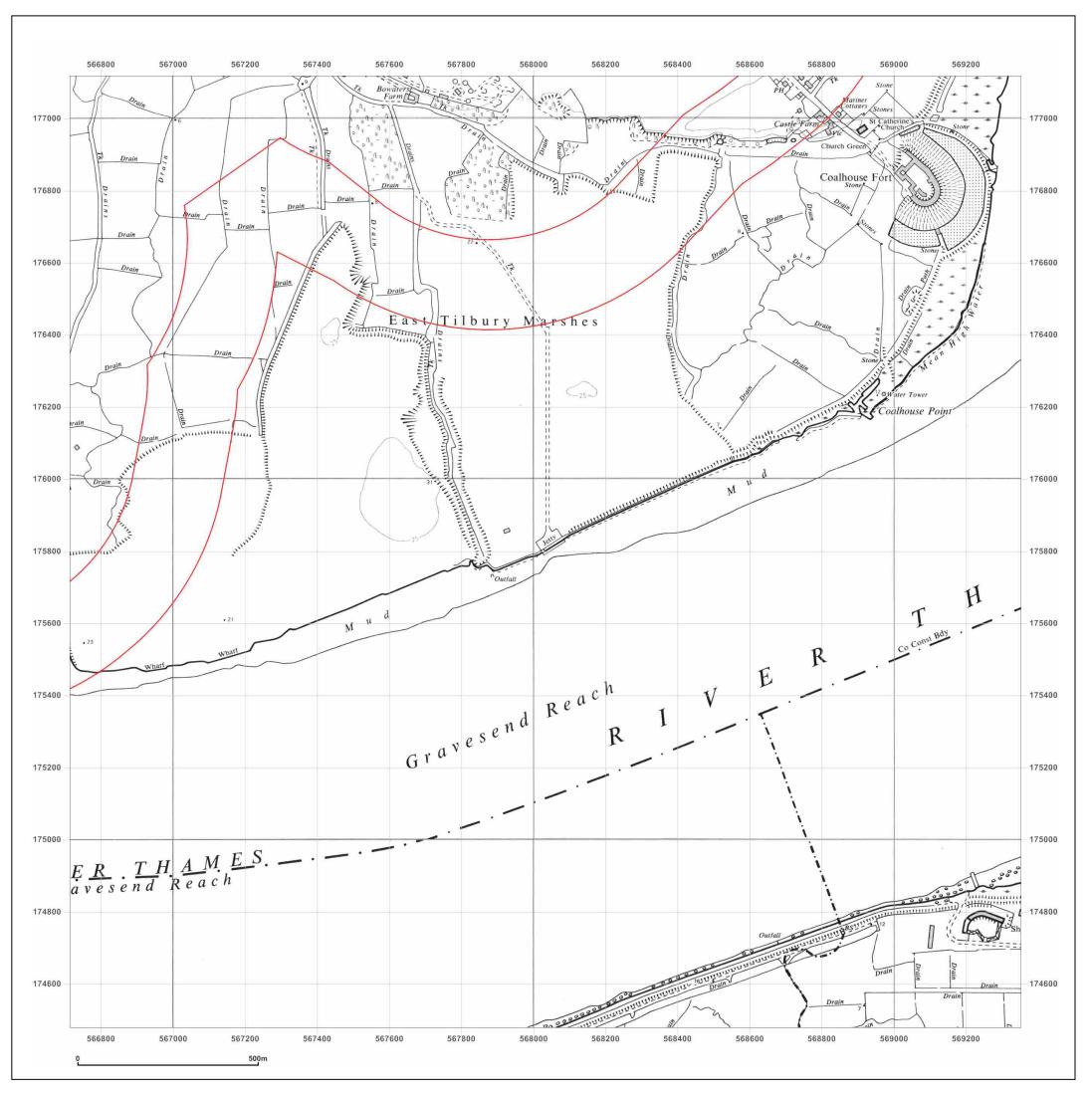
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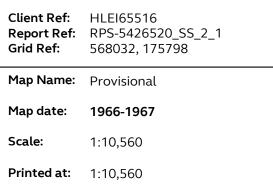
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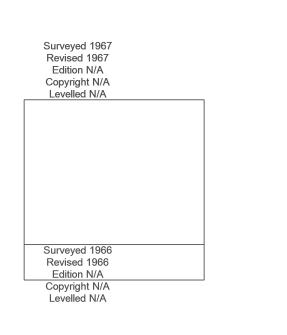




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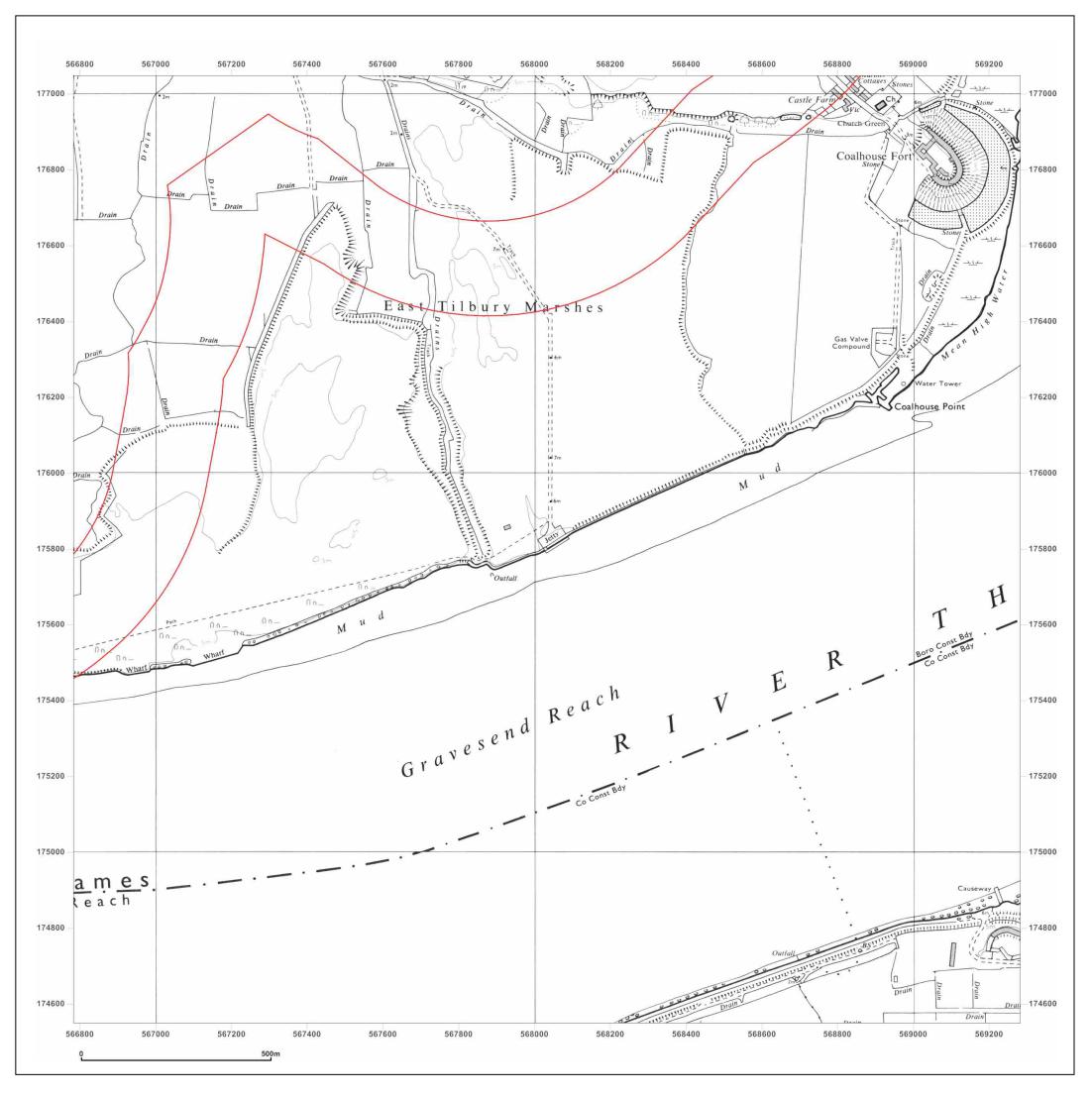




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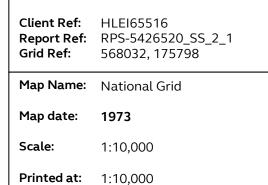
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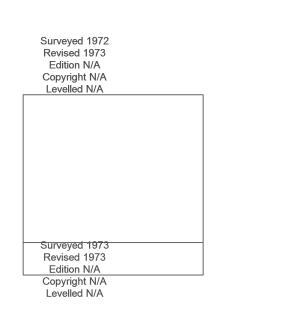




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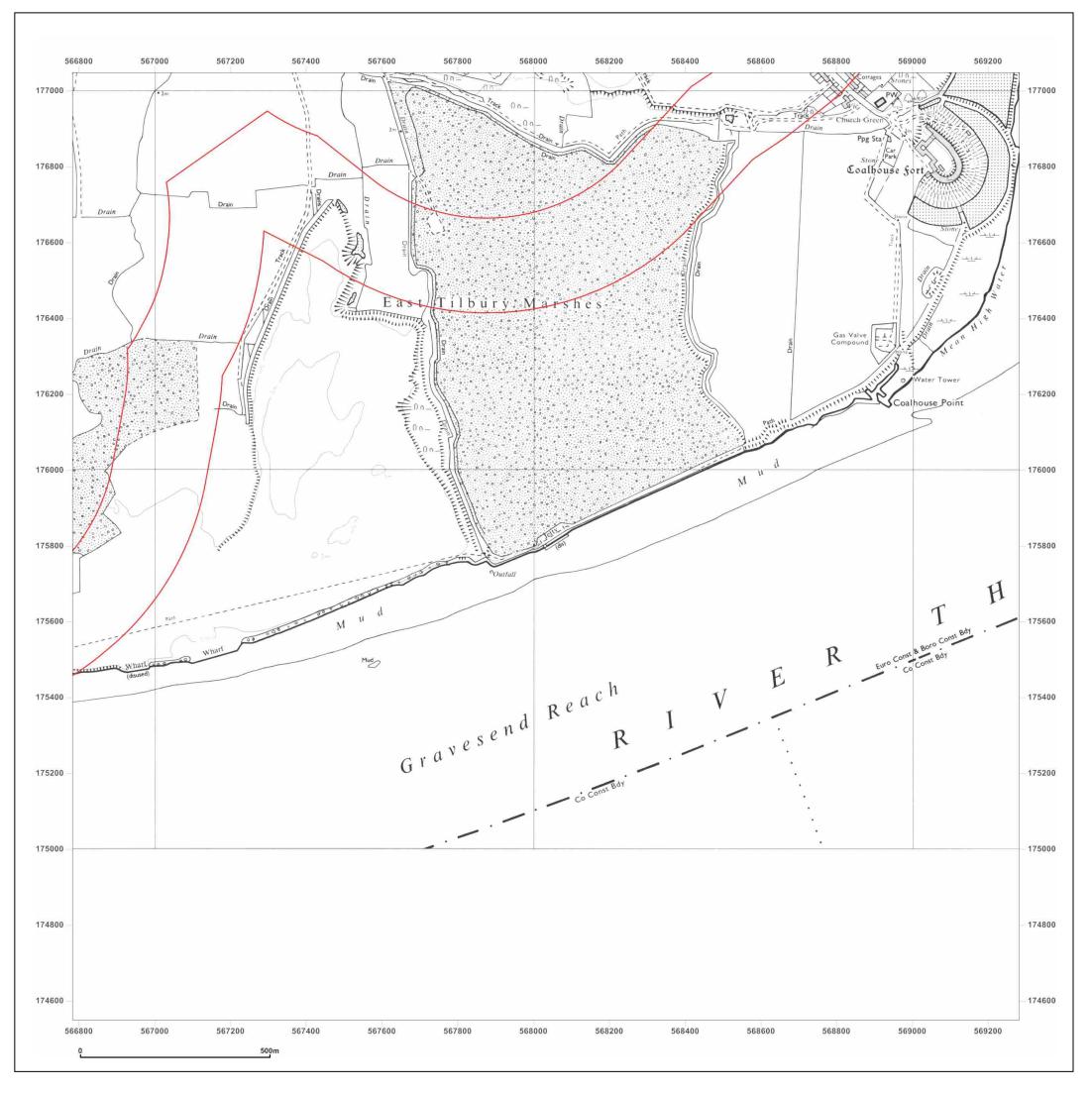




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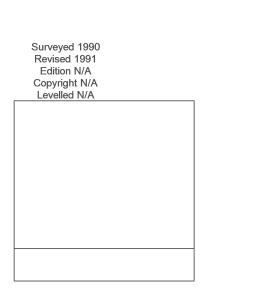




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Map Name:	National Grid
Map date:	1991
Scale:	1:10,000

Printed at: 1:10,000



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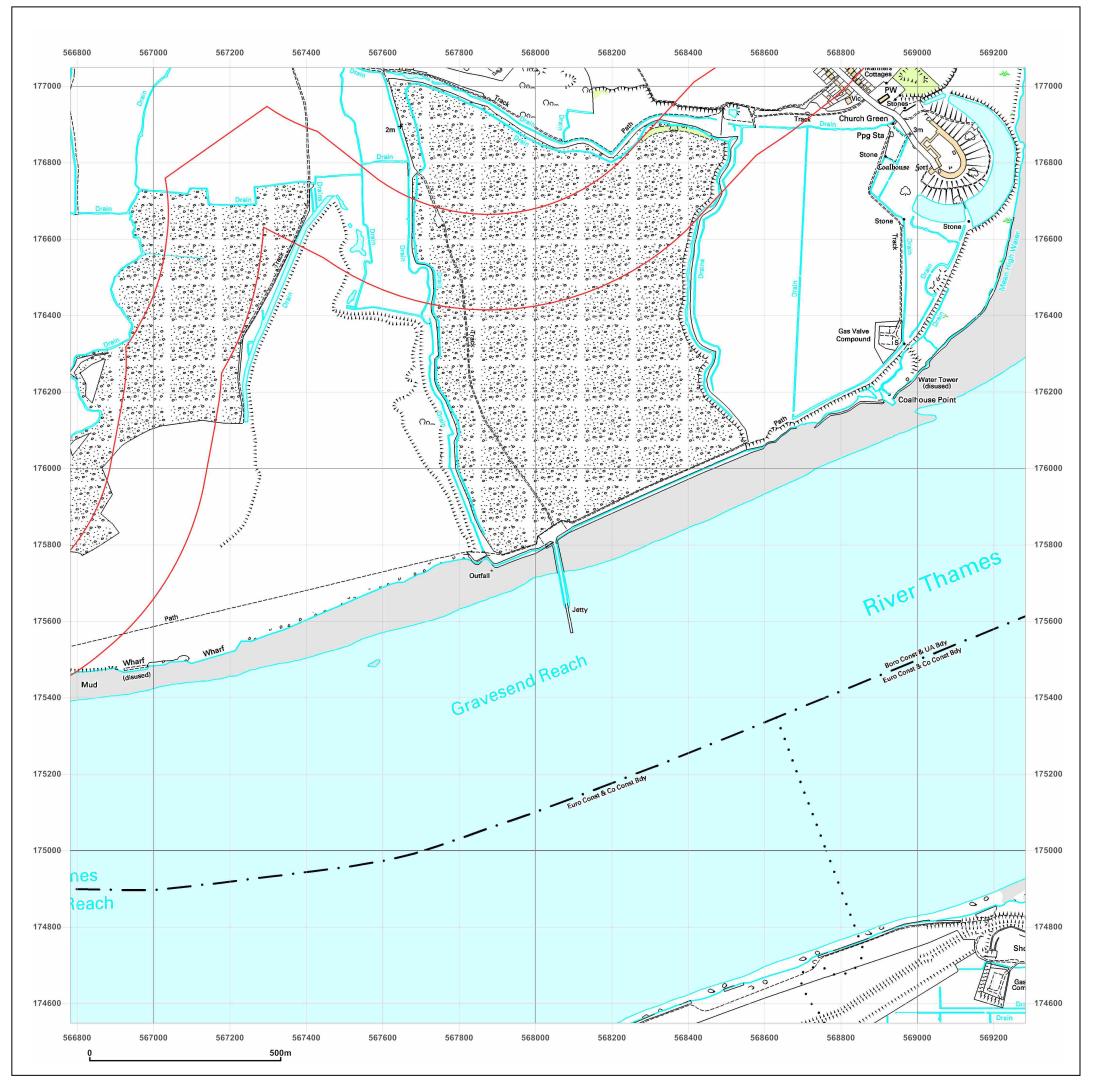
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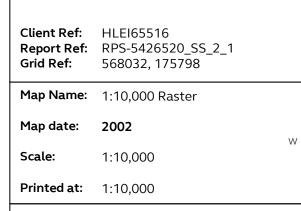


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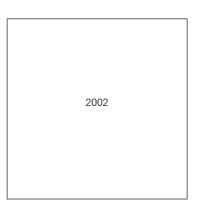


Site Details:

THURROCK FGP, TILBURY



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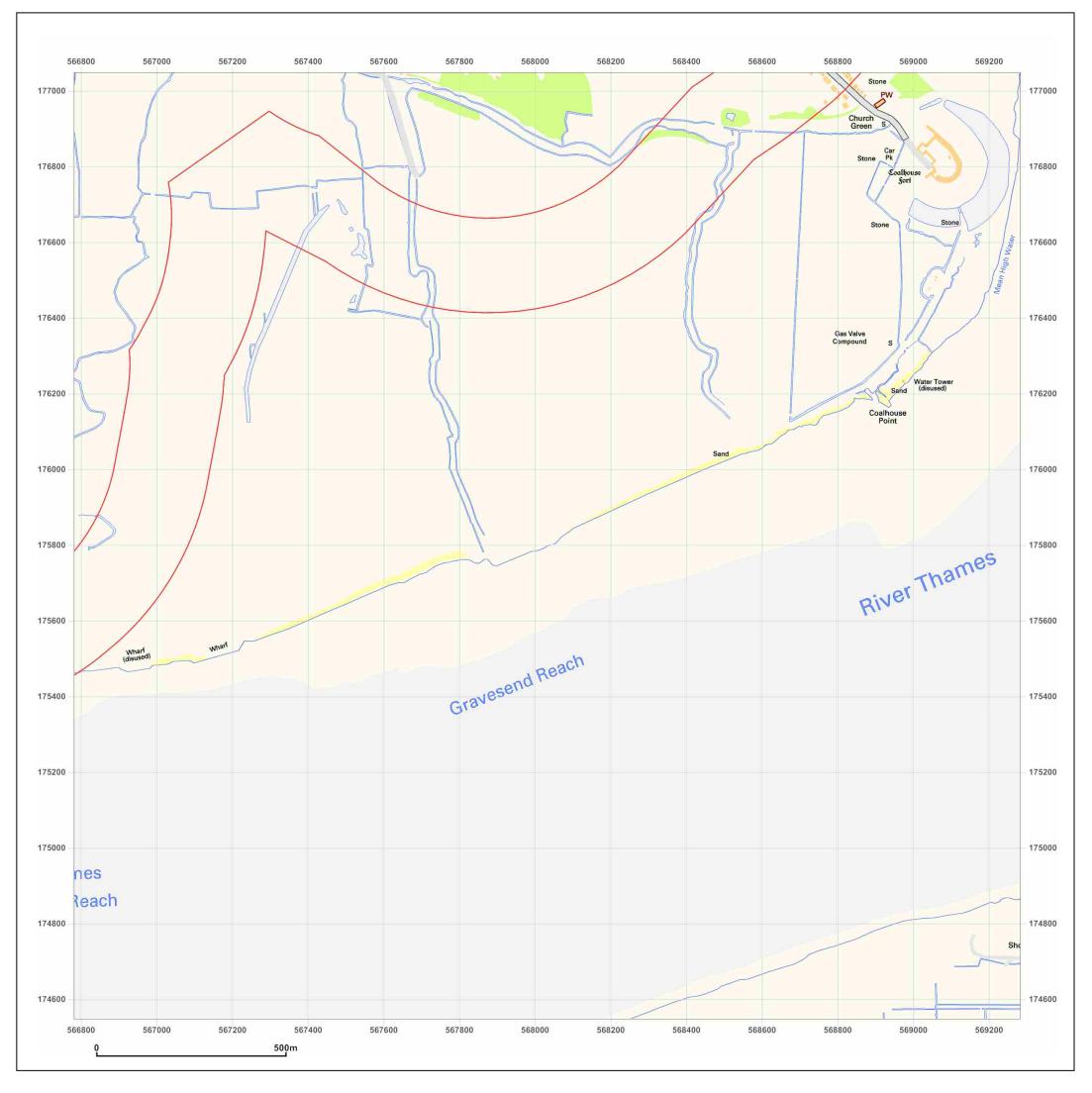


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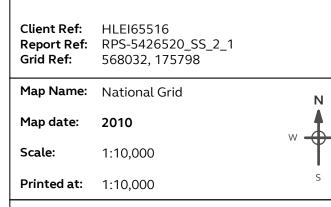
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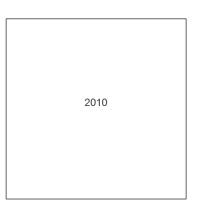
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THURROCK FGP, TILBURY





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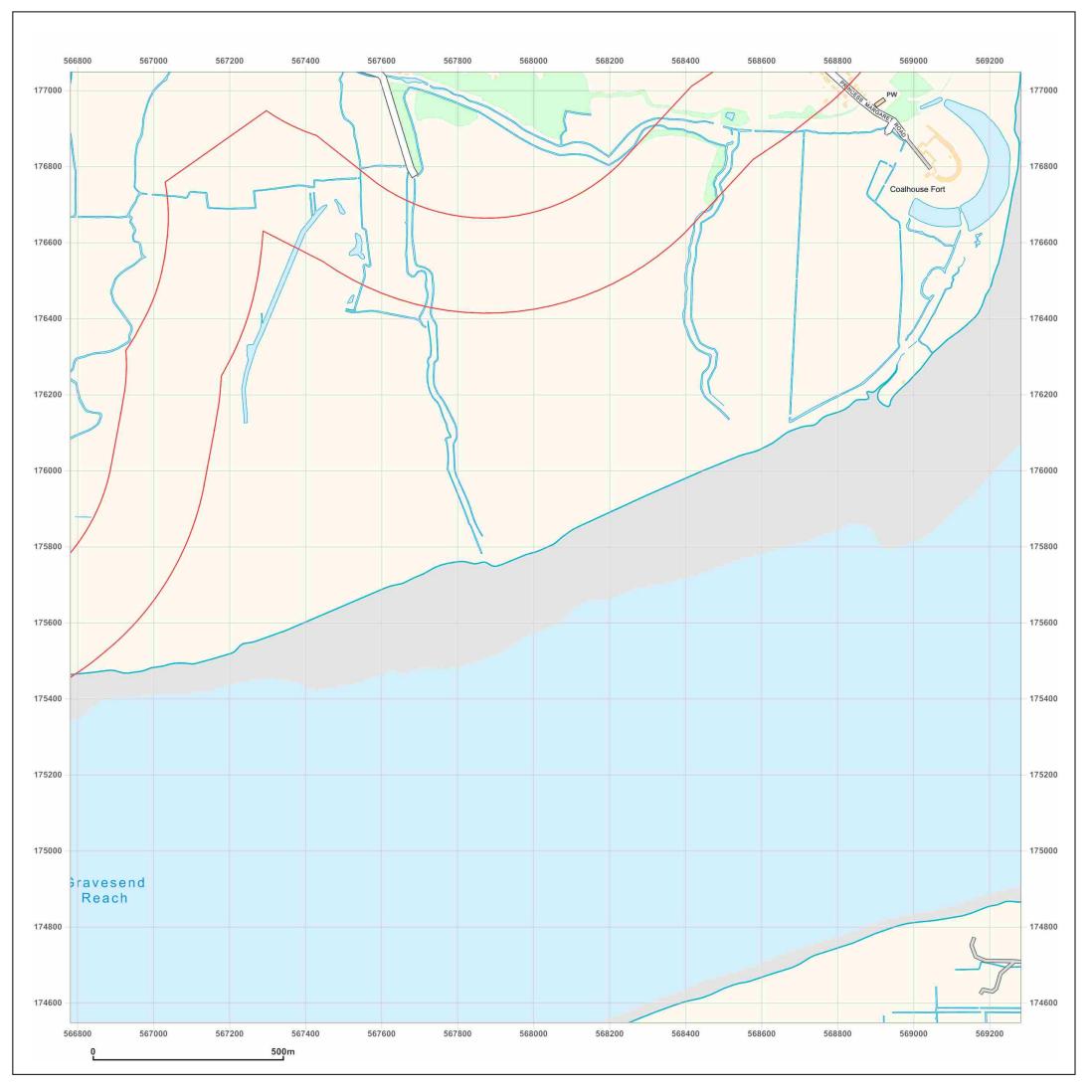
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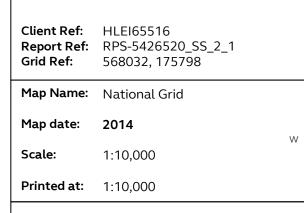
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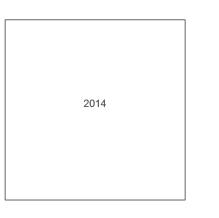
THURROCK FGP, TILBURY



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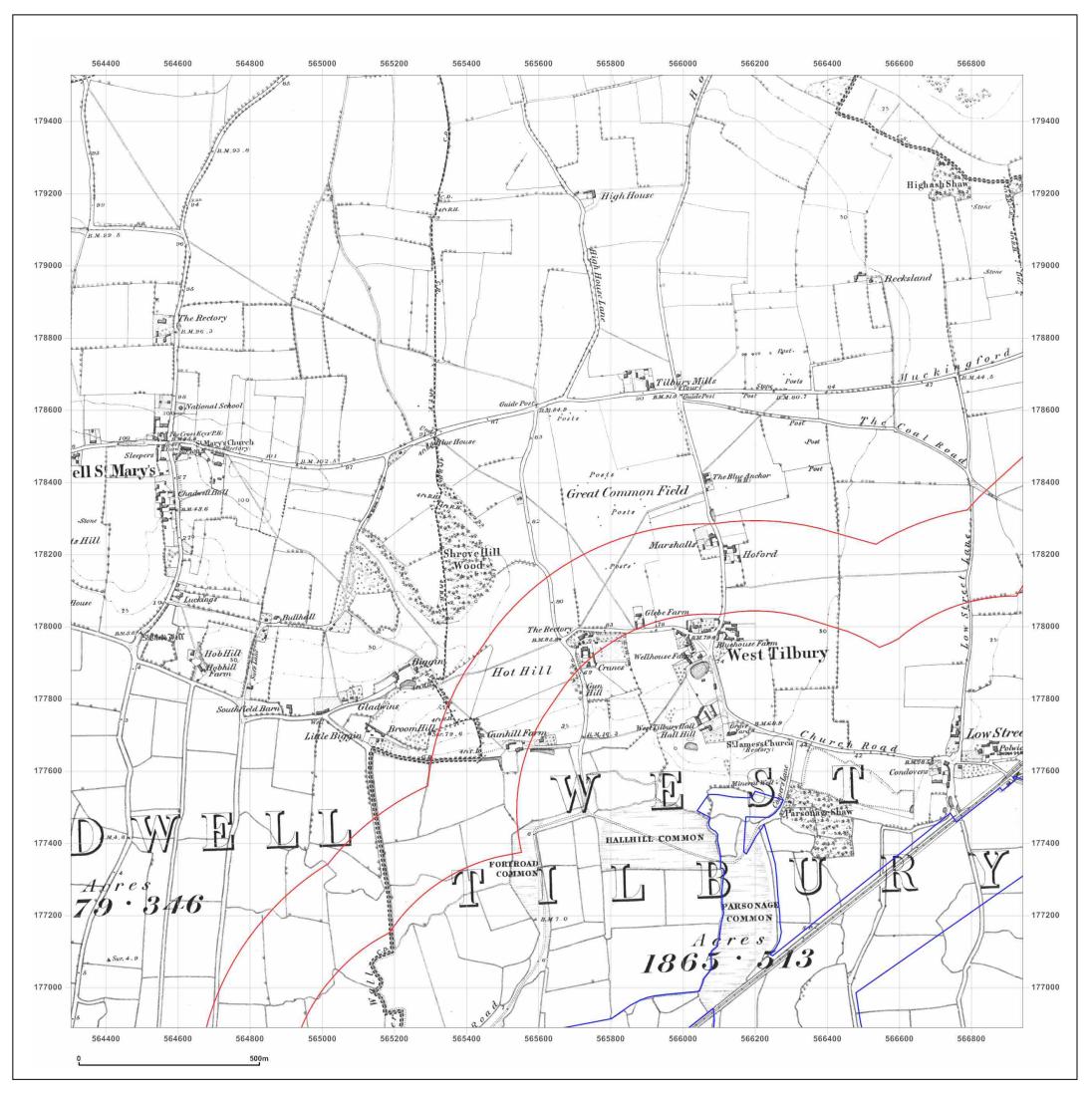




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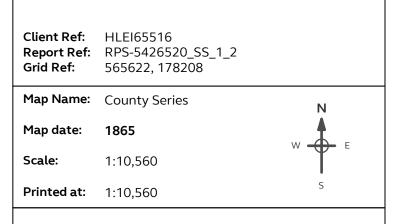
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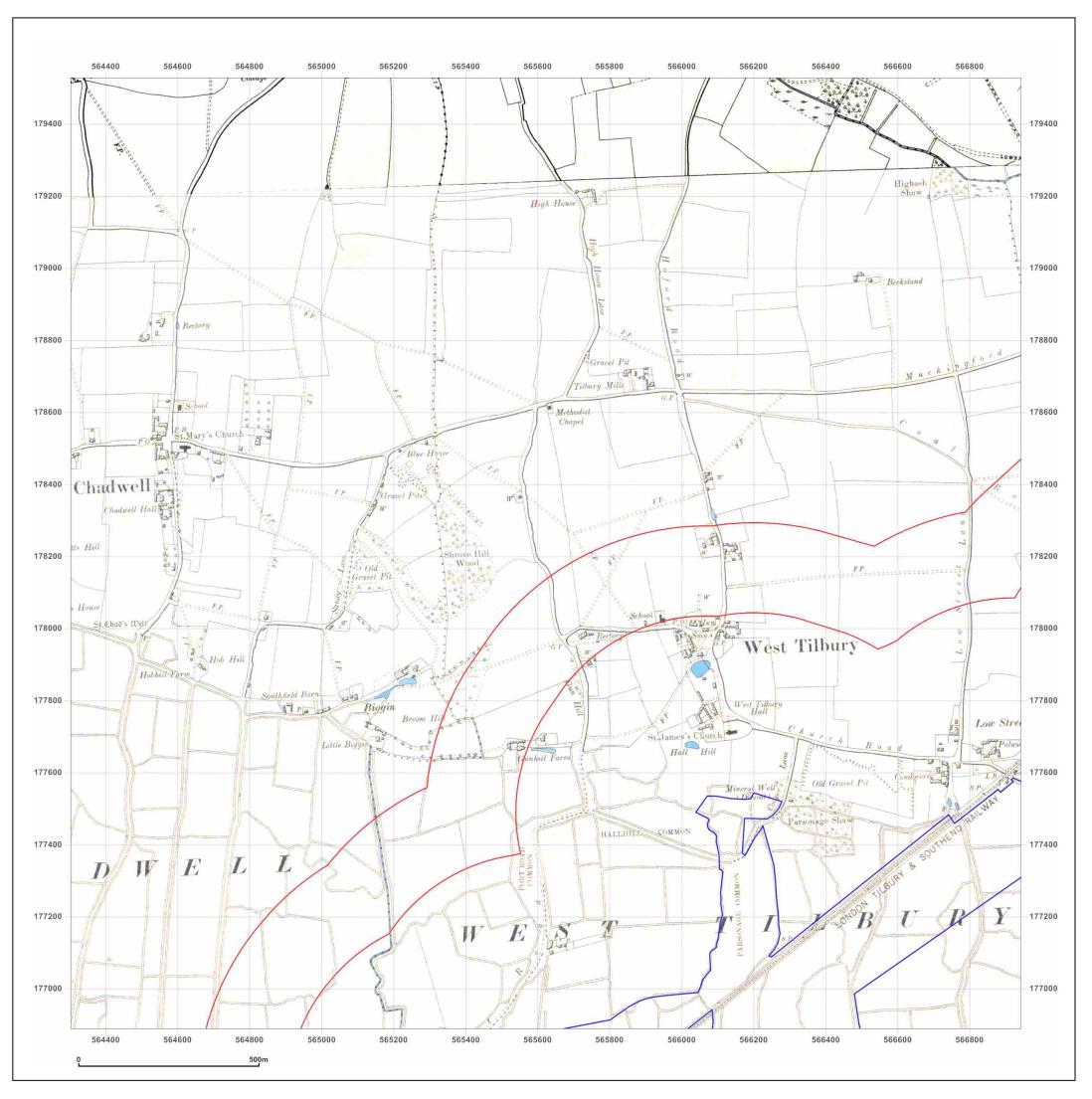
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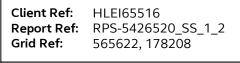
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THURROCK FGP, TILBURY



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Printed at: 1:10,560





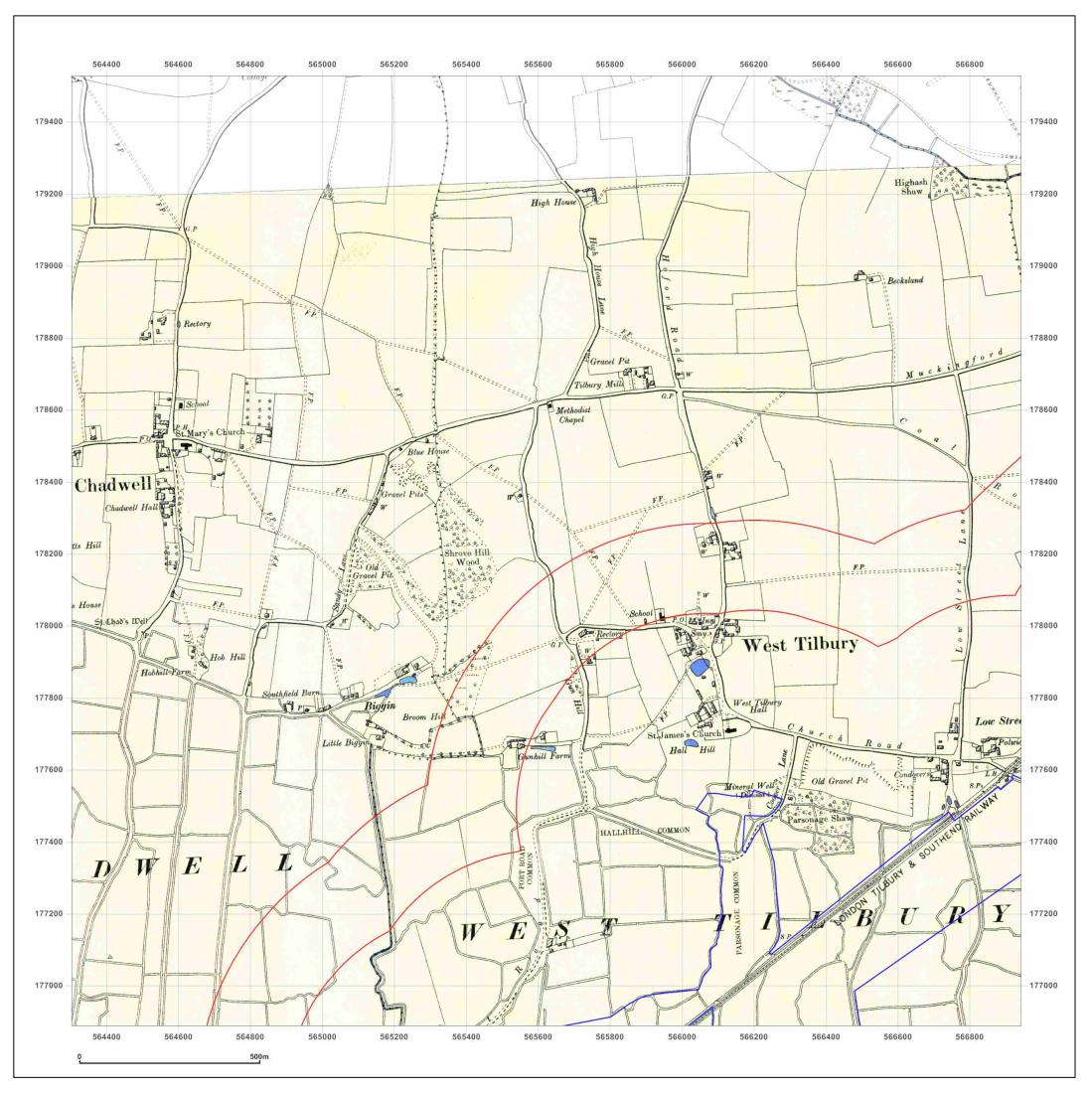
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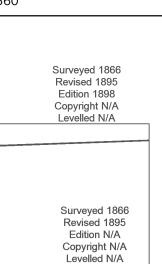
THURROCK FGP, TILBURY



- Map date: 1898

1:10,560 Scale:

Printed at: 1:10,560



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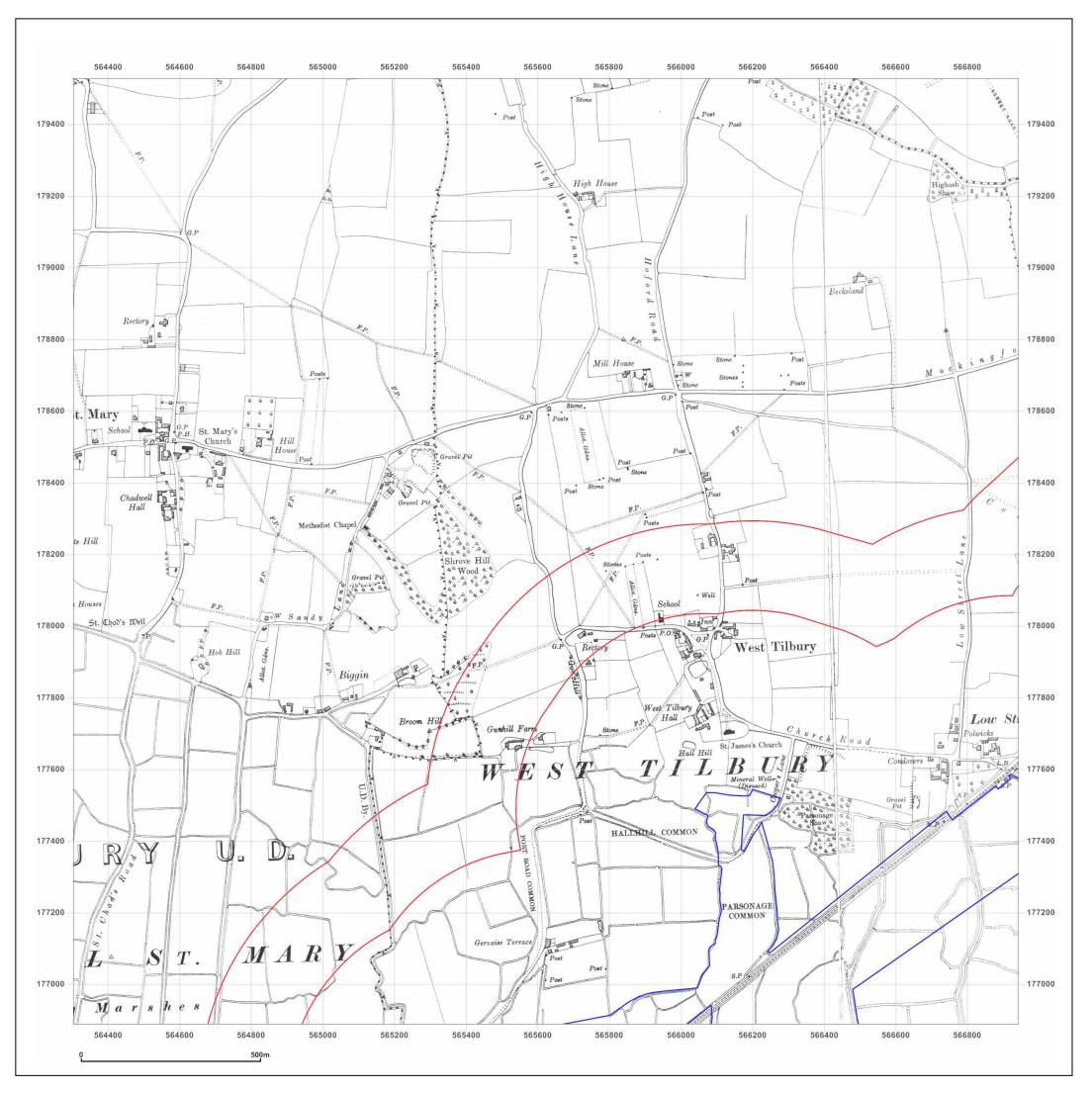
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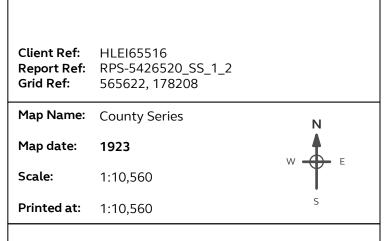
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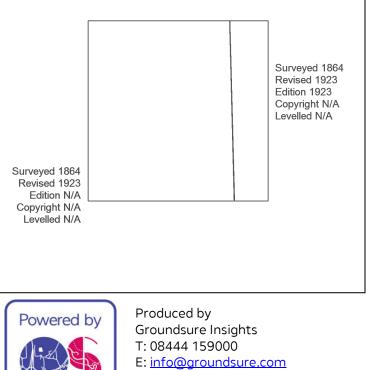
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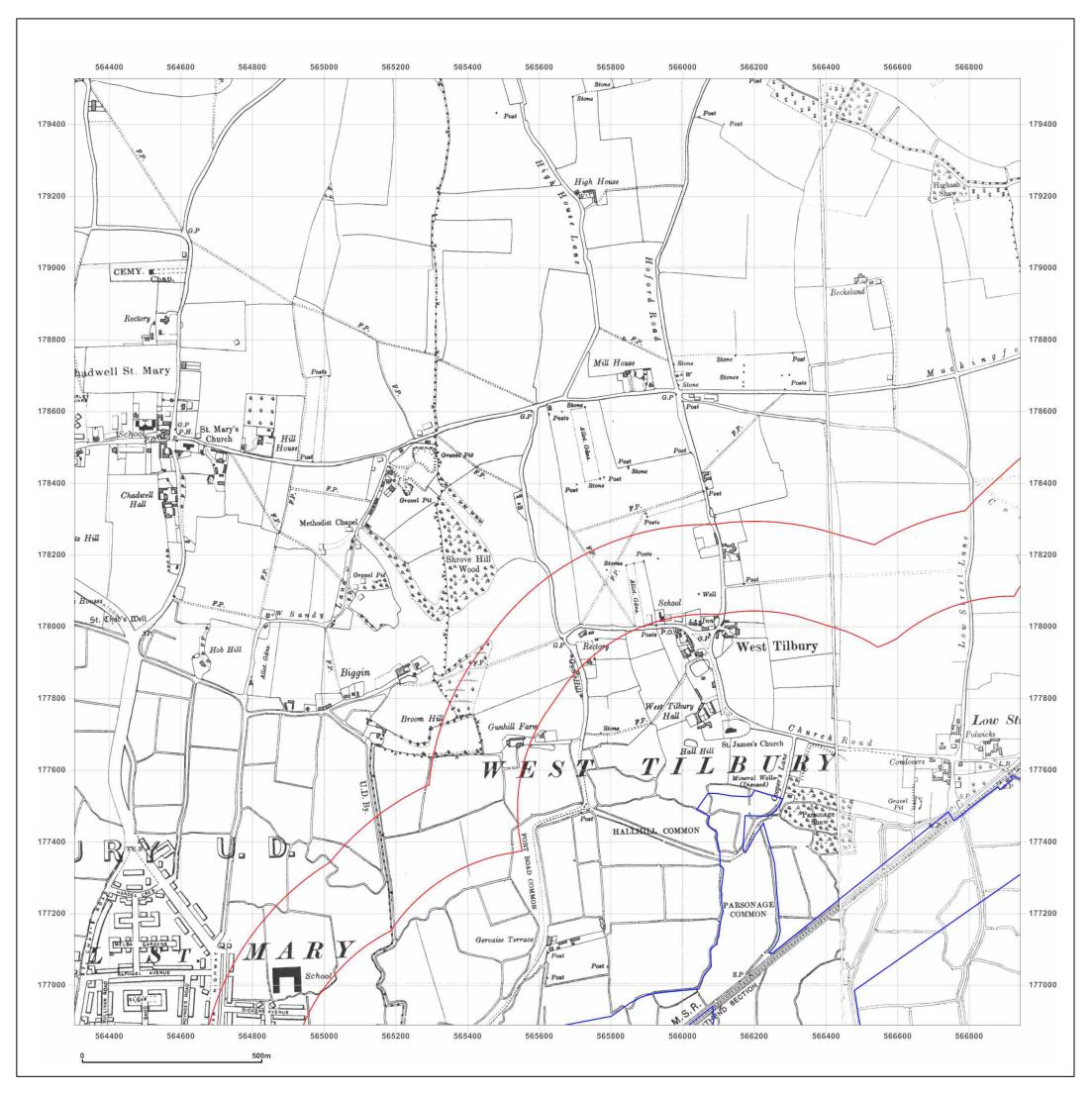




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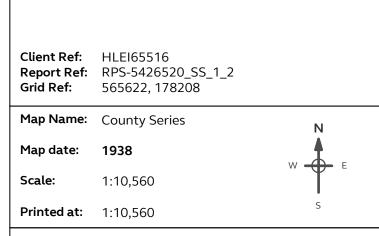
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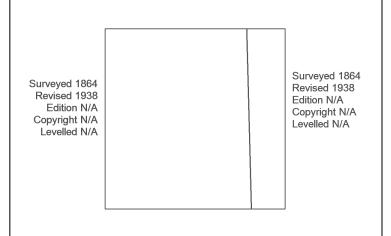
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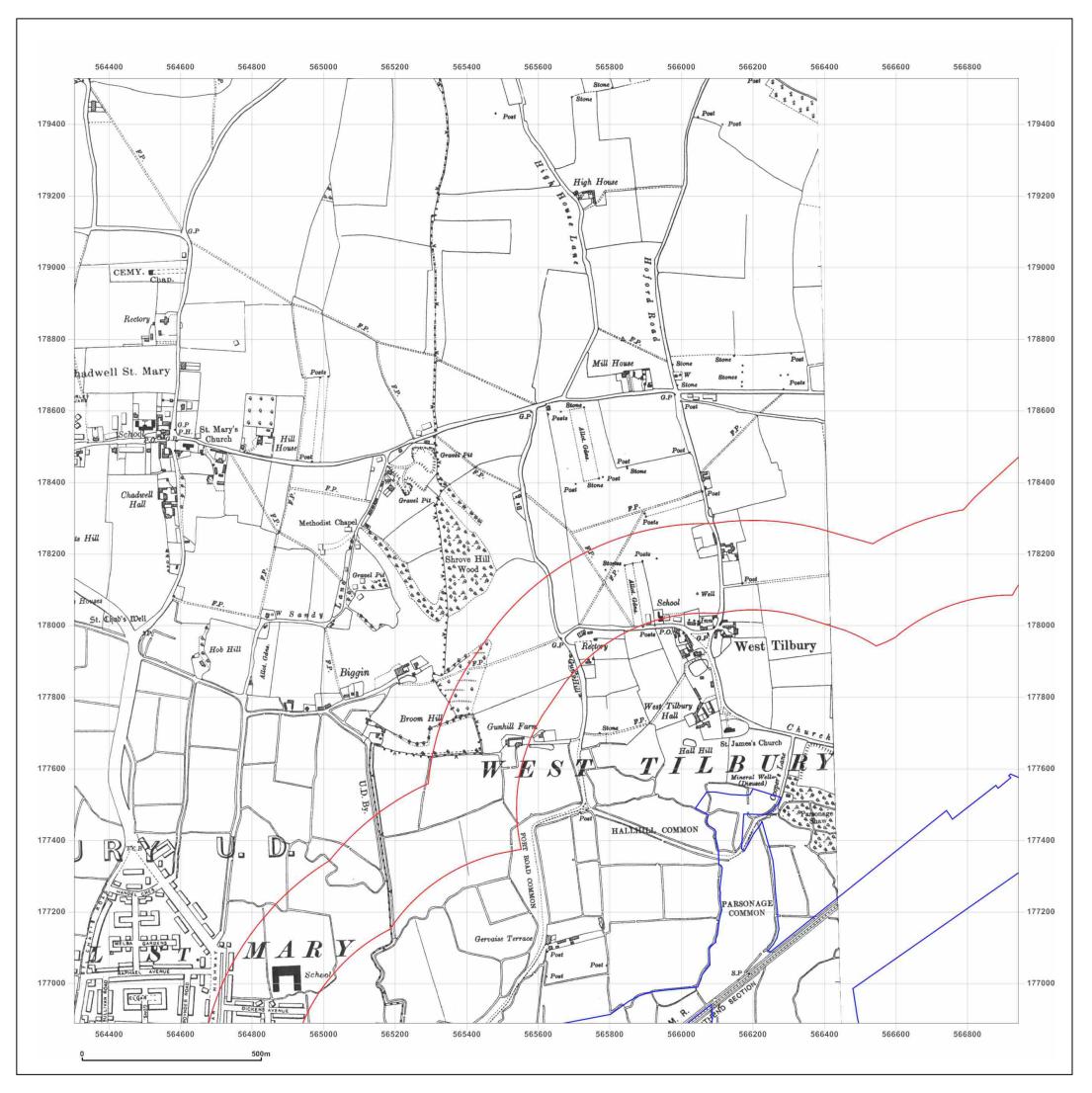




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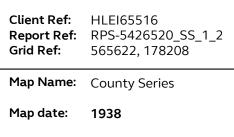
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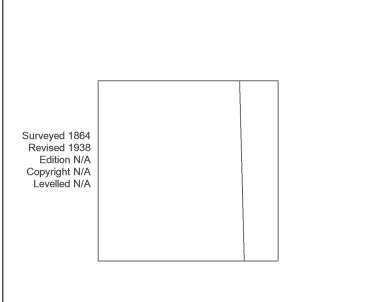
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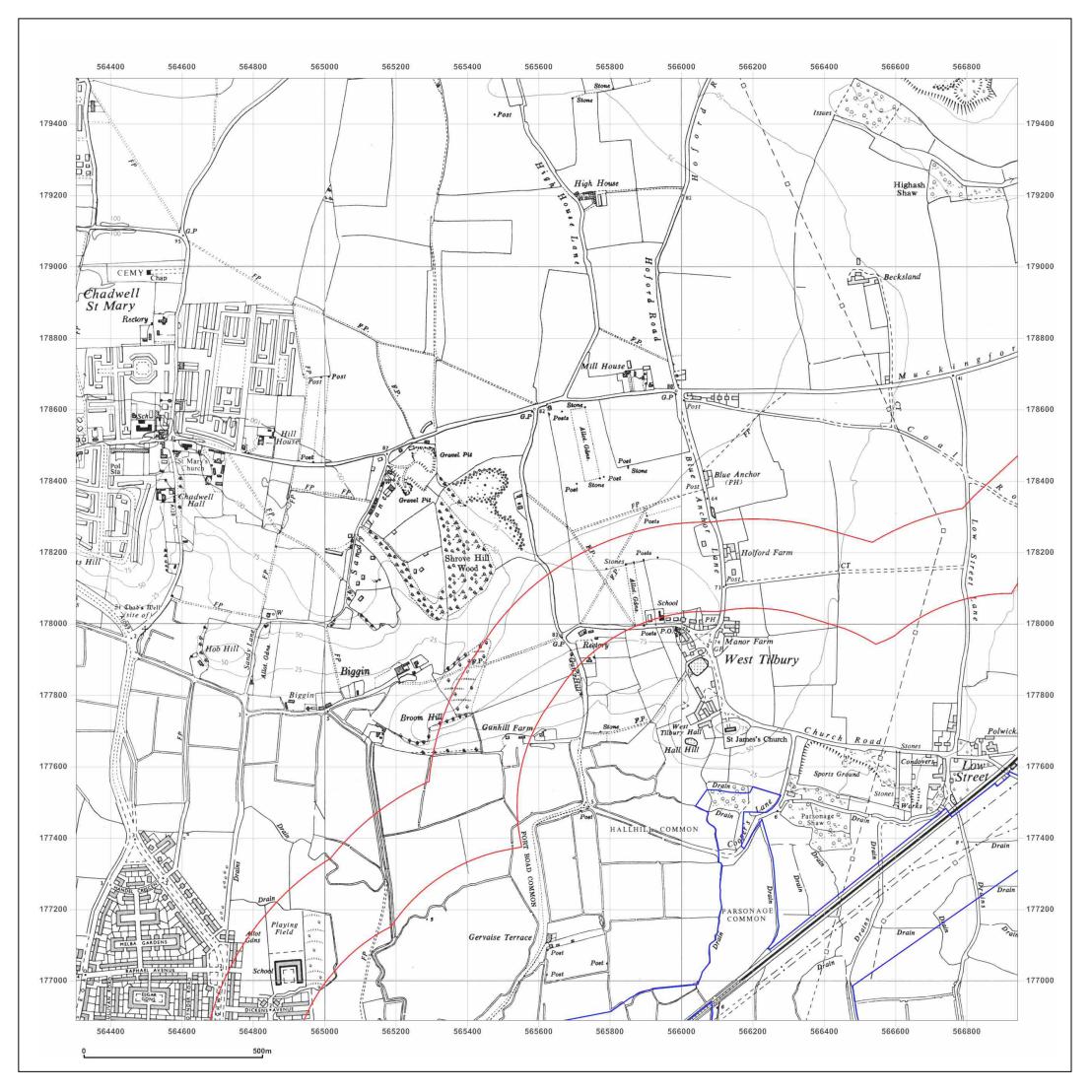




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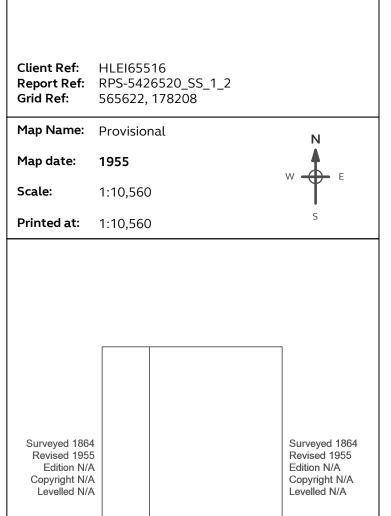
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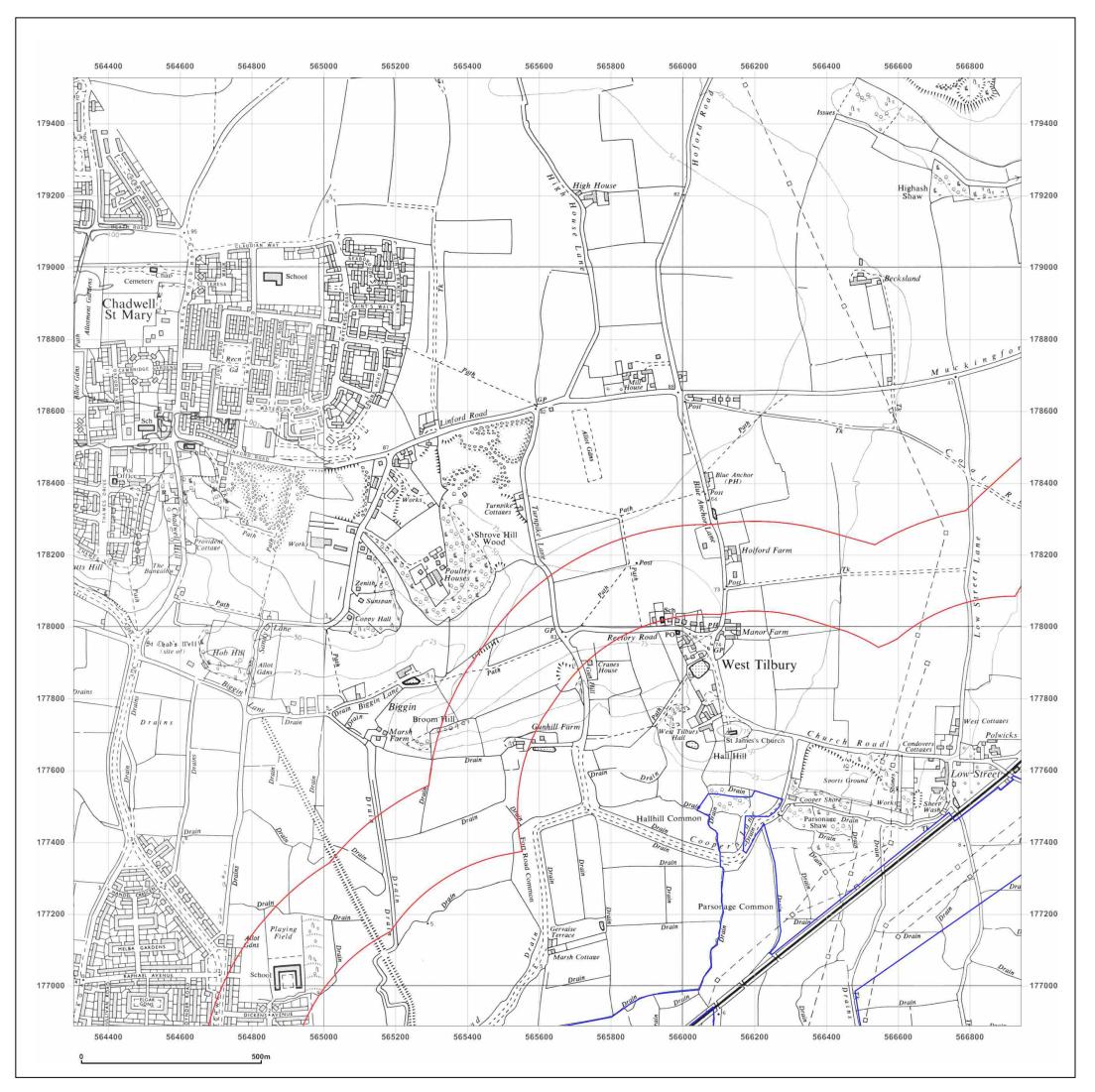




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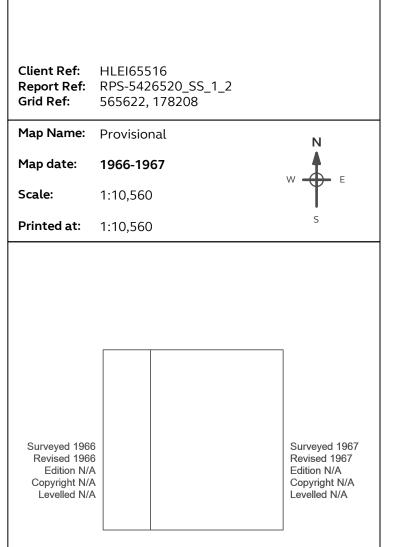
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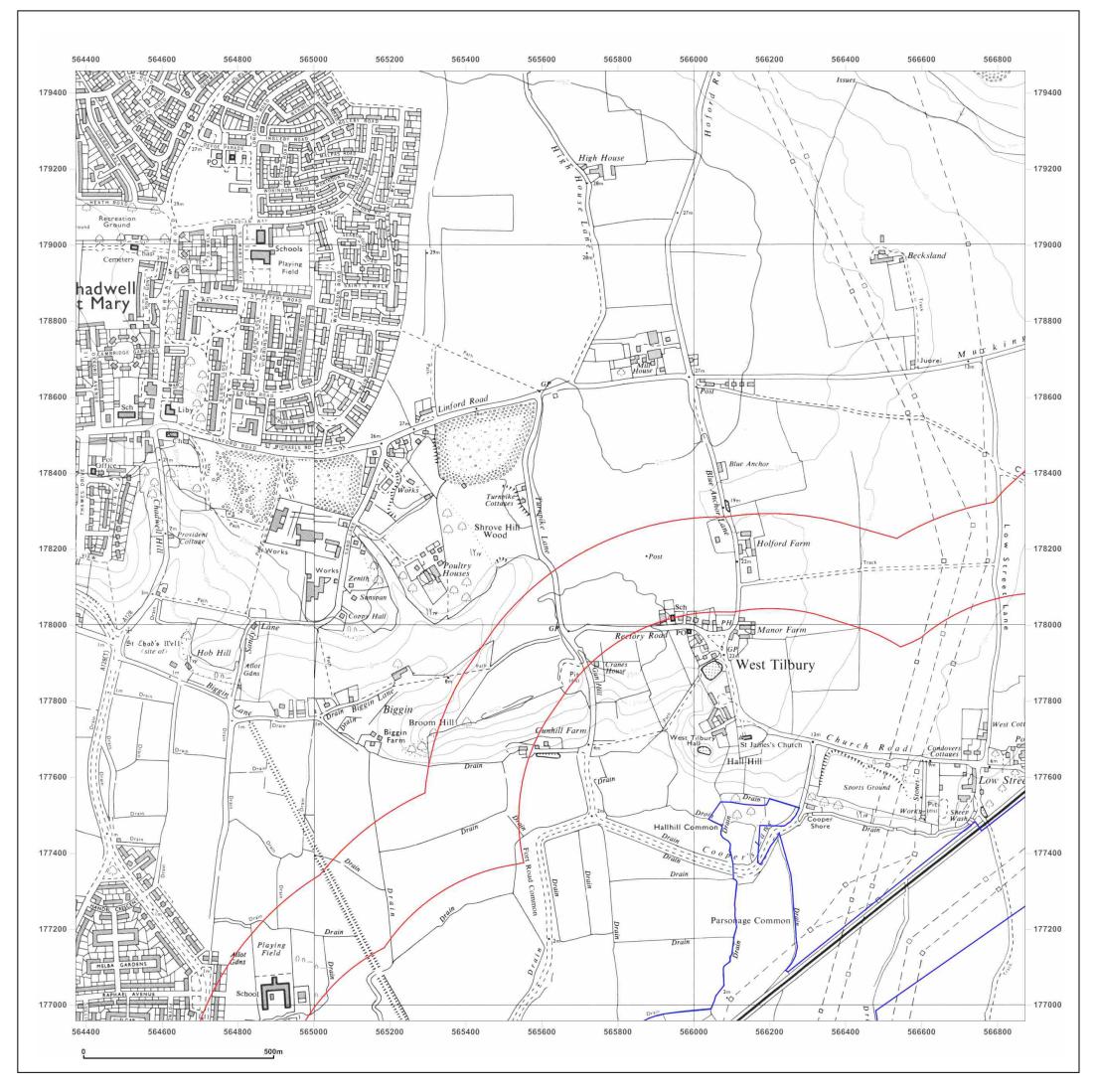




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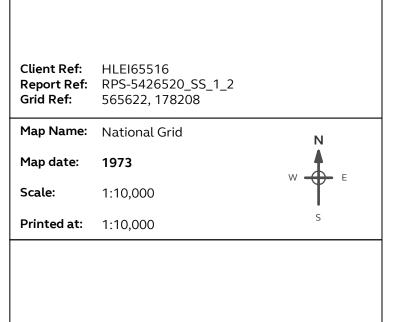
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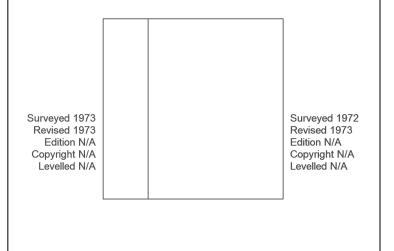
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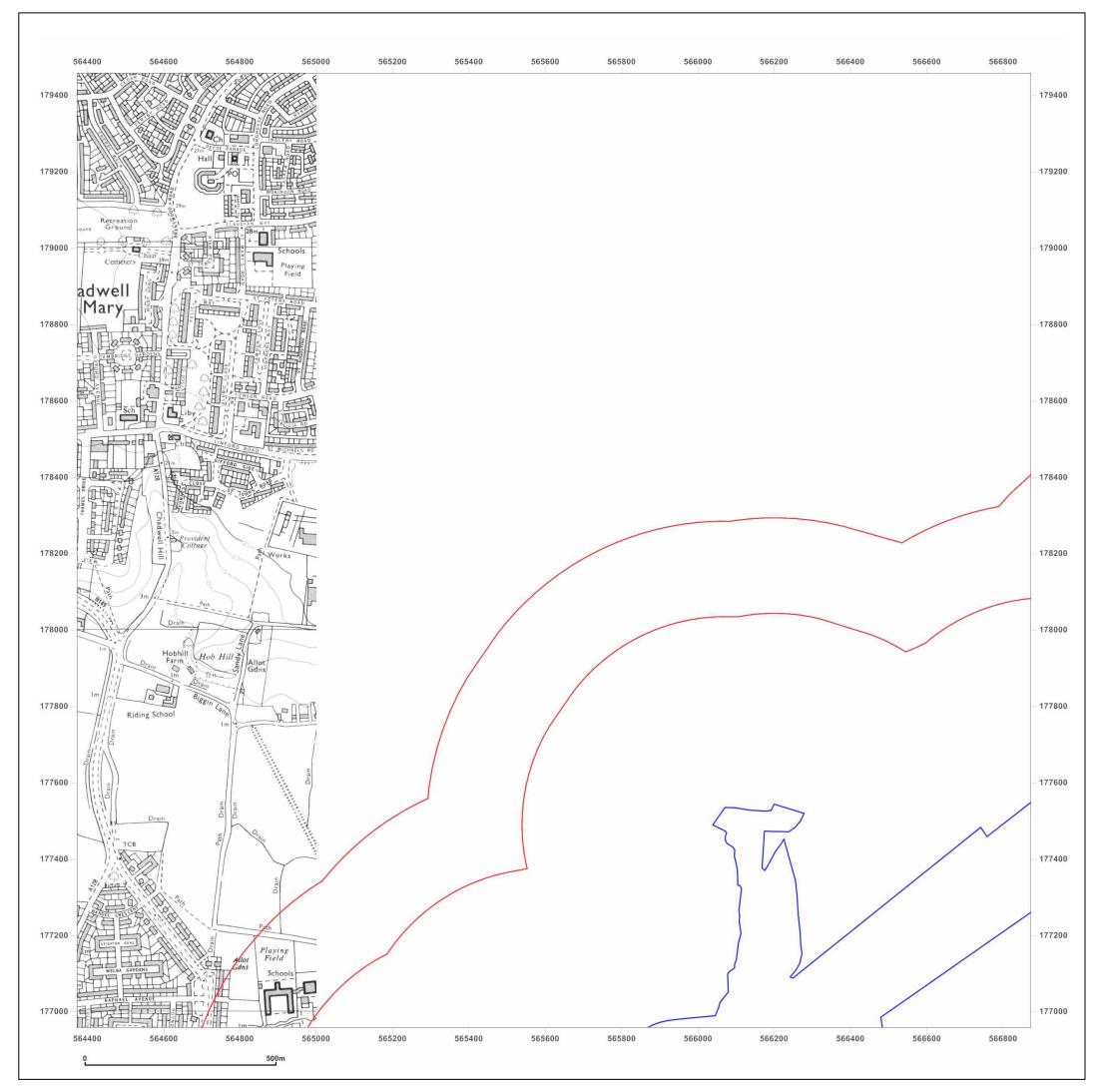




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Site Details:

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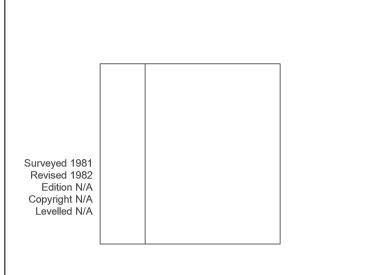


Map Name: National Grid

Map date: 1982

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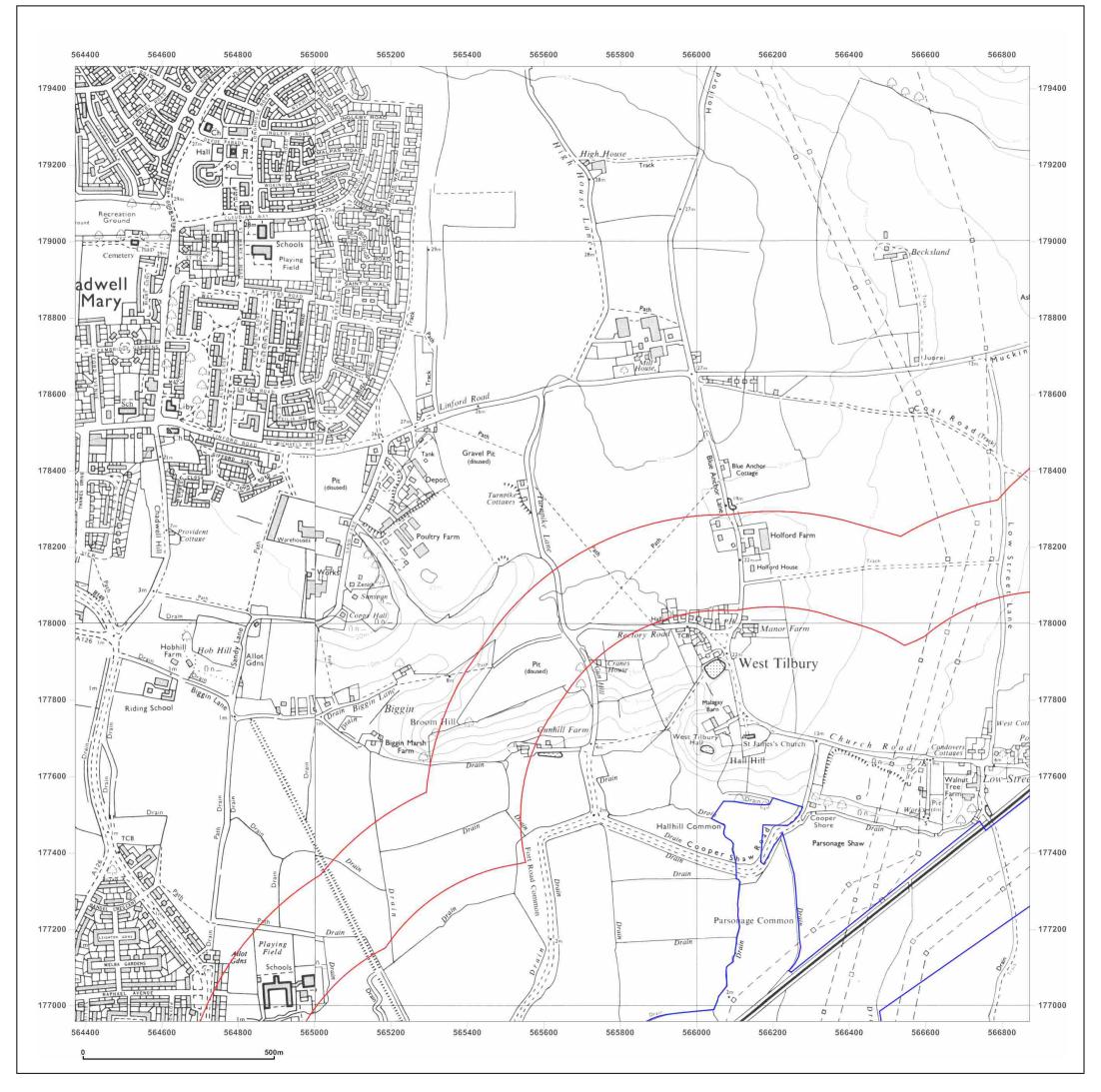




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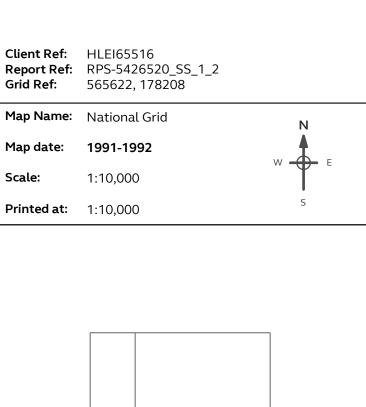
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Production date: 13 September 2018





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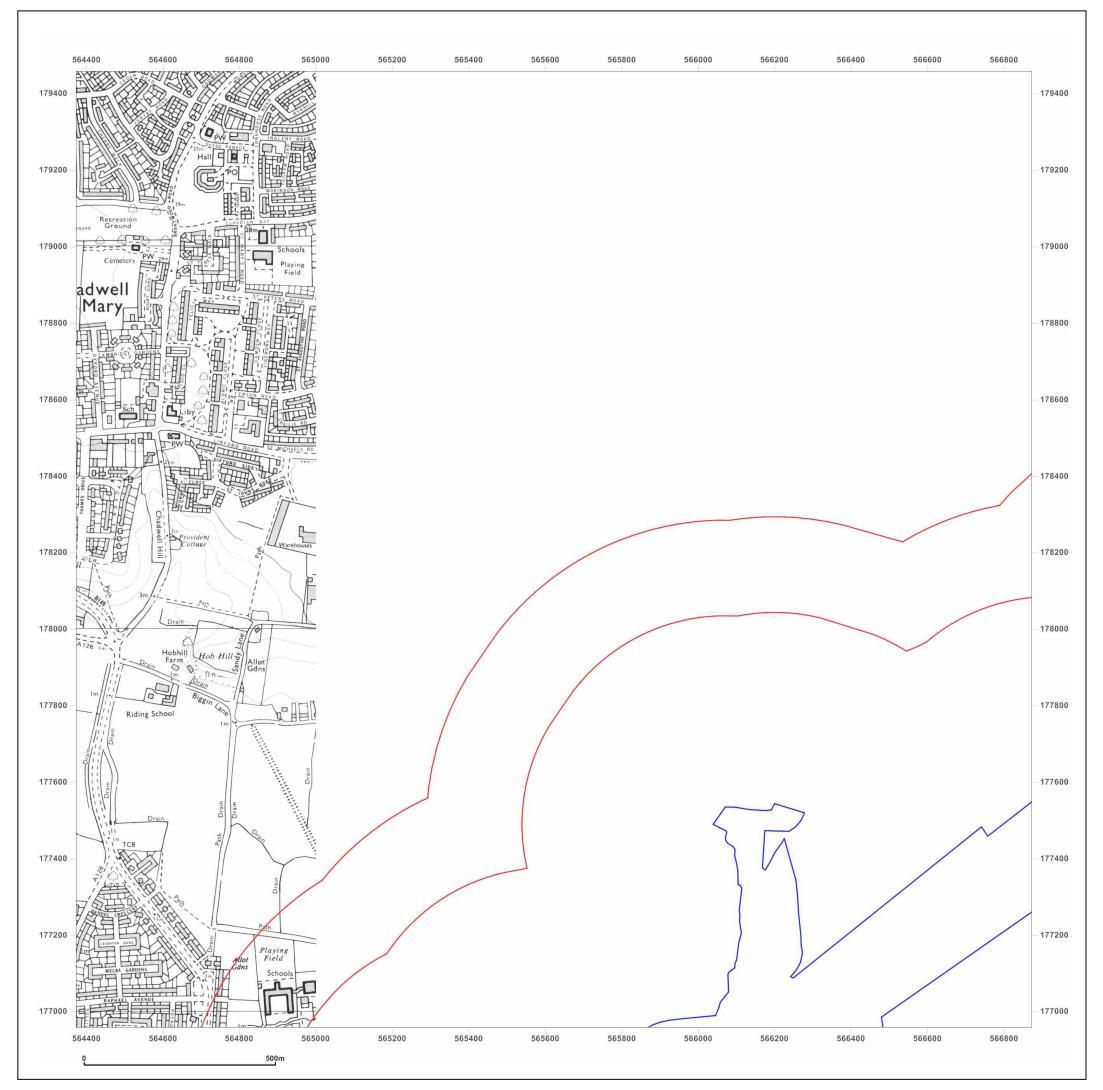
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THURROCK FGP, TILBURY

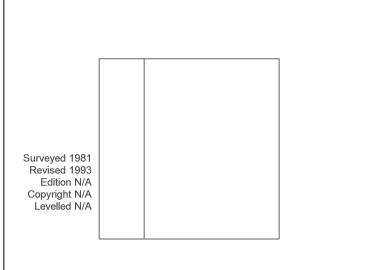


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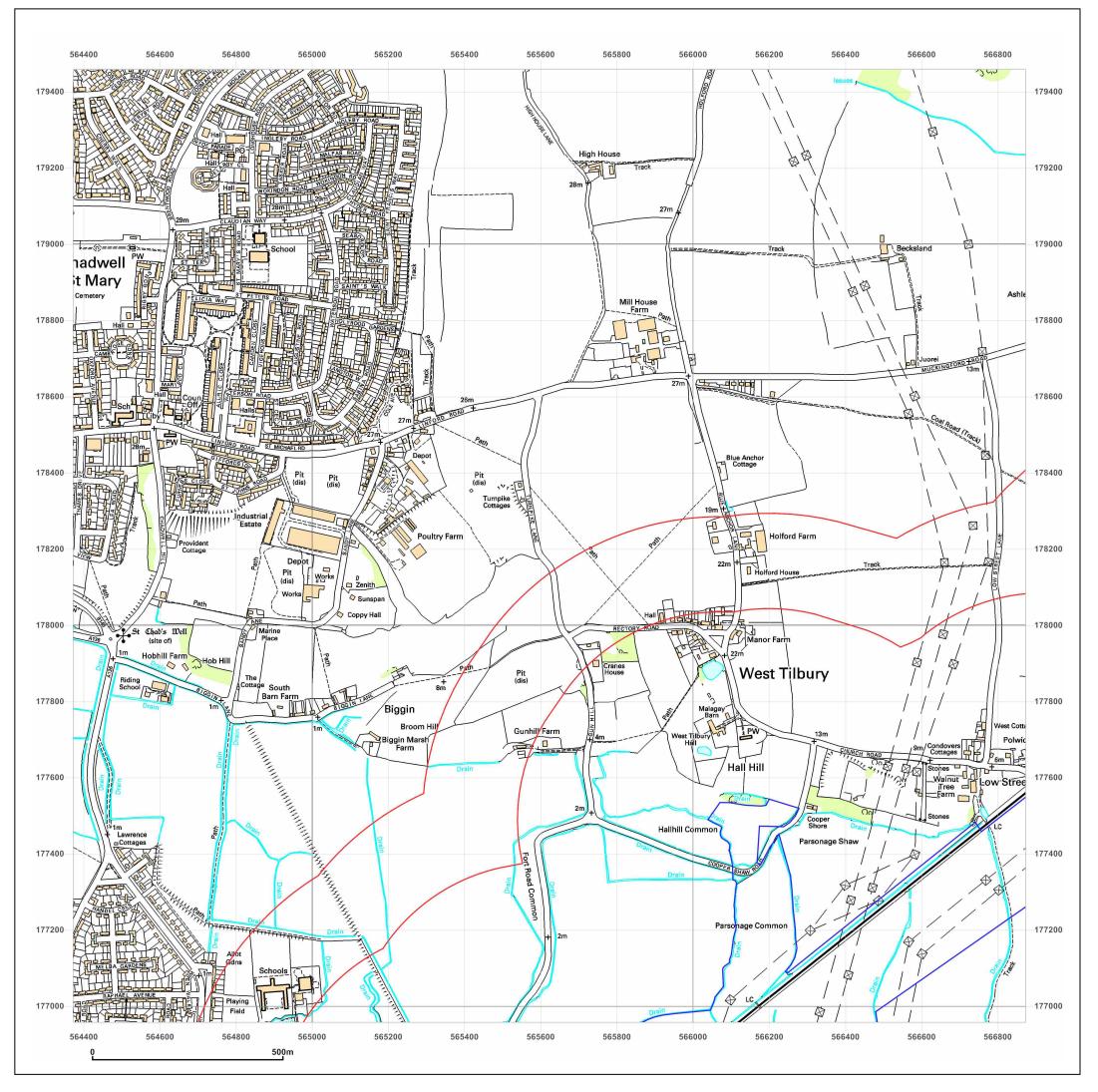


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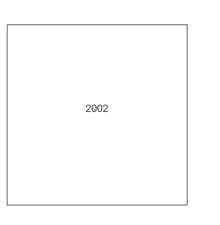




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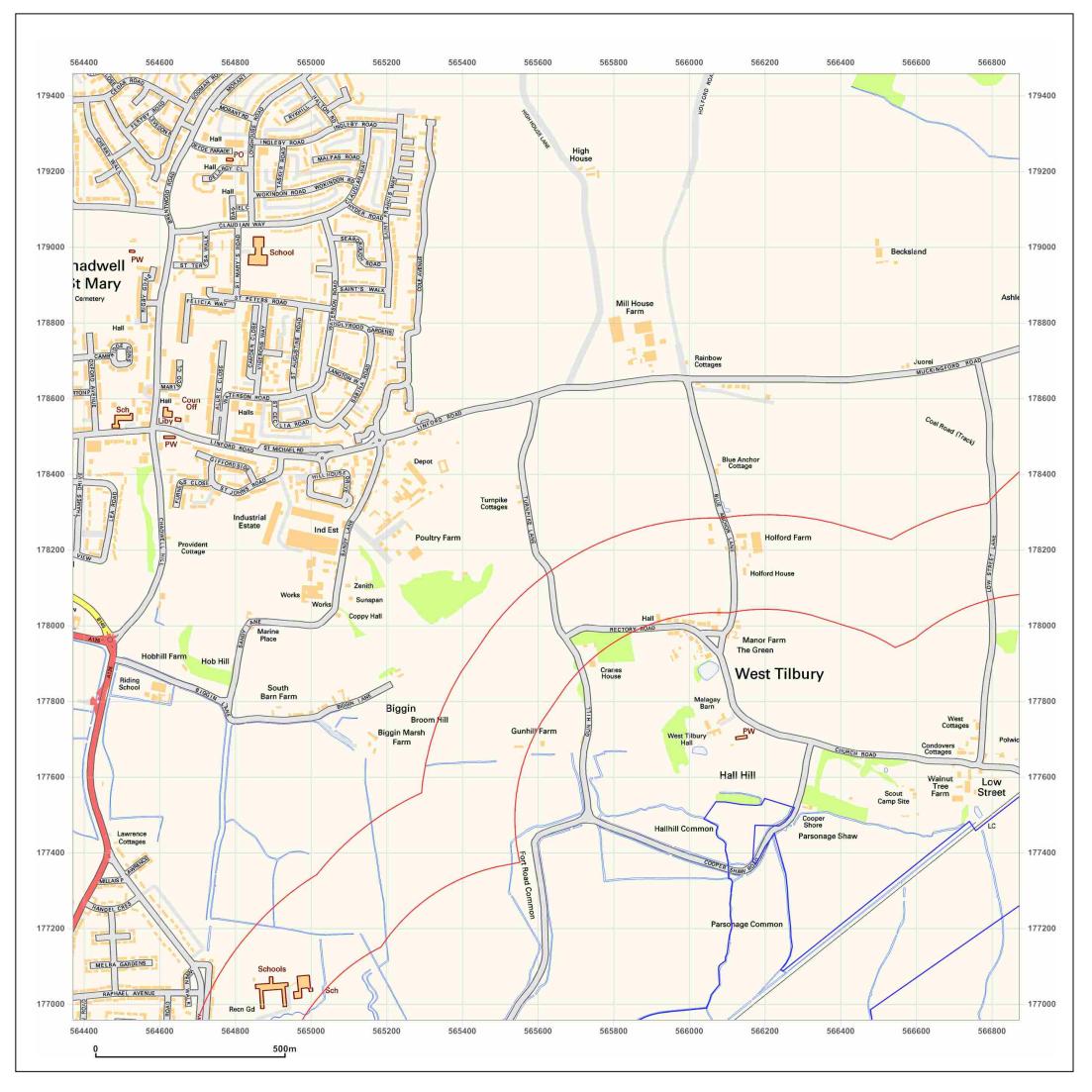
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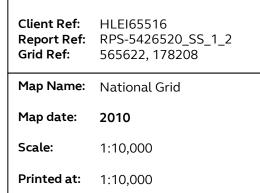
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Production date: 13 September 2018





THURROCK FGP, TILBURY





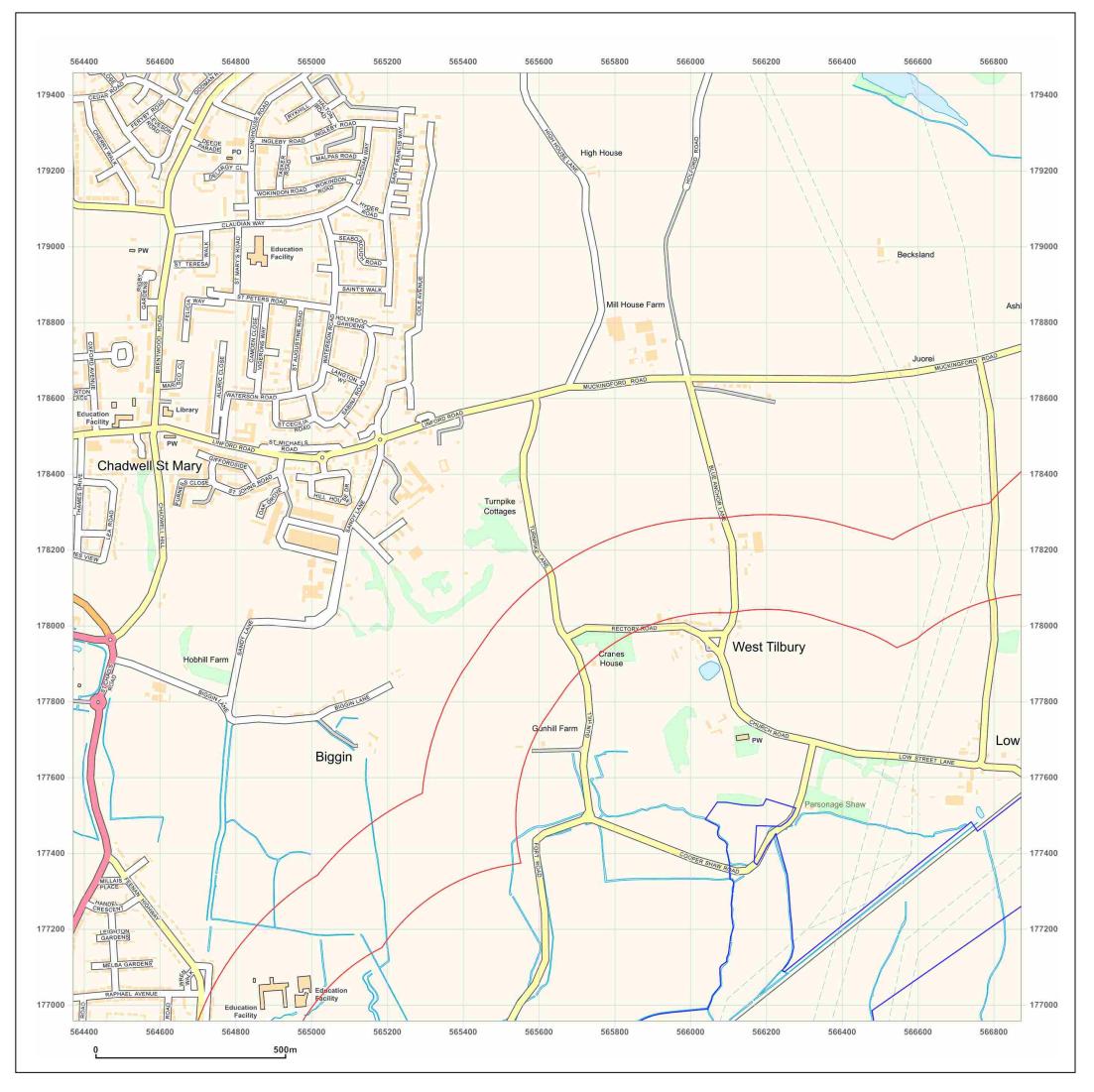
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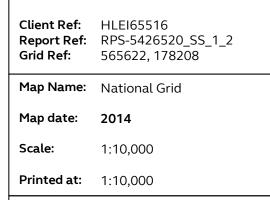
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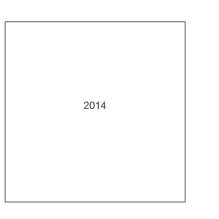
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THURROCK FGP, TILBURY





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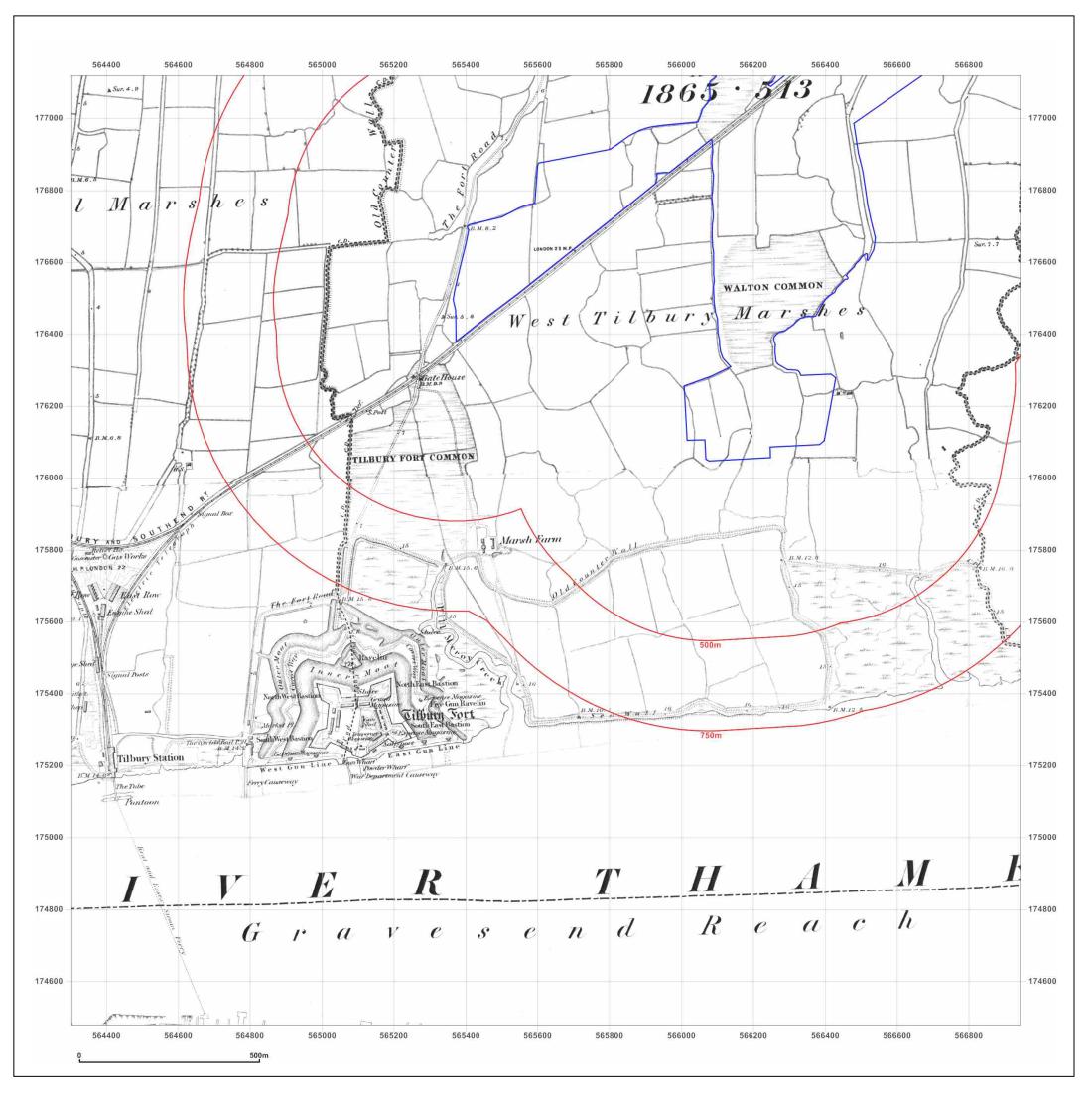
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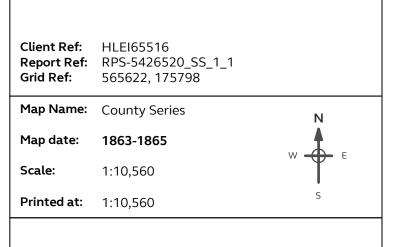
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THURROCK FGP, TILBURY



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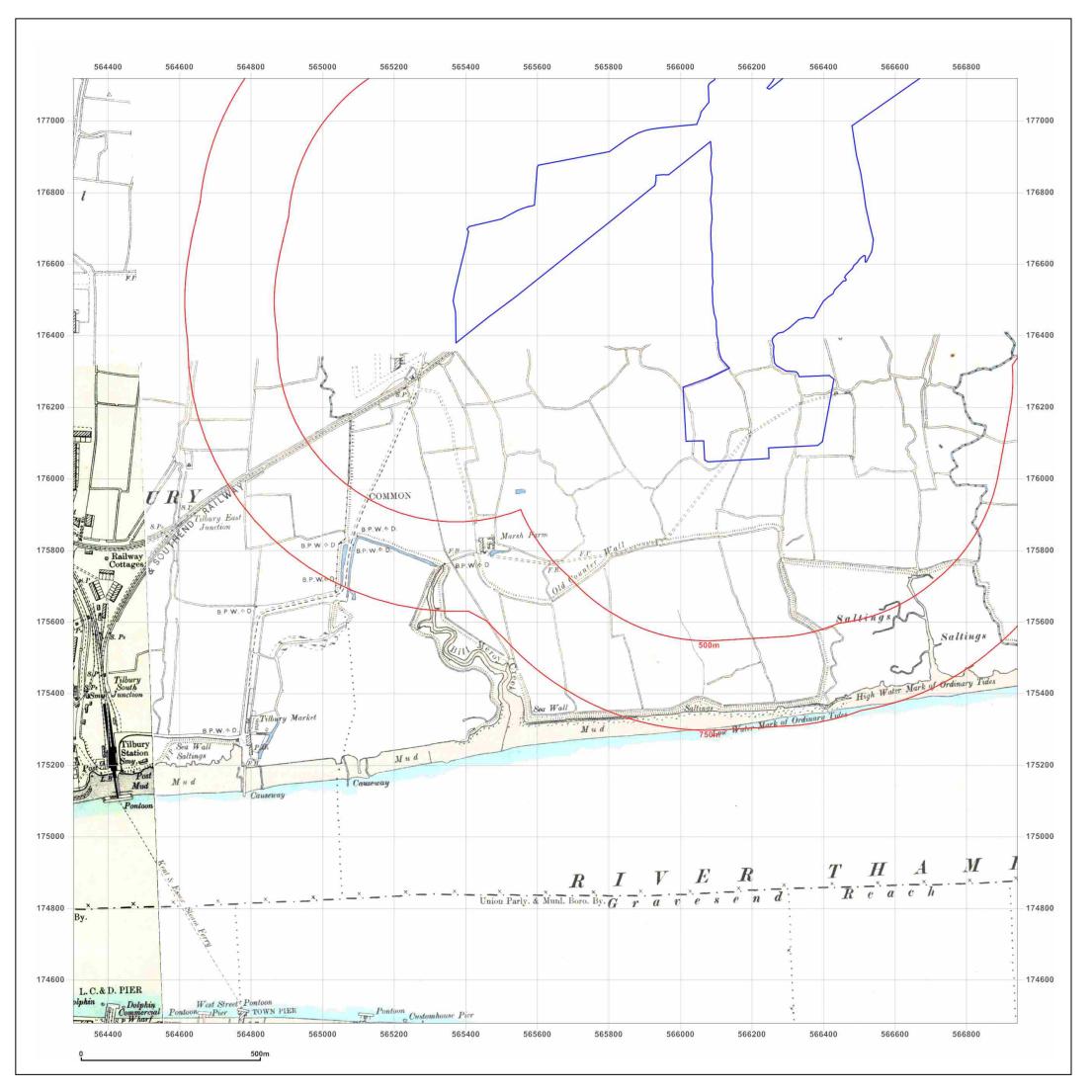
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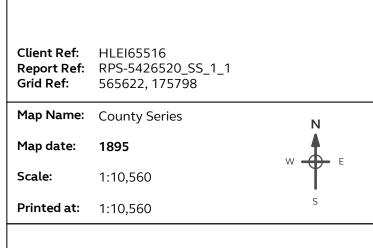
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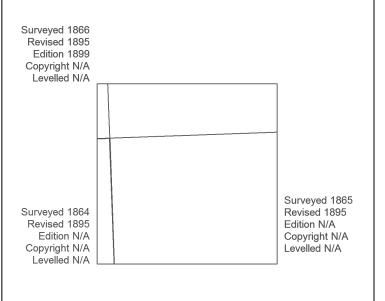
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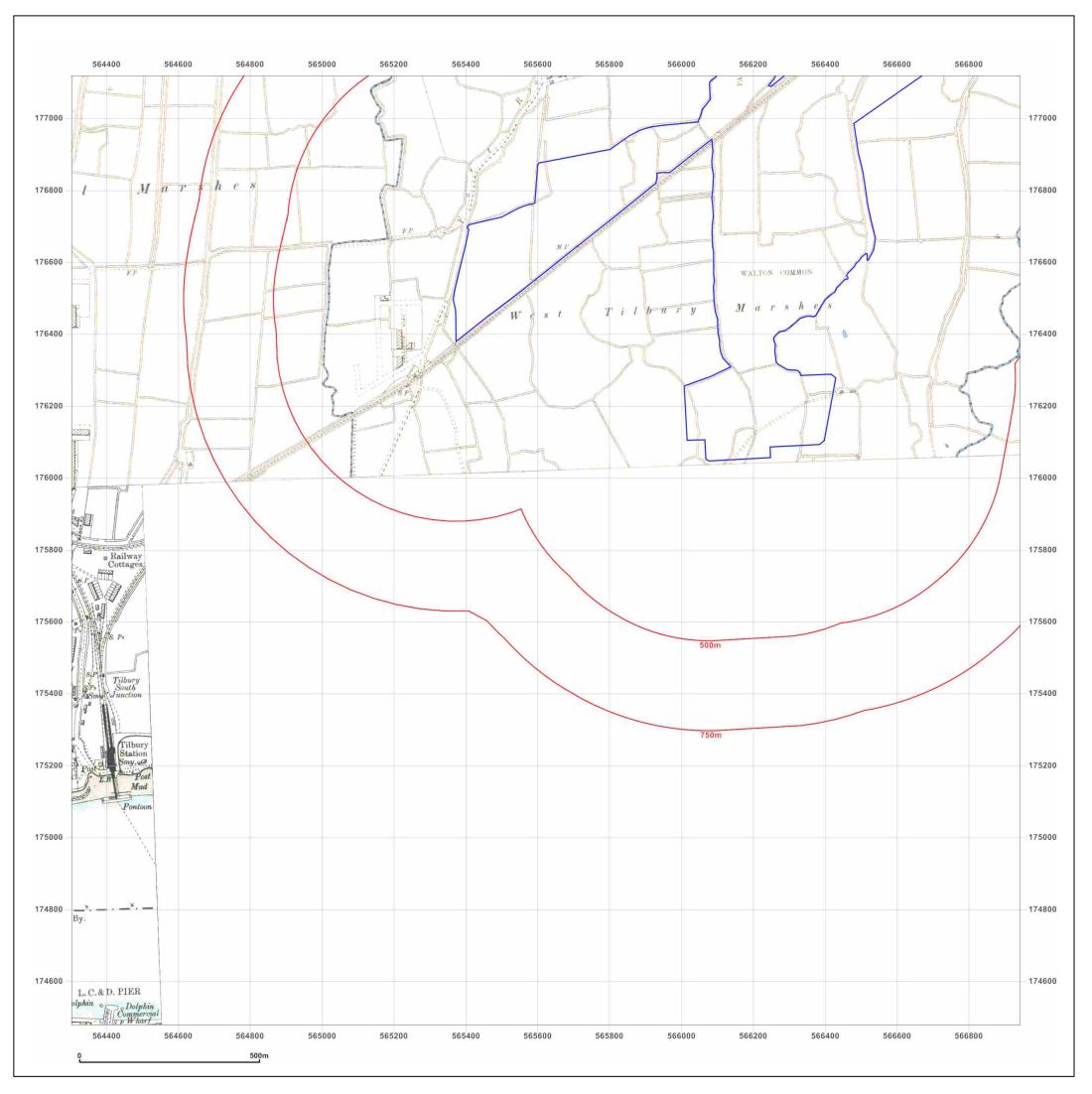




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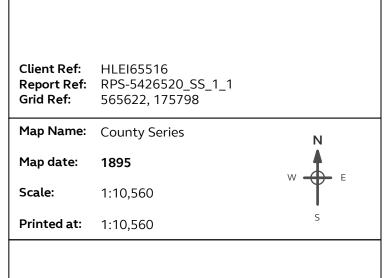
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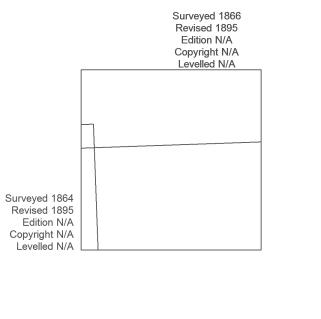
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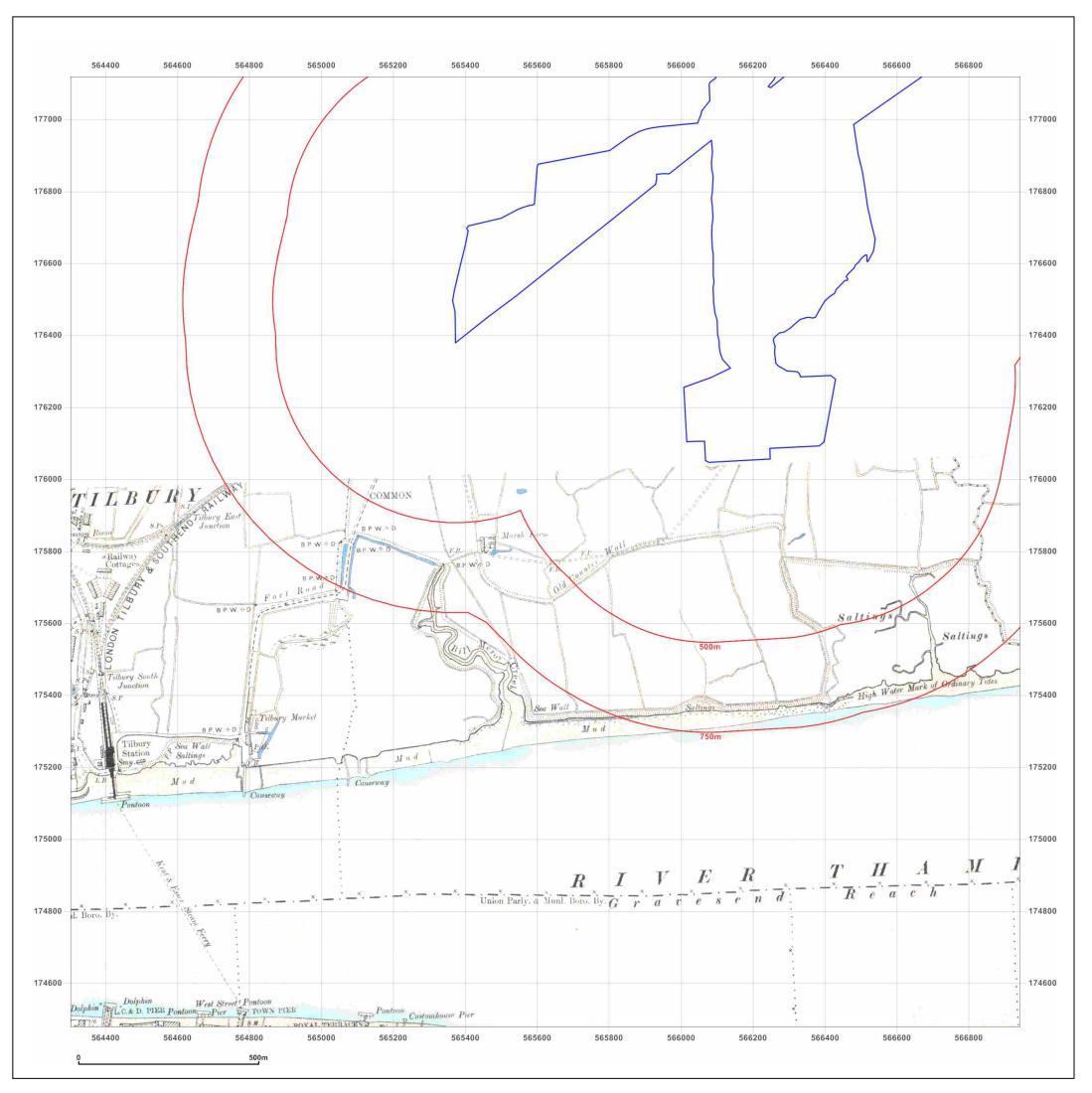




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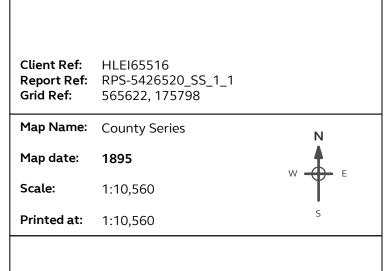
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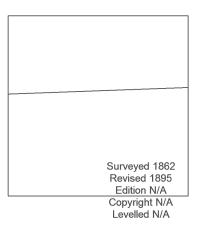
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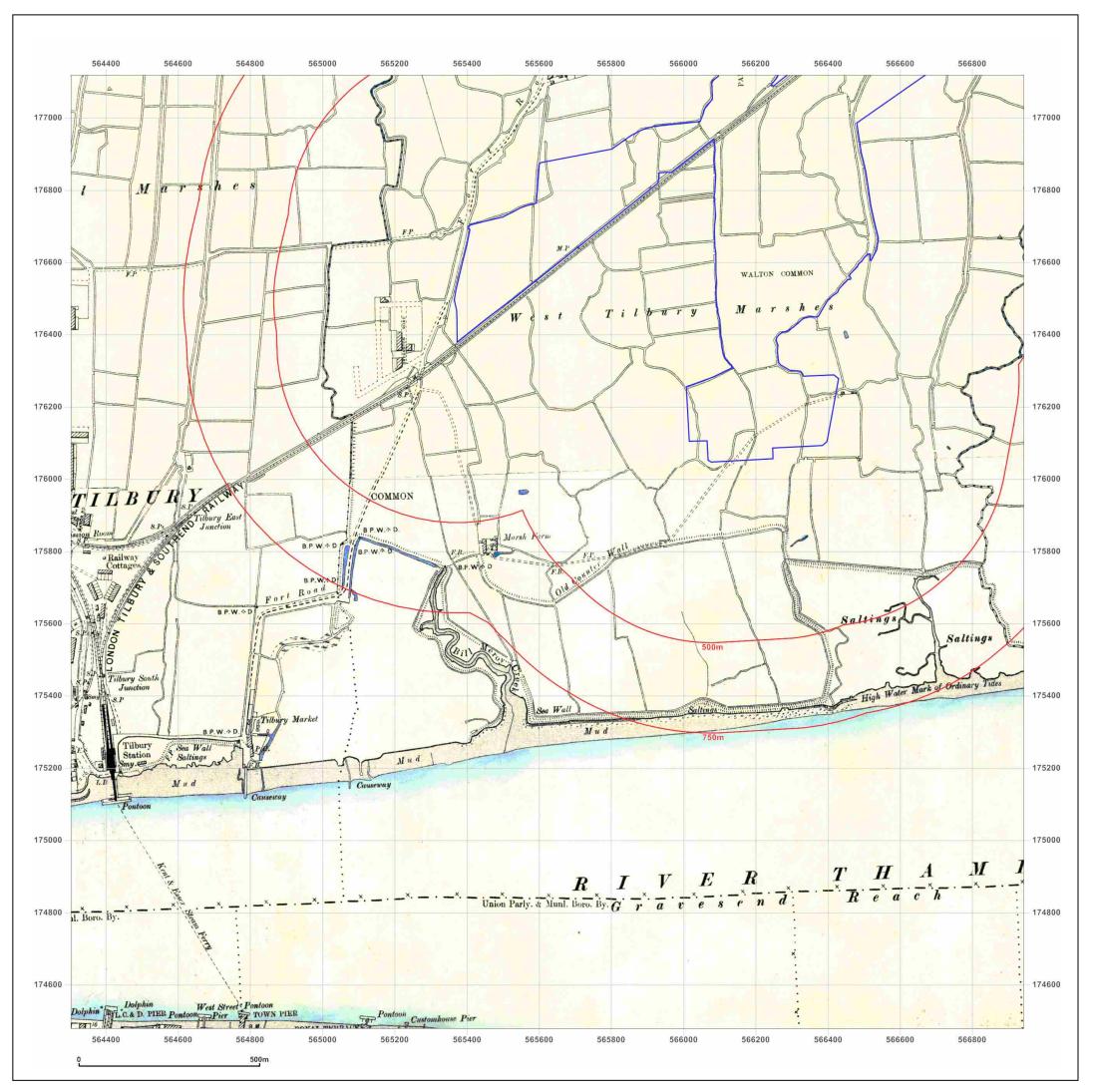




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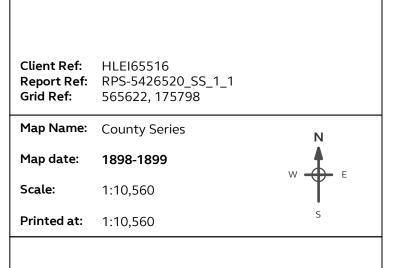
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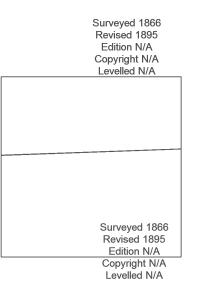
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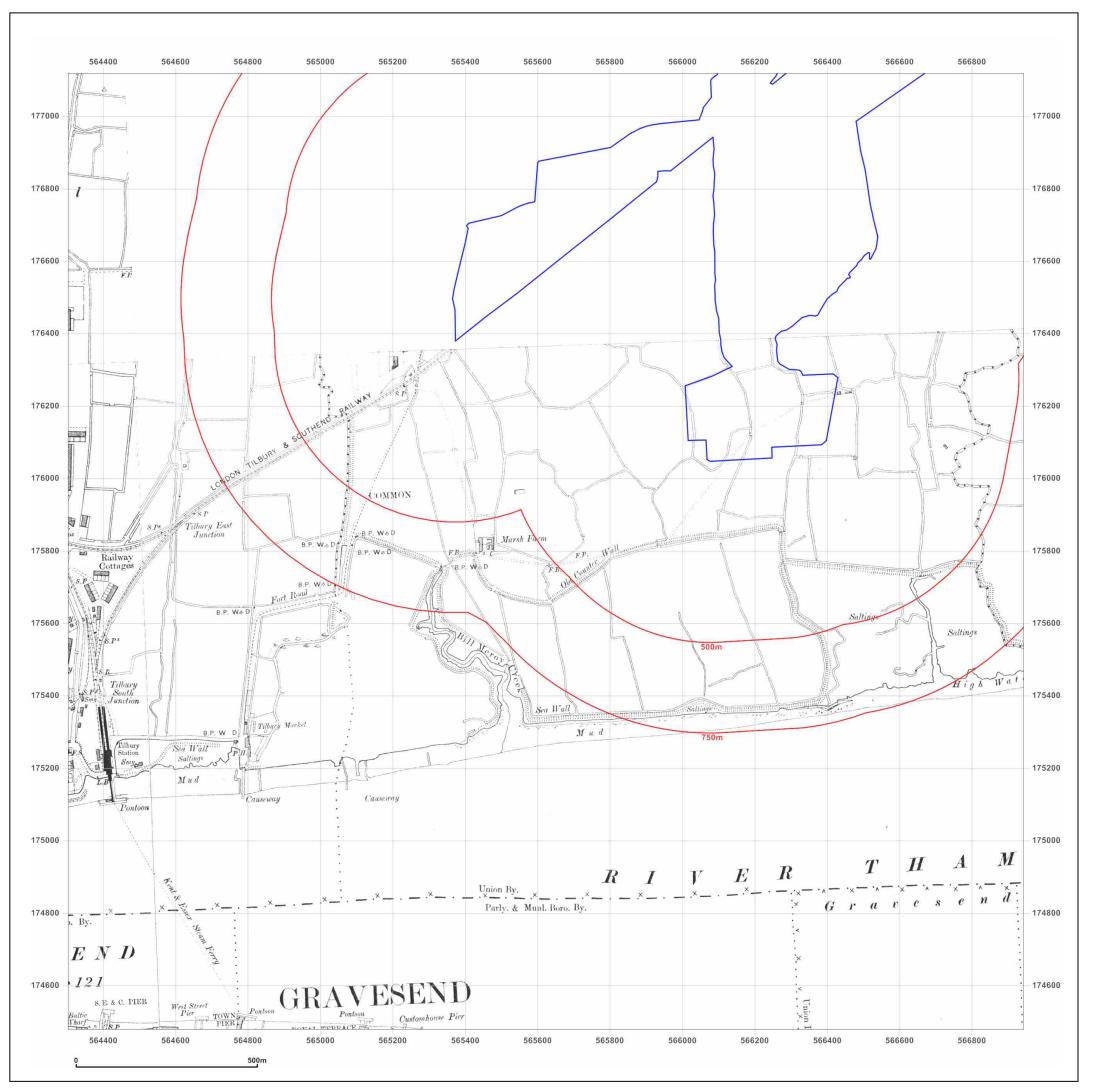




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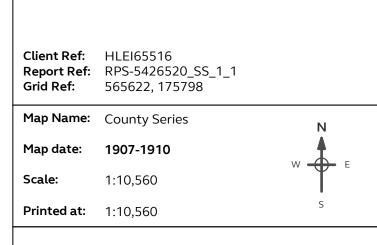
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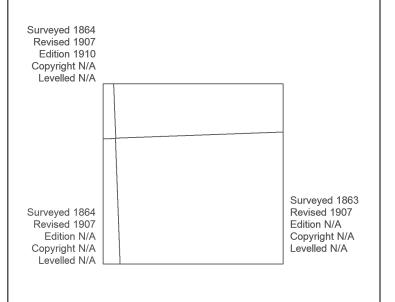
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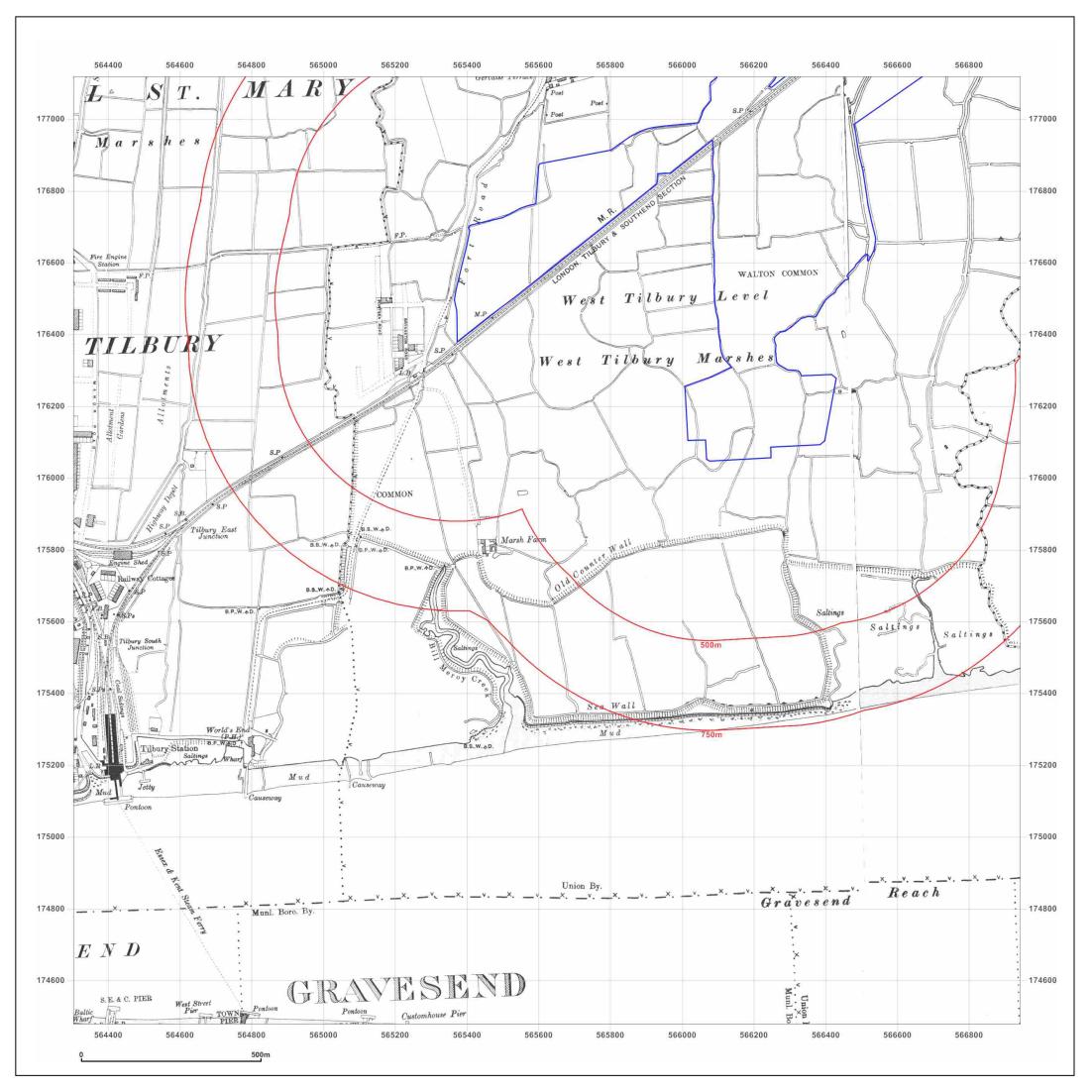




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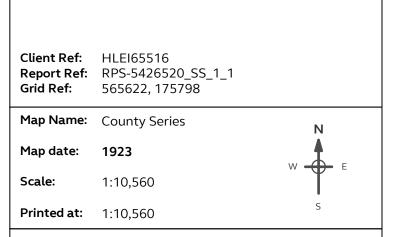
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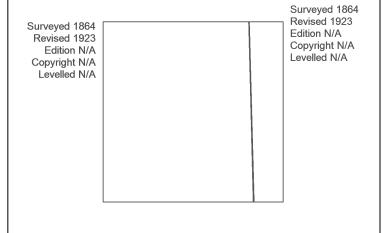
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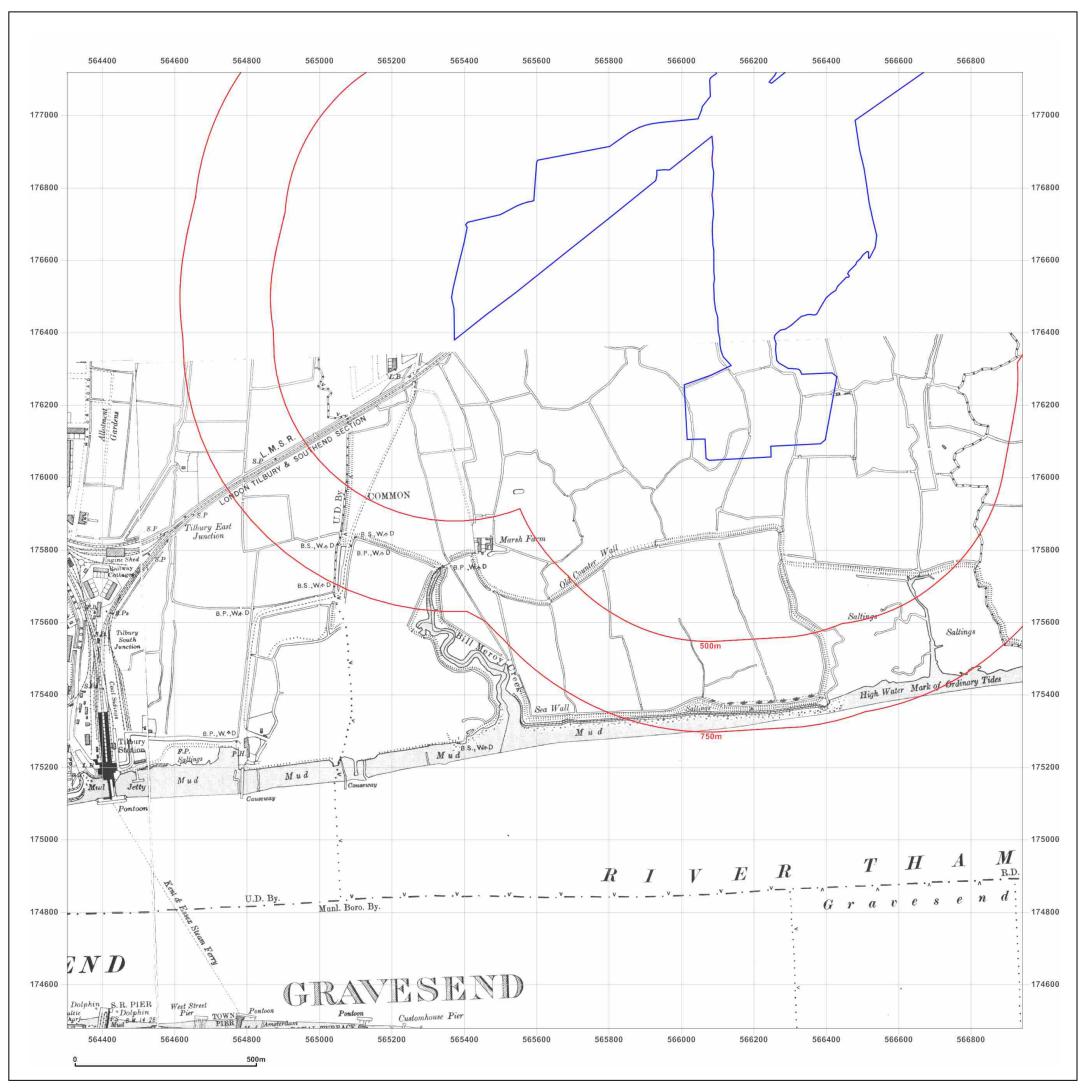




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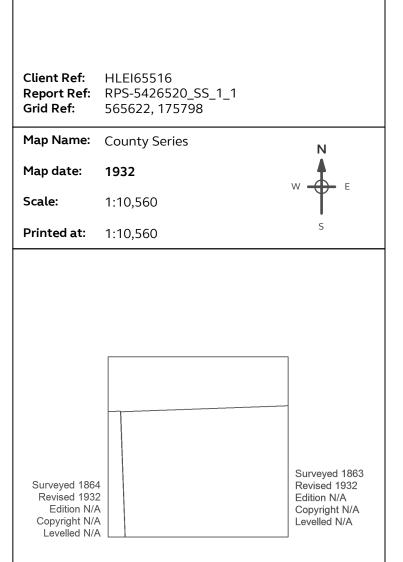
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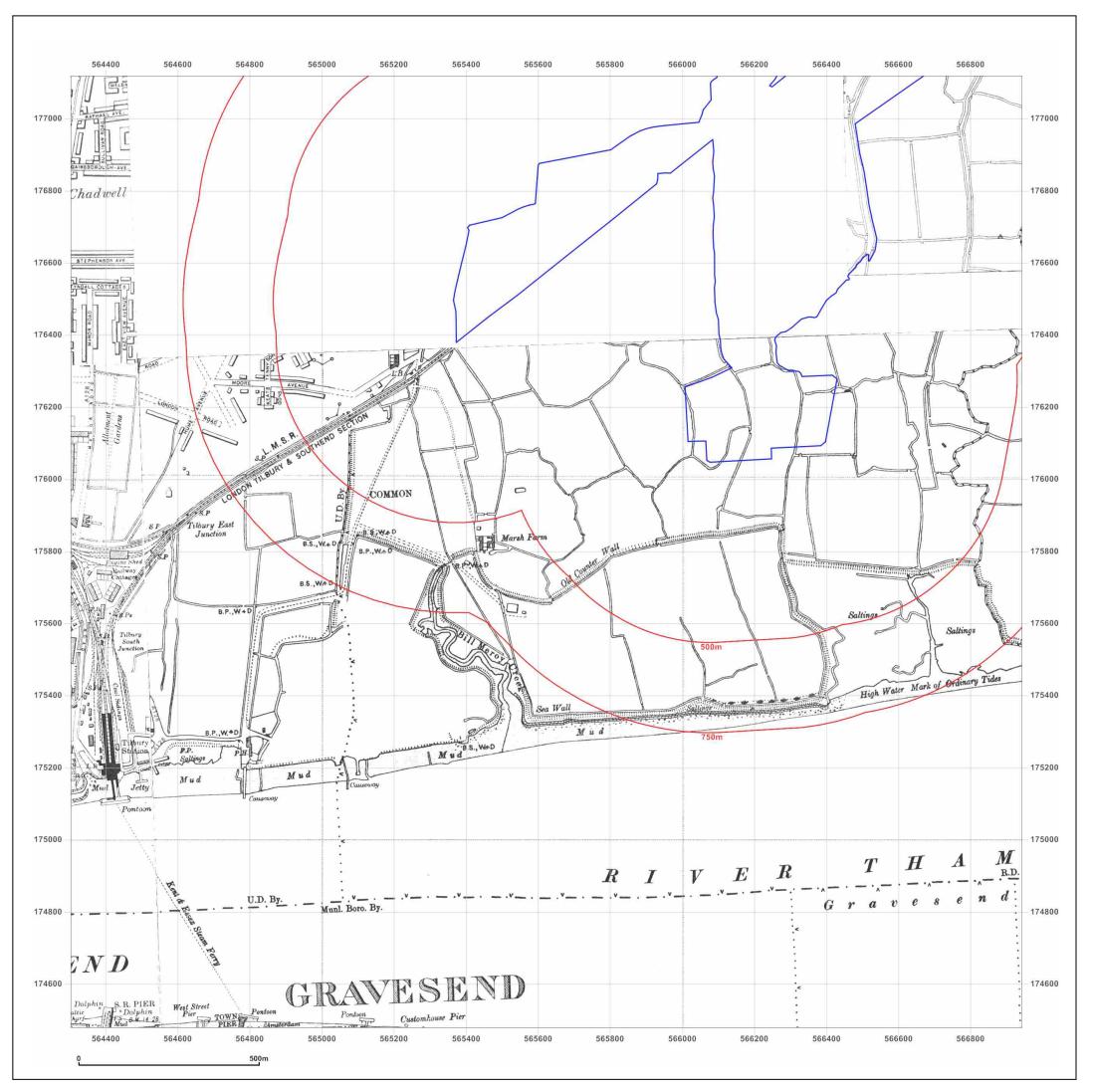




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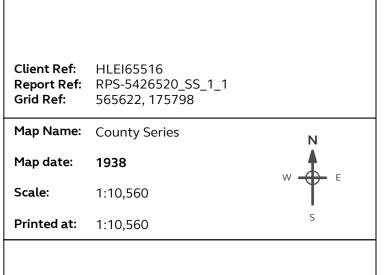
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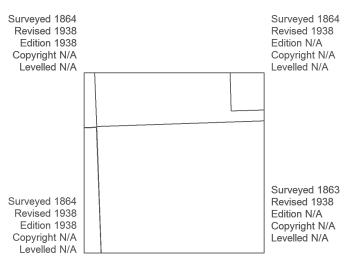
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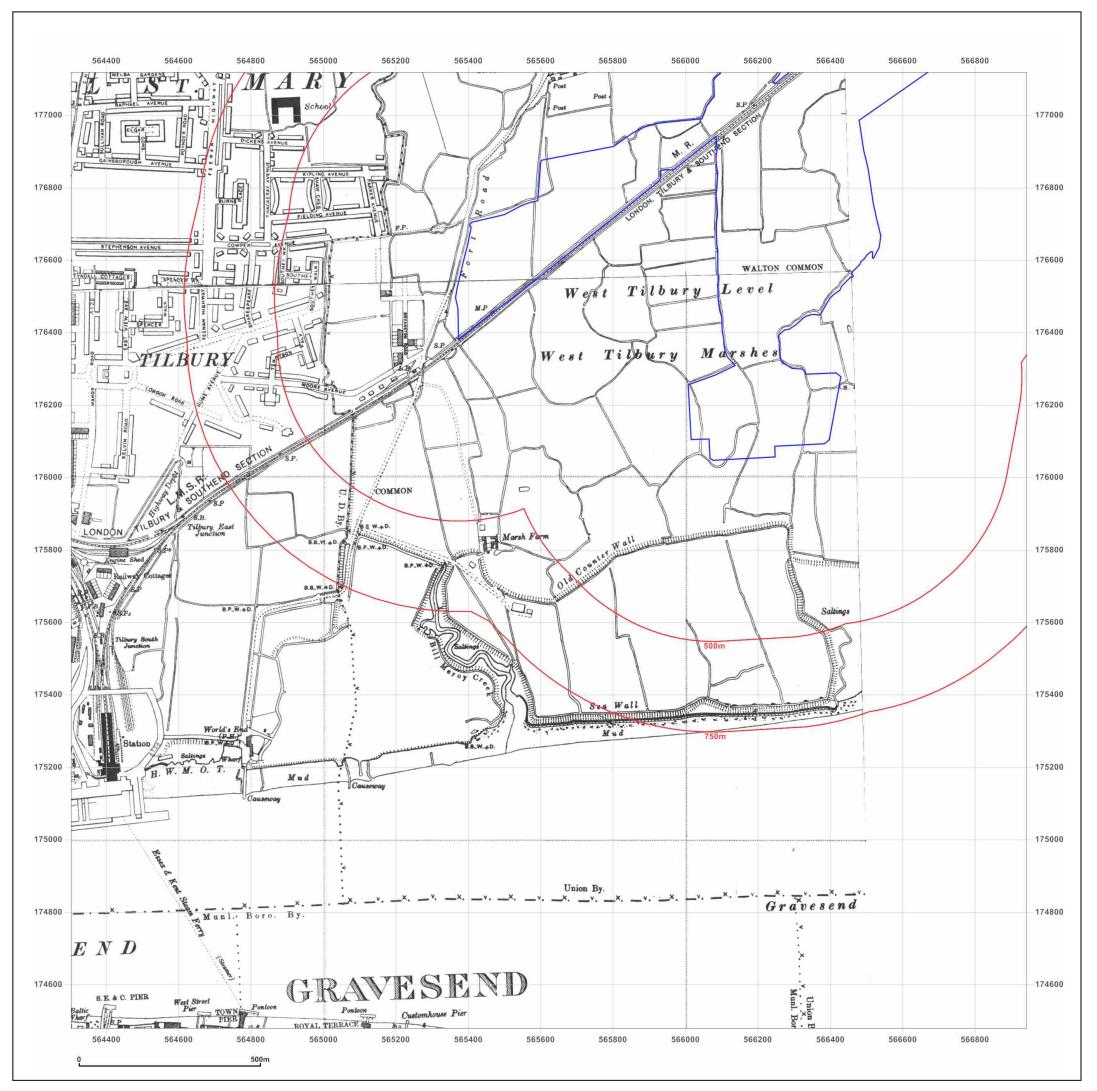




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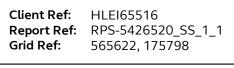
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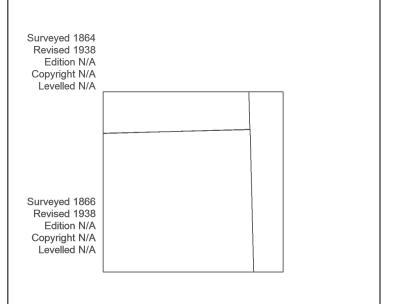


Map Name: County Series

1938 Map date:

Scale: 1:10,560

Printed at: 1:10,560



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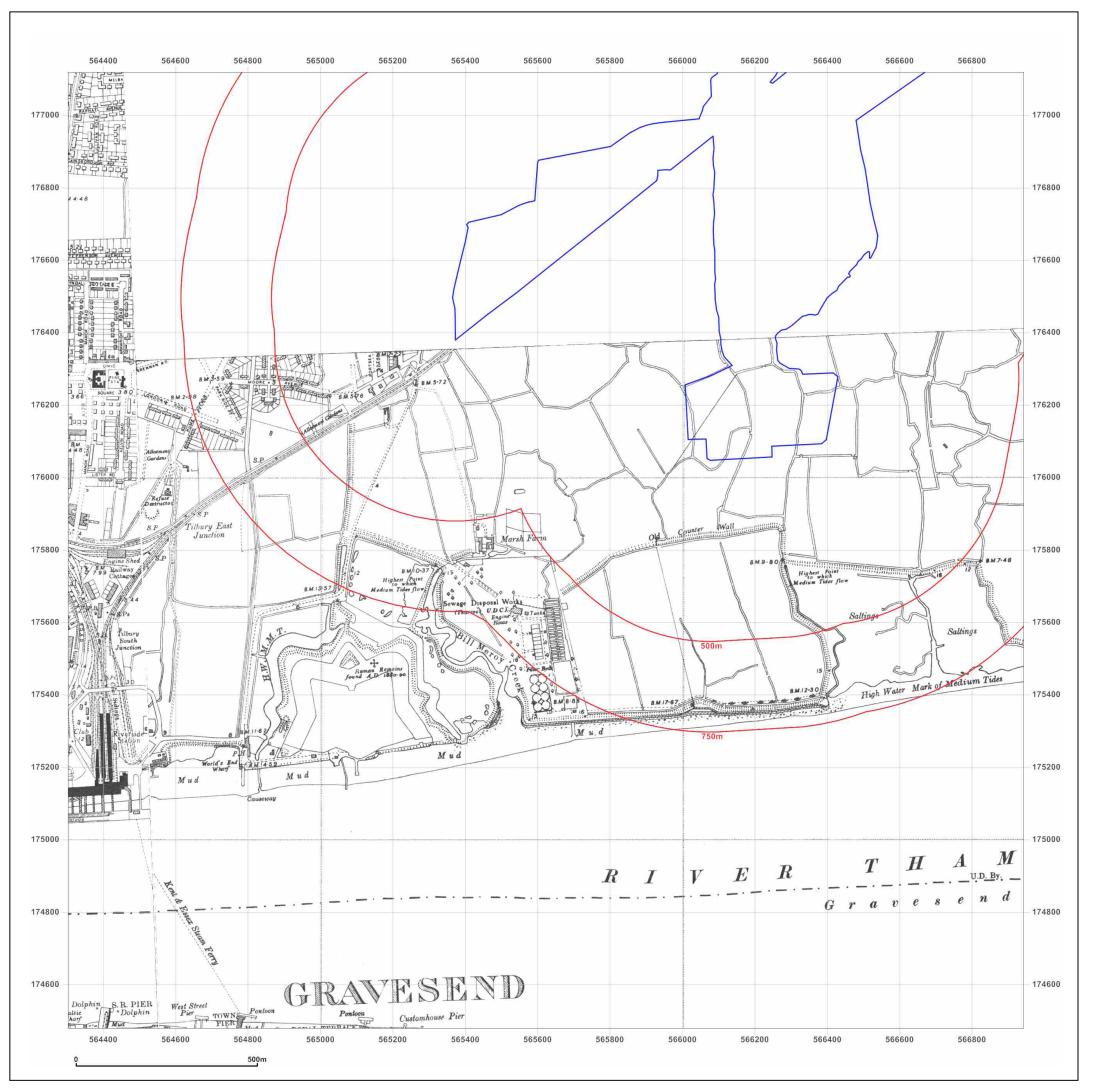
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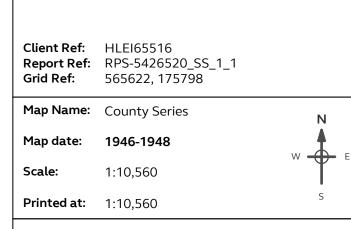
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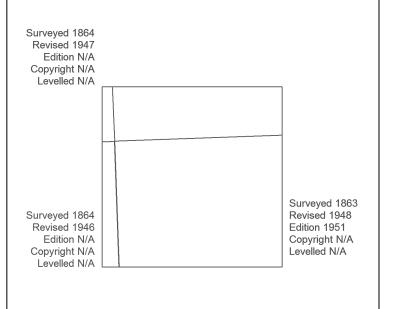
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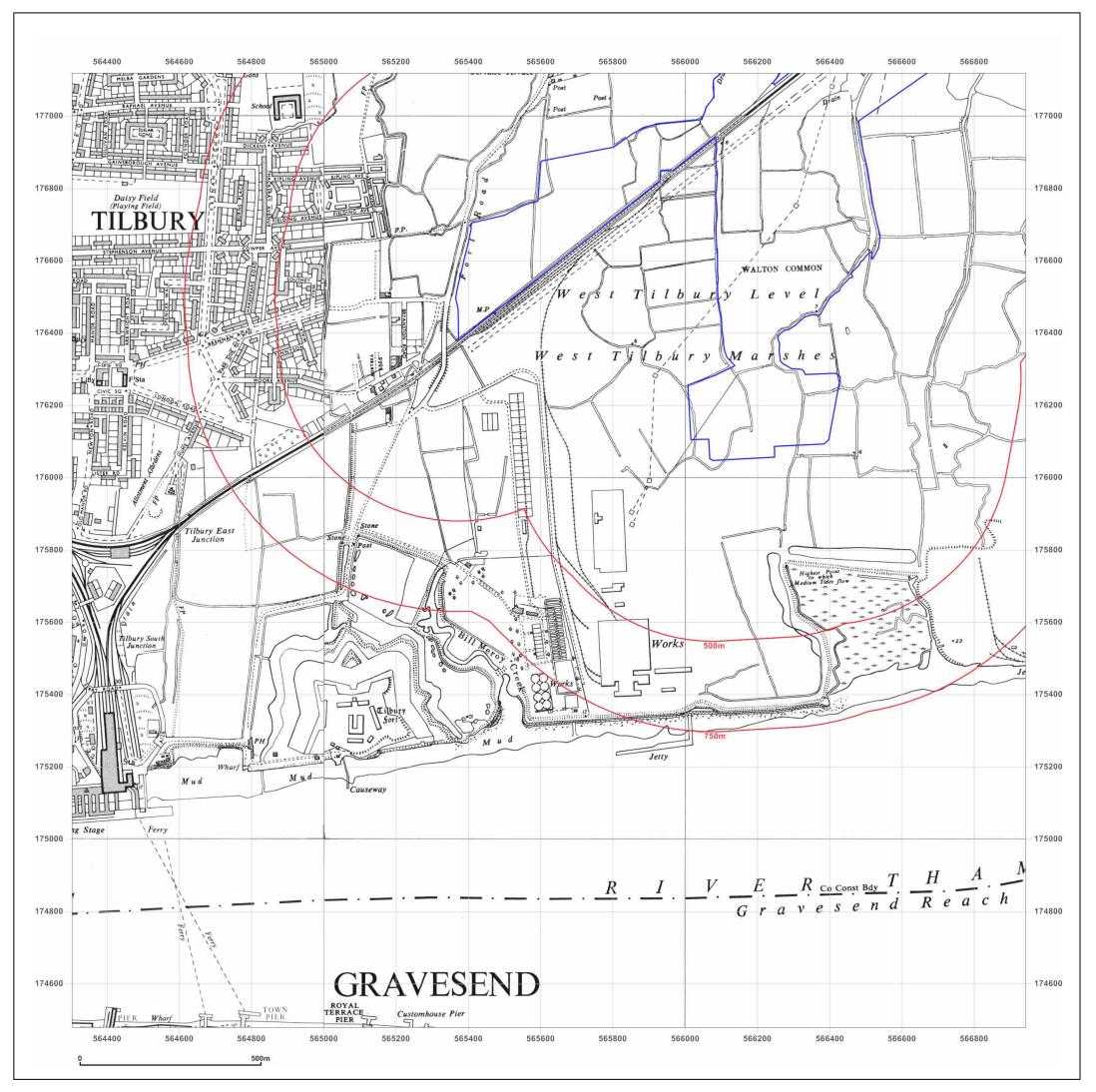




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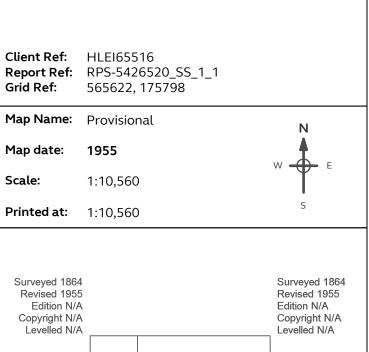


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Site Details:

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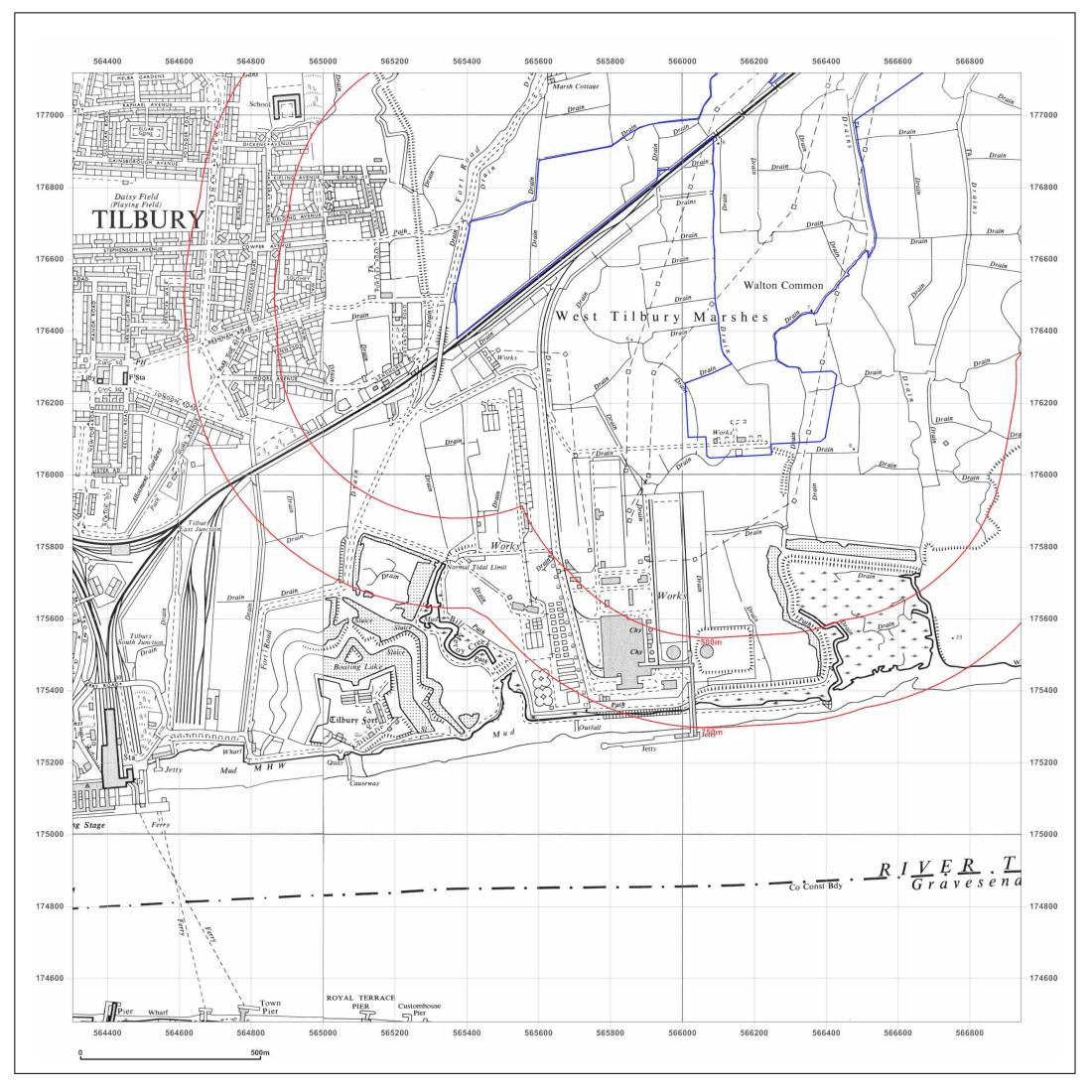


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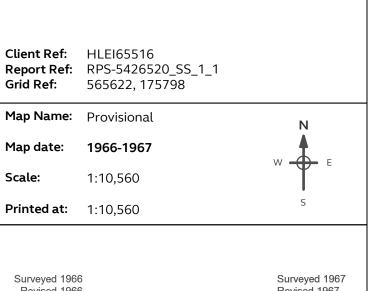
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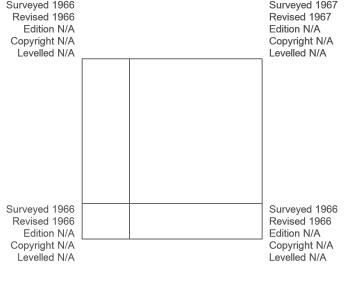
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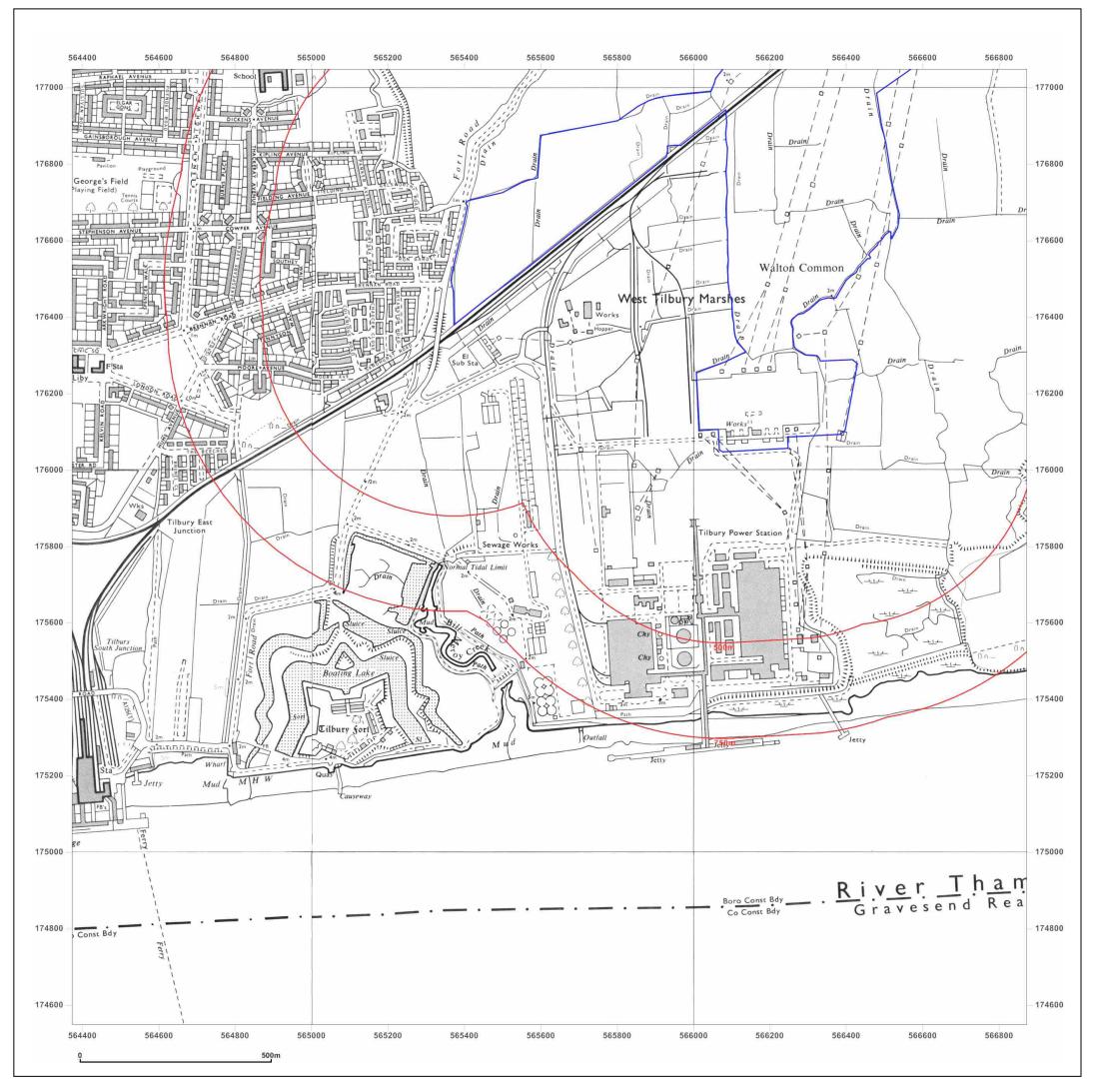




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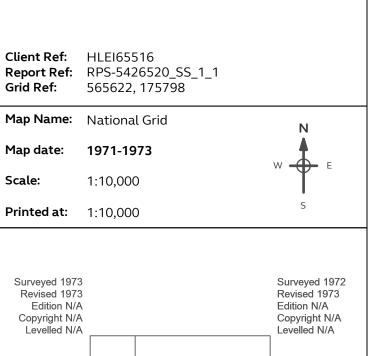
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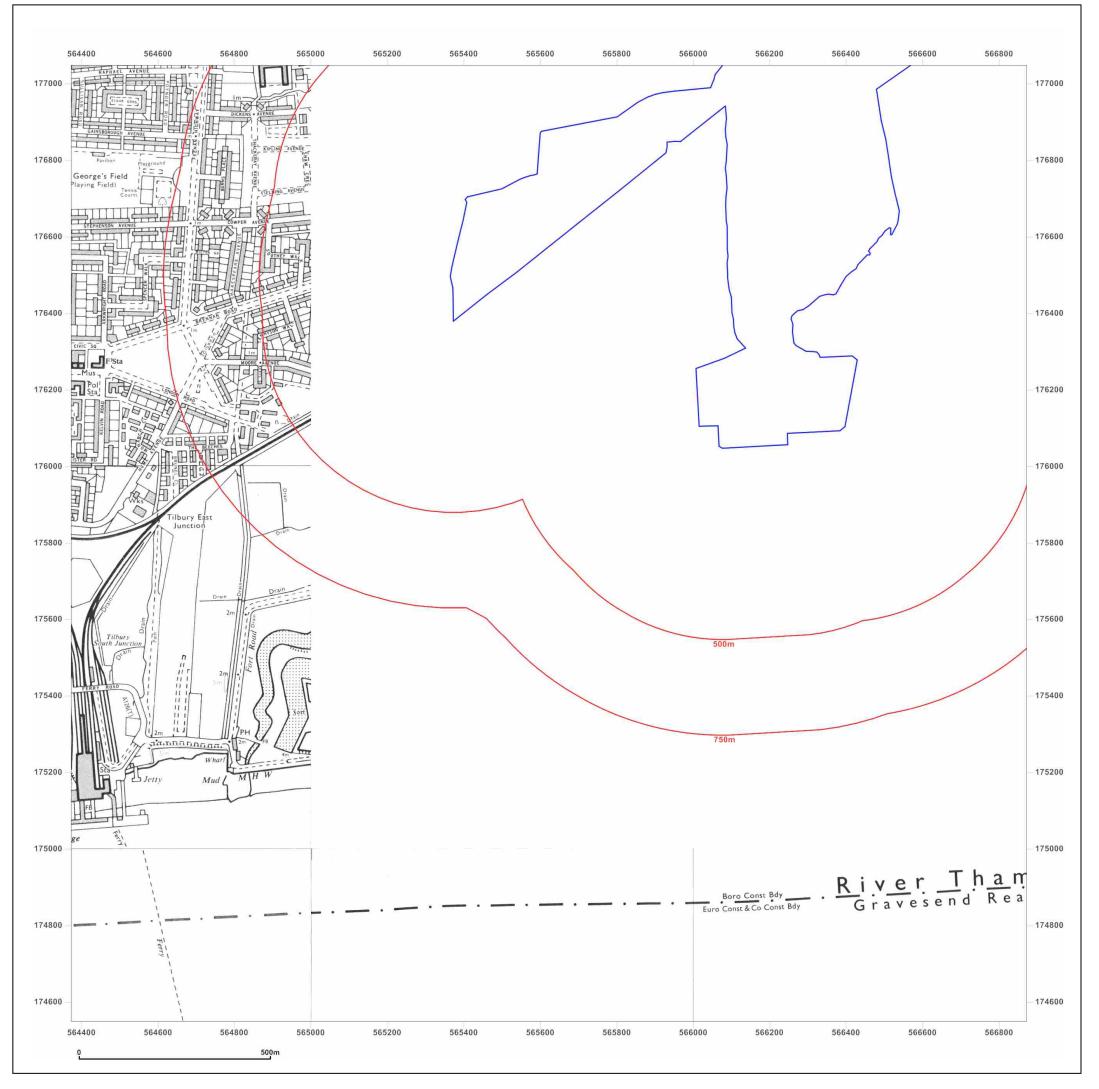
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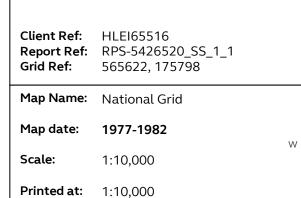
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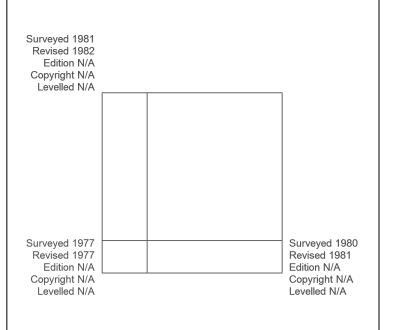


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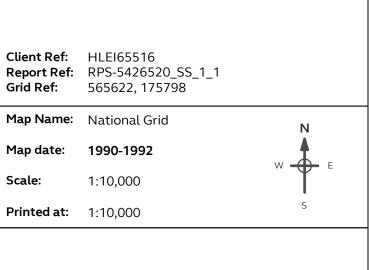
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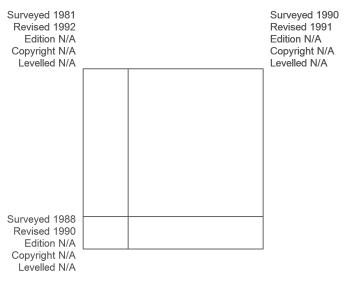
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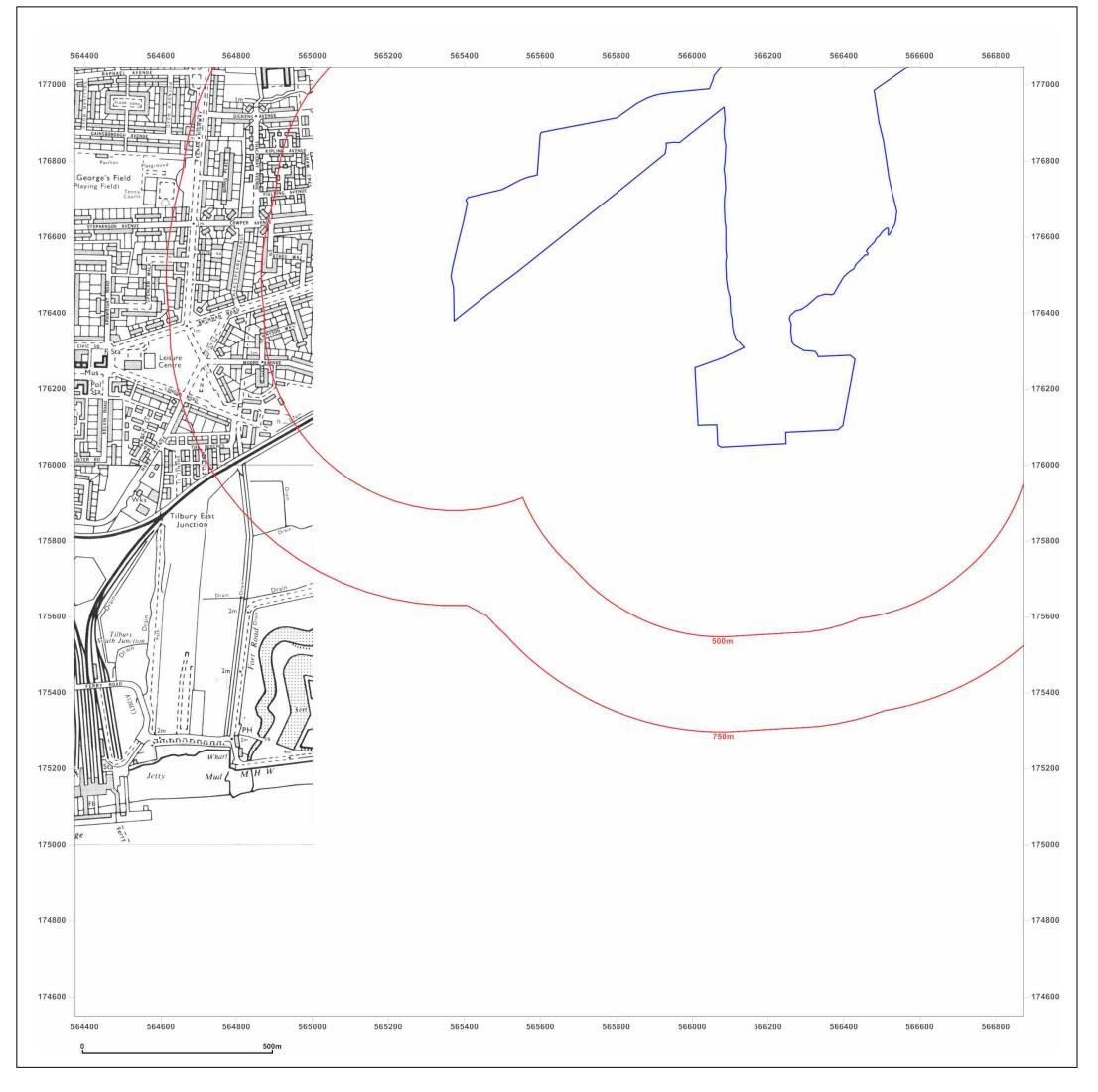




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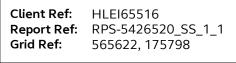
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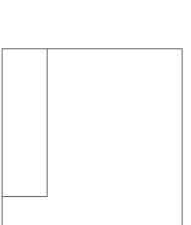
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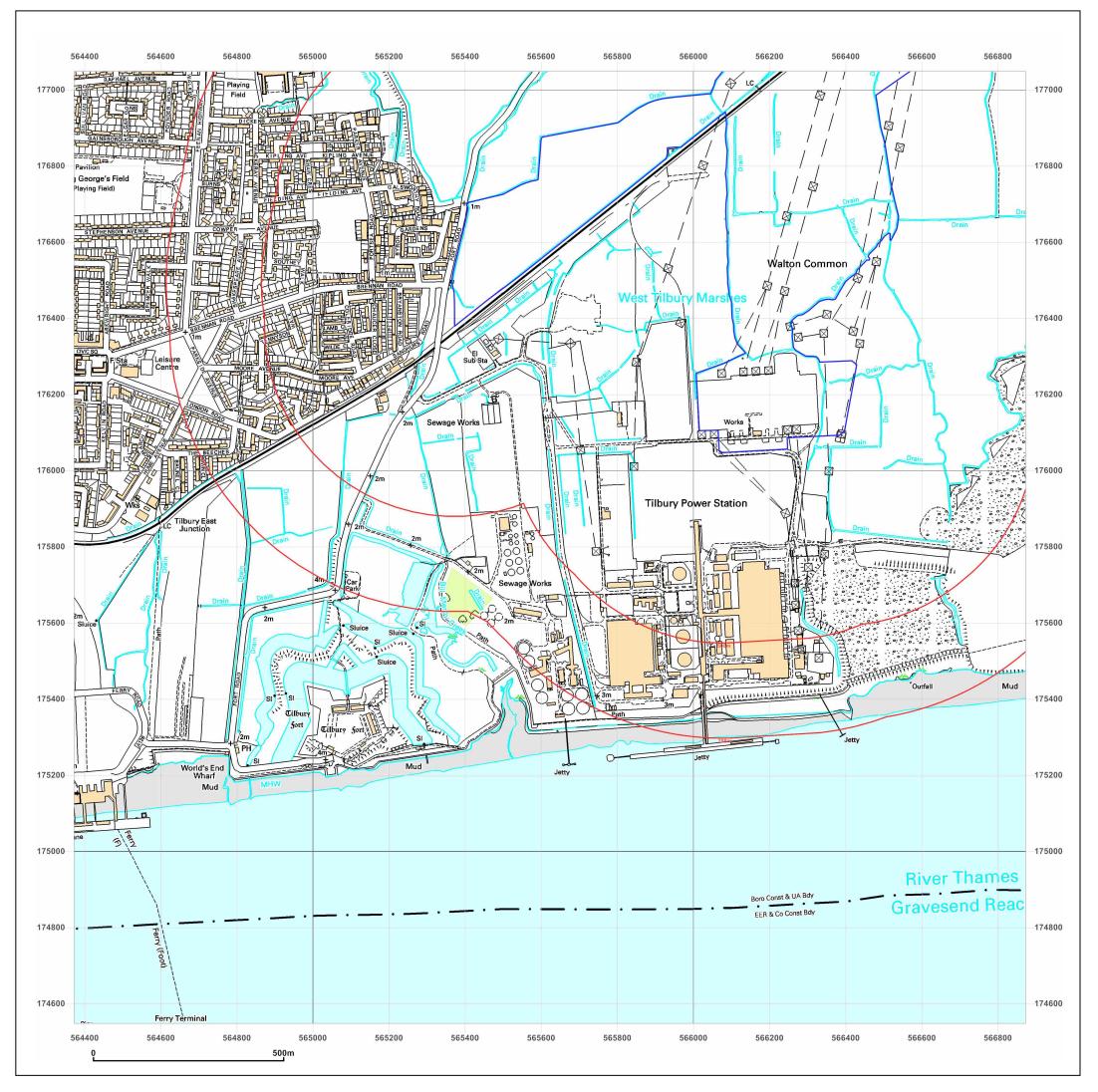
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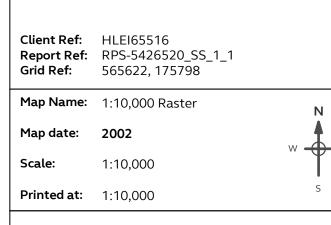
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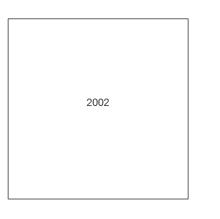




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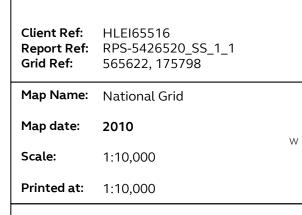
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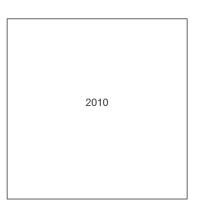
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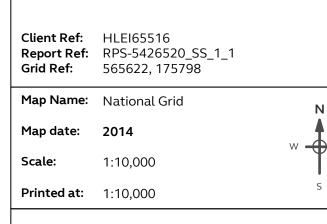
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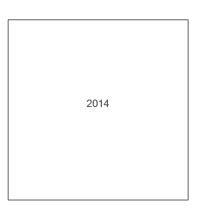




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