

# Case Name: Chain Home tower at Great Baddow

## Case Number: 1454834

### Background

Historic England has received an application to consider the Chain Home tower at Great Baddow for listing.

### Asset(s) under Assessment

Facts about the asset(s) can be found in the Annex(es) to this report.

Annex	List Entry Number	Name	Heritage Category	HE Recommendation
1	1456445	Chain Home tower at Great Baddow	Listing	Add to List

### Visits

Date	Visit Type
03 January 2019	Full inspection

### Context

The Chain Home tower at Great Baddow has previously been assessed for statutory listing on two occasions. The first assessment of the 'Marconi Radar Tower', dated 27 November 1996 (Historic England LMS ref: 40510) recommended that the tower should not be listed, stating that while the tower is an intact example and an impressive landmark, it has been removed from its original site and survives as only one of an original group of three transmitter towers.

A second listing assessment, dated 21 January 2009 (HE LMS ref: 164509), recommended that the 'Radar Tower' should not be listed, stating that 'it is not in situ, having been removed from the Chain Home station at Canewdon, Essex and has thus lost its military context' and 'by its relocation, the tower is no longer associated with other structures crucial to the operation of the early warning radar system which underpinned the successful air defence of the country during World War II.'

Both listing assessments compared the Great Baddow tower with listed examples at RAF Stenigot, RAF Dunkirk and Badwsey Manor (demolished), which survive in situ within their original Chain Home station and continue to be associated with other radar structures which are also designated. The 2009 advice considered that these listed examples 'retain their military context and demonstrate more clearly the process by which radar was so successfully deployed, unlike the Great Baddow tower which represents one aspect of radar operation.' The 2009 assessment concluded: 'Although largely intact, and a clear local landmark, unfortunately the [Great Baddow] tower has lost its context having been relocated several miles from its station. For a building type whose location was such a key component of its functionality, this greatly diminishes its special interest.'

Historic England received a third application to assess the former Chain Home tower at Great Baddow for listing in January 2018. The applicant stated their opinion that they considered the tower to possess evident significance, and be under threat due to reputed pre-planning discussions for potential demolition. During the initial assessment of the application, Historic England consulted an in-house specialist on historic military structures, who agreed with the applicant that the former Chain Home tower at Great Baddow retains its platforms and is the most complete surviving Chain Home tower. The Historic England specialist referred the Listing Team to two key sources which had been published since the tower was last assessed for listing: a book on radar by Colin Dobinson (2010); and a report by English Heritage on 'Buildings of the Radio Electronics Industry Chelmsford' (1997, revised 2007). Historic England concluded that the tower was not

under immediate threat, but that the application should be taken forward to full assessment as the tower was deemed to possess 'evident significance'.

The Great Baddow tower stands outside the boundary of Great Baddow Conservation Area. Chelmsford City Council has included the tower and nearby former offices of the Marconi Research Centre (1937-9, not listed) on the 'Register of buildings of local value in Great Baddow' (November 2009). There is no known immediate threat to the tower at this moment in time.

## Assessment

### CONSULTATION

The applicant, owner, local planning authority, Historic Environment Record (HER) Officer, Great Baddow Parish Council, Chelmsford Science and Engineering Society, Chelmsford Amateur Radio Society, Imperial War Museum, Bawdsey Radar Trust, Marconi Heritage Group, and interested individuals were invited to comment on the factual details of the case as part of the consultation process.

COMMENT 1: The applicant responded by email on 05, 15 and 27 January 2019, providing additional factual information regarding the former Chain Home radar site at RAF Canewdon (from where the tower was relocated to Great Baddow); the use of the Chain Home tower at Great Baddow after it was moved there in 1956; and highlighting the small number of surviving Chain Home towers nationally.

RESPONSE: The Adviser thanked the applicant for their responses, which have been carefully considered in the composition of the below recommendation to the Secretary of State. Relevant additional information and corrections were incorporated into the History and Details sections of the report.

COMMENT 2: The local planning authority responded by email on 17 January 2019, highlighting that the nearby office building is included on the Local List, and stating they had no further information or comments to add.

RESPONSE: The Adviser thanked the local planning authority for their response; no additions or corrections were required to the History or Details sections of the report.

COMMENT 3: A representative of the Imperial War Museum responded by email on 22 January 2019, highlighting that the Great Baddow tower is 'the only example with the original platforms', and 'the post-war importance of Great Baddow in radar research'.

RESPONSE: The Adviser thanked the representative for their response, which has been carefully considered in the composition of the below recommendation to the Secretary of State.

COMMENT 4: A representative of Bawdsey Radar Trust responded by email on 26 January 2019, providing a comparative example of the Chain Home tower at Bawdsey which was listed and fell in 2000. They wished to highlight that, though moved from Canewdon, they consider the Great Baddow tower to be unique, as 'there is not another 360ft Chain Home tower, with all its side platforms, still in existence'.

RESPONSE: The Adviser thanked the representative for their response, which has been carefully considered in the composition of the below recommendation to the Secretary of State.

COMMENT 5: An interested party responded by email on 28 January 2019, providing additional historic information and relevant sources.

RESPONSE: The Adviser thanked the individual for their response, which has been carefully considered in the composition of the below recommendation to the Secretary of State. Additional information has been incorporated into the History, Details and Sources sections of the report.

COMMENT 6: A representative of Great Baddow Parish Council responded by email on 05 February 2019, providing corrections and additional information to the History and Details sections of the report, and highlighting the special historic interest of the tower. The response also stated that the huts under the tower should be excluded from the listing.

RESPONSE: The Adviser thanked the representative for their response, which has been carefully considered in the composition of the below recommendation to the Secretary of State. Corrections and additional information have been incorporated into the History, Details and Sources sections of the report.

COMMENT 7: An interested party responded by email on 07 February 2019, stating their opinion that the tower should be listed due to its rarity and special historic interest, and their opinion that the tower merits listing at Grade II or Grade II\*.

RESPONSE: The Adviser thanked the individual for their response, which has been carefully considered in the composition of the below recommendation to the Secretary of State.

COMMENT 8: A heritage consultant representing the owner responded by email on 11 February 2019, discussing the previous assessment of the tower for listing in 2009. The heritage consultant stated their opinion that: 'the tower has not changed or been fundamentally altered since [2009]'; 'our understanding of the role of Chain Home Stations and indeed the role of radar development in Britain has not fundamentally changed'; and 'no new information has been introduced to inform the current 2019 assessment that wasn't already available when earlier listing applications were considered'. The response discusses the historic interest of the tower, the potential claims of group value in its previous and current location, and the survival of the tower as a single element of infrastructure.

RESPONSE: The Adviser thanked the individual for their response, which has been carefully considered in the composition of the below recommendation to the Secretary of State.

No other responses were received.

## DISCUSSION

The statutory criteria for listing are the special architectural or historic interest of a building, as set out in the Principles of Selection for Listed Buildings (DCMS, November 2018). To be of special architectural interest a building must be of importance in its architectural design, decoration or craftsmanship; and to be of special historic interest a building must illustrate important aspects of the nation's history. Before 1700, all buildings that retain a significant proportion of their original fabric are likely to be regarded of special interest; from 1700 to 1850, most buildings that retain a significant proportion of their original fabric are likely to be regarded of special interest, though some selection is necessary; from 1850 to 1945, because of the greatly increased number of buildings erected and the much larger numbers that have survived, progressively greater selection is necessary; careful selection is required for buildings from the period after 1945, another watershed for architecture.

Towards the end of the C20, as Britain approached the 50th anniversary of the end of the Second World War, the English Heritage Monuments Protection Programme began work to identify a sample of modern defence sites for statutory protection, the results of which were published in 1998. English Heritage (EH) published its first Listing Selection Guides in 2008 setting out broad approaches to conservation, and these were revised by EH in 2011 and subsequently by Historic England (HE) in 2017. Historic England's Listing Selection Guide for Military Structures (2017) discusses the history of military structures and provides guidelines on the specific considerations when assessing these structures for listing, including historical association, period, rarity, selectivity, survival, site significance and group value. Twentieth-century defensive structures survive in very considerable numbers, especially from the Second World War. All bear witness to the greatest conflict of world history, but claims to special interest vary widely. Discretion is thus required when assessing them for designation - designs were often standardised, construction was often rushed, and materials were often not intended to be durable. Our understanding has advanced considerably in recent years. The 2017 Selection Guide discusses the Chain Home network specifically, and states: 'While various sites have retained elements of the ground structures such as the transmitter or receiver building, buried reserves, accommodation buildings and perimeter defences, surviving examples of the iconic masts are very rare.'

Originally erected as one of a group of three Chain Home towers at RAF Canewdon in south-east Essex in 1937, the former Chain Home tower now at Great Baddow was relocated there in 1956. It is the only complete Chain Home transmitter tower surviving in the British Isles, standing to its full height of 109.12m (358 feet) and retaining all six working platforms. Three listed towers survive in England: one at Stenigot, Lincolnshire (listed Grade II); Dunkirk, Kent (listed Grade II); and Swingate, Kent (listed Grade II\*). However, none of these listed examples retain all of their working platforms and that at Dunkirk has been truncated. A listed example at Bawdsey, Suffolk and an unlisted tower at Swingate, Kent were condemned as unsafe and demolished in the early C21. Three other Chain Home towers are known to survive (2019) in the British Isles, but none are as complete as the tower at Great Baddow: a Group II tower standing to full height at Great Bromley, Essex, minus its working platforms; and two severely truncated examples, one situated at Elsham Wolds, Lincolnshire and the other at Watton, Norfolk. As such, the former Chain Home tower at Great Baddow clearly possesses special architectural interest as the only complete Chain Home transmitter tower surviving in the British Isles, standing to its full height, and retaining all six working platforms.

In addition to this special architectural interest, the former Chain Home tower possesses special historic interest as a rare and unusually intact surviving example of defence infrastructure which played a crucial role in the defence of the country leading up to and during the Second World War (1939-45). The Chain Home Radio Direction Finding (RDF) stations were decisive in providing early warning of Luftwaffe attacks, and the towers at RAF Canewdon played a particularly crucial role in the air defence of the country during the Battle

of Britain and in the defence of London throughout the Second World War, including the late war V1 flying-bomb campaign and the 'Big Ben' V2 missile tracking operations.

In 1956 one of the three (then obsolete) Chain Home towers at RAF Canewdon was moved approximately 14 miles north-west to the Marconi Company research site at Great Baddow, on the outskirts of Chemsford, popularly regarded as the 'birthplace of radio'. The scientists at the Great Baddow laboratories had designed the transmitter aerials for the Chain Home system, and during the Second World War, the Great Baddow site was utilised by the Royal Air Force and Royal Navy for development of radio technology, propagation and direction finding research, including the engineering of aerial, receiver and display units for the 960 naval radar, and early production of the resonant cavity magnetron, a vital breakthrough in radar technology. Following the Second World War, the research facility at Great Baddow continued to be recognised as a source of expertise on all aspects of radar research, including the study of wartime radar chain, which became urgent with the blockade of West Berlin in 1948 and the invasion of South Korea in 1950. Specialist experimental testing of radio, radar and telecommunications equipment continued at Great Baddow throughout the 1950s, most significantly the development of the radio guidance system for the British 'Blue Streak' intercontinental ballistic missile, developed between 1955 and 1957, utilising the former Chain Home tower relocated from RAF Canewdon in 1956. In its new location at Great Baddow, the tower continued to play an important role in radar research in the Cold War period, and radio and television communications in the late C20. Historic England considers that the tower clearly possesses special historic interest, not only for the role it played at RAF Canewdon in the air defence of the country leading up to and during the Second World War, but also its continued use in defence and communications research at Great Baddow from 1956 onwards. Such is the historic importance of this prominent and iconic landmark, that its distinctive form dominates the village sign of Great Baddow.

In recommending the extent of listing, we have considered whether powers of exclusion under s1 (5A) of the 1990 Act are appropriate, and consider that they are, which is made clear in the proposed List entry.

#### CONCLUSION

After examining all the available records and other relevant information and having carefully considered the architectural and historic interest of this case, the criteria for listing are fulfilled. Great Baddow Chain Home Tower is therefore recommended for listing at Grade II.

#### REASONS FOR DESIGNATION DECISION

Great Baddow Chain Home tower, originally erected at RAF Canewdon in south-east Essex in 1937, relocated to Great Baddow in 1956, is recommended for listing at Grade II for the following principal reasons:

##### Architectural interest:

- \* the tower at Great Baddow is the only complete Chain Home transmitter tower surviving in the British Isles, standing to its full height of 109.12m (358 feet) and retaining all six working platforms.

##### Historic interest:

- \* the Chain Home Radio Direction Finding stations were decisive in providing early warning of Luftwaffe attacks, and the towers at RAF Canewdon played a particularly crucial role in the air defence of the country during the Battle of Britain, and in the defence of London throughout the Second World War, including tracking of destructive V1 flying bombs and "Big Ben" V2 missiles late in the war;
- \* although the tower was moved to its current location in 1956 this contributes to, rather than detracts from, its special historic interest. Its relocation to the Marconi Company research site at Great Baddow provided a context in which the tower could play an important defence role during the Cold War. During this period Great Baddow tower continued to play an important role in defence research and communications, in particular the development of the radio guidance system for the British 'Blue Streak' intercontinental ballistic missile.

#### Countersigning comments:

Agree. The Chain Home tower at Great Baddow has been assessed previously but based on new evidence provided in two more recent publications, and a greater understanding of the significance of the Chain Home tower, it has been considered for a third time. As the only complete Chain Home transmitter tower surviving in the British Isles and because it continued to play an important role in defence research and communications during the Cold War, the Chain Home tower at Great Baddow is now considered to meet the criteria for listing at Grade II.

Caroline Skinner 20 September 2019.



**Annex 1****List Entry****List Entry Summary**

This building is listed under the Planning (Listed Buildings and Conservation Areas) Act 1990 as amended for its special architectural or historic interest.

**Name:** Chain Home tower at Great Baddow

**List Entry Number:** 1456445

**Location**

off Vicarage Lane, Great Baddow, Essex, CM2 8JG

The listed building(s) is/are shown coloured blue on the attached map. Pursuant to s1 (5A) of the Planning (Listed Buildings and Conservation Areas) Act 1990 ('the Act') structures attached to or within the curtilage of the listed building but not coloured blue on the map, are not to be treated as part of the listed building for the purposes of the Act. However, any works to these structures which have the potential to affect the character of the listed building as a building of special architectural or historic interest may still require Listed Building Consent (LBC) and this is a matter for the Local Planning Authority (LPA) to determine.

The building may lie within the boundary of more than one authority.

County	District	District Type	Parish
Essex	Chelmsford	District Authority	Great Baddow

**National Park:** Not applicable to this List entry.

**Grade:** II

**Date first listed:**

**Date of most recent amendment:**

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**Legacy System Information**

This section only relates to older records, created before the introduction of the National Heritage List for England in 2011.

**Legacy System:** Not applicable to this List entry.

**Legacy Number:** Not applicable to this List entry.

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**Asset Groupings**

This List entry does not comprise part of an Asset Grouping. Asset Groupings are not part of the official record but are added later for information.

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**List Entry Description****Summary of Building**

Chain Home tower, originally erected at RAF Canewdon in south-east Essex in 1937, relocated to Great Baddow in 1956.

### Reasons for Designation

Great Baddow Chain Home Tower, originally erected at RAF Canewdon in south-east Essex in 1937, relocated to Great Baddow in 1956, is listed at Grade II for the following principal reasons:

Architectural interest:

- \* the tower at Great Baddow is the only complete Chain Home transmitter tower surviving in the British Isles, standing to its full height of 109.12m (358 feet) and retaining all six working platforms.

Historic interest:

- \* the Chain Home Radio Direction Finding stations were decisive in providing early warning of Luftwaffe attacks, and the towers at RAF Canewdon played a particularly crucial role in the air defence of the country during the Battle of Britain, and in the defence of London throughout the Second World War, including tracking of destructive V1 flying bombs and "Big Ben" V2 missiles late in the war;
- \* although the tower was moved to its current location in 1956 this contributes to, rather than detracts from, its special historic interest. Its relocation to the Marconi Company research site at Great Baddow provided a context in which the tower could play an important defence role during the Cold War. During this period Great Baddow tower continued to play an important role in defence research and communications, in particular the development of the radio guidance system for the British 'Blue Streak' intercontinental ballistic missile.

### History

Guglielmo Marconi established the Wireless Telegraph and Signal Company in 1897, and in 1898 acquired a former silk mill in Chelmsford for the manufacture of Marconi radio equipment. During the First World War (1914-18), the research department of the Marconi Company was placed under the direction of the Admiralty, and 415 ships and 30 shore stations were equipped with wireless sets. The Marconi Company played a key role in the development of telephony and radar during the First World War and inter-war period. The company moved in to public broadcasting, with the first official radio broadcast from Chelmsford in June 1920, and took part in the formation of the British Broadcasting Company in 1922. By the early 1930s, Marconi was one of the principal suppliers of telephones, telegraph and wireless equipment to the British services, armed forces abroad, and civilian aerodromes. Under the trade name Marconiphone, the company was also a leading manufacturer of wireless sets for the domestic market, however sold this interest to the Gramophone Company in 1929. The Marconi research laboratories at Chelmsford continued to expand, and a decision was made in 1936 to acquire a large site on a hill at Great Baddow on the outskirts of Chelmsford, which was deemed sufficiently far away from possible sources of interference to conduct experiments. The laboratories at Great Baddow were constructed between 1937 and 1939, with a red brick laboratory building facing east to West Hanningfield Road (not listed).

Radio direction finding (later known as radar) was a well-established technique by the 1930s and widely used in civil as well as military applications for ship and aircraft navigation, utilising reflected radio waves to detect the approach of hostile craft. Robert Watson Watt and Arnold Wilkins carried out pioneering research at nearby Bawdsey Manor leading to the inception of the 'Chain Home' network, the first early warning radar network in the world, and the first military radar system to reach operational status. The siting of the Chain Home stations was of crucial importance to their successful operation; the specifications issued in 1936 required that a station should be well back from the coast, with a smooth slope between it and the sea, give good height and range finding, and be inconspicuous from the air. The first five stations, the (Thames) Estuary Chain, covered the approaches to London, and were used for system trials in 1937 before becoming fully operational in 1938. One of these five early stations was at RAF Canewdon in south-east Essex, established in August 1937, with three Chain Home towers providing long-range early warning for the Thames estuary and the north-eastern approaches to London. Twenty-one Chain Home stations were established along the south and east coasts of England during the Second World War (1939-45).

Initially, the transmitter aerials were suspended on 358ft self-supporting steel towers, between three working platforms on each side, cantilever to cantilever, but from 1941 the aerial arrays were suspended between the adjacent towers. Chain Home RDF (radar) stations did not sweep a rotating radar beam, but irradiated lobes of energy along a particular bearing or 'line of shoot'. Due to the shape of the main lobe, it was not possible to provide total coverage without a number of secondary lobes to 'gap-fill' the sides. The main lobes of the adjoining CH stations at RAF Great Bromley and RAF Dunkirk partially intersected that of RAF Canewdon, to produce continuous cover over the Thames Estuary. The plots of the same aircraft from the adjacent Chain Home stations were all sent to the 'Filter Room' at Fighter Command Headquarters, RAF Stanmore, where they could be filtered to provide a smooth course plot; data was also fed directly to the nearest Sector Operations Room, within the associated Fighter Group. The 'Final' Chain Home stations provided long-range,

early warning of enemy aircraft, with an average range of between 160.93 - 321.86km (100 – 200 miles), on aircraft flying at 4,572m (15,000ft), but were unable to detect aircraft flying below 60.9m (200ft). The Chain Home RDF stations were decisive in providing early warning of Luftwaffe attacks, and the towers at RAF Canewdon played a particularly crucial role in the air defence of the country during the Battle of Britain and in the defence of London throughout the Second World War, including the late war V1 flying-bomb campaign and the 'Big Ben' V2 missile tracking operations. Post-war, the radar equipment at RAF Canewdon quickly became obsolete and was not updated, resulting in the site not being included in the ROTOR radar reporting system; however, the northernmost tower remained in use for RAF aerial erector training purposes and for climbing tests until 1956.

The scientists at the Great Baddow laboratories designed the transmitter aerials for the Chain Home system, and at the outbreak of the Second World War, many of the Marconi Company's scientists and engineers were seconded to government research establishments. At Great Baddow, the Royal Air Force was engaged in research on radio propagation from 1940, and the Royal Navy was carrying out research under the Admiralty Signal Establishment from 1941. Most of the research work at Great Baddow related to the development of radio technology, and included system design, growing synthetic quartz crystals, and techniques such as direction finding linked with propagation. Used in aircraft, ships and mobile equipment, this technique could be used during warfare to identify the source of enemy agents' radio transmissions. During the Second World War, other important activities at the Great Baddow site included the engineering of aerial, receiver and display units for the 960 naval radar, and early production of the resonant cavity magnetron, a vital breakthrough in radar technology.

In the late 1940s Britain's wartime radar system was substantially updated to meet the threat posed by fast jet aircraft. The Marconi Company became a subsidiary of English Electric in 1946, and the Great Baddow site became a recognised source of expertise on all aspects of radar research, including the study of wartime radar chain, which became urgent with the blockade of West Berlin in 1948 and the invasion of South Korea in 1950. During the 1950s, small scale buildings and masts were built at Great Baddow for the experimental testing of radio, radar and telecommunications equipment, most significantly the development of the radio guidance system for the British 'Blue Streak' intercontinental ballistic missile, developed between 1955 and 1957. In 1956, the Marconi Company purchased one of the (then obsolete) towers from Canewdon in south-east Essex, and transported it to and re-erected it on the Great Baddow site the same year. The 1970 Ordnance Survey (OS) map shows the tower in its current position with a rectangular-plan hut underneath, laid out on an east-west axis. Additional buildings were constructed to the rear (west) of the 1930s building between 1957 and 1958 to the designs of Taylor and Collister. The Marconi Company became the primary defence subsidiary of the General Electric Company (GEC) around 1968, becoming GEC Marconi. In 1999, the defence manufacturing division, Marconi Electronic Systems, merged with British Aerospace to form BAE Systems, who still occupy the majority of the site.

The tower at Great Baddow is the only complete Chain Home transmitter tower surviving in the British Isles, standing to its full height of 109.12m (358 feet) and retaining all six working platforms. Three listed towers survive: one at Stenigot, Lincolnshire (listed Grade II); Dunkirk, Kent (listed Grade II); and Swingate, Kent (listed Grade II\*); however, none of these retain all of their working platforms and one has been truncated. A listed example at Bawdsey, Suffolk and a second tower at Swingate, Kent were condemned as unsafe and demolished in the early C21. Three other Chain Home towers are known to survive in the British Isles, but none are as complete as the tower at Great Baddow: a Group II tower standing to full height at Great Bromley, Essex, minus its working platforms; and two severely truncated examples, one situated at Elsham Wolds, Lincolnshire and the other at Watton, Norfolk.

## Details

Chain Home tower, originally erected at RAF Canewdon in south-east Essex in 1937, relocated to Great Baddow in 1956.

**MATERIALS:** galvanised-steel frame; timber and steel mesh flooring to the mid-level platforms; reinforced-concrete foundation pads.

**PLAN:** rectangular in plan.

**DESCRIPTION:** a Group II self-supporting transmitter tower, originally built by Radio Communication Ltd, based on an Air Ministry design by Mr Norman Garnish. The tower is of bolted galvanised-steel construction, attached to four reinforced-concrete foundation pads. It stands approximately 109.12m high, with three pairs of cantilevered working platforms at low (15.2m), mid- (62.2m) and high (107.9m) levels. The mid-level has timber flooring to its north platform, and late-C20 wire mesh flooring to its south platform; the flooring material



of the low-level platforms has been removed. The metal ladder and landing stages, of which there are approximately 12, were replaced in the late C20.

Three detached single-storey huts stand under the tower, and the site is bounded by a late C20 or early C21 wire-mesh and barb-wire fence; both are excluded from the listing.

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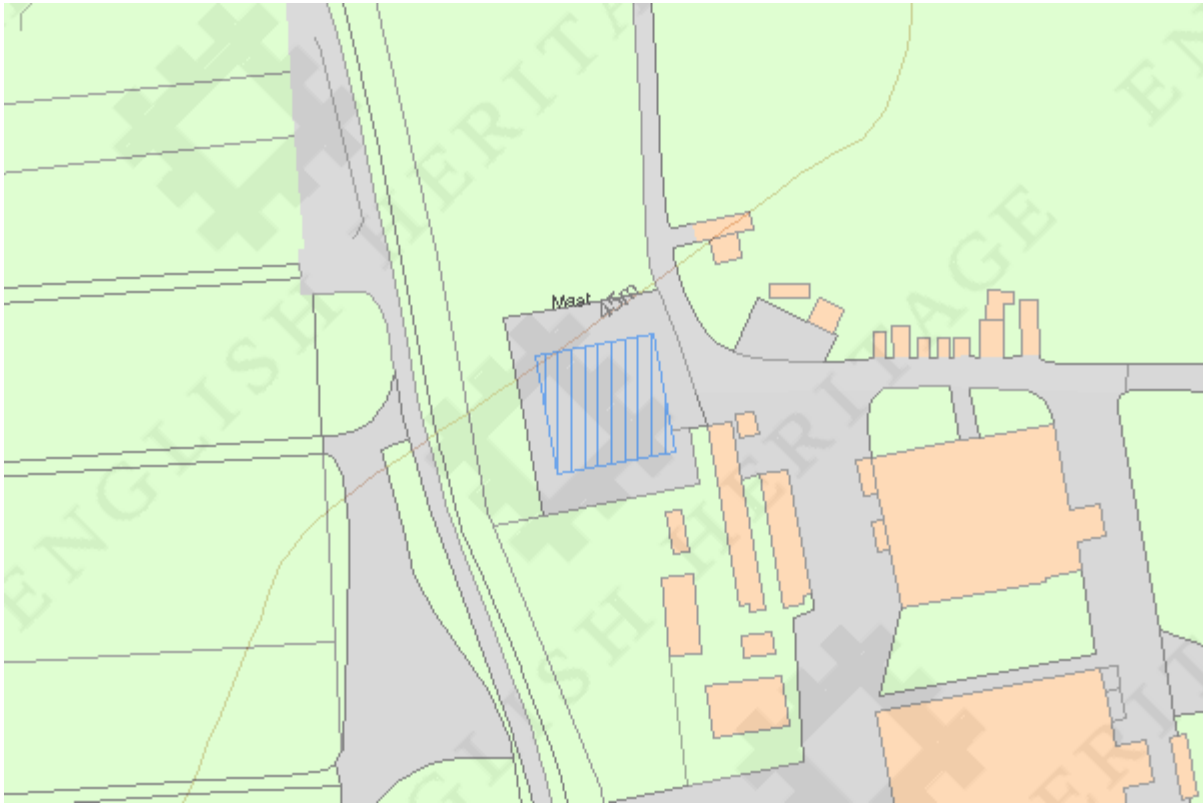
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**Other**

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**Map****National Grid Reference:** TL7266503914

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The above map is for quick reference purposes only and may not be to scale. For a copy of the full scale map, please see the attached PDF - 1456445\_1.pdf