Environmental Statement

Volume 2i: Scheme-wide Assessment

Chapter 18: Electromagnetic interference

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18. ELECTROMAGNETIC INTERFERENCE

Summary of principal findings

This chapter presents the assessment of electromagnetic interference and electromagnetic field exposure effects associated with the construction and operation of the Huddersfield to Westtown (Dewsbury) section of the Transpennine Route Upgrade (TRU) Programme. This chapter covers the assessment of the entirety of the Huddersfield to Westtown (Dewsbury) Route (herein referred to as the 'Scheme').

The study defined a corridor along the railway alignment based on the type of site under consideration and the significance of potential effects of electromagnetic interference to those sites assessed using a risk-based approach.

The following receptors (including GPS location) identified along the route have initially been classified as significant with regards to electromagnetic interference:

- Army Reserve Centre (53.642317, -1.779369);
- Yorkshire Children's Centre (53.647735, -1.785868);
- Vodafone Mobile Phone Mast (53.64966202, -1.78392398);
- SUEZ Recycling and Recovery UK – Kirklees (53.656476, -1.777942);
- Dr Reddy's Laboratories EU Ltd (53.670932, -1.679045);
- Longley Concrete (53.67579, -1.652752);
- Kirklees Council Recycling and Recovery UK – Dewsbury (53.682514, -1.644683); and,
- Vodafone and O2 Mobile Phone Mast (53.68304062, -1.645094395).

The following receptor will also require further assessment with regards to electromagnetic field exposure once the design matures:

- Yorkshire Children's Centre (53.647735, -1.785868).

The Army Reserve Centre (53.642317, -1.779369) is greater than 500m away from the centre line of the nearest track and the study did not identify any visible antenna/communication systems or heavy equipment. As such, the residual effect to this site is deemed not significant.

The Vodafone Mobile Phone Mast (53.64966202, -1.78392398) could not be identified in this area and is likely to have been relocated or superseded by a new base-station elsewhere. As such, the residual effect to this site is deemed not significant.

The remaining receptors will require further assessment during detailed design to determine any required mitigation measures in conjunction with the site owners. This further assessment will be undertaken as part of the full Electromagnetic Compatibility (EMC) hazard analysis during the course of the main design stages as part of the ongoing EMC assurance process.

Potential mitigations have been identified for these sites which include, but are not limited to:

- Relocation of susceptible equipment within the premises;
- Change of use in the rooms located nearest to the railway; and,
- Insulation or gapping and bonding of metallic utilities and buried services.

18.1 Introduction

18.1.1 This chapter has been produced to assess the electromagnetic interference effects associated with the construction and operation of the Huddersfield to Westtown (Dewsbury) portion of the Transpennine Route Upgrade (TRU) Programme. This chapter covers the assessment of the entirety of the Huddersfield to Westtown (Dewsbury) Route (herein referred to as the 'Scheme').

18.1.2 The assessment reported in this chapter is broken down into six Route Section areas for ease of the reader, however no separate Route Section Assessments are included within Volume 2ii of this Environmental Statement (ES).

18.1.3 This chapter is set out as follows:

- Legislative and policy context – relevant international, national and local policy requirements, legal requirements and guidance which have been used to define the assessment approach are outlined;
- Assessment methodology – the methodology the assessment follows is defined including the justification for the study area and the approach for determining significance of effects;
- Baseline – a summary of the electromagnetic environment baseline within the study area is provided;
- Potential effects – the potential impacts and effects (both beneficial and adverse) during construction and operation are characterised;
- Mitigation measures – agreed avoidance, mitigation, compensation and enhancement measures are described;
- Residual effects – the significance of residual effects (both beneficial and adverse) following the implementation of mitigation measures are assessed; and
- Cumulative effects – the potential likely significant cumulative effects of the Scheme are described.

18.1.4 A detailed description of the Scheme is provided in Chapter 2 (Scheme description) in Volume 2i of the ES and all appendices and figures referred to in this chapter are provided in Volumes 3 and 4 of this ES respectively.

Glossary of Terms

18.1.5 This chapter considers both Electromagnetic Interference (EMI) effects on electrical and electronic systems, and also established Electromagnetic Field (EMF) effects on human health.

18.1.6 EMFs are generated wherever electricity is produced, distributed and consumed including by railway electric traction systems, power lines and electrical and electronic equipment. EMFs may also be generated intentionally by radiocommunication systems.

18.1.7 EMI is an unwanted electromagnetic (EM) disturbance that affects an electrical system due to magnetic fields, electric fields, electromagnetic induction or electromagnetic radiation emitted from an external source. EMI can prevent electrical or electronic equipment from functioning correctly.

18.1.8 Electromagnetic Compatibility (EMC) is the engineering discipline concerned with ensuring that electrical and electronic equipment function normally in their intended operating environment without introducing intolerable electromagnetic disturbances to anything in that environment. EMC also ensures that the equipment will not be adversely affected by levels of EMI that might reasonably be expected to present in that environment.

18.1.9 The Scheme is not current electrified. Electrification as part of the Scheme may affect the Electromagnetic Environment (EME) and has the potential to disturb sensitive and safety critical equipment across a wide range of frequencies.

18.1.10 The Scheme will be electrified using Overhead Line Equipment (OLE) energised at 25,000 volts (25 kV), as is common throughout the UK rail network, with a supply frequency of 50 Hz AC (UK mains power frequency). An overview of this system is provided in Paragraph 18.1.15 to Paragraph 18.1.18.

18.1.11 To achieve EMC, two aspects need to be considered when making changes to a system:

- **Emissions:** The generation of EM energy (either intended or unintended) by a source which is termed emissions. Countermeasures may need to be taken to reduce such energy generation or avoid the escape of the energy into the external environment; and
- **Susceptibility or immunity:** The ability of electrical equipment, referred to as receptors, to operate as intended in the presence of a certain level of EMI is termed the immunity or susceptibility level of the equipment.

18.1.12 A change in the EME due to increased emissions may already be adequately mitigated by the immunity level of the existing equipment.

18.1.13 Strong EMFs can have a short-term impact on human health. The effects of EMFs are highly localised and have the most potential to affect people in buildings and locations that are immediately adjacent to high voltage traction power distribution equipment, electricity sub-stations and transformers. The assessment investigates baseline conditions and characterises the current EME of the study area with respect to EMC and Human Exposure to EMFs. The impact of the Scheme on the EME in the study area is evaluated with mitigation identified were necessary.

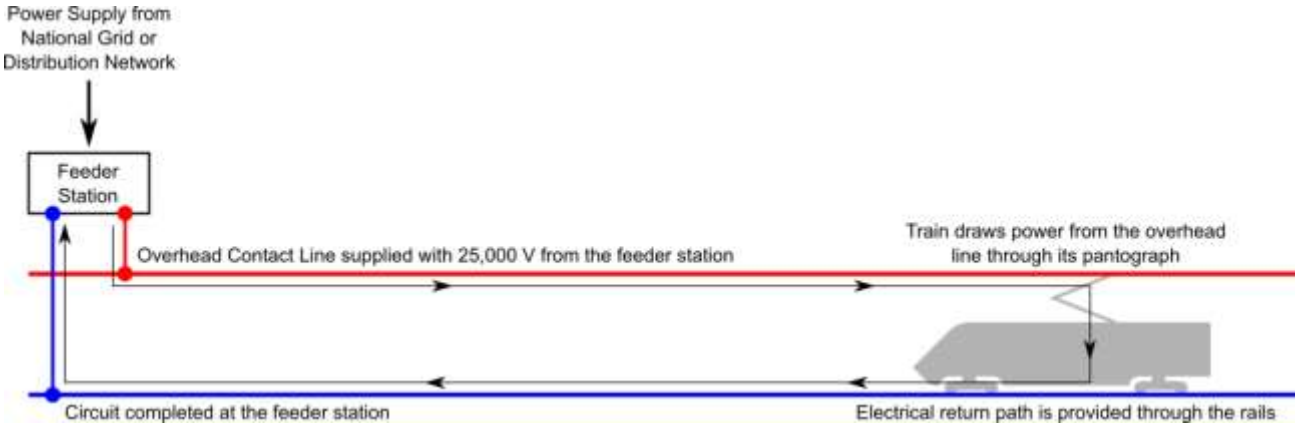
18.1.14 This chapter provides the findings of the EM hazard analysis undertaken as part of this ES which will form the basis of the full EM hazard analysis undertaken during the course of the detailed design stages.

Overview of 25 kV AC railway electrification

18.1.15 In the 25 kV AC railway electrification system, an overhead contact line is used to deliver electrical power to a train and is supported by structures, collectively known as OLE. The overhead contact line is supplied with 25 kV from feeder stations which are located at regular intervals along the Scheme. These feeder stations draw power from the National Grid or local distribution network and transform it to the required 25 kV.

18.1.16 An electric train draws power (known as “traction power”) from this overhead contact line through its pantograph[1] to power its motors and other on-board systems (e.g. interior lighting). The electrical return path is provided through the rails which complete the circuit at the feeder stations. This circuit is illustrated in Insert 18-1.

[1] Device fitted to the top of the train that collects electric current from the overhead contact wire to power the train.



Insert 18-1 Simplified overview of the 25 kV AC electrification system

18.1.17 There are often other additional conductors used in providing the return path to the feeder station. These can include:

- Aerial Earth Wires: these connect the OLE and other supporting structures over the railway to earth and the return circuit of the 25 kV electrification system; and
- Return Screening Conductors: these are cables that provides suppression of EMI into the lineside cables used for signalling and telecommunications.

18.1.18 Track sectioning sites also form part of the system and are found between feeder stations. These allow sections of the overhead line to be isolated during maintenance and also allow electrical power to be fed from alternative feeder stations when required.

18.2 Legislative and policy context

18.2.1 The assessment approach considers legislation, national standards, industry standard practice and guidance.

National legislation and policy

18.2.2 The regulatory framework for EMC has been in place since 1992 through *The Electromagnetic Compatibility Regulations 1992* in the UK and compliance with those EMC Regulations has been mandatory for equipment installed since then. All new electrical and electronic equipment installed within the Scheme boundary, including the whole railway, must comply with the requirements of *The Electromagnetic Compatibility Regulations 2016*, *Statutory Instrument 2016 No. 1091*[2]. Equipment containing radio transceivers must comply with *The Radio Equipment Regulations 2017*[3]*, Statutory Instrument 2017 No. 1206*. Medical devices fall under the remit of the *Medical Devices Regulations 2002 (as amended), Statutory Instrument 2002 No. 618*[4].

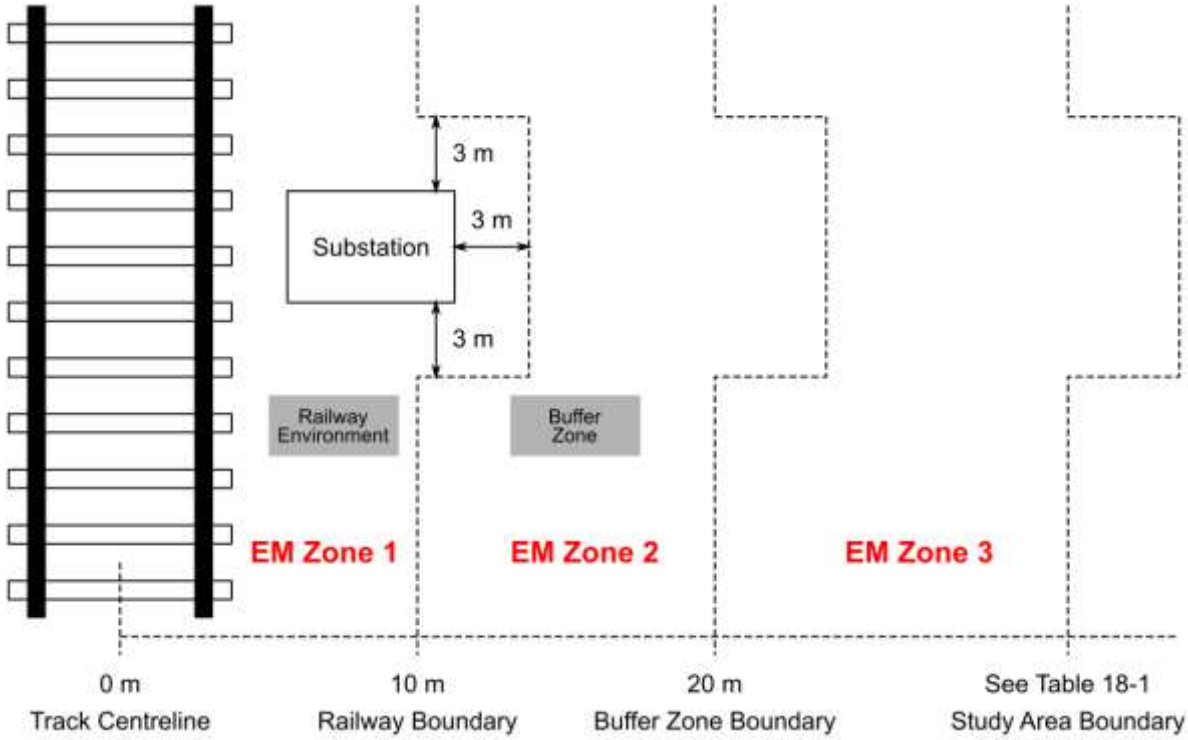
18.2.3 Occupational human exposure to EMFs is subject to *The Control of Electromagnetic Fields at Work Regulations 2016 (CEMFaW)*, Statutory Instrument 2016 No. 588[5]. The CEMFaW Regulations specifies Action Levels (ALs) for EMFs over a range of frequencies with limits based on the recommendations of the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

[2] The Electromagnetic Compatibility Regulations 2016. Available at: https://www.legislation.gov.uk/uksi/2016/1091/contents
[3] The Radio Equipment Regulations 2017. Available at: https://www.legislation.gov.uk/uksi/2017/1206/contents/made
[4] The Medical Devices Regulations 2002. Available at: https://www.legislation.gov.uk/uksi/2002/618/made
[5] The Control of Electromagnetic Fields at Work Regulations 2016. Available at: https://www.legislation.gov.uk/uksi/2016/588/made

The scope of the CEMFaW Regulations does not cover exposure of the public; the ALs given in the CEMFaW Regulations are only applicable for determining safe EMF levels for occupational exposure. Exposure of the public is within the domain of Public Health England, and in the absence of legislation the principal policy stance of Public Health England is to demonstrate compliance with the scientific evidence and guidelines in the ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz) (1998). ICNIRP 1998 specifies Reference Levels (RLs) for public exposure which are lower than the ALs for occupational exposure stipulated in the CEMFaW Regulations.

National standards

18.2.4 The BS EN 50121 series of railway-specific standards define electromagnetic emissions and immunity test limits for equipment placed within the railway boundary that are generally applied to demonstrate compliance with The EMC Regulations. The railway boundary in this instance is defined as an area up to 10m from the centre of the nearest running line and extending 3m from a substation boundary (EM Zone 1), as shown in Insert 18-2. EMC immunity limits contained within the BS EN 50121 suite of standards are generally equivalent to the limits defined for EMC standards relevant to the "heavy" industrial environments in BS EN 61000-6-2 (immunity) and BS EN 61000-6-4 (emissions).



Insert 18-2 Electromagnetic zoning principle

18.2.5 The Scheme's rolling stock could be a source of EM emissions and therefore it is necessary that the rolling stock specification is compatible with the infrastructure and its surroundings. Rolling stock used within the Scheme shall comply with the relevant National and International Standards – e.g. for new rolling stock the Rolling Stock National Technical Specification Notices[6]. This is managed through Network Rail's Route Acceptance process and infrastructure compatibility assessments by projects introducing new rolling stock. The main impact of EMI resulting from the rolling stock is on the railway infrastructure itself, such as

[6] National Technical Specification Notices. Available at: https://www.gov.uk/government/publications/railway-interoperability-national-technical-specification-notices-ntsns

train detection assets.

Technical guidance and standards

18.2.6 Network Rail's EMC Assurance Process, specified in company standard NR/L2/RSE/30041, defines the company's route to demonstrating compliance with The EMC Regulations. This process defines a further 10m Buffer Zone within which EMC standards BS EN 61000-6-1 (immunity) and BS EN 61000-6-3 (emissions) are deemed to be relevant to "light industrial", commercial and residential environments. Practically, it is more feasible that there is a steady transition from the heavy industrial limits to light industrial limits at the 20m buffer zone boundary rather than an abrupt change. This is in line with guidance provided in BS EN 50121 suite of standards for determining the zone of influence and study area for EMI to and/or from the railway that has been used as a basis for this assessment.

18.2.7 Rail Safety and Standards Board (RSSB) have published a guidance note, GL/GN1620[7] which provides guidance and a simple methodology that may be adopted by employers to demonstrate compliance with the Control of Electromagnetic Fields at Work Regulations in and around railway environments.

18.3 Assessment methodology

18.3.1 This section describes the study areas and data sources used to undertake the EMI assessment for the construction and operational phases of the Scheme, as well as the methodologies used to quantify impacts, assign significance and determine the need for mitigation measures.

18.3.2 The assessment set-out in this ES will form the basis of the full EMC hazard analysis to be undertaken during the course of the detailed design stages. The EMC hazard analysis forms part of the Network Rail Assurance Process, which fulfils Network Rails statutory requirements with respect to The EMC Regulations 2016.

Study area

18.3.3 The study area for EMI was defined by a corridor along the railway alignment with the extent of the corridor defined using a zoning concept which extends perpendicularly from the centreline of the nearest Scheme track alignment to a distance prescribed by Table 18-1. This distance is dependent on the type of property or installation under consideration.

Potential sources and receptors

18.3.4 Existing sources of EMI and EMF and property usage in the study area, including those within the existing railway infrastructure, were identified by a desktop study to establish a baseline EME.

Spatial scope

18.3.5 This assessment has identified potential EMI and EMF receptor sites within a zone boundary either side of the centreline of the outermost track along the line of route, or from the extent of the Scheme boundary in other areas such as stations, substations or construction sites.

18.3.6 The established zone of influence for determining susceptibility to EMI for the vast majority of receptors is 20m as per national, international and Network Rail EMC standards. However, a

[7] Guidance on the Application of the Control of Electromagnetic Fields at Work Regulations, GLGN1620 Issue 1. Available at: https://www.rssb.co.uk/en/standards-catalogue/CatalogueItem/GLGN1620-Iss-1

wider zone boundary has been used to identify particularly sensitive receptors (see the distances detailed in Table 18-1). Outside the 20m zone, the likelihood of conducted and radiated emissions affecting persons and systems is very low as the EM field levels emanating from traction power equipment on the railway decays rapidly and only particularly sensitive receptors, such as Radio Telescopes and Research Establishments are at risk.

18.3.7 The distance to the outer zone boundary for sites has been determined depending on the nature of the receptor according to applicable EMC standards, the zoning principle detailed below (see assessment criteria), and established engineering experience from previous electrification projects. The distances are given in Table 18-1 and were used for the initial identification of receptors of each type.

Table 18-1 Distance of outer zone boundary for receptors

Categories	Distance (m)
Hospitals, Clinics, Other Medical Establishments	100
Educational Premises	50
Airports	1000
Recording, Film Studios	100
Military Establishments	1000
Research Laboratories	1000
Intentional Radio Transmitters	50
Other Commercial Premises (Retail Unit, Light & Heavy Industrial, etc.)	50
Radio Telescopes	5000
High Voltage Transmission and Distribution Lines/Cables	500
Interfacing Railways	50
Railway Depots and Signal Control Centres	50
Other sites not listed above	20

18.3.8 Where the Scheme is adjacent to, or joins with, an existing railway (either electrified or non-electrified) there will be a significant interface with the existing railway network. Although the existing infrastructure may have systems and procedures to mitigate the effects of EMI, the introduction of the Scheme's electrification infrastructure may have an adverse effect on the existing railway infrastructure. Similarly, the existing railway infrastructure may influence the Scheme (both infrastructure and rolling stock). However, this shall be considered as part of the EMC assurance activities during the detailed design stages as this is not an environmental impact.

Temporal scope

18.3.9 The assessment has considered sources of EMI during both the construction stage and operational phase of the Scheme:

- **Construction phase sources:** Direct effects could be caused by construction, testing and commissioning activities. Construction activities will be supported from local work compounds close to the worksites, or larger construction compounds where equipment generating EMI may be used; and
- **Operational phase sources:** Direct effects could be caused by the normal, degraded and faulted modes of the operation of the Scheme and its supporting systems.

Data sources

18.3.10 The data collection for this study has been carried out using data provided in the following sources:

- Scheme design documents showing limits of changes and electrification and construction site locations as well as the Scheme boundary;
- Open Street Maps (https://www.openstreetmap.org/);
- Google Maps (https://www.google.co.uk/maps), including Street View;
- Google Earth (https://www.google.co.uk/intl/en_uk/earth);
- Bing Maps (https://www.bing.com/maps);
- Mastdata (https://www.mastdata.com), for radiotelecommunication site locations; and
- Cellmapper (https://www.cellmapper.net), for mobile telecommunication site locations.

18.3.11 The assessment set-out in this ES chapter has been undertaken using the latest publicly available information in order to provide an assessment of EMI on human health and receptors as identified in Table 18-1, paragraph 18.4.3 and paragraph 18.4.4. The assessment utilised resources available online and published by others. Although this is third-party data there is high confidence in its accuracy and therefore it has been deemed appropriate to inform our baseline and assessment.

18.3.12 A full EMC hazard analysis will be undertaken as part of the ongoing EMC assurance activities where further confirmation will be sought on third-party data used in this assessment.

Assessment criteria

18.3.13 The significance of potential effects of EMI and EMF has been assessed using a risk-based approach and recorded in a Risk Assessment according to the EMC zoning principle described in the following paragraphs. This zoning principle is based on the EMC and EMF standards and guidelines outlined in Section 18.2.

18.3.14 The definition of an EM zone is a bounded area in which specific levels of EM energy are deemed to exist. Some EM zones contain higher levels of EM energy than others. In the railway environment, the zone containing most energy exists on the trackside of the railway (where traction power is returned to the running rails) and close to traction or non-traction power distribution equipment.

18.3.15 The zoning principle is used to determine the required EMC immunity levels and control methods to be applied to equipment operating in this area. Three zones are identified, each with its boundary determined from a reference point (the centreline between the two running rails) as shown in Insert 18-2. As distance increases from this point, EMC immunity level requirements become less onerous as a new EMC boundary zone is crossed. It must be noted that there may be special circumstances in which the zoning approach cannot guarantee compatibility. Each potential hazard that falls into this category will have additional methods adopted to ensure electromagnetic compatibility in its EME.

- **EM Zone 1:** For equipment less than 10m from the centreline of the nearest track rails BS EN 50121-4 (Signalling and Telecommunication Apparatus) and BS EN 50121-5 (Fixed Power Supply Installations) limits shall be applied. The emission and immunity levels provided in BS EN 50121-4 shall be applied to any safety critical equipment located in this zone;
- **EM Zone 2:** For equipment greater than 10m, but less than 20m from the centreline of the nearest track rails the emission and immunity limits given in BS EN 61000-6-1 (Generic standard - Immunity for residential, commercial and light industrial environments) and BS EN 61000-6-3 (Generic standards - Emissions for residential, commercial and light industrial environments) shall be applied in general. However, BS EN 61000-6-2 (Generic standards - Immunity for industrial environments) and BS EN 61000-6-4 (Generic standard - Emissions for Industrial Environments) limits shall be applied for safety critical equipment; and

- **EM Zone 3:** For equipment greater than 20m from the centreline of the nearest track rails the emission and immunity limits given in BS EN 61000-6-1 (Generic standard - Immunity for residential, commercial and light industrial environments) and BS EN 61000-6-3 (Generic standards - Emissions for residential, commercial and light industrial environments) shall be applied in general. Specific assessment criteria for sites listed in Table 18-1 located beyond 20m are based on their particular susceptibility profiles and applicable EMC standards.

18.3.16 For human exposure to EMFs affecting the public outside the railway boundary, i.e. in EM Zones 2 and 3, Public RLs in the ICNIRP 1998 guidelines shall be applied. The area within the railway boundary (Zone 1) is not generally accessible to the public and Low ALs from the Control of Electromagnetic Fields at Work Regulations shall be applied.

18.3.17 The ALs defined in the Control of Electromagnetic Fields at Work Regulations for occupational exposure and the RLs defined in ICNIRP 1998 for public exposure at the power supply frequency of 50 Hz are summarised in Table 18-2. These limits are applied for EMFs emanating from traction power supply equipment. Other lineside equipment operating at a different frequency will have a different limit and the guidance and limits will be applied appropriately in each instance. Further details on the ALs and RLs and their applicability are given in paragraph 18.2.3 and paragraph 18.2.4, respectively.

Table 18-2 Limits for exposure to 50Hz EMFs

Limit	Magnetic field (mT)	Electric field (kV/m)
RL	0.1	5
Low AL	1	10
High AL	6	20

18.3.18 It is not anticipated that the public EMF exposure RLs given in Table 18-2 will be exceeded at any point beyond the operational railway boundary as the field strengths decay rapidly with distance from source. Detailed design will consider specific conditions, such as an overbridge accessible to the general public, which is in close proximity to OLE or with the railway operating in certain degraded modes (e.g. alternative electrical feeding arrangements) where it may be possible to exceed the reference level. Such scenarios are not currently known and will be assessed on a case by case basis as part of the EMC assurance activities during detailed design in accordance with the principles outlined in ICNIRP 1998.

18.3.19 Following the identification of receptors through the desktop study, each receptor is assessed for the impact of EMF exposure and EMC effects. The assessment has classified these impacts by considering factors such as:

- The distance of the receptor from the track (EM Zone);
- The receptors electromagnetic characteristics and EMC standards compliance; and
- The likelihood of it being affected.

18.3.20 This enables sensitivity and magnitude of impact to be assigned to each receptor.

Sensitivity of receptors

Receptors susceptible to EMI

18.3.21 The sensitivity of receptors to predicted EMI effects were defined as follows:

- **Low sensitivity:** A receptor whose failure when subjected to EMI is non-critical – i.e. has no impact with regard to safety or to operational integrity of a system or service;

- **Medium sensitivity:** Any receptor whose failure to perform as intended, may disrupt the normal operation of a system, the effect of which is to cause a delay to the production of a service or an annoyance;
- **High sensitivity:** A receptor that has safety-critical applications; and
- **Very high sensitivity:** A receptor that contains sensitive apparatus e.g. laboratories, military establishments.

18.3.22 Therefore, sensitivity to EMI is dependent on the type of receptor and the likelihood that it would be affected. A generic classification of sensitivity for the different receptor types is given in Table 18-3 based on the type of property. This shall be considered alongside the definitions provided in Paragraph 18.3.20 to classify the sensitivity of the receptor.

Table 18-3 Sensitivity of receptors with regards to EMI

Sensitivity of receptor (EMI)	Type of property
Very High	Sensitive sites which may include: • Research laboratories (including within universities); • Radiocommunication facilities; See Table 18-1 and Paragraph 18.4.4 for further details
High	Heavy industrial sites
Medium	Light industrial and commercial premises
Low	Residential properties

Receptors susceptible to EMFs

18.3.23 For EMF exposure, sensitivity is determined based on the location of the property with respect to the railway boundary as set-out in Table 18-4. It is classified either as high or low.

Table 18-4 Sensitivity of receptors with regards to EMF

Sensitivity of receptor (EMF)	Property Location
High	Property located inside the railway boundary (EM Zone 1).
Low	Property located outside the railway boundary (EM Zone 2 or 3).

Magnitude of impact

18.3.24 The magnitude of impact for the EMI and EMF assessment is categorised as detailed in Table 18-5. In determining the impact, the separation distance of the property from the railway shall be considered as detailed in paragraph 18.3.15.

Table 18-5 Magnitude of impact

Magnitude of impact	Impact of EMI	Impact of EMF
High	Any EMI effects lead to degradation of performance of equipment or systems in such a way that injury or worse may be incurred by the operator, third party or member of the public or which leads to unrecoverable operation of equipment or system itself.	EMF exposure levels may approach or exceed the applicable RL/AL at localised areas.

Magnitude of impact	Impact of EMI	Impact of EMF
Medium	Any EMI effects lead to degradation of equipment or system performance leading to maloperation or delay which requires intervention to recover following the removal of the disturbance.	EMF exposure levels are increased but remain within the applicable RL/AL.
Low	Any EMI effects lead to some degradation of equipment or system performance leading to annoyance or delay which is fully recoverable following the removal of the disturbance.	EMF exposure levels may be increased but remain well within the applicable RL/AL.
Very Low	Any EMI effects are negligible with regard to operation of equipment or systems which continue to operate as normal.	There is negligible effect on EMF exposure to people.

Significance criteria

18.3.25 The significance of an effect is categorised using the combination of sensitivity (see Table 18-3 for EMI and Table 18-4 for EMF) and magnitude of impact (see Table 18-5). The significance is classified as shown in Table 18-6. This criterion is also applicable for determining significance of residual effects.

Table 18-6 Assessment of significance of effect

Magnitude of impact	Sensitivity of receptor			
	Very high	High	Medium	Low
High	Significant	Significant	Significant	Significant
Medium	Significant	Significant	Significant	Not significant
Low	Significant	Significant	Not significant	Not significant
Very low	Significant	Not significant	Not significant	Not significant

Residual impact assessment

18.3.26 If further mitigation (in addition to that which is embedded in the Scheme design) is required to reduce otherwise significant EMI or EMF risks, this is identified in the residual impact section along with a final assessment of the ultimate impact. This has been an iterative process throughout the Scheme's design to ensure that mitigation can be built into the design wherever possible with the objective of removing all significant residual risks at the design stage.

18.3.27 For the purposes of EMI and EMF, the following embedded mitigations are assumed to be applied and form part of the initial significance classification of receptors in the risk assessment process:

- A robust EMC Assurance Process is in place throughout the project lifecycle to ensure that EMC/EMI and EMF is correctly managed;
- Application of applicable EMC standards and good practices by the designers and installers;
- Product acceptance and required levels of EMC compliance are achieved for apparatus to be procured as part of the Scheme;
- Where bridges will be retained, the design of the Scheme incorporates raising of parapet heights to railway standards (minimum 1.8m) to allow overhead line equipment to pass

safely underneath. Such measures are proposed at Westgate Overbridge (MVL3/90), Bradley's No.2 Overbridge (MVL3/105), Sands Lane Overbridge (MVN2/199) and Hunger Hill Overbridge (MVN2/201);

- Where construction of new or replacement bridges are proposed, the design of the Scheme will incorporate parapet heights to railway standards (minimum 1.8m) to allow overhead line equipment to pass safely underneath; and
- The findings of the risk assessments set-out in Table 18-8 to Table 18-14 are further developed and taken forward by the Scheme for management throughout the remainder of the project lifecycle to ensure the EMC/EMI and EMF risks to railway neighbours is addressed and managed.

Scoping and consultation

18.3.28 Residents within 100m of the Scheme have been informed of the Scheme proposals, through the community consultation events detailed in the Report Summarising Consultation Undertaken (NR07). Three public engagement events have been held (2019 and 2020) which have provided opportunities for residents to raise any issues, however it should be noted that no specific details were provided or queries raised regarding sensitive equipment that may need to be mitigated due to the Scheme. Further information on the proposed works will be supplied to residents prior to construction works commencing on site.

Assumptions and limitations

18.3.29 During the assessment, all properties or buildings which lie within the 50m zone of influence whose functionality or type could not be identified have been classified as residential.

18.3.30 Where the available mapping data did not provide additional information (including building purpose or type of industrial use), Google Maps and Bing Maps were consulted to attempt to determine the necessary data (so far as reasonably practicable).

18.3.31 The rolling stock and infrastructure introduced by the Scheme are expected to be compliant with the relevant Regulations, national and international standards.

18.3.32 It is anticipated that the Scheme will be categorised as a "Standard" installation by the Network Rail Designated Project Engineer (DPE) to satisfy the requirements of Network Rail's EMC Assurance Process NR/L2/RSE/30041. For standard installations, compliance with the British Standards (BS), railway National Technical Rules (NTR), Railway Industry Standards (RIS), and NR standards coupled with application of industry best practice with respect to EMC is sufficient to mitigate risks posed by the installation as a whole to the environment. Therefore, these standards have been used as the primary source of mitigation against EMI for all receptors identified as part of this study.

18.3.33 The Stakeholder Advisory Group on EMFs (SAGE) for the UK government and ICNIRP have carried out assessments to determine safe EMF exposure limits for people at particular risk, such as pregnant women, persons with active implanted medical devices (AIMDs) and body worn medical devices (BWMDs). Studies conducted by ICNIRP recognise a limit as low as 0.5mT for static magnetic field exposure. It is not anticipated that this limit will be exceeded at and beyond the operational railway boundary.

18.3.34 A detailed review of buried services records has not been carried out as the dataset is accompanied with a disclaimer regarding its validity and is not to be used for design purposes. A high-level review has been undertaken of the available buried services data and the findings set out in Paragraph 18.4.9. As part of the design development process, a detailed review of the instructed buried service information shall be undertaken at detailed design.

18.3.35 The Scheme is based on conventional lineside signalling systems. No consideration has been given to any new GSM-R (Global System for Mobile Communications – Railway) sites or any works required to support future introduction of ETCS (European Train Control System). It is understood that the Scheme requires relocation of two existing GSM-R masts. Any modifications to the GSM-R infrastructure (by this Scheme and any future projects) may have to complete co-site interference assessments with nearby mobile phone masts.

18.4 Baseline

Potential sources and receptors

18.4.1 No existing railway overhead electrification is present in the Scheme area. The main sources of both EMI and EMF from the Scheme is the traction power equipment. This includes:

- Components of the OLE;
- Earthing and bonding conductors;
- Electrical Feeding Stations (PSUs), distribution and sectioning sites (TSCs); and
- Traction power equipment installed on the rolling stock (trains) including the pantograph.

18.4.2 Other potential sources of EMI within the Scheme include:

- Radiocommunication systems, both lineside (e.g. Fixed Telecoms Network GSM-R masts) and on rolling stock, for example site radio systems used during construction and components of the signalling and telecommunication system during operation;
- Train detection assets; and
- Electrical machinery, such as pumps, generators and compressors.

18.4.3 Receptors (sites) along the Scheme where changes to the EME could give rise to significant effects include, but are not limited to, the following (note these are not necessarily Scheme specific):

- Residential, commercial and industrial properties;
- Education and research facilities such as schools and universities;
- Medical facilities;
- Transportation hubs such as airports, public transport interchanges; and
- Military establishments.

18.4.4 Based on the immunity levels in applicable EMC standards certain sites have the potential to host/operate particularly sensitive electrical equipment. These sensitive sites include:

- Hospitals;
- Airports;
- Research laboratories (including within universities);
- Radiocommunication facilities (including emergency and commercial radio);
- Audio/visual recording and broadcasting studios; and
- Military establishments.

18.4.5 Other receptors include metallic services and utilities, such as overhead power lines, telecommunication circuits and utility pipelines, in particular those that run parallel to the railway corridor for a significant distance at close proximity. Whilst utilities crossing at right angles will be subjected to minimal inductive effects, those that are buried may require insulation and/or gapping in accordance with the asset owner's requirements.

Interfaces with other railways

18.4.6 The Scheme interfaces with the following other existing railway lines, all of which are currently not electrified:

- Springwood Junction;
- Bradley Junction;
- Calder Valley Line – Heaton Lodge Junction to Brighouse; and,
- Calder Valley Line – Thornhill Junction.

National Grid interfaces

18.4.7 The high voltage overhead line interfaces with the route are presented in Table 18-7.

Table 18-7 High Voltage overhead line Interfaces

Interface type	GPS Location
400 kV overhead line crossings - 90° crossing angle	53.679371, -1.733046
33/66 kV overhead line crossings - 45° crossing angle	53.670626, -1.678467
132 kV overhead line crossings - 60° crossing angle	53.677962, -1.651420
275/132 kV overhead line crossings - 70° crossing angle	53.676158, -1.654238

18.4.8 Considering the angle of the crossings for the overhead lines detailed in Table 18-6, it is expected that they do not run parallel to the railway over a significant length.

Impact on utilities and buried services

18.4.9 Throughout the Scheme, the available buried services information shows several utilities and services with significant lengths of parallelism (≥ 1km) within 20m of the centreline of the nearest track. Information is provided as GPS co-ordinates:

- Telecommunications (Vodafone and Instalcom) – e.g. (53.643616, -1.798525) to (53.689276, -1.637057), parallel length of ~ 13km;
- Water – e.g. (53.670513, -1.676687) to (53.674653, -1.657503), parallel length of ~ 1.35km; and
- High Voltage Power cable – e.g. (53.671738, -1.671725) to (53.674700, -1.657548), parallel length of ~ 1.000km.

18.5 Potential effects

Route Section 1 – Huddersfield

18.5.1 Table 18-8 includes results for establishments that are considered at risk with respect to EMI in Route Section 1. The railway runs below ground through the Huddersfield and Gledholt Tunnels within this section of the route. Establishments located on the ground above the tunnel are considered not at risk from EMI effects.

18.5.2 Due to the proximity of the Yorkshire Children's Centre to the operational railway, it was also considered with respect to EMF as detailed in Table 18-9.

18.5.3 Route Section 1 includes Huddersfield Station which is located in the town centre and consequently includes several establishments within the considered distances from the centre of the track. There are refurbishments and expansions planned for Huddersfield Station as part of the Scheme which includes re-modelling and lengthening of platforms, alterations to the roofs of both train sheds and replacement of the existing platform canopies to cover the remodelled and extended platforms. For Huddersfield Station, EMI and EMF shall be managed by the Scheme throughout the project lifecycle.

Table 18-8 EMI risk assessment for Route Section 1

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
Army Reserve Centre	Military establishment	53.642317 -1.779369	680	Very High	Medium	Significant
Yorkshire Children's Centre	Education premises	53.647735 -1.785868	3	Medium	Medium	Significant
Vodafone	Radio/phone mast	53.64966202 -1.78392398	1	High	Medium	Significant
J S Motors	Light industry/commercial	53.651444 -1.782140	12.5	Medium	Very Low	Not Significant
The MOT Centre	Light industry/commercial	53.65159 -1.782076	18	Medium	Very Low	Not Significant
Perrys Huddersfield Mazda	Light industry/commercial	53.652128 -1.781631	13	Medium	Very Low	Not Significant
Halfords	Light industry/commercial	53.391033 -1.465615	19.5	Medium	Very Low	Not Significant

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
Perrys Huddersfield Citroen	Light industry/commercial	53.652128 -1.781631	17	Medium	Very Low	Not Significant
J Motor Mechanics	Light industry/commercial	53.653095 -1.781067	14	Medium	Very Low	Not Significant
Haworths (MOT Centre)	Light industry/commercial	53.653348 -1.781073	<20	Medium	Very Low	Not Significant
Motorcycle Services	Light industry/commercial	53.653454 -1.780967	<20	Medium	Very Low	Not Significant
A&A Mechanics	Light industry/commercial	53.653518 -1.780908	<20	Medium	Very Low	Not Significant
Go 2 Tyres	Light industry/commercial	53.653648 -1.780836	<20	Medium	Very Low	Not Significant
G S Motor Repair	Light industry/commercial	53.654067 -1.780595	<20	Medium	Very Low	Not Significant
AK Spares Huddersfield	Light industry/commercial	53.654397 -1.780131	10	Medium	Low	Not Significant

Table 18-9 EMF risk assessment for Route Section 1

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
Yorkshire Children's Centre	Education premises	53.647735 -1.785868	3	Low	High	Significant

Route Section 2 – Hillhouse and Fartown

18.5.4 Table 18-10 includes results for establishments that are considered at risk with respect to EMI in Route Section 2. This section of the line is predominantly surrounded by commercial buildings and fields. Residential areas are a safe distance away from the centre of the track.

18.5.5 There are no identified EMF risks to Route Section 2 receptors.

Table 18-10 EMI risk assessment for Route Section 2

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
SUEZ recycling and recovery UK - Kirklees	Heavy industry	53.656476 -1.77794	37	High	Low	Significant
Emerald Street Household Waste Recycling Centre	Light industry/commercial	53.65842 -1.775592	35	Medium	Very Low	Not Significant
Montgomery Engravers Ltd	Heavy industry	53.661789 -1.77117	21	High	Very Low	Not Significant
Playing fields	Light industry/commercial	53.663982 -1.766387	49	Medium	Very Low	Not Significant

Route Section 3 – Deighton and Bradley

18.5.6 Table 18-11 includes results for establishments that are considered at risk with respect to EMI in Route Section 3. This section of the line is predominantly surrounded by commercial buildings and fields. Residential areas are a safe distance away from the centre of the track.

18.5.7 There are no identified EMF risks to Route Section 3 receptors.

Table 18-11 EMI risk assessment for Route Section 3

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
Deighton Station	Light industry/commercial	53.668331 -1.752427	1	Medium	Low	Not Significant
Pro Remaps & Tuning	Light industry/commercial	53.668569 -1.750971	19	Medium	Very Low	Not Significant
P.J. Southernwood	Light industry/commercial	53.668972 -1.750036	16	Medium	Very Low	Not Significant
Whitacre Industrial Park	Heavy industry	53.66938 -1.749312	16	High	Very Low	Not Significant
Allcar Tyres & Exhausts	Light industry/commercial	53.671335 -1.747508	36	Medium	Very Low	Not Significant
BID - Ireland	Light industry/commercial	53.671803 -1.746013	8	Medium	Low	Not Significant
Huddersfield Volkswagen	Light industry/commercial	53.673053 -1.745379	10	Medium	Low	Not Significant
Ainley Industrial Estate	Light industry/commercial	53.674374 -1.744206	20	Medium	Very Low	Not Significant
Vodafone and O2	Radio/phone mast	53.6749649 -1.74346554	38.5	High	Very Low	Not Significant
P B S C Ltd	Light industry/commercial	53.675405 -1.742682	15	Medium	Very Low	Not Significant
Lantech Solutions Ltd	Light industry/commercial	53.67606 -1.741817	27	Medium	Very Low	Not Significant

Route Section 4 – Colne Bridge and Battyeford

18.5.8 Table 18-12 includes results for establishments that are considered at risk with respect to EMI in Route Section 4. This section of the line is predominantly surrounded by commercial buildings and fields. Residential areas are a safe distance away from the centre of the track.

18.5.9 There are no identified EMF risks to Route Section 4 receptors.

Table 18-12 EMI risk assessment for Route Section 4

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
Aspin House	Light industry/commercial	53.676799 -1.739105	4	Medium	Low	Not Significant
RYOBI Aluminium Casting (UK) Limited	Heavy industry	53.678011 -1.73625	21	High	Very Low	Not Significant
Mamas & Papas	Light industry/commercial	53.677757 -1.738287	18	Medium	Very Low	Not Significant
Nationwide Crash Repair Centres Ltd	Light industry/commercial	53.677799 -1.739404	11	Medium	Very Low	Not Significant
Heywood Williams Architectural	Heavy industry	53.678411 -1.736874	15	Medium	Very Low	Not Significant
Colne Bridge Autobody Shop	Light industry/commercial	53.679074 -1.73491	19	Medium	Very Low	Not Significant
Yorkshire Water Sewage works	Light industry/commercial	53.680726 -1.729536	15	Medium	Very Low	Not Significant

Route Section 5 – Mirfield and Lower Hopton

18.5.10 There are no identified EMF risks to Route Section 5 receptors.

18.5.11 Table 18-13 includes results for establishments that are considered at risk with respect to EMI in Route Section 5. This section of the line is predominantly surrounded by commercial buildings and fields. Residential areas are a safe distance away from the centre of the track.

18.5.12 There are no identified EMF risks to Route Section 5 receptors.

Table 18-13 EMI risk assessment for Route Section 5

Identifier/Name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
Jewson Mirfield	Light industry/commercial	53.671702 -1.693176	5	Medium	Low	Not Significant
Mirfield Station	Light industry/commercial	53.671517 -1.69305	1	Medium	Low	Not Significant
Depot	Light industry/commercial	53.670968 -1.6917	30	Medium	Very Low	Not Significant
Bespoke School Furniture	Light industry/commercial	53.671455 -1.692553	15	Medium	Very Low	Not Significant
Dr Reddy's Laboratories EU Ltd	Laboratories and heavy industry	53.670932 -1.679045	9	Very High	Medium	Significant

Route Section 6 – Ravensthorpe and Westtown

18.5.13 Table 18-14 includes results for establishments that are considered at risk with respect to EMI in Route Section 6. This section of the line is predominantly surrounded by commercial buildings and fields. Residential areas are a safe distance away from the centre of the track.

18.5.14 There are no identified EMF risks to Route Section 6 receptors.

Table 18-14 EMI risk assessment for Route Section 6

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
Newlay Concrete Ltd	Heavy industry	53.675010 -1.659913	15	High	Very Low	Not Significant
Thornhill Power Station	Heavy industry	53.677154 -1.655023	50	High	Very Low	Not Significant
Ravensthorpe Station	Light industry/commercial	53.675627 -1.655808	2	Medium	Low	Not Significant
Longley Concrete	Heavy industry	53.67579 -1.652752	17	High	Medium	Significant
Kirklees Council recycling and recovery UK – Dewsbury	Heavy industry	53.682514 -1.644683	17	High	Medium	Significant
Vodafone, O2	Radio/phone mast	53.68304062 -1.645094395	13.5	High	Medium	Significant
Armley Chair works Ltd	Light industry/commercial	53.683232 -1.643964	14	Medium	Very Low	Not Significant
Shackletons Ltd	Light industry/commercial	53.683751 -1.643175	13	Medium	Very Low	Not Significant
Stross House	Light industry/commercial	53.683322 -1.644748	20	Medium	Very Low	Not Significant
Compressor Shop	Light industry/commercial	53.686431 -1.64153	13	Medium	Very Low	Not Significant
Price Waste Services	Light industry/commercial	53.688334 -1.638607	6	Medium	Low	Not Significant
Sparkles Car Wash	Light industry/commercial	53.689374 -1.637045	6	Medium	Low	Not Significant

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance
JG Harrison and Sons ltd	Light industry/commercial	53.690069, -1.636657	10	Medium	Low	Not Significant

Interfaces with other railways

18.5.15 The existing interfacing railway line routes are presently non-electrified and consequently these interfaces are not likely to degrade the EM environment beyond that anticipated for the Scheme.

National Grid Interfaces

18.5.16 Considering the angle of the crossings for the overhead lines (see Table 18-6), it is expected that they do not run parallel to the railway over a significant length and that adverse electromagnetic coupling with the railway electrification system is unlikely. It is required however to maintain appropriate segregation distances between Grid HV cables and railway OLE, as per National Grid and Network Rail standards.

Impact on utilities and buried services

18.5.17 The introduction of electrification by the Scheme poses several hazards resulting from the induced voltage into to these parallel assets:

- Induced longitudinal voltage[8] into third party copper cables (including sheaths and armours) poses an electric shock risk to asset maintainers;
- Induced longitudinal voltage[8] into third party copper cables may damage or cause maloperation of connected third party assets; and
- Induced transverse voltage[9] into third party copper telecommunications cables that manifests as noise on analogue/voice circuits.

18.6 Mitigation measures

18.6.1 Many of the effects caused by EMI and EMF will be eliminated or reduced to acceptable levels during the detailed design and construction phase of the Scheme by the application of relevant BSs and industry best practice, for example, the use of standard separation distances for cables of different voltage and screening techniques (Embedded Mitigation).

18.6.2 A Power Supply Unit (PSU) is to be installed to the east of Ravensthorpe Station between the diverging lines (Thornhill Quarry landfill site). Due to the installation of this PSU, the environmental impacts of the new line will change. Consequently, a risk assessment shall be carried out at detailed design stages to identify and mitigate the risks induced by this installation. This assessment shall also consider any cumulative effects and identify any required additional mitigations necessary.

18.6.3 This new PSU is to utilise Static Frequency Converter technology which has only recently been trialled on Network Rail infrastructure at Potteric Carr (Doncaster) on the East Coast Main Line. Therefore, engagement with the East Coast Power Supply Upgrade project will be key in ensuring any associated EMC risks from this technology are identified and managed throughout the project lifecycle. Given that the nearest third party is greater than 40m from the feeder station, the use of Static Frequency Converter technology is unlikely to cause any EMC issues beyond the railway boundary.

18.6.4 Interfaces between different railways will be handled as part of the EMC management and integration plan to ensure adequate mitigations are implemented for immunisation of signalling and telecommunication cables and to prevent the exporting of hazardous touch voltages at

[8] The voltage developed along the length of a cable due to induction.
[9] The voltage developed between two wires forming a telecommunications pair as a result of the longitudinal voltage and cable imbalances.

the electrification boundaries. This ongoing management of EMC is undertaken throughout the project lifecycle in accordance with Network Rail's EMC Strategy and EMC Assurance Process.

18.6.5 The following section details specific mitigation measures required in addition to the embedded design measures. It must be noted that where an additional mitigation is described for an establishment, it consists of all parts of the establishment. For example, with regards to the stations, all commercial units such as cafes and ticket kiosks shall be considered as a part of the station.

18.7 Residual effects

18.7.1 For establishments classed as "Significant" in the assessments undertaken in the Section 18.5, the residual effects have been determined based on the proposed additional mitigation measures as set out in Table 18-15 for EMI and Table 18-16 for EMF.

18.7.2 Some of the sites classed as "Significant" require further assessment to be undertaken by the designer at detailed design stage and this has been identified against the relevant sites in Table 18-15 and Table 18-16. This further assessment shall be undertaken as part of the ongoing management of EMC throughout the project lifecycle in accordance with Network Rail's EMC Strategy and Assurance Process.

18.7.3 Residual EMI and EMF effects may also be mitigated by implementing operational control measures (e.g. access restrictions to HV equipment when live). The hazard identification, risk assessment and mitigation process will continue throughout the project lifecycle to identify and control the relevant EMC risks as part of the ongoing EMC assurance process.

Table 18-15 EMI risk assessment for sites deemed Significant

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance	Additional mitigation	Residual effect
Army Reserve Centre	Military establishment	53.642317 -1.779369	680	Very High	Medium	Significant	The army centre is located >500m distance away from the centreline of the nearest track. The desktop survey identified the premises as a traditional building with no visible antenna/communication systems or heavy equipment and consequently it is not considered as a sensitive receptor with respect to EMI.	Not Significant
Yorkshire Children's Centre	Education premises	53.647735 -1.785868	3	Medium	Medium	Significant	Given the proximity of this property to the track, further assessment will be required regarding EMI levels (e.g. modelling or calculation of anticipated field levels). This could potentially require relocation of any susceptible equipment within the premises or a change of use in the rooms located nearest to the railway. The understanding of the Children's Centre has been based on the submitted planning application (2015/62/90554/W). The final details of OLE (including the extent of electrification into the headshunt, if applicable), shall be reviewed and assessed prior to construction.	This assessment has determined that implementation of the additional mitigation measures would be sufficient to ensure no residual effect. Should mitigation such as relocation of sensitive equipment not be achievable or agreed to, residual effects will be reconsidered when the EMI risk assessment is carried out at detailed design.
Vodafone	Radio/phone mast	53.64966202 - 1.78392398	1	High	Medium	Significant	The location of this base-station mast (ID 3464) was obtained from the site-finder database which was last updated in 2012. The mast could not be identified in the vicinity by the desktop survey and is likely to have been relocated or superseded by a new base-station elsewhere.	Not Significant
SUEZ recycling and recovery UK – Kirklees	Heavy industry	53.656476 -1.777942	37	High	Low	Significant	Buried services records will have to be reviewed to identify any metallic cables and/or pipes originating from the compound and running close and/or parallel to the railway that may be susceptible to induced hazardous touch voltages which pose a risk of electric shock. Where metallic pipes are in close proximity to traction power and earth conductors, utilities may need to be gapped and bonded, or insulated to mitigate this risk (e.g. use of PVC piping). This shall be verified and investigated during detailed design to determine any additional mitigation measures once utilities survey data is available.	This assessment has determined that implementation of the additional mitigation measures would be sufficient to ensure no residual effect i.e. not significant.
Dr Reddy's Laboratories EU Ltd	Laboratories and Heavy industry	53.670932 -1.679045	9	Very High	Medium	Significant	Consultation with the site owner shall be undertaken to determine the presence of any highly sensitive equipment and its location within the site. An External Communications Programme will be produced under Part B of the Code of Construction Practice (CoCP) which will set out the procedure for engagement. The contents of the Communications Programme will be submitted to and agreed by the Local Authority pursuant to a condition attached to the deemed planning permission[10] before construction works commence. An EMI risk assessment will need to be carried out during detailed design to identify any specific mitigations required in conjunction with the owner (e.g. relocation of sensitive equipment within the premises) which will then need to be managed as part of the ongoing EMC assurance activities.	This assessment has determined that implementation of the additional mitigation measures would be sufficient to ensure no residual effect. Should mitigation such as relocation of sensitive equipment not be achievable or agreed to, residual effects will be reconsidered when the EMI risk assessment is carried out at detailed design.

[10] On making an order under the Transport and Works Act 1992, the Secretary of State may direct that planning permission shall be deemed to be granted, subject to such conditions (if any) as may be specified in the direction.

Identifier/name	Type	GPS location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance	Additional mitigation	Residual effect
Longley Concrete	Heavy industry	53.67579 -1.652752	17	High	Medium	Significant	A PSU site is proposed to the rear of these premises. Consultation with the owner in line with the engagement procedure which will be set out in the External Communications Programme (Part B of the CoCP) and a risk assessment will be undertaken during detailed to determine any additional mitigation measures required – e.g. relocation of sensitive equipment within the premises that may be susceptible to EMI.	This assessment has determined that implementation of the additional mitigation measures would be sufficient to ensure no residual effect i.e. not significant.
Kirklees Council recycling and recovery UK - Dewsbury	Heavy industry	53.682514 -1.644683	17	High	Medium	Significant	Buried services records will have to be reviewed to identify any metallic cables and/or pipes originating from the compound and running close and/or parallel to the railway that may be susceptible to induced hazardous touch voltages which pose a risk of electric shock. Where metallic pipes are in close proximity to traction power and earth conductors, utilities may need to be gapped and bonded, or insulated to mitigate this risk (e.g. use of PVC piping). This shall be verified and investigated during detailed design to determine any additional mitigation measures once utilities survey data is available.	This assessment has determined that implementation of the additional mitigation measures would be sufficient to ensure no residual effect i.e. not significant.
Vodafone, O2	Radio/phone mast	53.68304062 - 1.645094395	13.5	High	Medium	Significant	Buried services records will have to be reviewed to identify any metallic cables and/or pipes originating from the compound and running close and/or parallel to the railway that may be susceptible to induced hazardous touch voltages which pose a risk of electric shock. Where metallic pipes are in close proximity to traction power and earth conductors, utilities may need to be gapped and bonded, or insulated to mitigate this risk (e.g. use of PVC piping). This shall be verified and investigated during detailed design to determine any additional mitigation measures once utilities survey data is available.	This assessment has determined that implementation of the additional mitigation measures would be sufficient to ensure no residual effect i.e. not significant.

Table 18-16 EMF risk assessment for sites deemed Significant

Identifier/name	Type	GPS Location	Distance from centre of track (m)	Sensitivity	Magnitude	Significance	Additional mitigation	Residual effect
Yorkshire Children's Centre	Education premises	53.647735 -1.785868	3	Low	High	Significant	Given the proximity of this property to the track, further assessment will be required regarding EMF levels (e.g. modelling or calculation of anticipated field levels). The final details of OLE (including the extent of electrification into the headshunt, if applicable), shall be reviewed and assessed prior to construction.	This assessment has determined that implementation of the additional mitigation measures would be sufficient to ensure no residual effect.

18.8 Cumulative effects

18.8.1 Cumulative effects can include intra-Scheme effects and inter-Scheme effects.

- Intra-Scheme effects (or in-combination synergistic effects) are the combined impact from a single project on a single receptor or resource;
- Inter-Scheme effects are the combined impact of a number of different projects within the vicinity (in combination with the Scheme) on a single receptor.

Intra-Scheme (synergistic) impacts

18.8.2 Potential intra-Scheme effects may occur from interaction with other environmental topics.

18.8.3 No potential synergistic impacts have been identified that correspond to EMI/EMF. It is therefore considered that no synergic impacts are likely to be generated.

Inter-Scheme effects

18.8.4 Inter-Scheme cumulative effects may occur from interaction with other proposed developments (Reasonably Foreseeable Future Projects (RFFPs)) located near the Scheme. When combined with the works in the Scheme area these could cumulatively affect sensitive receptors. Inclusion of RFFPs includes their proximity to the Scheme, likely impacts and timing of construction and operation.

18.8.5 No potential inter-Scheme impacts have been identified that correspond to EMI/EMF. It is therefore considered that no cumulative effects are likely to be generated during either the construction or operation phase.