

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

Volume 5: Appendix EM-001-00000

Electromagnetic interference

Affected receptors within 50m of railway
and associated risks and mitigation

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Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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1 Introduction

- 1.1.1 This report is an appendix to the electromagnetic interference (EMI) assessment which forms part of Volume 5 of the Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES).
- 1.1.2 This appendix provides details of changes to the EMI assessment since the production of the High Speed Two (HS2) High Speed Rail (Crewe – Manchester) Environmental Statement (ES) published in 2022¹ (the main ES) and the Supplementary Environmental Statement 1 (SES1) and Additional Provision 1 Environmental Statement (AP1 ES) also published in 2022².
- 1.1.3 This report covers the following community areas (CA):
- Pickmere to Agden and Hulseheath (MA03) – to a limited extent only;
 - Hulseheath to Manchester Airport (MA06);
 - Davenport Green to Ardwick (MA07);
 - Manchester Piccadilly Station (MA08); and
 - Annandale depot (off-route works).
- 1.1.4 This appendix should be read in conjunction with:
- the EMI assessment in the main ES (see main ES Volume 3, Route-wide effects and Volume 5, Appendix: EM-001-00000);
 - the EMI assessment in the SES1 and AP1 ES (see SES1 and AP1 ES Volume 3, Route-wide effects and Volume 5, Appendix: EM-001-00000); and
 - SES2 and AP2 ES Volume 3, Route-wide effects.
- 1.1.5 This report is structured into two parts: Part 1 – SES2, and Part 2 – AP2 ES. These parts are subdivided into community areas, and then into the relevant SES2 changes and AP2 amendments which are of relevance to the EMI assessment. Part 1 also contains relevant updates to the EMI assessment of the original scheme as a result of updated baseline data.
- 1.1.6 In order to differentiate between the original scheme and the subsequent changes, the following terms are used:
- ‘the original scheme’ – the Bill scheme submitted to Parliament in 2022, which was assessed in the main ES;

¹ High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement*. Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.

² High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement*. Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement>.

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- ‘the SES1 scheme’ – the original scheme with any changes described in SES1 that are within the existing powers of the Bill;
- ‘the AP1 revised scheme’ – the original scheme as amended by the SES1 changes and AP1 amendments;
- ‘the SES2 scheme’ – the original scheme with any changes described in SES1 (submitted in July 2022) and in SES2; and
- ‘the AP2 revised scheme’ – the original scheme as amended by SES1 and SES2 changes (as relevant) and AP2 amendments.

2 Scope, methodology, data sources, assumptions and limitations

- 2.1.1 The assessment scope, key assumptions and limitations are as set out in the main ES, Environmental Impact Assessment (EIA) Scope and Methodology Report (SMR)³ (see main ES Volume 5, Appendix: CT-001-00001).
- 2.1.2 This report considers the electromagnetic interference impact of the SES2 changes and AP2 amendments to the original scheme and the AP1 revised scheme, together with an updated assessment of the original scheme based on revised baseline data - specifically associated with the following aspects:
- utilities assets as potential receptors of EMI; and
 - areas of the route where the 50m corridor defined with respect to the main running lines does not encompass proposed additional tracks, such as those associated with rolling stock maintenance facilities.
- 2.1.3 This assessment also takes into consideration committed development, reference is made in this report to the committed development reference codes set out in the Planning data report, see SES2 and AP2 ES Volume 5, Appendix: CT-004-00000, Planning data.

³ High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Environmental Impact Assessment Scope and Methodology Report*, Volume 5, Appendix: CT-001-00001. Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.

3 Assessment

3.1 Assessment of effects during construction

- 3.1.1 Construction machinery and plant, and associated communications (e.g. construction radios) will comply with the applicable standards for electromagnetic fields (EMF) and electromagnetic compatibility (EMC). Therefore, when installed, operated and maintained correctly, the risk of this apparatus producing EMF that exceeds published limits for workers and the public or causing EMI is considered to be low.
- 3.1.2 Power supplies used for construction are generally not sufficient to cause a major EMI risk. Specialist tunnel boring machines will be used for the construction of bored tunnel sections; these will typically require a high voltage electrical supply, normally at 11kV. This will come from the local Distribution Network Operator to a purpose-built sub-station within the work area. Such supplies will have no significant risk to health as the levels of EMF are very low for credible separation distances between such cables and the general public (expected to be greater than 250mm).
- 3.1.3 All construction activities will be confined to local areas. Mitigation will be controlled by adherence to British and European standards, which will be mandatory for all installation contractors. In addition, as set out in the draft Code of Construction Practice⁴ (CoCP), the nominated undertaker and its contractors will consider the impacts of EMI on wireless telecommunication systems whilst undertaking construction activities. This will include site-specific impacts from the demolition of buildings and the installation of tower cranes, and where appropriate will employ best practice technology to ensure that levels of radio frequency interference associated with construction activities are low and at acceptable levels.
- 3.1.4 It is therefore considered that there are no significant effects on a route-wide basis associated with construction.

3.2 Assessment of effects during operation

- 3.2.1 The primary source of EMF will be the traction power supplies generated at 25kV alternating current (AC); the voltages and currents generated in other electrical supplies used by the railway are not high enough to cause significant EMF outside the railway boundary.
- 3.2.2 The levels of EMF emitted by the traction power system will vary considerably along the HS2 route and the maximum values will last only for a few seconds at a time. The levels at any particular location depend on a number of variables, for example:

⁴ High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Draft Code of Construction Practice*, Volume 5, Appendix: CT-002-00000. Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.

- individual train performance at any particular instant i.e. whether it is accelerating, at constant velocity, braking or at rest;
- the number of individual trains in any one electrical section; and
- proximity to a traction feeder sub-station.

3.2.3 The effects of EMF rapidly diminish with distance from the source, both horizontally and vertically.

3.2.4 Preliminary traction power modelling has been undertaken by HS2 Ltd⁵ and the worst-case values of predicted EMF from this modelling have been used to estimate the levels of EMF at any particular location along the AP2 revised scheme⁶.

Effects of EMF on human health

3.2.5 The AP2 revised scheme will comply with the BS EN 50121 series of EMC standards⁷, which places limits on the maximum emission at the railway boundary. These limits are below the International Commission on Non-Ionising Radiation Protection (ICNIRP)⁸ guidelines, which define acceptable levels for EMF exposure of the general public and workers to provide protection against known adverse health effects.

3.2.6 At distances of between 7m and 10m from the track centreline of the HS2 route the estimated levels of EMF are below 10% of the maximum values of 100µT recommended by ICNIRP (1998) in relation to human health for magnetic field exposure at 50Hz. For electric field exposure, the estimated levels from the AP2 revised scheme are approximately 20% of the limits.

3.2.7 Where bridges will pass over or under the AP2 revised scheme, the level of EMF exposure may be higher than that at ground level, however it is unlikely to reach the maximum threshold. The level of exposure is also likely to be of a transient and short-term nature (e.g. crossing a bridge in a vehicle or on foot).

3.2.8 It is therefore considered that there are no significant EMF effects on a route-wide basis associated with operation.

Effects on electrical equipment due to EMI

3.2.9 It is possible that EMI risks may affect some residential receptors within 20m from the centre of the nearest track or industrial receptors with very sensitive electrical or electronic

⁵ EMC Strategy (2013), *C240-PBR-DS-STR-000-000001, Appendix A2*, pp.43-58.

⁶ The traction power modelling which underpins the EMF contour plots used in this assessment was for the HS2 Phase One section of route on which a higher service level (18TPH) is proposed compared to that for the HS2 Phase 2b section (between 4 and 10TPH). Hence this should add a further level of conservatism into the assessment.

⁷ British Standards Institution (2017), BS EN 50121, *Railway applications – Electromagnetic Compatibility*.

⁸ International Commission on non-ionizing radiation protection (2010), *Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (1Hz to 100 kHz)*.

equipment. This distance will depend on the localised situation, for example it will depend on whether the AP2 revised scheme is on a viaduct, in a cutting or tunnel. Where an EMI risk is identified, these receptors will be further evaluated during the detailed design stage and/or at testing and commissioning. Mitigation may be applied, for example in the form of replacement with less sensitive equipment or relocation of equipment where practicable.

- 3.2.10 Beyond 20m from the AP2 revised scheme, the estimated levels of EMI are below the threshold for electrical interference for residential, commercial and light-industrial receptors (specified in BS EN 61000-6-1⁹) and no risk has been identified.
- 3.2.11 The estimated levels of EMI are below the threshold for electrical interference for industrial receptors (specified in BS EN 61000-6-2¹⁰), excluding receptors with very sensitive electrical or electronic equipment. No risk to these receptors has been identified.
- 3.2.12 In accordance with guidance from the Medicines and Healthcare Products Regulatory Authority, EMF generated from power lines is not considered to pose a significant risk to people with active medical implants including pacemakers. Therefore, no potential significant impact on the operation of active medical implants is anticipated, provided the immunity performance is in line with the requirement of the applicable harmonised standards.

Other receptors

- 3.2.13 Where the AP2 revised scheme will run close to an existing conventional rail route, any effects of EMC, EMI or EMF will be mitigated by complying with the BS EN 50121 and BS EN 50122 suite of standards. It may be necessary for HS2 Ltd to agree and implement specific design solutions with Network Rail to mitigate or eliminate the risk of EMI to the conventional rail network.
- 3.2.14 Induced voltages from the HS2 overhead traction power system could affect metallic infrastructure that runs parallel to the AP2 revised scheme. For this to have a significant risk of interference, the infrastructure would have to run close to the AP2 revised scheme (e.g. 10m to 20m separation distance) and for a considerable distance, typically of the order of 1km or more. Any potential interference risk identified at this stage will be considered

⁹ British Standards Institution (2019), BS EN 61000-6-1, Electromagnetic compatibility (EMC), *Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*, BS EN 61000 Series.

¹⁰ British Standards Institution (2019), BS EN 61000-6-2, Electromagnetic compatibility (EMC), *Part 6-2: Generic standards – Immunity for industrial environments*, BS EN 61000 Series.

further in the detailed design stage. It is anticipated that the interference risks would be localised¹¹.

- 3.2.15 Other effects, such as induced voltages and earthing and bonding issues associated with the interface with other railways and third parties such as utilities, will be mitigated through design and construction in compliance with British, European and industry standards and best practice. Where required, HS2 Ltd will agree design solutions with affected third parties such as Network Rail, Transport for Greater Manchester, National Grid and National Highways, where reasonably practicable.
- 3.2.16 Cathodic protection (CP) systems as installed on neighbouring buried utilities such as some metallic pipelines could be affected by the HS2 traction power system. These risks will be considered further in the detailed design stage, and it is anticipated that the risk would be mitigated through application of British, European and industry standards and best practice.

Wildlife

- 3.2.17 The limited number of published studies addressing the risk of EMF to wildlife shows little or no evidence of a significant environmental impact. From current information, the exposure limits in the ICNIRP guidelines for protection of human health are also protective of wildlife.

Climate change

- 3.2.18 The levels of generated EMF and EMI are dependent on the traction power, which has been calculated for a worst-case scenario based on the maximum trains running per hour. Any change in climate is unlikely to affect the output from the traction power and cause any significant increase in EMF or EMI.

¹¹ Induced voltage impacts on third parties have been assessed against limits derived from the following standards:

- Railways: British Standards Institution (2022), BS EN 50122-1, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit, Part 1: Protective provisions against electric shock*.
- Pipelines: British Standards Institution (2011), BS EN 50443, *Effects of electromagnetic interference on pipelines caused by high voltage a.c. electric traction systems and/or high voltage a.c. power supply systems*.
- Telecommunications lines: International Telecommunications Union – Standardisation Sector (ITU-T) – formerly CCITT – (2008), *Directives concerning the protection of telecommunication lines against harmful effects from electric power and electrified railway lines - Volume VI: Danger, damage and disturbance*.
- Electricity Transmission and Distribution lines: British Standards Institution (2022), BS EN 50522, *Earthing of power installations exceeding 1 kV a.c.* (Note: This has been used on the basis that the limits it specifies are applicable within the electricity power supply industry and may therefore be reasonably applied to the range of scenarios relevant to electricity supply infrastructure, both high voltage and low voltage, for the purposes of this assessment).

Conclusions

- 3.2.19 The receptors that may be at risk due to revised baseline information, SES2 changes and AP2 amendments to the original scheme are included in Parts 1 and 2 of this report. The receptors listed here are supplementary to, or replace, those listed in the main ES (see main ES Volume 5, Appendix: EM-001-00000).
- 3.2.20 The SES2 changes and revised baseline data are not considered to result in any new or different likely significant route-wide effects from those presented in Volume 3 of the main ES.
- 3.2.21 The AP2 amendments are not considered to result in any new or different likely significant route-wide effects from those presented in Volume 3 of the main ES.
- 3.2.22 Receptors at potential risk from EMI (equipment immunity) are those residential and commercial buildings that will remain within 20m of the centre of the nearest track.
- 3.2.23 Within 20m, the levels of EMI emitted may cause some interference to sensitive electrical equipment. A further review will be undertaken at detailed design and/or testing and commissioning. Where electrical equipment is found to be adversely affected, initial mitigation would be to reposition the assets at the receptors locations, or if not possible, replace with less sensitive equipment.
- 3.2.24 Receptors at potential risk from induced voltages are infrastructure running close (within 50m) to and parallel for over 0.5km in length and include: other railway infrastructure, metallic fences, pipelines, overhead power cables and telecommunications cables on motorways.
- 3.2.25 Where induced voltages have been highlighted as a risk, the risk will be mitigated by designing, building, operating and maintaining the HS2 route to British, European and industry standards and best practice.

Part 1: Supplementary Environmental Statement 2

4 Introduction

4.1.1 In the following sections the EMI risk associated with the SES2 changes and revised baseline data is documented with updated lists of affected receptors. The original list of affected receptors was included in the main ES EMI assessment (see main ES Volume 5, Appendix: EM-001-00000). The changes relevant to the updated EMI assessment are summarised below.

4.2 Extension of the 50m corridor to allow for additional tracks (revised baseline information)

4.2.1 The original list of affected receptors reported in the main ES EMI assessment technical appendix was generated based on consideration of a 50m corridor from the centre line of the nearest HS2 track, considering only the principal HS2 running lines. A review was conducted to identify whether any additional receptors needed to be considered within the EMI assessment as a result of additional tracks associated with HS2 railway infrastructure, such as those associated with rolling stock depots or sidings. This review identified that an expanded assessment area needed to be considered for the Hulseheath to Manchester Airport area (MA06), based on applying a 50m corridor from the tracks at the edges of the area to be occupied by HS2 (at railway chainage MS 284+000). There were no additional receptors that were identified.

4.3 Utilities information (revised baseline information)

4.3.1 The utility information used for the EMI assessment was updated for community areas MA06 to MA08 and the updated list of EMI affected utility receptors is documented in Section 5.

4.4 Utility changes around Manchester Piccadilly (SES2-008-001, SES2-008-005 and SES2-008-006)

4.4.1 The updated baseline list of EMI affected utility receptors, referred to in Section 4.3, was further modified by the changes associated with utility changes in the vicinity of Manchester Piccadilly High Speed station for the SES2 scheme. The specific SES2 changes are noted below:

- changes to power supplies to Metrolink: Provision of a 6.6kV underground cable between the existing Electricity Northwest Primary Substation and the relocated Piccadilly Metrolink stop beneath Manchester Piccadilly High Speed station (SES2-008-001);
- change to requirement/assessment assumption for the demolition of Gateway House (SES2-008-005); and
- changes to Network Rail utilities: Provision of a 60m section of water main at Store Street (SES2-008-006).

4.4.2 These further utilities updates, as they relate to the EMI assessment, are also documented in Section 5.3 with the exception of those associated with SES2-008-005.

4.4.3 Since these cannot be considered in isolation of other utilities changes which are proposed in the same area, as described in Section 6.9, their effects are documented in Part 2 of this document in Section 7.4.

4.5 Substation relocation around Manchester Piccadilly (SES2-008-004)

4.5.1 The updated baseline list of EMI affected utility receptors, referred to above, was further modified by the changes associated with the relocation of six substations at Manchester Piccadilly High Speed station (SES2-008-004). These further utilities updates, as they relate to the EMI assessment, are also documented in Section 5.3.

5 Affected receptors

5.1 Hulseheath to Manchester Airport (MA06)

Electromagnetic field exposure assessment (health immunity)

5.1.1 No health immunity risks have been identified within this community area.

Electromagnetic compatibility assessment (equipment immunity)

5.1.2 The telecommunication mast information in Table 10 of the main ES Volume 5, Appendix: EM-001-00000 is superseded by the telecommunication mast information listed in Table 1 below. All remaining receptors in Table 10 of the main ES Volume 5, Appendix: EM-001-00000 remain unchanged.

5.1.3 Table 1 also identifies receptors due to updated information about committed developments.

Table 1: Potentially affected receptors within MA06 for electromagnetic compatibility assessment (equipment immunity) – updated baseline

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (A/m)	Estimated emission level (A/m)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-MT-0001	MS 283+267	31	Telecommunication Mast Asset owner: Unknown	Commercial	BS EN 61000-6-1	3	<3	N	N/A	Telecommunication mast has a separation of 31m from the alignment and therefore EMC risk is considered low.

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Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (A/m)	Estimated emission level (A/m)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-MT-0002	MS 290+40	30	Telecommunication Mast Asset owner: BT	Commercial	BS EN 61000-6-1	3	<3	N	N/A	Telecommunication mast to be removed from directly on top of the alignment of the . The new proposed location is 30m from the edge of the alignment.
MA06-CD-001	MS 290	0	Residential and commercial development	Commercial	BS EN 61000-6-1	3	>3	Y	To be determined at design stage	This receptor is a committed development [MA06/271S]. Timperley Wedge - site allocated for 2400 residential units, 60,000sqm of employment land and a new local centre. The receptor is over an extended area which includes the SES2 revised scheme in the vicinity of the existing Manchester Airport rail station. Specific immunity of equipment to be determined at the design stage to confirm whether the risk identified is significant.

Electromagnetic interference assessment (induced voltages on cables and pipes)

5.1.4 No induced voltage risks were identified in this community area in the previous assessment as reported in the main ES Volume 5, Appendix: EM-001-00000. The previous assessment is superseded by the information listed in Table 2.

Table 2: Potentially affected receptors within MA06 for electromagnetic compatibility assessment (induced voltages on cables and pipes) – updated baseline

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-PC-0001	MS 280+ 244 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Fuel pipeline	BS EN 50443	60 normal 1000 fault	To be determined at design stage	Y	To be determined at design stage	A section of the existing fuel pipeline route is to be abandoned with a proposed pipeline diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 80°. The asset may be equipped with a cathodic protection system which may be vulnerable to interference from the HS2 traction system.

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Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-FT-0046	MS 280+428 (crossing point)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Overhead telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Existing route crosses the alignment with a crossover angle of 75°. Parallelism is less than the threshold value.
MA06-CW-0006	MS 280+428 (crossover point)	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	Existing route crosses the alignment with a crossover angle of approximately 75°. Parallelism is less than the threshold value.
MA06-EN-0092	MS 281+331 (crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Overhead HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be removed with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 85°. Parallelism is less than the threshold value.

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Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-FT-0045	MS 280+331 (crossing point)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Overhead telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	A section of the existing telecoms cable route is to be removed with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 85°. Parallelism is less than the threshold value.
MA06-CW-0007	MS 281+331 (crossover point) MS 280+331 to MS 262+493	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the existing water distribution main route is to be abandoned with a proposed pipe diversion as the replacement. Existing route crosses the alignment with a crossover angle of approximately 85°. The proposed route runs parallel to the alignment for

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Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										approximately 162m with a minimum separation distance of 53m. Parallelism is less than the threshold value.
MA06-EN-0091	MS 280+331 (crossover point) MS 280+331 to MS 262+506	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Overhead HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be removed with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 85°. The proposed route runs parallel to the alignment for approximately 175m with a minimum separation distance of 53m. Parallelism is less than the threshold value.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-FT-0042	MS 281+291 (crossing point)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Existing route crosses the alignment with a crossover angle of 75°. Parallelism is less than the threshold value.
MA06-CW-0008	MS 281+612 (crossover point)	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water trunk main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the existing potable water trunk main route is to be abandoned with a proposed water trunk main diversion as the replacement. The proposed route crosses the alignment with a crossover angle of approximately 75°. Parallelism is less than the threshold value.
MA06-FT-0040	MS 282+250 (crossover point)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Existing route crosses the alignment with a crossover angle of 80°. Parallelism is less than the threshold value.
MA06-FT-0038	MS282+386	0	Utility	Below ground	CCITT part VI	25 normal 430 fault	To be determined	Y	To be determined	Existing route crosses the alignment with a

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
	(crossover point)		Asset Owner: British Telecom Material (where known): Not available	telecoms cable			at design stage		at design stage	crossover angle of 30°. Parallel for 175m, with a minimum separation of 2m.
MA06-EN-0093	MS 282+502 (crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be removed. Existing route crosses the alignment with a crossover angle of 85°. The route runs parallel to the alignment for approximately 83m with a minimum separation of 10m. Parallelism is less than the threshold value.
MA06-EN-0095	MS 282+235 (crossover point) MS 282+317 to MS 282+597	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Below ground 11kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be removed with a proposed cable diversion as the replacement. The proposed route crosses the alignment

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										with a crossover angle of 85°. The proposed route runs parallel to the alignment for approximately 280m with a minimum separation distance of 53m. Parallelism is less than the threshold value.
MA06-WW-0001	MS 283+402 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the existing gravity wastewater sewer is to be abandoned with a proposed double pipeline diversion. The proposed route crosses the alignment with a crossover angle of 90°. Parallelism is less than the threshold value.
MA06-EN-0081	MS 284+074 (crossover point)	0	Utility Asset Owner: National Grid Material (where known):	Overhead 400kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be removed with a proposed overhead

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
	MS 283+263 to MS 283+718									<p>cable diversion as the replacement.</p> <p>The proposed route crosses the alignment with a crossover angle of 50°.</p> <p>The proposed route runs parallel to the alignment for approximately 455m with a minimum separation distance of 57m.</p> <p>Parallelism is less than the threshold value.</p>
MA06-GN-0010	MS 284+547 (crossover point)	0	Utility Asset Owner: Cadent Gas Material (where known): Plastic	Gas main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	<p>A section of the existing gas main route is to be removed/abandoned with a gas main diversion as the replacement.</p> <p>The proposed route crosses the alignment with a crossover angle of approximately 85°.</p> <p>Parallelism is less than the threshold value.</p>

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-CW-0010	MS 284+552 (crossover point)	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the existing water distribution main route is to be abandoned with a proposed pipe diversion as the replacement. The proposed route crosses the alignment with a crossover angle of approximately 85°. Parallelism is less than the threshold value.
MA06-EN-0098	MS 285+141 (crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Below ground 11kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be removed with a proposed cable diversion as the replacement. The diversion starts at MS 284+669 with a minimum separation distance of 20.7m which is diverted away from the alignment.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										The proposed route then crosses the alignment at MS 285+070 with a crossover angle of 90°. Parallelism is less than the threshold value.
MA06-EN-0101	MS 286+034	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Overhead 11kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be removed with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 90°. Parallelism is less than the threshold value.
MA06-EN-0106	MS 287+240 (1st crossover point) MS 287+826 (2nd crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Overhead 11kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Two sections of the existing electrical cable route are to be removed with proposed cable diversions as the replacement.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										<p>The first proposed route crosses the alignment with a crossover angle of 90°.</p> <p>The second proposed route crosses the alignment with a crossover angle of 70°.</p> <p>The route is parallel for approximately 586m with a minimum separation of 70m.</p> <p>Parallelism is less than the threshold value.</p>
MA06-FT-0019	MS 287+240 (crossover point)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Overhead telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	<p>A section of the existing telecoms cable route is to be removed with a proposed cable diversion as the replacement.</p> <p>The proposed route crosses the alignment with a crossover angle of 90°.</p> <p>Parallelism is less than the threshold value.</p>

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-EN-0107	MS 287+537 (1st crossover point) MS 288+016 to MS 288+581 MS 288+661 (2nd crossover point) MS 288+817 (3rd crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Overhead 33kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing electrical cable route crosses the alignment with a crossover angle of 85°, after which it runs parallel to the alignment for 565m at a separation of 60m before crossing the alignment twice with crossover angles of 25° and 50° respectively. Parallelism is less than the threshold value.
MA06-EN-0110	MS 287+826 (crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Below ground HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing route crosses the alignment with a crossover angle of 50°. Parallelism is less than the threshold value.
MA06-EN-0109	MS 287+826 (crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Below ground HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing route crosses one track of the alignment with a crossover angle of 50° before routing back away from the alignment.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										Parallelism is less than the threshold value.
MA06-GN-0008	MS 287+826 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Gas main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the existing gas main route is to be abandoned with a gas main diversion as the replacement. The proposed route crosses the alignment with a crossover angle of approximately 50°. Parallelism is less than the threshold value.
MA06-EN-0118	MS 288+839 (crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Below ground 11kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 75°. Parallelism is less than the threshold value.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-FT-0010	MS 288+842 (crossover point)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	A section of the existing telecoms cable route is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 75°. Parallelism is less than the threshold value.
MA06-EN-0116	MS 288+837 (crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 75°. Parallelism is less than the threshold value.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-GN-0001	MS 288+838 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Gas main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the existing gas main route is to be abandoned with a gas main diversion as the replacement. The proposed route crosses the alignment with a crossover angle of approximately 75°. Parallelism is less than the threshold value.
MA06-CW-0047	MS 288+847 (1st crossover point) MS 288+814 to MS 289+877 (Parallel Section) MS 288+876 to MS 289+096 (Parallel Section) MS 289+097 (2nd	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the existing water distribution main route is to be abandoned with a proposed pipe diversion as the replacement, from which four pipe routes branches off. First part of the proposed route crosses the alignment at a crossover angle of 75°.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
	crossover point) MS 288+876 to MS 290+354									The new proposed pipeline then runs parallel for approximately 1063m with a minimum separation of 88m. After the parallel section the pipeline is to cross the alignment at 90°. The pipeline is to then stay in parallel to the alignment and carry on for a further 1478m with a minimum separation of 81m. Parallelism is less than the threshold value.
MA06-EN-0123	MS 288+837 (crossover point)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Overhead LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										with a crossover angle of 75°. Parallelism is less than the threshold value.
MA06-FT-0004	MS 289+97.41 (crossover point)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	A section of the existing telecoms cable route is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 90°. Parallelism is less than the threshold value.
MA06-FT-0066	MS290+005	0	Utility Asset Owner: Unknown Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	A section of the existing telecoms cable route is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 70°.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										Parallelism is less than the threshold value.
MA06-FT-0002	MS290+005	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	A section of the existing telecoms cable route is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 70°. The proposed route conjoins to a new proposed mast which lies 10m from the alignment. Parallelism is less than the threshold value.
MA06-FT-0004	MS 289+97.41	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be abandoned with a proposed cable diversion as the replacement.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										The proposed route crosses the alignment with a crossover angle of 90°. Parallelism is less than the threshold value.
MA06-EN-0127	MS288+839	0	Utility Asset Owner: Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 70°. Parallelism is less than the threshold value.
MA06-WW-0003	MS288+839	0	Utility Asset Owner: Unknown Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the existing wastewater sewer is to be abandoned with a proposed cable diversion as the replacement. The proposed route crosses the alignment

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										with a crossover angle of 70°. Parallelism is less than the threshold value.
MA06-FT-0055	MS288+839	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	A section of the telecoms cable is to be abandoned. A new proposed route is to be put in place which crosses the alignment at 70°. Parallelism is less than the threshold value.
MA06-GN-0002	MS288+839	0	Utility Asset Owner: Unknown Material (where known): Not available	Gas main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the gas main is to be abandoned. A new proposed route is to be put in place which crosses the alignment at 70°. Parallelism is less than the threshold value.
MA06-EN-0130	MS289+97	0	Utility Asset Owner: Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable is to be abandoned with a proposed cable

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 90°. Parallelism is less than the threshold value.
MA06-CW-0054	MS289+97	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The current potable water distribution main is to be abandoned. A new proposed route is to be introduced which crosses the alignment with a crossover angle of 90°. Parallelism is less than the threshold value.
MA06-EN-0139	MS290+17	0	Utility Asset Owner: Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Pre-existing below ground electrical line is to cross the alignment at 45°. Parallelism is less than the threshold value.

5.2 Davenport Green to Ardwick (MA07)

Electromagnetic field exposure assessment (health immunity)

5.2.1 No health immunity risks have been identified within this community area.

Electromagnetic compatibility assessment (equipment immunity)

5.2.2 The telecommunication mast information in Table 12 of the main ES Volume 5, Appendix: EM-001-00000 is superseded by the telecommunication mast information listed in Table 3 below.

5.2.3 Table 3 below also identifies receptors due to updated information about committed developments.

5.2.4 All remaining receptors in Table 12 of the main ES Volume 5, Appendix: EM-001-00000 remain unchanged.

Table 3: Potentially affected receptors within MA07 for electromagnetic compatibility assessment (equipment immunity) – updated baseline

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (A/m)	Estimated emission level (A/m)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-CD-001	MS 291+300	27	Housing	Residential	BS EN 61000-6-1	3	<3	N	N/A	This receptor is a committed development [MA07/545S]. Development proposal for a 4 bed children's home. The receptor is located where the HS2 scheme runs in a

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (A/m)	Estimated emission level (A/m)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										tunnel with a depth of 26.5m.
MA07-FT-0048	MS 293+111	7	Telecommunication Mast Asset owner: Unknown	Commercial	BS EN 61000-6-1	3	>3	Y	To be determined at design stage	Specific immunity of equipment to be determined to confirm whether the risk identified is significant.
MA07-FT-0049	MS 293+130	11	Telecommunication Mast Asset owner: Unknown	Commercial	BS EN 61000-6-1	3	>3	Y	To be determined at design stage	Specific immunity of equipment to be determined to confirm whether the risk identified is significant.
MA07-CD-002	MS 297+500	30	Residential housing	Residential	BS EN 61000-6-1	3	<3	N	N/A	This receptor is a committed development [MA07/561S]. Conversion and refurbishment of existing property comprising 6 bedsits/ flats to 5 self-contained flats including rooflights and rear dormer, together with associated car parking, cycle storage and bin storage.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (A/m)	Estimated emission level (A/m)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										The receptor is located where the HS2 scheme runs in a tunnel with a depth of 41.4m.
MA07-CD-003	MS 299+650	8	Workshop /Storage	Commercial	BS EN 61000-6-1	3	<3	N	N/A	This receptor is a committed development [MA07/549S]. Change of use to storage or distribution with associated external alterations including provision of disabled persons access ramp to front elevation. The receptor is located where the HS2 scheme runs in a tunnel with a depth of 41.3m.
MA07-CD-004	MS 299+800	0	Shopping centre	Commercial	BS EN 61000-6-1	3	<3	N	N/A	This receptor combines committed developments [MA07/524S] and [MA07/560S].

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (A/m)	Estimated emission level (A/m)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										Existing units allocated for demolition to make provisions for a new retail food store, and hot food delivery unit with associated car parking and landscaping. Also the installation of external plant and fascia sign. The receptor is located where the HS2 scheme runs in a tunnel with a depth of 41.2m.
MA07-MT-0003	MS 293+298	9	Telecommunication Mast Asset owner: Unknown	Commercial	BS EN 61000-6-1	3	>3	Y	To be determined at design stage	Specific immunity of equipment to be determined to confirm whether the risk identified is significant.

Electromagnetic interference assessment (induced voltages on cables and pipes)

5.2.5 No induced voltage risks were identified in this community area in the previous assessment as reported in the main ES Volume 5, Appendix: EM-001-00000. The previous assessment is superseded by the information listed in Table 4.

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Affected receptors within 50m of railway and associated risks and mitigation

Table 4: Potentially affected receptors within MA07 for electromagnetic compatibility assessment (induced voltages on cables and pipes) – updated baseline

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-FT-0001	MS 293+104	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Existing route crosses the alignment with a crossover angle of 40°. Parallelism is less than the threshold value.
MA07-CW-0004	MS 293+104	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water trunk main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	Existing route crosses the alignment with a crossover angle of 40°. Parallelism is less than the threshold value.
MA07-EN-0001 MA07-EN-0002 MA07-EN-0003 MA07-EN-0004 MA07-EN-0005 MA07-EN-0006	MS 293+104	0	Utility Asset Owner: Unknown Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing route crosses the alignment with a crossover angle of 40°. Parallelism is less than the threshold value.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-EN-0064	MS 294+965	0	Utility Asset Owner: National Grid Material (where known): Not available	Overhead 275kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing cable crosses the alignment with a crossover angle of 70°. Parallelism is less than the threshold value.
MA07-CW-0039 MA07-CW-0040	MS 295+105 to MS 295+500 (Parallel Section)	35	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Below ground telecoms cable runs alongside the alignment for 400m with a minimum separation of 33m. Parallelism is less than the threshold value.
MA07-EN-0088 MA07-EN-0089 MA07-EN-0090 MA07-EN-0091	MS 295+105 to MS 295+500 (Parallel Section)	34	Utility Asset Owner: Unknown Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Below ground electricity cable runs alongside the alignment for 400m with a minimum separation of 34m. Parallelism is less than the threshold value.
MA07-WW-0021	MS 295+105 to MS 295+500 (Parallel Section)	34	Utility Asset Owner: Unknown	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The gravity wastewater sewer runs alongside the alignment for 400m

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
			Material (where known): Not available							with a minimum separation of 34m. Parallelism is less than the threshold value.
MA07-FT-0059 MA07-FT-0060	MS 295+105 to MS 295+500 (Parallel Section)	35	Utility Asset Owner: Unknown Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Below telecoms cable runs alongside the alignment for 400m with a minimum separation of 35m. Parallelism is less than the threshold value.
MA07-GN-0015	MS 295+105 to MS 295+500 (Parallel Section) MS 295 + 309 (crossover point)	0	Utility Asset Owner: Cadent Gas Material (where known): Not available	Gas Pipeline (assumed to be high pressure)	BS EN 50443	60 normal 1000 fault	To be determined at design stage	Y	To be determined at design stage	The gas pipeline crosses the alignment at 80°. The pipeline also remains parallel to the alignment for 395m. The asset may be equipped with a cathodic protection system which may be vulnerable to interference from the HS2 traction system.
MA07-EN-0068	MS 297+255 (crossover point)	0	Utility Asset Owner: Unknown	Below ground LV	BS EN 50522	52 normal 320 fault	To be determined	N	N/A	The existing cable route crosses the alignment at 45°

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-EN-0069 MA07-EN-0070			Material (where known): Not available	electrical line			at design stage			Parallelism is less than the threshold value.
MA07-CW-0005	MS 297+255 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	New proposed water sewer crosses the alignment. The sewer crosses the alignment at 90°. Parallelism is less than the threshold value.
MA07-GN-0001 MA07-GN-0002 MA07-GN-0003 MA07-GN-0004	MS 297+255 (crossover point)	0	Utility Asset Owner: Cadent Gas (MA07-GN-0004) Others, unknown Material (where known): Clay (MA07-GN-0004) Others, unknown	Gas mains	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The existing gas mains cross the alignment at 45°. Low or medium pressure. Parallelism is less than the threshold value.
MA07-FT-0002 MA07-FT-0003 MA07-FT-0045	MS 297+255 (crossover point)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Below ground telecoms cable crosses the alignment at 40°. Parallelism is less than the threshold value.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-EN-0012	MS 297+255 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing cable crosses the alignment at an angle of 45°. Parallelism is less than the threshold value.
MA07-FT-0061	MS 299+655	0	Utility Asset Owner: Unknown Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Below ground telecoms cable crosses the alignment at 40°. Parallelism is less than the threshold value.
MA07-GN-0016	MS 299+655	0	Utility Asset Owner: Cadent Gas Material (where known): Not available	Gas Pipeline (assumed to be high pressure)	BS EN 50443	60 normal 1000 fault	To be determined at design stage	Y	To be determined at design stage	Existing cable crosses the alignment at an angle of 40°. The asset may be equipped with a cathodic protection system which may be vulnerable to interference from the HS2 traction system.
MA07-EN-0092 MA07-EN-0093	MS 299+655 (crossover point)	0	Utility Asset Owner: Unknown	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing cable crosses the alignment at an angle of 40°. Parallelism is less than the threshold value.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-EN-0094 MA07-EN-0095 MA07-EN-0096 MA07-EN-0097			Material (where known): Not available							
MA07-FT-0062 MA07-FT-0063 MA07-FT-0064	MS 299+655 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Below ground Telecoms cable crosses alignment at 40°. Parallelism is less than the threshold value.
MA07-WW-0022	MS 299+655 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The gravity wastewater sewer crosses the alignment at 40°. Parallelism is less than the threshold value.
MA07-CW-0001 MA07-CW-0002	MS 293+125 (crossover point)	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water Trunk main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	Two potable water trunks mains are to be crossing the alignment at an angle of 35°. Parallelism is less than the threshold value.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-WW-0001 MA07-WW-0002 MA07-WW-0003	MS 293+125 (crossover point)	0	Utility Asset Owner: United Utilities Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The gravity wastewater sewer crosses the alignment at 35°. Parallelism is less than the threshold value.
MA07-EN-0031 MA07-EN-0032 MA07-EN-0034	MS 303+261 to MS 303+323 (Parallel Section)	21	Utility Asset Owner: Unknown Material (where known): Not available	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Below ground electrical line to be abandoned. To be replaced with temporary lines which come within 21m of the alignment. Parallel for approximately 60m. Parallelism is less than the threshold value.

5.3 Manchester Piccadilly Station (MA08)

Electromagnetic field exposure assessment (health immunity)

5.3.1 No health immunity risks have been identified within this community area.

Electromagnetic compatibility assessment (equipment immunity)

5.3.2 The receptors in Table 14 of the main ES Volume 5, Appendix: EM-001-00000 remain unchanged.

Electromagnetic interference assessment (induced voltages on cables and pipes)

5.3.3 No induced voltage risks were identified in this community area in the previous assessment as reported in the main ES Volume 5, Appendix: EM-001-00000. The previous assessment is superseded by the information listed in Table 5.

Table 5: Potentially affected receptors within MA08 for electromagnetic compatibility assessment (induced voltages on cables and pipes) – updated baseline

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-GN-0024	MS 303+856 (crossover point) MS 303+965 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Gas main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A new gas main is proposed which is to cross the alignment at two points, both at 90°. The proposed route crosses the alignment twice both with a crossover angle of 90°. Parallel sections for 20m with a separation of 100m.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										Parallelism is less than the threshold value.
MA08-WW-0014	MS 304+120 (crossover point)	0	Utility Asset Owner: Unknown Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	Sewer is to be abandoned with proposed replacement to crossover the alignment at 90°. Parallelism is less than the threshold value.
MA08-FT-0080 MA08-FT-0085 MA08-FT-0086	MS 304+120 (1 st crossover point) MS 303+918 (2 nd crossover point) M 304+120 to MS 304+262 (Parallel Section)	0	Utility Asset Owner: Virgin Media Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	The existing route is to be abandoned and the proposed replacement route is to cross the alignment at 90°. The proposed route is also parallel to the alignment for 142m with an approximate separation of 28m. Parallelism is less than the threshold value.
MA08-CW-0012 MA08-CW-0014 MA08-CW-0018	MS 303+967 (crossover point) MS 304+70 (crossover point)	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	Current water distribution main to be removed. New water main is to cross the alignment at 3 points at the following angles at 90°, 90° and 90°.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-CW-0032	MS 304+228 (Crossing Point) MS 303+ 725 – MS 304+228 (Parallel Section) MS 304+228 – MS 817 (Parallel Section)									Parallel for two sections. First is approximately 503m with a separation of 63m. Second is approximately 589m with a minimum separation of 20m, Parallelism is less than the threshold value.
MA08-GN-0009	MS 303+602 (1 st crossover point) MS 303+856 (2 nd crossover point) MS 303+965 (3 rd crossover point) MS 304+108 (4 th crossover point) MS 304 + 118 (5 th crossover point)	0	Utility Asset Owner: Cadent Gas Material (where known): Steel	Gas main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A new gas main is proposed which crosses the alignment and five separate locations crossing the alignment at the following angles: 85°,90°,90°,80° and 80°. A 500m section of the gas main also runs parallel to the alignment between the given chainages. This section has a minimum separation of approximately 87m.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
	MS303+602 to MS304+118 (Parallel Section)									Parallelism is less than the threshold value.
MA08-CW-0012	MS 304+350 (crossover point)	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The potable distribution main intersects the alignment at 60°. Parallelism is less than the threshold value.
MA08-FT-0001 MA08-FT-0020 MA08-FT-0024 MA08-FT-0031 MA08-FT-0032 MA08-FT-0039 MA08-FT-0040 MA08-FT-0041	MS 303+855 (1 st crossover point) MS 303+970 (2 nd crossover point) MS 304+101 (3 rd crossover point) MS 304+124 (4 th crossover point) MS 304+123 – MS 304+708 (Parallel Section)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cables	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	The current routes are to be abandoned and new telecoms cables are to be installed. The new route is to cross the alignment at 3 sections at the following angles: 90°, 90° and 90°. The route is also parallel to the alignment for 585m, with a minimum separation of 15m. Parallelism is less than the threshold value.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-FT-0043										
MA08-FT-0045										
MA08-FT-0046										
MA08-FT-0054										
MA08-FT-0056										
MA08-FT-0058	MS 304+120 (crossover point)	0	Utility Asset Owner: Unknown	Below ground telecoms cables	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Multiple telecoms cables with a minimum separation of 20m.
MA08-FT-0059	MS 304+120		Material (where known): Not available							Multiple cables to be abandoned with a new proposed route planned.
MA08-FT-0060	to MS 304+708									The new proposed route is to cross the alignment at 85°.
MA08-FT-0061	(Parallel Section)									The replacement route is also parallel to the alignment for 588m with a minimum separation of approximately 20m.
MA08-FT-0062										
MA08-FT-0063										
MA08-FT-0064										
MA08-FT-0065										

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-FT-0066										Parallelism is less than the threshold value.
MA08-FT-0069										
MA08-FT-0093										
MA08-FT-0094										
MA08-FT-0095										
MA08-FT-0096										
MA08-FT-0097										
MA08-FT-0098										
MA08-FT-0102										
MA08-FT-0104										
MA08-FT-0105										
MA08-FT-0106										
MA08-FT-0107										

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-FT-0113										
MA08-CW-0032	MS 303+960 (crossover point) MS 303+860 (crossover point)	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The potable water distribution main is to cross the alignment at two points at 90°. The water main is parallel for approximately a 100m with a minimum separation of 111m. Parallelism is less than the threshold value.
MA08-CW-0018	MS 304+410 – MS 304+500 (Parallel Section)	4	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The existing potable water main runs parallel to the alignment for 90m with 4m separation. Parallelism is less than the threshold value.
MA08-WW-0001 MA08-WW-0004	MS 304+120 (Crossing Point) MS 304+120 – MS 304+708 (Parallel Section)	14	Utility Asset Owner: United Utilities Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	Existing route is to be abandoned. New proposed route is to run parallel to the alignment for 590m with a minimum separation of 18m.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										Parallelism is less than the threshold value.
MA08-EN-0001	MS 303+607 (1 st crossover point)	14	Utility Asset Owner: Unknown Material (where known): Not available	Below ground LV and High Voltage electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Multiple electrical cables are to be abandoned and rerouted within the region. The new proposed cables are to cross the alignment at three separate locations. The angles for the crossings are 80°,90° and 90° respectively. The new cables are to take two parallel routes either side of the alignment. The worst case is where cables will be parallel to the alignment for 267m with a minimum separation of 15m. Parallelism is less than the threshold value.
MA08-EN-0008	MS 303+865									
MA08-EN-0009	(2 nd crossover point)									
MA08-EN-0010	MS 303+969									
MA08-EN-0011	(3 rd crossover point)									
MA08-EN-0012	MS 303+969 – MS 304+100									
MA08-EN-0013	(Above Parallel Section)									
MA08-EN-0014	MS 303+975 – MS 304+708									
MA08-EN-0015	(Below Parallel Section)									
MA08-EN-0017										
MA08-EN-0018										
MA08-EN-0019										

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-EN-0020										
MA08-EN-0021										
MA08-EN-0023										
MA08-EN-0025										
MA08-EN-0041										
MA08-EN-0042										
MA08-EN-0053										
MA08-EN-0072										
MA08-EN-0078										
MA08-EN-0095										
MA08-EN-0103										
MA08-EN-0104										
MA08-EN-0120										

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-EN-0121										
MA08-EN-0129										
MA08-EN-0130										
MA08-EN-0147										
MA08-EN-0148										
MA08-EN-0156										

Table 6: Potentially affected receptors within MA08 for electromagnetic compatibility assessment (induced voltages on cables and pipes) – SES2 changes

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-EN-0025	MS 304+847	20	Utility Asset Owner: Unknown Material (where	Below ground LV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Due to SES2-008-001, a new power supply system for the Metrolink has been introduced. The system comes within 20m of the end of the alignment.

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
			known): Not available							Parallelism is less than the threshold value.
MA08-EN-0156	MS 304+817	48	Utility Asset Owner: Unknown Material (where known): Not available	Below ground 33 kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Due to SES2-008-004, six substations must be relocated at Manchester Piccadilly. The changes are occurring within the 50m boundary to the alignment. The new cables are to take two parallel routes either side of the alignment. One route is to be parallel to the alignment for 131m with a minimum separation of 75m. The other route is parallel to the alignment for 733m with a minimum separation of 21m. Parallelism is less than the threshold value.

Part 2: Additional Provision 2 Environmental Statement

6 Introduction

- 6.1.1 There are several changes between the original scheme and/or the AP1 revised scheme and the AP2 revised scheme which have EMI relevance.
- 6.1.2 In the following sections the EMI risk associated with the AP2 amendments is documented with updated lists of affected receptors. The original list of affected receptors was included in the main ES (see main ES Volume 5, Appendix: EM-001-00000), which was modified in part by the AP1 ES (see SES1 and AP1 ES Volume 5, Appendix: EM-001-00000) and the SES2 assessment presented in Part 1 of this document. The changes relevant to AP2 are summarised below.

6.2 Diversion of three high pressure gas pipelines near Millington Clough Ancient Woodland (AP2-003-003)

- 6.2.1 The updated baseline list of EMI affected utility receptors, referred to in the previous AP1 ES (see SES1 and AP1 ES Volume 5, Appendix: EM-001-00000), is further modified by the changes associated with the utilities diversions to accommodate the AP2 revised scheme in the vicinity of Millington Clough ancient woodland - additional land permanently required for the diversion of three high pressure gas pipelines near Millington Clough Ancient Woodland (AP2-003-003). These further utilities updates, as they relate to the EMI assessment, are documented in Section 7.1.

6.3 Revised National Grid 400kV overhead power line diversion near Ryecroft Covert LWS (AP2-006-006)

- 6.3.1 The updated baseline list of EMI affected utility receptors, referred to in Section 5.1 of Part 1 of this document, is further modified by the changes associated with additional land permanently required for a revised National Grid 400kV overhead power line diversion near Ryecroft Covert Local Wildlife Site (LWS) (AP2-006-006). These further utilities updates, as they relate to the EMI assessment, are documented in Section 7.2.

6.4 Reconfiguration of M56 Junction 6 (AP2-006-014) and modification of the Thorley Lane and Runger Lane junction (AP2-006-023)

6.4.1 The updated baseline list of EMI affected utility receptors, referred to in Section 5.1 of Part 1 of this document, is further modified by the changes associated with the following AP2 amendments:

- additional land permanently required to reconfigure M56 Junction 6 (AP2-006-014); and
- additional land permanently required for the modification of the Thorley Lane and Runger Lane junction (AP2-006-023).

6.4.2 The further utilities updates, as they relate to the EMI assessment, are documented in Section 7.2.

6.5 Sewer connection from Manchester Tunnel South Portal (AP2-007-001)

6.5.1 The updated baseline list of EMI affected utility receptors, referred to in Section 5.2 of Part 1 of this document, is further modified by the additional land temporarily required for changes to permanent sewer connection from Manchester tunnel south portal (AP2-007-001). The further utilities updates, as they relate to the EMI assessment, are also documented in Section 7.3.

6.6 Vent shaft relocation from Palatine Road to The Hollies (AP2-007-003)

6.6.1 The updated baseline list of EMI affected utility receptors, referred to in Section 5.2 of Part 1 of this document, will be further modified by the changes associated with a change to the route alignment to facilitate the relocation of a vent shaft from Palatine Road to The Hollies, between chainages MS 290+476 and MS 301+933 (change to Bill powers required for relocation of vent shaft and headhouse from Palatine Road to The Hollies (AP2-007-003)).

6.6.2 This change also affects non-utilities receptors. The updates, as they relate to the EMI assessment, are documented in Section 7.3.

6.7 Changes to Manchester tunnel north portal main compound (AP2-007-008)

6.7.1 The updated baseline list of EMI affected utility receptors, referred to in Section 5.2 of Part 1 of this document, is further modified by the changes associated with amendments to utilities

arrangements associated, primarily with the proposed additional land permanently required for changes to design elements managed by the Manchester tunnel north portal main compound (AP2-007-008). These further utilities updates, as they relate to the EMI assessment, are also documented in Section 7.3.

6.8 Reconfiguration of Ardwick construction sidings (AP2-007-009)

6.8.1 The updated baseline list of EMI affected utility receptors, referred to in Section 5.2 of Part 1 of this document, is further modified by the changes associated with additional land temporarily required for the reconfiguration of Ardwick construction sidings (AP2-007-009). These further utilities updates, as they relate to the EMI assessment, are documented in Section 7.3.

6.9 Utilities near Manchester Piccadilly Station (AP2-008-003 and AP2-008-006)

6.9.1 The updated baseline list of EMI affected utility receptors, referred to in Section 5.3 of Part 1 of this document, is further modified by the changes associated with utilities arrangements near Manchester Piccadilly station, including those impacted by the proposed demolition of Gateway House:

- additional land permanently required for modifications to the multi-modal transport hub (AP2-008-003); and
- additional land temporarily required for the diversion of Travis Street sewer via Ducie Street with a new compound within Ducie Street and the A665 Great Ancoats Street junction (AP2-008-006).

6.9.2 These further utilities updates, as they relate to the EMI assessment, are documented in Section 7.4.

6.10 Annandale depot wastewater drainage and utilities (AP2-ORW-001 and AP2-ORW-002)

6.10.1 This off-route area relates to the Annandale depot in Scotland. The identified changes relate to alterations to the utilities arrangements associated with the depot, both directly due to additional land permanently required for modifications to wastewater drainage at Annandale depot (AP2-ORW-001), and indirectly due to additional land permanently required for utility diversion and modifications at Annandale depot (AP2-ORW-002). The EMI assessment associated with this change is documented in Section 7.5.

7 Affected receptors

7.1 Pickmere to Agden and Hulseheath (MA03)

Electromagnetic field exposure assessment (health immunity)

7.1.1 No health immunity risks have been identified within this community area.

Electromagnetic compatibility assessment (equipment immunity)

7.1.2 No equipment immunity risks have been identified within this community area related to the AP2 amendments.

Electromagnetic interference assessment (induced voltages on cables and pipes)

7.1.3 The utilities information in Table 7 of the main ES Volume 5, Appendix: EM-001-00000, or Table 5 in SES1 and AP1 ES Volume 5, Appendix: EM-001-00000, is amended as set out in Table 7 below. All remaining receptors in Table 7 of the main ES Volume 5, Appendix: EM-001-00000 and/or Table 5 in SES1 and AP1 ES Volume 5, Appendix: EM-001-00000 remain unchanged.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Table 7: Potentially affected receptors within MA03 for electromagnetic compatibility assessment (induced voltages on cables and pipes) – AP2 amendments

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA03-GN-0012	MS 279+40	0	Utility Asset Owner: National Grid Material (where known): Not available	High Pressure Gas Pipeline	BS EN 50443	60 normal 1000 fault	To be determined at design stage	Y	Mitigation measures to be determined at design stage	Due to AP2-003-003, the high-pressure gas pipeline diversion to accommodate the AP2 revised scheme, is amended. The revised route crosses the alignment at 90°. The asset may be equipped with a cathodic protection system which may be vulnerable to interference from the HS2 traction system.
MA03-GN-0013	MS 279+900	0	Utility Asset Owner: National Grid Material (where known): Not available	High Pressure Gas Pipeline	BS EN 50443	60 normal 1000 fault	To be determined at design stage	Y	Mitigation measures to be determined at design stage	Due to AP2-003-003, the high-pressure gas pipeline diversion to accommodate the AP2 revised scheme, is amended. The revised route crosses the alignment at 90°. The asset may be equipped with a cathodic protection

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										system which may be vulnerable to interference from the HS2 traction system.
MA03-GN-0016	MS 280+46	0	Utility Asset Owner: National Grid Material (where known): Not available	High Pressure Gas Pipeline	BS EN 50443	60 normal 1000 fault	To be determined at design stage	Y	Mitigation measures to be determined at design stage	Due to AP2-003-003, the high-pressure gas pipeline diversion to accommodate the AP2 revised scheme, is amended. The revised route crosses the alignment at 85°. The asset may be equipped with a cathodic protection system which may be vulnerable to interference from the HS2 traction system.

7.2 Hulseheath to Manchester Airport (MA06)

Electromagnetic field exposure assessment (health immunity)

7.2.1 No health immunity risks have been identified within this community area.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Electromagnetic compatibility assessment (equipment immunity)

7.2.2 No equipment immunity risks have been identified within this community area related to the AP2 amendments.

Electromagnetic interference assessment (induced voltages on cables and pipes)

7.2.3 The receptor information in Table 2 of this document is superseded by the information listed in Table 8 below.

7.2.4 Where a receptor is listed in Table 2 but is not listed in Table 8, the assessment presented in Table 2 remains applicable.

Table 8: Potentially affected receptors within MA06 for electromagnetic compatibility assessment (induced voltages on cables and pipes) – AP2 amendments

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-EN-0081	MS 284+546 (crossover point)	0	Utility Asset Owner: National Grid Material (where known): Not available	Overhead 400kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be removed with a proposed overhead cable diversion as the replacement. The proposed route crosses the alignment with a crossover angle of 50°. Due to AP2-006-006 changes the path of

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										the receptor has been changed. The path is now no longer parallel to the alignment within the 200m corridor of interest. Parallelism is less than the threshold value.
MA06-EN-0122 MA06-EN-0123 MA06-EN-0121 MA06-EN-0116 MA06-EN-0125 MA06-EN-0128 MA06-EN-0127 MA06-EN-0130 MA06-EN-0131	MS 288+982 (crossover point) MS 288 + 837 (crossover point) MS 289 + 97 (crossover point) MS 288+960 – MS 290+228 (1 st Parallel Section) MS 289+93 – MS 289+867 (2 nd Parallel Section)	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Below ground LV electrical lines	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	A section of the existing electrical cable route is to be abandoned with a proposed cable diversion as the replacement. The original replacement was to cross the alignment at one point. However due to AP2-006-014 and AP2-006-023 changes the route for the following electricity cables has been changed. The AP2 revised scheme is to cross the alignment at three different

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-EN-0132 MA06-EN-0133 MA06-EN-0134										points, 70°, 60° and 90° respectively. The route is parallel in two sections. The first for 1268m with approximately 50m average separation and a minimum separation of 15m. Second for 774m with a minimum separation of 50m. Parallelism is less than the threshold value.
MMA06-FT-0004 MA06-FT-0005 MA06-FT-0006 MA06-FT-0007 MA06-FT-0009 MA06-FT-0011 MA06-FT-0012	MS 288+982 (crossover point) MS 288 + 837 (crossover point) MS 289 + 97 (crossover point) MS 288+960 – MS 290+228 (1 st Parallel Section)	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cables	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	A section of the existing telecoms cable route is to be abandoned with a proposed cable diversions as the replacement. The original replacement was to cross the alignment at one point. However due to AP2-006-014 and AP2-006-023 the route for the electricity cables has

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-FT-0013 MA06-FT-0014 MA06-FT-0052 MA06-FT-0055 MA06-FT-0059	MS 289+93 – MS 289+867 (2 nd Parallel Section)									been changed The AP2 revised scheme is to cross the alignment at three different points, 70°, 60° and 90° respectively. The route is parallel in two sections. The first for 1268m with approximately average separation and a minimum separation of 15m. Second for 774m with a minimum separation of 50m. Parallelism is less than the threshold value.
MA06-WW-0002 MA06-WW-0003 MA06-WW-0004 MA06-WW-0006 MA06-WW-0009	MS 288+982 (crossover point) MS 288 + 837 (crossover point) MS 289 + 97 (crossover point)	27	Utility Asset Owner: Unknown Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the wastewater line is to be abandoned with a proposed pipe diversion as the replacement. The original replacement was to cross the alignment at 1 point. However due to AP2-006-014 and AP2-006-

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA06-WW-0010	MS 288+960 – MS289 + 560 (Parallel Section)									023 the route for the wastewater sewer has been changed. The AP2 revised scheme is to cross the alignment at three different points, 70°, 60° and 90° respectively. The new route is parallel to the alignment for approximately 600m with a minimum separation of 55m. Parallelism is less than the threshold value.
MA06-CW-0047 MA06-CW-0054 MA06-CW-0055	MS 288+982 (crossover point) MS 288 + 837 (crossover point) MS 289 + 97 (crossover point) MS 288+960 – MS 290+228	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	A section of the waste distribution line is to be abandoned with a proposed pipe diversion as the replacement. The original replacement was to cross the alignment at 1 point. However due to AP2-006-014 and AP2-006-023 the route for the water distribution

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
	(1 st Parallel Section) MS 289+93 – MS 289+867 (2 nd Parallel Section)									main has been changed. The AP2 revised scheme is to cross the alignment at three different points, 70°, 60° and 90° respectively. The route is parallel in two sections. The first for 1268m with approximately 50m separation and a minimum separation of 15m. Second for 774m with a minimum separation of 50m. Parallelism is less than the threshold value.
MA06-WW-P003	MS 295+680	5	Utility Asset Owner: United Utilities Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The water main has been rerouted from Palatine Road and has a minimum 5m separation from the alignment. It diverges and has no significant parallelism. Parallelism is less than the threshold value.

7.3 Davenport Green to Ardwick (MA07)

Electromagnetic field exposure assessment (health immunity)

7.3.1 No health immunity risks have been identified within this community area.

Electromagnetic compatibility assessment (equipment immunity)

7.3.2 The receptor identifiers listed below are removed from Table 12 of the main ES Volume 5, Appendix: EM-001-00000, since they are no longer affected as a result of the vent shaft and headhouse relocation from Palatine Road to The Hollies (AP2-007-003). All remaining receptors in Table 12 of the main ES Volume 5, Appendix: EM-001-00000 remain unchanged.

- MA07-1541;
- MA07-1545;
- MA07-1554;
- MA07-1588;
- MA07-1560;
- MA07-1563;
- MA07-1566;
- MA07-1572;
- MA07-1576; and
- MA07-1581.

Electromagnetic interference assessment (induced voltages on cables and pipes)

- 7.3.3 The receptor information in Table 4 of this document is superseded by the information listed in Table 9 below.
- 7.3.4 Where a receptor is listed in Table 4 but is not listed in Table 9, the assessment presented in Table 4 remains applicable.
- 7.3.5 Note that, where the amended alignment, resulting from change AP2-007-003, altered existing descriptions only with respect to minor changes to approximate railway chainage and/or crossing angle, these have not been listed below. The existing descriptions in Table 4 are considered to be sufficiently representative of the modified interface for these cases.

Table 9: Potentially affected receptors within MA07 for electromagnetic compatibility assessment (induced voltages on cables and pipes) – AP2 amendments

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-EN-0064	MS 295	0	Utility Asset Owner: National Grid Material (where known): Not available	Overhead 275kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing cable crosses the alignment with a crossover angle of 85°. Parallelism is less than the threshold value. Note: There are additional utilities crossing the revised alignment, in the vicinity of this item, these include a gas pipeline (see MA07-GN-0015 listed below).

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										There is also LV cabling and telecoms cabling. These do not have specific identifiers. In both cases, the parallelism is less than the threshold value and there is no credible risk.
MA07-CW-0039 MA07-CW-0040	MS 295 (Parallel Section)	>50	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Below ground telecoms cable runs alongside the alignment for <1km with a minimum separation of ~75m. Parallelism is less than the threshold value. Note: Now outside +/- 50m corridor corresponding to HS2-related utilities assessment and hence identifiers referenced here are no longer used.
MA07-EN-0088	MS 295	>50	Utility Asset Owner:	Below ground LV	BS EN 50522	52 normal 320 fault	To be determined	N	N/A	Below ground electricity cable runs

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA07-EN-0089 MA07-EN-0090 MA07-EN-0091	(Parallel Section)		Unknown Material (where known): Not available	electrical line			at design stage			alongside the alignment for <1km with a minimum separation of ~75m. Parallelism is less than the threshold value. Note: Now outside +/- 50m corridor corresponding to HS2-related utilities assessment and hence identifiers referenced here are no longer used.
MA07-WW-0021	MS 295 (Parallel Section)	>50	Utility Asset Owner: Unknown Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	The gravity wastewater sewer runs alongside the alignment for <1km with a minimum separation of ~75m. Parallelism is less than the threshold value. Note: Now outside +/- 50m corridor corresponding to HS2-related utilities assessment and hence identifiers referenced

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Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										here are no longer used.
MA07-FT-0059 MA07-FT-0060	MS 295 (Parallel Section)	>50	Utility Asset Owner: Unknown Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Below telecoms cable runs alongside the alignment for <1km with a minimum separation of ~75m. Parallelism is less than the threshold value. Note: Now outside +/- 50m corridor corresponding to HS2-related utilities assessment and hence identifiers referenced here are no longer used.
MA07-GN-0015	MS 295	0	Utility Asset Owner: Cadent Gas Material (where known): Not available	Gas Pipeline (assumed to be high pressure)	BS EN 50443	60 normal 1000 fault	To be determined at design stage	Y	To be determined at design stage	The gas pipeline crosses the alignment at 80°. There is no longer a parallel section with the revised alignment. The asset may be equipped with a cathodic protection system which may be vulnerable to

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										interference from the HS2 traction system.
MA07-WW-P005	MS 303+256 (crossover point) MS 303+245 – MS 303+295 (Parallel Section)	0	Utility Asset Owner: Unknown Material (where known): Not available	Gravity wastewater sewer	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	AP2-007-009 describes changes having to be made to utilities to accommodate for modifications in the road network in the vicinity of Ardwick Sidings. The receptor relates to new sewers which are to be installed directed towards the Siemens Yard. The sewer is to cross the alignment at approximately 60° while also being parallel for approximately 50m. Parallelism is less than the threshold value.
MA07-CW-P005	MS 303+256 (crossover point) MS 303+245 – MS 303+295	0	Utility Asset Owner: United Utilities Material (where known): Not available	Potable water trunk main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	AP2-007-009 describes changes having to be made to utilities to accommodate for modifications in the road network.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
	(Parallel Section)									The receptor relates to a new water main which is to be installed directed towards the Siemens Yard. The water main is to cross the alignment at approximately 60° while also being parallel for approximately 50m. Parallelism is less than the threshold value.
MA07-FT-P001	MS 303+256 (crossover point) MS 303+245 – MS 303+295 (Parallel Section)	0	Utility Asset Owner: Unknown Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	AP2-007-009 describes changes having to be made to utilities to accommodate for modifications in the road network. The receptor relates to new telecoms cables which are to be installed directed towards the Siemens Yard. The telecoms cables are to cross the alignment at approximately 60° while also being

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
										parallel for approximately 50m. Parallelism is less than the threshold value.
MA08-EN-P001	MS 303+424	22	Utility Asset Owner: Unknown Material (where known): Not available	Overhead 33kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Due to AP2-007-008, new autotransformer is to be installed 22m from the alignment. The high voltage line is to be in parallel to the alignment for approximately 150m with a separation of 35m. Parallelism is less than the threshold value.

7.4 Manchester Piccadilly Station (MA08)

Electromagnetic field exposure assessment (health immunity)

7.4.1 No health immunity risks have been identified within this community area.

Electromagnetic compatibility assessment (equipment immunity)

7.4.2 No equipment immunity risks have been identified within this community area related to the AP2 amendments.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Electromagnetic interference assessment (induced voltages on cables and pipes)

7.4.3 The receptor information in Table 5 of this document is superseded by the information listed in Table 10 below.

7.4.4 Where a receptor is listed in Table 5, but is not listed in either Table 6 or Table 10, the assessment presented in Table 5 remains applicable.

Table 10: Potentially affected receptors within MA08 for electromagnetic compatibility assessment (induced voltages on cables and pipes) – AP2 amendments

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
MA08-GN-0018 MA08-GN-0021 MA08-GN-0022 MA08-GN-0023 MA08-GN-0024 MA08-GN-0025	MS 303+713 (1 st crossover point) MS 303 + 964 (2 nd crossover point) MS 304+225 (3 rd crossover point) MS 304+227 (4 th crossover point) MS 303+713 – MS 304+225 (1 st Parallel Section)	0	Utility Asset Owner: Cadent Gas (MA08-GN-0024) Others, unknown Material (where known): Not available	Gas mains	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	Medium or low pressure gas mains. Gas mains to be removed with replacement crossing the alignment at 4 points. 90°, 80°, 90° and 80° respectively. There are also two parallel sections, the first with a separation of 90m and the second with a minimum separation of 24m. AP2 amendments move the points

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
	MS 304+227-MS 304 + 450 (2 nd Parallel Section)									where the gas mains cross the alignment. Parallelism is less than the threshold value.

7.5 Off-route areas (Annandale depot)

Electromagnetic field exposure assessment (health immunity)

7.5.1 This off-route area was not assessed in the main ES Volume 5, Appendix: EM-001-00000 and since the changes for AP2 relate only to utility modifications, health immunity risks in this area have not been assessed here.

Electromagnetic compatibility assessment (equipment immunity)

7.5.2 This area was not assessed in the main ES Volume 5, Appendix: EM-001-00000 and since the changes for AP2 relate only to utility modifications, equipment immunity risks in this area have not been assessed here.

Electromagnetic interference assessment (induced voltages on cables and pipes)

7.5.3 This area was not assessed in the main ES Volume 5, Appendix: EM-001-00000. The following potentially affected utilities receptors have been identified with respect to the AP2 amendments.

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Table 11: Potentially affected receptors within the Annandale depot area for electromagnetic compatibility assessment (induced voltages on cables and pipes) – AP2 amendments

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
ORW-CW-001	N/A – Chainage not available	0	Utility Asset Owner: Scottish Water Material (where known): Not available	Potable water distribution main	BS EN 50443	60 normal 1000 fault	To be determined at design stage	N	N/A	Part of the existing route to be removed with a replacement route that crosses the depot alignment at 90°. Parallelism is less than the threshold value.
ORW-FT-001	N/A – Chainage Not Available	0	Utility Asset Owner: British Telecom Material (where known): Not available	Below ground telecoms cable	CCITT part VI	25 normal 430 fault	To be determined at design stage	N	N/A	Existing BT cable route to be removed with a proposed route as the replacement. Route crosses the alignment at 90° before diverting away. Parallelism is less than the threshold value.
ORW-EN-001	N/A – Chainage not available	45.89 (proximity to depot alignment) 25.11	Utility Asset Owner: Scottish Power Material (where known): Not available	Overhead 11kV HV electrical line	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing 11kV overhead electrical cable route to be removed with a proposed route as the replacement. Minimum separation is 45.89m from the depot alignment

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Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
		(proximity to mainline)								before diverting away. The proposed cable route then re-joins the existing cable route with a minimum separation of 25.11m. Parallelism is less than the threshold value.
ORW-EN-002	N/A – Chainage not available	0	Utility Asset Owner: Scottish Power Material (where known): Not available	Low-Voltage Overhead Cable	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing LV overhead electrical cable route to be removed with a proposed route as the replacement. Route crosses the depot alignment at 90° Parallelism is less than the threshold value.
ORW-EN-003	N/A – Chainage not available	0	Utility Asset Owner: Scottish Power Material (where known): Not available	132kV Overhead Cables (between SP Energy Network Pylons)	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing 132kV overhead electrical cable route to be removed with a proposed route as the replacement. Route crosses the alignment at 90° Parallelism is less than the threshold value.

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SES2 and AP2 ES Volume 5, Appendix: EM-001-00000

Electromagnetic interference

Affected receptors within 50m of railway and associated risks and mitigation

Identifier	Approximate railway chainage (km + m)	Horizontal distance from route centre line (m)	Sensitive installation	Receptor	Reference	Immunity limit (V)	Estimated emission level (V)	Is there potential EMC risk? (Y/N)	Mitigation measures	Comments
ORW-EN-004	N/A – Chainage Not Available	17.5	Utility Asset Owner: Scottish Power Material (where known): Not available	11kV & LV Overhead Cable	BS EN 50522	52 normal 320 fault	To be determined at design stage	N	N/A	Existing 11kV overhead electrical cable route to be removed with a proposed route as the replacement. Part of the proposed cable route runs parallel for approximately 231m with a minimum separation distance of 17.5m. Parallelism is less than the threshold value.

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