Rosefield Solar Farm

Environmental Statement

Volume 4
Appendix 5.6: Electromagnetic Field Assessment

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

EN010158/APP/6.4
September 2025
Rosefield Energyfarm Limited

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1. Executive Summary

1.1. Report Purpose

1.1.1. This High-Level Electromagnetic Field Assessment has been prepared on behalf of Rosefield Energyfarm Limited ('the Applicant') to assess the potential electromagnetic fields generated by electrical equipment associated with a ground-mounted solar photovoltaic development with respect to safe levels for human exposure, in relation to the Development Consent Order (DCO) application for the construction, operation (including maintenance), and decommissioning of Rosefield Solar Farm (hereafter referred to as the 'Proposed Development').

1.1.2. The Proposed Development comprises the construction, operation (including maintenance), and decommissioning of solar photovoltaic ('PV') development and energy storage, together with associated infrastructure and an underground cable connection to the National Grid East Claydon Substation.

1.2. Emissions

1.2.1. All electrical equipment emits electric and magnetic radiation. Power cables produce both electric and magnetic fields, which can potentially affect human health. Electromagnetic radiation from underground cables is generally less than electromagnetic radiation from overhead powerlines because emissions from adjacent conductors within a cable tend to cancel each other out. When assessing the impacts of overhead power lines, it is important to consider the impact of both electric and magnetic fields. Underground cables generally cause a negligible electric field above ground but can cause a significant magnetic field, which is dependent on the current in the conductors.

1.3. Standards in the UK

1.3.1. The UK Policy on public exposure limits to Electromagnetic Fields (EMF) radiation is designed to comply with the 1998 ICNIRP (International Commission on the Non-Ionizing Radiation Protection) guidelines in terms of the 1999 EU Recommendation. In 2010 ICNIRP produced new guidelines but these have not been incorporated into UK Policy. The public exposure limits in UK policy define reference levels for electric and magnetic fields. Where field levels exceed these reference levels in significantly occupied spaces, further investigation is warranted.

1.4. Overall Conclusion

1.4.1. Maximum electromagnetic radiation levels from the proposed underground cables are predicted to be below ICNIRP reference levels for all 33kV circuit configurations, including cumulative trench configurations. The maximum magnetic field produced by the 400kV cables is predicted to be 192.34 micro-Tesla, which is above the 100 micro-Tesla public exposure reference level. A 5m clearance distance is recommended and a review of aerial imagery confirms that the nearest dwelling is approximately 165m from this cable route. No significant impacts associated with the proposed underground cables are predicted.

1.4.2. Electromagnetic radiation from the transformers and PV inverters will be even less significant due to 'CE' marking (Conformité Européene, or European Conformity marking), and/or 'UKCA' marking (UK Conformity Assessed), ensuring compliance with electromagnetic disturbance standards.

1.4.3. Additionally, electromagnetic radiation from the Rosefield Substation and BESS will not be significant as they will be located at least 274m from any surrounding dwellings. For users of Public Rights of Way (PRoWs), any radiation effects are expected to be minimal due to their transient exposure.

1.5. 33kV to 400kV Underground Cables

1.5.1. The maximum magnetic field produced by the proposed underground cables (33kV to 400kV) in single circuit configurations is predicted to be 96.17 micro-Tesla, which is below the 100 micro-Tesla public exposure reference level. A cumulative assessment of the trench configurations has been considered, with the maximum magnetic field produced predicted to be 192.34 micro-Tesla, which is above the 100 micro-Tesla public exposure reference level. A 5m clearance distance is recommended for this trench configuration, as receptors beyond this distance are unlikely to experience magnetic fields exceeding the reference limits. A review of aerial imagery confirms that the nearest dwelling is approximately 165m from this cable route. Given this separation, no significant impacts are predicted.

1.5.2. For users of PRoWs, any electromagnetic radiation effects are expected to be minimal due to their transient exposure as these are not continually occupied. Rather they are moving receptors, as opposed to residential dwellings and workplaces.

1.5.3. Therefore, no significant impacts associated with the proposed underground cables are predicted.

1.6. Transformers and PV Inverters

1.6.1. Notable sources of electromagnetic radiation other than the cables will be the conversion units (transformers/PV inverters) positioned across the Proposed Development.

1.6.2. The electrical equipment associated with the transformers and PV inverters will be 'CE' marked, and/or 'UKCA' marked. CE and UKCA markings indicate that a product has been assessed by the manufacturer and determined to meet the safety, health, and environmental protection requirements of the European Union and the United Kingdom, respectively. CE marking requirements were adopted and extended indefinitely in Great Britain until the UK left the EU in 2020. From 1 January 2021, the UKCA mark started to replace the CE mark for goods sold within Great Britain, and the CE mark has continued to be required for goods sold in Northern Ireland. The CE marking should ensure that electrical and electronic equipment does not generate, or is not unintentionally affected by, electromagnetic disturbance.

1.6.3. Therefore, no significant impacts associated with the proposed conversion units are predicted.

1.7. Substations and BESS

1.7.1. The Solar PV Development will connect to the proposed Rosefield Substation. According to UK regulations, the Rosefield Substation conforms with the applicable exposure limitations for the general public, and the field from the equipment inside a substation does not extend far, if at all, outside the perimeter fence. Additionally, the Solar PV Development will include a connection to a BESS. Electrical equipment associated with the Rosefield Substation will be 'CE' or 'UKCA' marked thus predicted to produce fields at a lower level than that of underground cables. Additionally, the perimeters of the Rosefield Substation are more than 274m from any identified dwelling and comply with public exposure limits, as electromagnetic fields from the equipment do not extend significantly beyond the perimeter fence.

1.7.2. The BESS contributes to the electromagnetic radiation produced by the Proposed Development. The proposed location for the BESS is at Parcel 2, Fields D8 and D9, as shown in **Figure 2** of **Section 1.3**. The proposed BESS location is situated more than 387m from any identified dwelling. As electromagnetic radiation levels reduce with increased distance, all nearby dwellings and workplaces are expected to be situated at a safe distance from the BESS installations.

2. About Pager Power

2.1.1. Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 62 countries internationally.

2.1.2. The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

2.1.3. Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects;
- Building developments;
- Aviation and telecommunication systems.

2.1.4. Pager Power prides itself on providing comprehensive, understandable, and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

2.1.5. Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

3. Introduction

3.1. Purpose of the Study

3.1.1. Pager Power has been retained to assess the potential electromagnetic fields generated by electrical equipment within a ground-mounted solar photovoltaic development with respect to safe levels for human exposure. The Proposed Development is located near Botolph Claydon, Buckinghamshire, England, and will include underground power cables, transformers, photovoltaic (PV) inverters, substations and a Battery Energy Storage System (BESS).

3.2. Proposed Development Site Areas

3.2.1. **Figure 3.1** below shows the Order Limits for the Proposed Development.

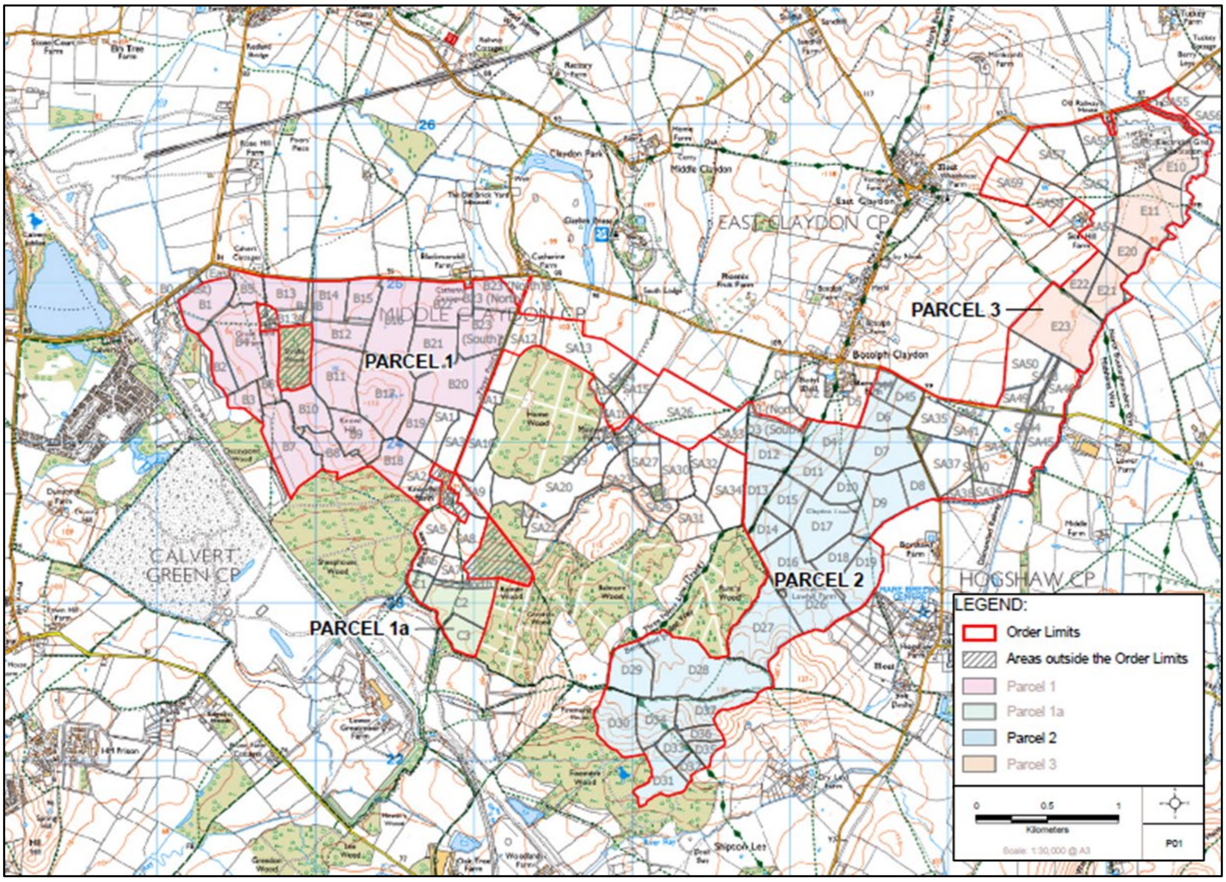

Figure 3.1 Proposed Development site areas and cable route

3.3. Assessed Infrastructure

3.3.1. The known locations of assessed infrastructure are overlaid onto aerial imagery and shown in **Figure 3.2** on the following page, these include:

- Approximate proposed solar array footprint (dark blue polygons);
- 33kv proposed underground cable route corridors (orange lines);
- 400kv proposed underground cable route corridor (yellow lines);
- PV inverters/transformers (circular icons);
- Substations (green areas); and
- BESS (light blue areas).

3.3.2. Assessment of the proposed underground cable routes is based on the cable route centreline, as this is most representative of the likely impacts. The locations shown on the following page are based on an indicative site layout.

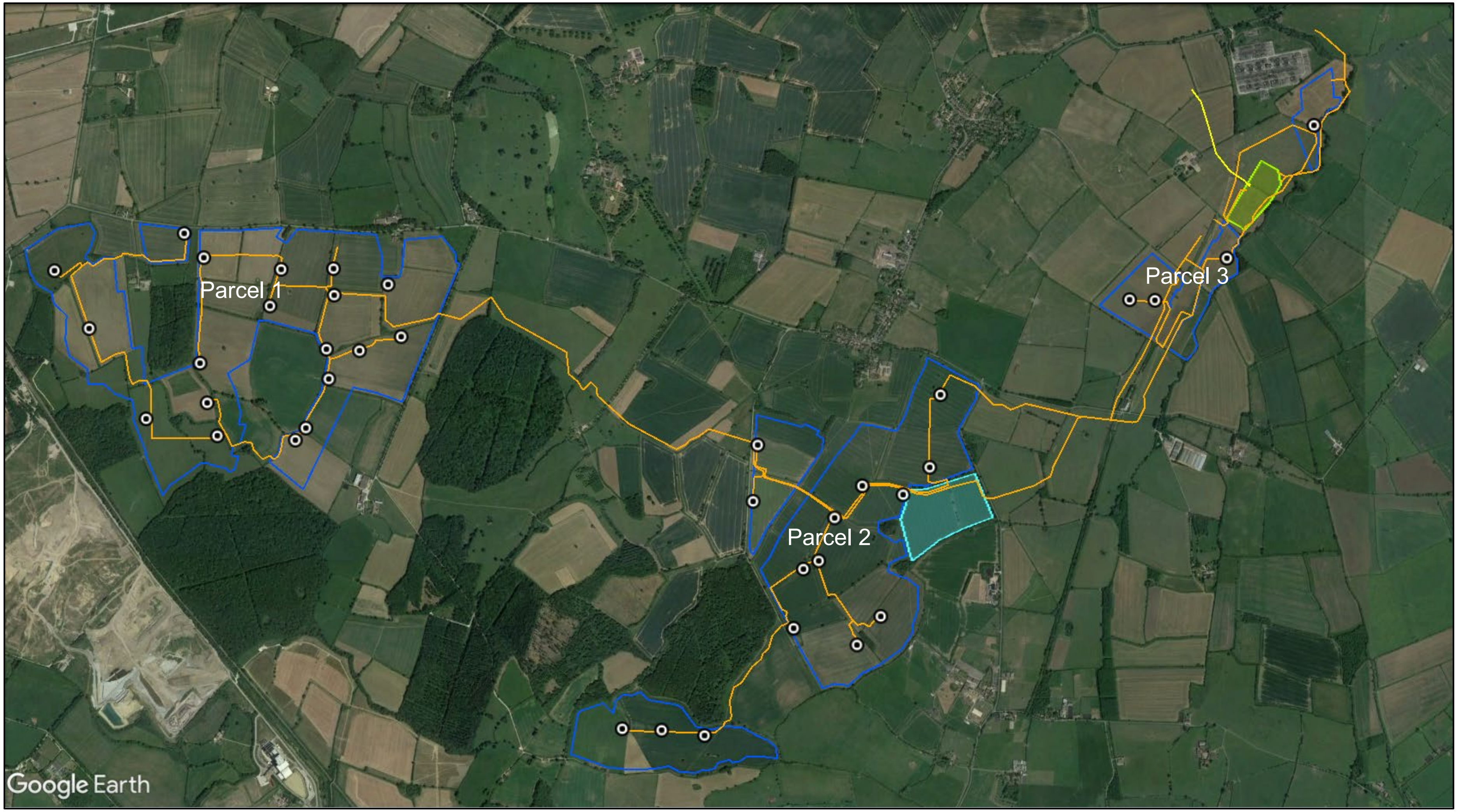

Figure 3.1 Assessed infrastructure – indicative locations

3.4. Assessed Infrastructure Technical Information

3.4.1. The technical information considered in this assessment is presented in **Tables 3.1** and **3.2** below and on the following page.

Table 3.1 Assessed infrastructure technical information

Assessed Infrastructure Technical Information		
Underground Cables	Voltages	33kV to 400kV cables
	Locations	Highlighted in **Figure 1.2**
	Minimum Depth	1.1m
Substations	Voltages	Up to 400kV substations
	Proposed location	Parcel 3, Fields E11 and E20
BESS	Proposed locations	Parcel 2, Fields D8 and D9
Conversion Units (Transformers and PV inverters)	Proposed locations	Positioned across the Proposed Development

Table 3.2 Cable route technical information

Cable route locations	Tench configurations
Parcel 1	33kV 10 circuits
Parcel 1 to 2	33kV 10 circuits
Parcel 2	33kV 8 circuits
Parcel 2 (Fields D28 and D29)	33kV 2 circuits
Rosefield BESS to Rosefield Substation	33kV 33 circuits
Parcel 3	33kV 2 circuits
Parcel 3 to Rosefield Substation	33kV 2 circuits
Rosefield Substation	400kV 2 circuits

4. Technical Background

4.1. Emissions

4.1.1. All electrical equipment emits electric and magnetic radiation. Power cables produce both electric and magnetic fields, which can potentially affect human health. Electromagnetic radiation from underground cables is generally less than electromagnetic radiation from overhead lines because emissions from adjacent conductors within a cable tend to cancel each other out. When assessing the impacts of overhead powerlines, it is important to consider the impact of both electric and magnetic fields.

4.1.2. Underground cables generally cause a negligible electric field above ground but can cause a significant magnetic field, which is dependent on the current in the conductors.

4.2. Electromagnetism

4.2.1. The movement of electric charge causes electric and magnetic fields to be produced in the space surrounding the charge. Human exposure to such fields can cause health problems if persistent and/or they are of high strength. The magnitude of the effects is dependent on both the field strength and the exposure time.

4.3. Health Concerns – Potential Effects

4.3.1. The potential effects on human health caused by time-varying magnetic fields, such as those generated by AC cables, are due to induced current on functions of the central nervous system. There are various international bodies which provide maximum safe exposure levels to time varying electromagnetic fields.

4.3.2. Various sources of information relating to safe exposure levels have been reviewed as part of this study.

4.3.3. The UK Policy on public exposure limits to EMF radiation is designed to comply with the 1998 ICNIRP (International Commission on the Non-Ionizing Radiation Protection) guidelines in terms of the 1999 EU Recommendation. In 2010 ICNIRP produced new guidelines but these have not been incorporated into UK Policy. The public exposure limits in UK policy define reference levels for electric and magnetic fields. Where field levels exceed these reference levels in significantly occupied spaces, further investigation is warranted.

4.3.4. Another relevant resource consulted is the EMFs.info webpage , where the UK electricity industry has collected the relevant studies pertaining to safe limits on exposure in the UK and elsewhere in the world. The relevant sections are analysed in the next chapter.

4.4. Electromagnetic Radiation from Home Electrical Equipment

4.4.1. The World Health Organization (WHO) publishes data regarding electromagnetic fields, including the typical levels for home electrical equipment, as shown in **Table 4.1** below.

Table 4.1 Typical emissions from home electrical equipment

Appliance	Electric field strength (Volts per metre)	Magnetic field strength (micro-Tesla, μT) (at 1 metre)
Hair Dryer	80	0.01 – 7
Iron	120	0.12 – 0.3
Vacuum Cleaner	50	2 – 20
Refrigerator	120	0.01 – 0.25
Television	60	0.04 - 2

4.5. Electromagnetic Radiation Reduction with Distance

4.5.1. Electromagnetic radiation levels reduce with distance which means, for example, the typical magnetic field from a vacuum cleaner reduces from 800 micro-Tesla to 2 micro-Tesla when the separation distance increases from 3 centimetres to 100 centimetres.

4.5.2. This means electromagnetic radiation levels from the cables, transformers, PV inverters, substations and BESS will tend to reduce with distance in any direction – including towards a receptor.

5. Overview of Electromagnetic Fields

5.1. Overview

5.1.1. The Electricity Networks Association provides a comprehensive overview of electromagnetic fields (EMFs) and the issues associated with these on their webpage . Regarding health issues caused by EMFs they state the following:

5.1.2. However, there are suggestions that magnetic fields may cause other diseases, principally childhood leukaemia, at levels below these limits. The evidence for this comes from epidemiology studies, which have found a statistical association - an apparent two-fold increase in leukaemia incidence, from about 1 in 24,000 per year up to 1 in 12,000 per year, for the children with the top half percent of exposures. The evidence is strong enough for magnetic fields to be classified by the World Health Organization as "possibly carcinogenic". But because these studies only show statistical associations and do not demonstrate causation, and because the evidence from the laboratory is against, the risk is not established, it remains only a possibility.

5.2. Exposure limits in the UK

5.2.1. As set out in the previous section, the limits in the UK come from the 1998 ICNIRP guidelines. The original guidance in 1999 specified:

i) Basic Restrictions

These are the levels at which electromagnetic radiation is potentially harmful to humans. This is a current density given in mA m-2 (milliamps per metre squared).

ii) Reference Level (Investigation Level)

Provided for practical exposure assessment purposes to determine whether the basic restrictions are likely to be exceeded. Compliance with the reference level will ensure compliance with the relevant basic restriction.

iii) Field Actually Required

This is the field strength at which the basic restriction is likely to be exceeded.

5.2.2. The values for the above stated in the ICNIRP 1998 paper are shown in **Table 5.1** on the following page. These are the public exposure values, not the occupational exposure values – the former is more conservative than the latter by a factor of five.

Table 5.1 ICNIRP 1998 – Public Exposure Limits

ICNIRP 1998 – Public Exposure Limits	
Basic Restriction (mA m-2)	2
Magnetic Fields Reference Level (μT)	100
Electric Fields Reference Level (kV m-1)	5
Magnetic Field Actually Required to Exceed Basic Restriction (μT)	360
Electric Field Actually Required to Exceed Basic Restriction (kV m-1)	9

5.2.3. The public exposure limits in **Table 5.1** will be considered within this analysis.

5.3. Height Above Ground Used for Testing Compliance

5.3.1. EMFs.info specifically states the following with regard to the height to be used to test compliance:

5.3.2. *The standard height for measuring fields, especially from power lines, is 1 m above ground level ... This isn't just because it's a convenient round number, it's because roughly half way up the height of a standing person is actually the height that gives the best approximation to the induced current in the body.*

5.4. Safe Levels – Summary

5.4.1. The values of interest are those shown in **Table 5.1** above. Effectively, this means that in locations of significant exposure time, such as residences, levels should be below:

- 100μT (magnetic fields);
- 5kV m^{-1} (electric fields).

5.4.2. Values exceeding the limits above, at one metre above ground level, would suggest that further investigation is required.

6. Technical Assessment

6.1. Field Levels – 400kV Underground Cables

6.1.1. Field level data from various cable configurations have been sourced from EMFS.info. The data below and on the following page show the magnetic fields for 400kV cables, which represent the maximum assumed voltage for underground cables in the Proposed Development, considering a worst-case scenario. Typical values for magnetic fields are approximately a quarter of these maximum values. The assessment accounts for varying cable voltages in the Proposed Development, with the analysis based on the maximum voltage and shallowest depths to adopt a conservative approach. Maximum field data has been used where possible to provide a more conservative assessment. It's important to note that there are no electric fields above ground associated with underground cables. The relevant chart is shown in **Figure 6.1** below. **Table 6.1** on the following page provides the associated indicative numerical values at set distances .

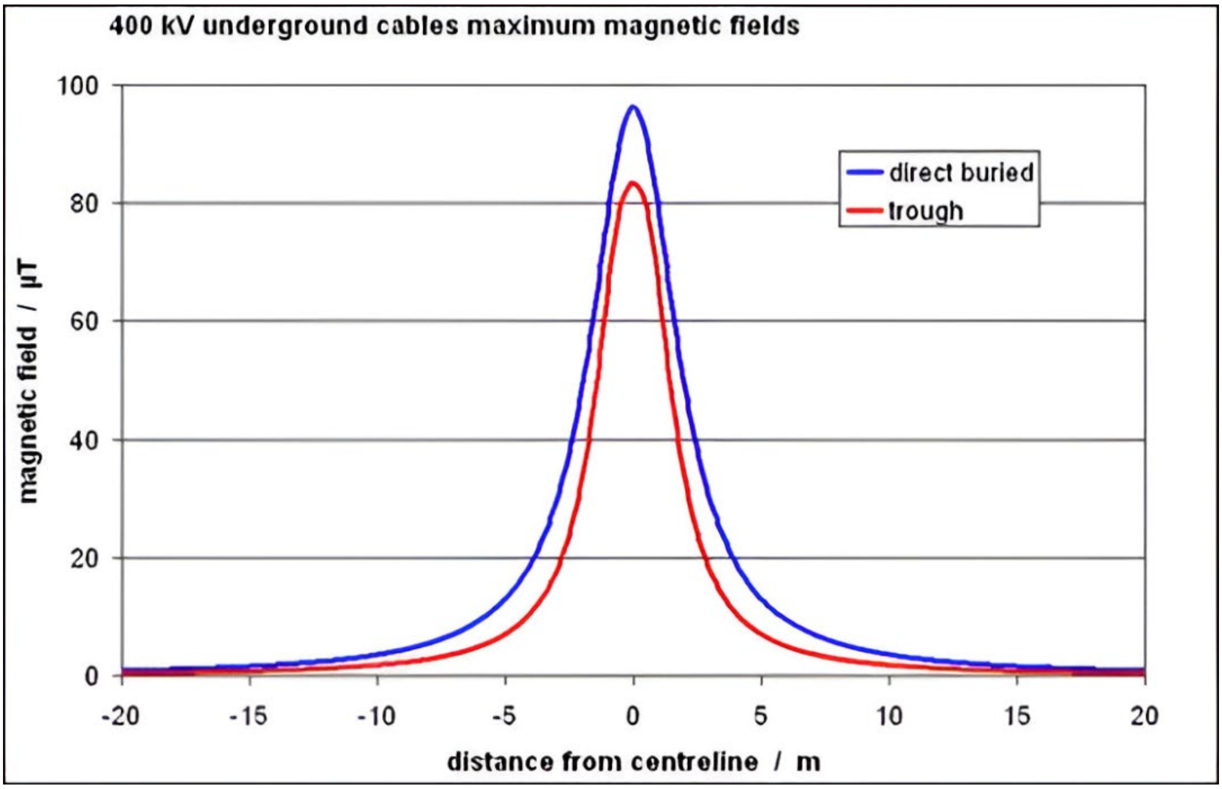

Figure 6.1 Maximum magnetic fields associated with 400kV underground cables

Table 6.1 Maximum magnetic field levels for an underground 400kV cable

Distance from Centreline (m)	Magnetic Field (trough double circuit cable with 0.13m spacing and 0.3m depth)	Magnetic Field (direct buried single cable with 0.5m spacing and 0.9m depth)
0	83.30 micro Teslas	96.17 micro Teslas
5	7.01 micro Teslas	13.05 micro Teslas
10	1.82 micro Teslas	3.58 micro Teslas
20	0.46 micro Teslas	0.92 micro Teslas

6.2. Field Levels – 33kV Underground Cables

6.2.1. The data below shows the magnetic fields for 33 kV cables. The relevant chart for the magnetic fields associated with 33kV underground cables is shown in **Figure 6.2** below. **Table 6.2** on the following page provide the associated indicative numerical values at set distances.

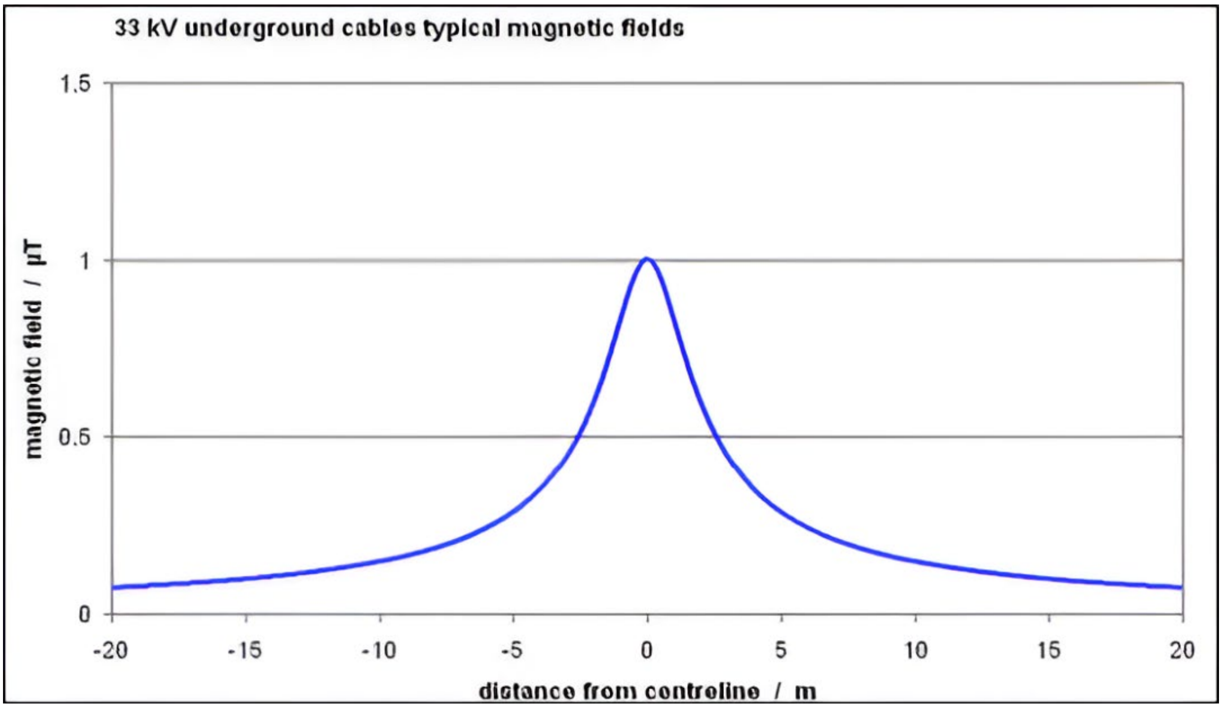

Figure 6.2 Typical magnetic fields associated with 33 kV underground cable

Table 6.2 Typical magnetic field levels for an underground 33 kV cable

Distance from Centreline (m)	Magnetic Field (single 33 kV cable at 0.5m depth)
0	1.00 micro Teslas
5	0.29 micro Teslas
10	0.15 micro Teslas
20	0.07 micro Teslas

6.3. Recommended Minimum Clearance Distances

6.3.1. The recommended minimum clearance distances for underground cables based on the public exposure limits previously referenced in this report for magnetic and electric fields are presented in **Table 6.3** below.

6.3.2. The dataset provided maximum values and typical values for single circuit configurations of the cables that have been evaluated – in all cases the 'maximum' option has been chosen where possible in order to remain conservative.

Table 6.3 Typical magnetic field levels for an underground 33 kV cable

Type of Line	Estimated Maximum Magnetic Field (micro-Tesla)	Recommended minimum Clearance Distance (m)	Estimated Maximum Electric Field (kV/m)
400kV underground cable	96.17 (below 100 limit)	None	-
33 kV underground cable	1.00 (below 100 limit)	None	-

6.3.3. **Table 6.3** confirms that clearance distances are not required for any proposed single-circuit underground cables. The table demonstrates that the maximum magnetic fields generated by these cables remain below the acceptable exposure limit, and no significant effects on human health are anticipated.

6.3.4. For the trench configurations outlined in **Table 3.2** in **Section 3.4**, the worst case is based upon the addition of source a and source b; however, it is important to note that this is only true for magnetic fields that are exactly in line. When the electromagnetic fields are not in line, the sum of these is less than 'a+b'. The estimated maximum magnetic fields and associated recommended minimum clearance distances are outlined in **Table 6.4** below.

Table 6.4 Recommended clearance distances for assessed trench configurations

Cable route locations	Trench configurations	Estimated Maximum Magnetic Field (micro-Tesla)	Recommended minimum Clearance Distance (m)
Parcel 1	33kV 10 circuits	10.00 (below 100 limit)	None
Parcel 1 to Parcel 2	33kv 10 circuit	10.00 (below 100 limit)	None
Parcel 2	33kV 8 circuits	8.00 (below 100 limit)	None
Parcel 2 (Fields D28 and D29)	33kV 2 circuits	2.00 (below 100 limit)	None
Rosefield BESS to Rosefield Substation	33kV 33 circuit	33.00 (below 100 limit)	None
Parcel 3	33kV 2 circuits	2.00 (below 100 limit)	None
Parcel 3 to Rosefield Substation	33kV 2 circuits	2.00 (below 100 limit)	None
Rosefield Substation	400kV 2 circuits	192.34 (above 100 limit)	5m

6.3.5. All of the assessed trench configurations for the 33kV cables are below the ICNIRP 1998 public exposure reference limit for magnetic fields (100 μT). A review of the aerial imagery, as shown in **Figure 6.3** on the following page, confirms that the closest identified dwelling is 80.2m from the cable route. Therefore, significant effects upon human health are not predicted.

6.3.6. The assessed trench configuration for the 400kV cables is expected to exceed the ICNIRP 1998 public exposure reference limit. However, this remains below the threshold of the 360 μT required to exceed basic restrictions. A 5m clearance distance is recommended for this trench configuration, as receptors beyond this distance are unlikely to experience magnetic fields exceeding the reference limits. A review of aerial imagery, as shown in **Figure 6.4** on the following page, confirms that the nearest dwelling is approximately 165m from this cable route. Given this separation, no significant impacts are predicted.

6.3.7. The above assessment has been completed based on an indicative site layout. The developer has expressed that future designs may consider the use of 66kV underground cabled. Based on the above, and considering the typical estimated magnetic field from 132kV underground cables (5.01), it can be concluded that the above circuit configurations would be below the ICNIRP 1998 public exposure reference limits for magnetic fields originating from 66kV underground cables.

Figure 6.3 Nearest dwelling to the assessed cable route (33kV cables)

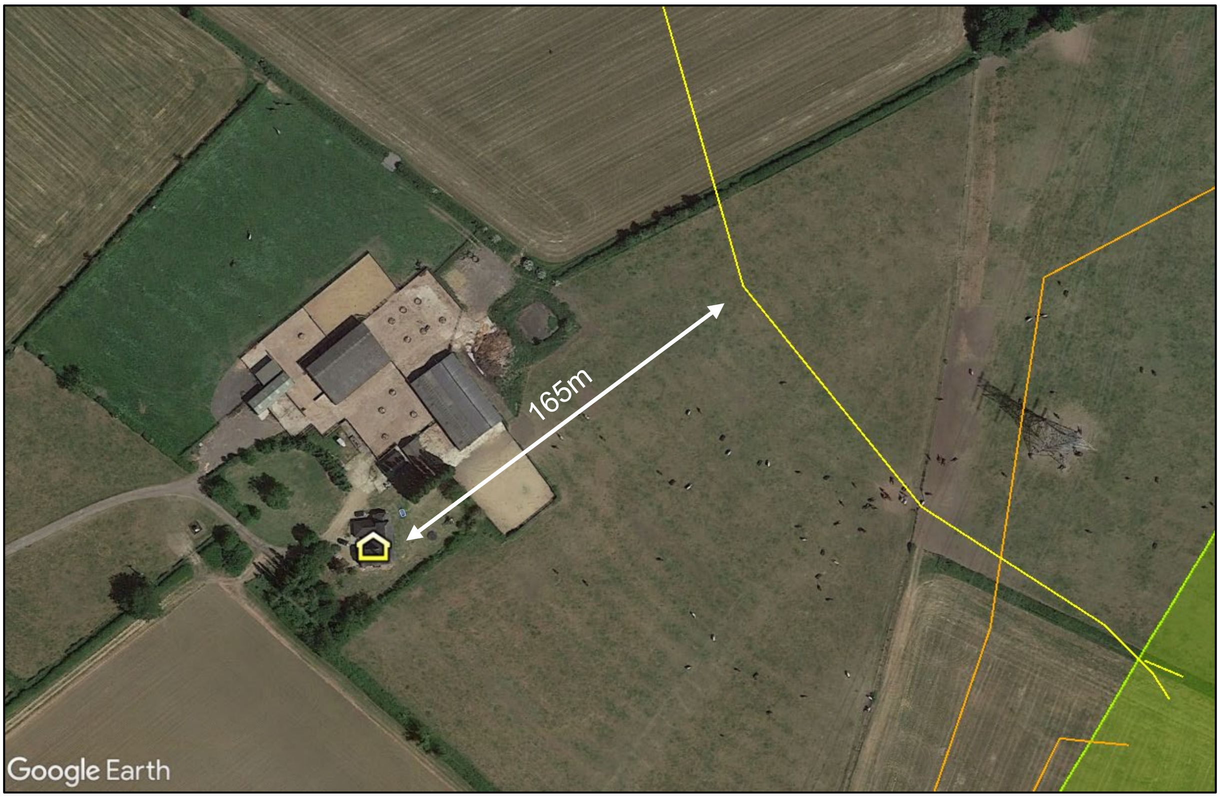

Figure 6.4 Nearest dwelling to the assessed cable route (400kV cables)

6.4. Electromagnetic Radiation from Other Components of the Proposed Development

Transformers and PV Inverters

6.4.1. Notable sources of electromagnetic radiation, other than the underground cables, will include the transformers and PV inverters positioned across the Proposed Development. The proposed locations are shown in **Figure 3.2** in **Section 3.3**.

6.4.2. The transformers and PV inverters should be CE marked (Conformité Européene, or European Conformity marking), and/or ‘UKCA’ marked (UK Conformity Assessed). CE and UKCA marking indicates that a product has been assessed by the manufacturer and deemed to meet the safety, health and environmental protection requirements of the European Union[1] and the United Kingdom[2], respectively. CE marking requirements have been adopted and extended indefinitely in Great Britain until the UK left the EU in 2020. From 1 January 2021, the UKCA mark started to replace the CE mark for goods sold within Great Britain, and the CE mark has continued to be required for goods sold in Northern Ireland. This will be confirmed prior to installation.

6.4.3. The relevant EU Directive for CE marking is[3] Electromagnetic Compatibility Directive 2014/30/EU, and the relevant UK Statutory guidance for UKCA marking is the Electromagnetic Compatibility Regulations 2016[4]. This legislation should ensure that electrical and electronic equipment should not generate, or be affected by, electromagnetic disturbance.

Substations and BESS

6.4.4. Other notable sources of electromagnetic radiation associated with the Proposed Development include the Rosefield Substation and BESS. The proposed site for the BESS is within Parcel 2, Fields D8 and D9.

6.4.5. Furthermore, as detailed in **Table 3.1** within **Section 3.4**, the Proposed Development will include a connection to a proposed 400kV substation within Parcel 3, Fields E11 and E20. The proposed locations of which are detailed in **Figure 3.2** of **Section 3.3**.

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[1] Source: https://europa.eu/youreurope/business/product-requirements/labels-markings/ce-marking/index_en.htm.
[2] Source: https://www.gov.uk/guidance/using-the-ukca-marking.
[3] Source: https://ec.europa.eu/growth/sectors/electrical-engineering/emc-directive_en.
[4] Source: https://www.gov.uk/government/publications/electromagnetic-compatibility-regulations-2016/electromagnetic-compatibility-regulations-2016-great-britain.

6.4.6. A detailed overview of the potential BESS locations (light blue) and proposed 400kV Rosefield Substation (green) is shown in **Figures 6.5** and 6.6 on the following pages.

Rosefield
Solar Farm

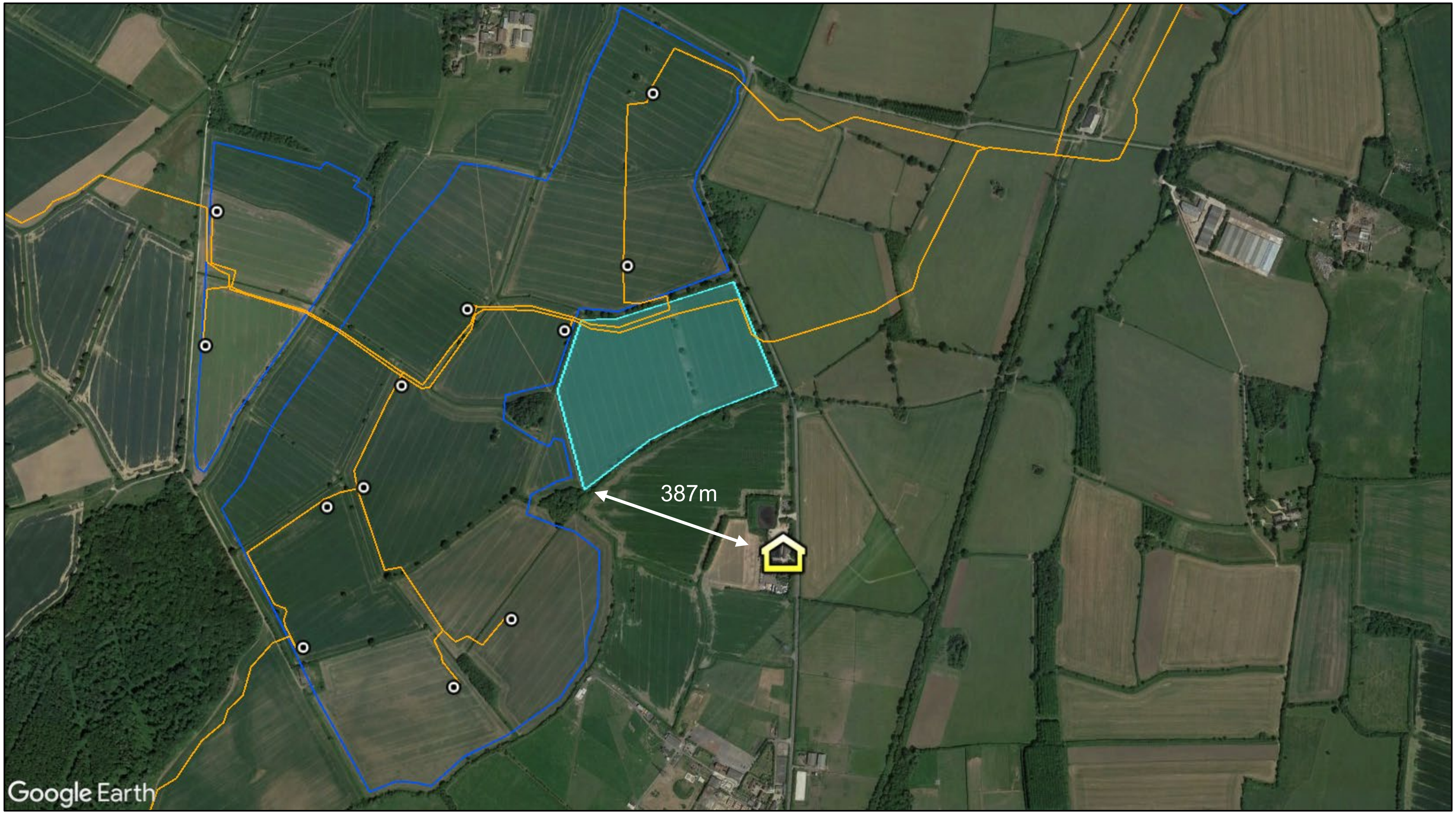

Figure 6.5 Minimum distance between BESS and the nearest dwellings

Figure 6.6 Minimum distance between the proposed Rosefield Substation and the nearest dwelling

6.4.7. The minimum horizontal distance between the proposed BESS and any dwelling is approximately 387m, and 274m between the proposed Rosefield Substation and any dwelling.

6.4.8. Based on a desk-based review of imagery, there are overhead powerlines surrounding the proposed BESS and Rosefield Substation connecting to the nearby existing National Grid East Claydon Substation. These are likely to be 400kV pylons. 400kV overhead powerlines would produce more significant electric and magnetic fields than any type of electrical infrastructure proposed as a part of this development. Therefore, the most significant source of electromagnetic radiation for these dwellings is the existing overhead powerlines[5] connecting to the National Grid East Claydon Substation. These dwellings are already considerably close to the existing substation and are in even closer proximity to the existing overhead power cables, which are a much more significant source of electromagnetic radiation. Additionally, the magnetic fields from the proposed underground cable routes have been assessed accordingly within this report for the nearest dwelling locations.

6.4.9. Similarly to the transformers and PV inverters, the additional proposed Rosefield Substation, of up to 400kV, is expected to be comprised of equipment that is ‘CE’ and/or ‘UKCA’ marked. CE and ‘UKCA’ marking should ensure that electrical and electronic equipment does not generate, or is not unintentionally affected by, electromagnetic disturbance.

6.4.10. Significant electromagnetic radiation is not predicted from the existing National Grid East Claydon substation, proposed Rosefield Substation and BESS because:

- The perimeters of the National Grid East Claydon Substation and the proposed 400kV Rosefield Substation are more than 274m from any dwelling and would be required to comply with the relevant exposure limits for the general public, and the electromagnetic fields from the equipment inside a substation do not extend far if at all outside the perimeter fence;
- The proposed BESS location within Fields D8 and D9 is more than 387m from any dwelling, meaning that all dwellings are at a safe distance as electromagnetic radiation levels reduce as the separation distance increases;
- For users of Public Rights of Way (PRoWs), any electromagnetic radiation effects would likely be minimal as these are not continually occupied, rather they are moving receptors, as opposed to residential dwellings and workplaces.

[5] Understood to be 400kV.

6.5. Comparative Assessment

6.5.1. The maximum magnetic field produced by household appliances like vacuum cleaners can reach up to 50 micro-Tesla[6]. It would follow that appliances with higher voltages would generate stronger magnetic fields. For instance, the proposed underground cables are projected to produce a maximum magnetic field of 96.17 micro-Tesla. While this value is notably higher than that of household appliances, it remains within acceptable exposure limits. Notably, the magnetic field strength is expected to drop to approximately 13 micro-Tesla just 5 meters from the source for 400kV cables less than 1 meter deep; a value even less than that of a vacuum cleaner. With the confirmed depth of the high voltage 400kV underground cables being a minimum of 0.9 metres for the Proposed Development, a likely reduction in the strength of the magnetic field is predicted.

6.5.2. Moreover, the transformers and PV inverters will produce magnetic fields at levels lower than the underground cables.

6.6. Cumulative Effects

6.6.1. When assessing the cumulative effects of electromagnetic fields, the worst case is based upon the addition of source a and source b; however, it is important to note that this is only true for magnetic fields that are exactly in line. When the electromagnetic fields are not in line, the sum of these is less than ‘a+b’.

6.6.2. For the purpose of this assessment, the worst case has been calculated i.e. based upon ‘a+b’. As there are no proposed overhead powerlines to consider for the Proposed Development, there are no cumulative effects to assess in this regard.

6.6.3. There are existing overhead lines in the baseline environment, particularly in the vicinity of the National Grid East Claydon Substation. Existing electrical infrastructure will comply with the ICNIRP reference levels and respect any required setback distances. Significant cumulative impacts are not predicted based on the relative locations of existing and proposed electrical infrastructure relative to the receptors. It is understood that the existing National Grid East Claydon Substation will be replaced with a larger substation; the above reasoning remains applicable and significant cumulative impacts are not predicted.

6.6.4. As discussed in **Section 6.5**, the transformers, PV inverters, substation and BESS produce smaller magnetic fields than that of the underground cables, thus, considering all sources of electromagnetic radiation and their

[6] Source: https://www.nationalgrid.com/electricity-transmission/document/141896/download#:~:text=Normally%20these%20underground%20cables%20will,do%20not%20emit%20electric%20fields.

relative locations, it is predicted that the cumulative magnetic and electric fields are likely to be below the acceptable exposure limits.

6.6.5. The cumulative effects are not significantly impacted by the use of household items. Electrical household appliances will add to the overall exposure of electromagnetic fields. However, these levels will still remain below the recommended exposure limit due to the lower voltages of the appliances, and are not used constantly, providing only a temporary addition to the resultant electromagnetic field levels.

6.6.6. The electrical design considers multiple high-voltage cables within a single trench along certain sections of the cable route. The cumulative resultant fields and associated setback distances have been assessed in **Table 6.3** in **Section 6.4**.

7. Conclusions

7.1. 33kV to 400kV Underground Cables

7.1.1. The maximum magnetic field produced by the proposed underground cables (33kV to 400kV) in single circuit configurations is predicted to be 96.17 micro-Tesla, which is below the 100 micro-Tesla public exposure reference level. A cumulative assessment of the trench configurations has been considered, with the maximum magnetic field produced predicted to be 192.34 micro-Tesla, which is above the 100 micro-Tesla public exposure reference level. A 5m clearance distance is recommended for this trench configuration, as receptors beyond this distance are unlikely to experience magnetic fields exceeding the reference limits. A review of aerial imagery confirms that the nearest dwelling is approximately 165m from this cable route. Given this separation, no significant impacts are predicted.

7.1.2. For users of PRoWs, any electromagnetic radiation effects are expected to be minimal due to their transient exposure as these are not continually occupied. Rather they are moving receptors, as opposed to residential dwellings and workplaces.

7.1.3. Therefore, no significant impacts associated with the proposed underground cables are predicted.

7.2. Transformers, and PV Inverters

7.2.1. Notable sources of electromagnetic radiation other than the cables will be the conversion units (transformers/PV inverters) positioned across the Proposed Development.

7.2.2. The electrical equipment associated with the transformers and PV inverters will be ‘CE’ marked, and/or ‘UKCA’ marked. Therefore, no significant impacts associated with the proposed conversion units are predicted.

7.3. Substations and BESS

7.3.1. The Solar PV development will connect to the proposed Rosefield Substation. According to UK regulations, the Rosefield Substation conforms with the applicable exposure limitations for the general public, and the field from the equipment inside a substation does not extend far, if at all, outside the perimeter fence. Additionally, the perimeters of the Rosefield Substation are more than 274m from any identified dwelling and comply with public exposure limits, as electromagnetic fields from the equipment do not extend significantly beyond the perimeter fence.

7.3.2. The Solar PV development will also include a connection to a BESS. The proposed location for the BESS is at Parcel 2, Fields D8 and D9. The proposed BESS location is situated more than 387m from any identified dwelling. As electromagnetic radiation levels reduce with increased distance, all nearby dwellings and workplaces are expected to be situated at a safe distance from the BESS installations.

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