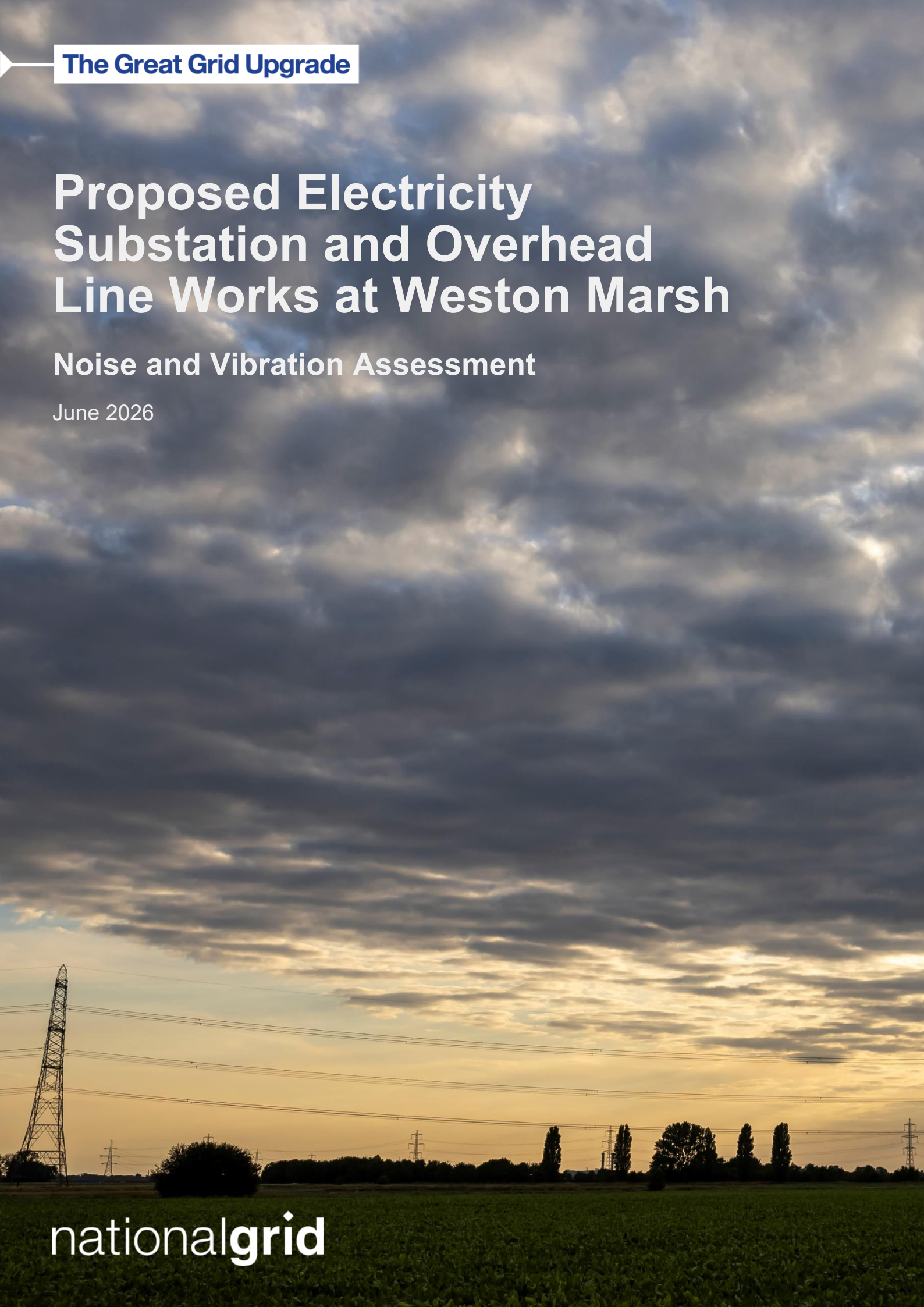
The Great Grid Upgrade

Proposed Electricity Substation and Overhead Line Works at Weston Marsh

Noise and Vibration Assessment

June 2026



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Contents

1. Introduction

1.1 Overview

1.1.1 This Noise and Vibration Assessment has been prepared on behalf of National Grid Electricity Transmission plc (National Grid).

1.1.2 National Grid are proposing to undertake works to construct a new electricity substation, new sections of overhead line and modification of existing overhead lines south west of the Spalding Tee-Point in the Weston Marsh area, within the administrative boundary of South Holland District Council (SHDC) in Lincolnshire.

1.2 Summary of the Scheme

1.2.1 In totality, the Scheme consists of four components, each planned to be progressed via separate consenting routes. These are summarised in **Table 1.1**.

Table 1.1 Components of the Scheme

Works Required	Consenting Regime
Construction of the new Air Insulated Substation (AIS) – 400kV Weston Marsh Substation A, associated landscaping and environmental mitigation works, drainage, highways and other associated works.	Town and Country Planning Act 1990 (TCPA) (Ref 1) Component referred to as '**Substation Works'**
Construction of a new section of overhead line to connect the new substation into the existing 4ZM overhead line. Removal of a section of the existing 4ZM overhead line. Other associated works.	Section 37 of the Electricity Act 1989 (Ref 2) and deemed consent pursuant to section 90(2) of the Town and Country Planning Act 1990 Component referred to as '**S37 4ZM Overhead Line Works**'
Construction of new sections of overhead line to connect the existing 2WS overhead line into the new substation. Removal of a section of the existing 2WS overhead line. Other associated works.	Section 37 of the Electricity Act 1989 and deemed consent pursuant to section 90(2) of the Town and Country Planning Act 1990 Component referred to as '**S37 2WS Overhead Line Works**'
Reconductoring works required on the existing 4ZM overhead line. Two spans of temporary overhead lines.	The Town and Country Planning (General Permitted Development) (England) Order 2015 (Ref 3) and The Overhead Lines (Exemption) (England and Wales) Regulations 2009 (Ref 4) Component referred to as '**Exempt Overhead Line Works'**

1.2.2 The Substation Works will require consent from SHDC under the TCPA.

1.2.3 The S37 4ZM Overhead Line Works and the S37 2WS Overhead Line Works (collectively referred to as the "S37 Overhead Line Works") will require consent from the Secretary of State for Energy Security and Net Zero under Section 37 of the Electricity Act 1989 (Section 37).

1.2.4 The Exempt Overhead Line Works constitute permitted development under Part 15 Class B of the Town and Country Planning (General Permitted Development) (England) Order 2015 and The Overhead Lines (Exemption) (England and Wales) Regulations 2009.

1.2.5 The Scheme Site Boundary, which consists of the land required to construct and operate the Scheme in its entirety, is illustrated on **Figure 1**. The areas of land required to construct and operate each individual component described in **Table 1.1** are also illustrated on **Figure 1**.

1.2.6 The Scheme in its totality is a standalone development to enable connection of the Outer Dowsing Offshore Wind Farm to the national electricity transmission system. Each component stated in **Table 1.1** is required for the Scheme to fully function as part of the National Electricity Transmission System (NETS).

1.3 Purpose of this report

1.3.1 This assessment has been prepared in support of the necessary consent applications required to deliver the Scheme. It has been informed by engagement between National Grid and the relevant consenting authorities.

1.3.2 The assessment considers the Scheme in its entirety. Where the potential impacts of the Scheme are associated with specific components as set out within **Table 1.1**, this is clearly identified within the following sections. This approach enables the relevant consenting authority to readily identify and consider only those impacts that are associated with the application before them, whilst also maintaining a clear understanding of the Scheme in its wider context.

1.3.3 The purpose of this report is to provide an assessment of potential noise and vibration impacts from the Scheme at nearby noise sensitive receptors (NSRs). The report summarises the legislative and policy framework, assessment methodology, assessment results, and outline mitigation, where applicable.

2. Legislative and Policy Framework

2.1.0 Legislation and national and local planning policy relevant to the Scheme is described in the Planning, Design and Access Statement (TCPA application) and Section 37 (S37 applications). Key legislation and policy specifically relevant to the noise and vibration assessment is summarised in the following sections.

2.1 Legislation and National Policy

National Planning Policy Framework

2.1.1 The National Planning Policy Framework (NPPF) as revised in December 2024 (Ref 5) sets out national planning policies that reflect priorities of the Government for the operation of the planning system and the economic, social, and environmental aspects of the development and use of land in England. The NPPF has a strong emphasis on sustainable development, with a presumption in favour of such development.

2.1.2 Paragraph 187 states that: '*Planning policies and decisions should contribute to and enhance the natural and local environment by*:

'[…]

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of […] noise pollution […]. Development should, wherever possible, help to improve local environmental conditions […].'

2.1.3 Paragraph 198 states that: '*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should*:

'a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;

[…]'

2.1.4 The terms 'adverse impacts' and 'significant adverse impacts' are defined within the explanatory note of the Noise Policy Statement for England (NPSE) (as referred to at footnote 72 of the NPPF).

Overarching National Planning Statement for Energy (EN-1)

2.1.5 The Overarching National Policy Statement (NPS) for Energy (EN-1) (Ref 6) sets out the national policy for energy infrastructure projects. As stated in paragraph 1.2.1 of EN-1, in England, in combination with any relevant technology specific NPSs, it may be a material consideration in decision making on applications that fall under the TCPA. Paragraphs 5.12.1 to 5.12.7 of NPS EN-1 state:

'Excessive noise can have wide-ranging impacts on the quality of human life and health such as annoyance, sleep disturbance, cardiovascular disease and mental ill health. It can also have an impact on the environment and the use and enjoyment of areas of value such as quiet places and areas with high landscape quality.

The Government's policy on noise is set out in the Noise Policy Statement for England. It promotes good health and good quality of life through effective noise management. Similar considerations apply to vibration, which can also cause damage to buildings. In this section, in line with current legislation, references to 'noise' below apply equally to assessment of impacts of vibration.

Noise resulting from a proposed development can also have adverse impacts on wildlife and biodiversity. Noise effects of the proposed development on ecological receptors should be assessed by the Secretary of State in accordance with the Biodiversity and Geological Conservation section of this NPS...

….Factors that will determine the likely noise impact of a proposed development include:

- *The inherent operational noise from the proposed development, and its characteristics;*
- *the proximity of the proposed development to noise sensitive premises (including residential properties, schools, and hospitals) and noise sensitive areas (including certain parks and open spaces);*
- *the proximity of the proposed development to quiet places and other areas that are particularly valued for their soundscape or landscape quality; and*
- *the proximity of the proposed development to sites where noise may have an adverse impact on protected species or other wildlife including migratory species.*

Where noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment:

- *a description of the noise generating aspects of the development proposal leading to noise impacts, including the identification of any distinctive tonal characteristics, if the noise is impulsive, whether the noise contains particular high or low frequency content or any temporal characteristics of the noise;*
- *identification of noise sensitive receptors and noise sensitive areas that may be affected;*
- *the characteristics of the existing noise environment;*
- *a prediction of how the noise environment will change with the proposed development;*
    - *In the shorter term such as during the construction period;*

- *in the longer term, during the operating life of the infrastructure; and*
- *at particular times of the day, evening and night (and weekends) as appropriate, and at different times of year.*

- *An assessment of the effect of predicted changes in the noise environment on any noise-sensitive receptors, including an assessment of any likely impact on health and quality of life / well-being where appropriate, particularly among those disadvantaged by other factors who are often disproportionately affected by noise-sensitive areas…and*
- *All reasonable steps taken to mitigate and minimise potential adverse effects on health and quality of life.*

The nature and extent of the noise assessment should be proportionate to the likely noise impact.'

National Policy Statement for Electricity Networks Infrastructure (EN-5)

2.1.6 The NPS for electricity networks infrastructure (EN-5) (Ref 7) provides supplementary policy alongside EN-1. As stated in paragraph 1.2.1 of EN-1, whilst primarily applicable to National Significant Infrastructure Projects (NSIPs), technology specific NPSs may also be a material consideration in decision making on applications that fall under the TCPA.

2.1.7 EN-5 provides outline guidance on the assessment of noise from electricity network projects, including overhead lines and substations. EN-5 sets out relevant design principles, including reference to the Holford Rules (Ref 8) and Horlock Rules (Ref 9), which should be embodied in applicant's proposals for new overhead lines and substations respectively. These include keeping noise and other environmental effects to a reasonably practicable minimum.

2.1.8 EN-5 also sets out policy guidance on the assessment of noise from substations and overhead lines, including the adoption of appropriate assessment methodologies and the application of the principles of the relevant British Standards, including BS4142:2014+ A1:2019 'Methods for rating and assessing industrial and commercial sound' (Ref 10).

Noise Policy Statement for England

2.1.9 The NPSE (Ref 11) sets out the long-term vision of Government noise policy in England:

'to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.'

2.1.10 The NPSE outlines three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

1) Avoid significant adverse impacts on health and quality of life;
2) mitigate and minimise adverse impacts on health and quality of life; and
3) where possible, contribute to the improvement of health and quality of life.

2.1.11 In its aims, the NPSE uses the key phrases ‘significant adverse’ and ‘adverse’. The NPSE states in its explanatory note that there are two established concepts that are currently being applied to noise impacts, which are:

1) NOEL – No Observed Effect Level. This is the level below which no effect can be detected; and

2) LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.

2.1.12 The NPSE then extends this concept to include: SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

2.1.13 The NPSE notes that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to vary for different noise sources, receptors and times.

Planning Practice Guidance for Noise

2.1.14 The UK Government’s Planning Practice Guidance on Noise (PPGN) (Ref 12) provides a framework for assessing and managing noise impacts in the planning system in England. It emphasises that noise should be considered when development may generate additional noise or be sensitive to the existing acoustic environment. The guidance encourages early consideration of good acoustic design to identify cost-effective solutions and improve the acoustic environment where possible.

2.1.15 A key concept in PPGN is the Noise Exposure Hierarchy, which categorizes noise impacts into four levels:

1) No Observed Effect Level (NOEL);

2) No Observed Adverse Effect Level (NOAEL);

3) Lowest Observed Adverse Effect Level (LOAEL); and

4) Significant Observed Adverse Effect Level (SOAEL).

2.2 Regional and Local Policy

2.2.1 Regional and local plans or policies relevant to this assessment are as follows:

1) South East Lincolnshire Local Plan 2011-2036, Adopted March 2019 (Ref 13):

   a) Policy 2: Development Management: which sets out sustainable development considerations against which planning applications are determined by the local planning authority, including impacts upon neighbouring land uses by reason of noise.

   b) Policy 30: Pollution: which stipulates that development will not be permitted where it would lead to unacceptable adverse impacts due to noise, including vibration.

   c) Policy 31: Climate Change and Renewable and Low Carbon Energy: in relation to the development of renewable energy facilities and associated

infrastructure, development will be permitted provided that there would be no significant harm to residential amenity in respect to noise, vibration and other factors.

3. Methodology

3.1 Scope of the Assessment

3.1.1 The scope of this assessment has been informed through consultation and engagement with relevant consultees, as well as a screening process for both the Substation Works and S37 Overhead Line Works.

3.1.2 The scope of the noise and vibration assessment covers the following:

1) Construction noise;
2) construction vibration on people within buildings; and
3) construction vibration on buildings and structures.

3.1.3 The scope of the noise and vibration assessment excludes:

1) Construction traffic noise and vibration;
2) operational noise from overhead lines;
3) operational noise from substation plant; and
4) operational vibration.

3.1.4 Construction traffic noise is not assessed as construction traffic flows are low on all proposed routes and would not lead to significant adverse effects in terms of either noise level change or absolute noise levels.

3.1.5 Construction vibration is not assessed as vibration is caused by irregularities (e.g. potholes) in the road surface. Where a road surface is well maintained, significant levels of vibration would not occur.

3.1.6 A low noise overhead line conductor system is proposed. The low noise overhead line would produce noise levels that are below the lowest observed adverse effect level (LOAEL), even directly underneath the line. Adverse impacts from overhead line noise are therefore not expected. However, additional information on noise from overhead lines, including an outline assessment, is provided in **Appendix A**.

3.1.7 Exempt Overhead Line Works constitute permitted development under Part 15 Class B of the General Permitted Development Order 2015 and The Overhead Lines (Exemption) (England and Wales) Regulations 2009. Although this is permitted development, noise from these works have been assessed.

3.1.8 Noise generating equipment (such as transformers) would not be required within the proposed Weston Marsh Substation A, as the substation is for grid connections only. Noise from the normal operation of the proposed Weston Marsh Substation A is therefore not assessed.

3.1.9 Operational vibration is not assessed as there are no sources of operational vibration associated with the Scheme.

3.2 Study Area

Study Area for Construction Noise and Vibration

3.2.1 The assessment Study Area for construction noise impacts comprises NSRs within 300 m from construction works associated with the Scheme. This is based on guidance in BS 5228-1:2009+A1:2014 Code of practice for Noise and Vibration control on construction and open sites – Part 1: Noise (BS 5228-1) (Ref 14) and the Design Manual for Roads and Bridges LA 111 Noise and vibration (DMRB LA 111) (Ref 15).

3.2.2 The assessment Study Area for construction vibration impacts, based on guidance from BS 5228-2:2009+A1:2014 Code of practice for Noise and Vibration control on construction and open sites – Part 2: Vibration (BS 5228-2) (Ref 16) and DMRB LA 111, comprises NSRs within 100 m from construction activities with a potential to generate vibration, such as piling or compaction.

3.3 Data Collection

Desk Study

3.3.1 The following data has been used to inform the baseline conditions:

1) Ordnance Survey (OS) AddressBase Plus data;
2) Department for Environment, Food and Rural Affairs (Defra) strategic noise mapping (Ref 17). This represents the daytime ambient noise levels from road and rail sources and Noise Important Areas (NIAs); and
3) current OS mapping.

3.4 Assessment Approach

Construction Noise Assessment Approach

3.4.1 Construction noise impacts have been assessed in accordance with BS 5228-1 (Ref 14) and with the guidance of DMRB LA 111 (Ref 15).

3.4.2 Construction noise levels have been calculated at the façades of NSRs within the Study Area in accordance with the methodology described in Annex F of BS 5228-1. The predicted construction noise levels at NSRs have been compared against the lower noise thresholds (Category A) as detailed in Section E.3.2 of BS 5228-1 (the 'ABC' method). The Category 'A' construction noise thresholds represent the lowest assessment criteria (typically used to assess impacts in rural areas) and are proposed to be used throughout the Scheme as a worst-case unless there is a justification for a higher threshold to be set at specific locations.

3.4.3 The lowest observed adverse effect level (LOAEL) and significant observed adverse effect level (SOAEL) for construction noise have been established in accordance with **Table 3.1.**

Table 3.1 Construction noise LOAELs and SOAELs at residential receptors

Time Period	LOAEL	SOAEL
Weekdays 7:00am to 7:00pm, and Saturdays 7:00am to 1:00pm	50 dB $L_{Aeq,T}$	65 dB $L_{Aeq,T}$
Weekdays 7:00pm to 11:00pm, Saturdays 1:00pm to 11:00pm, and Sundays 7:00am to 11:00pm	50 dB $L_{Aeq,T}$	55 dB $L_{Aeq,T}$
Night-time 11:00pm to 7:00am	40 dB $L_{Aeq,T}$	45 dB $L_{Aeq,T}$

3.4.4 Based on guidance from DMRB LA 111 (Ref 15), noise from construction activities would constitute a significant adverse impact at residential NSRs where it is determined that the SOAEL would be exceeded for a duration exceeding:

1) 10 or more days or nights in any 15 consecutive days or nights; and/or

2) a total number of days or nights exceeding 40 in any six consecutive months.

Construction Vibration Assessment Approach

Construction Vibration on Human Receptors

3.4.5 Construction vibration levels have been calculated and assessed in accordance with the methodologies described in BS 5228-2 (Ref 16). Construction vibration impact threshold levels, including applicable LOAEL and SOAEL, are presented in **Table 3.2**.

Table 3.2 Construction vibration impact levels at residential receptors

Vibration Level mm/s Peak Particle Velocity (PPV)	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments (LOAEL).
1.0	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents (SOAEL).
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

3.4.6 Vibration from construction activities would constitute a significant adverse impact at residential NSRs where it is determined that the SOAEL would be exceeded for a duration exceeding:

1) 10 or more days or nights in any 15 consecutive days or nights; and/or

2) a total number of days or nights exceeding 40 in any six consecutive months.

Construction Vibration on Structures

3.4.7 As above, construction vibration levels have been calculated and assessed in accordance with the methodologies described in BS 5228-2 (Ref 16).

3.4.8 In the case of potential structural damage, an impact magnitude scale is not deemed appropriate. BS 5228-2 notes that the probability of damage tends towards zero at 12.5 mm/s PPV. Buildings and structures where the predicted vibration level is above or approaching this value will be highlighted such that measures can be put in place by the contractor to reduce and manage vibration levels. The specific threshold may be reviewed for specific structures as deemed appropriate. As such, fixed threshold for potential risk (12.5 mm/s PVV) has been used to identify potential risk of building damage, rather than a range of impact magnitude values.

3.5 Assumptions and Limitations

3.5.1 The following general assumptions and limitations are applicable to the noise and vibration assessment:

1) The construction noise and vibration assessment is based on proposed construction activities and associated indicative plant noise and vibration data. Further detailed assessments will be conducted by the contractor prior to commencing works, based on their specific construction methodologies, to inform their specific mitigation proposals and finalisation of the Construction Environment Management Plan (CEMP).

4. Baseline and Evaluation

4.1.1 The Scheme Site Boundary, the location of nearby NSRs and the construction noise and vibration study area are illustrated on **Figure 2**.

4.1.2 The Scheme is located within a predominantly rural area. The majority of assessed NSRs within the Study Area are isolated dwellings and farms and small settlements, however, the Scheme is located in proximity to several villages and built-up areas. These include:

1) Surfleet Seas End, approximately 800m west of the Scheme Site Boundary;
2) Spalding, approximately 200m south west of the Scheme Site Boundary; and
3) Weston, approximately 200m south east of the Scheme Site Boundary.

4.1.3 The noise environment is expected to vary around the Study Area depending on the nature of the area. For example, close to noise sources, such as roads and in built up areas, ambient noise levels are expected to be higher. Further away from roads and in rural areas which cover most of Scheme area, ambient and background noise levels would be expected to be lower. The majority of the Scheme is located away from major noise sources and as such the existing noise climate is expected to be low based on Defra strategic noise mapping data (Ref 17).

4.1.4 Acceptable levels of vibration during construction are higher than those that would be acceptable under normal operating conditions. This reflects the recognised principle that temporary vibration impacts may be an unavoidable consequence of construction activity. Existing baseline vibration levels at NSRs within the Study Area are assumed to be negligible relative to the construction vibration threshold values presented in **Table 3.2**, due to the absence of existing significant vibration-generating sources. Construction vibration impacts are therefore assessed against the fixed threshold values, rather than against thresholds defined relative to baseline conditions.

4.1.5 The main sources of environmental noise within the Study Area include the A16 approximately 0.5 to 3 km west of the Scheme Site Boundary, and the A151 approximately 150m to the south of the Scheme Site Boundary, as well as traffic on local roads. In terms of industrial sources, the main source of noise is likely to be agricultural activity.

5. Construction Noise and Vibration Mitigation

5.1.1 Best Practicable Means (BPM) as defined by The Control of Pollution Act 1974 (Ref 18) and detailed in BS 5228-1:2009+A1:2014 Code of practice for Noise and Vibration control on construction and open sites – Part 1: Noise, and Part 2: Vibration will be employed by the contractor(s) to reduce any potential adverse impacts. These measures will be detailed further within the CEMP, which will be finalised prior to construction based upon the detailed design and refined construction and logistics plans.

5.1.2 As set out within the supporting Outline CEMP [document number GWNC-ARU-SS50-XXXXXX-RPT-ES-000019] the following measures will be implemented:

1) The Scheme will be compliant with all relevant legislation, consents and permits.
2) Suitably experienced Environmental Advisers will be appointed for the duration of the construction phase. In addition, qualified and experienced Environmental Clerk of Works (EnvCoW(s)) will be available during the construction phase to advise, supervise and report on the delivery of the mitigation methods and controls outlined in the CEMP and any supporting documents. The EnvCoW(s) will monitor that the works proceed in accordance with relevant environmental requirements and adhere to the required good practice and mitigation measures.
3) Construction workers will undergo training to increase their awareness of environmental issues as applicable to their role on the Scheme. Topics will include where appropriate:
    a) pollution prevention and pollution incident response;
    b) location and protection of sensitive environmental sites and features;
    c) adherence to protected environmental areas around sensitive features;
    d) working hours and noise and vibration reduction measures; and
    e) agreed traffic routes, access points, etc.
4) The CEMP will set out site specific measures and construction methodologies to avoid or reduce potential impacts of the Scheme on the environment during construction. The contractor(s) shall undertake daily site inspections to check conformance to the CEMP and Construction Traffic Management Plant (CTMP)).
5) The name and contact details for the Scheme will be displayed at the entrance to all compounds.
6) Any activity carried out or equipment located within a construction compound that may produce a noticeable nuisance, including but not limited to dust, noise, vibration and lighting, will be located away from sensitive receptors such as residential properties or ecological sites where practicable.
7) Vehicles will be correctly maintained and operated in accordance with manufacturer's recommendations and in a responsible manner. All plant and

vehicles will be required to switch off their engines when not in use and when it is safe to do so. Electric, or other low carbon plant and equipment should be used where available and where practicable.

8) Materials and equipment will not be moved or handled unnecessarily. When loading and unloading materials from vehicles, including excavated materials, drop heights will be limited.

9) Working areas will be appropriately fenced. The type of fencing installed will depend on the area to be fenced and will take into consideration the level of security required in relation to the surrounding land and public access, rural or urban environment and arable or stock farming. For some locations the fence used may also serve to provide acoustic and visual screening of the work sites and reduce the potential for disturbance of users in the surrounding areas. Fencing will be regularly inspected and maintained and removed as part of the demobilisation unless otherwise specified.

10) Members of the community and local businesses will be kept informed regularly of the works through active community liaison. This will include notification of noisy activities, heavy traffic periods and start and end dates of key phasing. A contact number will be provided which members of the public can use to raise any concerns or complaints about the Scheme. All construction related complaints will be logged by the contractor(s) in a complaints register, together with a record of the responses given and actions taken.

11) The Construction Traffic Management Plan (CTMP) will set out measures to reduce route and journey mileage to and from and around site, and prevent nuisance to the residents, businesses and the wider community caused by parking, vehicle movements and access restrictions. It will also provide suitable control for the means of access and egress to the public highway and set out measures for the maintenance and upkeep of the public highway. The plan will also identify access for emergency vehicles. It will also set out measures to reduce safety risks through construction vehicle and driver quality standards and measures to manage abnormal loads.

12) Construction working will be undertaken within the agreed working hours unless the works are under an exception to the set working hours in which case they will be carried out in a manner that minimises Noise and Vibration at all times.

13) BPM measures may include consideration of construction plant and methods, siting semi-static equipment as far as reasonably practicable away from sensitive areas, screening, enclosures, and temporal restrictions.

14) The contractor will conduct detailed construction noise and vibration assessments to determine whether there are likely to be any new or different significant adverse impacts at NSRs and therefore whether additional measures, including site-specific BPM, may be required.

5.1.3 Specific mitigation measures will be identified by the contractor(s). However, example standard noise and vibration mitigation measures that may be employed to avoid significant adverse effects and minimise adverse effects are provided in **Table 5.1** and **Table 5.2**, respectively.

Table 5.1 Examples of construction noise mitigation measures

Example Mitigation	Likely Attenuation
Screening	5 dB where activities are partially obscured and 10 dB where activities are totally obscured
Specified use of quieter plant	5 to 10 dB
Suitable material handling methods. Do not drop materials from excessive heights	Up to 15 dB
Alternative methods for pylon construction e.g. use of pad foundation	10 to 20 dB
Use an acoustic shed with adequate ventilation around trenchless crossing machinery	Up to 15 dB
Use of temporal restrictions	Avoiding temporal significance criteria being exceeded

Table 5.2 Examples of construction vibration mitigation measures

Example Mitigation	Likely Attenuation
Alternative methods for pylon construction, for example use of pad foundation or press-in piles	Would not generate material levels of vibration, therefore removing impact.
Reducing energy per blow	Depends on the energy reduction but could be set relative to the impact thresholds. However, this may increase the duration of activities.
Pre-boring for piled foundations	Dependent on ground conditions.

6. Assessment of Construction Noise Impacts

6.1.1 The assessment of construction noise is based on indicative construction plant data shown in **Appendix B**. This is based upon precedent experience of typical plant types for comparable substation and overhead line construction.

6.1.2 Although BPM to reduce construction noise impacts would be employed by the contractor, for the purposes of the assessment, it is assumed that no noise mitigation, such as screening, is included. This is so that potential noise 'hot-spots' can be identified which would require specific mitigation measures to avoid significant adverse impacts. However, BPM to reduce construction noise impacts would be employed by the contractor, as presented in **Section 5**.

Main construction activities

6.1.3 The main construction activities considered within the assessment are the following:

1) Establishment and operation of construction compounds (Substation Works and S37 Overhead Line Works);
2) pylon construction (S37 Overhead Line Works);
3) overhead line stringing (S37 Overhead Line Works); and
4) substation construction (Substation Works).

An indicative assessment of construction noise for the above activities is provided in **Table 6.1**. The assessment considers the worst-case, closest NSRs for each activity and compares predicted noise levels against the criteria stated in **Table 3.1**, above.

Table 6.1 Predicted construction noise levels at worst-case NSR, without mitigation

Activity	Closest Receptor (Distance, m)	Predicted noise level at NSR, without mitigation, dBA	Impact
Construction compound construction (Substation Works and S37 Overhead Line Works)	2, Crowtree Cottages, Marsh Road, Weston, Spalding, PE12 6HF (270m)	56	Significant adverse impacts are not expected during 'weekday' daytime periods. Potential significant adverse impacts during weekend periods, without mitigation. However, with standard mitigation measures outlined in

Activity	Closest Receptor (Distance, m)	Predicted noise level at NSR, without mitigation, dBA	Impact
			Section 5, significant adverse impacts are not expected.
Construction compound operation (Substation Works and S37 Overhead Line Works)	2, Crowtree Cottages, Marsh Road, Weston, Spalding, PE12 6HF (270m)	50	Significant adverse impacts are not expected at any time.
Pylon construction (S37 Overhead Line Works and Exempt Overhead Line Works)	Old School House, Marsh Road, Weston, Spalding, PE12 6HQ (160m)	62	Significant adverse impacts are not expected during 'weekday' daytime periods. Potential significant adverse impacts during weekend periods, without mitigation. However, with standard mitigation measures significant adverse impacts are not expected.
Overhead line stringing (S37 Overhead Line Works and Exempt Overhead Line Works)	Weston Barn House, Marsh Road, Weston, Spalding, PE12 6HQ (170m)	56	Significant adverse impacts are not expected during 'weekday' daytime periods. Potential significant adverse impacts during weekend periods, without mitigation. However, with standard mitigation measures significant adverse impacts are not expected.
Substation construction (Substation Works)	Weston Barn House, Marsh Road, Weston, Spalding, PE12 6HQ and 2, Crowtree Cottages, Marsh Road, Weston, Spalding, PE12 6HF (both approximately 400m)	53	Significant adverse impacts are not expected at any time.

6.1.4 The assessment indicates that significant adverse impacts from construction noise are not expected. For most activities, this would be the case even without mitigation. For some activities, mitigation measures are required to avoid potential significant adverse impacts if works are undertaken during weekend periods. However, with standard mitigation measures noise levels can be readily mitigated to non-significant levels during weekend periods.

6.1.5 BPM would be employed to reduce noise levels from all works. As such, noise levels would be expected to be lower than those stated in **Table 6.1**. Examples of BPM are provided in section 5 and further relevant information is also included within the Outline CEMP.

Other construction activities

6.1.6 A number of other activities are required during the construction phase, as follows:

1) Access construction (other associated works);
2) highways interventions (other associated works);
3) bridge working areas (other associated works);
4) environmental mitigation (Substation Works);
5) drainage (Substation Works); and
6) crossing protection (S37 2WS Overhead Line).

6.1.7 There are no locations where such works would lead to potential significant adverse impacts , either due to proximity to NSRs or due to the short term nature of the activities (or both). Significant adverse impacts from these activities are therefore not expected.

6.2 Construction Vibration Impacts

6.2.1 A number of activities are required during the construction phase that have the potential to generate vibration, as follows:

1) Pylon construction (potential piling) (S37 2WS Overhead Line Works);
2) substation construction (potential piling and vibratory compaction) (Substation Works); and
3) access construction and highways interventions (potential vibratory compaction) (other associated works).

6.2.2 The assessment of construction vibration is based on indicative construction plant data shown in **Appendix C**.

6.2.3 There are no NSRs within the study area for potential piling activities. Vibration levels would therefore be below the level (<1.0 mm/s PPV) that may give rise to significant adverse impacts at all nearby NSRs. As such construction vibration from potential piling activities would not lead to significant adverse impacts.

6.2.4 However, there are a small number of residential NSRs where there are potential SOAEL exceedances due to potential vibratory compaction works, with a predicted vibration level of up to approximately 3.7 mm/s PPV at the nearest NSR. These are all in relation to road widening on Stone Gate. This compaction activity should only

occur over a relatively short duration and as such significant adverse impacts are not expected where residents are.

6.2.5 Additionally, vibration levels would be below the level where potential damage may occur at all nearby buildings and structures.

6.2.6 BPM, examples of which are provided in **Section 5**, would be employed to reduce vibration levels from all works. Further relevant information is also included within the Outline CEMP. As such, vibration levels would be expected to be lower than those stated in **Table 3.2**.

7. Summary

7.1.1 National Grid are proposing to undertake works to construct a new electricity substation, new sections of overhead line and modification of existing overhead lines south west of the Spalding Tee-Point in the Weston Marsh are, within the administrative boundary of South Holland District Council in Lincolnshire.

7.1.2 An assessment of potential noise and vibration impacts resulting from the Scheme has been undertaken in accordance with current guidance and good practice.

7.1.3 The assessment indicates that significant adverse impacts are not expected from the Scheme during either the construction or operational phases where standard mitigation measures are incorporated into the works.

7.1.4 Outline noise and vibration mitigation options have been provided indicating how significant adverse effects can be avoided and adverse impacts would be mitigated and minimised during construction.

References

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Ref 6 UK Government (2025). Overarching National Policy Statement for Energy (EN-1). Available online: https://www.gov.uk/government/publications/overarching-national-policy-statement-for-energy-en-1-2025 [Accessed 31 March 2026].

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Ref 13 South East Lincolnshire Local Plan 2011-2036, Adopted March 2019 . Available at: https://southeastlincslocalplan.org/article/20102/Adopted-Plan [Accessed 19 March 2026].

Ref 14 BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise, British Standard Institution, 2014.

Ref 15 Highways England et al. (2020). Design Manual for Roads and Bridges LA 111 Noise and vibration

Ref 16 BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration, British Standard Institution, 2014

Ref 17 Defra Strategic Noise Mapping, 2024. Available at: https://www.gov.uk/government/publications/strategic-noise-mapping-2022/explaining-the-2022-noise-maps [Accessed 19 March 2026].

Ref 18 Control of Pollution Act 1974 [online]. Available at: https://www.legislation.gov.uk/ukpga/1974/40/contents [Accessed 19 March 2026].

Ref 19 Technical Guidance Note TGN(E)322 - Operational Audible Noise Assessment Process for Overhead Lines (New Build, Reconductoring, Reconfiguration and Uprating).

Figures

Figure 1 Scheme Site Boundary

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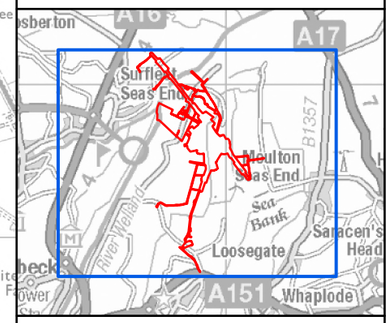

Legend

- Scheme Site Boundary
- Substation Works Site Boundary
- S37 OHL Works Site Boundary
- Exempt Overhead Line Works Site Boundary
- S37 - 2WS - OHL Works Site Boundary
- S37 - 4ZM - OHL Works Site Boundary

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Purpose: NOISE AND VIBRATION

Scheme: PROPOSED ELECTRICITY SUBSTATION AND OVERHEAD LINE WORKS AT WESTON MARSH

Document Title: FIGURE 1 SCHEME SITE BOUNDARY

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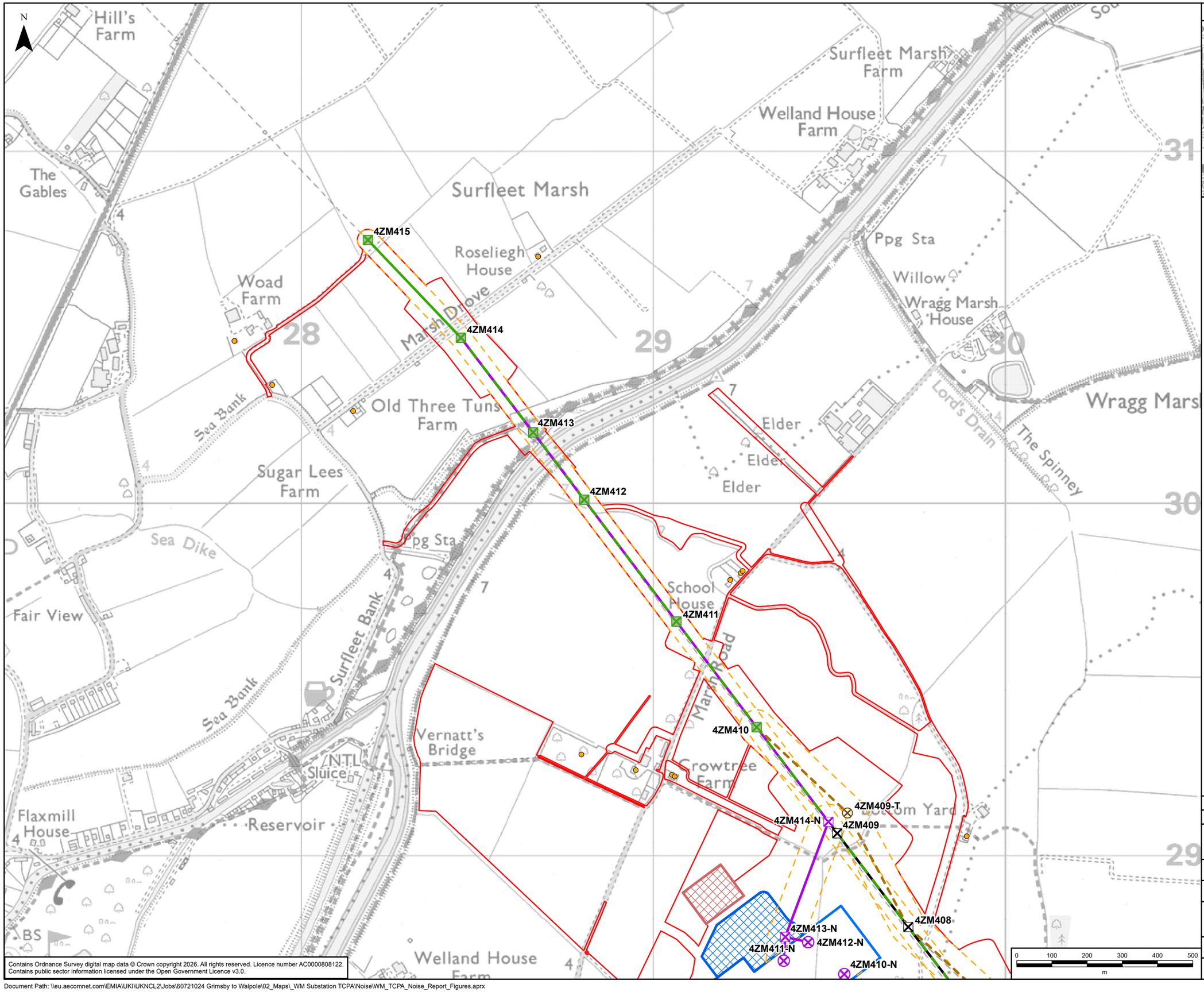
Figure 2 Noise Receptor Locations



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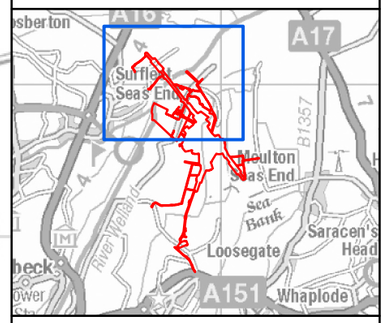

Legend

- Scheme Site Boundary
- LoD
- Substation,Permanent
- Main Substation Construction Compound,Temporary
- Construction Compound,Temporary
- Dismantled NG OHL
- Existing NG OHL
- Modified NG OHL
- New NG OHL
- Temporary OHL
- Existing Pylon
- Existing Pylon to be Dismantled
- New Gantry
- New Pylon
- Indicative Temporary Structure

Receptor Locations

Sensitivity

- Medium

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A	01/05/2026	First Issue	MM	DF	DG

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Purpose: NOISE AND VIBRATION

Scheme: PROPOSED ELECTRICITY SUBSTATION AND OVERHEAD LINE WORKS AT WESTON MARSH

Document Title: FIGURE 2 NOISE SENSITIVE RECEPTOR LOCATIONS

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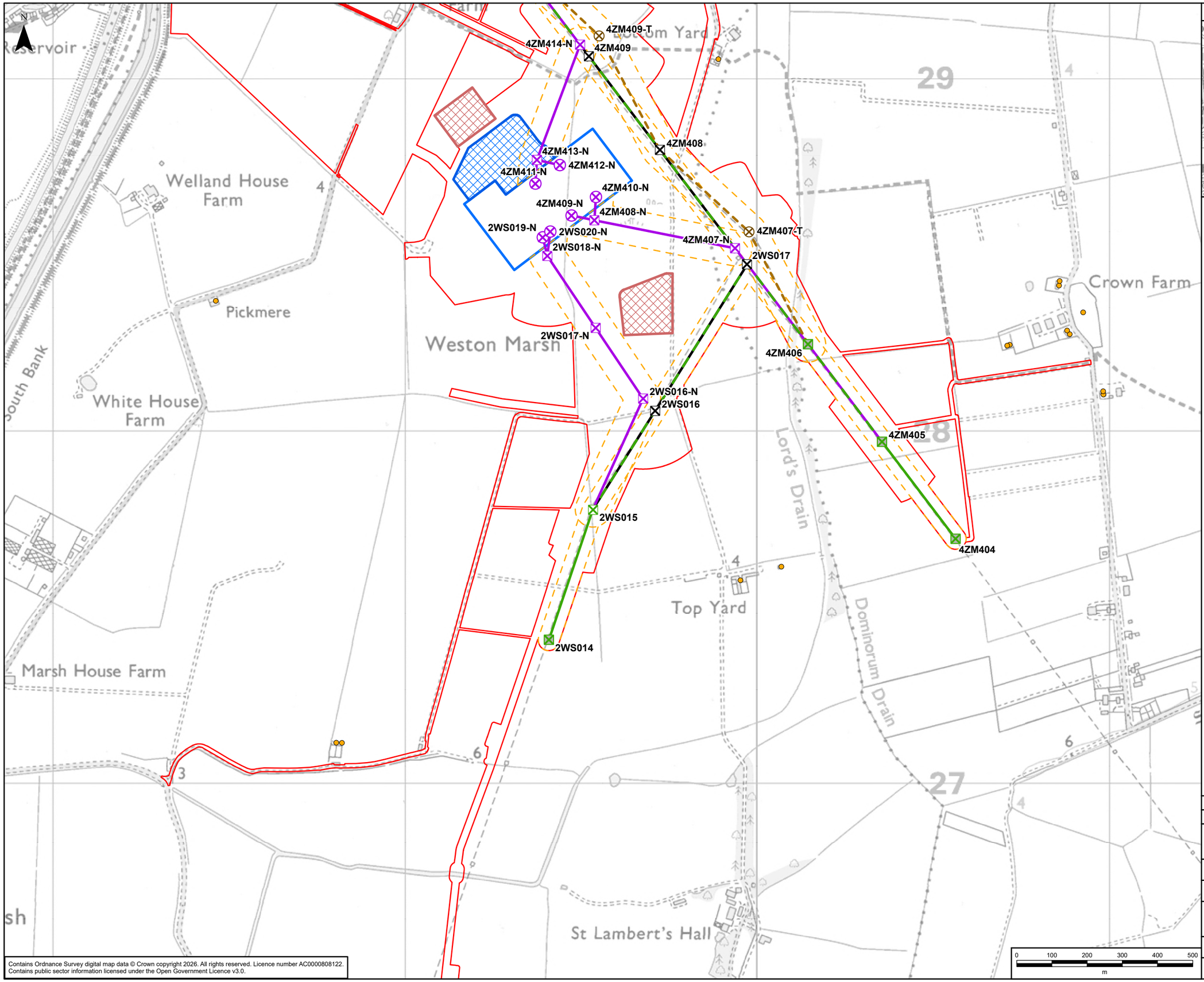

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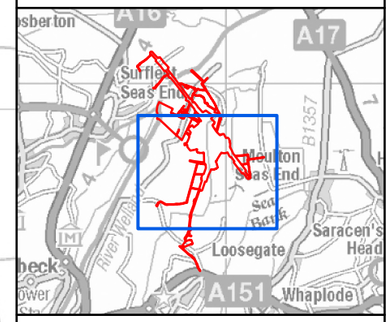

Legend

- Scheme Site Boundary
- LoD
- Substation,Permanent
- Main Substation Construction Compound,Temporary
- Construction Compound,Temporary
- Dismantled NG OHL
- Existing NG OHL
- Modified NG OHL
- New NG OHL
- Temporary OHL
- Existing Pylon
- Existing Pylon to be Modified
- Existing Pylon to be Dismantled
- New Gantry
- New Pylon
- Indicative Temporary Structure

Receptor Locations

Sensitivity

- Medium

Rev	Date	Description			
A	01/05/2026	First Issue	MM	DF	DG

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Purpose: NOISE AND VIBRATION

Scheme: PROPOSED ELECTRICITY SUBSTATION AND OVERHEAD LINE WORKS AT WESTON MARSH

Document Title: FIGURE 2 NOISE SENSITIVE RECEPTOR LOCATIONS

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N

Marsh House Farm

Wykeham Chapel (remains of)

Wykeham Farm

Shepherds Farm

Stone Gate

St Lambert's Hall

St Lambert's Cottages

Hall Gate

Wiseman's Gate

Chestnut House

Wimberley Hall Farm

Rood's Lane

Lord's Drain

Wheat Mere Drain

White House Farm

Cross

Weston

Allot Gdns

Baytree Garden Centre

Sch

MS

Low Gate

Moulton

Lowgate Hou

27

26

25

0 100 200 300 400 500
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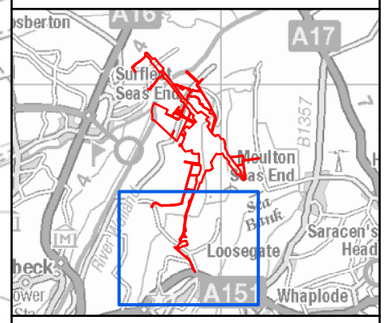

Legend

- Scheme Site Boundary
- LoD
- Construction Compound,Temporary

Receptor Locations

Sensitivity

- High
- Medium

Rev	Date	Description	GIS	Chk	App
A	01/05/2026	First Issue	MM	DF	DG

nationalgrid

Purpose: NOISE AND VIBRATION

Scheme: PROPOSED ELECTRICITY SUBSTATION AND OVERHEAD LINE WORKS AT WESTON MARSH

Document Title: FIGURE 2 NOISE SENSITIVE RECEPTOR LOCATIONS

Creator:	Date:	Checker:	Date:	Approver:	Date:
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Appendices

Appendix A Overhead Line Operational Noise (Informative)

A.1. Introduction

A.1.1. This appendix provides evidence to support scoping out operational noise from the overhead lines from the assessment and provides information to demonstrate that any noise that may occur during the operation of the overhead transmission line would not lead to significant adverse impacts.

A.1.2. Operational noise from the overhead lines is scoped out of the assessment as the proposed overhead line system would use 'triple Araucaria' conductors or alternative technology that performs to the same or better standard in relation to noise for reducing operational noise. This would be regarded as practically quiet. In addition, pylon fittings, such as insulators, dampers, spacers and clamps, are designed and procured in accordance with a series of National Grid technical specifications and must be type registered. These processes reduce the potential for audible noise and tones to occur from all types of fittings, including insulators.

A.2. Background

Noise from Overhead Lines

A.2.1. Noise from high voltage overhead lines is primarily due to a phenomenon called corona discharge. Line noise is generated when the conductor surface voltage gradient (electric stress, or Emax expressed in kilovolts per centimetre (kV/cm)) exceeds the inception level for corona discharge activity which is released as acoustic energy and radiates into the air as sound. In UK conditions, the corona inception level is regarded to occur when electric stress is in the range 17 to 20 kV/cm. Whilst most high voltage overhead lines are designed to operate below this level, those that operate close to this may produce audible noise when enhancement of conductor surface electric stress occurs due to rainfall (wet noise) or the presence of conductor surface contamination (dry noise). Overhead lines that operate significantly below the corona inception level are much less likely to produce audible noise.

A.2.2. When it occurs, overhead line noise can be described as a 'crackle', which is sometimes accompanied by a tonal 'hum' in wet conditions. The highest noise levels generated by an overhead line generally occur during rainfall. Hum, if it occurs, is typically more annoying than crackle alone and therefore the occurrence of wet noise is considered worst-case.

National Grid Technical Guidance

A.2.3. National Grid has a suite of documents relating to the management of audible noise from its overhead lines. These documents are described in **Table A.1**.

Table A.1 National Grid Technical Guidance Documents

Document	Description
Policy Statement PS(T)134 - Operational Audible Noise Policy for Overhead Lines (National Grid, 2021)	Applies to environmental noise due to the operation of new overhead lines, reconductoring, reconfiguration and uprating projects for overhead lines operated at 275 kV and 400 kV.
Technical Report TR(E)564 - Development of Method for Assessing the Impact of Noise from Overhead Lines (New Build, Reconductoring, Reconfiguration and Uprating) (National Grid, 2021)	The policy describes a three-tier assessment process and sets noise impact criteria against which predicted levels of noise from operational overhead lines can be assessed.
Technical Guidance Note TGN(E)322 - Operational Audible Noise Assessment Process for Overhead Lines (New Build, Reconductoring, Reconfiguration and Uprating) (National Grid, 2021)	Explains how the noise criteria presented in PS(T)134 were developed, taking into account the UK noise policy context and UK national and international guidance, including World Health Organisation guidelines and evidence for health effects.

A.2.4. PS(T)134 describes a method for predicting the environmental impact due to audible noise caused by new, reconductored, diverted or uprated overhead transmission lines. The method uses internationally recognised line noise prediction methodology to calculate noise emission levels based on operating voltage, conductor design and pylon geometry. PS(T)134 also sets out noise criteria against which predicted levels of noise from operational overhead lines can be assessed.

A.2.5. The PS(T)134 criteria applies a +6 decibel (dB) character correction to wet noise effects to account for the additional 'hum' generated during worst-case wet weather conditions and a +3 dB correction to dry noise effects to account for the 'crackle'. This means that the assessment method is consistent with guidance contained in Section 9 of British Standard 4142:2014+ A1:2019 'Methods for rating and assessing industrial and commercial sound' (BS 4142) (BSI, 2019), which takes account of acoustic features by applying a character correction to the specific sound level to calculate a BS 4142 rating level.

A.2.6. The overhead line noise assessment process set out in PS(T)134 follows a three-tier 'screening' approach based on predicted source noise level and the distance to NSRs. If predicted worst case wet-noise levels fail the Tier 1 test, a Tier 2 assessment would be undertaken and if predicted noise levels fail the Tier 2 test, a Tier 3 assessment would be undertaken. The three-tier approach comprises the following steps which are designed to screen out of further assessment where there would be no adverse impact:

1) **Tier 1**: A primary screening step based on 'worst-case' absolute wet noise effects and the pre-determined assessment criteria set out in PS(T)134;

2) **Tier 2**: A further screening step based on combined absolute wet noise and dry noise effects and recalculated assessment criteria. This step takes account of the fact that wet noise occurs only during periods of wet weather and therefore does not occur all the time; and

3) **Tier 3**: Full assessment following the principles of BS 4142 for both wet noise and dry noise.

A.2.7. Noise criteria have been set taking account of the UK policy context and evidence from multiple sources, including the World Health Organisation and BS 4142, for noise and associated health impacts. The criteria have been developed by National Grid based on health impact data associated with the night-time period. The night-time period is considered more sensitive than the daytime, as background sound levels are normally lower and people are trying to sleep. National Grid Technical Report TR(E)564 explains the reasoning behind the noise criteria set out in PS(T)134.

A.3. Assessment

Tier Assessment for Proposed 400kV Overhead Lines

Tier 1 Assessment Criteria

A.3.1. The Tier 1 Assessment criteria set out in PS(T)134 are shown in **Table A.2**. The 'No Adverse Impact' criteria applicable to residential NSRs for worst-case wet weather noise is 34 dBA. In the case of the Tier 1 assessment, this is a rating level which includes a +6 dB character correction to account for the occurrence of transmission line 'hum' in wet weather. The criteria for NSRs that may be regarded as highly sensitive to noise (for example vulnerable subgroups as defined by the World Health Organisation) is 5 dB lower, while the criteria for NSRs that may be regarded as less sensitive to noise (for example those not used at night and those used for commercial purposes) is 5 dB higher.

Table A.2 Tier 1 Noise Impact Criteria (Wet Noise), from PS(T)134

NSR Group	No Adverse Impact (Screened Out)	Further Assessment Necessary (Tier 2 Assessment Required)
Vulnerable subgroups	< 29 dBA	≥ 29 dBA
Residential	< 34 dBA	≥ 34 dBA
Schools and hotels	< 39 dBA	≥ 39 dBA

A.3.2. For the purposes of the Tier 1 assessment, 34 dBA is considered to be the Lowest Observed Adverse Effect Level (LOAEL) for residential NSRs used for sleeping at night. These levels are free-field and apply at the façade of an NSR. Where vulnerable subgroups are present, the LOAEL is 29 dBA.

Tier 1 Wet Noise Prediction

A.3.3. Worst-case wet noise levels for the proposed triple Araucaria conductor system have been predicted using the proprietary line noise prediction software EFC-400. This software is widely used across the electricity industry to calculate conductor surface

electrical stress, to assess compliance with electric and magnetic field guidelines and to predict transmission line noise levels under a range of weather conditions.

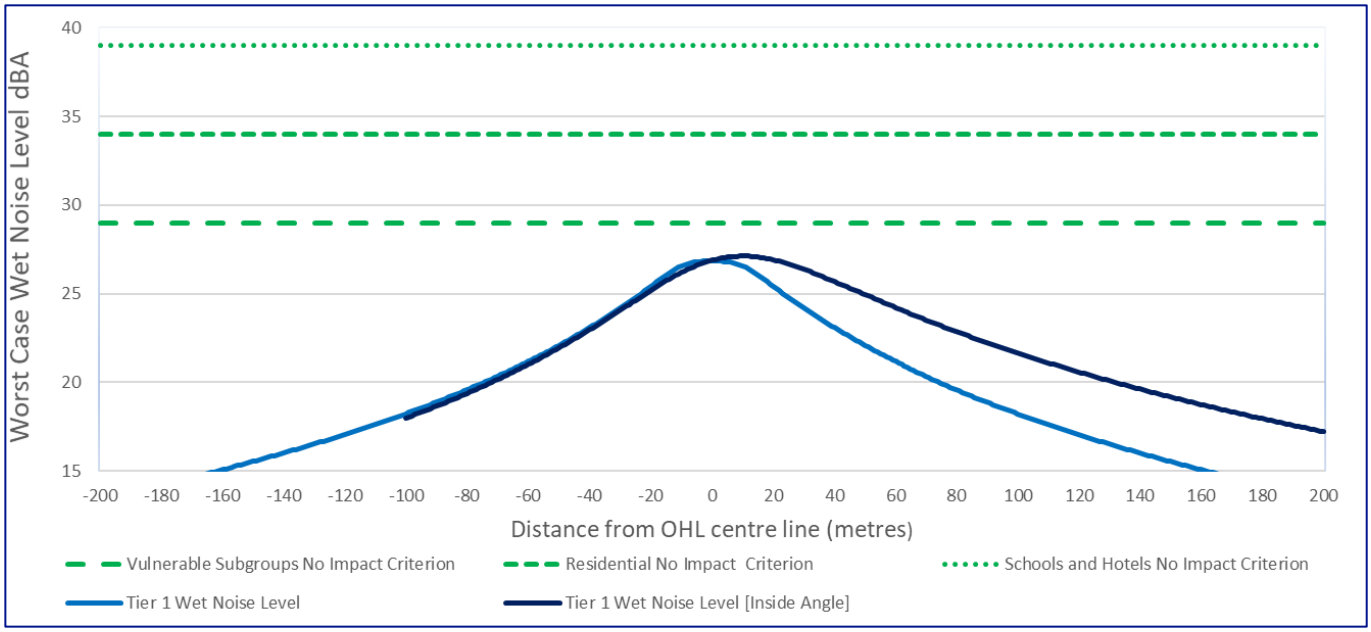
A.3.4. Overhead line noise source prediction is calculated by EFC 400 using the internationally recognised Electrical Power Research Institute method. Propagation either side of a modelled line is calculated according to International Organisation for Standardisation (ISO) ISO 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors (ISO 2024). Modelling assumptions include:

1) A normalised wet noise third octave spectrum which contains 'hum' at 100 Hertz (Hz) and 200 Hz, harmonics of the electricity supply frequency of 50 Hz;
2) air temperature = 10˚C;
3) relative humidity = 90%;
4) downwind propagation; and
5) porous ground = 1.0

A.3.5. Image A.1 shows the predicted worst-case wet noise levels at distances up to 200 m either side of the proposed overhead line alignment. Two scenarios are considered: a straight section of line (blue curve) and an angled section of line (dark blue curve). For the angled section, the inside of the angle is shown on the right of the chart. The consideration of an inside angle accounts for a NSR that may receive a greater combined effect from adjacent overhead line spans due to the overhead line deviating around the NSR.

A.3.6. Image A.1 also shows the Tier 1 No Adverse Impact assessment criteria for each of the three NSR groups (green dashed lines).

Image A.1 EFC-400 Wet Noise Prediction for Proposed Overhead Line (Tier 1 Screening)



A.3.7. The predicted noise levels are significantly below the No Adverse Impact Criteria for all three NSR groups.

A.3.8. This assessment is worst case as it assumes wet noise and hence hum would occur 100% of the time. In reality, these worst-case conditions are predicted to occur for only 5% of the year in the region.

A.3.9. The Tier 1 assessment therefore concludes that the predicted worst-case noise rating level for operational noise at all NSRs due to the proposed 400 kV overhead line would be significantly below the 'No Adverse Impact' assessment criteria set out in PS(T)134.

A.3.10. As the worst-case wet noise from the triple Araucaria conductor design on lattice pylons is below the Tier 1 No Adverse Impact criteria for all NSR groups, there is no requirement to undertake a Tier 2 or Tier 3 assessment.

A.3.11. Operational noise from the proposed 400 kV overhead line would therefore not lead to significant adverse impacts. It is therefore justified that operational noise from the proposed overhead line is therefore not assessed further.

Overhead Line Fixtures and Fittings

A.3.12. To be approved for use on the National Grid high voltage electricity transmission network, each fitting design must be 'Type Registered'. Type registration comprises a series of tests on the fitting in question to provide compliance with the relevant technical specification. These tests include performance requirements for corona inception and audible noise on all fittings along with wind tunnel testing of insulators for audible tones generated by Aeolian mechanisms.

A.3.13. Once the fitting has been Type Registered and approved for use, a number of further tests are also carried out post-manufacture in the form of sample testing. This demonstrates that the fitting design conforms to the specification in the Type Registration document.

A.3.14. The Technical Specification and Type Registration processes reduce the potential for audible noise and tones to occur from all types of fittings, including insulators. Where noise does occur, it is likely to be localised and of short duration. If due to a fault, actions can be taken to rectify it. Where noise from fittings does occur, which results in a complaint, appropriate actions can be taken to seek to remedy the cause of the noise, usually through cleaning or replacement of the relevant fitting. Therefore, noise from fixtures and fittings is scoped out.

A.4. Conclusions

A.4.1. This appendix presents the technical background to demonstrate that operational audible noise from the proposed 400 kV overhead line would be below the LOAEL for all NSR groups and would therefore not lead to significant adverse impacts due to the very low predicted noise levels even under worst-case wet noise conditions.

A.4.2. National Policy Statement for Electricity Networks Infrastructure (EN-5) includes the requirement for the applicant to consider noise from overhead lines. Paragraphs 2.9.27 to 2.9.44 and 2.11.7 to 2.22.8 provide guidelines on what needs to be considered during the application and decision-making process. The evidence presented within this Appendix satisfies the requirements of the relevant paragraphs in EN-5 and provides sufficient information to demonstrate that the residual noise impacts of the proposed overhead line would not lead to significant adverse impacts. This note considers:

1) Worst-case wet noise during rainfall.

2) An appropriate method as set out in PS(T)134 and the internationally recognised prediction tool EFC-400 to predict overhead line source noise levels.

3) The use of a triple Araucaria conductor system, or alternative technology that performs to the same or better standard in relation to noise, for reducing dry and wet noise from the operation of the overhead line.

4) Use of tested and type-registered fixtures and fittings.

Appendix B Construction Noise Data

Table B.1 Construction activity plant and noise data

Activity	Plant Item	Number of Plant Items	BS 5228-1 Ref	Per cent on time	A-weighted Sound Pressure Level at 10m, dBA	Average Activity Sound Pressure Level at 10m, dBA
General Works						
Site preparation	Tracked excavator	2	C2.7	70	70	79
	Dozer	3	C2.1	70	75	
Top soil strip	Tracked excavator	2	C2.7	70	70	79
	Dozer	3	C2.1	70	75	
Temporary access route	Wheeled backhoe loader	1	C2.8	70	68	79
	Dumper	2	C4.4	70	76	
	Vibratory roller	1	C2.40	70	73	
Temporary Construction Compounds						
Site preparation	Tracked excavator	2	C2.7	70	70	79
	Dozer	3	C2.1	70	75	
Road construction	Dumper	3	C4.4	70	76	82
	Road Roller	1	C5.19	70	80	
Compound buildings	Telehandler	2	C4.55	50	70	70
	Generator	2	C3.33	100	57	
Compound operation	Lorry	1	C2.34	25	80	76
	Telehandler	2	C4.55	50	70	
	Generator	2	C3.33	100	57	

Overhead Line Construction						
Pylon construction	Tracked excavator	1	C2.7	70	70	83
	Steel tube piling rig	1	C3.8	25	88	
	Concrete pump	1	C3.26	50	75	
Pylon Assembly	Telehandler	1	C4.55	50	70	67
Pylon installation	Crane lifting pylon	1	C4.46	10	67	57
Cable tensioning	Winder	1	Suppliers' data	60	77	78
	Rear Winder	1	Suppliers' data	60	77	
Substation Construction						
Site preparation	Tracked excavator	2	C2.7	70	70	79
	Dozer	3	C2.1	70	75	
Substation assembly	Telehandler	2	C4.55	50	70	82
	Generator	2	C3.33	100	57	
	Vibratory piling rig	1	C3.8	25	88	

Appendix C Construction Vibration Data

C.1.1. The construction vibration assessment has been undertaken with reference to the methods and empirical data outlined in BS 5228-2:2009+A1:2014 Code of practice for Noise and Vibration control on construction and open sites – Part 2: Vibration (BS 5228-2).

C.1.2. The main significant sources of vibration during construction activities are expected to be ground compaction, and percussive or vibratory piling. These processes may be required during the following activities:

1) Ground compaction with vibratory roller:
   a) setup of site compounds;
   b) site preparation; and
   c) temporary access route construction.
2) Piling:
   a) pylon foundations; and
   b) substation construction.

Prediction of Construction Vibration

C.1.3. Peak particle velocity (PPV) vibration levels in mm/s generated by ground compaction and piling activities can be predicted using the guidance and empirical formulae in Table E1 of BS 5228-2. The formulae are shown below.

Vibratory roller calculation formula

$$v_{res} = k_s\sqrt{n_d}\left[\frac{A}{x+L_d}\right]^{1.5}$$ (Equation 1)

Where:

1) Vres = Resultant PPV, in millimetres per second (mm/s).
2) ks = Scaling factor (and probability of predicted value being exceeded).
3) nd = Number of vibrating drums.
4) A = Maximum amplitude of drum vibration, in millimetres (mm).
5) x = Distance measured along the ground surface, in metres (m).
6) Ld = vibrating roller drum width, in metres (m).

Percussive piling calculation formula

$$v_{res} \leq k_p\left[\frac{\sqrt{W}}{r^{1.3}}\right]$$ (Equation 2)

Where:

1) Vres = Resultant PPV, in millimetres per second (mm/s).

2) Kp = Scaling factor (depending on soil conditions).

3) W = Nominal hammer energy, in joules (J).

4) r = Slope distance from the pile toe, in metres (m).

Assumptions

C.1.4. The following conservative assumptions have been made to predict vibration levels to assess a reasonable worst-case:

5) Vibratory Roller assumptions:

   a) scaling factor of 75, representative of average conditions; and

   b) vibratory roller data based on worst case Bomag BW 213, 1 drum of 2.13 m width and maximum amplitude of 1.1 mm.

6) Percussive piling assumptions:

   a) typical value of nominal hammer energy of 25 kJ; and

   b) scaling factor of 1.5 representative of typical soil conditions.

Vibration prediction results

C.1.5. Equations 1 and 2 have been used to predict the minimum distances within which the vibration threshold values, in terms of the significant observed adverse effect level (SOAEL) on human receptors, and potential cosmetic building damage, may be exceeded (1.0mm/s, and 12.5mm/s PPV respectively). The calculated distances in **Table C.1** are used in the preliminary assessment to identify areas where NSRs are potentially affected by construction vibration.

Table C.1 Construction activity plant and noise data

Activity	Distance Within Which SOAEL May Be Exceeded (m)	Distance Within Which Building Damage May Occur (m)
Ground compaction	18	<2
Percussive piling	70	<10

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