A66 Northern Trans-Pennine Project
TR010062

7.52 Habitats Regulations Assessment Supplementary Note – North Pennine Moors SAC/SPA

Planning Act 2008

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7.52 HABITATS REGULATIONS ASSESSMENT SUPPLEMENTARY NOTE – NORTH PENNINE MOORS SAC/SPA

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1 Introduction

1.1.1 This HRA Supplementary Note has been prepared in response to comments received by National Highways on the HRA Stage 2 SIAA (ES Document Reference 3.6: Habitats Regulations Assessment (HRA) Stage 2 Statement to Inform Appropriate Assessment) (SIAA) [APP-235] from Natural England (NE). The comments relate to the assessment of potential air quality impacts on the North Pennine Moors Special Area of Conservation (SAC).

1.1.2 The information provided within this technical note focusses on the North Pennine Moors SAC, however data within it clarifies and supports the findings of the HRA conclusions in the SIAA in relation to the North Pennine Moors SPA (as described in Section 5), the extent of which is consistent with the boundary of the SAC within the area immediately adjacent to the existing A66. No information presented in this note changes the findings of either the ES or the SIAA.

The key points/questions raised by Natural England

1.1.3 The key points/questions raised by Natural England are summarised below and reference made to where in this note they are addressed:

1. The SIAA only refers to nitrogen deposition as the relevant threat mechanism. Both NOx and ammonia are emitted from road traffic (they are different pollutants with different mechanisms of impact) – addressed in Section 2, Section 4 and Section 5.
2. Supporting justification requested regarding no mitigation being required and the conclusion of no adverse effect on site integrity – addressed in Section 4 and Section 5.
3. Clarificatory information required in relation to the conclusion that the Project does not undermine Natural England's ability to achieve the conservation objectives of North Pennine Moors SAC in the future – addressed Section 4 and Section 5.
4. Clarificatory information required on the method of in-combination assessment in relation to exceedances of the critical load within 60m of North Pennine Moors SAC alone and in-combination with other existing and committed sources of the same pollutants – addressed in Section 2 and Section 4.
5. Blanket bog in a mosaic with other flora/habitat types still represents the designated and sensitive features that Natural England must protect and enhance and therefore should be included within the calculation of area of blanket bog to be affected – addressed in Section 4.
6. NECR210[17] states that in the case of bog habitat, the observed relationship between species richness and nitrogen deposition is not curvi-linear. Species richness is not considered an appropriate metric to use in assessing change at bog sites because there are very few species present in this habitat type. This is not an appropriate evidence source to apply as part of this assessment – addressed in addressed in Section 2.

1.1.4 This note is intended to address NE's comments relating only to the assessment of the potential for adverse effects on North Pennine Moors

SAC through changes in air quality during operation (associated with the affected road network (ARN)). The assessment of the potential for other adverse effects on other European sites is found within the SIAA.

1.1.5 The North Pennine Moors SAC is designated for various habitats. European dry heaths, blanket bog, petrifying springs with tufa formation and siliceous scree of the montane to snow levels are present within Unit 1, 2 and 3 of the Bowes Moor Site of Special Scientific Interest (SSSI) which forms a component to the SAC.

1.1.6 As described in the HRA Screening (ES Document Reference 3.5: Habitats Regulations Assessment Stage 1: Likely Significant Effects Report) [APP-234], likely significant effects could not be excluded for North Pennine Moors SAC as a result of the potential for adverse effects through changes in air quality during operation (associated with the ARN).

1.1.7 The key characteristics of the North Pennine Moors SAC are provided in Table 1.

Table 1: North Pennine Moors SAC.

North Pennine Moors SAC (Joint Nature Conservation Committee, 2015)[1]	
Physical area of the European site	103,014.48ha
The qualifying interests of the European site	Annex I habitats that are a primary reason for selection of this site: • European dry heaths • Juniperus communis formations on heaths or calcareous grasslands • Blanket bogs[2] • Petrifying springs with tufa formation (*Cratoneurion*) • Siliceous rocky slopes with *chasmophytic* vegetation • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: • Northern Atlantic wet heaths with *Erica tetralix* • Calaminarian grasslands of the *Violetalia calaminariae* • Siliceous alpine and boreal grasslands • Semi-natural dry grasslands and scrubland facies on calcareous substrates *Festuco Brometalia* (includes the priority feature 'important orchid sites') • Alkaline fens • Siliceous scree of the montane to snow levels *Androsacetalia alpinae* and *Galeopsietalia ladani* • Calcareous rocky with slopes with chasmophytic vegetation Annex II species that are a primary reason for selection of this site: • Marsh saxifrage (*Saxifraga hiruculus*)

[1]Joint Nature Conservation Committee (2015) Natura 2000 Standard Data Form: North Pennine Moors (UK0030033), available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030033.pdf [accessed: 01/05/23]
[2] Priority habitat if active bog.

North Pennine Moors SAC (Joint Nature Conservation Committee, 2015)[1]	
European site conservation objectives	The *European Site Conservation Objectives for North Pennine Moors Special Area of Conservation (North Pennine Moors SAC Conservation Objectives)* (Natural England, 2018)[3] aim to: Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring: • The extent and distribution of qualifying natural habitats and habitats of qualifying species • The structure and function (including typical species) of qualifying natural habitats • The structure and function of the habitats of qualifying species • The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely • The populations of qualifying species • The distribution of qualifying species within the site.
Details of the existing baseline conditions of the European site including details of data collection methodologies and consultations undertaken	A desktop study review of the SAC was undertaken in 2022 to establish the baseline conditions for qualifying interest features. This included assessing the *North Pennine Moors SAC Conservation Objectives,* the *European Site Conservation Objectives: Supplementary advice on conserving and restoring site features for North Pennine Moors Special Area of Conservation (North Pennine Moors SAC Conservation Objectives Supplementary Advice*) (Natural England, 2023)[4], the Site *Improvement Plan North Pennines Group (SIP North Pennines)* (Natural England, 2014)[5] and Natural England's *Designated Sites View* (Natural England, 2023)[6] for details on the condition of the SSSI management units underpinning the SAC. A habitat survey using the Joint Nature Conservation Committee (JNCC) Phase 1 Habitat classification was undertaken of habitats within 200m of the ARN within the North Pennine Moors SAC boundary. The purpose of the survey was to determine the presence of Annex I and Annex II qualifying features. The results of the survey were able to confirm habitat types present and subsequently those which may be impacted by changes in air quality. Field notes were taken on habitat types and species composition. The survey was undertaken in September 2021. Full details are included in Table 2: North Pennine Moors SAC baseline habitat survey.
The value of the site and qualifying interests therein to the	The North Pennine Moors SAC supports much of the upland heathland of northern England. The most abundant heath communities are heather - wavy hair grass *Calluna vulgaris* - *Deschampsia flexuosa* heath and heather - bilberry *Vaccinium myrtillus* heath. At high altitudes and to the wetter west and north of the site complex, the heaths grade into extensive areas of blanket

[3] Natural England (2018) European Site Conservation Objectives for North Pennine Moors Special Area of Conservation Site Code: UK0030033 (version 3), available at: http://publications.naturalengland.org.uk/publication/6361191412662272 [accessed: 01/05/23]
[4] Natural England (2022) European Site Conservation Objectives: Supplementary advice on conserving and restoring site features for North Pennine Moors Special Area of Conservation Site Code: UK0030033, available at: [redacted] [accessed: 22/05/23]
[5] Natural England (2014) Site Improvement Plan North Pennines Group http://publications.naturalengland.org.uk/publication/6534899699810304 [accessed: 01/05/23]
[6] Natural England (2023) Designated Site Viewer, available at: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK0030033&SiteName=north%20pennine%20moor&countyCode=&responsiblePerson=&SeaArea=&IFCAArea= [accessed: 01/05/23]

North Pennine Moors SAC (Joint Nature Conservation Committee, 2015)[1]	
European site network	bog. A significant proportion of the bog remains active with accumulating peat. The main type is heath - hare's-tail cottongrass *Eriophorum vaginatum* blanket mire. The site contains other wetland habitats including wet heaths and calcium-rich fens, which support populations of yellow marsh saxifrage (*Saxifraga hirculus*). Tufa-forming springs are localised in occurrence, but where the habitat does occur it is species-rich with abundant bryophytes, sedges and herb including bird's-eye primrose (*Primula farinosa*) and marsh valerian (*Valeriana dioica*) (*North Pennine Moors SAC Citation, Natural England, 2014)*[7]. Acidic rock outcrops and screes are well-scattered across the North Pennine Moors and support a range of lichens and bryophytes. The site also contains base-rich rocks that support calcicole crevice vegetation communities. The site contains important areas of calcareous grassland, montane acid grassland and grasslands on soils rich in heavy metals, such as old lead mines. The JNCC *Standard Data Form* (JNCC, 2015)[1] states that qualifying features are considered the best in the areas in the UK or considered to support a significant presence.
Likely future changes in baseline conditions at the site in the absence of the Project	In the absence of the Project, future changes in baseline condition are likely to be in relation to identified threats and pressures and changes in management measures as outlined in the *SIP North Pennines Group*. The North Pennine Moors SAC comprises many SSSI, but the A66 bisects the Bowes Moor SSSI. At the site scale the current condition of the SSSI is 80.05% Unfavourable - Recovering an 19.95% Unfavourable – No change (*Designated Sites View*, Natural England, 2023)[6]. Current condition (01/05/23) of individual Bowes Moor SSSI units that interact with the Project ARN (i.e. within 200m of the ARN) are as follows: • Unit 001: Unfavourable - Recovering (30/03/2016) • Unit 003: Unfavourable - No change (02/03/2015) • Unit 004: Unfavourable - No change (29/02/2016) All units interacting with the Project are in Unfavourable condition and are therefore not meeting their conservation objectives. Based on current information, the future baseline for Units 001, 003 and 004 are considered to be Unfavourable. Managed rotational burning, inappropriate grazing, change in land management, hydrological changes, game management of grouse moors, direct land take from development, air pollution, agricultural management practices, and private and public access are all issues currently impacting or threatening the condition of the qualifying features as set out in the *SIP North Pennines Group.*
Details of the key species, habitat dynamics and functional relationships that maintain the site integrity	The Annex I habitats are dependent on maintaining the extent and reducing fragmentation and habitat loss which could occur as a result of factors such as managed rotational burning, hydrological changes, agricultural management practices and air pollution. The condition of these habitats supports the requirement for the Annex II qualifying feature. In particular, hydrological regime is important for wetland features such as blanket bog, wet heaths and fens.

[7] Natural England (2014) North Pennine Moors SAC Citation, available at: http://publications.naturalengland.org.uk/publication/6361191412662272 [accessed: 01/05/23]

2 Air Quality Assessment

2.1.1 This section summarises the methodology for the air quality assessment of impacts at North Pennine Moors SAC and SPA. All data and methodology presented in this report have been previously presented to Natural England in either the ES or the Ammonia note[8], with the exception of the analysis of ammonia concentrations against the Critical Level of 3µg/m^3 which is the supporting information as requested. All information presented in the Ammonia note pertaining to the North Pennine Moors SAC/SPA is reproduced in this Note for ease of reference.

2.1.2 A key purpose of this note is to provide all relevant air quality data together. Therefore, this note provides a summary of the results for nitrogen deposition, Ammonia and NOx.

2.1.3 The full methodology and results are presented in Chapter 5: Air Quality, ES Volume 1, Application Document 3.2) and its associated appendices.

Nitrogen Deposition

2.1.1 Receptor transects (receptor points every 10m away from the roadside) within the boundary of North Pennine Moors SPA and SAC up to 200m from the roadside were assessed to allow assessment of the drop off in emissions and deposition at increasing distances from the road. All ecological receptor locations were modelled at a height of 0m.

2.1.2 National Highways have developed a tool to account for the additional contribution of ammonia (NH_3) emissions from vehicles to deposited nitrogen. This has been used in the assessment to determine the nitrogen deposition at North Pennine Moors SAC.

2.1.3 Following DMRB LA 105[15], in the first instance, the magnitude of change in annual mean nitrogen deposition at North Pennine Moors SAC was determined. The change in nitrogen deposition has also been calculated as a percent change against the do minimum scenario, and as a percent change against the lower Critical Load for nitrogen deposition.

2.1.4 In line with advice from Natural England, the theoretical loss of one species metric, as presented in Table 21 *NECR210* (Natural England, 2016b[17]) has not been used to support this assessment, as it is not considered a suitable metric for assessing bog habitats. It should also be noted that no designated sites were screened out of further assessment based on the theoretical loss of one species metric, either at Stage 1 (Screening) or during Stage 2 (Appropriate Assessment) of the HRA process.

2.1.5 Appendix 5.4 of Chapter 5 Air Quality (ES Application Document 3.4) and Table A2 of this note details the change in AADT and exceedance of 1% critical load as a result of the Project.

2.1.6 The modelled points which fall within the North Pennine Moors SAC show an exceedance of 1% during operation up to 65m from the road north of

[8]An Ammonia (NH_3) Note was prepared for NE on request following the ES to consider and assess the potential impact of changes in NH_3 concentrations from road vehicles associated with the Project. The consideration of NH_3 in isolation is not currently in the DMRB LA105 method.

the existing A66 and 37m from the road south of the existing A66 (Table A2).

2.1.7 The maximum impact in nutrient nitrogen deposition at North Pennine Moors SAC is predicted to be 0.9 kg N/ha/year. At this location, 5m from the edge of the road, as a percentage of the lower critical load for the relevant habitat (5 kg N/ha/yr), there is a 17.6% increase in nitrogen deposition. Existing nitrogen deposition levels at this location are however already significantly exceeding the lower critical load. It should be noted that this change is based on a 3.9% change in relation to DM nitrogen deposition. The change in nitrogen deposition reduces moving away from road to a change of 0.2 kg N/ha/yr at 65m (1.1% in relation do DM nitrogen deposition).

2.1.8 Beyond 65m the impact of air pollution is considered to be imperceptible and therefore results have not been presented for any further transect points.

Ammonia

2.1.9 The SIAA did not include the assessment of NH_3 concentrations against the NH_3 critical levels in line with DMRB LA 105[15] guidance. Following consultation with Natural England, an assessment of NH_3 concentrations on relevant sensitive ecological sites (considering both ‘lichens and bryophytes’ and ‘higher plants’) impacted by the scheme has been undertaken on a sensitivity test basis to demonstrate that the conclusions of the SIAA would not change; the results pertaining to the North Pennine Moors SAC are presented here. The methodology for the NH_3 assessment is provided below and results presented in

2.1.10 Table A3.

2.1.11 Sites within 200m of the ARN identified as having the potential for the presence of lichens and bryophytes, which are considered to be most sensitive to NH_3 concentrations were assessed in the air quality assessment. Emissions of NH_3 generated by road traffic at all relevant sites were extracted from the National Highways NH_3 tool which was run during the production of the ES. NH_3 background concentrations were downloaded from Air Pollution Information System (APIS) for each ecological site and added to the Project NH_3 contribution generated by the NH_3 tool.

2.1.12 The only European sites present within 200m of the ARN were the North Pennine Moors SAC and the North Pennine Moors SPA, both of which are known to support lichens and bryophytes, which are considered to be most sensitive to increases in NH_3 concentrations, and higher plants.

2.1.13 The difference between the without Project (Do Minimum (DM)) and with Project (Do Something (DS)) NH_3 concentrations were compared against the relevant critical levels for NH_3.

2.1.14 The NH_3 concentration predicted in the modelled opening year, and the predicted magnitude of change between DM and DS scenarios for transect points within the North Pennine Moors SPA and SAC with a change in NOx concentrations of over 0.3ug/m^3 and a change of over 1% of the NH_3 critical level are presented in

2.1.15 Table A3.

2.1.16 The maximum increase in NH_3 concentrations as a result of the Project in 2029 is predicted to be 0.1µg/m^3 at the North Pennine Moors (SPA and SAC) at a location 5m from the edge of the road. At this location, as a percentage of the lower critical level (1µg/m^3) there is predicted to be a 13.7% increase in NH_3 concentrations, relative to the lower critical level. This reduces to 3.5% at 65m from the edge of the road. The SAC experiences an increase as a result of an increase of 5,941 Annual Average Daily Traffic (AADT) movements, 319 AADT Heavy Duty Vehicles (HDV) movements. There is no change in speedband at this location as a result of the Project. The road is also dualled in this location bringing the alignment closer to this site.

2.1.17 The NH_3 lower critical level of 1µg/m^3 is exceeded at all ecological sites assessed when considering the background concentration plus Project impacts, however a review of NH_3 background concentrations indicates that the critical level is already exceeded or very close to being exceeded at all sites. The backgrounds make up between 58% and 84% of the total ammonia concentrations with the road contribution of total NH_3 concentrations reducing away from the road, and as a result the background contribution increasing.

2.1.18 When considering the potential impact of ammonia on higher plants which from part of the blanket bog habitat (in addition to lichens and bryophytes), the relevant critical level of 3µg/m^3 was used. There is predicted to be a maximum increase of 4.6% in NH_3 concentrations at 5m, relative to the critical level for higher plants, reducing to 1.2% at 65m from the edge of the carriageway. Predicted concentrations are well below the critical level of 3µg/m^3 at all modelled receptor locations within the North Pennine Moors SAC.

2.1.19 Beyond 65m the impact of air pollution is considered to be imperceptible and therefore results have not been presented for any further transect points.

Oxides of Nitrogen (NOx)

2.1.20 Modelled NOx concentrations at all transect points assessed for North Pennine Moors SAC were predicted using the ADMS Roads dispersion model. Modelled outputs were adjusted using the verification factor for rural sites outlined in Chapter 5 Air Quality of the Environmental Statement. Background NOx concentrations for each modelled location were identified using Defra background maps[9]. This was added to the verified model outputs to provide total NOx concentration at each transect point. These results have been presented in this note, along with the change between DM and DS scenarios, and the change compared against the Critical Level (30µg/m^3).

2.1.21 No exceedances of the Critical Level for NOx (30µg/m^3) as a result of the Project were predicted within 200m of the ARN at the North Pennine Moors

[9] DEFRA (2023) UK AIR Air Information Resource, available at https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018 [accessed 18/05/2023]

SAC (Table A4). The maximum DS concentration was predicted at Receptor point 1, located 5m from the northern carriageway of the A66. There was a change of 1.2μg/m^3 predicted at this location, which was also the maximum change at all locations modelled for this site. This represents a change of 12.5% at the location 5m from the edge of the carriageway, reducing to 4.8% at 65m from the edge of the carriageway.

In-Combination Assessment

2.1.22 The air quality assessment has considered potential in-combination effects. The traffic data provided was from the strategic traffic model which includes background growth and all committed developments in the area which impact traffic flows and followed DfT guidance on Forecasting and Uncertainty[10]. A full list of the committed developments included in the traffic data are identified in the DCO Combined Modelling and Appraisal (COMMA) Report (Document Reference: 3.8, APP-237). Any developments that are not explicitly described in the COMMA report, and non-traffic sources, including sources relating to agriculture and industry, have been reviewed to ensure that there are no other sources that could act in combination that are not accounted for in the background concentrations.

2.1.23 A review of APIS[11] has also been undertaken to understand the proportion of sources of nitrogen deposition at a UK and local scale (Figure 1 and Figure 2). Nationally, road transport contributes 1.9kg N/ha/yr (6.5%) to the total background. The largest contributor is livestock, which contributes 39.9% and 15.3% coming from Europe. Figure 2 shows that the largest source of nitrogen deposition on a local scale is from livestock, representing 61.6% of total contributions. By considering the contribution to background deposition from other sources, National Highways are confident it has considered the total predicted impacts.

2.1.24 The contribution to nitrogen deposition in the area is small compared to other sources and therefore is not considered to materially affect total nitrogen deposition at the SAC. In addition, a conservative approach has been taken by not assuming any reductions in background nitrogen deposition rates in future years.

[10] Department for Transport (2022) Transport Analysis Guidance Unit M4 Forecasting and Uncertainty – Department for Transport, available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1139995/tag-m4-forecasting-and-uncertainty.pdf [accessed: 01/05/23]
11 APIS (2023) https://www.apis.ac.uk/ [accessed 18/05/2023]

Figure 1: Sources ranked by total nitrogen deposition (Kg N/ha/yr) from combined UK sources

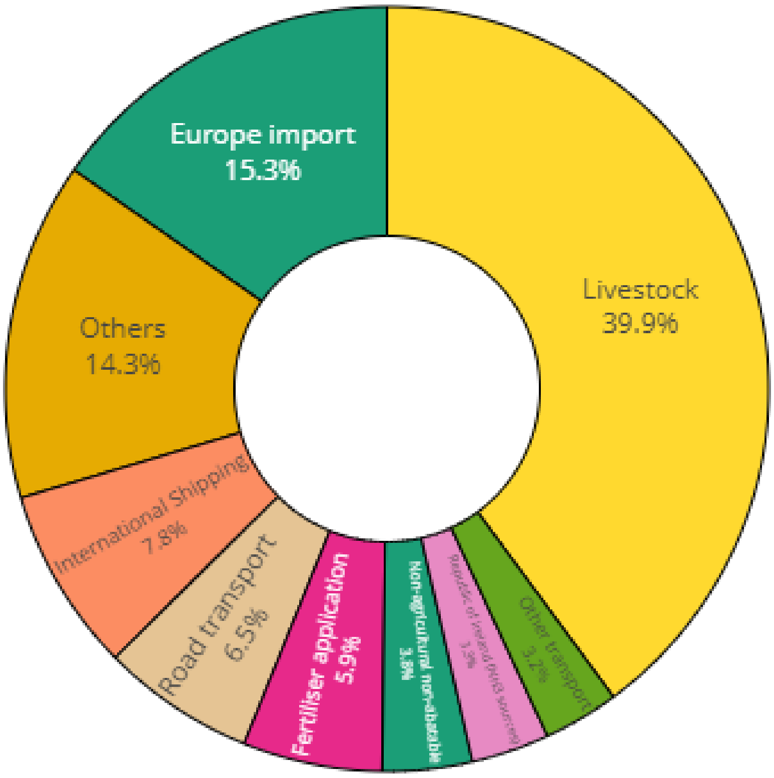
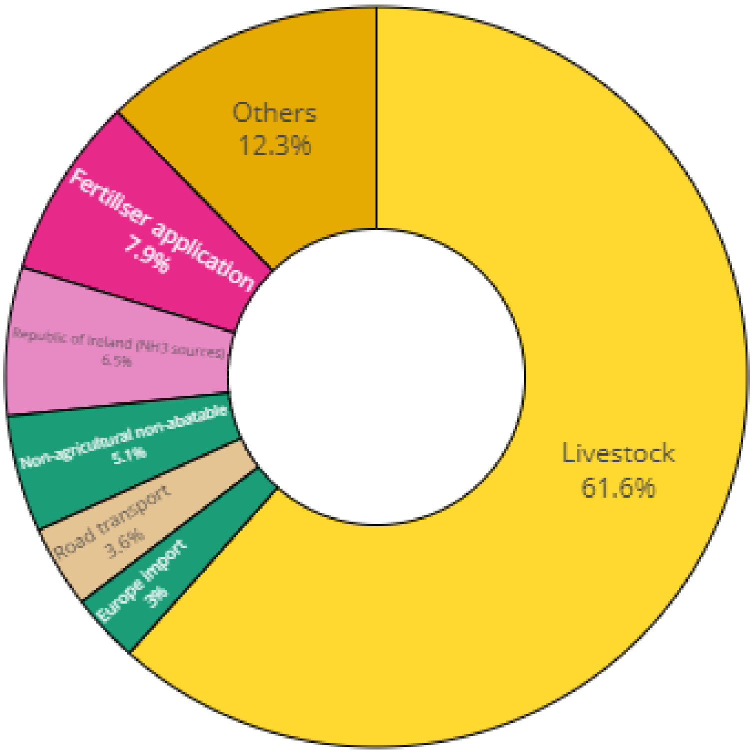


Figure 2: Local contributions to nitrogen deposition (Kg N/ha/yr) from sources (UK)


Others
12.3%
Fertiliser application
7.9%
Republic of Ireland (NH3 sources)
6.5%
Non-agricultural non-abatable
5.1%
Road transport
3.6%
Europe import
3%
Livestock
61.6%

3 Potential Impacts

3.1 North Pennine Moors SAC

3.1.1 The location of the North Pennine Moors SAC in relation to the Project schemes and ARN is shown in the SIAA Appendix A: European Designated Sites Location Plan and the Project.

3.1.2 The North Pennine Moors SAC is classified for supporting Annex I habitats, as outlined in Table 1.

3.1.3 M6 Junction 40 to Kemplay Bank, Penrith to Temple Sowerby, Temple Sowerby to Appleby, Cross Lanes to Rokeby, Stephen Bank to Carkin Moor and A1(M) Junction 53 Scotch Corner, are located over 2km from North Pennine Moors SAC. Appleby to Brough is located approximately 902m south and Bowes Bypass is located approximately 255m south-east. Accordingly, due to these distances and lack of pollution pathways, these schemes have been screened out alone with no residual effects (Document Reference 3.5: Habitats Regulations Assessment Stage 1: Likely Significant Effects Report).

3.1.4 The air quality criteria for assessment within DMRB LA105 (Highways England, 2019[15]) states designated habitats within 200m of the ARN should be included within the air quality assessment. Accordingly, LSE(s) could not be screened out for the ARN (ES Document Reference 3.5: Habitats Regulations Assessment Stage 1: Likely Significant Effects Report) and has been taken forward for stage 2 assessment, as presented in this note.

Desk study information

3.1.5 The Bowes Moor SSSI units which occur within 200m of the ARN are Unit 1, Unit 3 and Unit 4. According to the Designated Sites View (Natural England, 2023)[12], the SAC qualifying features that are recorded to be within all three of these units are:

- European dry heaths.
- Blanket bog.
- Petrifying springs with tufa formation.
- Siliceous scree of the montane to snow levels.

3.1.6 On review of historical habitat mapping in the *Conservation objectives and definitions of favourable condition for designated features of interest* (Natural England, 2009)[13], habitat mapping of the NVC communities within the SAC was undertaken in 2002. The mapping confirms the results of the habitat survey undertaken in 2021 that areas of blanket bog within 200m of the A66 (within units 1 and 3) were very limited in extent and the majority of habitat was recorded to be one of the calcifugous grassland and montane

[12] Natural England (2022) Designated Sites Viewer, available at [redacted] [accessed: 01/05/23]

[13] Natural England (2009) Conservation objectives and definitions of favourable condition for designated features of interest.

communities. No blanket bog was recorded within 200m south of the existing A66 (within Unit 4).

Baseline surveys

3.1.7 A habitat survey was undertaken aligned to Phase 1 Habitat survey methodology *Handbook for Phase 1 habitat survey – a technique for environmental audit* (JNCC, 2010)[14] on areas within the North Pennine Moors SAC which were located within 200m of the ARN to determine the presence and extent of cover of qualifying features of the SAC (Table 2 and SIAA Appendix E: North Pennine Moors Survey Map & Species List).

3.1.8 Blanket bog was the only qualifying feature recorded within the survey area. For the purpose of this assessment, areas of recorded blanket bog are assumed to be Annex I. Blanket bog was often recorded in a mosaic with acid and marshy grassland; for the purposes if this assessment this habitat is assume to be Annex I blank bog. Areas of blanket bog were recorded to be on the edge of the SAC. The habitat areas adjacent to the A66 were frequently recorded to be acid grassland. Areas of blanket bog were recorded across unit 1 and unit 3. Two small, isolated areas of blanket bog (totalling approximately 0.05ha) were recorded within the area of unit 4 south of the A66 within the habitat survey area. The remaining 12 habitats and one Annex II species for which the SAC is designated (as primary reasons for selection and qualifying features) were not recorded within the survey area Table 2).

3.1.9 It should be noted that the areas of Unit 1, Unit 3 and Unit 4 extend much further into the North Pennine Moors SAC (relating to Bowes Moor SSSI) and that the habitat survey was undertaken within 200m of the existing A66 only, in line with *DMRB LA 105* (Highways England, 2019[15]).

Table 2: North Pennine Moors SAC baseline habitat survey.

Qualifying Feature	Survey Methodology	Survey Results	Appendix
H7130 Blanket bog	Habitat mapping	Areas of blanket bog (assumed to be H7130) were confirmed within 200m of the ARN; blanket bog was also recorded within areas of mosaic habitat consisting of blanket bog with acid and marshy grassland (on a precautionary basis this habitat is also assumed to qualify as H7130). Areas of blanket bog and blanket bog habitat mosaic were recorded across unit 1 and unit 3. Two small isolated areas (totalling approximately 0.05ha) of blanket bog were recorded within the area of unit 4 south of the A66 within the habitat survey area.	*SIAA Appendix E: North Pennine Moors Survey Map & Species List*

[14] JNCC (2010) Handbook for Phase 1 Habitat survey – a technique for environmental audit.
[15] Highways England (2019) Design Manual for Roads and Bridges LA 105 Air quality

Qualifying Feature	Survey Methodology	Survey Results	Appendix
		Species present included *Sphagnum spp., Dicranum scroparium, Rhytidiadelphus squarrosus, Calluna vulgaris, Erica cinerea, Vaccinium myrtillus, Galium palustre, Potentilla erecta and Eriophorum vaginatum*.	
H4030 European dry heaths	Habitat mapping	The species composition and vegetation communities recorded within 200m of the ARN did not meet the definitions of the Phase 1 Habitat classifications of these qualifying features.	*SIAA Appendix E: North Pennine Moors Survey Map & Species List*
H5130 Juniperus communis formations on heaths or calcareous grasslands			
H7220 Petrifying springs with tufa formation (Cratoneurion)			
H8110 Siliceous rocky slopes with chasmophytic vegetation			
H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles			
H4010 Northern Atlantic wet heaths with Erica tetralix			
H6130 Calaminarian grasslands of the Violetalia calaminariae			
H6150 Siliceous alpine and boreal grasslands			
H6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates Festuco Brometalia (includes the priority feature			

Qualifying Feature	Survey Methodology	Survey Results	Appendix
'important orchid sites')			
H7230 Alkaline fens			
H8110 Siliceous scree of the montane to snow levels Androsacetalia alpinae and Galeopsietalia ladani			
H8210 Calcareous rocky with slopes with chasmophytic vegetation			
S1528 Marsh saxifrage			

Summary of potential impacts

3.1.10 Based on the survey information within Table 2 and the desk study information (the SSSI unit information and historical mapping information (Natural England, 2009[13])[13]) the following qualifying features are removed from further consideration:

- European dry heaths.
- Juniperus communis formations on heaths or calcareous grasslands.
- Petrifying springs with tufa formation (Cratoneurion).
- Siliceous rocky slopes with chasmophytic vegetation.
- Old sessile oak woods with Ilex and Blechnum in the British Isles.
- Northern Atlantic wet heaths with *Erica tetralix.*
- Calaminarian grasslands of the *Violetalia calaminariae.*
- Siliceous alpine and boreal grasslands.
- Semi-natural dry grasslands and scrubland facies on calcareous substrates *Festuco Brometalia* (includes the priority feature 'important orchid sites').
- Alkaline fens.
- Siliceous scree of the montane to snow levels *Androsacetalia alpinae* and *Galeopsietalia ladani.*
- Calcareous rocky with slopes with chasmophytic vegetation.
- Marsh saxifrage.

3.1.11 Subsequently, the only qualifying feature taken forward for the appropriate assessment is detailed in Table 3.

Table 3: Summary of potential impacts on North Pennine Moors SAC

Potential impact	Threat mechanism	Features at risk	Relevant scheme

Air quality	• Nutrient enrichment as a result of nitrogen deposition • Increase in ammonia concentrations • Increase in NOx concentrations	Blanket bog (H7130)	ARN

3.1.12 For the avoidance of doubt, whenever 'blanket bog' or ‘blanket bog habitat mosaic’ is mentioned hereafter, this is reference to the qualifying Annex I feature 'H7130 blanket bog'.

Sources of information

3.1.13 The assessment of potential impacts of air quality as a result of the Project in combination with background growth and committed developments on the North Pennine Moors SAC is outlined in Section 4: Appropriate Assessment with reference to the following sources of information:

- A habitat mapping survey undertaken in September 2021 as evidence to inform this HRA Appropriate Assessment, refer to *SIAA Appendix E: North Pennine Moors Survey Map & Species List.*
- North Pennine Moors SAC Conservation objectives supplementary advice[4], which identifies air quality as a supporting process on which the qualifying feature being assessed i.e. blanket bog, relies.
- The APIS[11] website which provides critical load levels for the qualifying feature being assessed, i.e. blanket bog.
- Natural England (2009)[13] Conservation objectives and definitions of favourable condition for designated features of interest.
- Appendix 5.3 of Chapter 5 Air Quality (ES Application Document 3.4) of the potential air quality impact as a result of the Project on habitats within North Pennine Moors SAC.
- Natural England (2016a) Potential risk of impacts of nitrogen oxides from road traffic on designated nature conservation sites (NECR200).[16]
- Natural England (2016b) Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance (NECR210).[17]
- Natural England (2018) NEA001 Internal Guidance – Approach to advising competent authorities on Road Traffic Emissions and HRAs V1.4 Final – June 2018[18]

3.1.14 The locations of the modelled receptor points within the North Pennine Moors SAC, as assessed in the air quality assessment, are presented in Table A. A summary of the air quality impacts on NOx concentrations,

[16] Natural England (2016a) Potential risk of impacts of nitrogen oxides from road traffic on designated nature conservation sites (NECR200).
[17] Natural England (2016b) Caporn, S., Field, C., Payne, R., Dise, N., Britton, A., Emmett, B., Jones, L., Phoenix, G., Power, S., Sheppard, L. & Stevens, C. 2016. Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance. Natural England Commissioned Reports, Number 210 (NECR210).
[18] Natural England (2018) Approach to advising competent authorities on Road Traffic Emissions and HRAs V1.4 Final – June 2018 (NEA001).

Nitrogen (N) Deposition and Ammonia concentrations have been presented in Table A2, 3.1.15 Table A3 and Table A4 respectively.

4 Appropriate Assessment

Assessment without mitigation

4.1.1 The SAC is located outside of all schemes of the Project, however, it is located within 200m of the ARN (*SIAA Appendix A: European Designated Sites Location Plan and the Project*) for approximately 6.1km. The traffic modelling and associated potential air quality impacts for this section of the ARN is based on:

- Construction - No change in AADT as a result of the Project.
- Operation – changes in nutrient nitrogen deposition, NH3 and NOx concentrations resulting from the Project, in combination with background growth and committed developments. The air quality modelling was based on modelled traffic data; all potential sources identified without the Project are included in the ‘do minimum’ traffic data, and all potential sources identified with the Project are included in the ‘do something’ traffic data.

4.1.2 As described in Section 2 (Air Quality Assessment) increased air pollution associated with the additional emissions have the potential to increase nutrient nitrogen deposition on habitat within 200m and are subject to air quality modelling. Many habitats of nature conservation importance in the UK, including blanket bog, are adapted to low nutrient conditions and are considered sensitive to increases in concentrations of airborne NOx and ammonia (in addition to nutrient nitrogen).

4.1.3 The potential for adverse effects on site integrity of the SAC, as a result of increased nutrient nitrogen, NH_3 and NOx is assessed in this below.

Baseline condition

4.1.4 As outlined in Section 3.1 (form paragraph 3.1.8), during the habitat survey, the habitat areas adjacent (within 200m) to the A66 were frequently recorded to be acid grassland and mosaics of acid and marshy grassland.

4.1.5 Areas of blanket bog and blanket bog mosaic were recorded within 200m of the ARN across SSSI Unit 1 and Unit 3 to the north of the road. Two small and isolated areas of blanket bog were also recorded to the south of the road, within SSSI Unit 4 (*SIAA Appendix E: North Pennine Moors Survey Map & Species List*).

4.1.6 The area of the SAC which was surveyed is bisected by the existing A66. Consequently, the survey area comprised the edge areas of the SAC boundary. The blanket bog and blanket bog mosaic within the survey area is subject to sheep grazing and associated pressures e.g. grazing, trampling and dunging.

4.1.7 No other Annex I habitat which the SAC is designated for was recorded adjacent (within 200m) to the A66. Subsequently blanket bog is the only feature considered at risk from a reduction in air quality as a result of the Project (*SIAA Appendix E: North Pennine Moors Survey Map & Species List*).

4.1.8 As discussed, the SSSI units which occur within 200m of the ARN are Unit 1 and Unit 3 to the north of the A66, and Unit 4 to the south. According to

NE's most recent Common Standards Monitoring (CSM) condition assessment (March, 2016), Unit 1 is in unfavourable - recovering condition; at the unit scale it was noted that the condition of the blanket bog in Unit 1 had improved since the previous CSM assessment. The unit comprises a range of blanket bog habitats. Grazing pressure, burning practices and vehicle access damage were the pressures identified. In addition, the species composition and structure had been affected by an outbreak of heather beetle (*Lochmaea suturalis*). The CSM assessment states that "*following discussions with the farmer, all sheep were to be offwintered for the remainder of the management agreement, subsequently this would have reduced grazing pressure"*. In order to achieve the conservation objectives of maintaining or restoring the structure and function of habitats (vegetation community composition), these land management pressures have been identified to be addressed within the *Conservation Objectives Supplementary advice* (Natural England, 2019[4])[4] and *North Pennines Group SIP* (Natural England, 2014[5]). This information is the most up to date at the time of writing this note.

4.1.9 According to NE's most recent Common Standards Monitoring (CSM) condition assessment (March, 2015), Unit 3 is in unfavourable - no change condition. The unit comprises extensive areas of blanket bog in the north and central area. Areas of dry heath and degraded bog were recorded in the eastern part of the unit. The CSM assessment identified the following pressures "*localised heavy grazing pressure and associated winter feeding remaining on the heather, vehicle access damage and burning on sensitive no burn areas"*. In order to achieve conservation objectives of maintaining or restoring the structure and function of habitats (vegetation community composition), these land management pressures have been identified to be addressed within the *Conservation Objectives Supplementary advice* (Natural England, 2019[4])[4] and *North Pennines Group SIP* (Natural England, 2014[5]). This information is the most up to date at the time of writing this note.

According to NE's most recent Common Standards Monitoring (CSM) condition assessment (February 2016), Unit 4 was noted to be in unfavourable - no change condition. Blanket bog was reported to cover the majority of the unit, although surveys to inform this assessment, undertaken within 200m of the road identified only two small, isolated areas of blanket bog and no blanket bog mosaic habitat. The CSM assessment identified the following pressures "*localised heavy grazing pressure and associated fodder locations, burning on sensitive no burn areas and vehicle access damage were the pressures identified during. Numerous active drains were identified within the unit which required blocking"*. Management measures relating to these pressures were identified within *Conservation Objectives Supplementary advice* (Natural England, 2019[4])[4] and *North Pennines Group SIP* (Natural England, 2014[5]). This information is the most up to date at the time of writing this note.

Threats

4.1.10 The following threats were identified as a result of changes in air quality along the ARN (i.e. 200m of habitat adjacent to the ARN):

- Nutrient enrichment of a qualifying habitat (blanket bog only)
- Increase in ammonia concentrations in a qualify habitat (blanket bog only)
- Increase in NOx concentrations in a qualify habitat (blanket bog only)

4.1.11 The *Conservation Objectives Supplementary advice* (Natural England, 2019[4]) details important targets which require attention in order to maintain or restore blanket bog. The majority of these threats and pressures are related to management of the habitat e.g. grazing pressure, burning and vehicle access, which are not considered further within the assessment as the Project is unrelated to these pressures and threats. Furthermore, the supporting processes; hydrology and conservation management will also be unaffected by the Project due to there being no pathway for effect. The supporting process considered further is regarding air quality.

4.1.12 The specific air quality attribute which supports processes within the SAC indicates that blanket bog is considered sensitive to changes in air quality. This is considered further below in relation to nitrogen deposition, ammonia and NOx.

Nitrogen Deposition

4.1.13 Exceedance of critical loads for nitrogen deposition may modify the chemical status of substrate, accelerating or damaging plant growth, altering its vegetation structure and composition, and causing the loss of sensitive typical species associated with it. Indicators of exceedance of critical loads for nutrient nitrogen in blanket bog includes the increase in nitrogen loving plants such as the graminoids (grasses and sedges), altered growth and species composition in bryophytes and increased nitrogen in peat and peat water[17]. This may alter species composition and result in the loss of key blanket bog species (such as mosses, bryophytes and heather) due to increased competition from faster-growing species.[17][19]

4.1.14 In addition, damage or loss of certain species associated with the shift to a grass dominated assemblage, has the potential to adversely affect peat formation. Typical species important for peat-formation include species such as bog-mosses *Sphagnum spp*. and cotton-grasses *Eriophorum* spp., or purple moor-grass *Molinia caerulea* in certain circumstances, together with heather and other ericaceous species (*Conservation Objectives Supplementary advice* (Natural England, 2022[4]).

4.1.15 Common heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix*, cotton-grasses *Eriophorum spp*., deer-grass *Trichophorum cespitosum* and bog-mosses such as *Sphagnum papillosum*, *Sphagnum tenellum* and *Sphagnum capillifolium* are characteristic of blanket bog throughout its UK range.[4]

4.1.16 The *Conservation Objectives Supplementary advice* (Natural England, 2022[4]) sets a target to maintain or restore as appropriate the abundance of the following species to enable each of them to be a viable component of

[19] Stevens, C.J., Smart, S.M., Henrys, P., Maskell, L.C., Walker, K.J., Preston, C.D., Crowe, A., Rowe, E., Gowing, D.J. and Emmett, B.A. (2011). Collation of evidence of nitrogen impacts on vegetation in relation to UK biodiversity objectives. JNCC report 447.

the blanket bog habitat: common heather, cross leaved heath, bell heather *Erica cinerea*, billberry *Vaccinium myrtillus*, crowberry *Empetrum nigrum*, cowberry *Vaccinium vitis-idaea*, sundew *Drosera spp*., common cottongrass *Eriophorum angustifolium*, hare's-tail cotton-grass *Eriophorum vaginatum* and an assemblage of sphagnum mosses.

4.1.17 Bog-mosses and bryophytes (including *Sphagnum spp*., broom fork-moss *Dicranum scroparium* and springy turf-moss *Rhytidiadelphus squarrosus*), heather (common heather and bell heather *Erica cinerea*) and cottongrass (hare's-tail cotton-grass) were recorded during surveys (*SIAA Appendix E: North Pennine Moors Survey Map & Species List*).

4.1.18 Loss or damage of peat-forming species (as a result of nitrogen deposition) in the area adjacent to the road has the potential to reduce or inhibit peat formation locally. In addition, the reduction in such species, which provide protection to underlying peat, has the potential to leave peat more exposed to other pressures such as drying and erosion which are exacerbated by climate change.

4.1.19 The *Conservation Objectives Supplementary advice* (Natural England, 2022[4]) sets a target of maintaining or restoring the appropriate concentrations and deposition of air pollutants to at, or below, the site-relevant Critical Load or Level values indicated on *APIS* (APIS, 2022)[20]. This equates to 5-10kgN/ha/yr for blanket bog within the SAC. The current levels of nitrogen deposition on the SAC are exceeded with an average 19.4kgN/ha/yr. The outcome of this exceedance is that the levels of current nitrogen deposition conflict with the conservation objectives which are to restore as necessary the concentrations and deposition of air pollutants to below the site-relevant Critical Load.

4.1.20 As described in the air quality assessment (Section 2) the modelled points which fall within the North Pennine Moors SAC predict an exceedance of 1% during operation up to 65m north of the road edge and 37.7m south of the road edge. This equates to a zone of potential increased nitrogen deposition which extends 60m north into the SAC and 30m south of the existing A66 (Table A2).

4.1.21 The maximum impact in nutrient nitrogen deposition at North Pennine Moors SAC is predicted to be 0.9 kg N/ha/year. At this location, 5m from the edge of the road, as a percentage of the lower critical load for the relevant habitat (5 kg N/ha/yr), there is an 17.6% increase in nitrogen deposition predicted. Existing nitrogen deposition levels at this location are already significantly exceeding the lower critical load. This change is based on a 3.9% increase in nitrogen deposition in relation to DM nitrogen deposition. The predicted change in nitrogen deposition reduces moving away from road to a distance of 65m (60m into the SAC), beyond which point there is an imperceptible change in nitrogen deposition.

4.1.22 The total area of blanket bog (including blanket bog recorded as a mosaic with acid/marshy grassland) that is predicted to receive a perceptible increase in nitrogen deposition is 8.28 ha. Whilst blanket bog was recorded

[20] APIS (2023), available at: http://www.apis.ac.uk [accessed: 01/05/23]

within the survey area south of the road (i.e. within 200m of the road), no blanket bog (or blanket bog recorded as a mosaic with acid/marshy grassland) was recorded within the 30m of the SAC located south of the existing A66 (i.e. the zone where a perceptible change in nitrogen deposition is estimated to occur). Consequently, the total area of habitat which qualifies as Annex I blanket bog potentially impacted by an increase in nitrogen deposition is 8.28 ha (Table 4).

Table 4: Areas of blanket bog and blanket bog mosaic habitat within the SAC where an exceedance of 1% critical load is breached.

Habitat classification	Area of habitat where an exceedance of 1% critical load is breached (ha)
Blanket bog (H7130 blanket bog)	3.18
Mosaic of blanket bog and acid grassland (H7130 blanket bog)	5.11
TOTAL	8.28

4.1.23 In line with *DMRB LA105 Air Quality* (Highways England, 2019[15]) and the *Conservation Objectives Supplementary Advice* (Natural England, 2022[4])[4] for the SAC, the target for the air quality sub-attribute is considered to be 'restore as necessary the site-relevant critical load (in this case nitrogen) for blanket bog' as the North Pennine Moors SAC is already exceeding the lower nitrogen critical load of 5kgN/ha/yr.

4.1.24 The *Conservation Objectives Supplementary Advice* (Natural England, 2022[4])[4] states that approximately 38% of the site supports blanket bog. The SAC covers an area of approximately 103,109.42ha. Therefore, blanket bog covers an area of approximately 39,181.58ha. The area of blanket bog potentially impacted (to a varying degree decreasing with distance from the road, as presented in Table A2) by increased nitrogen deposition will be limited to a 60m zone of the SAC north of the existing A66. No blanket bog (including blanket bog recorded as a mosaic with acid/marshy grassland) was recorded to the south of the road. Therefore, the zone in which the potential impacts described above may occur equates to 0.021% of the total blanket bog within the SAC and 0.008% of the entire SAC.

4.1.25 The Habitats Regulations Assessment Handbook (Tyldesley and Chapman, 2013)*[21]* and Natural England guidance (NEA001)[18] considers the ‘integrity’ of a site to be *'the coherence of its ecological structure and function across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species which the site is (or will be) designated'.* In this regard, 99.98% of the blanket bog feature of the SAC, and twelve of the thirteen qualifying habitats of the SAC, remain unaffected by the Project; it is therefore considered that the integrity of the SAC is maintained.

4.1.26 Blanket bog habitat that will receive a perceptible increase in nitrogen deposition are subject to existing levels of deposition from road transport

[21] Tyldesley, D., and Chapman, C., (2013) The Habitats Regulations Assessment Handbook, November 2018 edition UK: DTA Publications.

and given their proximity to the road are subject to impacts associated with existing maintenance (e.g. localised drainage for the road, salt spray, compaction from road maintenance vehicles and roadside vegetation maintenance). The distance at which these impacts affect vegetation will be dependent on variables such as season and speed of road traffic.

4.1.27 With regards to other pressures acting on the SAC, it should also be noted that the local contributions to nitrogen deposition (kg N/ha/yr) in the North Pennine Moors SAC (shown in Figure 2) shows that the largest contributor is livestock (61.6% 11.25 kgN/ha/yr). Nitrogen deposition in relation to road transport represents only small amount (3.6 % 1.84 kgN/ha/yr) of the total nitrogen deposition (APIS, 2023[22]). This suggests that future restoration of the site would likely focus on other (non-road transport) sources of nitrogen. Whilst it is acknowledged that an increase in nitrogen deposition locally does not equate to restoring the site, the contribution made by the Project, and road traffic in general, is low in the context of nitrogen sources from air pollution (Figure 2).

4.1.28 The Project would not inhibit other (non-road transport related) future restoration measures being implemented across the vast majority (99.98%) of the SAC, which remains unaffected by the Project. In summary, the Project does not inhibit the conservation objectives to restore the, as necessary, the concentrations and deposition of air pollutants to below the site-relevant Critical Load (breaches of which are largely driven by sources other than road traffic) being realised across 99.98% of the site.

4.1.29 Further to the above, when considering the integrity test, i.e. *'the coherence of its ecological structure and function across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species which the site is (or will be) designated*' the location of the impact within the site should be considered. The areas of blanket bog, or blanket bog mosaic recorded within the area north of the existing A66 within the potential zone of impact, are at the peripheral boundary of the SAC and at the extreme southern extent of the blanket bog habitat. This means the coherence (or the quality of forming a unified whole) would be maintained and the impact will not result in habitat severance or damage of less modified blanket bog habitat further north into the SAC. This is indicated by the fact that limited blanket bog was recorded south or the road (*SIAA Appendix E: North Pennine Moors Survey Map & Species List*) and that the fact that, with the exception of Unit 1 to the far west of the SAC, the SAC boundary does not extend south of the road.

4.1.30 It should also be noted that the increases in nitrogen deposition presented (Table A2) are not permanent and there is potential for recovery and reversibility of the air quality impacts presented in future years. National Highways are confident that the impacts of road transport and from the additional contributions from the Project will not delay attainment of the

[22] Air Pollution Information System (APIS) Designates Sites App (Noth Pennine Moors SAC), available at:
http://www.apis.ac.uk/app [accessed: 22/05/23]

Lower Critical Load of 5kg N/ha/yr due (as per the SAC conservation objectives) to the following reasons:

4.1.31 The transport emission projections published in the Emission Factor Toolkit (EFT v11) by Defra show a steady reduction in emissions over time. This reflects the uptake of cleaner petrol and diesel powered vehicles and the increased transition to electric vehicles which on a precautionary basis, the assessment hasn't taken into account.

4.1.32 According to data provided by APIS, removal of the entire nitrogen deposition contribution from the road transport sector on a local scale would have a marginal change on the background nitrogen deposition, reducing from 17.8kg N/ha/yr down to 17.2kg N/ha/y, still more than three times the Lower Critical Load (LCL) (Figure 2).

4.1.33 In addition to the above, work undertaken by JNCC as part of their nitrogen futures project (JNCC, 2020[23]) indicates that under a Business as Usual scenario there is expected to be a 14% reduction in nitrogen deposition by 2030. Emissions from road transport will decline more quickly due to policies such as the Transport Decarbonisation Plan[24] which is likely to accelerate the uptake of fully electric vehicles which will mean that road transport in the future will be a very small source of emissions effecting nitrogen (heavier vehicles are likely to remain as the main emitters but have less of an impact as diesel has much lower ammonia emissions than petrol).

4.1.34 Therefore, even if the road transport element was zero, this would not affect achieving the SAC conservation objective target of the nitrogen LCL (5kg N/ha/yr). A substantial reduction in nitrogen deposition from a wide variety of other sources would be required to achieve this, including nitrogen from European contributions (15.3%) for the LCL to be met.

4.1.35 Based on the Emission Factor Toolkit Version 11, nitrogen deposition including ammonia is forecast to reduce by over 30% between 2019 and 2050. The proportions of electric vehicles have been revised upwards since EFTv11 was released (as part of the TAG Databook, which is the basis of the EFT assumed electric proportions) and therefore this reduction is likely to be very conservative.

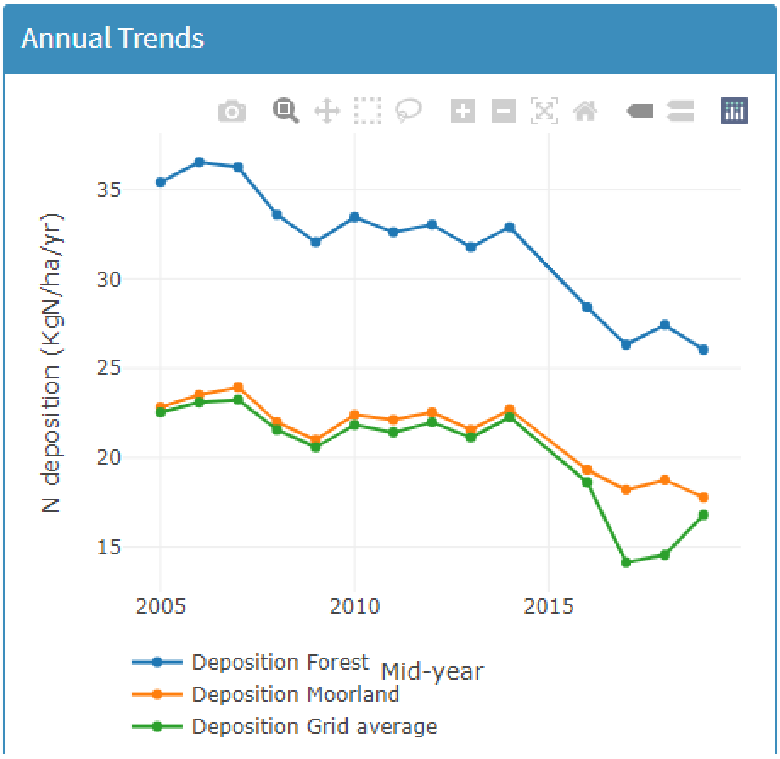
4.1.36 As a result it is likely that the road transport source contribution to total background nitrogen deposition will be much smaller than the 6.5% currently in the near future (see Section 2.1.21). National Highways are not aware of policies that would lead to substantive reductions in all other sources of nitrogen deposition that would mean that road transport would become the largest contributor to nitrogen deposition and therefore delay achieving the conservation objectives of site.

4.1.37 In addition, the trend in the variation in nitrogen deposition over time can be seen in Figure 3. There has been a downward trend in nitrogen

[23] JNCC (2023) The Nitrogen Futures Project https://jncc.gov.uk/our-work/nitrogen-futures/ [10/05/2023]
[24] Department for Transport (2023) Transport Decarbonisation Plan https://www.gov.uk/government/publications/transport-decarbonisation-plan [10/05/2023]

deposition since 2005, but there have been variations over this time where background nitrogen deposition loads have varied by approximately 1kg N/ha/yr year to year. This is greater than the predicted increase associated with the Project on the North Pennine Moor SAC. National Highways considered that the variation of 1kg N/ha/yr in nitrogen deposition year-to-year that would not inhibit recovery of air quality within the potentially affected area. Based on the information in Figure 3 nitrogen deposition is decreasing over time and road emissions also continue to decrease over time.

Figure 3: Annual trends for nitrogen deposition (taken from APIS)



Ammonia

4.1.38 The SIAA and this document (from 4.1.13) assessed the change in nutrient nitrogen deposition to the North Pennine Moors SAC as a result of the ARN.

4.1.39 Many habitats of nature conservation importance in the UK, including blanket bog, are adapted to low nutrient conditions and/or are vulnerable to additional NH_3. Changes in the composition of ground-flora, bryophyte and lichen communities may occur and there may also be subtle changes in plant morphology, physiology and biochemistry which not only increases growth, but also increases sensitivity to environmental factors such as wind, frost, drought and pests (e.g. increased tissue N concentrations can predispose plants to insect attack)[26].

4.1.40 A long-term field experiment in bog habitat that compared ammonia effects with those of wet deposition (Sheppard et al., 2011)[25] showed that ammonia was far more damaging than wet deposition per unit nitrogen applied. Significant changes in species composition and loss of the hummock forming keystone species *Sphagnum*, *S. capillifolium* were observed. Reductions in the cover of keystone species, absence of characteristic species, changes in species composition, and expansion of nitrophilous species (e.g. graminoids) at the expense of lower plants were the main causes for concern.

4.1.41 Ammonia exposure will predispose sensitive plants to stress much faster than wet nitrogen deposition. Direct damage to sensitive species (e.g. bleaching and leaf discoloration) has been observed in *Sphagnum spp*. and the lichen *Cladonia portentosa* at high (>20µg/m^3) concentrations. Bleaching is a particularly likely consequence of NH_3 exposure. There is potential for breakdown of peat forming *Sphagnum spp*. hummocks and an increase in bare peat which can increase the likelihood of erosion and surface oxidation.[26]

4.1.42 Increased ammonia concentration can reduce the ability of stomata to close under drought conditions, leading to plant water stress. This has been demonstrated for *Calluna*. Other ericoids e.g. *Vaccinium myrtillus*, *Empetrum nigrum* and *Erica tetralix* appear to be less sensitive (Sheppard et al 2008[27]).

As described in Section 2 from paragraph 2.1.16 and presented in

[25] Sheppard, L.J.; Leith, I.D.; Mizunuma, T. ; Cape, J.N.; Crossley, A.; S., Leeson ; Sutton, M.A.; Fowler, D.; Dijk, N. 2011 Dry deposition of ammonia gas drives species change faster than wet deposition of ammonium ions: evidence from a long-term field manipulation Global Change Biology 17 (12) 3589-3607

[26] APIS (2023) Ammonia: Bogs Effects and implications, [redacted] [accessed 09/05/2023]

[27] Sheppard, L.J.; Leith, I.D.; Crossley, A.; Dijk, N.; Fowler, D.; Sutton, M.A.; Woods, C. 2008 Stress responses of Calluna vulgaris to reduced and oxidised N applied under 'real world conditions' Environmental Pollution 154 404-413

4.1.43 Table A3, the maximum increase in NH_3 concentrations as a result of the Project in 2029 is predicted to be 0.1µg/m^3 at the North Pennine Moors SAC at a location 5m from the edge of the road. At this location, as a percentage of the lower critical level (1µg/m^3) there is predicted to be a 13.7% increase in NH_3 concentrations, relative to the critical level. This reduces to 3.5% at 65m from the edge of the road and 60m into the SAC; beyond this point the change in NH_3 concentration is considered to be imperceptible.

4.1.44 Therefore, the zone of potential impact from increased NH_3 concentration, within which the aforementioned impacts may occur is consistent with that presented for nitrogen deposition. In this regard, 99.98% of the blanket bog feature of the SAC, and twelve of the thirteen qualifying habitats of the SAC, remain unaffected by the Project; it is therefore considered that the integrity of the SAC is maintained.

Likewise, the Project does not inhibit the conservation objectives to restore the as necessary the concentrations and deposition of air pollutants to below the site-relevant Critical Load (breaches of which are largely driven by sources other than road traffic) being realised across 99.98% of the site.

Oxides of Nitrogen (NOx)

4.1.45 Direct effects of NOx (the sum of nitric oxide (NO) and nitrogen dioxide (NO_2)) have been recognised in the setting of a critical level concentration. The gases are considered together partly because their concentrations in air are inextricably linked through their atmospheric chemistry, and partly because little is known of the direct effects of NO alone. Direct effects of NOx may occur in the immediate vicinity of major roads and in urban areas, caused by high NOx emissions from vehicles.

4.1.46 Increases in the concentration of NOx may lead to ground flora changes related to eutrophication; in an ecological context, growth stimulation and reduction are both potentially negative responses. For instance, NOx (and NH_3 and NH_4 +) generally cause an increase in the shoot:root ratio, which may or may not be beneficial (APIS, 2023[28]).

4.1.47 A literature review of plant responses to the exposure of the motor vehicle exhaust and motor vehicle pollutants under controlled conditions (Bignal et al 2004[29]) show the following responses to NO_2 and NO; altered growth, visible injury, photosynthesis, NaR or NiR enzyme activity, ethylene production, leaf/tissue chemistry (nitrogen) and chlorophyll concentration.

4.1.48 As described in Section 2 from paragraph 2.1.21 and presented in Table A4, no exceedances of the Critical Level for NOx (30µg/m^3) as a result of the Project were predicted within 200m of the ARN at the North Pennine Moors SPA or SAC. The maximum DS concentration was predicted at Receptor point 1, located 5m from the northern carriageway of the A66.

[28] APIS (2023) Ammonia: Bogs Effects and implications, [redacted] [accessed 09/05/2023]

[29] Bignal, K. ; Ashmore, M. ; Power, S. 2004 The Ecological Effects of Diffuse Air Pollution from Road Transport. English Nature Research Report

There was a change of 1.2µg/m^3 predicted at this location, which was also the maximum change at all locations modelled for the SAC.

4.1.49 This represents a change of 12.5% at the location 5m from the edge of the carriageway, reducing to 4.8% at 65m from the edge of the carriageway. Beyond 65m the impact of NOx is considered to be imperceptible and therefore results have not been presented for any further transect points.

4.1.50 Therefore, the zone of potential impact from increased NOx concentration, within which the aforementioned impacts may occur is consistent with that presented for nitrogen deposition.

4.1.51 In this regard, 99.98% of the blanket bog feature of the SAC, and twelve of the thirteen qualifying habitats of the SAC, remain unaffected by the Project; it is therefore considered that the integrity of the SAC is maintained.

4.1.52 Likewise, the Project does not inhibit the conservation objectives to restore the as necessary the concentrations and deposition of air pollutants to below the site-relevant Critical Load (breaches of which are largely driven by sources other than road traffic) being realised across 99.98% of the site.

5 Conclusions

5.1.1 Based on the evidence presented in Section 4, it is considered that adverse effects on the integrity of the North Pennine Moors SAC, as a result of the Project in combination with background growth and committed developments, can be ruled out beyond reasonable scientific doubt. Consequently, no mitigation and no further assessment is required and the HRA can be concluded at Stage 2: Appropriate Assessment. Accordingly, there is no requirement to move to HRA Stages 3 and 4 for the purposes of compliance with the Conservation of Habitats and Species Regulations 2017 (as amended).

Whilst localised increases in nutrient nitrogen deposition, NH_3
concentration and NOx concentrations are high (as presented in Table A2,

5.1.2 Table A3 and Table A4), modelling based on conservative principles has shown that the area of blanket bog subject to a potential adverse effect (to a varying degree, decreasing with distance from the road) will be limited to 8.28 ha. This equates to 0.021% of the total blanket bog within the SAC and 0.008% of the entire SAC.

5.1.3 The Habitats Regulations Assessment Handbook (Tyldesley and Chapman, 2013)[30] and Natural England guidance (NEA001)[18] considers the 'integrity' of a site to be *'the coherence of its ecological structure and function across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species which the site is (or will be) designated'.* In this regard, 99.98% of the blanket bog feature and twelve of the thirteen qualifying habitats remain unaffected by the Project.

5.1.4 The SAC target for the air quality sub-attribute is considered to be "*restore as necessary the concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values*' as the North Pennine Moors SAC is already exceeding the lower nitrogen critical load of 5kg N/ha/yr.

5.1.5 In the short term, the Project would not inhibit restoration measures being implemented across the vast majority (99.98%) of the SAC, which remains unaffected by the Project. In the long-term the air quality effects presented immediately adjacent to the ARN are not permanent and there is potential for recovery and reversibility of the air quality impacts presented in future years. National Highways are confident that the impacts of road transport and from the additional contributions from the Project will not delay attainment of the Lower Critical Load of 5kg N/ha/yr due to reasons presented in Section 4.

Assessment with mitigation

5.1.6 It is considered that adverse effects on the integrity of the North Pennine Moors SAC as a result of the Project, in combination with background growth and committed developments, can be ruled out (beyond reasonable scientific doubt). Consequently, no mitigation and no further assessment is required.

[30] Tyldesley, D., and Chapman, C., (2013) The Habitats Regulations Assessment Handbook, November 2018 edition UK: DTA Publications.

Integrity of site checklist

North Pennine Moors SAC

5.1.7 Table 5: Integrity of site checklist - North Pennine Moors SAC and Table 6: Other indicators - North Pennine Moors SAC

Table 5: Integrity of site checklist - North Pennine Moors SAC

Conservation objectives	Yes/No
Does the Project have potential to:	
Cause delays in progress towards achieving the conservation objectives of the site?	No
Interrupt progress towards achieving the conservation objectives of the site?	No
Disrupt those factors that help to maintain the favourable conservation objectives of the site?	No
Interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?	No

Table 6: Other indicators - North Pennine Moors SAC

Other indicators	Yes/No
Does the Project have the potential to:	
Cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem?	No
Change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site?	No
Interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)?	No
Reduce the area of key habitat?	No
Reduce the population of key species?	No
Change the balance between key species?	No
Reduce the diversity of the site?	No
Result in disturbance that could affect population size or density or the balance between key species?	No
Result in fragmentation?	No
Result in loss or reduction of key features (e.g. tree cover, tidal exposure, annual flooding etc.)?	No

North Pennine Moors SPA

5.1.8 The information provided within this technical note clarifies and supports the findings of the HRA conclusions in the SIAA . The extent of the SPA is consistent with the boundary of the SAC within the area immediately adjacent to the ARN which this assessment covers.

Note Appendix A

Table A1: Ecological Receptors

Receptor ID	Site Name	ES Figure 5.4: Air Quality Operational Phase Assessment (Application Document 3.3) (Sheet Number)	Coordinates (based on OS grid reference, m)		Distance from road edge (m)
			X	Y	
Special Protection Area (SPA)					
SPA_NorthPennineMoors_1	North Pennine Moors SPA	6	389699	512347	5.0
SPA_NorthPennineMoors_2		6	389700	512356	15.0
SPA_NorthPennineMoors_3		6	389703	512367	25.0
SPA_NorthPennineMoors_4		6	389704	512377	35.0
SPA_NorthPennineMoors_5		6	389706	512387	45.0
SPA_NorthPennineMoors_6		6	389707	512396	55.0
SPA_NorthPennineMoors_7		6	389709	512407	65.0
SPA_NorthPennineMoors_22		6	389884	512287	7.7
SPA_NorthPennineMoors_23		6	389883	512279	17.7
SPA_NorthPennineMoors_24		6	389699	512347	27.7
SPA_NorthPennineMoors_25		6	389700	512356	37.7
Special Area of Conservation (SAC)					
SAC_NorthPennineMoors_1	North Pennine Moors SAC	6	389699	512347	5.0
SAC_NorthPennineMoors_2		6	389700	512356	15.0
SAC_NorthPennineMoors_3		6	389703	512367	25.0
SAC_NorthPennineMoors_4		6	389704	512377	35.0
SAC_NorthPennineMoors_5		6	389706	512387	45.0

Receptor ID	Site Name	ES Figure 5.4: Air Quality Operational Phase Assessment (Application Document 3.3) (Sheet Number)	Coordinates (based on OS grid reference, m)		Distance from road edge (m)
			X	Y	
SAC_NorthPennineMoors_6		6	389707	512396	55.0
SAC_NorthPennineMoors_7		6	389709	512407	65.0
SAC_NorthPennineMoors_22		6	389884	512287	7.7
SAC_NorthPennineMoors_23		6	389883	512279	17.7
SAC_NorthPennineMoors_24		6	389699	512347	27.7
SAC_NorthPennineMoors_25		6	389700	512356	37.7

Table A2: Predicted Nitrogen Deposition (N dep) rates for Ecological Receptors

Receptor ID	Distance from road edge (m)	Critical Load (kg N ha yr)	Nitrogen Deposition (kg N ha year)					% Change against Critical Load
			2019 Base	2029 Do-Minimum	2029 Do-Something	Change in N dep	% Change in N dep	
Special Protection Area (SPA)								
SPA_NorthPennineMoors_1	5.0	5 to 10	22.5	22.1	23.0	0.9	3.9%	17.6%
SPA_NorthPennineMoors_2	15.0		21.3	21.0	21.6	0.6	2.7%	11.6%
SPA_NorthPennineMoors_3	25.0		20.7	20.4	20.8	0.4	2.0%	8.3%
SPA_NorthPennineMoors_4	35.0		20.3	20.1	20.5	0.3	1.6%	6.7%
SPA_NorthPennineMoors_5	45.0		20.1	19.9	20.2	0.3	1.4%	5.6%
SPA_NorthPennineMoors_6	55.0		20.0	19.8	20.0	0.2	1.2%	4.9%
SPA_NorthPennineMoors_7	65.0		19.8	19.7	19.9	0.2	1.1%	4.3%

Receptor ID	Distance from road edge (m)	Critical Load (kg N ha yr)	Nitrogen Deposition (kg N ha year)					% Change against Critical Load
			2019 Base	2029 Do-Minimum	2029 Do-Something	Change in N dep	% Change in N dep	
SPA_NorthPennineMoors_22	7.7		21.1	20.8	21.4	0.5	2.6%	10.8%
SPA_NorthPennineMoors_23	17.7		20.5	20.3	20.7	0.4	1.9%	7.8%
SPA_NorthPennineMoors_24	27.7		20.1	19.9	20.2	0.3	1.4%	5.7%
SPA_NorthPennineMoors_25	37.7		19.9	19.7	20.0	0.2	1.2%	4.7%
Special Area of Conservation (SAC)								
SAC_NorthPennineMoors_1	5.0	5 to 10	22.5	22.1	23.0	0.9	3.9%	17.6%
SAC_NorthPennineMoors_2	15.0		21.3	21.0	21.6	0.6	2.7%	11.6%
SAC_NorthPennineMoors_3	25.0		20.7	20.4	20.8	0.4	2.0%	8.3%
SAC_NorthPennineMoors_4	35.0		20.3	20.1	20.5	0.3	1.6%	6.7%
SAC_NorthPennineMoors_5	45.0		20.1	19.9	20.2	0.3	1.4%	5.6%
SAC_NorthPennineMoors_6	55.0		20.0	19.8	20.0	0.2	1.2%	4.9%
SAC_NorthPennineMoors_7	65.0		19.8	19.7	19.9	0.2	1.1%	4.3%
SAC_NorthPennineMoors_22	7.7		21.1	20.8	21.4	0.5	2.6%	10.8%
SAC_NorthPennineMoors_23	17.7		20.5	20.3	20.7	0.4	1.9%	7.8%
SAC_NorthPennineMoors_24	27.7		20.1	19.9	20.2	0.3	1.4%	5.7%
SAC_NorthPennineMoors_25	37.7		19.9	19.7	20.0	0.2	1.2%	4.7%

Table A3: Predicted ammonia concentrations

Receptor ID	Distance from road edge (m)	Ammonia Concentration (µg/m³)				Critical Level (CL) (µg/m³) – Lichens and bryophytes present	% Change against lower CL	Total DS conc. exceeding CL	Critical Level (CL) (µg/m³) – Higher plants	% Change against upper CL	Total DS conc. exceeding upper CL
		DM	DS	Change	% Change						
Special Protection Area (SPA)											
SPA_NorthPennineMoors_1	5.0	1.4	1.5	0.1	9.8%	1	13.7%	Y	3	4.6%	N
SPA_NorthPennineMoors_2	15.0	1.2	1.3	0.1	7.5%	1	9.2%	Y	3	3.1%	N
SPA_NorthPennineMoors_3	25.0	1.1	1.2	0.1	5.8%	1	6.7%	Y	3	2.2%	N
SPA_NorthPennineMoors_4	35.0	1.1	1.1	0.1	4.9%	1	5.4%	Y	3	1.8%	N
SPA_NorthPennineMoors_5	45.0	1.1	1.1	<0.1	4.3%	1	4.5%	Y	3	1.5%	N
SPA_NorthPennineMoors_6	55.0	1.0	1.1	<0.1	3.8%	1	4.0%	Y	3	1.3%	N
SPA_NorthPennineMoors_7	65.0	1.0	1.1	<0.1	3.4%	1	3.5%	Y	3	1.2%	N
SPA_NorthPennineMoors_22	7.7	1.2	1.3	0.1	7.1%	1	8.6%	Y	3	2.9%	N
SPA_NorthPennineMoors_23	17.7	1.1	1.2	0.1	5.5%	1	6.2%	Y	3	2.1%	N
SPA_NorthPennineMoors_24	27.7	1.1	1.1	<0.1	4.3%	1	4.6%	Y	3	1.5%	N
SPA_NorthPennineMoors_25	37.7	1.0	1.1	<0.1	3.6%	1	3.8%	Y	3	1.3%	N
Special Area of Conservation (SAC)											
SAC_NorthPennineMoors_1	5.0	1.4	1.5	0.1	9.8%	1	13.7%	Y	3	4.6%	N
SAC_NorthPennineMoors_2	15.0	1.2	1.3	0.1	7.5%	1	9.2%	Y	3	3.1%	N
SAC_NorthPennineMoors_3	25.0	1.1	1.2	0.1	5.8%	1	6.7%	Y	3	2.2%	N
SAC_NorthPennineMoors_4	35.0	1.1	1.1	0.1	4.9%	1	5.4%	Y	3	1.8%	N
SAC_NorthPennineMoors_5	45.0	1.1	1.1	<0.1	4.3%	1	4.5%	Y	3	1.5%	N
SAC_NorthPennineMoors_6	55.0	1.0	1.1	<0.1	3.8%	1	4.0%	Y	3	1.3%	N

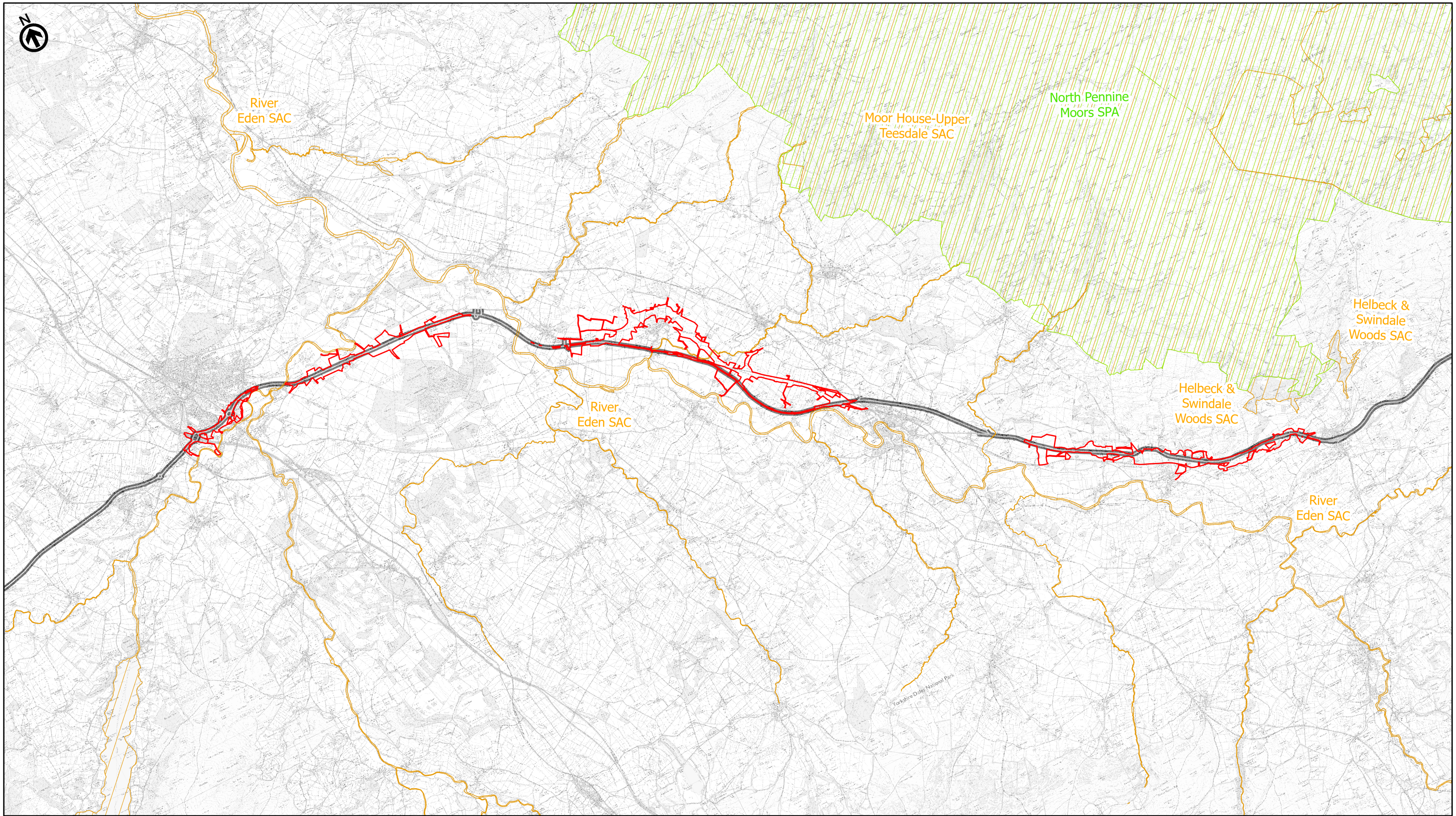
Receptor ID	Distance from road edge (m)	Ammonia Concentration (µg/m³)				Critical Level (CL) (µg/m³) – Lichens and bryophytes present	% Change against lower CL	Total DS conc. exceeding CL	Critical Level (CL) (µg/m³) – Higher plants	% Change against upper CL	Total DS conc. exceeding upper CL
		DM	DS	Change	% Change						
SAC_NorthPennineMoors_7	65.0	1.0	1.1	<0.1	3.4%	1	3.5%	Y	3	1.2%	N
SAC_NorthPennineMoors_22	7.7	1.2	1.3	0.1	7.1%	1	8.6%	Y	3	2.9%	N
SAC_NorthPennineMoors_23	17.7	1.1	1.2	0.1	5.5%	1	6.2%	Y	3	2.1%	N
SAC_NorthPennineMoors_24	27.7	1.1	1.1	<0.1	4.3%	1	4.6%	Y	3	1.5%	N
SAC_NorthPennineMoors_25	37.7	1.0	1.1	<0.1	3.6%	1	3.8%	Y	3	1.3%	N

Table A4: Predicted NOx Concentrations for Ecological Receptors

Receptor ID	Distance from road edge (m)	Critical Level (µg/m³)	Oxides of Nitrogen (NOx) concentration (µg/m³)				
			2019 Base	2029 Do-Minimum	2029 Do-Something	Change in NOx concentration	% Change in NOx concentration
Special Protection Area (SPA)							
SPA_NorthPennineMoors_1	5.0	30	18.1	9.6	10.8	1.2	12.5%
SPA_NorthPennineMoors_2	15.0		13.9	8.2	9.0	0.8	9.9%
SPA_NorthPennineMoors_3	25.0		11.5	7.4	7.9	0.6	8.0%
SPA_NorthPennineMoors_4	35.0		10.3	6.9	7.4	0.5	6.8%
SPA_NorthPennineMoors_5	45.0		9.6	6.7	7.1	0.4	6.0%
SPA_NorthPennineMoors_6	55.0		9.0	6.5	6.8	0.4	5.4%
SPA_NorthPennineMoors_7	65.0		8.6	6.3	6.6	0.3	4.8%
SPA_NorthPennineMoors_22	7.7		13.3	7.9	8.7	0.8	9.5%
SPA_NorthPennineMoors_23	17.7		11.1	7.2	7.7	0.5	7.6%

Receptor ID	Distance from road edge (m)	Critical Level (µg/m³)	Oxides of Nitrogen (NOx) concentration (µg/m³)				
			2019 Base	2029 Do-Minimum	2029 Do-Something	Change in NOx concentration	% Change in NOx concentration
SPA_NorthPennineMoors_24	27.7		9.6	6.7	7.1	0.4	6.1%
SPA_NorthPennineMoors_25	37.7		8.8	6.4	6.8	0.3	5.2%
Special Area of Conservation (SAC)							
SAC_NorthPennineMoors_1	5.0	30	18.1	9.6	10.8	1.2	12.5%
SAC_NorthPennineMoors_2	15.0		13.9	8.2	9.0	0.8	9.9%
SAC_NorthPennineMoors_3	25.0		11.5	7.4	7.9	0.6	8.0%
SAC_NorthPennineMoors_4	35.0		10.3	6.9	7.4	0.5	6.8%
SAC_NorthPennineMoors_5	45.0		9.6	6.7	7.1	0.4	6.0%
SAC_NorthPennineMoors_6	55.0		9.0	6.5	6.8	0.4	5.4%
SAC_NorthPennineMoors_7	65.0		8.6	6.3	6.6	0.3	4.8%
SAC_NorthPennineMoors_22	7.7		13.3	7.9	8.7	0.8	9.5%
SAC_NorthPennineMoors_23	17.7		11.1	7.2	7.7	0.5	7.6%
SAC_NorthPennineMoors_24	27.7		9.6	6.7	7.1	0.4	6.1%
SAC_NorthPennineMoors_25	37.7		8.8	6.4	6.8	0.3	5.2%

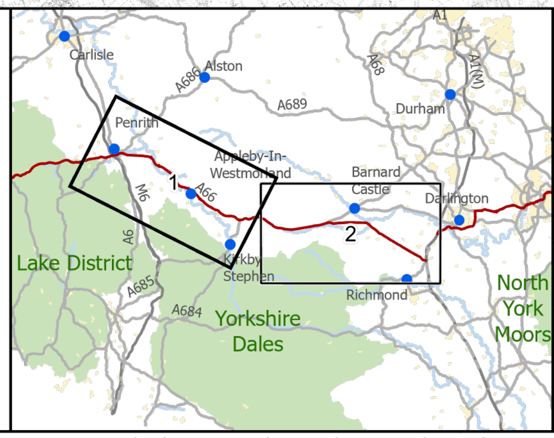
A.1 HRA Appendix A: European Designated Sites Location Plan and the Project



- Order Limits
- Existing A66

Statutory Designated Sites

- Special Protection Areas (SPA)
- Special Area of Conservation (SAC)



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Revision	First Issue				
P02	KBIG	PKEL	THOU	AMIT	KWHA
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Revision	Created	Checked	Reviewed	Approved	Authorised

Kilometres

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Scale @ A3:1:100,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title

Figure 1.1
Appendix A European Designated Sites Location Plan
and the Project
Scheme: 0106, M6 Junction 40 to Brough
Sheet 1 of 13

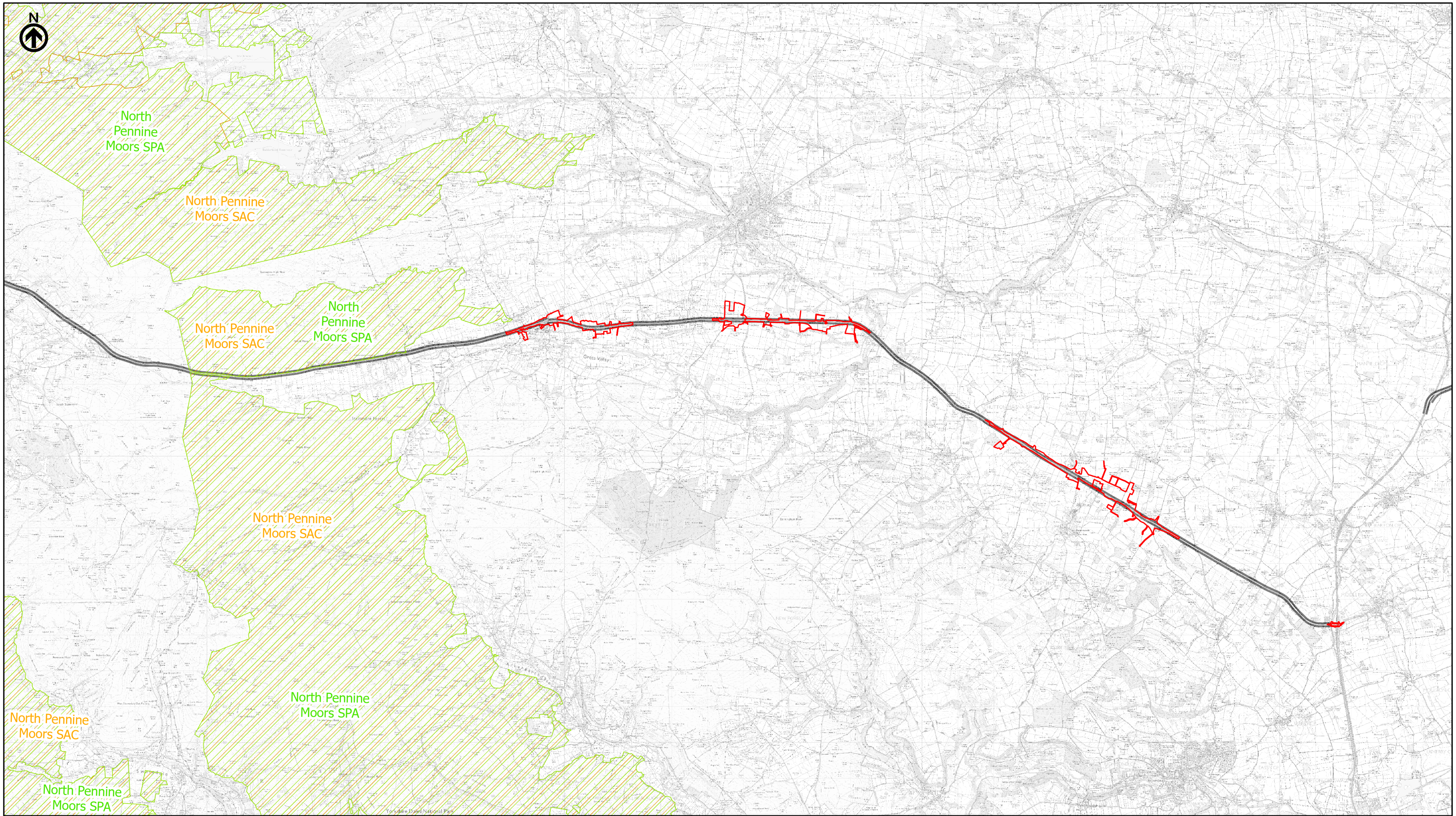
Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003326

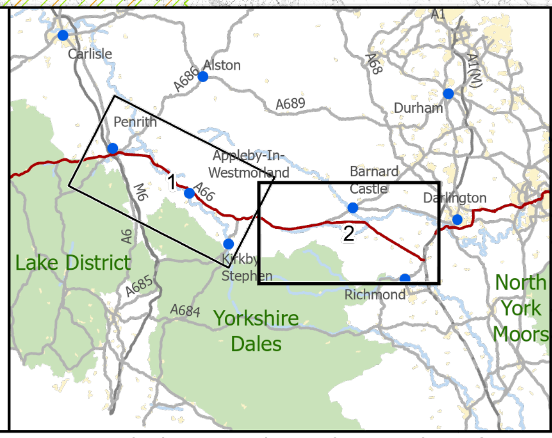
Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6



Order Limits
Existing A66
Statutory Designated Sites
Special Protection Areas (SPA)
Special Area of Conservation (SAC)



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Scale @ A3:1:100,000 | Project Ref No HE565627 | Stage: Stage 3

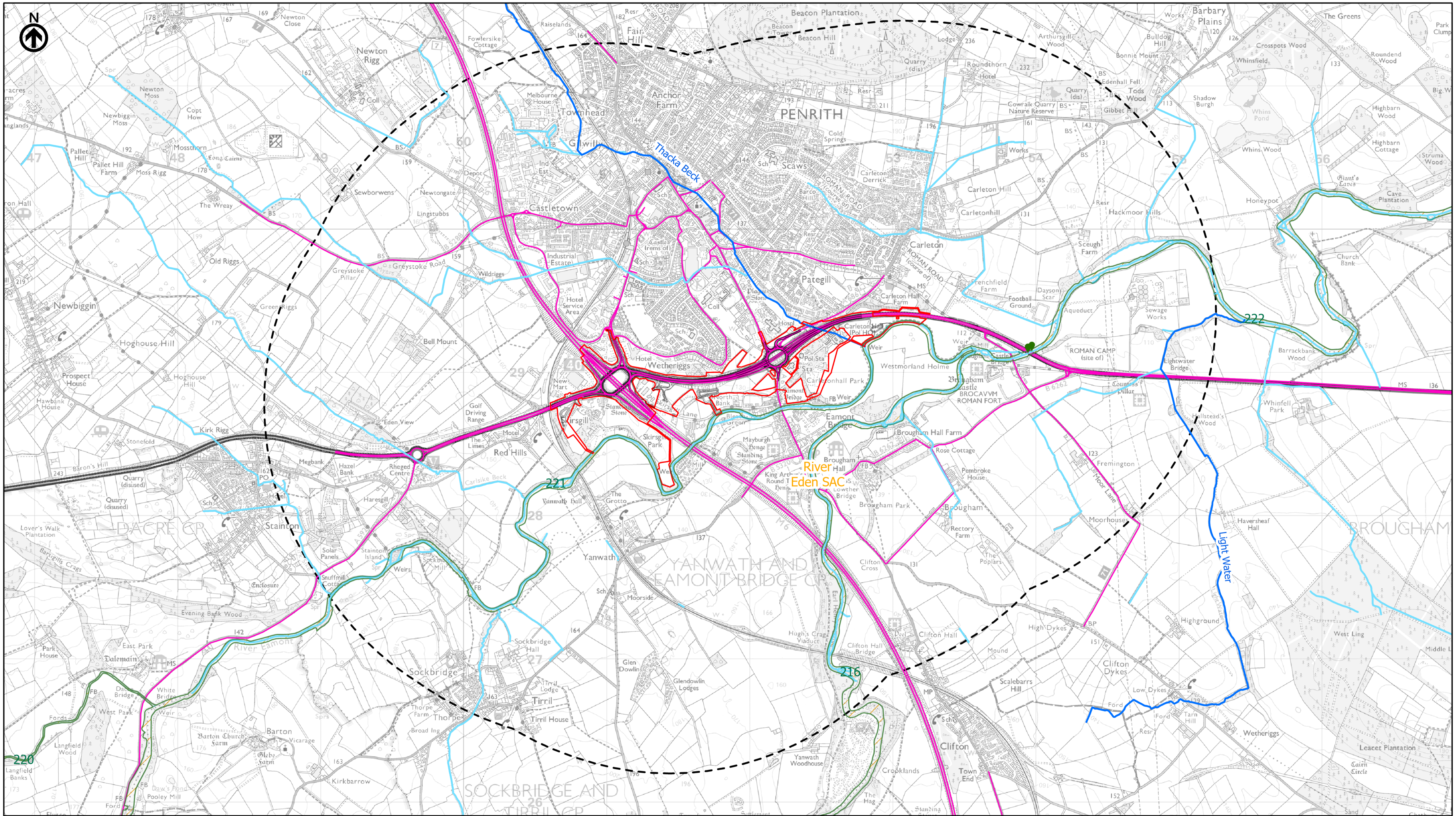
Project Name
A66 Northern Trans-Pennine Project

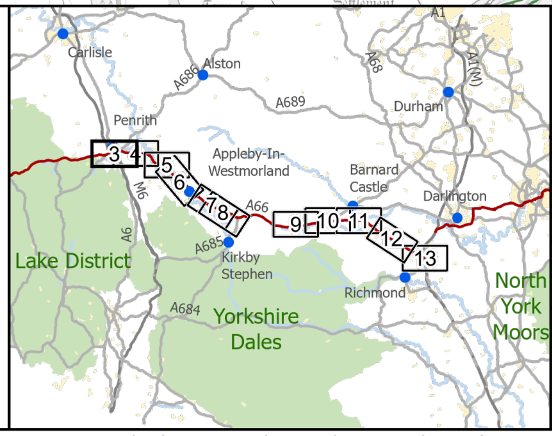
Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 0711, Bowes Bypass to A1(M) Junction 53 Scotch Corner
Sheet 2 of 13

Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003327

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02





Route Alignment
Existing A66
Affected Road Network ES
Order Limits
Study Area 2000m
River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

Special Protection Areas (SPA)
Special Area of Conservation (SAC)
Site of Special Scientific Interest Units (WIth IDs)

Watercourses

Watercourses Functionally Linked To The SAC That Interact With The Project
Other Watercourse

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Revision	Created	Checked	Reviewed	Approved	Authorised

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Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 0102, M6 Junction 40 to Kemplay Bank
Sheet 3 of 13

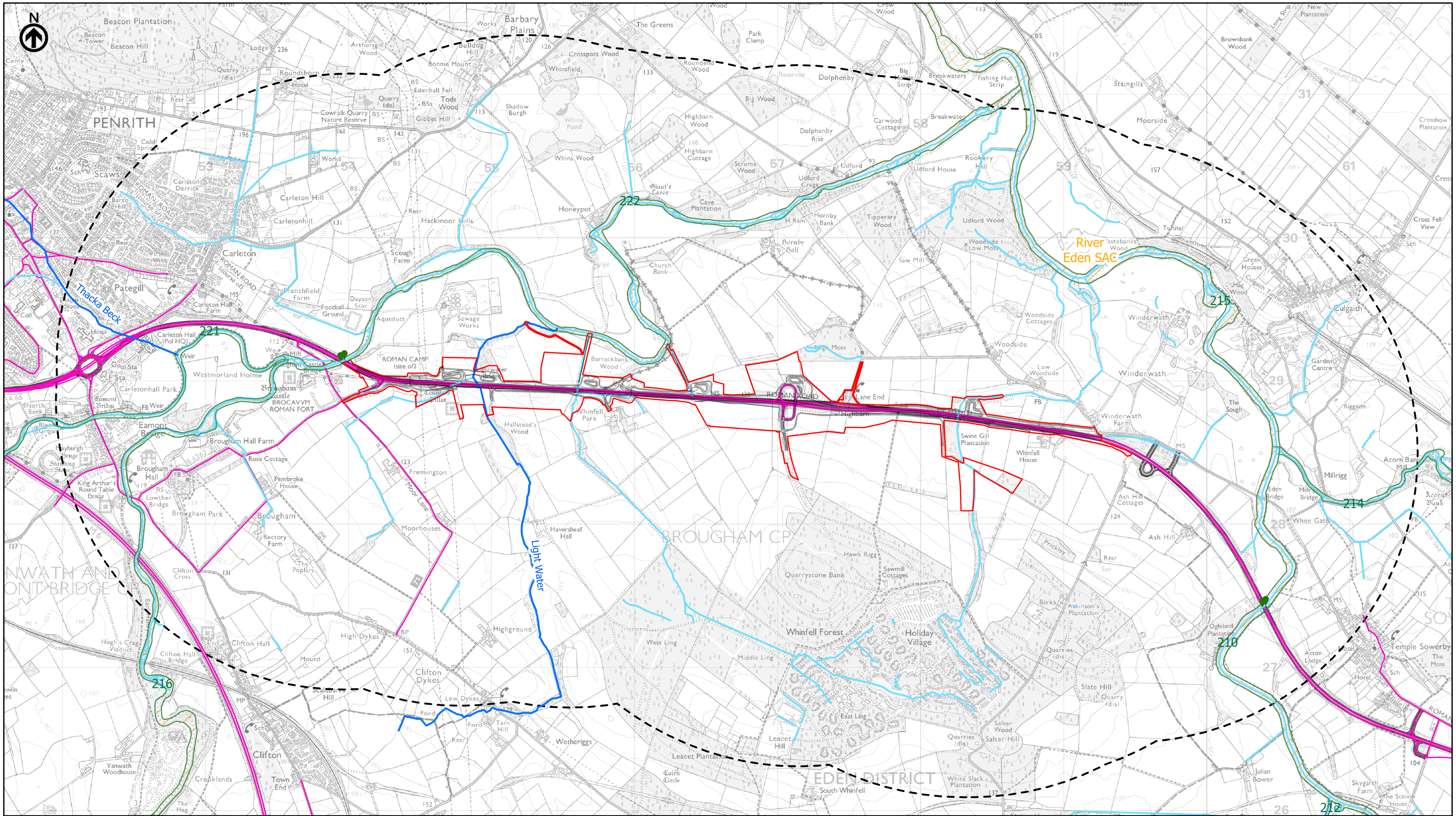
Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003328

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6



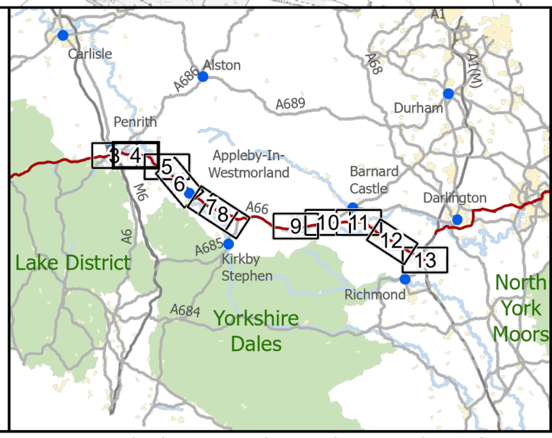
- Route Alignment
- Existing A66
- Affected Road Network ES
- Order Limits
- Study Area 2000m
- River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

- Special Protection Areas (SPA)
- Special Area of Conservation (SAC)
- Site of Special Scientific Interest Units (WIth IDs)

Watercourses

- Watercourses Functionally Linked To The SAC That Interact With The Project
- Other Watercourse



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Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 03, Penrith to Temple Sowerby
Sheet 4 of 13

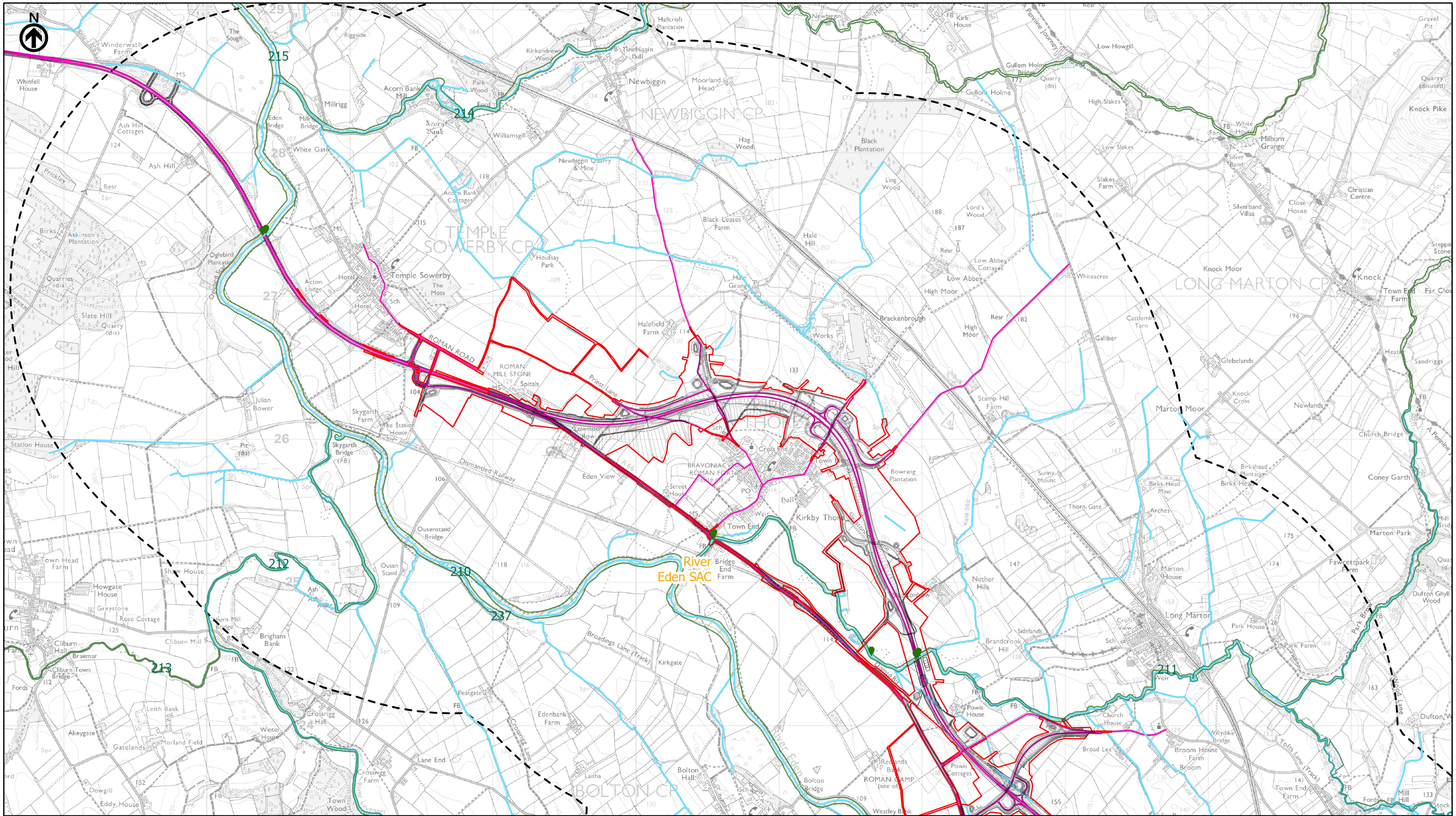
Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003329

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6



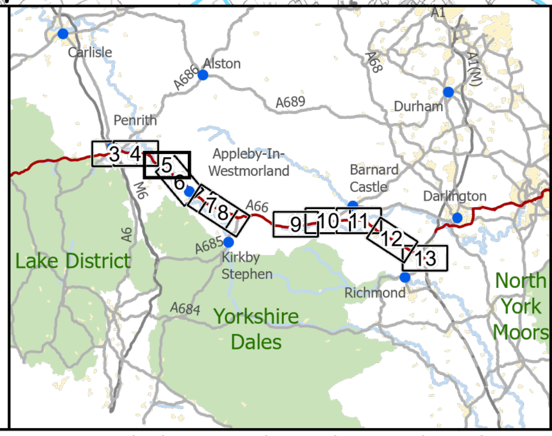
	Route Alignment
	Existing A66
	Affected Road Network ES
	Order Limits
	Study Area 2000m
	River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

	Special Protection Areas (SPA)
	Special Area of Conservation (SAC)
	Site of Special Scientific Interest Units (WIth IDs)

Watercourses

	Watercourses Functionally Linked To The SAC That Interact With The Project
	Other Watercourse



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P02	KBIG	PKEL	THOU	AMIT	KWHA
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Revision	Created	Checked	Reviewed	Approved	Authorised

Kilometres
0 1 2

Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

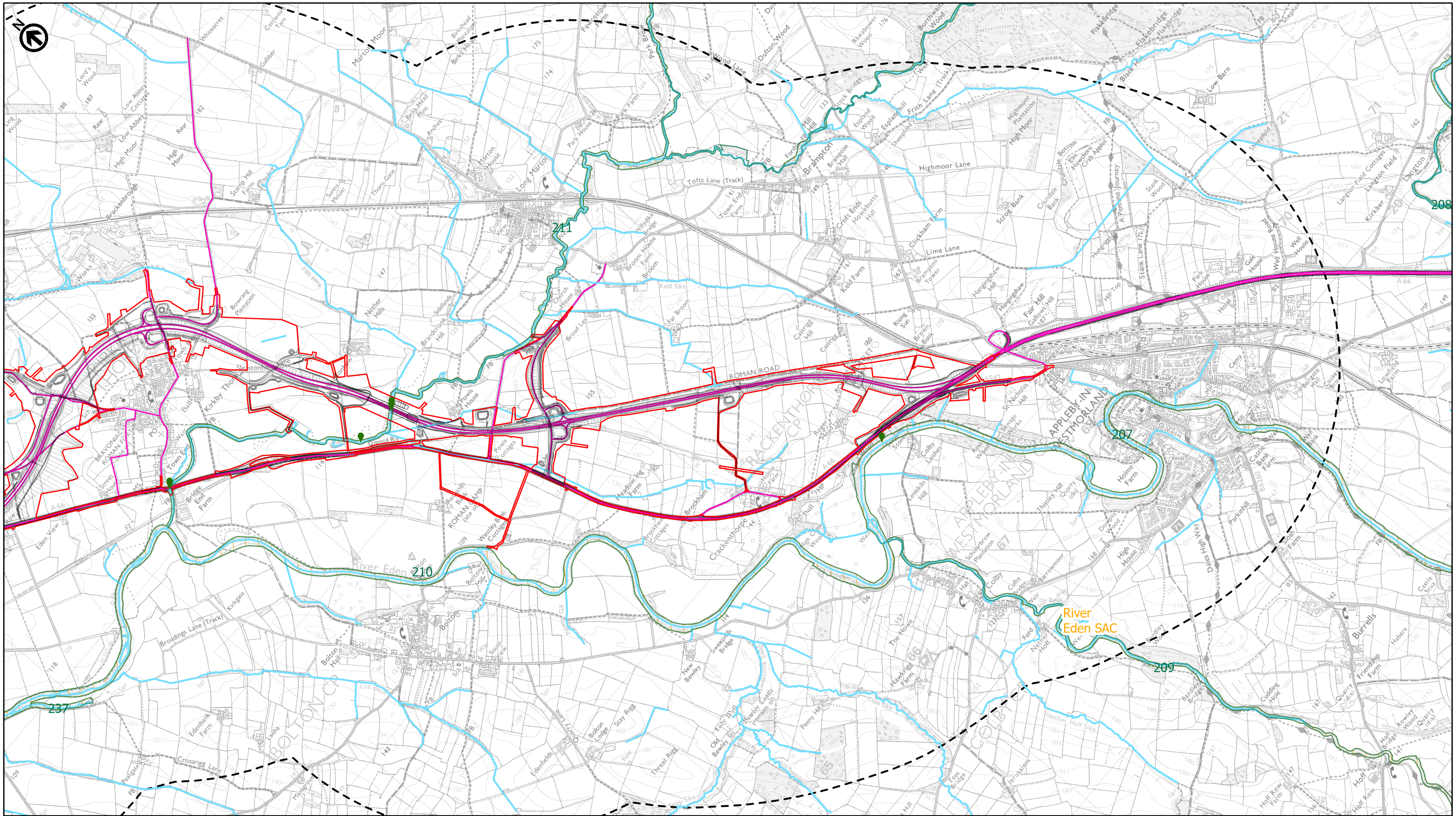
Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 0405, Temple Sowerby to Appleby
Sheet 5 of 13

Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003330

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02



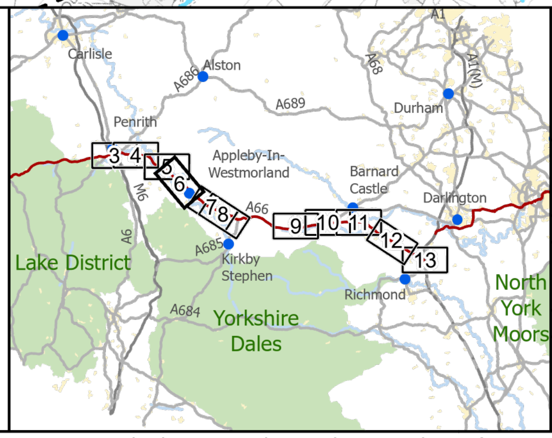
Route Alignment
Existing A66
Affected Road Network ES
Order Limits
Study Area 2000m
River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

Special Protection Areas (SPA)
Special Area of Conservation (SAC)
Site of Special Scientific Interest Units (WIth IDs)

Watercourses

Watercourses Functionally Linked To The SAC That Interact With The Project
Other Watercourse



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3 Piccadilly Place
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Revision	Created	Checked	Reviewed	Approved	Authorised
P02	First Issue				
	KBIG	PKEL	THOU	AMIT	KWHA
	10/03/22	14/03/22	21/03/22	20/04/22	20/04/22

Kilometres
0 1 2

Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

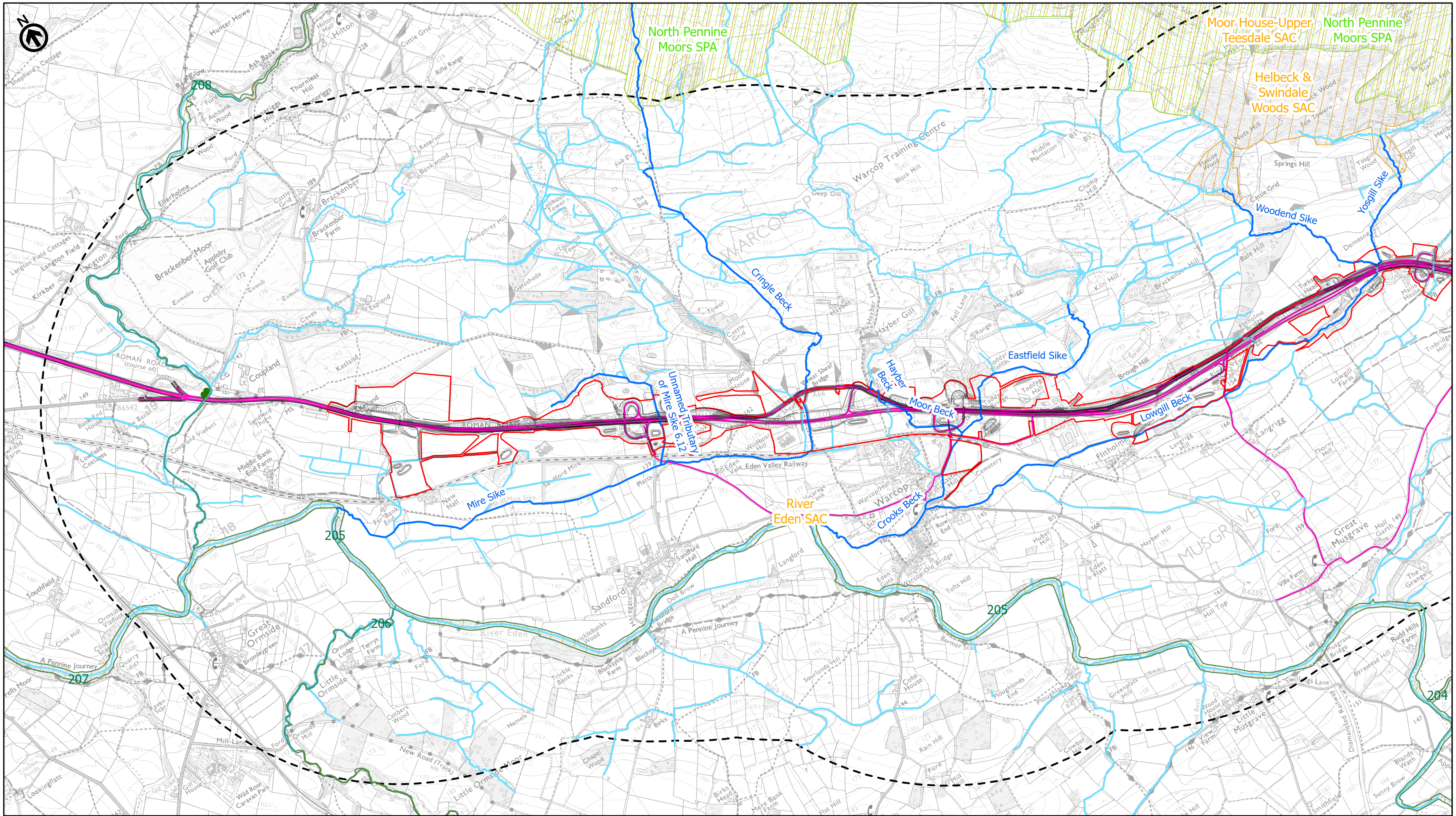
Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 0405, Temple Sowerby to Appleby
Sheet 6 of 13

Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003331

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.



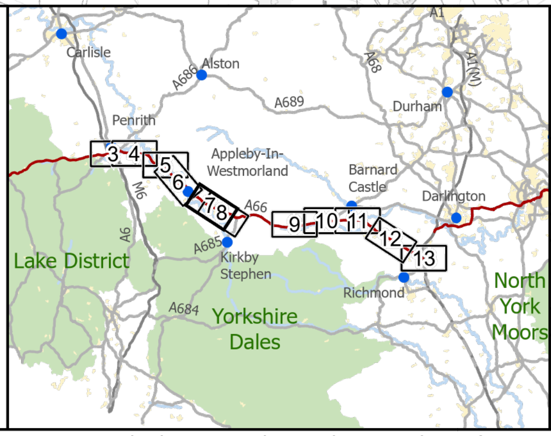
Route Alignment
Existing A66
Affected Road Network ES
Order Limits
Study Area 2000m
River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

Special Protection Areas (SPA)
Special Area of Conservation (SAC)
Site of Special Scientific Interest Units (WIth IDs)

Watercourses

Watercourses Functionally Linked To The SAC That Interact With The Project
Other Watercourse



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	First Issue				
P02	KBIG	PKEL	THOU	AMIT	KWHA
	10/03/22	14/03/22	21/03/22	20/04/22	20/04/22
Revision	Created	Checked	Reviewed	Approved	Authorised

Kilometres
0 1 2

Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 06, Appleby to Brough
Sheet 7 of 13

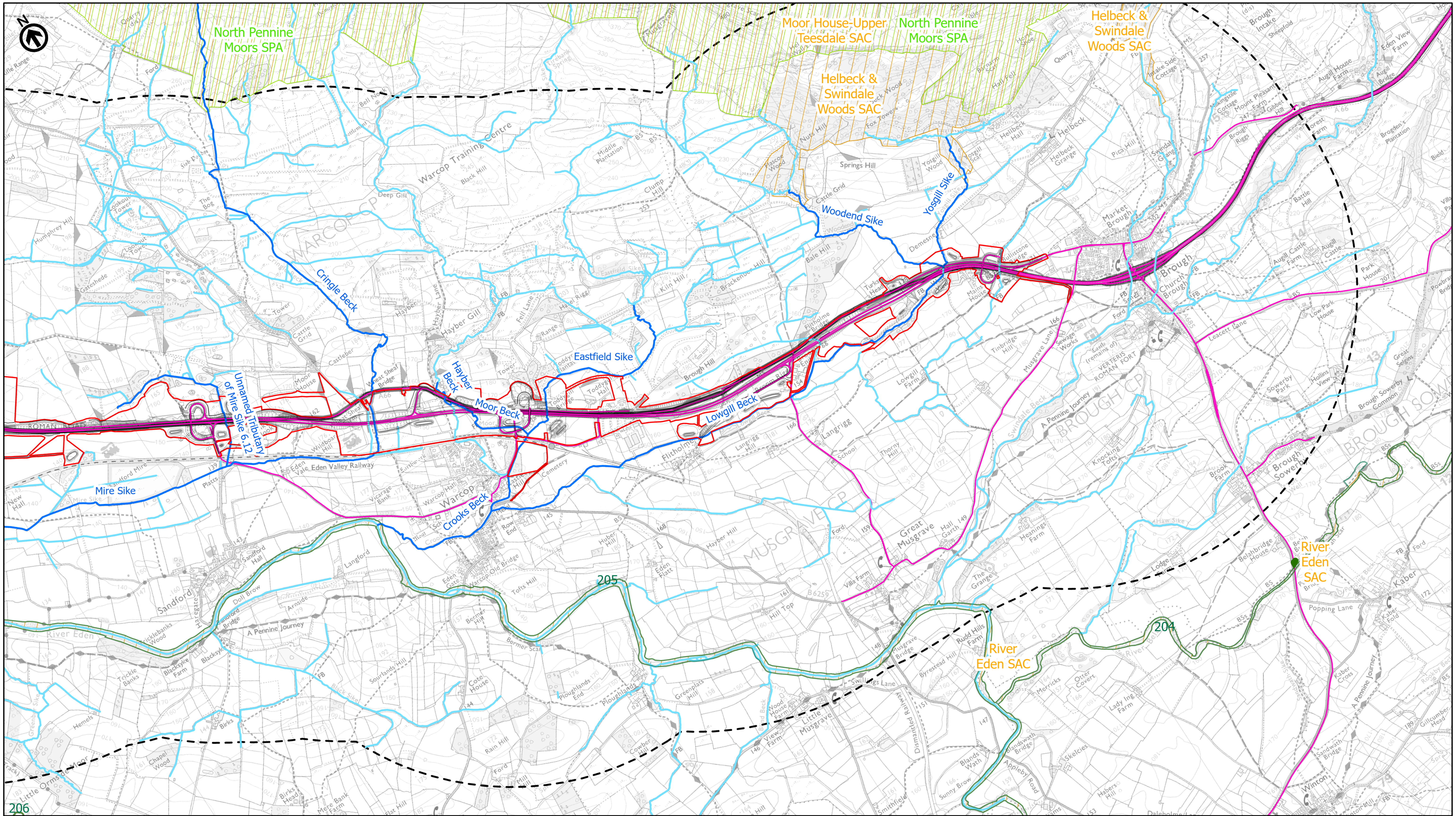
Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003332

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6



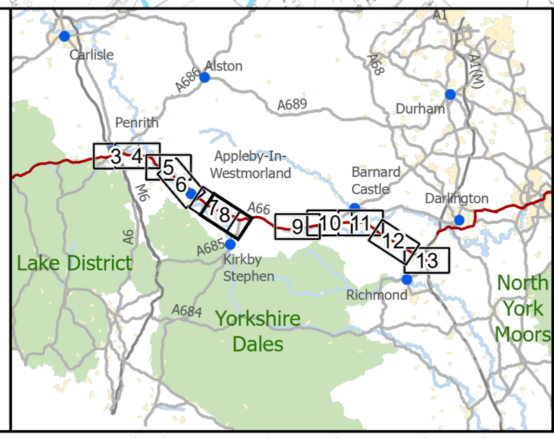
Route Alignment
Existing A66
Affected Road Network ES
Order Limits
Study Area 2000m
River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

Special Protection Areas (SPA)
Special Area of Conservation (SAC)
Site of Special Scientific Interest Units (WIth IDs)

Watercourses

Watercourses Functionally Linked To The SAC That Interact With The Project
Other Watercourse



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Revision	Created	Checked	Reviewed	Approved	Authorised
	First Issue				
P02	KBIG	PKEL	THOU	AMIT	KWHA
	10/03/22	14/03/22	21/03/22	20/04/22	20/04/22

Kilometres
0 1 2

Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 06, Appleby to Brough
Sheet 8 of 13

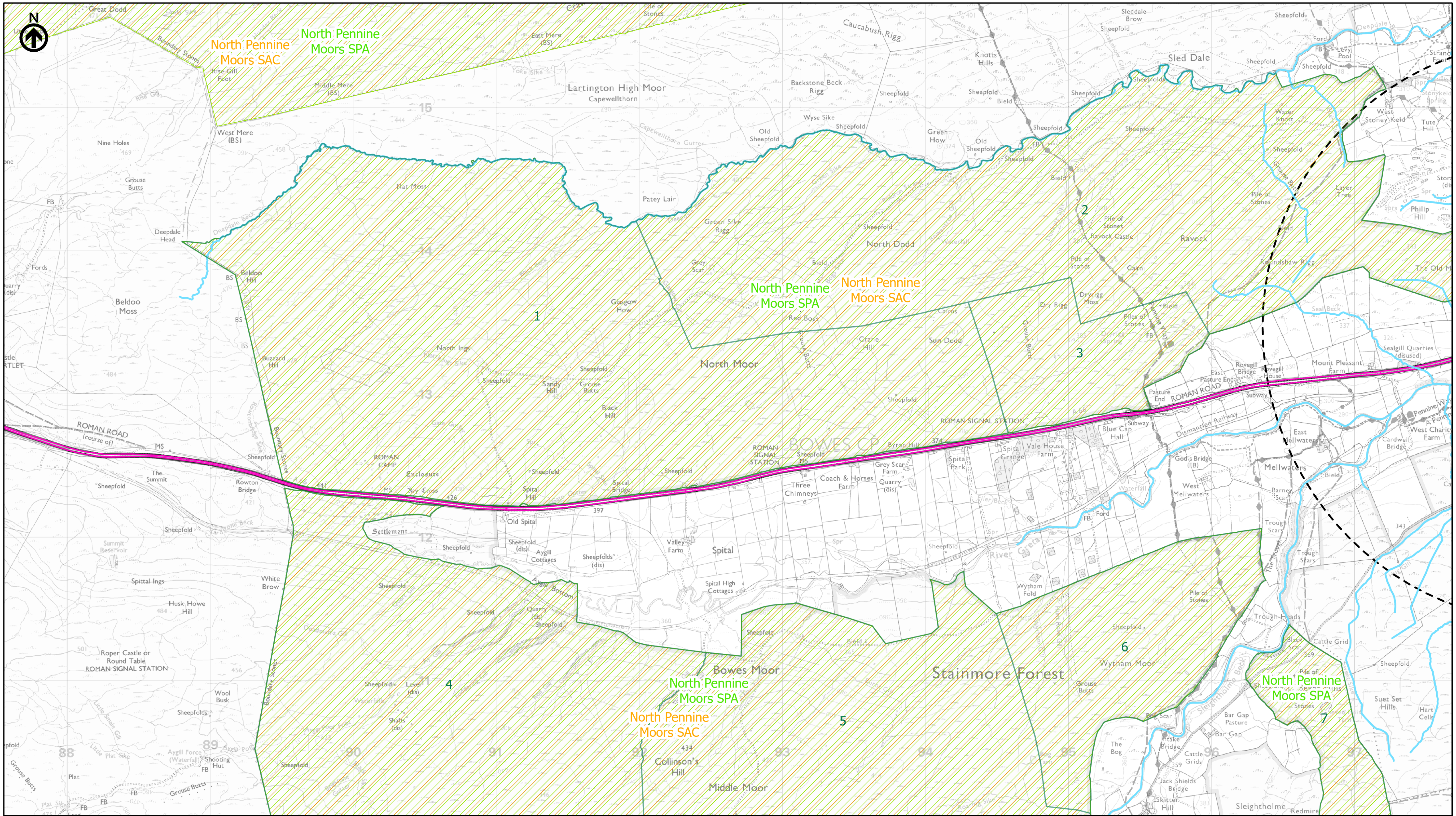
Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003333

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6



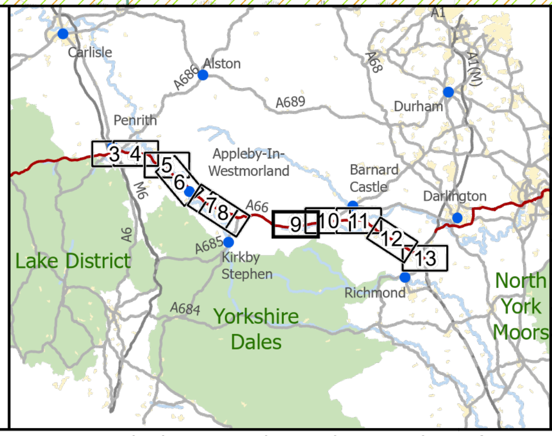
Route Alignment
Existing A66
Affected Road Network ES
Order Limits
Study Area 2000m
River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

Special Protection Areas (SPA)
Special Area of Conservation (SAC)
Site of Special Scientific Interest Units (WIth IDs)

Watercourses

Watercourses Functionally Linked To The SAC That Interact With The Project
Other Watercourse



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Revision	First Issue				
P02	KBIG	PKEL	THOU	AMIT	KWHA
	10/03/22	14/03/22	21/03/22	20/04/22	20/04/22
	Created	Checked	Reviewed	Approved	Authorised

Kilometres
0 1 2

Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

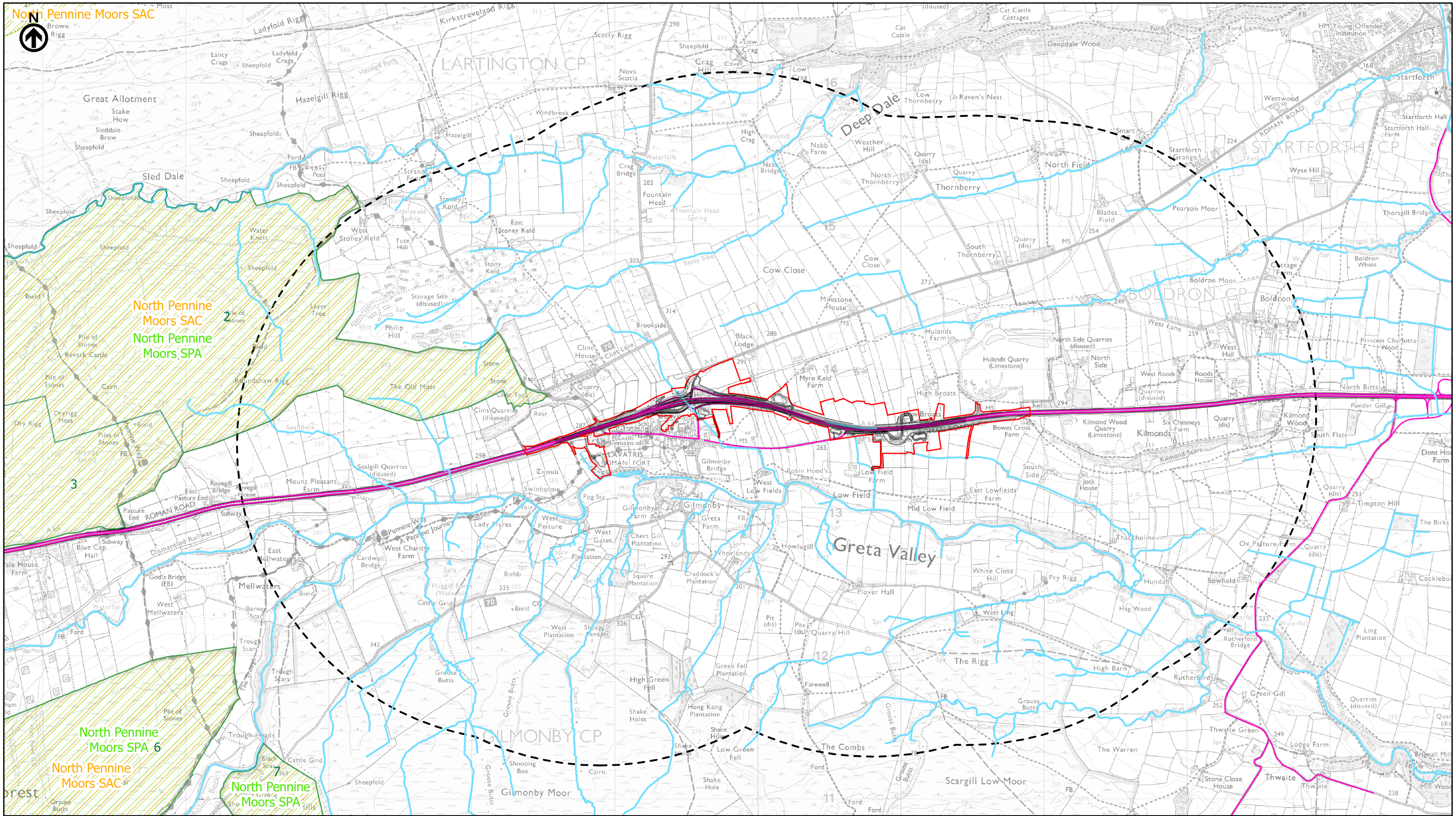
Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 07, Bowes Bypass
Sheet 9 of 13

Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003334

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.



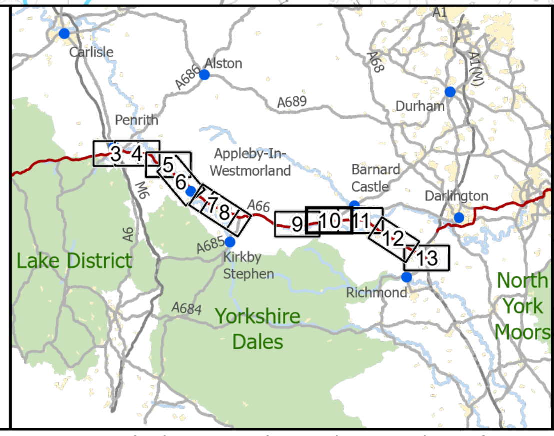
- Route Alignment
- Existing A66
- Affected Road Network ES
- Order Limits
- Study Area 2000m
- River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

- Special Protection Areas (SPA)
- Special Area of Conservation (SAC)
- Site of Special Scientific Interest Units (WIth IDs)

Watercourses

- Watercourses Functionally Linked To The SAC That Interact With The Project
- Other Watercourse



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Revision	First Issue Created	Checked	Reviewed	Approved	Authorised
P02	KBIG 10/03/22	PKEL 14/03/22	THOU 21/03/22	AMIT 20/04/22	KWHA 20/04/22

Kilometres
0 1 2

Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 07, Bowes Bypass
Sheet 10 of 13

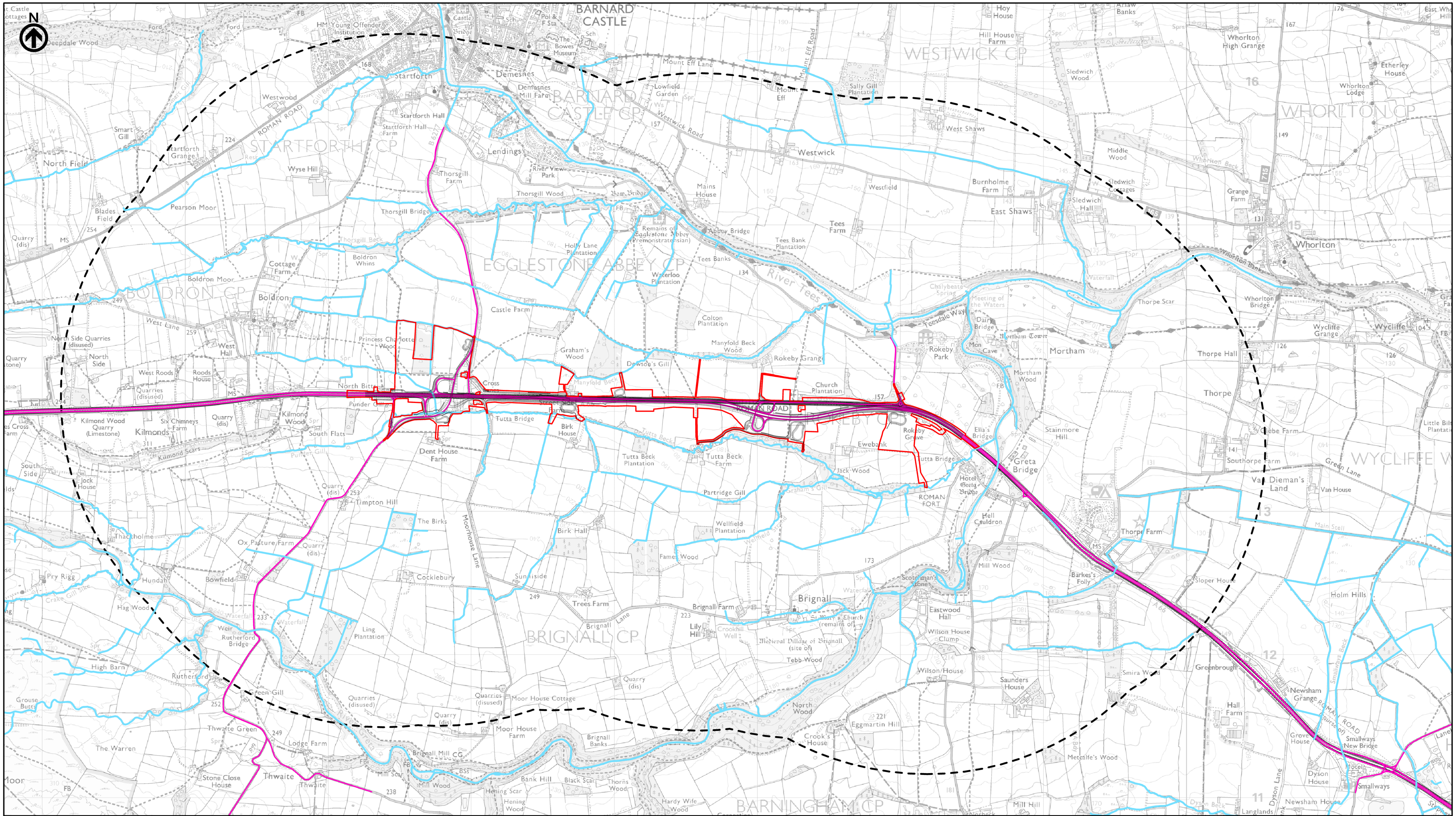
Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003335

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6



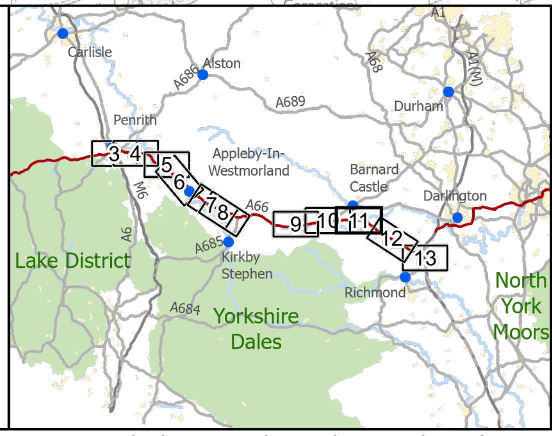
Route Alignment
Existing A66
Affected Road Network ES
Order Limits
Study Area 2000m
River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

Special Protection Areas (SPA)
Special Area of Conservation (SAC)
Site of Special Scientific Interest Units (WIth IDs)

Watercourses

Watercourses Functionally Linked To The SAC That Interact With The Project
Other Watercourse



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Revision	Created	Checked	Reviewed	Approved	Authorised
	First Issue				
P02	KBIG	PKEL	THOU	AMIT	KWHA
	10/03/22	14/03/22	21/03/22	20/04/22	20/04/22

Kilometres
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Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 08, Cross Lanes to Rokeby
Sheet 11 of 13

Map Number

Project	Originator	Volume
HE565627 -	AMY -	EBD -

Location	Type	Role	Number
S00 -	MP -	LB -	003336

Suitability	Suitability Description	Revision
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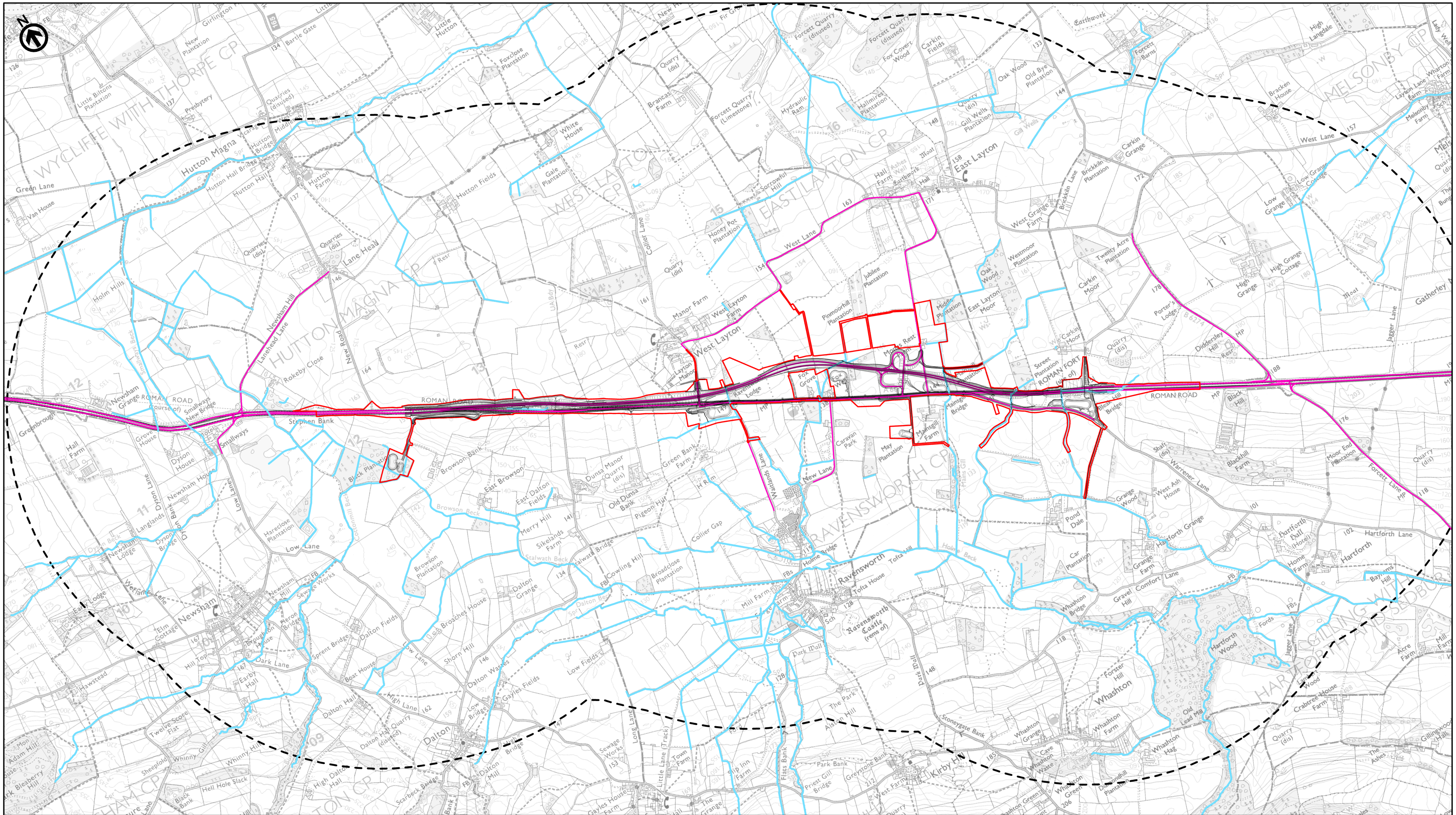


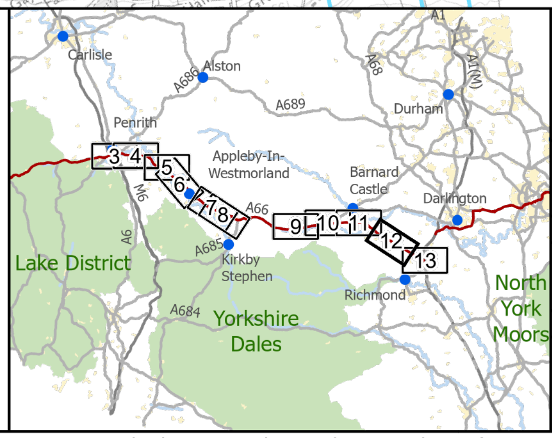
Route Alignment
Existing A66
Affected Road Network ES
Order Limits
Study Area 2000m
River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

Special Protection Areas (SPA)
Special Area of Conservation (SAC)
Site of Special Scientific Interest Units (WIth IDs)

Watercourses

Watercourses Functionally Linked To The SAC That Interact With The Project
Other Watercourse



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Revision	First Issue				
P02	KBIG	PKEL	THOU	AMIT	KWHA
	10/03/22	14/03/22	21/03/22	20/04/22	20/04/22
Revision	Created	Checked	Reviewed	Approved	Authorised

Kilometres
0 1 2

Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

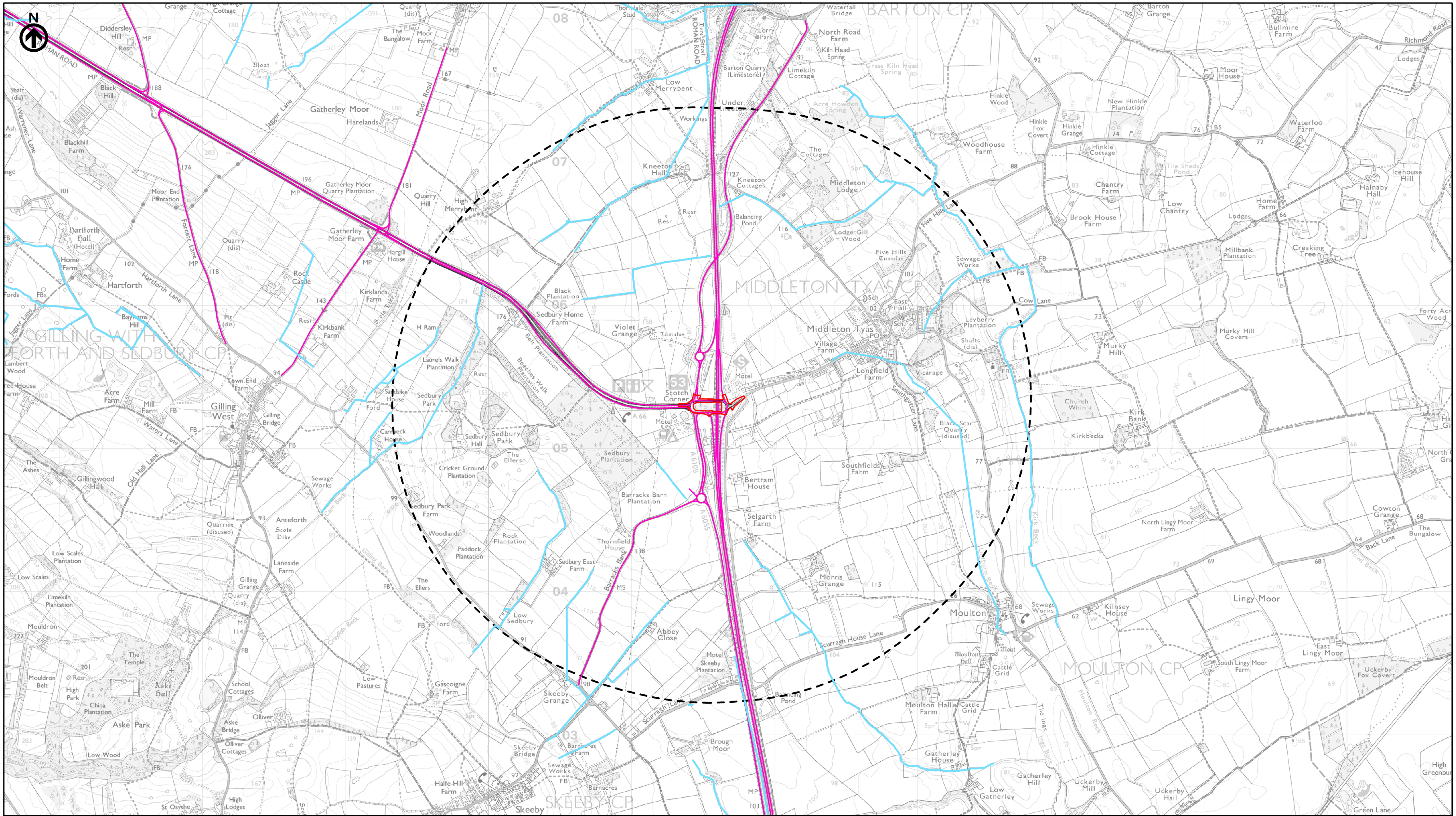
Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 09, Stephen Bank to Carkin Moor
Sheet 12 of 13

Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003337

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.



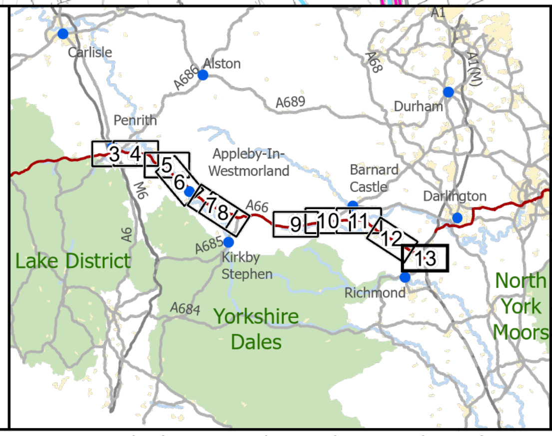
- Route Alignment
- Existing A66
- Affected Road Network ES
- Order Limits
- Study Area 2000m
- River Eden SAC Affected Road Network Crossing Point

Statutory Designated Sites

- Special Protection Areas (SPA)
- Special Area of Conservation (SAC)
- Site of Special Scientific Interest Units (WIth IDs)

Watercourses

- Watercourses Functionally Linked To The SAC That Interact With The Project
- Other Watercourse



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Revision	First Issue				
P02	KBIG	PKEL	THOU	AMIT	KWHA
	10/03/22	14/03/22	21/03/22	20/04/22	20/04/22
Revision	Created	Checked	Reviewed	Approved	Authorised

Kilometres
0 1 2

Scale @ A3: 1:25,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix A European Designated Sites Location Plan and the Project
Scheme: 11, A1(M) Junction 53 Scotch Corner
Sheet 13 of 13

Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003338

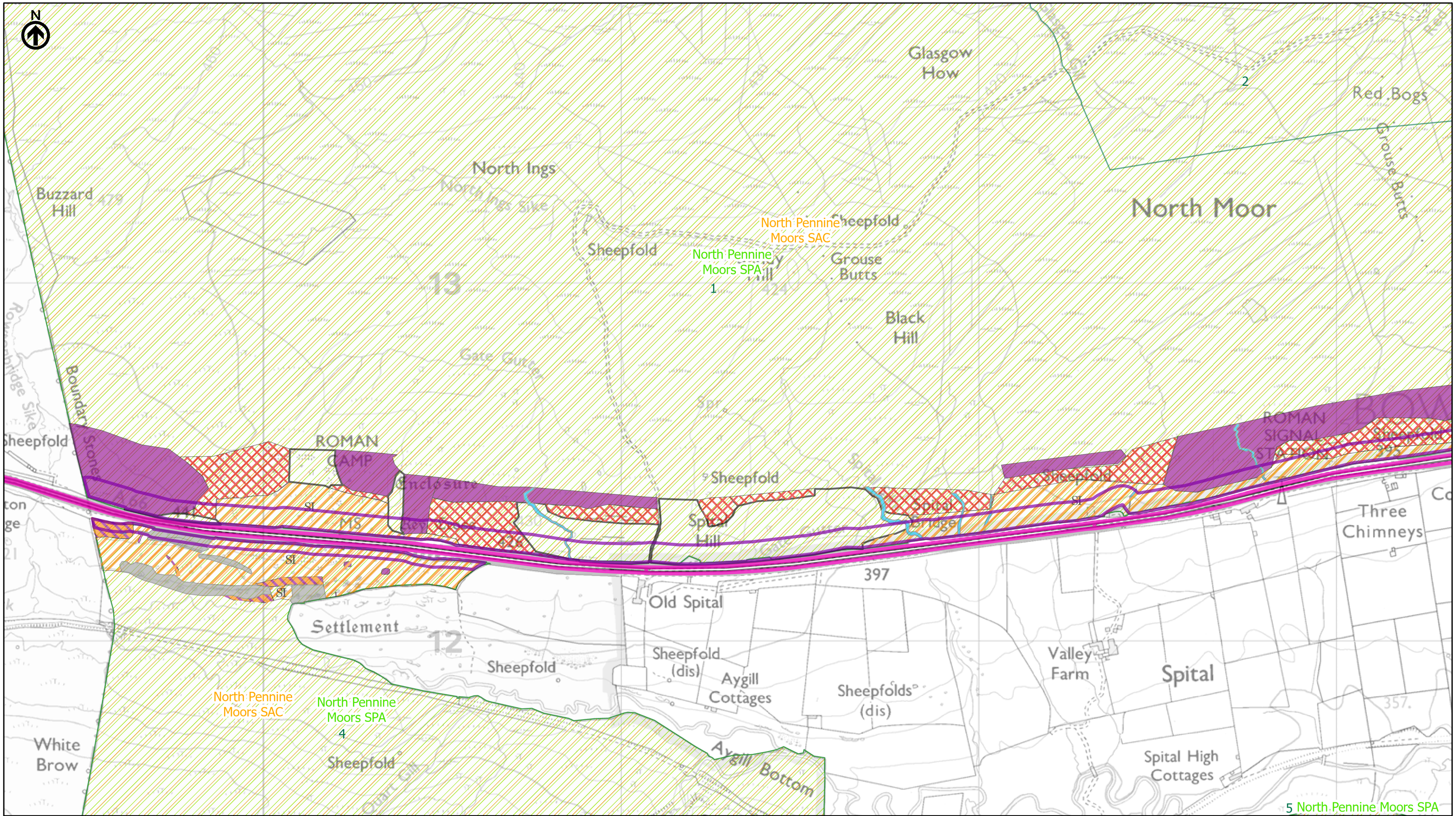
Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) &5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6

A.5 HRA Appendix E: North Pennine Moors Survey Map & Species List

Habitat type	Species recorded
Blanket bog	*Sphagnum spp., Dicranum scroparium, Rhytidiadelphus squarrosus, Calluna vulgaris, Erica cinerea, Vaccinium myrtillus, Galium palustre, Potentilla erecta and Eriophorum vaginatum*
Marshy grassland	*Juncus spp., Juncus effuses, Juncus squarrosus, Juncus acutiflorus*
Acid grassland	Nardus stricta, *Juncus squarrosus, Potentilla erecta, Galium palustre, Juncus effuses, Deschampsia flexuosa, Rhytidiadelphus spp., Festuca ovina, Agrostis spp., Euphrasia nemorosa, Thymus polytrichus.*



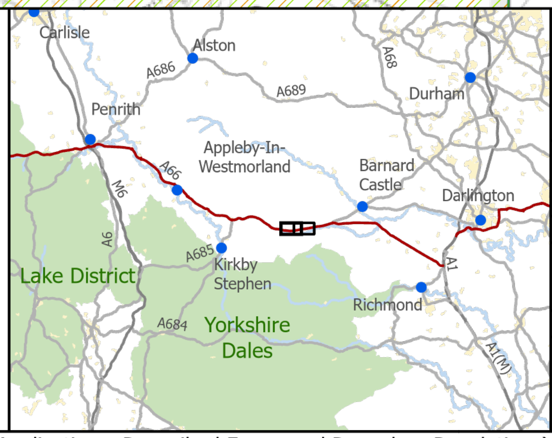
Existing A66
Affected Road Network (ARN)
Area Where a Change in Nitrogen Deposition Exceeds 1% of the Critical Load, as Defined by the Air Quality Modelling Data

Statutory Designated Sites

Special Area of Conservation
Special Protection Areas
Site of Special Scientific Interest Units (With IDs)

SAC Survey Habitat Description

Blanket Bog - Assumed to be Annex 1 following Phase 1 survey methodology
Blanket Bog Habitat Mosaic
SI Acid Grassland
Acid/Marshy Grassland Mosaic
Marshy Grassland
Rock Exposure and Waste
Watercourse
Flush and Spring



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3 Piccadilly Place
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Revision	First Issue				
P02	CESL	LHAN	THOU	AWAR	KWHA
	12/04/22	19/04/22	20/04/22	21/04/22	21/04/22
Revision	Created	Checked	Reviewed	Approved	Authorised

Kilometres
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Scale @ A3: 1:10,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix E: North pennine Moors Survey Map
Appleby to Brough to Bowes Bypass
Sheet 1 of 2

Map Number

Project	Originator	Volume
HE565627 -	AMY -	EBD -

Location	Type	Role	Number
S00 -	MP -	LB -	003354

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

Existing A66

Affected Road Network (ARN)

Area Where a Change in Nitrogen Deposition Exceeds 1% of the Critical Load, as Defined by the Air Quality Modelling Data

Statutory Designated Sites

Special Area of Conservation

Special Protection Areas

Site of Special Scientific Interest Units (With IDs)

SAC Survey Habitat Description

Blanket Bog - Assumed to be Annex 1 following Phase 1 survey methodology

Blanket Bog Habitat Mosaic

SI Acid Grassland

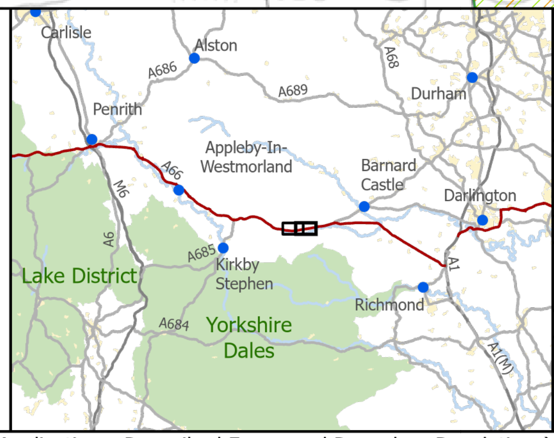
Acid/Marshy Grassland Mosaic

Marshy Grassland

Rock Exposure and Waste

Watercourse

Flush and Spring



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	First Issue				
P02	CESL	LHAN	THOU	AWAR	KWHA
	12/04/22	19/04/22	20/04/22	21/04/22	21/04/22
Revision	Created	Checked	Reviewed	Approved	Authorised

Kilometres
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Scale @ A3: 1:10,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
Appendix E: North pennine Moors Survey Map
Appleby to Brough to Bowes Bypass
Sheet 2 of 2

Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003324

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) and 5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.